DRAFT

INITIAL STUDY/ MITIGATED NEGATIVE DECLARATION

LAS TRAMPAS CREEK BRIDGE AT SOUTH MAIN STREET REPLACEMENT PROJECT

WALNUT CREEK, CALIFORNIA

EXISTING BRIDGE NO. 28C-0075

LSA

February 2024

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WALNUT CREEK, CALIFORNIA

EXISTING BRIDGE NO. 28C-0075

Submitted to:

City of Walnut Creek
Engineering Department
1666 North Main Street
Walnut Creek, California 94596

Prepared by:

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Project No. QCE1702

February 2024

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LIST OF ABBREVIATIONS AND ACRONYMS

AASHTO	Association of State Highway and Transportation Officials
ACM	asbestos-containing materials
ADT	average daily trips
APE	Area of Potential Effects
BAAQMD	Bay Area Air Quality Management District
Basin Plan	San Francisco Bay Regional Water Quality Control Board Basin Plan
BMP	best management practice
BSA	biological study area
BTEX	xylenes
CAL FIRE	California Department of Forestry and Fire Protection
Cal/OSHA	California Division of Occupational Safety and Health
CalEEMod	California Emissions Estimator Model
CalRecycle	California Department of Resources Recycling and Recovery
CAP	Climate Action Plan
Cc	Clear Lake clay
CCCSD	Central Contra Costa Sanitary District
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CeA	Conejo clay loam
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH_4	methane
CIA	Community Impact Analysis
City	City of Walnut Creek
Clean Air Plan	Bay Area Air Quality Management District 2017 Clean Air Plan
CNEL	community noise equivalent level
CO	carbon monoxide
CO_2	carbon dioxide

Construction General Permit	NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities
Corps	United States Army Corps of Engineers
County	County of Contra Costa
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DCE	cis-1,2-dichloroethene
DPR	California Department of Parks and Recreation
DTSC	Department of Toxic Substances Control
EBMUD	East Bay Municipal Utility District
EIA	Energy Information Administration
ESA	Environmentally Sensitive Area
ESLs	Environmental Screening Levels
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	greenhouse gas
GSAs	groundwater sustainability agencies
GWP	Global Warming Potential
HPSR	Historic Property Survey Report
I-680	Interstate 680
in/sec	inches per second
ISA	Initial Site Assessment
IS/MND	Initial Study/Mitigated Negative Declaration
LBP	lead-based paint
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum noise level
LRA	Local Responsibility Area
MBTA	Migratory Bird Treaty Act

mg/kg	milligrams per kilogram
MLD	Most Likely Descendant
MLRA	Major Land Resource Area
MRP	Municipal Regional. Stormwater Permit
MTBE	methyl tertiary butyl ether
MU-C	Mixed Use-Commercial
N_2O	nitrous oxide
NAHC	Native American Heritage Commission
ND	not detected
NEPA	National Environmental Policy Act
NES(MI)	Natural Environment Study (Minimal Impacts)
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NWIC	Northwest Information Center
PCE	tetrachloroethylene
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter less than 10 microns in size
$PM_{2.5}$	particulate matter than 2.5 microns in size
ppm	parts per million
PPV	peak particle velocity
P-R	Pedestrian Retail
PRC	Public Resources Code
PRD	Permit Registration Document
project	Las Trampas Creek Bridge at South Main Street Replacement Project
PSI	Preliminary Site Investigation
RECs	Recognized Environmental Conditions
Roadmod	Sacramento Air Quality Management District's Road Construction Emissions Model
ROG	reactive organic gases

RWQCB	Regional Water Quality Control Board
SAP	Sustainability Action Plan
SR 24	State Route 24
SF_6	sulfur hexafluoride
SGMA	Sustainable Groundwater Management Act
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMARTS	Stormwater Multiple Application and Report Tracking System
SO_2	sulfur dioxide
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACs	toxic air contaminants
TCE	trichloroethylene
TMP	Transportation Management Plan
TPHd	total petroleum hydrocarbons as diesel
TPHg	total petroleum hydrocarbons as gasoline
TPHmo	total petroleum hydrocarbons as motor oil
TPZ	Tree Protection Zone
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VHFHSZ	Very High Fire Hazard Severity Zone
VMT	vehicle miles traveled
VOC	volatile organic compound
WQO	water quality objectives
XPI	Extended Phase I

1.0 PROJECT INFORMATION

1. **Project Title:** Las Trampas Creek Bridge at South Main Street Replacement Project (Bridge No. 28C-0075)

2. **Lead Agency Name and Address:**

   City of Walnut Creek
   Department of Public Works
   1666 North Main Street
   Walnut Creek, California 94596

3. **Contact Person and Phone Number:**

   Neil Mock
   City Project Manager
   City of Walnut Creek Public Works Engineering Division
   (925) 943-5899 x2109

4. **Project Location:** The Las Trampas Creek Bridge at South Main Street Replacement Project (project) site is a bridge on South Main Street approximately 0.1 mile south of Olympic Boulevard in Walnut Creek, Contra Costa County, California. The project site is in the South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is one-half block north of the Kaiser Permanente Hospital. The Area of Potential Effects (APE) is 2.5 acres in size (the APE is considered the project boundary throughout this document). **Figure 1: Regional Location** and **Figure 2: Project Vicinity** show the location of the project site on a regional and local scale, respectively.

5. **Project Sponsor's Name and Address:**

   City of Walnut Creek Department of Public Works
   1666 North Main Street
   Walnut Creek, California 94596

6. **General Plan Designation:** Per the City of Walnut Creek 2025 General Plan Land Use Map (2020), land to the east of South Main Street is designated as P-R (Pedestrian Retail) and land to the west of South Main Street is designated as MU-C (Mixed Use-Commercial). According to the Core Area Map found in the Walnut Creek General Plan (City of Walnut Creek 2006), this section of South Main Street forms the southwestern edge of the Pedestrian Retail District and falls within the Core Area Zone.

7. **Zoning:** Land to the east of South Main Street is designated as PD (Planned Development, Ordinance 2122) and land to the west of South Main Street is designated as MU-C and P-R.

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LEGEND

☆ Project Location

FIGURE 1

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Regional Location

N

0 2.5 5
Miles

SOURCE: ESRI World Street Map (2017)

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LEGEND

Project Area

USGS 7.5' Quad Boundaries

N

0 1000 2000

FEET

FIGURE 2

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Project Vicinity

SOURCE: USGS 7.5-minute topographic quadrangle Walnut Creek, Calif. (1993, ed. 1997)

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8. Description of Project:

Existing Facility

The City of Walnut Creek (City) is proposing to replace the five-span, reinforced concrete, “T”-beam/slab bridge structure (Bridge No. 28C-0075) over Las Trampas Creek. The existing bridge was built in 1919. In 1950, the bridge was widened on the south side with a reinforced concrete “T”-beam superstructure, and in 1956, the bridge was widened on the north side with a reinforced concrete slab superstructure. The existing structure is approximately 131 feet long on bent style abutments.

The existing bridge contains numerous cracks with efflorescence in the soffit and regions of severe spalling with exposed rusted rebar, and there is inadequate clear lane width for existing traffic. Therefore, the existing structure has been classified as structurally deficient and functionally obsolete, with an overall sufficiency rating of 47.4. Sufficiency ratings are determined by the Federal Highway Administration’s (FHWA) 1995 *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges*. Sufficiency ratings range from a low of 0 to a high of 100, and a sufficiency rating of less than 50 qualifies a bridge for replacement.

The existing bridge is approximately 74.5 feet to 81 feet wide including five traffic lanes and sidewalks and does not provide shoulders on either side. The existing north approach roadway clear width is 62.7 feet, which includes five traffic lanes and a 4.2-foot raised median. The south approach roadway is approximately 69.9 feet wide, which includes five 12-foot traffic lanes, and a 6-foot-wide raised median. The difference between the two approaches is the parking lane on the south approach.

Roadway Classification

The City of Walnut Creek 2025 General Plan (2006) classifies South Main Street as an arterial roadway. Per the California Road System Maps, South Main Street is functionally classified as a minor arterial in the project area (Caltrans 2021), although it is a major collector north of the project site between Mt. Diablo Boulevard (approximately 0.2 mile north of the project site) and Ygnacio Valley Road (approximately 0.7 mile north of the project site) and is considered part of the Federal Aid Highway System. Based on the available data, the average daily trips (ADT) for South Main Street is 9,000 vehicles per day (Fehr & Peers 2021).

Proposed Project

The existing five-span bridge would be replaced with a new two-span precast-prestressed voided concrete slab bridge. The bridge would be replaced in two phases, Phase 1 would construct the Pedestrian/Utility Bridge and Phase 2 would construct the Replacement Bridge which would require closing South Main Street. The proposed Pedestrian/Utility Bridge would be approximately 105-ft long and provide a 10-foot-wide pedestrian path. The proposed vehicular bridge (Replacement Bridge) would be 104 feet long and approximately 92 feet wide including barriers, one 10-foot sidewalk in compliance with the Walnut Creek Pedestrian Master Plan design guidelines for the Core Area Zone, and one 4-foot-wide median. The bridge would convey vehicular traffic on four 12-foot through lanes and a left-turn lane that would vary in width. The proposed vertical profile is planned to be similar to the existing profile to minimize cut/fill requirements adjacent to the proposed bridge. The proposed roadway approaches are planned to be slightly realigned from their existing condition between the intersections at Botelho Drive and Broadway Plaza to conform to the new bridge width. Improvements to the north and south roadway approaches are anticipated to be less than 200 feet long on either side of the proposed bridge. Under the Federal Highway Bridge Program guidelines, local agencies are reimbursed for up to 200 feet of approach roadway on each side of the bridge (for on-system bridges) unless longer approaches can be justified to provide the minimum horizontal and vertical conforms. Modifications to existing driveways and pedestrian paths would be minimized. A majority of the project (88.53 percent) would be funded with Federal Highway Bridge Program funds and a small percentage of the project (11.47 percent) would be funded by local matching funds.

Cross Section

The project includes 12-foot lanes and 8-foot shoulders based upon recommended American Association of State Highway and Transportation Officials (AASHTO) guidelines and County of Contra Costa (County) standards and includes 10-foot sidewalks on either side based on County Core Area Zone design guidelines. The bridge would also include a 4-foot-wide, raised median.

The proposed clear roadway width at the proposed bridge would vary from approximately 85 feet to 95 feet and would accommodate the left-turn pockets approaching the intersections of Botelho Drive and Broadway Plaza.

Driveways

There is an existing driveway/ramp at the southwest corner of the bridge near the newly constructed Agora Retail patio area and the Pacific Catch restaurant. This ramp provides vehicular/maintenance access for a flood-control easement. The location of the ramp would be shifted farther to the southwest to accommodate the roadway realignment. The ramp would be reconstructed along the proposed edge of pavement on South Main Street.

The driveway at the northeast corner of the bridge provides vehicular access to the parking structure in Broadway Plaza. There is no planned realignment for this driveway.

The driveway at the northwest corner of the bridge provides vehicular access to the Ross Dress for Less Parking lot and vehicular egress for the alleyway behind Gott's Roadside Restaurant. The location of the ramp would be shifted farther to the southwest to accommodate the roadway realignment. The ramp would be reconstructed along the proposed edge of pavement on South Main Street.

Right-of-Way

According to Caltrans' right-of-way maps, and other recorded maps within the project area, there is a current right-of-way which encompasses the existing bridge as well as South Main Street to the north and south of the existing bridge. It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements would be minimized by maintaining the existing roadway alignment. Some right-of-way acquisition would be required to accommodate the bridge widening and associated improvements.

Project Construction

Construction of the project will be in two phases. Phase 1 would construct the Pedestrian/Utility Bridge and is estimated to begin in the spring of 2025 and would be completed by the winter of 2025. Phase 2 would construct the Replacement Bridge and is estimated to begin in 2026 and would be completed by December 2026. The total project area would be 400 feet long and approximately 1 acre in size. The project would not require any permanent soil import; however, approximately 800 cubic yards of temporary soil import would be required for an earthen ramp that would allow equipment access in the creek. The project would result in approximately 300 cubic yards of soil export, as well as approximately 350 tons of asphalt export and approximately 400 tons of asphalt import.

The South Main Street over Las Trampas Creek Bridge would be closed for the duration of Phase 2 construction activities. Closing South Main Street during construction would require pedestrian, bicycle, transit, and vehicle detours for the duration of construction activities. During construction, traffic lanes along South Main Street north of Botelho Drive and south of Broadway Plaza would be reconfigured to align with the detour around South Main Street. Contractors would direct the traveling public to approved detour routes consistent with the Traffic Management Plan, as discussed under Section 3.17.

Superstructure, Substructure, and Foundations

The project is a two-span bridge with a center pier aligned with the existing nose wall of the adjacent downstream culvert structure, which would require a pier support within the channel. The abutments of the proposed bridge would be just behind piers 2 and 5 of the existing bridge, providing a total bridge length of approximately 104 feet. Viable superstructure types include:

- Cast-in-place, post-tensioned concrete slab
- Precast, prestressed voided concrete slab

Large diameter cast-in-drilled-hole concrete piles would likely be used to minimize vibration impacts to adjacent structures and utilities.

Hydraulics

Las Trampas Creek is a concrete-lined channel with a double-barrel concrete box culvert approximately 30 feet downstream of the bridge with a drop structure and energy dissipaters upstream.

Existing freeboard is 0.3 foot for the 100-year water surface elevation and 2.1 feet for the 50-year water surface elevation. The proposed bridge soffit would be designed to be at or above the existing soffit elevation of 145.6 feet to maintain the existing freeboard.

Utilities

Utilities at the project site include underground electrical, telephone, cable, and water. Several conduits including 15 4-inch AT&T ducts are mounted on the downstream side of the bridge. Additional conduits including a 4-inch Pacific Gas and Electric Company (PG&E) ducts are mounted on the upstream side of the bridge. These side-mounted conduits would likely be relocated to the sidewalks of the proposed bridge. The as-built plans also show a 12-inch-diameter water line that runs roughly down the centerline of the existing bridge and is mounted on the columns below the bridge. Several utility manholes and vaults occupy the areas on roadway approaches. Fire sprinkler valves are at the northwest corner of the bridge.

Due to the extremely high density of underground utilities in this section of South Main Street, it would be necessary to relocate utilities as part of project construction. Based on field observations and experience with other projects in the area, utilities likely to be encountered at the project site are:

- PG&E
- AT&T
- East Bay Municipal Utility District
- Central Contra Costa Sanitary District (CCCSD)
- Contra Costa Water District

There are multiple telecommunications, television, or internet providers in the City may also include:

- Comcast/Xfinity
- Wave
- Windstream
- Verizon
- Astound
- Sonic
- HughesNet
- New Edge Networks

Other infrastructure at the site that the project may impact include City street lighting, fire hydrants, and privately owned landscape and irrigation systems. The northbound travel lanes also have traffic signal detector loops for the adjacent intersection at Botelho Drive and Newell Avenue that would need to be relocated on the new bridge.

9. **Surrounding Land Uses and Setting:** The project site is along South Main Street in the South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue. South Main Street Bridge crosses over a segment of Las Trampas Creek that flows through a concrete-lined channel. The project is surrounded by a shopping center with a parking lot, residential units (Agora at South Main Apartments), a parking garage, and several restaurants, banks, and retail stores.

10. Other Public Agencies Whose Approval is Required (i.e., permits, financial approval, or participation agreements):

Agency	Permit/Approval
California Department of Transportation (Caltrans) District 4	National Environmental Policy Act (NEPA) Approval
California Department of Fish and Wildlife (CDFW)	Section 1602 Streambed Alteration Agreement for impacts to riparian vegetation of Las Trampas Creek[1]
State Water Resources Control Board (SWRCB)	Compliance with SWRCB's National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (NPDES NO. CAS000002, Order No2022-0057-DWQ) (Construction General Permit) (with requisite Storm Water Pollution Prevention Plan, Conceptual Storm Water Pollution Prevention Plan, and Permanent Control Measures)
San Francisco Bay Regional Water Quality Control Board (SFBRWQCB)	Compliance with NPDES General Permit for Waste Discharge Requirements (WDRs) per the Municipal Regional Stormwater Permit (NPDES Permit No. CAS612008, Order No. R2-2022-0018, Adopted May 11, 2022) [2] and SFBRWQCB's Volatile Organic Compound (VOC) and Fuel General Permit (Order No. R2-2017-0048, as amended by Order No. R2-2018-0050)
Regional Water Quality Control Board (RWQCB)	Section 401 Water Quality Certification for impacts to Las Trampas Creek[2]
United States Army Corps of Engineers (Corps)	Section 404 Nationwide Permit for impacts to Las Trampas Creek

Source: LSA (2021).

1 The CDFW can require a streambed alteration agreement under the California Fish and Game Code to protect Las Trampas Creek, its riparian habitat, and dependent fishery or wildlife resources.

2 The San Francisco Bay RWQCB can impose WDRs under the Porter-Cologne Water Quality Control Act. The RWQCB must review a final California Environmental Quality Act document prior to taking an action on an application for water quality certification and/or WDRs.

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resource Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of the significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?

The Native American Heritage Commission (NAHC) was contacted on November 15, 2017, to conduct a Sacred Lands File search and provide a Native American Contact List for the project. The NAHC responded on November 27, 2017, stating that a Sacred Lands File search was completed for the project site with negative results. The NAHC also recommended that six Native American tribes be contacted for information regarding cultural resources that could be affected by the project. These six tribes were contacted via a letter sent on November 29, 2017, pursuant to Section 106, describing the project with maps depicting the project study area. Mr. Andrew Galvan of the Ohlone Indian Tribe, Inc. responded via email on December 2, 2017. Mr. Galvan did not express concerns about any tribal cultural resources that were in the project area that could be impacted by the project but asked if a literature review and/or pedestrian survey had already been completed for the project, and if so, requested a copy of the report. LSA clarified on December 7, 2017, that no report for the specific project area was on file, but Mr. Galvan was offered a copy of the Basin Research report for the property immediately to the south of the project area. Mr. Galvan declined the offered copy but requested a copy of the completed report for the current project once it was available.

Follow-up letters were sent on March 18, 2021, to the six tribes to update them on the project and inform them of proposed Extended Phase I testing. No response was received to the email sent March 18, 2021.

LSA did not receive a response to the letter of November 29, 2017, or follow-up telephone call on December 8, 2017, from the Indian Canyon Mutsun Band of Costanoan Indians. However, in response to the email update sent March 18, 2021, Ms. Kanyon Sayers-Roods responded on March 22, 2021, and recommended Native American monitoring and archaeological monitoring at all times during the project. Ms. Sayers-Roods also suggested cultural awareness training and consultation to explore interpretive or educational mitigation in her email.

Consultation with tribes did not result in the identification of any tribal cultural resources.

2.0 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist in Chapter 3.0.

☒ Aesthetics	☐ Agriculture and Forestry Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☐ Energy
☒ Geology/Soils	☐ Greenhouse Gas Emissions	☒ Hazards and Hazardous Materials
☒ Hydrology/Water Quality	☐ Land Use/Planning	☐ Mineral Resources
☒ Noise	☐ Population/Housing	☐ Public Services
☐ Recreation	☒ Transportation	☒ Tribal Cultural Resources
☒ Utilities/Services Systems	☒ Wildfire	☒ Mandatory Findings of Significance

2.1 DETERMINATION

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "Potentially Significant Impact" or "Potentially Significant Unless Mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature

Date

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3.0 CEQA ENVIRONMENTAL CHECKLIST

3.1 AESTHETICS

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
a. Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway	☐	☐	☐	☒
c. In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☒	☐
d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

3.1.1 Environmental Setting

The assessment of aesthetic impacts is subjective by nature. This analysis attempts to identify and objectively examine factors that contribute to the perception of aesthetic impacts that would be caused by implementation of the project.

The impact analysis focuses on aesthetic-related changes to the project site and surrounding area that may result from the construction of the project. This would include changes in viewsheds where visual changes would be evident, potential conflicts with applicable zoning and other regulations governing scenic quality, changes to scenic resources along designated scenic roads, and the introduction of new sources of light and glare.

The project site includes the Las Trampas Creek Bridge on South Main Street, 0.1 mile south of Olympic Boulevard. The bridge is in a developed area and is adjacent to the South Main Street/Broadway Plaza shopping area. Views in the project area are limited to the urban environment, with commercial buildings and landscape trees. The existing bridge crosses over Las Trampas Creek without changing grade in a visually significant way. The segment of the Las Trampas Creek flowing below the bridge is a concrete-lined channel which is most visible to the southwest of the bridge. Las Trampas Creek is visible to the northeast briefly before it continues under the pedestrianized shopping area along Broadway Lane leading from South Main Street to Broadway Plaza. There are no historic sites adjacent to the project boundary. The bridge itself is not eligible for listing on the National Register of Historic Places. Views of Mount Diablo can be seen from Mt. Diablo Boulevard, north of the project site.

3.1.2 Impact Analysis

a. Would the project have a substantial effect on a scenic vista?

The project site is in an urban area and no scenic vistas are within or adjacent to the project site. Although Mount Diablo can be seen from areas north of the project site, there are no vistas from within the project site. Therefore, the project would not have a substantial effect on a scenic vista.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

The project site is along South Main Street, which is not designated as a State scenic highway. While State Route 24 (SR 24) and Interstate 680 (I-680) in the project area are designated as State Scenic Highways, the project site is not visible from these highways, and neither highway is visible from the project site. Therefore, the project would not substantially damage scenic resources within a State scenic highway.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

c. Would the project, if in non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Walnut Creek, where the project site is located, is within the Concord, California Urbanized Area (United States Census Bureau 2010). As described in *State CEQA Guidelines* Section 15387 and defined by the United States Census Bureau, an "urbanized area" is a central city or a group of contiguous cities with a population of 50,000 or more people, together with adjacent densely populated areas having a population density of at least 1,000 people per square mile. Because Walnut Creek is in an urbanized area, for the purposes of this analysis the project site is considered an urbanized area.

The project site is in the Core Area of Walnut Creek. The Core Area has a unique character that includes regional- and local-serving commercial and residential development and is both the economic and cultural center of Walnut Creek. The Core Area is composed of multiple commercial, mixed-use, and residential areas that are considered the downtown area of Walnut Creek. The visual character of the project site is defined by urban and built-up features. The Walnut Creek General Plan 2025 (2006) contains several policies and actions aimed at governing scenic quality in the project area. Priorities in the project area include preservation of visual corridors, a circulation plan, bike and pedestrian access to and through the site, improved pedestrian and visual access to the creek amenities, undergrounding of utilities, preservation and protection of tree resources, and the preservation of Core Area visual character. The project is not situated in a scenic corridor, nor does the project site provide scenic urban views or views to Mount Diablo, both protected by the City of Walnut Creek's visual guidance.

The project would replace the existing bridge structure with one that is the same height and roughly the same length and width and require minor modifications to the north and south roadway approaches to the new bridge. Most visual changes would be temporary (over the construction period) and are considered to be minor.

3.1.2.1 Temporary Construction Impacts

During construction of the project, the presence of construction equipment and materials in the project site as well as construction activities (such as clearing and grubbing) would temporarily change the visual quality and character of the site. Closure of the bridge during construction and the use of nearby parking lots as staging areas would require temporary detour and road signage to be installed to alert drivers and pedestrians of the construction and the subsequent detours. During construction, regular area users such as business owners, employees, and residents and occasional area users such as shoppers, motorists travelling through Walnut Creek's downtown, and other visitors would notice a negligible change in visual conditions compared to existing conditions. However, construction impacts are temporary and would cease once construction is complete.

3.1.2.2 Operational Impacts

Although implementation of the project would result in a wider bridge, the approximately 20 ft change in the width of the bridge would not be perceptible to travelers along South Main Street or from viewpoints in the surrounding project area. The project would replace railings and guardrails on either side of the bridge approaches. Overhead utilities that are relocated as part of the project would be placed underground in compliance with City policies.

Changes to the bridge width and design would be negligible to travelers along South Main Street when compared to the existing bridge and would not substantially degrade the existing visual character or quality of the project site and its surroundings. Once the project is operational, regular area users such as business owners, employees, and residents and occasional area users such as shoppers, motorists travelling through Walnut Creek's downtown, and other visitors may notice a slight visual change compared to existing conditions, but this would not conflict with applicable zoning and other regulations governing scenic quality.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

d. Would the project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

The project is surrounded by commercial development and is located in an area that is fully built-up. Existing streetlamps are along the center of the bridge structure. The proposed bridge structure would have similar lighting, including downward-cast streetlamps. Materials used on the bridge structure would not produce glare. Therefore, the project would not create new sources of substantial light or glare which would adversely affect day or nighttime views in the area and impacts would be less than significant**.** No mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.2 AGRICULTURE AND FORESTRY RESOURCES

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the State's inventory of forest land, including the Forest and Range Assessment Project, the Forest Legacy Assessment Project, and the forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	☐	☐	☐	☒
d. Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

3.2.1 Environmental Setting

The project site is in an urban area of Walnut Creek, there is no farmland or forest land in the project vicinity.

3.2.2 Impact Analysis

a. Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland) as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

The project site does not contain Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. Therefore, there would be no impact to Important Farmland during construction and operation of the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?

The project site is in an area that is fully developed and is zoned PD and MU-C. No Williamson Act parcels are within the project vicinity. Therefore, the project would not conflict with existing zoning for agricultural use or a Williamson Act contract. Thus, there would be no impact associated with conflict with existing zoning for agricultural use or with a Williamson Act contract during construction and operation of the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

c. Would the project conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?

The project site is in an area that is fully developed and is zoned PD and MU-C. No forest land or timberland is within or adjacent to the project site. Therefore, there would be no impact associated with conflicts with existing zoning for, or cause rezoning of, forest land or timberland during construction and operation of the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

d. Would the project result in the loss of forest land or conversion of forestland to non-forest use?

The project site does not contain forest land. Therefore, no impacts to forest land would occur during construction and operation of the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

e. Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

The project site is in an area that is fully developed. Replacement of the Las Trampas Creek Bridge would not result in the conversion of farmland or forest land to non-agricultural or non-forest use, respectively. Therefore, there would be no impact to farmland or forest land during construction and operation of the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.3 AIR QUALITY

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations.

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Conflict with or obstruct implementation of the applicable air quality plan?	☐	☒	☐	☐
b. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	☐	☒	☐	☐
c. Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☐	☒	☐

3.3.1 Environmental Setting

The project is in Walnut Creek and is within the jurisdiction of the Bay Area Air Quality Management District (BAAQMD), which regulates air quality in the San Francisco Bay Area. Air quality conditions in the San Francisco Bay Area have improved significantly since the BAAQMD was created in 1955. Ambient concentrations of air pollutants and the number of days during which the region exceeds air quality standards have fallen substantially. In Walnut Creek and the rest of the air basin, exceedances of air quality standards occur primarily during meteorological conditions conducive to high pollution levels, such as cold, windless winter nights, or hot, sunny summer afternoons.

Within the BAAQMD, ambient air quality standards for ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter with a diameter less than 10 microns in size (PM_{10}), particulate matter with a diameter less than 2.5 microns in size ($PM_{2.5}$), and lead have been set by both the State of California and the federal government. The State has also set standards for sulfate and visibility. The BAAQMD is under State non-attainment status for ozone and particulate matter standards. The BAAQMD is classified as non-attainment for the federal ozone 8-hour standard and non-attainment for the federal $PM_{2.5}$ 24-hour standard.

3.3.2 Impact Analysis

a. Would the project conflict with or obstruct implementation of the applicable air quality plan?

The applicable air quality plan is the BAAQMD 2017 Clean Air Plan (Clean Air Plan) (BAAQMD 2017) which the agency adopted on April 19, 2017. The Clean Air Plan is a comprehensive plan to improve Bay Area air quality and protect public health. The Clean Air Plan defines control strategies to reduce emissions and ambient concentrations of air pollutants; safeguard public health by reducing exposure to air pollutants that pose the greatest heath risk, with an emphasis on protecting the communities most heavily affected by air pollution; and reduce greenhouse gas emissions to protect the climate. Consistency with the Clean Air Plan can be determined if the project (1) supports the goals of the Clean Air Plan, (2) includes applicable control measures from the Clean Air Plan, and (3) would not disrupt or hinder implementation of any control measures from the Clean Air Plan.

3.3.2.1 Clean Air Plan Goals

The primary goals of the Clean Air Plan are to attain air quality standards, reduce population exposure and protect public health in the Bay Area, and reduce greenhouse gas (GHG) emissions and protect the climate. The BAAQMD has established significance thresholds for project construction and operational impacts at a level at which the cumulative impact of exceeding these thresholds would have an adverse impact on the region's attainment of air quality standards. The health and hazard thresholds were established to help protect public health. As discussed in more detail in Response b) below, implementation of the project would result in less-than-significant operation-period emissions and, with implementation of **Mitigation Measure AIR-1**, which requires the project contractor to implement the BAAQMD's Basic Construction Mitigation Measures to reduce fugitive dust emissions associated with construction activities, the project would result in less-than-significant construction-period emissions. Therefore, the project would not conflict with the Clean Air Plan.

3.3.2.2 Clean Air Plan Control Measures

The control strategies of the Clean Air Plan include measures in the following categories: Stationary Source Measures, Transportation Measures, Energy Measures, Building Measures, Agriculture Measures, Natural and Working Lands Measures, Waste Management Measures, Water Measures, and Super GHG Pollutants Measures.

- **Stationary Source Control Measures:** The stationary source measures, which are designed to reduce emissions from stationary sources such as metal melting facilities, cement kilns, refineries, and glass furnaces, are incorporated into rules adopted by the BAAQMD and then enforced by the BAAQMD's Permit and Inspection programs. Because the project would not include any stationary sources, the Stationary Source Measures of the Clean Air Plan are not applicable to the project.

- **Transportation Control Measures:** The BAAQMD identifies Transportation Measures as part of the Clean Air Plan to decrease emissions of criteria pollutants, toxic air contaminants (TACs), and GHGs by reducing demand for motor vehicle travel, promoting efficient vehicles and transit service, decarbonizing transportation fuels, and electrifying motor vehicles and equipment. The project would replace an existing bridge structure over Las Trampas Creek, which is considered to be structurally deficient and functionally obsolete. The proposed roadway approaches are planned to be slightly realigned from their existing condition between the intersections at Botelho Drive and Broadway Plaza. The roadway edges would conform to the existing sidewalks and driveways with as minimal an impact as possible. The project would not result in new vehicle trips or increase vehicle miles traveled (VMT). Therefore, the project would not hinder or disrupt the BAAQMD's initiatives to reduce vehicle trips and VMT.

- **Energy Control Measures:** The Clean Air Plan also includes Energy Measures, which are designed to reduce emissions of criteria air pollutants, TACs, and GHGs by decreasing the amount of electricity consumed in the Bay Area, as well as decreasing the carbon intensity of the electricity used by switching to less GHG-intensive fuel sources for electricity generation. Because these measures apply to electrical utility providers and local government agencies (and not individual projects), the energy control measures of the Clean Air Plan are not applicable to the project.

- **Building Control Measures:** The BAAQMD has authority to regulate emissions from certain sources in buildings such as boilers and water heaters but has limited authority to regulate buildings themselves. Therefore, the strategies in the control measures for this sector focus on working with local governments that do have authority over local building codes, to facilitate adoption of best GHG control practices and policies. The project would not add or alter any buildings. Therefore, the project would not conflict with these measures.

- **Agriculture Control Measures:** The Agriculture Control Measures are designed to primarily reduce emissions of methane. Because the project does not include any agricultural activities, the Agriculture Control Measures of the Clean Air Plan are not applicable to the project.

- **Natural and Working Lands Control Measures:** The Natural and Working Lands Control Measures focus on increasing carbon sequestration on rangelands and wetlands, as well as encouraging local governments to adopt ordinances that promote urban-tree plantings. Because the project does not include the disturbance of any rangelands or wetlands, the Natural and Working Lands Control Measures of the Clean Air Plan are not applicable to the project.

- **Waste Management Control Measures:** The Waste Management Measures focus on reducing or capturing methane emissions from landfills and composting facilities, diverting organic materials away from landfills, and increasing waste diversion rates through efforts to reduce, reuse, and recycle. The project would comply with local requirements for waste management (e.g., recycling and composting services) as discussed in Section 3.19.2(d). Therefore, the project would be consistent with the Waste Management Control Measures of the Clean Air Plan.

- **Water Control Measures:** The Water Control Measures focus on reducing emissions of criteria pollutants, TACs, and GHGs by encouraging water conservation, limiting GHG emissions from publicly owned treatment works, and promoting the use of biogas recovery systems. Because these measures apply to publicly owned treatment works and local government agencies (and not individual projects), the Water Control Measures are not applicable to the project.

- **Super GHG Control Measures:** The Super GHG Control Measures are designed to facilitate the adoption of best GHG control practices and policies through the BAAQMD and local government agencies. Because these measures do not apply to individual projects, the Super GHG Control Measures are not applicable to the project.

3.3.2.3 Clean Air Plan Implementation

As discussed above, implementation of the project would not conflict with the Clean Air Plan goals and would generally implement the applicable measures outlined in the Clean Air Plan, including Transportation Control Measures. Therefore, the project would not disrupt or hinder implementation of a control measure from the Clean Air Plan. This impact would be less than significant with mitigation incorporated.

Significance Determination: Potentially Significant Impact

Mitigation Measures: The following mitigation measures would be implemented to avoid impacts to air quality standards associated with construction from the proposed project:

Mitigation Measure AIR-1 **Basic Construction Mitigation Measures**. Consistent with the Basic Construction Mitigation Measures required by the Bay Area Air Quality Management District (BAAQMD), the City of Walnut Creek (City) shall incorporate the following actions into construction contracts and specifications for the project:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

- Post a publicly visible sign with the telephone number and person to contact at the City regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Significance Determination after Mitigation: Less than Significant

b. Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

The BAAQMD is currently designated as a non-attainment area for State and federal ozone standards and federal particulate matter ambient air quality standards. The BAAQMD's non-attainment status is attributed to the region's development history. Past, present, and future development projects contribute to the region's adverse air quality impacts on a cumulative basis. By its very nature, air pollution is largely a cumulative impact. No single project is sufficient in size to, by itself, result in non-attainment of ambient air quality standards. Instead, a project's individual emissions contribute to existing cumulatively significant adverse air quality impacts. If a project's contribution to the cumulative impact is considerable, then the project's impact on air quality would be considered significant.

In developing thresholds of significance for air pollutants, the BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project exceeds the identified significance thresholds, its emissions would be cumulatively considerable, resulting in significant adverse air quality impacts to the region's existing air quality conditions.

According to the BAAQMD's CEQA Guidelines, to meet air quality standards for operational-related criteria air pollutant and air precursor impacts, the project must not:

- Generate average daily construction emissions of reactive organic gases (ROG), oxides of nitrogen (NO_x), or $PM_{2.5}$ greater than 54 pounds per day or PM_{10} exhaust emissions greater than 82 pounds per day;

- Contribute to CO concentrations exceeding the State ambient air quality standards; or

- Generate operation emissions of ROG, NO_x, or $PM_{2.5}$ of greater than 10 tons per year or 54 pounds per day,
- Generate operation emissions of PM_{10} greater than 15 tons per year or 82 pounds per day.

Construction and operation emissions associated with the project are analyzed below.

3.3.2.4 Construction Impacts

During construction of the project, short-term degradation of air quality may occur due to the release of particulate matter emissions (i.e., fugitive dust) generated during construction activities. Emissions from construction equipment are also anticipated and would include CO, NO_x, ROG, directly emitted particulate matter ($PM_{2.5}$ and PM_{10}), and TACs such as diesel exhaust particulate matter.

Site preparation and project construction could involve demolition, grading, paving, and other activities. Construction-related effects on air quality from projects would be greatest during the site preparation phase due to the disturbance of soils. If not properly controlled, these activities would temporarily generate particulate emissions. Sources of fugitive dust would include disturbed soils at construction sites. Unless properly controlled, vehicles leaving sites would deposit dirt and mud on local streets, which could be an additional source of airborne dust after it dries. PM_{10} emissions would vary, depending on the nature and magnitude of construction activity and local weather conditions. PM_{10} emissions would depend on soil moisture, silt content of soil, wind speed, and the amount of operating equipment. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances from the construction sites.

Water or other soil stabilizers can be used to control dust, resulting in emission reductions of 50 percent or more. The BAAQMD has established standard measures for reducing fugitive dust emissions (PM_{10}). With the implementation of these Basic Construction Mitigation Measures, included in **Mitigation Measure AIR-1**, fugitive dust emissions from construction activities would not result in adverse air quality impacts.

In addition to dust-related PM_{10} emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO, SO_2, NO_x, volatile organic compounds (VOCs) and some soot particulate ($PM_{2.5}$ and PM_{10}) in exhaust emissions. If construction activities were to increase traffic congestion in the area, CO and other emissions from traffic would increase slightly while those vehicles idle in traffic. These emissions would be temporary in nature and limited to the immediate area surrounding the construction site.

Construction emissions were estimated for the project using the Sacramento Air Quality Management District's Road Construction Emissions Model, Version 9.0.0. (Roadmod), as recommended by the BAAQMD for linear projects. Specific construction details are not yet known; therefore, default assumptions (e.g., construction fleet activities) from Roadmod were used. For purposes of this analysis, the construction schedule for all improvements was assumed to be approximately 20 months, beginning in March 2021, and completing in November 2022. In addition, the project would include approximately 800 cubic yards of soil import and 300 cubic yards of soil export, which were included as inputs to Roadmod. Construction-related emissions are presented in **Table A: Project Construction Emissions (in Pounds Per Day)**. Roadmod output details are included in Appendix A.

Table A: Project Construction Emissions (in Pounds Per Day)

Project Construction	ROG	NO_x	Exhaust PM_{10}	Fugitive Dust PM_{10}	Exhaust $PM_{2.5}$	Fugitive Dust $PM_{2.5}$
Grubbing/Land Clearing	1.1	9.9	0.5	10.0	0.5	2.1
Grading/Excavation	9.4	71.4	4.7	10.0	4.1	2.1
Drainage/Utilities/Sub-Grade	5.9	48.7	2.9	10.0	2.4	2.1
Paving	1.0	12.9	0.5	0.0	0.5	0.0
Maximum (pounds per day)	9.4	71.4	4.7	10.0	4.1	2.1
Total (tons per construction period)	1.3	10.7	0.6	1.9	0.6	0.4
Average (pounds per day)	**4.3**	**35.7**	**2.0**	**6.3**	**2.0**	**1.3**
BAAQMD Threshold (average pounds per day)	**54.0**	**54.0**	**82.0**	**BMP**	**54.0**	**BMP**
Exceed Threshold?	**No**	**No**	**No**	**No**	**No**	**No**

Source: Compiled by LSA using Roadmod (October 2018).
BAAQMD = Bay Area Air Quality Management District
BMP = best management practice
NO_x = oxides of nitrogen
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
PM_{10} = particulate matter less than 10 microns in size
Roadmod = Sacramento Air Quality Management District's Road Construction Emissions Model

As shown in Table A, construction emissions associated with the project would be less than significant for ROG, NO_x, exhaust $PM_{2.5}$, and exhaust PM_{10} emissions. **Mitigation Measure AIR-1** requires the project contractor to implement the BAAQMD's Basic Construction Mitigation Measures to reduce construction fugitive dust emissions to a less-than-significant level. Therefore, with implementation of **Mitigation Measure AIR-1**, construction of the project would not result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard and impacts would be less than significant with mitigation.

3.3.2.5 Operational Emissions – Regional Emissions Analysis

Long-term air emission impacts are associated with stationary sources and mobile sources. Stationary source emissions result from the consumption of natural gas and electricity. Mobile source emissions result from vehicle trips and result in air pollutant emissions affecting the entire air basin. The project would replace an existing bridge to improve safety and efficiency. No stationary sources are associated with the project. In addition, the project would not result in new vehicle trips or significantly increase VMT. Therefore, once completed, the project would not result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or State ambient air quality standard. Operational impacts would be less than significant.

3.3.2.6 Localized CO Impacts

Emissions and ambient concentrations of CO have decreased dramatically in the Bay Area with the introduction of the catalytic converter in 1975. No exceedances of the State or federal CO standards have been recorded at Bay Area monitoring stations since 1991. The BAAQMD 2017 CEQA Guidelines include recommended methodologies for quantifying concentrations of localized CO levels for proposed transportation projects. A screening level analysis using guidance from the BAAQMD CEQA Guidelines was performed to determine the impacts of the project. The screening methodology provides a conservative indication of whether the implementation of a project would result in significant CO emissions. According to the BAAQMD CEQA Guidelines, a project would result in a less-than-significant impact to localized CO concentrations if it meets the following screening criteria:

- The project is consistent with an applicable congestion management program established by the county congestion management agency for designated roads or highways, and the regional transportation plan and local congestion management agency plans.

- Project traffic would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour.

- The project would not increase traffic volumes at affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, or below-grade roadway).

Implementation of the project would not conflict with standards established by the Contra Costa County Transportation Authority for designated roads and highways, a regional transportation plan, or other agency plans. The project site is not in an area where vertical or horizontal mixing of air is substantially limited. Implementation of the project would not increase traffic volumes at intersections to more than 44,000 vehicles per hour and intersection level of service associated with the project would not decline. Therefore, the project would not result in localized CO concentrations that exceed State or federal standards. This impact would be less than significant.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure AIR-1 would be implemented to avoid impacts to air quality standards associated with construction from the proposed project.

Significance Determination after Mitigation: Less than Significant

c. Would the project expose sensitive receptors to substantial pollutant concentrations?

Sensitive receptors are defined as residential uses, schools, daycare centers, nursing homes, and medical centers. Individuals particularly vulnerable to diesel particulate matter are children, whose lung tissue is still developing, and the elderly, who may have serious health problems that can be aggravated by exposure to diesel particulate matter. Exposure from diesel exhaust associated with construction activity contributes to both cancer and chronic non-cancer health risks.

The project is in an urbanized portion of Walnut Creek. The closest sensitive receptor is a mixed-use building at 1305 South Main Street. The mixed-use building is four stories in height with the first floor occupied by retail/restaurant uses and floors two through four occupied by multi-family residential units. The sensitive receptor is approximately 60 feet from the nearest point of the project construction footprint and 31.9 feet from the nearest edge of the closest traffic lane on South Main Street.

Implementation of the project could expose sensitive receptors to increased levels of particulate matter during the project's construction period. As described above, construction of the project may expose surrounding sensitive receptors to airborne particulates, as well as a small quantity of construction equipment pollutants (i.e., usually diesel-fueled vehicles and equipment). However, the Construction Contractor would be required to implement **Mitigation Measure AIR-1**. With implementation of this mitigation measure, construction emissions would be below the BAAQMD significance thresholds. Additionally, due to the linear nature of the project, construction activities at any one receptor location would occur for a limited duration. Once the project is constructed, the project would not be a source of substantial emissions. Therefore, sensitive receptors are not expected to be exposed to substantial pollutant concentrations during construction or operation, potential impacts would be less than significant with implementation of **Mitigation Measure AIR-1**.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure AIR-1 would be implemented to avoid impacts to air quality standards associated with construction from the proposed project.

Significance Determination after Mitigation: Less than Significant

d. Would the project result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

During project construction, some odors may be present due to diesel exhaust. However, these odors would be temporary and limited to the construction period. The project would not include any activities or operations that would generate objectionable odors and once operational, the project would not be a source of odors. Therefore, the project would not create objectionable odors affecting a substantial number of people. This impact would be less than significant**,** and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.4 BIOLOGICAL RESOURCES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c. Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☒	☐	☐
f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

3.4.1 Environmental Setting

The *Natural Environment Study (Minimal Impacts) Las Trampas Creek Bridge Replacement Project Walnut Creek, California* (NES[MI]) (LSA 2018a) was prepared for the project in September 2018 (see Appendix B). The information included in this section is based on the study.

Four land cover types were identified within the biological study area (BSA): urban, landscaped, willow thickets, and stream. Each land cover type is detailed below.

Urban areas within the BSA are those where vegetation has been cleared and altered for residential or commercial development, parking, and city streets. These areas are largely covered by cement or pavement and do not contain native habitats. There are 1.981 acres of urban habitat in the BSA.

Landscaped areas occur adjacent to Las Trampas Creek and along South Main Street. This land cover type includes native and non-native species purposely planted as landscaping within hardscape elements such as sidewalk planting strips and parking lots. The landscaped areas along Las Trampas Creek include some native trees that may predate the surrounding developments; however, they are included here because they occur with planted trees and no longer represent a distinct natural vegetation community. Tree and shrub species included in the landscaped areas are listed in the NES(MI), found in Appendix B of this document. There is 0.595 acre of landscaped area in the BSA.

Willow thicket is found immediately upstream of the bridge. This natural vegetation community consists of one multi-stemmed arroyo willow (*Salix lasiolepis*) tree and one multi-stemmed red willow (*Salix laevigata*) tree among other plant species, as listed in the NES(MI), (Appendix B). Willow thicket covers 0.015 acre in the BSA.

The stream land cover type within the BSA consists of Las Trampas Creek and Tice Creek. At the project location, Las Trampas Creek is a concrete-lined channel and includes some areas of sediment or gravel deposition. Tice Creek enters Las Trampas Creek 120 feet upstream of the bridge. There is 0.344 acre of stream in the BSA.

The project site is in a highly urbanized environment and provides limited availability of natural habitats. For this reason, the BSA has relatively limited value as wildlife habitat. Trees within the BSA provide bird nesting and foraging habitat. The bridge itself also provides nesting bird habitat. In addition, Las Trampas Creek provides limited habitat for aquatic species. Although Las Trampas Creek connects with Suisun Bay through Walnut Creek, the creek does not provide habitat for anadromous fishes due to drop structures in Las Trampas Creek. The creek does serve as a movement corridor for other wildlife species such as river otter (*Lontra canadensis*) and western pond turtle (*Actinemys marmorata*). The western pond turtle is a California Species of Special Concern.

Based on background research and surveys conducted, it was concluded that the BSA does not provide habitat for salmonids, special-status plant species, or species requiring specific habitats such as inland dunes, vernal pools, tidal salt marsh, and brackish marsh. The project area consists of a densely populated urban area and the stream channel is lined with concrete.

Potentially jurisdictional waters within the BSA include 0.33 acre of stream and 0.01 acre of culvert, for a total of 0.34 acre of other waters of the United States. No wetland characteristics were observed within the BSA.

A total of 45 native and non-native trees were surveyed within the BSA. The project would require the removal of 14 trees, including 1 London plane, 2 valley oaks, 3 coast live oaks, 1 arroyo willow, 1 red willow, 3 coast redwoods, 2 black walnuts, and 1 evergreen oak.

3.4.2 Impact Analysis

a. Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

The project site is in a highly urbanized environment. The project site does not provide habitat for any special-status plant species. The western pond turtle, a special-status animal species, is known to occur within the project site. The project site does not provide any upland habitat for the species. However, Las Trampas Creek does provide marginal aquatic habitat and a movement corridor for western pond turtles. The project would result in approximately 0.25 acre of temporary impacts and approximately 0.01 acre of permanent impacts to western pond turtle aquatic habitat and movement corridor. Therefore, the project may adversely affect this species due to the loss of habitat. The project site does not provide habitat for any other special-status wildlife species. Though impacts to western pond turtle would be minimal and largely due to temporary disturbance during construction, implementation of **Mitigation Measure BIO-1**, which requires a pre-constructions surveys and the possible relocation of western pond turtles should they be present within the work area during construction, would ensure that impacts to western pond turtle resulting from construction of the project would be reduced to a less-than-significant level.

No compensatory mitigation for impacts to western pond turtle is necessary given the relatively small impact area and the marginal nature of the western pond turtle habitat.

The project includes removing the existing five span bridge and replacing it with a two-span bridge, which would result in an overall reduction in the number of bridge footings in Las Trampas Creek. Removing structures in the creek represents an overall net gain in western pond turtle habitat and movement corridors once the project is operational. Therefore, project operations would result in a beneficial impact to western pond turtles.

The federal Migratory Bird Treaty Act (MBTA) prohibits the taking, hunting, killing, selling, purchasing, etc. of migratory birds, parts of migratory birds, or their eggs and nests. Most bird species native to the United States are covered by this act. Most existing vegetation within the BSA has at least some potential to support nests of native birds protected under the MBTA and California Fish and Game Code. In addition, cliff swallow nests, protected under the MBTA, were seen under the bridge during the general plant and animal survey conducted on September 15, 2017. The swallows likely return to the bridge to nest each year and are likely to be present at the time of construction. Therefore, it is recommended that vegetation removal and trimming be conducted during the non-breeding season for birds (between September 1 and February 14) to avoid impacts to birds to the greatest extent practicable. If vegetation and clearing must occur during the breeding season for birds, **Mitigation Measure BIO-2** requires a pre-construction bird survey by a qualified biologist to ensure there are no active nests within the limits of construction. If a nest is found, an appropriate buffer shall be established, and the next monitored to ensure birds are not being impacted by construction activities.

Implementation of **Mitigation Measure BIO-2**, which requires pre-construction bird surveys, reduce construction-related impacts to nesting birds, if present, to a less-than-significant level. Project operations would not result in additional modifications to nesting habitat. Therefore, project operations would result in no impact to nesting birds.

With implementation of **Mitigation Measures BIO-1 and BIO-2**, project impacts to species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or United States Fish and Wildlife Service would be reduced to less than significant.

Significance Determination: Potentially Significant Impact

Mitigation Measures: The following mitigation measures would be implemented to avoid impacts to Western pond turtle and nesting birds associated with project construction:

Mitigation Measure BIO-1 **Preconstruction Surveys for the Western Pond Turtle.** A qualified biologist shall conduct a pre-construction survey for western pond turtles on the first working day immediately prior to the start of work to ensure that no individuals are present. On all subsequent days prior to the start of work, a designated construction monitor, trained by the qualified biologist, shall inspect the work area for western pond turtles. If a western pond turtle is observed in the immediate work area in these instances, no work shall commence along the bank until the turtle has moved out of harm's way or the qualified biologist has arrived at the site and relocated the turtle.

Mitigation Measure BIO-2 **Nesting Bird Protection Measure.** If construction is to be conducted during the nesting season (February 15–August 31), a qualified biologist shall conduct a pre-construction survey for nesting birds on the first day of work immediately prior to the start of construction activities to ensure that no individuals are present. If a nest is found, the biologist conducting the pre-construction survey shall determine an appropriate buffer (typically 50 to 100 feet) based on nest site characteristics and the acclimation of the nesting birds to disturbance.

Significance Determination after Mitigation: Less than Significant

b. Would the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

The project site is in an urban environment. The creek and adjacent uplands within the project site are mostly covered in concrete or asphalt. There is no riparian, wetland, or other sensitive natural community within the project site. The project would have no impact on any riparian habitat or other sensitive natural community.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

c. Would the project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Implementation of the project has the potential to result in temporary or permanent impacts to federally protected wetlands as defined by Section 404 of the Clean Water Act (CWA).

The project site includes 0.33 acre of stream and 0.01 acre of culvert, totaling 0.34 acre of other waters of the United States (404 Waters). No wetland characteristics were observed within the project site. The project would result in 0.25 acre of temporary impacts to 1602 jurisdictional waters and 0.01 acre of permanent impacts to jurisdictional waters.

Temporary and permanent impacts to the non-wetland waters of the United States shall be minimized through the implementation of **Mitigation Measures BIO-3 through BIO-8**, which would ensure contractors receive resource training, restrict the work area with Environmentally Sensitive Area (ESA) fencing, require best management practices (BMPs) to restrict equipment maintenance and refueling from occurring within Las Trampas Creek, require measures to reduce erosion, and require purchase of land or mitigation credits. With the implementation of **Mitigation Measures BIO-3 through BIO-8**, temporary and permanent impacts to non-wetland waters protected under Section 404 of the CWA would be reduced to a less-than-significant level.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures BIO-3 through BIO-8 would be implemented to avoid impacts to wetlands associated with construction and operations of the proposed project:

Mitigation Measure BIO-3	**Qualified Biologist/Biological Monitor.** Prior to initial ground disturbance, the Construction Manager or the Contractor shall hire a qualified biologist. The qualified biologist shall be present at the work site until all ground-disturbing activities in all portions of the project site have been completed and workers have received environmental training. At that time, the Construction Manager or the Contractor shall designate a monitor who shall ensure on-site compliance with all avoidance and minimization efforts when the qualified biologist is not on site. The qualified biologist shall ensure the monitor is familiar with the avoidance and minimization efforts and able to identify all the special-status species of potential occurrence in the Biological Study Area (BSA). The monitor and the qualified biologist shall have the authority to halt any action that might result in impacts that exceed the levels anticipated by the United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Wildlife (CDFW) at any point during construction. If work is stopped, either the qualified biologist or the on-site monitor shall immediately notify the California Department of Transportation (Caltrans) and the City of Walnut Creek. If a

federally listed species is found in the work area during construction and a Biological Opinion has not been issued for the proposed project, then the qualified biologist must stop work and immediately notify Caltrans. Caltrans shall then consult with the USFWS or National Marine Fisheries Service (NMFS) and shall then advise the Construction Contractor on how to proceed. Likewise, should a State-listed species be found in the work area for which no incidental take permit has been issued, the City of Walnut Creek's (City) Project Manager shall then consult with CDFW and shall advise the Construction Contractor on how to proceed.

Mitigation Measure BIO-4 **Environmental Study Area Fencing:** Prior to the start of and during construction, the contractor shall implement the following measure:

- Prior to construction activities, the qualified biologist shall identify the locations for the placement of Environmentally Sensitive Area (ESA) fencing to protect jurisdictional areas adjacent to the construction area and to delineate a projection zone beyond which construction activities are prohibited. The Construction Contractor, with the assistance of the qualified biologist, shall install the ESA fencing, where feasible, prior to construction activities. The qualified biologist shall verify the correct placement and installation of the ESA fences before work begins in the area.

Mitigation Measure BIO-5 **Worker Awareness Training:** Prior to the start of and during construction, the contractor shall implement the following measure:

- Prior to initial ground disturbance, the qualified biologist shall conduct an environmental training session for all construction and maintenance personnel. At a minimum, the training shall include a description of the special-status species that may occur at the project site, their habitat requirements, and the measures being implemented to avoid and minimize impacts to these species. The environmental training shall include a discussion of the boundaries behind which the workers and equipment must remain.

Mitigation Measure BIO-6 **Wetland Pre-Construction Measures:** Prior to the start of and during construction, the Construction Contractor shall implement the following measures:

- The Construction Contractor shall ensure all trash generated by the project shall be promptly and properly removed from the project site.

- All refueling of construction and maintenance vehicles shall be staged in paved areas away from the top of bank of the creek.

- Hazardous material absorbent pads and similar materials shall be available on site by contractor in the event of a spill that could potentially impact jurisdictional waters.

- If the work area needs to be dewatered during project construction, water shall be allowed to flow around the work area to maintain downstream flow.

- If water is pumped from the work area during dewatering, it shall be allowed to settle to reduce turbidity prior to being released back into the creek.

- Appropriate erosion-control measures (e.g., fiber rolls, filter fences) shall be used on site if needed to reduce siltation and runoff of contaminants into the stream. Filter fences and mesh shall be of material that would not entrap reptiles and amphibians.

- Fiber rolls used for erosion control shall be certified as free of noxious weed seed and shall not contain plastics of any kind.

Mitigation Measure BIO-7 **Post-Construction Erosion Control.** After construction, if disturbed areas are to be seeded for erosion control, the contractor shall reseed using seed mixtures that do not contain invasive, non-native species; they shall use mixes composed only of native species or sterile non-native species.

Herbicides shall not be applied within 100 feet of the creek unless specifically approved by regulatory agencies. If approved, herbicides that have been approved by the U.S. Environmental Protection Agency for use in or adjacent to aquatic habitats may be used as long as label instructions are followed, and applications avoid or minimize impacts on covered species and their habitats. Herbicide drift shall be minimized by applying the herbicide as close to the target area as possible.

Mitigation Measure BIO-8 **Wetlands Mitigation Credits.** Prior to construction or concurrent with work**,** compensation for impacts to jurisdictional waters shall be achieved through one of the following options: (1) the City shall purchase mitigation credits from one or more mitigation banks approved by the U.S. Army Corps of Engineers, the RWQCB, and the CDFW that include the project site within their service areas; (2) the

City shall purchase and preserve an approved, off-site parcel with establishment of a conservation easement, development of a management plan, and provision of a perpetual endowment sufficient to cover management of protected lands; or (3) a combination of the above two approaches.

Significance Determination after Mitigation: Less than Significant

d. Would the project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Much of the project site occurs within a highly urbanized environment and has limited value as wildlife habitat. Las Trampas Creek does not provide habitat for anadromous fish due to drop structures downstream of the project site. Other wildlife species, such as river otter and western pond turtle, use Las Trampas Creek as a movement corridor. Trees along the creek and South Main Street provide nesting and foraging habitat for migratory birds. In addition, cliff swallow nests were observed under the bridge during the general plant and animal survey conducted on September 15, 2017. The swallows likely return to the bridge to nest each year and are likely to be present at the time of construction. With implementation of **Mitigation Measure BIO-1 and BIO-2,** which requires pre-construction surveys for Western pond turtle and Nesting Bird Protection measures, impacts associated with use or movement of a native resident or migratory wildlife species would be reduced to a less-than-significant level.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures BIO-1 and BIO-2 would be implemented to avoid impacts to inference with the movement of migratory fish or wildlife species associated with construction from the proposed project.

Significance Determination after Mitigation: Less than Significant

e. Would the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

The project would result in the removal of 14 trees including 1 London plane, 2 valley oaks, 3 coast live oaks, 1 arroyo willow, 1 red willow, 3 coast redwoods, 2 black walnuts, and 1 evergreen oak. Trees would be permanently removed from the project site to establish access for construction equipment, to allow for existing bridge demolition, to allow for the reconstruction of the creek banks, and to allow demolition and reconstruction of the sidewalk and median. Projects resulting in tree removals on private land are required to apply for permits from the City and must comply with the Walnut Creek Tree Ordinance. Though trees slated for removal in the project site are not on private land, **Mitigation Measures BIO-9 and BIO-10** would be implemented to reduce potential impacts associated with tree removal within the project site and comply with the requirements under the tree ordinance. With implementation of **Mitigation Measure BIO-9,** which require tree protection measures and **Mitigation Measure BIO-10**, which requires either payment of an in-lieu fee or replanting in kind tree species at a 1:1 ratio in accordance with the City of Walnut Creek's Tree Protection Ordinance, project impacts to trees would be reduced to less-than-significant levels.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures BIO-9 and BIO-10 would be implemented to avoid impacts to local policies or ordinances protecting biological resources associated with construction and operations of the proposed project:

Mitigation Measure BIO-9 **Tree Protection Measures.** Prior to and during construction, the City's Construction Contractor shall implement the following recommended actions to protect trees:

- Tree Avoidance. The project would retain as many existing trees as possible on the project site.

- Tree Protection Fencing. Tree protection fencing would be used during construction to prevent direct damage to trees that would not be removed during construction (avoided trees). The fencing would consist of a 6-foot-high ESA fence (or other material approved by the City of Walnut Creek). The fence would be installed around the dripline of each retained tree. All fence sections would be clearly marked with a sign stating, "This is a Tree Protection Zone (TPZ) and no one is allowed to disturb this area". The sign would list contact information for the contractor and the arborist, and clearly state that a violation of the TPZ would result in a stop work order.

- Construction Monitoring. The existing ground within the dripline of any tree would not be cut, filled, or compacted unless otherwise approved by the City of Walnut Creek. Mechanical excavation within the dripline of any tree, when permitted, would be conducted in a manner that minimizes root damage and would be monitored by a certified arborist.

- Storage of Construction Equipment and Materials. No oil, gasoline, chemicals, liquid waste, solid waste, heavy construction machinery, or other construction materials would be stored or allowed to stand within the dripline of any avoided tree. No equipment would be washed within the dripline of any avoided tree.

- Trimming. Pruning of any retained tree would be consistent with good pruning practices as outlined in the International

Society of Arboriculture's Tree Pruning Guidelines and the American National Standards Institute for tree work (ANSI A-300).

Mitigation Measure BIO-10 **Compensatory Tree Mitigation.** Compensatory mitigation may consist of an in-lieu fee to be paid prior to construction, onsite replanting, or off-site restoration. For replanting, within a year from the start of construction, the City shall complete mitigation plantings only in areas that fall within the CDFW jurisdiction of the same species at a 1:1 ratio, in accordance with the mitigation requirements under the City's Tree Protection Ordinance. For off-site restoration, replacement would need to be in the same watershed and for equivalent or higher habitat value.

Significance Determination after Mitigation: Less than Significant

f. Would the project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

The project site is not within any adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved habitat conservation plan. The project would have no impact on an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved habitat conservation plan.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.5 CULTURAL RESOURCES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	☐	☐	☐	☒
b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c. Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

3.5.1 Environmental Setting

The *Historic Property Survey Report for Federal Project BRLS-5225(026)* (HPSR) was prepared for the project (LSA 2021) and approved by Caltrans in August 2021 (Appendix C). Preparation of the HPSR included background research (including records searches and pertinent literature reviews), consultation with interested parties, and fieldwork. The information included in this section is based on the findings as documented in the HPSR.

The project site (discussed in the HPSR as the Area of Potential Effects [APE]) includes the maximum extent of ground disturbance associated with the project, including bridge demolition and construction, street demolition and construction, installation of streambank erosion control measures, utility replacement, and staging areas. It is located within urbanized downtown Walnut Creek, which was inhabited by Native Americans, specifically the Bay Miwok people, prior to European contact. The HPSR concluded that precontact and historic-period subsurface archaeological deposits may be present in the project site.

3.5.2 Project Impact Analysis

a. Would the project cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?

CEQA defines a "historical resource" as a resource that meets one or more of the following criteria: (1) listed in, or determined eligible for listing in, the California Register of Historical Resources (California Register); (2) listed in a local register of historical resources as defined in the California Public Resources Code (PRC) Section 5020.1(k); (3) identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or (4) determined to be a historical resource by a project's lead agency (PRC Section 21084.1 and *State CEQA Guidelines* Section 15064.5(a)).

No historical resources were identified within the project site as a result of the work conducted as part of the HPSR preparation. The background research did not identify any previously recorded archaeological cultural resources in the project site and the fieldwork (consisting of a pedestrian survey and a subsurface archaeological investigation) did not identify any previously unknown subsurface archaeological deposits.

As such, there are no known historical resources as defined in Section 15064.5 of the *State CEQA Guidelines* located within the project site. The project would not cause a substantial adverse change in the significance of a historical resource, and no mitigation is required.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

An archaeological sensitivity assessment completed during preparation of the HPSR concluded that the project site is sensitive for precontact and historic-period archaeological deposits. As such, there is potential that ground-disturbing construction activities would impact previously unidentified archaeological resources. **Mitigation Measure CULT-1** requires archaeological monitoring of all ground-disturbing work associated with the project. If archaeological resources are encountered during ground-disturbing work, construction activities in the area of the find would stop and the resource would be evaluated for significance. When archaeological resources are assessed and/or protected as they are discovered, impacts to these resources would be less than significant.

Significance Determination: Potentially Significant Impact

Mitigation Measures: The following mitigation measure would be implemented to avoid impacts to archaeological resources associated with construction of the proposed project:

Mitigation Measure CULT-1 **Archaeological Monitoring.** Prior to issuance of a grading activities for the project, a qualified archaeologist (one who meets the Secretary of the Interior's standards) shall be retained to provide professional archaeological services. The qualified archaeologist (or an archaeologist supervised by the qualified archaeologist) shall be present at the preconstruction conference to provide a brief cultural resources sensitivity training. The qualified archaeologist (or an archaeologist supervised by the qualified archaeologist) shall conduct on-site archaeological monitoring during all ground-disturbing work associated with the project. The monitoring archaeologist shall be empowered to temporarily halt or redirect work to allow for the sampling, identification, and evaluation of resources deemed by the qualified archaeologist to potentially be historical resources or unique archaeological resources under the California Environmental Quality Act (CEQA).

Should archaeological resources be discovered during project work, ground-disturbing construction activities shall be halted within 50 feet of the find and work shall be redirected to allow for the proper evaluation for significance and treatment of the resources, which may include additional cultural resources work. Additional cultural resources work, if determined necessary, may include, but is not limited to, collection and documentation of artifacts, documentation of the cultural resources on State of California Department of Parks and Recreation (DPR) Series 523 forms, or subsurface archaeological testing. Upon completion of any cultural resources work for the project, the archaeologist shall prepare a report to document the methods and results of the work. This report shall be submitted to the City of Walnut Creek, any descendant community involved in the investigation(s), and the Northwest Information Center (NWIC).

Significance Determination after Mitigation: Less than Significant

c. Would the project disturb any humans remains, including those interred outside of formal cemeteries?

No human remains have been identified within the project site. However, consultation with a Native American representative of the Ohlone Indian Tribe, Inc., conducted during preparation of the HPSR, indicated previous projects had identified Native American burials in the vicinity of the project site. Additionally, undiscovered human remains may be present below the ground surface on any property.

Implementation of **Mitigation Measure CULT-2** would reduce potential impacts on unknown buried human remains to a less-than-significant level.

Significance Determination: Potentially Significant Impact

Mitigation Measures: The following mitigation measure would be implemented to avoid impacts to human remains associated with construction from the proposed project:

Mitigation Measure CULT-2 **Discovery of Human Remains.** In the event that human remains are encountered on the project site, work within 50 feet of the discovery shall be redirected and the Contra Costa County Coroner notified immediately consistent with the requirements of California Code of Regulations (CCR) Section 15064.5(e). State Health and Safety Code Section 7050.5 states that no further disturbance shall occur until the County Coroner has made a determination of origin and disposition pursuant to Public Resources Code (PRC) Section 5097.98. If the remains are determined to be Native American, the County Coroner shall notify the Native American Heritage Commission (NAHC) within 24 hours, which shall determine and notify a Most Likely Descendant (MLD). With the permission of the property owner, the MLD may inspect the site of the discovery. The MLD shall complete the inspection within 48 hours of being granted access to the project site. The MLD may recommend scientific removal and nondestructive analysis of human remains and items associated with Native American burials.

3.6 ENERGY

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b. Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐

3.6.1 Environmental Setting

Typically, energy consumption is associated with fuel used for vehicle trips and electricity and natural gas use.

Electricity is a manmade resource. The production of electricity requires the consumption or conversion of energy resources (including water, wind, oil, gas, coal, solar, geothermal, and nuclear resources) into energy. Electricity is used for a variety of purposes (e.g., lighting, heating, cooling, and refrigeration, and for operating appliances, computers, electronics, machinery, and public transportation systems) (United States Energy Information Administration [EIA] 2021a).

Natural gas is a nonrenewable fossil fuel. Fossil fuels form when layers of decomposing plant and animal matter are exposed to intense heat and pressure under the surface of the Earth over millions of years. Natural gas is a combustible mixture of hydrocarbon compounds (primarily methane) that is used as a fuel source. Natural gas is found in naturally occurring reservoirs in deep underground rock formations. Natural gas is used for a variety of uses (e.g., heating buildings, generating electricity, and powering appliances such as stoves, washing machines and dryers, gas fireplaces, and gas grills) (EIA 2021b).

Petroleum is also a nonrenewable fossil fuel. Petroleum is a thick, flammable, yellow-to-black mixture of gaseous, liquid, and solid hydrocarbons that occurs naturally beneath the earth's surface. Petroleum is primarily recovered by oil drilling. It is refined into a large number of consumer products, primarily fuel oil, gasoline, and diesel.

3.6.2 Impact Analysis

a. Would the project result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during Project construction or operation?

This analysis evaluates energy consumption for both construction and operation of the project, including diesel fuel use for construction off-road equipment.

3.6.2.1 Construction

Construction of the project would require the use of energy to fuel grading vehicles, trucks, and other construction vehicles. All or most of this energy would be derived from nonrenewable resources. To increase energy efficiency on the site during project construction, the project would restrict equipment idling times to 5 minutes or less and would require construction workers to shut off idle equipment, as required by **Mitigation Measure AIR-1,** detailed in Section 3.3, Air Quality. In addition, construction activities are not anticipated to result in an inefficient use of energy as gasoline and diesel fuel would be supplied by construction contractors who would conserve the use of their supplies to minimize their costs on the project. Energy usage on the project site during construction would be temporary in nature and would be relatively small in comparison to the State's available energy sources. Therefore, construction energy impacts would be less than significant.

3.6.2.2 Operation

As discussed above, typically, energy consumption is associated with fuel used for vehicle trips and electricity and natural gas use. The project would replace an existing bridge to improve safety and efficiency. The project would not result in new vehicle trips or significantly increase vehicle miles traveled (VMT) and, therefore, would not increase fuel usage. In addition, implementation of the project would not include lighting or features that could contribute to a significant new source of electricity and natural gas usage. Therefore, implementation of the project would not result in a long-term demand for electricity and natural gas, nor would the project require new service connections or construction of new off-site service lines or substations to serve the project. The nature of proposed improvements would not require substantial amounts of energy for either construction or maintenance purposes. Therefore, the project would not use nonrenewable resources in a wasteful or inefficient manner. Therefore, operational energy impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: Mitigation Measure AIR-1 would be implemented to avoid impacts to energy consumption associated with construction of the proposed project.

Significance Determination after Mitigation: Less than Significant

b. Would the project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

In 2002, the Legislature passed Senate Bill 1389, which required the California Energy Commission (CEC) to develop an integrated energy plan every 2 years for electricity, natural gas, and transportation fuels, for the California Energy Policy Report. The plan calls for the State to assist in the transformation of the transportation system to improve air quality, reduce congestion, and increase the efficient use of fuel supplies with the least environmental and energy costs. The CEC approved the *2020 Integrated Energy Policy Report* in March 2021 (CEC 2020). The *2020 Integrated Energy Policy Report* provides the results of the CEC's assessments of a variety of energy issues facing California. Many of these issues would require action if the State were to meet its climate, energy, air quality, and other environmental goals while maintaining energy reliability and controlling costs. The *2023 Integrated Energy Policy Report* covers a broad range of topics, including implementation of Senate Bill 350, integrated resource planning, distributed energy resources, transportation electrification, solutions to increase resiliency in the electricity sector, energy efficiency, transportation electrification, barriers faced by disadvantaged communities, demand response, transmission and landscape-scale planning, the California Energy Demand Preliminary Forecast, the preliminary transportation energy demand forecast, renewable gas (in response to Senate Bill 1383), updates on California electricity reliability, natural gas outlook, and climate adaptation and resiliency.

As indicated above, energy usage in the project site during construction and operation would be relatively small in comparison to the State's available energy sources, and energy impacts would be negligible at the regional level. Because California's energy conservation planning actions are conducted at a regional level, and because the project's total impact to regional energy supplies would be minor, the project would not conflict with California's energy conservation plans as described in the CEC's *2023 Integrated Energy Policy Report*. Thus, as shown above, the project would avoid or reduce the inefficient, wasteful, and unnecessary consumption of energy and not result in any irreversible or irretrievable commitments of energy. Impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.7 GEOLOGY AND SOILS

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii. Strong seismic ground shaking?	☐	☐	☒	☐
iii. Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv. Landslides?	☐	☐	☒	☐
b. Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒
f. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐

3.7.1 Environmental Setting

The *Draft Preliminary Foundation Report Las Trampas Bridge Replacement on South Main Street City of Walnut Creek, California* (WRECO 2019) was prepared for the project in July 2019 (see Appendix E). The information included in this section is based on that study.

3.7.1.1 Geology

Walnut Creek is within the Coast Range Geomorphic Province of California, which is predominantly composed of thick late Mesozoic and Cenozoic sedimentary rocks (California Geological Survey 2015). The United States Geological Survey (USGS) identifies in its published map, *Preliminary Geologic Map of the Walnut Creek Quadrangle, Contra Costa County, California,* that the project site has surficial alluvial deposits from the Holocene Epoch and is bordered to the west by older alluvial deposits from the Pleistocene Epoch (Dibblee 1980).

3.7.1.2 Topography

The project site is in a fully developed area that has generally flat to gently rolling topography. Farther away from the project site, the topography of the region becomes more pronounced with ridgelines and hilltops in the distance.

3.7.1.3 Soils

The project site is composed of two soils, Clear Lake clay (Cc), 0 to 15 percent slopes, Major Land Resource Area (MLRA) 15, and Conejo clay loam (CeA), 0 to 2 percent slopes. Clear Lake clay is found in basin-form remnants and its parent material is clayey alluvium derived from metamorphic and sedimentary rock. Conejo clay loam is found in valleys and its parent material is alluvium derived from sedimentary rock. Additional attributes of these soils are described in **Table B: Project Site Soils**, some of which are explained in more detail below.

Table B: Project Site Soils

Attribute	Clear Lake Clay (Cc), 0–15% Slopes, MLRA 15	Conejo Clay Loam (CeA), 0–2% Slopes
Proportion of project site	65.6%	34.4%
Depth to restrictive feature	More than 80 inches	More than 80 inches
Natural drainage class	Poorly drained	Well drained
Runoff class	High	Low
Depth to water table	More than 80 inches	More than 80 inches
Frequency of flooding	Rare	None
Frequency of ponding	Frequent	None
Hydrologic soil group	C	C
K factor, whole soil	0.24	0.20
Linear Extensibility	8.3%	4.5%

Source: National Resources Conservation Service (2017).
MLRA = Major Land Resource Area

3.7.2 Impact Analysis

a. Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

Surface rupture occurs when the ground surface breaks due to fault movement during an earthquake. The location of surface rupture generally can be assumed to be along an active or potentially active major fault trace. According to the *City of Walnut Creek General Plan 2025 Environmental Impact Report* (City of Walnut Creek 2005), the Concord Fault has been identified as the only "active" fault in Walnut Creek. The edge of the Concord Fault Alquist-Priolo Zone is 4.3 miles east of the project site. Several other potentially active faults are closer to the project site than the Concord Fault. Although there is the possibility that ground rupture could occur along these mapped fault traces, the project site is a minimum of 0.59 mile from each of these fault lines. At this distance, it is unlikely that fault rupture would occur within the project site, because earthquake fault zones delineated around active faults average 0.25 mile wide. Therefore, impacts associated with rupture of a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map or other known faults would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No Mitigation is Required

Significance Determination after Mitigation: Less than Significant

ii. Strong seismic ground shaking?

The project site is in an area of California that is considered to have a high earthquake shaking potential. However, the project would be engineered and designed based on the Caltrans' Seismic Design Criteria (2019), which include measures for bridges to reduce their susceptibility to strong seismic shaking. Therefore, impacts associated with strong seismic ground shaking would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

iii. Seismic-related ground failure, including liquefaction?

The project site is underlain by soils with a moderate to high susceptibility for liquefaction. Given the soils on the project site and the project site's potential for strong seismic shaking events, the project site could be susceptible to liquefaction events. However, the project would be engineered and designed based on the Caltrans' Seismic Design Criteria, which include measures for bridges to reduce their susceptibility to liquefaction. Therefore, impacts associated with seismic-related ground failure, including liquefaction, would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

iv. Landslides?

The project site is generally flat and therefore the likelihood of landslides is low. The proposed project would not alter slopes in the project site in a manner that would increase the risk of landslides. Furthermore, the project site of the new bridge project would be designed in accordance with modern engineering standards to withstand potential landslide activity. Implementation of the project would not adversely affect persons or structures due to landslides. Impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

b. Would the project result in substantial soil erosion or the loss of topsoil?

The project site is within a densely urbanized area and is largely covered by concrete or pavement. At the location of the project site, Las Trampas Creek flows through a concrete-lined channel. The project would require the removal of vegetation within the project site during construction as well as the removal and reconstruction of concrete. However, implementation of **Mitigation Measure HYD-1 and HYD-2**, which require compliance with the Construction General Permit, the preparation of a Stormwater Pollution Prevention Plan (SWPPP), and the preparation of a construction erosion and sediment control plan in compliance with the City of Walnut Creek Municipal Code. Implementation of **Mitigation Measures HYD-1 and HYD-2** would reduce any impacts to soil erosion or loss of topsoil to less-than-significant levels**,** and no further mitigation measures are required.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures HYD-1 and HYD-2 would be implemented to avoid impacts during construction that could result in substantial soil erosion or loss of topsoil.

Significance Determination after Mitigation: Less than Significant

c. Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

As described above, the potential hazards from liquefaction and lateral spreading events at the project site are moderate to high, whereas the potential hazards from landslide events at the project site are low. The project would be engineered and designed based on the Caltrans' Seismic Design Criteria, which include measures for bridges to reduce their susceptibility to soil instability. Therefore, impacts associated with seismic-related ground failure, including liquefaction, subsidence, lateral spreading, and landslides would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

d. Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

The northern portion of the project site is atop soils with a high shrink-swell potential and the southern portion of the project site is atop soils with a moderate shrink-swell potential. Design of the project would include detailed analysis following the procedures of the Caltrans' Memo to Designers 20-15 (Caltrans 2017a), which outlines how to estimate and account for lateral spreading in bridge design. The project would be engineered and designed based on the Caltrans' Seismic Design Criteria. Therefore, impacts associated with expansive soil creating substantial risks to life or property would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

e. Would the project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

The project does not propose the use or construction of septic tanks or alternative wastewater disposal systems. Such facilities are not needed, as the project would be limited to bridge replacement and roadway improvements. The project would have no impact on the area's ability to adequately support the use of septic tanks or alternative wastewater disposal systems.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

f. Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

No paleontological resources or unique geologic features are known to exist within the APE. If such resources are discovered during project construction, implementation of **Mitigation Measure GEO-1** would reduce potential impacts to paleontological resources to a less-than-significant level.

Significance Determination: Potentially Significant Impact

Mitigation Measures: The following mitigation measure would be implemented to avoid impacts to paleontological resources associated with construction from the proposed project:

Mitigation Measure GEO-1 **Discovery of Unknown Paleontological Resources.** During construction, if paleontological resources are encountered, work shall be halted immediately within 50 meters (165 feet) of the find until a professional paleontologist can evaluate it. The City of Walnut Creek Public Works Department and a professional paleontologist shall be immediately contacted by the responsible individual present on site. When contacted, the project planner and the paleontologist shall immediately visit the site to determine the extent of the resources and to develop proper mitigation measures required for the discovery per the *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources* put forth by the Society of Vertebrate Paleontology (2010).

Significance Determination after Mitigation: Less than Significant

3.8 GREENHOUSE GAS EMISSIONS

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

3.8.1 Environmental Setting

Greenhouse gases (GHGs) are present in the atmosphere naturally, are released by natural sources, or form from secondary reactions taking place in the atmosphere. The gases that are widely seen as the principal contributors to human-induced global climate change are:

- Carbon dioxide (CO_2),
- Methane (CH_4),
- Nitrous oxide (N_2O),
- Hydrofluorocarbons,
- Perfluorocarbons, and
- Sulfur hexafluoride (SF_6).

Over the last 200 years, humans have caused substantial quantities of GHGs to be released into the atmosphere. These extra emissions are increasing GHG concentrations in the atmosphere and enhancing the natural greenhouse effect, believed to be causing global warming. While manmade GHGs include naturally occurring GHGs such as CO_2, CH_4, and N_2O, some gases, like hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are completely new to the atmosphere.

Certain gases, such as water vapor, are short-lived in the atmosphere. Others remain in the atmosphere for significant periods of time, contributing to climate change in the long term. Water vapor is excluded from the list of GHGs above because it is short-lived in the atmosphere and its atmospheric concentrations are largely determined by natural processes, such as oceanic evaporation.

These gases vary considerably in terms of Global Warming Potential (GWP), a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The GWP is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and length of time that the gas remains in the atmosphere ("atmospheric lifetime"). The GWP of each gas is measured relative to CO_2, the most abundant GHG. The definition of GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to the ratio of heat trapped by one unit mass of CO_2 over a specified time period. GHG emissions are typically measured in terms of pounds or tons of "CO_2 equivalents".

3.8.2 Impact Analysis

a. Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

This section describes the project's construction- and operational-related GHG emissions and contribution to global climate change. The Bay Area Air Quality Management District (BAAQMD) has not addressed emission thresholds for construction in its 2017 CEQA Guidelines; however, the BAAQMD encourages quantification and disclosure. Thus, construction emissions are discussed in this section.

3.8.2.1 Construction Activities

Construction activities associated with the project would produce combustion emissions from various sources. During construction, GHGs would be emitted through the operation of construction equipment and from worker and builder supply vendor vehicles, each of which typically use fossil-based fuels to operate. The combustion of fossil-based fuels creates GHGs such as CO_2, CH_4, and N_2O. Furthermore, CH_4 is emitted during the fueling of heavy equipment. Exhaust emissions from on-site construction activities would vary daily as construction activity levels change.

The BAAQMD does not have an adopted threshold of significance for construction-related GHG emissions. However, lead agencies are encouraged to quantify and disclose GHG emissions that would occur during construction. Using Roadmod, it is estimated that construction of the project would generate 2,637 metric tons of CO_2 equivalents. Implementation of **Mitigation Measure AIR-1**, as provided in Section 3.3, Air Quality, would reduce GHG emissions by reducing the amount of construction vehicle idling and by requiring the use of properly maintained equipment. Therefore, project construction impacts associated with GHG emissions would be considered less than significant with mitigation incorporated.

3.8.2.2 Operational Emissions

Mobile-source GHG emissions include project-generated vehicle trips for the project. Area-source emissions include activities such as landscaping and maintenance on the project site. As discussed above, the project would replace an existing bridge to improve safety and efficiency. The project would not increase the existing vehicle use at the project site and, therefore, would not result in an increase in the generation of GHG emissions from existing conditions. Therefore, the project would have a less-than-significant impact on the environment related to GHG emissions, and no mitigation measures are required.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure AIR-1 would be implemented to avoid impacts to GHG emissions associated with construction and operation of the proposed project.

Significance Determination after Mitigation: Less than Significant

b. Would the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

The City adopted its Sustainability Action Plan (SAP) in July 2023 as an update to the previous Climate Action Plan (CAP) in April 2012. The City's SAP meets the BAAQMD requirements for a Qualified Greenhouse Gas Reduction Strategy. The SAP serves as an ongoing planning process that assesses, prepares, and mitigates climate change. The SAP also identifies how the City would achieve its GHG reduction through sustainability strategies and actions that would promote sustainability and resilience. The SAP provides 21 sustainability strategies that are organized in the following sectors: energy supply, buildings, transportation and land use, water and wastewater, waste, outdoor equipment, and community health and resilience. The SAP includes the following sustainability strategies:

- Energy Supply
  - **1:** Require transition to renewable and carbon-free energy sources.
- Buildings
  - **2:** Facilitate energy efficiency and electrification at existing municipal buildings and infrastructure.
  - **3:** Facilitate energy efficiency and electrification at existing buildings and infrastructure.
  - **4:** Require electrification and low-carbon materials for new buildings.
- Transportation and Land Use
  - **5:** Expand adoption and accessibility of electric vehicle modes.
  - **6:** Increase availability of electric vehicle charging.
  - **7:** Electrify the City's vehicle fleet.
  - **8:** Promote sustainable development, which reduces vehicle miles traveled and greenhouse gas emissions.
  - **9:** Ensure safe, efficient, and reliable mobility options throughout the community.
  - **10:** Support reduction of school-related emissions and vehicle miles traveled.
  - **11:** Expand and improve transportation partnerships to reduce local and regional vehicle miles traveled and emissions.
- Water and Wastewater
  - **12:** Expand City-led efforts to reduce water use community-wide.

- **13:** Expand water reuse community wide.

- Waste
  - **14:** Reduce the amount of generated landfilled waste so ensure a diversion rate of 75 percent by 2030.
- Outdoor Equipment
  - **15:** Transition to pollution-free outdoor equipment.
- Community Health and Resilience
  - **16:** Reduce the impacts of poor air quality and improve air quality in the community.
  - **17:** Decrease the community vulnerabilities to climate change hazards.
  - **18:** Create a network of local resilience hubs and support regional resilience hubs.
  - **19:** Support a fair and just countrywide and statewide transition to a low-carbon economy.
  - **20:** Reduce carbon emissions through local and in-state nature-based solutions, including sequestration.
  - **21:** Explore unique community-led sustainability techniques.

As the project would replace an existing bridge to improve safety and efficiency, the SAP strategies would not apply to the project. Therefore, the project would not conflict with plans, policies, or regulations adopted for the purpose of reducing GHG emissions. In addition, the project would not result in a substantial increase in GHG emissions. Therefore, the project would not conflict with the City's SAP. This impact would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.9 HAZARDS AND HAZARDOUS MATERIALS

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☒	☐	☐
d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☒	☐	☐
e. For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
g. Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

3.9.1 Environmental Setting

The parcels immediately surrounding the project site consist of commercial and retail developments, a parking structure, and Las Trampas Creek. South Main Street is a five-lane arterial road that runs from Mt. Diablo Boulevard (where it turns into North Main Street) to I-680 Walnut Creek, and includes the existing Las Trampas Creek Bridge, Bridge No. 28C-0075, that crosses over Las Trampas Creek. Within the project limits, South Main Street remains generally flat in elevation. Las Trampas Creek flows approximately southwest to northeast across the project site.

WRECO prepared the *Hazardous Waste Initial Site Assessment/Preliminary Site Investigation for the Las Trampas Creek Bridge at South Main Street Replacement Project Walnut Creek, California* (ISA/PSI) (WRECO 2018a) for the project in October 2018 (see Appendix F). The ISA/PSI concluded that there was no evidence of Activity and Use Limitations at the project site or adjacent parcels. However, several current and potential Recognized Environmental Conditions (RECs) were identified during preparation of the ISA/PSI, including:

- A former Texaco service station (circa 1980s to 1991), 1275 Main Street: petroleum hydrocarbons in the soil and the groundwater (case closed April 2001)

- The Virginia Cleaners Facility (Diablo Cleaners 1957 to 1973; Virginia Cleaners 1973 to 1998), 1305 and 1335 South Main Street: tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride in soil and groundwater

- Former Unocal Station (1950 to 1978), 1322 South Main Street: petroleum hydrocarbons in the soil and the groundwater (case closed May 1998)

- Former ARCO service station (1955 to 1978), 1345 South Main Street: petroleum hydrocarbons, VOCs, lead, and polyaromatic hydrocarbons in the soil and the groundwater

The findings of the RECs triggered the need to conduct the ISA/PSI for the project, the results of which are incorporated in the analysis presented below. Soil samples (seven) and groundwater samples were tested for benzene, toluene, ethylbenzene, xylenes (BTEX), methyl tertiary butyl ether (MTBE), total petroleum hydrocarbons as gasoline (TPHg), total petroleum hydrocarbons as diesel (TPHd), total petroleum hydrocarbons as motor oil (TPHmo), VOCs, and metals. Concentrations of metals in the soil tests were below the Regional Water Quality Control Board (RWQCB) Environmental Screening Levels (ESLs), total threshold limit concentration and Soluble Threshold Limit Concentrations limits, except for arsenic. Arsenic concentrations in the soil samples ranged from 3.8 to 9.2 milligrams per kilogram (mg/kg), which exceeds the ESLs for residential, commercial-industrial, and construction workers. Of the seven soil samples collected, only four soil samples had detectable concentrations of BTEX, MTBE, TPHg, TPHd, TPHmo, and VOCs below the Tier 1 RWQCB ESLs.

Soil sample S-01-A (5-foot depth) contained detectable TPHd (10 mg/kg) and TPHmo (130 mg/kg) concentrations. Soil sample SB-02 (5-foot depth) contained detectable TPHd (1.7 mg/kg) and TCE (0.0073 mg/kg) concentrations. Soil sample SB-02 (15-foot depth) contained a detectable TPHg (3.4 mg/kg) concentration. Soil sample SB-02 (20-foot depth) contained detectable TCE (0.0075 mg/kg) and cis-1,2-dichloroethene (DCE) (0.011 mg/kg) concentrations. Groundwater sample concentrations exceeded RWQCB Tier 1 ESLs for TPHg, TPHd, ethylbenzene and xylenes, DCE, PCE, and vinyl chloride, and most water quality objectives (WQO), California Toxics Rule, and United States Environmental Protection Agency (USEPA) National Toxics Rule criteria for surface water for these constituents.

The ISA/PSI prepared for the project also tested for asbestos-containing materials (ACM) and lead-based paint (LBP) in the existing bridge that would be demolished.

3.9.1.1 Asbestos-Containing-Materials

Three of the four suspected ACM samples, collected from the Las Trampas Creek Bridge roadway and concrete sidewalks, were below detection limits for asbestos content (less than 1 percent). One sample contained 10 percent asbestos which exceeds the USEPA and California Department of Public Health (CDPH) regulatory threshold of 1 percent, and Department of Toxic Substances Control (DTSC) standard with concentrations greater than 1 percent asbestos. Another sample from the covering along the utility piping on the underside of the bridge (on both the eastern and western sides) contained 10 percent asbestos, an amount that exceeds the USEPA and CDPH regulatory threshold of 1 percent. The bridge structure demolition is regulated by the USEPA's National Emission Standards for Hazardous Air Pollutants regulations as ACM or Regulated Asbestos-Containing Material, and it is regulated by the California Division of Occupational Safety and Health (Cal/OSHA) as ACM, and DTSC for waste disposal.

3.9.1.2 Lead-Based Paint

Suspect LBP samples, collected from the Las Trampas Creek Bridge area, had lead concentrations that ranged from not detected (ND) to 105 parts per million (ppm), that are well below the regulatory threshold value of 5000 ppm, provided by the USEPA and CDPH (0.5 percent by weight or 5,000 ppm by paint chip analysis). Cal/OSHA considers any level of lead in paint to be a potential exposure hazard for construction workers.

3.9.2 Impact Analysis

a. Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Construction of the project would temporarily increase the regional transport, use, and disposal of construction-related hazardous materials and petroleum products (e.g., diesel fuel, lubricants, paints and solvents, and cement products containing strong basic or acidic chemicals). These materials are commonly used at construction sites, and the construction activities would be required to comply with applicable State and federal regulations for proper transport, use, storage, and disposal of excess hazard hazardous materials and hazardous construction waste. In addition, **Mitigation Measures HYD-1, HYD-2, and HYD-3,** provided in Section 3.10, Hydrology and Water Quality, of this IS/MND, would require compliance with applicable permits and municipal code requirements to avoid potential impacts to water quality due to spills or runoff from hazardous materials used during construction.

The project would not alter the existing use or vehicle use at the project site. Therefore, the use of hazardous materials during project operations (i.e., bridge and roadway maintenance) would not change from the existing condition and the project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

Overall, with implementation of **Mitigation Measures HYD-1, HYD-2, and HYD-3** during construction, the project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. Impacts would be less than significant, and no further mitigation measures are required.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures HYD-1, HYD-2, and HYD-3 would be implemented to avoid impacts to the project from the routine transport, use or disposal of hazardous materials associated with construction and operation of the proposed project.

Significance Determination after Mitigation: Less than Significant

b. Would the project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

During construction activities, the project has the potential to result in a release of hazardous materials into the environment, due to remnant materials in on-site soil and ACM/LBP in the existing bridge to be demolished. Soil and groundwater samples were taken as part of the preparation of the ISA/PSI for the project and determined both contained materials that exceed hazardous materials thresholds. Seven soil samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, and metals. All soil samples had arsenic concentrations that exceeded the ESLs for residential, commercial/industrial uses, and construction worker exposure but were below the total threshold concentration limit. Laboratory results indicated low detectable concentrations of TPHg (3.4 mg/kg), TPHd (10 mg/kg), and TPHmo (130 mg/kg), and TPHd (1.7 mg/kg). Soil from 5–20 feet below ground surface may contain arsenic that exceeds ESLs (residential, commercial/industrial, and construction worker), and shallow soil contains low concentrations of petroleum hydrocarbons. Therefore, implementation of **Mitigation Measure HAZ-1** would be implemented to limit construction workers' exposure to hazards and hazardous materials during construction.

Two groundwater samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, VOCs, and metals. Groundwater samples exceeded RWQCB Tier 1 ESLs for arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, silver, vanadium, zinc, TPHg, and TPHd. In addition, sample ethylbenzene and xylenes had Tier 1 ESL exceedances for mercury, TPHmo, ethylbenzene, and xylenes; sample vinyl chloride had Tier 1 ESL exceedances for DCE, TCE, and vinyl chloride. Most of these constituents exceeded the RWQCB WQOs, California Toxics Rule, and USEPA National Toxics Rule criteria for surface water. Therefore, the applicant shall obtain coverage under the SFBRWQCB volatile Organic Compound (VOC) and Fuel NPDES General Permit (Order No. R2-2017-0048) prior to discharging to Las Trampas Creek, as required in **Mitigation Measure HYD-3**.

Lead-based paint samples were taken from the existing Las Trampas Creek Bridge to determine if lead could be released during demolition activities. Sampling indicated that lead concentrations up to 105 parts per million (ppm) were well below the USEPA and the CDPH regulatory threshold values of 5,000 ppm. Based on the lead concentrations, debris from the demolition of the existing bridge can be disposed of at a Class II or Class III landfill.

Samples of the existing bridge were also taken to determine concentrations of ACM as the bridge was originally built in 1919. Three of the four samples that were collected were below detection limits for asbestos content; however, one sample contained 10 percent asbestos which exceeds the USEPA and CDPH regulatory threshold of 1 percent and DTSC standard of friable material with concentrations greater than 1 percent asbestos. The covering along the utility piping on the underside of the existing bridge also contained 10 percent asbestos, which exceeds the USEPA and CDPH regulatory threshold of 1 percent. For these reasons, implementation of **Mitigation Measure HAZ-1** would ensure ACMs are not released during demolition activities and are disposed of properly.

Once the project is complete and operational, no features associated with the project would create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

Significance Determination: Potentially Significant Impact

Mitigation Measures: In addition to the measures listed below, refer to **Mitigation Measure HYD-3** in Section 3.10, which would be implemented to address impacts from groundwater dewatering during construction of the project.

The following mitigation measure would be implemented to avoid impacts to the public and environment from hazardous materials associated with construction from the proposed project:

Mitigation Measure HAZ-1 The following remediation measures pertaining to excavated surface soil, painted surfaces, concrete and pipe jackets, and concrete and asphalt demolition waste shall be implemented during project construction and demolition activities and shall be confirmed completed by the City of Walnut Creek (City) Public Works Department, or designee:

- **Excavated Surface Soil:** The Construction Contractor shall dispose of excavated soils as designated or non-hazardous waste at Class II unit or Class III landfills depending on facility acceptance standards. Soil excavated along sewer lines adjacent to the former dry cleaner site shall be screened for tetrachloroethylene (PCE) and its breakdown products to properly classify excavated soils for disposal.

- **Painted Surfaces (Bridge Railing, Light Post, White Roadway Striping, Red Painted Curbs):** The Construction Contractor shall manage debris, construction worker safety, and waste pursuant to the California Division of Occupational Safety and Health (Cal/OSHA) T8 California Code of Regulations (CCR) Section 1532.1.

- **Concrete and Pipe Jacket (Utilities Along the Side of Bridge), Asphalt:** The Construction Contractor shall provide demolition notification to the Bay Area Air Quality Management District (BAAQMD) prior to the commencement of demolition activities. The Construction Contractor shall abate 10 percent potentially friable Asbestos-Containing Material (ACM)/Regulated Asbestos-Containing Material using a State-licensed asbestos abatement contractor prior to demolition. The Construction Contractor shall manage debris and waste pursuant to Cal/OSHA T8 CCR Section 1529.

- **Concrete and Asphalt Waste:** All asphalt grindings shall be disposed of, by the Construction Contractor, or designee, at a Class I landfill or reused in accordance with the California Department of Fish and Wildlife Agreement on AC Grindings, Chunks, and Pieces (1993) and the California Department of Transportation's Asphalt-Concrete and Portland Cement Concrete Grindings Reuse Guidance (2007).

Significance Determination after Mitigation: Less than Significant

c. Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Las Lomas High School, located at 1460 South Main Street, is 0.23 mile south of the project site. After project construction, the newly constructed bridge on South Main Street crossing Las Trampas Creek would operate in a similar manner as under existing conditions; therefore, operation of the project would not result in hazardous emissions or the handling of hazardous materials, substances, or waste in the vicinity of an existing or proposed school.

Construction of the project would include the removal of on-site soil and dewatering activities that may result in the unintentional release of hazardous materials within the vicinity of Las Lomas High School. As discussed under Threshold 3.9 (b), **Mitigation Measure HAZ-1** would be implemented to remediate contaminated soil, groundwater, and debris with ACM and LBP on the project site to ensure proper handling and disposal of such hazardous materials. Implementation of the remediate actions described under **Mitigation Measure HAZ-1**, would require actions addressing the potential release of hazardous materials to avoid impacts to nearby land uses, including Las Lomas High School. Therefore, impacts associated with hazardous emissions or the handling of hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school would be less than significant with mitigation incorporated.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure HAZ-1 would be implemented to avoid impacts that would emit hazardous emissions, materials, or substances within 0.25 mile of a school from construction of the proposed project.

Significance Determination after Mitigation: Less than Significant

d. Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

The ISA/PSI that prepared for the project reviewed lists of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and determined that the project site was not listed as a hazardous materials site. However, the following properties/parcels adjacent or within 500 feet of the project site were identified as RECs during preparation of the ISA:

- A former Texaco service station (circa 1980s to 1991), 1275 Main Street: petroleum hydrocarbons in the soil and the groundwater (case closed April 2001)
- The Virginia Cleaners Facility (Diablo Cleaners 1957 to 1973; Virginia Cleaners 1973 to 1998), 1305 and 1335 South Main Street: PCE, TCE, and vinyl chloride in soil and groundwater
- Former Unocal Station (1950 to 1978), 1322 South Main Street: petroleum hydrocarbons in the soil and the groundwater (case closed May 1998)
- Former ARCO service station (1955 to 1978), 1345 South Main Street – petroleum hydrocarbons, VOCs, lead, and polyaromatic hydrocarbons in the soil and the groundwater

Due to the proximity of the above-identified properties, an ISA/PSI was prepared for the project and soil/groundwater sampling was conducted to determine if the project site has been contaminated through migration of materials from the nearby properties. As described above, soil and groundwater sampling on the site indicated that hazardous materials above threshold levels do exist within the project site boundary. Remediation measures as identified in **Mitigation Measure HAZ-1** would be implemented during project construction and demolition to ensure that a significant hazard to the public or the environment would not occur. Impacts associated with a site, which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment, would be less than significant with mitigation incorporated.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure HAZ-1 would be implemented to avoid impacts from hazardous materials pursuant to Government Code Section 65962.5 from construction of the proposed project.

Significance Determination after Mitigation: Less than Significant

e. Would the project be located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

The nearest public airport is Buchanan Field Airport, 5.8 miles north of the project site. No private airstrips are within the project vicinity. There is a heliport located atop the John Muir Walnut Creek Medical Center, 1.5 miles northwest of the project site. The project site is not within an airport land use plan or within 2.0 miles of a public airport or public use airport. No impact would occur, and no mitigation measures are required.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

f. Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

The project includes the replacement of an existing bridge structure along South Main Street. Once complete, the newly constructed bridge crossing over Las Trampas Creek along South Main Street would operate as under existing conditions; therefore, operation of the project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

South Main Street, where the project is located, is a major thoroughfare through the downtown area of Walnut Creek and provides access to I-680 to the north and to the south of the project site. Prior to construction of the project, there will be a complete road closure at the bridge location until the new bridge is constructed. The new bridge would be constructed utilizing the complete road closure and traffic would be redirected to neighboring streets. As a standard condition, the Construction Contractor of the project, prior to the commencement of construction, would provide the City and emergency responders (fire, police, and ambulance companies) with a construction detour plan to ensure that emergency response or evacuation in the area can still take place. Additionally, as described in **Mitigation Measure TRAN-1**, provided in Section 3.17, Transportation, the City of Walnut Creek Public Works Department would be required to prepare a Transportation Management Plan (TMP) during final design to address detours and notification for emergency service providers, local agencies, and the public during construction. The TMP would include an emergency evacuation plan, the installation of detour signs, and advance notice to local emergency service providers regarding the timing, location, and duration of road closure. Overall, implementation of the project would not substantially impair an adopted emergency response plan or emergency evacuation plan. Impacts would be less than significant with implementation of **Mitigation Measure TRAN-1**.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure TRAN-1 would be implemented to avoid impacts to an adopted emergency response plan or evacuation plan from construction of the proposed project.

Significance Determination after Mitigation: Less than Significant

g. Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The project site is surrounded by urban development and no wildlands are in the project vicinity. Therefore, the project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. Please refer to Section 3.20, Wildfire, of this IS/MND, for a thorough discussion and analysis of wildfire impacts. Impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.10 HYDROLOGY AND WATER QUALITY

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Violate any water quality standards or waste discharge requirements or wastewater discharge requirements or otherwise substantially degrade surface or groundwater quality?	☐	☒	☐	☐
b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impeded sustainable groundwater management of the basin?	☐	☐	☒	☐
c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i. result in substantial erosion or siltation on- or off-site;	☐	☒	☐	☐
ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐
iii. create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage system or provide substantial additional sources of polluted runoff; or	☐	☒	☐	☐
iv. impede or redirect flood flows?	☐	☐	☒	☐
d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☐	☒
e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☒	☐	☐

3.10.1 Environmental Setting

The *Las Trampas Creek Bridge at South Main Street Replacement Project City of Walnut Creek, California Water Quality Assessment Report* (WRECO 2018b) was prepared for this project in November 2018 (see Appendix I). The information for the following section was based on this study.

3.10.2 Impact Analysis

a. Would the project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

The project is located in the Las Trampas Sub-Watershed, within the Walnut Creek Watershed, and is within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). The project is not within a Groundwater Basin, according to the SFBRWQCB Basin Plan (Basin Plan). The primary receiving water for stormwater from the project site is Las Trampas Creek, located within the project site. At the project location, Las Trampas Creek is a concrete-lined channel that flows underground immediately downstream of the South Main Street bridge crossing. Las Trampas Creek converges with San Ramon Creek at Liberty Bell Plaza approximately 0.25 mile downstream of the project site to form Walnut Creek. San Ramon Creek is not affected by the project.

The Basin Plan states the goals and policies, beneficial uses, and water quality objectives that apply to water bodies throughout the San Francisco Bay region. The Basin Plan identifies general water quality objectives for inland surface waters associated with bacteria, bioaccumulation, biostimulatory substances, color, dissolved oxygen, floating material, oil and grease, population and community ecology, pH, radioactivity, salinity, sediment, settleable material, suspended material, sulfide, tastes and odors, temperature, toxicity, turbidity, un-ionized ammonia, and chemical constituents.

Water quality objectives established for groundwaters in the Basin Plan include limits on bacteria, organic and inorganic chemical constituents, radioactivity, and taste and odors. These objectives do not need improvement, so they are not required to follow regulations under the Clean Water Act.

Las Trampas Creek has the following beneficial uses: cold freshwater habitat, preservation of rare and endangered species, warm freshwater habitat, wildlife habitat, contact water recreation, and non-contact water recreation. Walnut Creek, which is close to the project, has the same beneficial uses as Las Trampas Creek, with an additional beneficial use of fish spawning.

During construction, it would be necessary to work in the Las Trampas Creek channel. Construction activities in the channel would consist of demolition of the existing bridge, piles and abutments as well as the removal of existing erosion control measures such as concrete-filled sandbags embedded within the banks.

Temporary impacts to water quality during construction include sediment-laden discharge from excavation activities, pollutant-laden discharge from storage or work areas, and discharge of contaminated groundwater during dewatering activities. Dewatering is anticipated for the project both during shallow excavations near the creek bottom and deeper foundation excavations.

The State Water Resources Control Board (SWRCB) requires dischargers whose projects disturb one or more acres of soil to obtain coverage under the SWRCB's National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) (NPDES No. CAS000002, Order No. WQ 2022-0057-DWQ). Construction activity subject to this permit includes clearing, grading, and disturbances to the ground, such as stockpiling or excavation.

The project includes the replacement of an existing bridge across Las Trampas Creek. Construction of the project would result in approximately 1 acre of disturbed soil. Therefore, the project would require coverage under the Construction General Permit.

Pollutants and hazardous materials, such as gasoline, diesel, oil, solvents, and trash would be stored and used during construction of the project. However, implementation of **Mitigation Measure HAZ-1**, provided in Section 3.9, Hazards and Hazardous Materials, and implementation of **Mitigation Measures HYD-1 and HYD-2** would reduce the potential for pollutants and hazardous materials to enter drainages and degrade downstream water quality. **Mitigation Measure HAZ-1** provides remediation measures to be implemented during project construction and demolition activities pertaining to excavated surface soil, painted surfaces, groundwater, concrete and pipe jackets, and concrete and asphalt demolition waste. **Mitigation Measure HYD-1** would require that coverage be obtained under the Construction General Permit and would therefore require the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) and implementation of construction best management practices (BMPs) to control potential pollutants and avoid violating any water quality standards or waste discharge requirements, or otherwise substantially degrading surface or ground water quality.

Soil removed during construction would be stored and controlled to reduce soil erosion and sedimentation of downstream waterways. Implementation of **Mitigation Measure HYD-2** would require the preparation of an Erosion Control Plan approved by the City's Public Services Department to ensure compliance with the City's Grading, Excavation, and Filling Ordinance (Walnut Creek Municipal Code 9.9).

During construction, dewatering would be required. Groundwater at the project site is not suitable for discharge on site relative to Water Quality Objectives or Effluent Limitations listed in the SFBRWQCB Basin Plan due to potential contaminants in aquifers from a pre-existing dry-cleaning facility adjacent to the project. **Mitigation Measure HYD-3** would require that coverage be obtained for discharge of contaminated groundwater under the SFBRWQCB General Waste Discharge Requirements for Discharge or Reclamation of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds (VOCs), Fuel Leaks, Fuel Additives, and Other Related Wastes (VOC and Fuel NPDES General Permit) (NPDES Permit No. CAG912002, Order No. R2-2017-0048, as amended by Order No. R2-2018-0050) prior to discharging to Las Trampas Creek.

Implementation of the project during operations would add 0.97 acre of impervious surface to the project area, resulting in an increase of stormwater discharging into the City's drainage facilities. The City is enrolled in the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (Municipal Regional Stormwater Permit) (NPDES Permit No. CAS612008, Order No. R2-2022-0018, Adopted May 11, 2022) issued by the SFBRWQCB. As part of the program, and in compliance with the Walnut Creek Storm Water Management and Discharge Control Ordinance (Walnut Creek Municipal Code Chapter 9.16), the City is required to develop and implement a Stormwater Control Plan for the project that meets the criteria in the most recent version of the Contra Costa Clean Water Program' *Stormwater C.3. Guidebook*. Implementation of **Mitigation Measure HYD-4** would require preparation of the Stormwater Control Plan to ensure compliance with the Phase I program. The Stormwater Control Plan would specify the BMPs to be incorporated into the project design that would target and reduce pollutants of concern in stormwater runoff from the project site and would reduce impacts associated with the increase in impervious surfaces. Therefore, through compliance with the requirements of the Municipal Regional Stormwater Permit, once operational, the project would not violate any water quality standards or waste discharge requirements.

Operation of the proposed project would be subject to Treatment Best Practices (BMPs) per San Francisco Bay Municipal Regional. Stormwater Permit (MRP) requirements for the City of Walnut

Creek, as specified in **Mitigation Measure HYD-5**. With implementation of **Mitigation Measure HYD-5,** the potential operational impacts to surface and groundwater quality related to waste discharge requirements and water quality standards would be less than significant.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures HYD-1 through HYD-5 would be implemented to avoid impacts to water quality standards and waste discharge requirements associated with construction and operations of the proposed project:

Mitigation Measure HYD-1 **Construction General Permit.** Prior to commencement of construction activities, the Contractor shall obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit), NPDES No. CAS000002, Order No. 2022-0057-DWQ, or any other subsequent permit. This shall include submission of Permit Registration Documents (PRDs), including permit application fees, a Notice of Intent, a risk assessment, a site plan, a Stormwater Pollution Prevention Plan (SWPPP), applicable plans, calculations, and other supporting documentation for compliance with the existing Phase 1 Municipal Regional Stormwater Permit or the post-construction standards of this General Permit, and any other compliance-related documents required by the permit, to the State Water Resources Control Board via the Stormwater Multiple Application and Report Tracking System (SMARTS). Construction activities shall not commence until a Waste Discharge Identification Number is obtained for the project from the SMARTS and provided to the Director of the City of Walnut Creek Public Works Department, or designee, to demonstrate that coverage under the Construction General Permit has been obtained. Project construction shall comply with all applicable requirements specified in the Construction General Permit, including but not limited to, preparation of a SWPPP and implementation of construction site best management practices (BMPs) to address all construction-related activities, equipment, and materials that have the potential to impact water quality for the appropriate risk level identified for the project. The SWPPP shall identify the sources of pollutants that may affect the quality of stormwater and shall include BMPs (e.g., Sediment Control, Erosion Control, and Good Housekeeping BMPs) to control the pollutants in stormwater runoff. Upon completion of construction activities and stabilization of the project site, a Notice of Termination shall be submitted via SMARTS.

Mitigation Measure HYD-2 **Construction Erosion and Sediment Control Plan.** In compliance with the City of Walnut Creek Municipal Code (Chapter 9, Article 1), the project Contractor shall submit a construction erosion and sediment control plan to the Director of the City of Walnut Creek Public Works Department, or designee, for review and approval prior to issuance of a grading permit for the project.

Mitigation Measure HYD-3 **Groundwater Dewatering Permit/On-site Treatment.** Prior to commencement of construction activities, the Contractor shall obtain coverage under the SFBRWQCB General Waste Discharge Requirements for Discharge or Reclamation of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds (VOCs), Fuel Leaks, Fuel Additives, and Other Related Wastes (VOC and Fuel NPDES General Permit) (NPDES Permit No. CAG912002, Order No. R2-2017-0048, as amended by Order No. R2-2018-0050) prior to discharging to Las Trampas Creek.

Mitigation Measure HYD-4 **Stormwater Control Plan.** Prior to construction, a Stormwater Control Plan shall be prepared per the criteria in the most recent version of the Contra Costa Clean Water Program *Stormwater C.3. Guidebook.* The Stormwater Control Plan shall be implemented by the City or its designated contractor in compliance with the provisions of the Contra Costa County Municipal Regional Stormwater Permit (NPDES Permit No. CAS612008, Order No. R2-2022-0018, Adopted May 11, 2022) issued by the SFBRWQCB and the Walnut Creek Storm Water Control Ordinance (Walnut Creek Municipal Code Chapter 9.16). The Stormwater Control Plan shall describe the BMPs, measurable goals, and timetables for implementation of the following five minimum control measures: Construction Site Stormwater Runoff Control; Illicit Discharge Detection and Elimination; Pollution Prevention/ Good Housekeeping for Municipal Operations; Post-Construction Stormwater Runoff Management; and Public Education and Public Participation.

Mitigation Measure HYD-5 **Treatment Best Management Practices.** Final design of the proposed project shall include Treatment BMPs. The Treatment BMPs shall comply with the provisions of the San Francisco Bay Municipal Regional. Stormwater Permit (MRP) requirements and the City of Walnut Creek Stormwater Management and Discharge Control Ordinance (Municipal Code, Chapter 16). Project construction shall not be deemed complete until the Treatment BMPs are installed and a long-term BMP maintenance plan is prepared.

Significance Determination after Mitigation: Less than Significant

b. Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

According to the SFBRWQCB Basin Plan, the project is not within a groundwater basin. Based on the SWRCB's GeoTracker database, depth-to-groundwater near the project area ranges from approximately 14 to 16 feet below ground surface, and groundwater flow direction is typically to the northwest. Regional groundwater flows are estimated to be west-northwest. Soil borings taken during geotechnical exploration on August 2 and September 6, 2017, showed groundwater at depths of 18 to 24.5 feet (WRECO 2018b).

During construction, dewatering would be required. Groundwater dewatering would be temporary in nature and would cease following completion of construction. It is not anticipated that the volume of groundwater extracted during dewatering activities would be substantial. Therefore, construction activities associated with the proposed project would result in a less-than-significant impact associated with the depletion of groundwater supplies or interference with groundwater recharge. No mitigation is required.

Project operation would not require groundwater extraction. Implementation of the project would add 0.97 acre of impervious surface to the project area, which could decrease on-site infiltration. A decrease in infiltration can decrease the amount of water that is able to recharge the aquifer/ groundwater. However, the project site is not located within a groundwater basin. Therefore, the minor decrease in infiltration would not interfere with groundwater supplies. Furthermore, once operational, the project would not require the use of water, as no irrigation for landscaping would be included. Therefore, operation of the project would not substantially decrease groundwater supplies and substantially interfere with groundwater recharge.

Permanent or long-term impacts to groundwater are not anticipated. Impacts would be less than significant to groundwater supplies, groundwater recharge, and sustainable groundwater management of the basin, and no mitigation measures are required.

Significance Determination: Less Than Significant

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

c. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i. Result in substantial erosion or siltation on- or off-site?

During construction activities, excavated soil would be exposed and disturbed, drainage patterns could be temporarily altered, and there would be an increased potential for soil erosion and transport of sediment downstream when compared with existing conditions. During a storm event, soil erosion could occur at an accelerated rate. Additionally, construction activities would involve the removal of concrete-filled sandbags embedded in the banks adjacent to the bridge, as well as the concrete-lined streambed. Disturbance to soils behind and beneath these features would be up to 1 foot deep. Erosion control elements such as a new concrete streambed slope paving would be constructed to replace removed erosion control elements (e.g., concrete-filled sandbags, concrete-lined streambed). As discussed under Threshold 3.10 (a) above and specified in **Mitigation Measures HYD-1 and HYD-2**, the Construction General Permit and City Municipal Code require preparation of a SWPPP and an Erosion and Sediment Control Plan and implementation of construction BMPs to reduce impacts to water quality during construction, including those impacts associated with soil erosion and siltation. Additionally, if water is present in Las Trampas Creek during construction, water would be pumped and treated in accordance with **Mitigation Measure HYD-3**. Separating construction activities from the creek flow would reduce the potential for erosion to occur within the creek.

The project involves replacing an existing bridge and modifying the existing roadway approaches. Operation of the project would increase impervious surface area by 0.97 acre. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm event that can lead to changes in downstream erosion and siltation patterns. As specified in **Mitigation Measures HYD-5 and HYD-6**, the project would be required to implement post-construction BMPs in compliance with Contra Costa County's Municipal Regional Stormwater Permit to ensure that post-construction drainage would not result in substantial erosion or siltation on site or off site. With implementation of these measures, potential impacts related to altering the existing drainage pattern of the project site during project operations in a manner that would result in substantial erosion or siltation on site or off site would be less than significant with mitigation incorporated.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures HYD-1, HYD-2, HYD-3, HYD-5, and HYD-6 would be implemented to avoid impacts that would result in erosion or siltation due to construction and operations of the proposed project.

Significance Determination after Mitigation: Less than Significant

ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

During construction, soil would be disturbed and compacted, and drainage patterns would be temporarily altered, which can increase the volume and velocity of stormwater runoff and increase the potential for localized flooding compared to existing conditions. As discussed above and specified in **Mitigation Measures HYD-1 and HYD-2**, the Construction General Permit and City Municipal Code require the preparation of a SWPPP and an Erosion Control Plan and implementation of construction BMPs to control and direct surface runoff on site. By controlling and directing surface runoff on site, the BMPs would direct additional runoff into Las Trampas Creek, which has additional capacity. Because additional runoff during construction would be channeled to las Trampas Creek, which has capacity, construction activities would not result in on- or off-site flooding. With adherence to **Mitigation Measures HYD-1 and HYD-2**, construction impacts related to altering the existing drainage pattern of the site or area or increasing the rate or amount of surface runoff in a manner that would result in flooding on site or off site would be less than significant.

The project would permanently increase the impervious surface by 0.97 acre. The project would maintain the overall on-site drainage patterns and continue to direct surface water to storm drain facilities that outfall to Las Trampas Creek. Also, the project would be required to implement **Mitigation Measures HYD-5 and HYD-6,** which require post-construction stormwater management. Adherence to **Mitigation Measures HYD-5 and HYD-6** would reduce post-construction impacts related to altering the existing drainage pattern of the site or area or increasing the rate or amount of surface runoff in a manner that would result in flooding on site or off site to a less-than-significant level.

Significance Determination: Less than Significant Impact.

Mitigation Measures: Mitigation Measures HYD-1, HYD-2, HYD-5, and HYD-6 would be implemented to avoid impacts that would result in increased rates of surface runoff during construction and operations of the proposed project.

Significance Determination after Mitigation: Less than Significant

iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

As discussed above, earthwork activities would compact soil (which can increase stormwater runoff during construction), drainage patterns could be temporarily altered during grading and other construction activities, and construction-related pollutants (e.g., liquid and petroleum products and concrete-related waste) could be spilled, leaked, or transported via storm runoff into adjacent drainages and into downstream receiving waters. The project would be required to implement **Mitigation Measures HYD-1 and HYD-2**, the Construction General Permit and County Municipal Code, which require preparation of a SWPPP and Erosion and Sediment Control Plan and implementation of construction BMPs to control stormwater runoff, including the discharge of pollutants.

Stormwater runoff from excavated areas between the former drycleaner site and the project and areas along sanitary sewer lines should be presumed to be impacted by VOCs. Stockpiles of soils excavated adjacent to the former dry cleaner must be managed as VOC-impacted soil until screened. Implementation of **Mitigation Measure HAZ-1,** provided in Section 3.9, Hazards and Hazardous Materials, would be implemented during project construction and demolition activities and would require remediation of excavated soils along sewer lines adjacent to the former dry-cleaner site.

With adherence to **Mitigation Measures HYD-1, HYD-2, and HAZ-1**, potential construction-related impacts from the project which would not exceed the capacity of the stormwater drainage system or provide substantial additional sources of polluted runoff and would be less than significant with mitigation incorporated.

As discussed above, operation of the project would result in a permanent increase of impervious surface area of 0.97 acre compared to existing conditions. However, the project would maintain the overall on-site drainage patterns and continue to direct surface runoff to the existing storm drains, which discharge to Las Trampas Creek. The project would be required to implement **Mitigation Measures HYD-5 and HYD-6,** which require post-construction stormwater management. With adherence to these mitigation measures, project-related impacts associated with excess runoff exceeding the capacity of the existing storm drain system and Las Trampas Creek and contributing substantial additional sources of pollutants to the storm drain system and Las Trampas Creek would be less than significant with mitigation incorporated.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measures HAZ-1, HYD-1, HYD-2, HYD-5, and HYD-6 would be implemented to avoid impacts that would result surface runoff that would exceed existing storm drain capacity during construction and operations of the proposed project.

Significance Determination after Mitigation: Less than Significant

iv. Impede or redirect flood flows?

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, the project site is in shaded Zone A, which represents areas subject to flooding by the 100-year flood event. The existing bridge is downstream of an area classified by FEMA as Special Flood Hazard Area Zone AE, which represents areas subject to flooding by the 100-year flood event. The area upstream of the project site is also within a regulatory floodway. The area downstream of the project site is in shaded Zone X, which represents areas between the limits of the base flood (100-year) and the 0.2-percent annual-chance (or 500-year) flood.

The existing bridge would be removed as part of the project and replaced with a wider bridge. The proposed vertical profile is planned to be similar to the existing bridge to minimize cut/fill requirements adjacent to the proposed bridge.

A total of two abutments and four bents would be removed, and the project would construct a new bridge with two abutments and a central pier. The two new roadway approaches would be replaced in largely the same alignment as the existing approaches. The replacement bridge would include fill in the floodplain associated with the new abutments and pier. However, the proposed bridge would be two spans, compared to the existing bridge with multiple rows of bents, so the proposed bridge would reduce the number of piers in the channel, which would result in a decrease in the water surface elevation for the 100-year design flow. Construction of the new bridge would not adversely affect flow capacity. Therefore, the project would not impede or redirect flood flows, and impacts related to the placement of structures within a 100-year flood hazard area would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

d. Would the project be in a flood hazard, tsunami, or seiche zones, risk release of pollutants due to Project inundation?

As discussed above, the project is within a FEMA-designated 100-year floodplain. The existing bridge would be removed as part of the project and replaced with a wider bridge. The replacement bridge would include fill in the floodplain associated with the new abutments and pier. However, the proposed bridge would be two spans, compared to the existing bridge with multiple rows of bents, so the proposed bridge would reduce the number of piers in the channel, which would result in a decrease in the water surface elevation for the 100-year design flow. Therefore, the project would not result in an increased risk of flood hazard. The project site is not near an enclosed body of water or the ocean. As such, the project would not be susceptible to inundation by a seiche or tsunami. The project would not risk release of pollutants due to project inundation, and no impact would occur.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

e. Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

As discussed above, the project falls within the purview of SFBRWQCB's Basin Plan which designates beneficial uses for all surface and groundwater within its jurisdiction and established the water quality objectives and standards necessary to protect those beneficial uses. As summarized below, the project would comply with the applicable NPDES permits and State and local regulations and would implement construction BMPs to reduce pollutants of concern and stormwater runoff. NPDES permits and associated BMPs are designed to ensure that the water quality objectives in the Water Quality Control Plan are not exceeded and that beneficial uses of receiving waters are not impaired.

During construction activities, soil would be disturbed, and there would be an increased potential for soil erosion compared to existing conditions. Additionally, construction-related pollutants such as liquid and petroleum products and concrete-related waste may be spilled or transported via stormwater runoff into downstream receiving waters. As specified in **Mitigation Measures HYD-1 and HYD-2**, the project would require preparation of a SWPPP and Erosion Control Plan and implementation of construction BMPs to control stormwater runoff, including the discharge of pollutants. As discussed **Mitigation Measure HYD-3**, groundwater dewatering during construction would be conducted in accordance with the requirements of the SFBRWQCB VOC and Fuel NPDES General Permit (NPDES Permit No. CAG912002, Order No. R2-2017-0048, as amended by Order No. R2-2018-0050).

Operation of the project would result in a permanent increase of impervious surface area of 0.97 acre compared to existing conditions. However, the project would maintain the overall on-site drainage patterns and continue to direct surface runoff to the existing storm drains, which discharge to Las Trampas Creek. The project would comply with the provisions of the San Francisco Bay MRP requirements and the City of Walnut Creek Stormwater Management and Discharge Control Ordinance, including the implementation of treatment BMPs during project operations.

Because the project would comply with NPDES requirements including implementation of construction and operational BMPs, the project would not result in water quality impacts that would conflict with the San Francisco RWQCB's Basin Plan. Therefore, temporary and permanent impacts related to conflicts with a water quality control plan would be less than significant.

The Sustainable Groundwater Management Act (SGMA) was enacted in September 2014. SGMA requires governments and water agencies of high and medium priority basins to halt overdraft of groundwater basins. SGMA requires the formation of local groundwater sustainability agencies (GSAs) in high and medium priority basins, that are required to adopt Groundwater Sustainability Plans to manage the sustainability of the groundwater basins. The project is not located within a groundwater basin. Furthermore, the project would not require the use of water, such as irrigation for landscaping. Therefore, operation of the project would not substantially interfere with groundwater recharge or substantially decrease groundwater supplies.

Project construction would require the removal of contaminated water. However, the project would be required to implement **Mitigation Measure HYD-3**, which requires coverage under the SFBRWQCB VOC and Fuel NPDES General Permit to prevent the discharge and infiltration of contaminated groundwater.

The project does not have the potential to impact groundwater quality, interfere with groundwater recharge, or decrease groundwater supplies. Therefore, temporary and permanent impacts related to conflicts with a water quality control plan or the implementation of a sustainable groundwater management plan would be less than significant.

Significance Determination: Less than Significant Impact

Mitigation Measures: Mitigation Measures HYD-3, HYD-5, and HYD-6 would be implemented to avoid impacts that would result in a conflict with a water quality control plan or sustainable groundwater management plan during construction and operations of the proposed project.

Significance Determination after Mitigation: Less than Significant

3.11 LAND USE AND PLANNING

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Physically divide an established community?	☐	☐	☐	☒
b. Cause a significant environmental impact due to a conflict with any land use plan policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒

3.11.1 Environmental Setting

The project is along an existing major roadway in Walnut Creek. Land uses surrounding the project site include retail and commercial uses. The Agora at South Main apartments are the only residential units in the project vicinity, located at the northwest corner of the Newell Avenue/South Main Street intersection.

3.11.2 Impact Analysis

a. Would the project physically divide an established community?

The project would not divide an established community as the project includes improvements to an existing bridge along an existing roadway. Residential and driveway access would be maintained, and detours are available during construction-period bridge closure. Therefore, the project would have no impact associated with the dividing an established community.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project cause a significant environmental impact due to a conflict with any land use plan policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

The City of Walnut Creek 2025 General Plan Land Use Map (2020) identifies South Main Street as a "Major Roadway." Land to the east of the roadway is designated as Pedestrian Retail and land to the west of the roadway is designated as Mixed Use-Commercial. The project would not result in any changes to land use and is consistent with the City of Walnut Creek 2025 General Plan and the Walnut Creek Municipal Code. Therefore, the project would have no impact associated with conflicts with an applicable land use plan, policy, or regulation of an agency with jurisdiction over the project.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.12 MINERAL RESOURCES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

3.12.1 Environmental Setting

Minerals are any naturally occurring chemical element or compound, or groups of elements and compounds, formed from inorganic processes and organic substances including, but not limited to, coal, peat, and oil-bearing rock, but excluding geothermal resources, natural gas, and petroleum. Rock, sand, gravel, and earth are also considered minerals by the California Department of Conservation when extracted by surface mining operations. According to the Contra Costa General Plan, Walnut Creek is not in a Mineral Resource Area (Contra Costa County 2005). No mines are on or in the vicinity of the project site.

3.12.2 Impact Analysis

a. Would the project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

The project is not in a Mineral Resource Area, nor is one near the site. Therefore, the project would have no impact associated with the loss of availability of a known mineral resource that would be of value to the region and the residents of the State.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

No mineral resource recovery sites are delineated on the City of Walnut Creek General Plan 2025 (2006). No mines are on or in the vicinity of the project site. Implementation of the project would have no impact associated with the loss of a locally important mineral resource.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.13 NOISE

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project result in:				
a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b. Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

3.13.1 Environmental Setting

The *Las Trampas Creek Bridge at South Main Street Replacement Project Technical Noise Memorandum* (Noise Technical Memorandum) (LSA 2018b) was prepared for the project in September 2018 (see Appendix G). The information for the following section was based on this memorandum.

3.13.1.1 Fundamentals of Noise

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep. To the human ear, sound has two significant characteristics: pitch and loudness. A specific pitch can be an annoyance, whereas loudness can affect human's ability to hear. Pitch is the number of complete vibrations or cycles per second of a wave, that results in the range of tone from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment, and it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments.

Several noise measurement scales are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense. Each 10 dB increase in sound level is perceived as approximately a doubling of loudness. Sound intensity is normally measured through the

A-weighted sound level (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Noise impacts can be described in three categories. The first is audible impacts, which refers to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater since this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise level of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise sensitive receptor of concern. There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and community noise equivalent level (CNEL) or the day-night average level (L_{dn}) based on dBAs. CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours. Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by L_{max} for short-term noise impacts. L_{max} reflects peak operating conditions and addresses the annoying aspects of intermittent noise.

Another noise scale often used together with the L_{max} in noise ordinances for enforcement purposes is noise standards in terms of percentile noise levels. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tension, and thereby affecting blood pressure, functions of the heart, and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas. It is not only exposure to extremely high noise levels that can lead to hearing loss. Irreversible hearing damage can occur with long-term cumulative exposure to levels as low as 70 dBA. This 70 dBA threshold is not for singular or peak events; rather it is the average environmental sound level a person is exposed to over weeks and years that is critical in preventing hearing loss. So, if enough “quiet times” are also experienced, this threshold can be surpassed without significant damage occurring.

3.13.1.2 Characteristics of Vibration

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible. Typically, there is more adverse reaction to effects associated with the shaking of a building. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet of the vibration source, although there are examples of ground-borne vibration causing interference to distance greater than 200 feet (Federal Transit Administration [FTA] 2018). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface would be smooth enough that ground-borne vibration from street traffic would not exceed the impact criteria; however, the construction of the project could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for typical construction activities to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square velocity or peak particle velocity (PPV). The root-mean-square is best for characterizing human response to building vibration, and PPV is used to characterize potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where L_v is the vibration velocity in decibels, "V" is the root-mean-square velocity amplitude, and "V_{ref}" is the reference velocity amplitude, or 1 x 10^{-6} inches per second (in/sec) used in the United States.

3.13.2 Applicable Noise Standards

The following information provides standards to which potential noise impacts would be compared. Where exceedances have been identified, impacts are described, and mitigation measures implemented.

- **City of Walnut Creek Noise Regulations:** The City of Walnut Creek Municipal Code (Chapter 6 Nuisances, Article 2 Noise, Section 4-6.203 Prohibited Noises Enumerated) provides guidance on construction noise for various situations within the City. The City prohibits construction, except by permit, during any time other than between the hours of 7:00 a.m. and 6:00 p.m. on weekdays which are not holidays. If the Chief of Code Enforcement determines that the public health, safety, and welfare would not be impaired by construction activities outside the hours of 7:00 a.m. and 6:00 p.m. on weekdays that are not holidays, he or she may grant permission for such work to be done, the specific hours and days of operations to be enumerated in the permit.

  The City does not provide construction noise threshold limits for sensitive receptors.

3.13.3 Applicable Vibration Standards

The following information provide standards to which potential vibration impacts would be compared. Where exceedances have been identified, impacts are discussed, and mitigation measures implemented.

- **City of Walnut Creek Vibration Regulations:** Chapter 6, Article 2 of the City of Walnut Creek Municipal Code indicates that "…the creation or maintenance of excessive noise or vibration which is prolonged or unreasonable in its time, place and use is deemed to be a serious detriment to the public health, safety and quality of life of the residents of the City…" However, neither the City's Municipal Code nor the City's General Plan establishes thresholds pertaining to construction vibration and damage to buildings or the annoyance to humans it can cause.

- **Caltrans:** The criteria for environmental impacts resulting from ground-borne vibration and noise are based on the maximum levels for a single event. The City's Municipal Code does not include specific criteria for assessing vibration impacts associated with structural damage. Therefore, for the purpose of determining the significance of vibration impacts experienced at sensitive uses surrounding the project site, the guidelines within the Caltrans' 2020 *Transportation and Construction Vibration Guidance Manual* have been used to determine vibration impacts (refer to **Table C: Guideline Vibration Damage Potential Threshold Criteria**, below).

Table C: Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)
Extremely fragile historic buildings, ruins, ancient monuments	0.08
Fragile buildings	0.1
Historic and some old buildings	0.25
Older residential structures	0.3
New residential structures	0.5
Modern industrial/commercial buildings	0.5

Source: *Transportation and Construction Vibration Guidance Manual,* Table 20, Guideline Vibration Damage Potential Threshold Criteria, page 38 (Caltrans, April 2020).
Caltrans = California Department of Transportation
in/sec = inches per second
PPV = peak particle velocity

The Caltrans' Vibration Guidance Manual shows that a vibration level of up to 0.1 PPV (in/sec) is considered safe for fragile buildings to vibration damage and would not result in any construction vibration damage. Therefore, to be conservative, the 0.1 PPV (in/sec) threshold has been used when evaluating vibration impacts at the nearest structures to the site (i.e., mixed-use building adjacent to the project site).

To provide numerical thresholds related to ground-borne vibration impacts, criteria for human annoyance are shown in **Table D: Guideline Vibration Annoyance Potential Criteria.** As shown in Table D, vibration levels exceeding 0.04 PPV (in/sec) would constitute a distinctly perceptible impact.

Table D: Guideline Vibration Annoyance Potential Criteria

Human Response	Maximum PPV (in/sec)
Barely perceptible	0.01
Distinctly perceptible	0.04
Strongly perceptible	0.10
Severe	0.4

Source: *Transportation and Construction Vibration Guidance Manual,* Table 20, Guideline Vibration Damage Potential Threshold Criteria, page 38 (Caltrans, April 2020).
Caltrans = California Department of Transportation
in/sec = inches per second
PPV = peak particle velocity

3.13.4 Project Location and Existing Noise Sensitive Receptors

The project is in downtown Walnut Creek on South Main Street between Botelho Drive to the north and Broadway Plaza to the south and Newell Avenue approximately 400 feet farther south, at Latitude 37.894754 degrees and Longitude -122.059153 degrees.

The project is in an urbanized portion of Walnut Creek. The closest sensitive receptor is a mixed-use building at 1305 South Main Street. The mixed-use building is four stories in height with the first floor occupied by retail/restaurant uses and floors two through four occupied by multi-family residential units. The sensitive receptor is approximately 60 feet from the nearest point of the project construction footprint. This sensitive receptor is 31.9 feet from the nearest edge of the closest traffic lane on South Main Street.

It should also be noted that two restaurants (Stanford's Restaurant and Bar at 1300 South Main Street and Gott's Restaurant at 1275 South Main Street), both with outside seating areas, are also considered sensitive receptors. The outside seating area at Stanford's is 124 feet from the nearest point of the project construction footprint and 22 feet from the nearest edge of the closest traffic lane on South Main Street. The outside seating area at Gott's Restaurant is 72 feet from the nearest point of the project construction footprint and 16.7 feet from the nearest edge of the closest traffic lane on South Main Street.

3.13.5 Impact Analysis

a. Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

3.13.5.1 Construction Noise

Two types of short-term noise impacts would occur during project construction, including (1) equipment delivery and construction worker commutes, and (2) project construction operations.

The first type of short-term construction noise would result from the transport of construction equipment and materials to the project site and from construction worker commutes. These transportation activities would incrementally raise noise levels on roads leading to the project site. Larger trucks used in equipment delivery are expected to generate higher noise impacts than trucks associated with worker commutes. The single-event noise from equipment trucks passing at a distance of 50 feet from a sensitive noise receptor would reach a maximum level of 84 dBA L_{max}. However, the pieces of heavy equipment for grading and construction activities would be moved on site just one time and would remain for the duration of construction. This one-time trip, when heavy construction equipment is moved on and off-site, would not add to the daily traffic noise in the project vicinity. Furthermore, the projected traffic from the construction worker commutes would be minimal when compared to existing traffic volumes on roadways near the project and other affected streets, and its associated long-term noise level change would not be perceptible. Therefore, equipment transport noise and construction-related worker commute impacts would be short-term and would not be substantial.

The second type of short-term noise impact is related to noise generated during project construction. Construction is performed in discrete steps, each having its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated, as well as the noise levels in the study area as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. **Table E: Typical Construction Equipment Noise Levels,** lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments based on a distance of 50 feet between the equipment and a noise receptor.

Table E: Typical Construction Equipment Noise Levels

Equipment Description[1]	Maximum Noise Level (L_{max}) at 50 Feet[2]
Backhoes	80
Compactor (ground)	80
Cranes	85
Dozers	85
Dump Trucks	84
Excavators	85
Flat Bed Trucks	84
Front-end Loaders	80
Graders	85
Jackhammers	85
Pick-up Truck	55
Pneumatic Tools	85
Pumps	77
Rock Drills	85
Rollers	85
Scrapers	85
Tractors	84

Source: Roadway Construction Noise Model (FHWA, January 2006).
Note: Noise levels reported in this table are rounded to the nearest whole number.
[1] Maximum noise levels were developed based on Spec 721.560 from the Central Artery/Tunnel program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.
FHWA = Federal Highway Administration
L_{max} = maximum instantaneous sound level

It should be noted that construction of the project is not anticipated to include pile driving activities; as such, noise and vibrations generated by the use of pile driving equipment is not analyzed as part of this project.

Normal construction operations, specifically during the site preparation phase which includes excavation and grading, may generate high noise levels from an active construction area. Earth moving equipment and compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings.

Noise associated with the use of earthmoving equipment is estimated between 55 and 85 dBA L_{max} at a distance of 50 feet from each piece of equipment. As seen in Table E, the maximum noise level generated by each excavator, bulldozer and pickup truck is assumed to be approximately 85 dBA L_{max}, 85 dBA L_{max}, and 55 dBA L_{max} at 50 feet, respectively. Each piece of construction equipment operates as an individual point source.

In general, doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

The closest sensitive receptor, the mixed-use building occupied by multi-family residential units, is approximately 60 feet from the edge of the proposed construction footprint. The results of the equations above show that this sensitive receptor may be subject to short-term noise reaching 86 dBA L_{max} during general construction activities. This sensitive receptor would be exposed to short-term construction-related noise levels above existing ambient noise levels. Therefore, **Mitigation Measure NOI-1** is required to reduce temporary noise impacts associated with construction to less-than-significant levels.

3.13.5.2 Operational Noise

The project would replace the existing five-lane bridge with a new five-lane bridge that would be widened to accommodate two 8-foot-wide shoulders and 10-foot-wide sidewalks. The project would not include a change in the horizontal or vertical alignment or increase the number of through-traffic lanes on the Las Trampas Creek Bridge or South Main Street. Operation of the project would not result in any changes in noise sources or noise levels at the project site beyond the existing conditions. Therefore, the project would have no impact associated with the generation of a substantial permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. No mitigation measures are required.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure NOI-1 would be implemented to avoid impacts to noise level standards associated with construction from the proposed project:

Mitigation Measure NOI-1 **Standard Construction Noise Measures.** The following measures shall be implemented, to the extent feasible, during construction activities:

- The Construction Contractor and the City of Walnut Creek (City) shall ensure that construction equipment would be equipped with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- The Construction Contractor shall locate stationary noise generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near the construction area.
- The Construction Contractor shall utilize “quiet” air compressors and other stationary noise sources where technology exists.

- The City shall designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., starting too early, bad muffler) and would require that reasonable measures warranted to correct the problem be implemented. The disturbance coordinator shall post a telephone number at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

- If the Director of Public Works determines that the public health, safety, and welfare would not be impaired by construction activities outside the hours of 7:00 a.m. and 6:00 p.m. on weekdays that are not holidays, the Construction Contractor may be granted permission for such work to be done, the specific hours and days of operations to be enumerated in the permit issued by the City.

Significance Determination after Mitigation: Less than Significant

b. Would the project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors. Vibration energy propagates from a source, through intervening soil and rock layers, to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by the occupants as the motion of building surfaces, rattling of items on shelves or hanging on walls, or as a low-frequency rumbling noise. The rumbling noise is caused by the vibrating walls, floors, and ceilings radiating sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., pavement breaking and operating heavy-duty earthmoving equipment), and occasional traffic on rough roads. Ground-borne vibration levels from construction activities very rarely reach levels that can damage structures; however, these levels are perceptible near the active construction site. With the exception of buildings constructed prior to the 1950s, or buildings of historic significance, potential structural damage from heavy construction activities rarely occurs. When roadways are smooth, vibration from traffic (even heavy trucks) is rarely perceptible.

Once constructed, the project pavement would be smooth, and unlikely to cause significant ground-borne vibration. In addition, the rubber tires and suspension systems of on-road vehicles make it unusual for on-road vehicles to cause ground-borne noise or vibration problems. It is, therefore, assumed that no such vehicular vibration impacts would occur.

Ground-borne noise and vibration from construction activity would be low. **Table F: Vibration Source Amplitudes for Construction Equipment** provides reference PPV values and vibration levels (in terms of velocity in decibels) from typical construction vibration sources at 25 feet. Outdoor site preparation for the project is expected to use a bulldozer, loaded truck, and caisson drilling. The greatest levels of vibration are anticipated during the site preparation and drilling phase. All other phases are expected to result in lower vibration levels. Per Caltrans' standards, it would take a minimum of 0.1 PPV (in/sec) to cause any potential building damage to fragile structures. Vibration source amplitudes for construction equipment are shown in Table F, below.

Table F: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV (in/sec) at 25 feet
Hoe Ram	0.089
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozer	0.003

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
FTA = Federal Transit Administration
in/sec = inches per second
PPV = peak particle velocity

The closest structure to the project construction boundary is the mixed-use building approximately 60 feet from the limits of construction activity. Given that this structure is more than 25 feet from the project construction area limits, the estimated vibration impacts are propagated for distance based on the following equation.

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.1}$$

Using the reference data from Table E and the equation above, the operation of typical construction equipment would generate ground-borne vibration levels of ranging between 0.029 to 0.034 PPV (in/sec). This vibration level would not exceed the 0.1 PPV (in/sec) threshold considered safe for fragile buildings. Given that this structure is more than 25 feet from the project construction area limits, vibration levels at the adjacent mixed-use building would be lower; therefore, construction would not result in any vibration damage. Vibration experienced by residents occupying the adjacent mixed-use building would be exposed to vibration levels from construction equipment that are below distinctly perceptible. As such, the project would not generate excessive ground-borne vibration that would annoy the residences in the mixed-use building.

Therefore, ground-borne vibration impacts from project-related construction activities would be considered less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

According to the *Walnut Creek General Plan 2025 Environmental Impact Report* (2005), there are no public or private airports currently in or planned within the City of Walnut Creek. The closest airport to the project site is Buchanan Field Airport located at 550 Sally Ride Drive in Concord, 6.4 miles north of the project site. The project is not within the noise contours of Buchanan Field Airport; as such, airport noise from this facility would not affect people working at the project site. No impact would occur.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.14 POPULATION AND HOUSING

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b. Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

3.14.1 Environmental Setting

The project site is in downtown Walnut Creek. Proximate land uses include Pedestrian Retail and Mixed Use-Commercial. The *Technical Memo: Community Impact Analysis (CIA) Memorandum South Main Street over Las Trampas Creek Bridge* (Community Impacts Assessment/Land Use Memo) (LSA 2022) (see Appendix D) was prepared for the project in January 2022, and portions have been incorporated into this section. The 2012-2016 American Community Survey 5-Year Estimates indicate a total population of 3,243 people within Census Tract 3390.01 of Contra Costa County, CA (U.S. Census Bureau 2016a). Data from the 2012-2016 American Community Survey 5-Year Estimates report that Census Tract 3390.01 had a total population of 3,238 people in housing units, of which 146 people lived in owner-occupied units and 3,092 people lived in renter occupied units (U.S. Census Bureau 2016b).

3.14.2 Impact Analysis

a. Would the project induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

The project would replace an existing bridge within the urban core of Walnut Creek. The purpose of the project is to replace the structurally deficient bridge and realign and widen the existing roadway to allow adequate capacity for current and future average daily trips (ADT). The project would not directly induce population growth in the Walnut Creek area as it does not include the development of new homes or businesses. While the project would widen the existing roadway and bridge structure to meet Association of State Highway and Transportation Officials (AASHTO) standards, the project does not add travel capacity. Therefore, the project would have no impact on population growth in the project area.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Would the project displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

Housing units in the project vicinity are limited to the Agora at South Main Apartments. These units are located outside of the project site. Implementation of the project would not displace these housing units, necessitating the construction of replacement housing elsewhere. The project would be no impact associated with displacing a substantial number of existing people or housing, necessitating the construction of replacement housing elsewhere.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.15 PUBLIC SERVICES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
i. Fire protection?	☐	☒	☐	☐
ii. Police protection?	☐	☒	☐	☐
iii. Schools?	☐	☒	☐	☐
iv. Parks?	☐	☒	☐	☐
v. Other public facilities?	☐	☐	☒	☐

3.15.1 Environmental Setting

The project site is in an urban area of Walnut Creek. The public services available are described below.

3.15.1.1 Fire Protection

The Contra Costa County Fire Protection District provides emergency services within Contra Costa County and the project area. The Fire Protection District responds to structure, automobile, and wildland fires, emergency medical incidents, rescues, hazardous materials incidents, hazardous conditions, and other special operations situations (e.g., seismic events). The closest station to the project site is Fire Station No. 1, located at 1330 Civic Drive in Walnut Creek. Fire Station No. 1 is about 0.5 mile north of project site.

3.15.1.2 Law Enforcement

The Walnut Creek Police Department provides law enforcement services to Walnut Creek. The Department headquarters is at 1666 North Main Street at City Hall, about 0.4 mile north of the project site. The Operations Division of the Department has a Division captain, a Special Operations lieutenant, a Special Operations sergeant, 4 officers on the Special Enforcement Team, 3 officers/handlers on the K9 Team, 4 officers on the Traffic Team, and 7 patrol teams consisting of a total of 3 lieutenants, 7 sergeants, and 40 officers.

3.15.1.3 School

In the project area, the Walnut Creek School District maintains establishments that provide education to students in kindergarten through eighth grade. These establishments include:

- Buena Vista Elementary
- Indian Valley Elementary
- Murwood Elementary
- Parkmead Elementary
- Walnut Heights Elementary
- Walnut Creek Intermediate

The Acalanes Union High School District provides establishments for high school education in the project area, including Acalanes High School, Las Lomas High School, and Del Oro High School.

The school nearest to the project area is Las Lomas High School, which is 0.13 mile south of the southernmost potential staging area for the project.

3.15.1.4 Parks

Walnut Creek has 7 community parks and 10 neighborhood parks maintained by the City's Parks Division. Las Lomas High School includes ballfields, tracks, basketball and tennis courts, and is the closest recreational facility to the project site.

3.15.2 Impact Analysis

a. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

i, ii, iii, iv. Fire protection, Police protection, Schools, and Parks?

The project would include the demolition of an existing bridge on South Main Street spanning Las Trampas Creek, reconstruction of a newly aligned bridge, and relocation of existing utilities. The project would not increase demand for public services, nor degrade the quality of existing public services.

Prior to construction of the project, there will be a permanent road closure at the bridge location until the new bridge is constructed. The new bridge would be constructed utilizing the permanent road closure and traffic would be redirected to neighboring streets. As a standard condition, the Construction Contractor of the project, prior to the commencement of construction, would provide the City and emergency responders (fire, police, ambulance companies) with a construction detour plan to ensure that emergency response or evacuation in the area can still take place amidst the road closure. Additionally, as described in **Mitigation Measure TRAN-1**, provided in Section 3.17, Transportation, the City of Walnut Creek Public Works Department would be required to prepare a Transportation Management Plan (TMP) during final design to address detours and notification for emergency service providers, local agencies, and the public during construction. The TMP would include an emergency evacuation plan, the installation of detour signs, and advance notice to local emergency service providers regarding the timing, location, and duration of road closure. Overall, implementation of the project would not substantially impair emergency response times for fire, or police or affect usage of park and school facilities. Impacts would be less than significant with implementation of **Mitigation Measure TRAN-1**.

Once operational, the project would have no impact on any fire, police, park, or school facilities.

Significance Determination: Potentially Significant Impact

Mitigation Measures: With implementation of **Mitigation Measure TRAN-1,** the project would not affect response times with fire or police services, nor interfere with park or school facilities during construction. The project would have no impact on these public services during operations.

Significance Determination after Mitigation: Less than Significant

v. Other public facilities?

Public parking could be temporarily impacted by the project's construction. However, additional public parking lots and structures are available in the surrounding area and would provide alternative parking on a temporary basis during construction. No permanent, significant impacts to parking would occur. Therefore, the project would have less-than-significant impacts on other public facilities**,** and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.16 RECREATION

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

3.16.1 Environmental Setting

Walnut Creek has 7 community parks and 10 neighborhood parks, which the City's Parks Division maintains. Additionally, the Parks Division maintains three City-owned "special-use areas." In total, the City owns and/or maintains a total park area of 411 acres. The nearest recreation facility to the project site is Las Lomas High School, which includes ballfields, tracks, and basketball and tennis courts (City of Walnut Creek 2005).

3.16.2 Impact Analysis

a. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

The project is a bridge replacement and road widening project with the purpose of addressing existing structural and functional deficiencies. The project does not include the construction of new housing or employment centers, nor would it cause an increase in housing supply indirectly through an increased demand for housing. Therefore, the project would not generate an increased demand for park space or recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. Therefore, implementation of the project would have no impact on the use and/or deterioration of an existing neighborhood or regional park or other recreational facility.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

The project is a bridge replacement and road widening project with the purpose of addressing existing structural and functional deficiencies. The project does not include the construction of a new recreational facility, nor would it require the expansion of an existing recreational facility. Therefore, implementation of the project would have no impact on recreational facilities.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.17 TRANSPORTATION

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☐	☐	☒	☐
b. Would the project conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?	☐	☐	☐	☒
c. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d. Result in inadequate emergency access?	☐	☒	☐	☐

3.17.1 Environmental Setting

The project, when completed, would provide a cross section of four 12-foot traffic lanes (two lanes in each direction), a 4-foot median, an 8-foot shoulder on each side of the roadway, and a 10-foot wide10-foot-wide sidewalk on each side of the bridge. The project would also be designed to accommodate the existing northbound left turn pocket at Botelho Drive/South Main Street and the southbound left turn pocket at Broadway Plaza/South Main Street intersections. After completion, the project would provide the same vehicular capacity and multimodal access as under existing conditions. The *Final Memorandum: Focused Transportation Impact Assessment for the Las Trampas Creek Bridge Replacement Project in Walnut Creek, California* (Traffic Memo) (Fehr & Peers 2021) (Appendix H) was prepared for the project in May 2021, and portions have been incorporated into this section.

3.17.2 Impact Analysis

a. Would the project conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?

The project is an infrastructure replacement project that would replace the existing Las Trampas Road Bridge and modify the roadway approaches to match the width of the bridge.

Project construction would last for an approximately 20-month period. Project construction would require a full road closure of the bridge to avoid or minimize construction impacts to the neighboring areas. Nearby roadways such as Botelho Drive and Newell Avenue could experience an increase in vehicle traffic because of the road closure. Additionally, local bus, bicycle, and pedestrian traffic would be detoured onto surrounding roadways. However, the changes in local transportation patterns would only be temporary until the new bridge is fully constructed and would not permanently impede normal traffic flows or circulation in the area. Therefore, project construction would not conflict with a program, plan, ordinance, or policy addressing the circulation system.

Project operations would not alter current transportation uses or traffic volumes at the project site. Because the proposed project involves replacing an existing bridge and would not permanently affect normal traffic flow or circulation in the project area during project operation, operation of the proposed project would not conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities, and impacts would be less than significant.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

b. Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?

State CEQA Guidelines Section 15064.3, subdivision (b) states that "Transportation projects that reduce, or have no impact on, vehicle miles traveled should be presumed to cause a less than significant transportation impact." As described above, project construction would take place for a period of approximately 20 months, requiring staged construction. The proposed project involves replacement of an existing bridge and would not add travel lane capacity. The project would not result in any long-term increase in vehicle miles traveled (VMT). Given the fact that the proposed project does not involve land development activities or changes to the roadway and would not alter travel patterns or travel demand, the proposed project would not conflict with or be inconsistent with *State CEQA Guidelines* Section 15064.3.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

c. Would the project substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The project includes the replacement of an existing bridge and would include updated design features that would reduce hazards for vehicles and pedestrians by bringing the facility up to current Association of State Highway and Transportation Officials (AASHTO) minimum lane and shoulder width standards and enhance overall traffic safety. The project is within an urbanized area and would not be incompatible with surrounding uses. There would be no impacts associated with increased hazards due to a design feature, and no mitigation measures are required.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

d. Would the project result in inadequate emergency access?

Emergency services in the proposed project area are provided by the City of Walnut Creek fire and police departments. The proposed project is an infrastructure replacement project and would not construct any structures for occupancy or that would require additional emergency services. Project construction would last for an approximately 20-month period, during which time the Las Trampas Road Bridge would undergo a permanent road closure to expedite construction and minimize construction impacts to the surrounding area. Nearby roadways such as Botelho Drive and Newell Avenue, could experience and increase in vehicle traffic because of the road closure. The reduced number of travel lanes on Las Trampas Bridge would increase travel times for emergency vehicles along Las Trampas Bridge. Furthermore, shifting traffic patterns to avoid using Las Trampas Bridge during project construction could increase congestion on nearby roadways, which would result in increases in travel times for emergency service vehicles.

To address temporary impacts on travel times for emergency vehicles, the City would be required to implement **Mitigation Measure TRAN-1. Mitigation Measure TRAN-1** would require development of a Traffic Management Plan (TMP) in coordination with emergency service providers to address the road closure and detours and notify emergency service providers, local agencies, and the public. The TMP will include an emergency evacuation plan prior to start of construction to ensure that emergency service providers will have adequate time to respond and arrive to the project site. The emergency evacuation plan will identify exit routes and safety areas that are easily accessible to the emergency service providers. The emergency evacuation plan will also include appropriate evacuation procedures for construction workers to alleviate safety concerns related to bridge construction. The TMP would include the emergency evacuation plan, the installation of signs for alternative routes, notices in the local media, and advance notice to local emergency service providers regarding the timing, location, and duration of the road closure on Las Trampas Bridge.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Implementation of **Mitigation Measure TRAN-1** would minimize temporary impacts of project construction to emergency services.

Mitigation Measure TRAN-1 **Transportation Management Plan (TMP).** As part of Project final design, the City, in coordination with emergency service providers, shall prepare a TMP to determine detours, if necessary, and notify the community of the construction of the bridge and the closing of South Main Street. During construction, the City shall require the Construction Contractor to adhere to all requirements of the TMP. The TMP shall include the following: an emergency evacuation plan, installation of detour signs, if applicable, notices in local media, and advance notice to the public and local emergency service providers regarding the timing, location, and duration of construction activities. Throughout the construction period, the City shall provide regular communication to emergency service providers and property owners in the project vicinity in order to minimize disruption associated with construction of the project.

Significance Determination after Mitigation: Less than Significant

3.18 TRIBAL CULTURAL RESOURCES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code Section 5020.1(k)? Or	☐	☒	☐	☐
ii. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1? In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐

3.18.1 Environmental Setting

Assembly Bill 52, a law signed by then-Governor Jerry Brown in 2014, amended the California Environmental Quality Act (CEQA) to require Tribal Cultural Resources to be considered as potentially significant cultural resources under the CEQA environmental review process. The procedures under Assembly Bill 52 offer tribes an opportunity to take an active role in the CEQA process in order to protect tribal cultural resources.

LSA completed consultation with the Native American Heritage Commission (NAHC) and Native American contacts provided by the NAHC. Pursuant to Assembly Bill 52, if a Native American identifies tribal cultural resources within the Area of Potential Effects (APE) for the project, the Native American shall contact the local lead agency.

As discussed in the Cultural Resources, Section 3.5 above, background research, consultation with potentially interested parties, and a field survey were conducted regarding historical properties and Native American cultural sites in the project APE. The Las Trampas Creek Bridge, located within the APE, was previously determined not eligible for the National Register of Historic Places.

The NAHC was contacted on November 15, 2017, to conduct a Sacred Lands File search and provide a Native American Contact List for the project. The NAHC responded on November 27, 2017, stating that a Sacred Lands File search was completed for the project site with negative results. The NAHC also recommended that six Native American tribes be contacted for information regarding cultural resources that could be affected by the project. These six tribes were contacted via a letter sent on

November 29, 2017, pursuant to Section 106 describing the project with maps depicting the project study area. Mr. Andrew Galvan of the Ohlone Indian Tribe, Inc. responded via email on December 2, 2017. Mr. Galvan did not express concerns about any tribal cultural resources that were in the project area that could be impacted by the project but asked if a literature review and/or pedestrian survey had already been completed for the project, and if so, requested a copy of the report. LSA clarified on December 7, 2017, that no report for the specific project area was on file, but Mr. Galvan was offered a copy of the Basin Research report for the property immediately to the south of the project area. Mr. Galvan declined the offered copy but requested a copy of the completed report for the current project once it was available.

Follow-up letters were sent on March 18, 2021, to the six tribes to update them on the project and inform them of proposed Extended Phase I (XPI) testing. No response was received to the email sent March 18, 2021.

LSA did not receive a response to the letter of November 29, 2017, or follow-up telephone call on December 8, 2017, from the Indian Canyon Mutsun Band of Costanoan Indians. However, in response to the email update sent March 18, 2021, Ms. Kanyon Sayers-Roods responded on March 22, 2021, and recommended Native American monitoring and archaeological monitoring at all times during the project. Ms. Sayers-Roods also suggested cultural awareness training and consultation to explore interpretive or educational mitigation in her email.

Consultation with tribes did not result in the identification of any tribal cultural resources.

3.18.2 Impact Analysis

a. *Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:*

    i. *Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code Section 5020.1(k)? Or*

    ii. *A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1? In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.*

No specific tribal cultural resources were identified within the APE. However, the APE was identified as sensitive for precontact and historic-period archaeological deposits. In addition, consultation with Native American tribe representatives raised concerns of potential nearby human remains. No tribal cultural resources were identified that are listed or eligible for listing in the California Register of Historical Resources, in a local register of historical resources as defined in Public Resources Code Section 5020.1(k) or have been determined by the City to be significant pursuant to Public Resources Code Section 5024.1.

Implementation of **Mitigation Measures CULT-1 and CULT-3**, as presented in Cultural Resources, Section 3.5 above, would reduce any potentially significant impacts from the project to tribal cultural resources, including remains that may be discovered during construction, to a less-than-significant level.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Implementation of **Mitigation Measures CULT-1 and CULT-2** would reduce impacts to tribal cultural resources during construction.

Significance Determination after Mitigation: Less than Significant

3.19 UTILITIES AND SERVICE SYSTEMS

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐
b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?	☐	☐	☐	☒
c. Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
d. Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☒	☐	☐
e. Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☐	☒

3.19.1 Environmental Setting

The project site is in an urban area of Walnut Creek where utilities are available. Walnut Creek is within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Region 2.

3.19.1.1 Water

Two districts supply Walnut Creek with water: the East Bay Municipal Utility District (EBMUD), which serves about two-thirds of the City; and the Contra Costa Water District, which serves approximately one-third of the City. The EBMUD water treatment facility is in Walnut Creek and treats water in the regional transmission main. Other treatment facilities are the separate EBMUD and Contra Costa Water District systems throughout Contra Costa County (City of Walnut Creek 2005).

3.19.1.2 Wastewater

The Central Contra Costa Sanitary District (CCCSD) provides sanitary collection and wastewater treatment to the City. The City of Walnut Creek does not own or operate any wastewater treatment facilities. CCCSD's wastewater collection system within the Walnut Creek area consists of gravity sewer lines and pump stations (City of Walnut Creek 2005).

3.19.1.3 Solid Waste

The Central Contra Costa Solid Waste Authority oversees solid waste collection, disposal, and recycling services in Walnut Creek. Central Contra Costa Solid Waste Authority has agreements with Pleasant Hill Bayshore Disposal for the collection, transfer, and disposal of residential and commercial solid waste, and with Valley Waste Management for the curbside collection and marketing of residential recycling and used motor oil (City of Walnut Creek 2005). The Keller Canyon Landfill is the closest solid waste facility to the project area. The landfill is permitted to accept a capacity of 3,500 tons of waste per day (City of Walnut Creek 2005). The estimated closure date for this landfill is December 31, 2030 (CalRecycle 2017). The City's Sustainability Action Plan (2023) requires the recycling of construction waste for all City and private projects. The City has implemented a construction and demolition materials recycling program to enforce the construction material recycling requirements.

3.19.1.4 Power

PG&E is the electricity service purveyor in Walnut Creek. Underground electrical lines are located within the project site. Four-inch PG&E ducts are mounted on the upstream side of the bridge.

3.19.2 Impact Analysis

a. Would the project require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

The project involves the demolition and the construction of a new bridge along South Main Street at the Las Trampas Creek crossing. The project would relocate any water, sewer, electric, natural gas, and telecommunications utilities that run through the project site. Overhead utilities would be relocated underground in compliance with the City's policies. Water would be used for dust-controlling and hydroseeding activities during construction activities. However, due to the relatively small areas that would require soil watering and the temporary nature of construction, soil watering would not generate an increase in demand for water. It is anticipated that water used for dust control would be provided by truck. Any wastewater that is generated at the project site during construction would be temporary and would hauled off-site to the CCCSD treatment facility for processing.

The project is a bridge replacement project and does not include uses that generate a demand for water or wastewater treatment other than those potentially necessary during the construction phase. Therefore, operation of the project would not generate a new demand for water or wastewater treatment and would not adversely affect long-term water supplies or require the construction of new wastewater treatment facilities or the expansion of existing facilities. Impacts related to water supply and wastewater treatment would be less than significant, and no mitigation measures are required.

The project includes the replacement of an existing bridge. The existing bridge has stormwater drainage facilities on each end of the bridge. The project does not include replacement or expansion of existing facilities, nor would it require the expansion of existing facilities. Refer to Section 3.10, Hydrology and Water Quality, for further discussion. Therefore, there would be no impacts related to new or expanded stormwater drainage facilities.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

b. Would the project have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?

Water would be required during construction for dust control and hydroseeding activities. Water for dust control activities would be trucked in from off site. The project site is relatively small and so the amount of water required for dust control activities would be minimal and temporary. Therefore, there are sufficient water supplies available to serve project construction activities. The project is a bridge replacement project and, once operational, does not include any features that demand water. Therefore, the project would have no impacts associated with available water supplies during normal or dry years.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

c. Would the project result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

The proposed project is a bridge replacement project and, as such, does not involve uses requiring wastewater treatment. Any wastewater generated during construction of the proposed project would be temporary and would be disposed of properly by the project contractor as required by the Construction General Permit. Refer to the Section 3.10, Hydrology and Water Quality, for further discussion. Therefore, the project would have no impact associated with wastewater treatment.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

d. Would the project generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

The project would generate construction waste that would require disposal in local landfills. Construction-related solid waste generated by the project would include wood and concrete debris, inert materials, and mixed municipal from construction workers on the project site. Construction waste would be recycled as appropriate and consistent with State and local management and solid waste reduction statutes and regulations. Implementation of **Mitigation Measure UTIL-1**, which requires compliance with City waste management policies and recycling requirements would reduce impacts associated with the generation of solid waste during construction activities. The project is a bridge replacement project and does not include uses that generate a substantial amount of solid waste during project operations. Operation of the project would not increase the demand for solid waste disposal (landfill service facilities).

Significance Determination: Potentially Significant Impact

Mitigation Measures: Mitigation Measure UTIL-1 would be implemented to avoid impacts to solid waste standards associated with construction from the proposed project:

Mitigation Measure UTIL-1	**City of Walnut Creek Waste Management Plan.** Prior to construction, the Construction Contractor shall prepare and submit to the City a Waste Management Plan (WMP) that complies with City waste management policies and recycling requirements, including diversion of 65% of materials to recycling or reuse. The WMP shall identify all the materials estimated to be recycled, salvaged, or disposed as well as the handling procedure, approved hauler, and destination of each material type. The WMP shall be approved by the City prior to construction commencement.

Significance Determination after Mitigation: Less than Significant

With implementation of **Mitigation Measure UTIL-1,** temporary impacts associated with the generation of solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, would be less than significant with mitigation incorporated.

e. Would the project comply with federal, state, and local statutes and regulations related to solid waste?

The project would comply with federal, State, and local regulations related to solid waste. No impact would occur.

Significance Determination: No Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: No Impact

3.20 WILDFIRE

If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a. Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☒	☐	☐
b. Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☒	☐
c. Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☒	☐
d. Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☒	☐

3.20.1 Environmental Setting

The Fire and Resource Assessment Program of the Catt designates the project site as a Non-Very High Fire Hazard Severity Zone (Non-VHFHSZ) of a Local Responsibility Area (LRA) within an incorporated city (CAL FIRE 2009). The project site is in an urbanized portion of Walnut Creek on South Main Street. Las Trampas Creek flows beneath the project site. Trees, shrubs, bushes, and some grass line Las Trampas Creek and adjacent parcels are landscaped with ornamental trees.

3.20.2 Impact Analysis

a. Would the project substantially impair an adopted emergency response plan or emergency evacuation plan?

The City adopted an *Emergency Management Plan* for the City in October 2019. The Emergency Management Plan is an all-hazard plan designed as a reference and guiding document establishing the emergency organization, task assignment, specific policies and general procedures, and coordination of the responsibilities of the City as a member of the Contra Costa Operation Area with other Operation Area member organizations, in both response and recovery procedures. The City does not have an established emergency evacuation plan; however, main roads in Walnut Creek connect with SR 24 and I-680 to allow residents and employees in the City to exit into other regions of Contra Costa County.

During construction of the project, detours would be available around the area where construction would take place. However, due to the large average daily trips on this facility, the construction would require full road closure. As a standard condition, the Construction Contractor of the project, prior to the commencement of construction, would provide the public and emergency responders with a construction detour plan and emergency evacuation plan to ensure that emergency response or evacuation in the area can still take place. Additionally, as described in **Mitigation Measure TRAN-1**, in Section 3.17, Transportation, the City of Walnut Creek Public Works Department would be required to prepare a Transportation Management Plan (TMP) during final design to address detours and notification for fire services during construction. The TMP would include the installation of detour signs and advance notice to the public and emergency service providers regarding the timing, location, and duration of road closures. Overall, implementation of the project would not substantially impair an adopted emergency response plan or emergency evacuation plan. Impacts would be less than significant with implementation of **Mitigation Measure TRAN-1**.

Significance Determination: Potentially Significant Impact

Mitigation Measures: Implementation of **Mitigation Measure TRAN-1** would reduce impacts that could impair an adopted emergency response plan or emergency evacuation plan during construction.

Significance Determination after Mitigation: Less than Significant

b. Would the project, due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

The project site is in an urban area that includes roadways, buildings, infrastructure (e.g., bridge), and utilities. Small areas of natural vegetation occur within Las Trampas Creek and ornamental vegetation exists within landscaped areas of adjacent and/or nearby parcels. Work conducted in Las Trampas Creek may require vegetation removal. However, replanting would take place as necessary once the project is complete. The project site is relatively flat except for slightly sloped banks within Las Trampas Creek. The project includes the replacement of the existing Las Trampas Bridge over Las Trampas Creek and improvements to roadway approaches along South Main Street. None of the project features project would exacerbate wildfire risks beyond the conditions that currently exist at the site. Implementation of the project would not exacerbate wildfire risks due to slope, prevailing winds, or other factors and would not expose the traveling public to pollutant concentrations from a wildfire or uncontrolled spread of a wildfire. Impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

c. Does the project require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

The project would include the removal of the existing Las Trampas Creek Bridge on South Main Street and the installation of a new, modern bridge. South Main Street approaches on the north and south side of the bridge would be modified to ensure proper alignment with the new bridge. The project would also require the relocation of utilities; however, the Construction Contractor would coordinate with utility providers to ensure relocations of utilities in the project area are compliant with utility and City fire standards. Utility relocations associated with the project are not anticipated to result in temporary or ongoing impacts to the environment and exacerbate wildfire risk. Impacts would be less than significant, and no mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

d. Would the project expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

The project is in an LRA Non-VHFHSZ designated area and no VHFHSZ areas are near the project site.

The project site is relatively flat and is in an urban area; therefore, the project site is not susceptible to landslides caused by post-fire conditions. Las Trampas Creek provides drainage for the project area as well as areas outside of the city. In the project area, Las Trampas Creek is a concrete-lined channel with a double barrel concrete box culvert approximately 30 feet downstream of the bridge with a drop structure and energy dissipaters upstream. The creek drains a watershed of 27.2 square miles and the peak discharge area is at the confluence of San Ramon Creek, 1,485 feet downstream of the project site. As part of the project, the new bridge would be designed with a soffit maintained at or above an elevation of 145.6 feet, which would allow 100-year water surface and 50-year water surface elevation flooding clearance requirements over Las Trampas Creek. Therefore, the risk of downslope or downstream flooding or landslides as a result of runoff, post-fire slope instability, or drainage changes is less than significant. No mitigation measures are required.

Significance Determination: Less than Significant Impact

Mitigation Measures: No mitigation is required

Significance Determination after Mitigation: Less than Significant

3.21 MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☒	☐
c. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

3.21.1 Impact Analysis

a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Less Than Significant with Mitigation Incorporated

The project would include the demolition of an existing bridge over Las Trampas Creek along South Main Street and development of a replacement bridge. As described throughout this Initial Study/ Mitigated Negative Declaration (IS/MND), implementation of the project would have the potential to adversely impact sensitive natural communities, special-status animals, and previously undiscovered cultural resources and/or human remains. With implementation of the mitigation measures recommended in this IS/MND, compliance with City requirements, and application of standard practices, development of the project would not (1) degrade the quality of the environment, (2) substantially reduce the habitat of fish or wildlife species, (3) cause a fish or wildlife population to drop below self-sustaining levels, (4) threaten to eliminate a plant or animal community, (5) reduce the number or restrict the range of a rare or endangered plant or animal, or (6) eliminate important examples of the major periods of California history or prehistory.

b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?

Less Than Significant Impact

The project would include the demolition of an existing bridge and development of a replacement bridge over Las Trampas Creek along South Main Street. All environmental impacts that could occur as a result of the project would be reduced to a less-than-significant level with implementation of the mitigation measures recommended throughout this IS/MND. Furthermore, the impacts relevant to the project are localized and confined to the immediate project area. Given that the potential project-related impacts are less than significant and geographically limited, impacts of the project would not be cumulatively considerable when viewed in conjunction with other closely related past, present, or reasonably foreseeable future projects.

c. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Less Than Significant with Mitigation Incorporated

The purpose of the project is to replace the structurally deficient bridge and realign and widen the existing roadway to meet Association of State Highway and Transportation Officials (AASHTO) and current Caltrans' bridge standards. As described in this IS/MND, implementation of the project could result in temporary aesthetic, air quality, biology, cultural, geology and soils, GHG, hazardous waste, hydrology, noise, transportation and traffic, tribal resource, and utility and service system impacts during the construction period. Implementation of the mitigation measures recommended in this IS/MND, compliance with City regulations, and application of standard construction practices would ensure that the project would not result in environmental impacts that would cause substantial direct or indirect adverse impacts on human beings.

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APPENDIX A

AIR QUALITY ROADMOD OUTPUT

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Road Construction Emissions Model **Version 9.0.0**

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	Las Trampas Creek Bridge at South Main Street Replacement Project	
Construction Start Year	2021	Enter a Year between 2014 and 2040 (inclusive)
Project Type	3	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	20.00	months
Working Days per Month	22.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	1	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the Ione formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	0.08	miles
Total Project Area	1.00	acre
Maximum Area Disturbed/Day	1.00	acre
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing			
	Grading/Excavation	20.00	800.00	300.00
	Drainage/Utilities/Sub-Grade			
	Paving			
Asphalt	Grubbing/Land Clearing			
	Grading/Excavation			
	Drainage/Utilities/Sub-Grade			
	Paving			

Mitigation Options

On-road Fleet Emissions Mitigation		Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation		Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/Mitigation). Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing		2.00		1/1/2021
Grading/Excavation		8.00		3/3/2021
Drainage/Utilities/Sub-Grade		7.00		11/2/2021
Paving		3.00		6/3/2022
Totals (Months)	20			

Note: Soil Hauling emission default values can be overridden in cells D61 through D64, and F61 through F64.

Soil Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing		30.00		0	0.00
Miles/round trip: Grading/Excavation		30.00		55	1650.00
Miles/round trip: Drainage/Utilities/Sub-Grade		30.00		0	0.00
Miles/round trip: Paving		30.00		0	0.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Grading/Excavation (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Draining/Utilities/Sub-Grade (grams/mile)	0.04	0.42	3.07	0.11	0.05	0.02	1,757.08	0.00	0.28	1,839.44
Paving (grams/mile)	0.04	0.42	3.08	0.11	0.05	0.02	1,748.57	0.00	0.27	1,830.52
Grubbing/Land Clearing (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.15	1.54	11.57	0.41	0.18	0.06	6,472.41	0.01	1.02	6,775.76
Tons per const. Period - Grading/Excavation	0.01	0.14	1.02	0.04	0.02	0.01	569.57	0.00	0.09	596.27
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.01	0.14	1.02	0.04	0.02	0.01	569.57	0.00	0.09	596.27

Note: Asphalt Hauling emission default values can be overridden in cells D91 through D94, and F91 through F94.

Asphalt Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing		30.00		0	0.00
Miles/round trip: Grading/Excavation		30.00		0	0.00
Miles/round trip: Drainage/Utilities/Sub-Grade		30.00		0	0.00
Miles/round trip: Paving		30.00		0	0.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Grading/Excavation (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Draining/Utilities/Sub-Grade (grams/mile)	0.04	0.42	3.07	0.11	0.05	0.02	1,757.08	0.00	0.28	1,839.44
Paving (grams/mile)	0.04	0.42	3.08	0.11	0.05	0.02	1,748.57	0.00	0.27	1,830.52
Grubbing/Land Clearing (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Worker commute default values can be overridden in cells D121 through D126.

Worker Commute Emissions User Input	User Override of Worker Commute Default Values	Default Values	Calculated Daily Trips	Calculated Daily VMT
Miles/ one-way trip		20		
One-way trips/day		2		
No. of employees: Grubbing/Land Clearing		5	10	200.00
No. of employees: Grading/Excavation		28	56	1,120.00
No. of employees: Drainage/Utilities/Sub-Grade		18	36	720.00
No. of employees: Paving		8	16	320.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.02	1.10	0.10	0.05	0.02	0.00	339.80	0.00	0.01	342.28
Grading/Excavation (grams/mile)	0.02	1.10	0.10	0.05	0.02	0.00	339.80	0.00	0.01	342.28
Draining/Utilities/Sub-Grade (grams/mile)	0.02	1.03	0.09	0.05	0.02	0.00	331.79	0.00	0.01	334.10
Paving (grams/mile)	0.02	1.00	0.08	0.05	0.02	0.00	328.72	0.00	0.01	330.96
Grubbing/Land Clearing (grams/trip)	1.18	2.95	0.34	0.00	0.00	0.00	72.81	0.08	0.04	85.39
Grading/Excavation (grams/trip)	1.18	2.95	0.34	0.00	0.00	0.00	72.81	0.08	0.04	85.39
Draining/Utilities/Sub-Grade (grams/trip)	1.12	2.87	0.32	0.00	0.00	0.00	71.17	0.08	0.03	83.25
Paving (grams/trip)	1.11	2.85	0.32	0.00	0.00	0.00	70.54	0.08	0.03	82.43

Emissions	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Pounds per day - Grubbing/Land Clearing	0.03	0.55	0.05	0.02	0.01	0.00	151.43	0.00	0.00	152.80
Tons per const. Period - Grubbing/Land Clearing	0.00	0.01	0.00	0.00	0.00	0.00	3.33	0.00	0.00	3.36
Pounds per day - Grading/Excavation	0.20	3.08	0.28	0.11	0.05	0.01	848.01	0.02	0.02	855.69
Tons per const. Period - Grading/Excavation	0.02	0.27	0.02	0.01	0.00	0.00	74.62	0.00	0.00	75.30
Pounds per day - Drainage/Utilities/Sub-Grade	0.12	1.86	0.16	0.07	0.03	0.01	532.31	0.01	0.01	536.93
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.01	0.14	0.01	0.01	0.00	0.00	40.99	0.00	0.00	41.34
Pounds per day - Paving	0.05	0.81	0.07	0.03	0.01	0.00	234.39	0.01	0.01	236.39
Tons per const. Period - Paving	0.00	0.03	0.00	0.00	0.00	0.00	7.74	0.00	0.00	7.80
Total tons per construction project	0.03	0.45	0.04	0.02	0.01	0.00	126.68	0.00	0.00	127.81

Note: Water Truck default values can be overridden in cells D153 through D156, I153 through I156, and F153 through F156.

Water Truck Emissions	User Override of	Program Estimate of	User Override of Truck	Default Values	Calculated	User Override of	Default Values	Calculated
User Input	Default # Water Trucks	Number of Water Trucks	Round Trips/Vehicle/Day	Round Trips/Vehicle/Day	Trips/day	Miles/Round Trip	Miles/Round Trip	Daily VMT
Grubbing/Land Clearing - Exhaust		1		5	5		8.00	40.00
Grading/Excavation - Exhaust		1		5	5		8.00	40.00
Drainage/Utilities/Subgrade		1		5	5		8.00	40.00
Paving		1		5	5		8.00	40.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Grading/Excavation (grams/mile)	0.04	0.42	3.06	0.11	0.05	0.02	1,779.29	0.00	0.28	1,862.69
Draining/Utilities/Sub-Grade (grams/mile)	0.04	0.42	3.07	0.11	0.05	0.02	1,757.08	0.00	0.28	1,839.44
Paving (grams/mile)	0.04	0.42	3.08	0.11	0.05	0.02	1,748.57	0.00	0.27	1,830.52
Grubbing/Land Clearing (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.04	0.31	0.01	0.00	0.00	156.91	0.00	0.02	164.26
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.01	0.00	0.00	0.00	3.45	0.00	0.00	3.61
Pounds per day - Grading/Excavation	0.00	0.04	0.31	0.01	0.00	0.00	156.91	0.00	0.02	164.26
Tons per const. Period - Grading/Excavation	0.00	0.00	0.03	0.00	0.00	0.00	13.81	0.00	0.00	14.45
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.04	0.31	0.01	0.00	0.00	154.95	0.00	0.02	162.21
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.02	0.00	0.00	0.00	11.93	0.00	0.00	12.49
Pounds per day - Paving	0.00	0.04	0.32	0.01	0.00	0.00	154.20	0.00	0.02	161.42
Tons per const. Period - Paving	0.00	0.00	0.01	0.00	0.00	0.00	5.09	0.00	0.00	5.33
Total tons per construction project	0.00	0.01	0.07	0.00	0.00	0.00	34.28	0.00	0.01	35.89

Note: Fugitive dust default values can be overridden in cells D183 through D185.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		1.00	10.00	0.22	2.08	0.05
Fugitive Dust - Grading/Excavation		1.00	10.00	0.88	2.08	0.18
Fugitive Dust - Drainage/Utilities/Subgrade		1.00	10.00	0.77	2.08	0.16

Off-Road Equipment Emissions

Grubbing/Land Clearing	Default Number of Vehicles	Mitigation Option Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Crawler Tractors	0.55	2.44	6.97	0.26	0.24	0.01	760.36	0.25	0.01	768.56
			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		Model Default Tier	Excavators	0.46	6.54	4.31	0.21	0.19	0.01	1,000.38	0.32	0.01	1,011.17
			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Signal Boards	0.06	0.30	0.36	0.01	0.01	0.00	49.31	0.01	0.00	49.56
			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
			pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing	pounds per day	1.07	9.28	11.63	0.49	0.45	0.02	1,810.06	0.57	0.02	1,829.30
Grubbing/Land Clearing	tons per phase	0.02	0.20	0.26	0.01	0.01	0.00	39.82	0.01	0.00	40.24

Grading/Excavation	Default Number of Vehicles	Mitigation Option Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Cranes	0.41	1.98	4.85	0.20	0.18	0.01	558.74	0.18	0.01	564.76
	2		Model Default Tier	Crawler Tractors	1.10	4.87	13.94	0.52	0.48	0.02	1,520.73	0.49	0.01	1,537.12
			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4		Model Default Tier	Excavators	0.92	13.09	8.61	0.42	0.38	0.02	2,000.77	0.65	0.02	2,022.34
			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		Model Default Tier	Graders	0.91	3.53	11.85	0.38	0.35	0.01	1,283.37	0.42	0.01	1,297.19
			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3		Model Default Tier	Rollers	0.57	5.64	5.77	0.35	0.32	0.01	762.27	0.25	0.01	770.48
			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3		Model Default Tier	Rubber Tired Loaders	1.03	4.80	11.59	0.39	0.36	0.02	1,815.68	0.59	0.02	1,835.29
	4		Model Default Tier	Scrapers	3.72	28.02	42.81	1.67	1.53	0.06	5,871.65	1.90	0.05	5,934.95
	1		Model Default Tier	Signal Boards	0.06	0.30	0.36	0.01	0.01	0.00	49.31	0.01	0.00	49.56
			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		Model Default Tier	Tractors/Loaders/Backhoes	0.37	4.52	3.79	0.22	0.21	0.01	601.80	0.19	0.01	608.28
			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day		9.09	66.75	103.57	4.16	3.83	0.15	14,464.32	4.67	0.13	14,619.98
	Grading/Excavation	tons per phase		0.80	5.87	9.11	0.37	0.34	0.01	1,272.86	0.41	0.01	1,286.56

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Air Compressors	0.28	2.42	1.92	0.11	0.11	0.00	375.26	0.02	0.00	376.73
			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Generator Sets	0.34	3.68	2.99	0.15	0.15	0.01	623.04	0.03	0.00	625.19
	2		Model Default Tier	Graders	0.85	3.47	10.88	0.35	0.32	0.01	1,282.78	0.41	0.01	1,296.60
			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Plate Compactors	0.04	0.21	0.25	0.01	0.01	0.00	34.48	0.00	0.00	34.65
			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Pumps	0.36	3.73	3.04	0.16	0.16	0.01	623.04	0.03	0.00	625.24
			Model Default Tier	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Rough Terrain Forklifts	0.12	2.29	1.52	0.05	0.05	0.00	333.76	0.11	0.00	337.36
			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4		Model Default Tier	Scrapers	3.40	26.20	37.72	1.47	1.35	0.06	5,878.54	1.90	0.05	5,941.91
	1		Model Default Tier	Signal Boards	0.06	0.30	0.36	0.01	0.01	0.00	49.31	0.01	0.00	49.56
			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		Model Default Tier	Tractors/Loaders/Backhoes	0.34	4.49	3.47	0.19	0.18	0.01	602.29	0.19	0.01	608.77
			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage/Utilities/Sub-Grade	pounds per day		5.78	46.79	62.16	2.52	2.35	0.10	9,802.50	2.72	0.09	9,896.01
	Drainage/Utilities/Sub-Grade	tons per phase		0.45	3.60	4.79	0.19	0.18	0.01	754.79	0.21	0.01	761.99

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Pavers	0.21	2.88	2.10	0.10	0.09	0.00	455.26	0.15	0.00	460.17
	1		Model Default Tier	Paving Equipment	0.18	2.55	1.74	0.08	0.08	0.00	394.47	0.13	0.00	398.73
			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Rollers	0.17	1.86	1.73	0.10	0.09	0.00	254.10	0.08	0.00	256.84
			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			Model Default Tier	Scrapers		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1		Model Default Tier	Signal Boards		0.06	0.30	0.36	0.01	0.01	0.00	49.31	0.01	0.00	49.56
			Model Default Tier	Skid Steer Loaders		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Surfacing Equipment		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Sweepers/Scrubbers		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		Model Default Tier	Tractors/Loaders/Backhoes		0.33	4.48	3.35	0.18	0.17	0.01	602.48	0.19	0.01	608.96
			Model Default Tier	Trenchers		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Model Default Tier	Welders		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab					ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles		Equipment Tier		Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		N/A			0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Paving			pounds per day		0.94	12.07	9.27	0.48	0.44	0.02	1,755.62	0.56	0.02	1,774.26
	Paving			tons per phase		0.03	0.40	0.31	0.02	0.01	0.00	57.94	0.02	0.00	58.55
Total Emissions all Phases (tons per construction period) =>						1.30	10.08	14.46	0.59	0.54	0.02	2,125.41	0.65	0.02	2,147.35

Equipment default values for horsepower and hours/day can be overridden in cells D403 through D436 and F403 through F436.

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		221		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		231		8
Crawler Tractors		212		8
Crushing/Proc. Equipment		85		8
Excavators		158		8
Forklifts		89		8
Generator Sets		84		8
Graders		187		8
Off-Highway Tractors		124		8
Off-Highway Trucks		402		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		168		8
Pavers		130		8
Paving Equipment		132		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		80		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		247		8
Rubber Tired Loaders		203		8
Scrapers		367		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		263		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		97		8
Trenchers		78		8
Welders		46		8

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Las Trampas Creek Bridge at South Main Street Replacement Project

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	1.11	9.87	11.99	10.52	0.52	10.00	2.54	0.46	2.08	0.02	2,118.40	0.58	0.05	2,146.36
Grading/Excavation	9.44	71.41	115.74	14.69	4.69	10.00	6.14	4.06	2.08	0.22	21,941.64	4.70	1.20	22,415.70
Drainage/Utilities/Sub-Grade	5.90	48.69	62.64	12.60	2.60	10.00	4.47	2.39	2.08	0.11	10,489.76	2.73	0.12	10,595.15
Paving	0.99	12.91	9.66	0.52	0.52	0.00	0.46	0.46	0.00	0.02	2,144.21	0.56	0.05	2,172.08
Maximum (pounds/day)	9.44	71.41	115.74	14.69	4.69	10.00	6.14	4.06	2.08	0.22	21,941.64	4.70	1.20	22,415.70
Total (tons/construction project)	1.34	10.68	15.59	2.51	0.64	1.87	0.95	0.57	0.39	0.03	2,855.94	0.65	0.12	2,907.31

Notes:	
Project Start Year ->	2021
Project Length (months) ->	20
Total Project Area (acres) ->	1
Maximum Area Disturbed/Day (acres) ->	1
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	200	40
Grading/Excavation	1,100	0	1,650	0	1,120	40
Drainage/Utilities/Sub-Grade	0	0	0	0	720	40
Paving	0	0	0	0	320	40

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Las Trampas Creek Bridge at South Main Street Replacement Project

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.02	0.22	0.26	0.23	0.01	0.22	0.06	0.01	0.05	0.00	46.60	0.01	0.00	42.84
Grading/Excavation	0.83	6.28	10.18	1.29	0.41	0.88	0.54	0.36	0.18	0.02	1,930.86	0.41	0.11	1,789.51
Drainage/Utilities/Sub-Grade	0.45	3.75	4.82	0.97	0.20	0.77	0.34	0.18	0.16	0.01	807.71	0.21	0.01	740.11
Paving	0.03	0.43	0.32	0.02	0.02	0.00	0.02	0.02	0.00	0.00	70.76	0.02	0.00	65.03
Maximum (tons/phase)	0.83	6.28	10.18	1.29	0.41	0.88	0.54	0.36	0.18	0.02	1930.86	0.41	0.11	1,789.51
Total (tons/construction project)	1.34	10.68	15.59	2.51	0.64	1.87	0.95	0.57	0.39	0.03	2855.94	0.65	0.12	2,637.49

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

APPENDIX B

NATURAL ENVIRONMENT STUDY (MINIMAL IMPACTS)

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Natural Environment Study

(Minimal Impacts)

Las Trampas Creek Bridge Replacement Project

Walnut Creek, California

Federal Project #BRLS-5225(026)

September 2018

STATE OF CALIFORNIA
Department of Transportation
City of Walnut Creek

Prepared By:	Jennifer Roth Jennifer Roth Associate/Senior Wildlife Biologist LSA 510-236-6810	Date: 9/28/18
Approved By:	Alex Wong City of Walnut Creek Public Works Department 925-943-5899 x2239	Date: 9/12/18
Recommended for Approval By:	Keevan Harding Environmental Planner – Natural Sciences Office of Local Assistance Caltrans, District 4 (510) 622-5912	Date: 11/16/18
Approved By:	Tom Holstein Senior Environmental Planner Office of Local Assistance Caltrans, District 4 510-286-6371	Date: 16 Nov 2018

Summary

The City of Walnut Creek proposes to replace the existing bridge over Las Trampas Creek at South Main Street. The existing bridge was built in 1919 and previously widened on the south and north sides in 1950 and 1956, respectively. The bridge has numerous cracks and severe spalling and has been classified as "Structurally Deficient and Functionally Obsolete". The purpose of the project is to replace the existing bridge to meet current design standards and to ensure that it will handle future traffic volumes.

The bridge is located on South Main Street, approximately 0.1 mile south of Olympic Boulevard, in the City of Walnut Creek, Contra Costa County, California. The proposed project will include slight realignments of the roadway approaches between the intersections of Botelho Drive and Broadway Plaza. The new bridge will provide 12-foot-wide travel lanes, 8-foot-wide shoulders, 10-foot-wide sidewalks, and a 4- to 5-foot-wide median. The existing bridge will be replaced with a two-span bridge with a center pier aligned with the existing nose wall of the adjacent downstream culvert structure.

The proposed project will have minimal impacts on biological resources as the BSA is located within a dense urban area and the bed and banks of Las Trampas Creek are lined with concrete at the bridge location. There will be approximately 0.25 acre of temporary impacts and approximately 0.01 acre of permanent impacts to jurisdictional waters. A total of 18 trees will be removed as part of the project. There is no habitat for special-status plants within the project footprint. Las Trampas Creek does provide marginal movement habitat for western pond turtle (*Actinemys marmorata*), a California Species of Special Concern. There will be ***no effect*** on federally or state listed species as a result of the proposed project. Avoidance and minimization measures for unavoidable impacts to jurisdictional waters, trees, and special-status species are provided herein.

Compensation for impacts to jurisdictional waters will be achieved through one of the following options: (1) purchase of mitigation credits from one or more mitigation banks approved by the United States Army Corps of Engineers (ACOE), Regional Water Quality Control Board (RWQCB), and California Department of Fish and Wildlife (CDFW) that include the project site within their service areas; (2) purchase and preservation of an approved, off-site parcel with establishment of a conservation easement, development of a management plan, and provision of a perpetual endowment sufficient to cover management of protected lands; or (3) a combination of the above two approaches. Compensatory mitigation for loss of trees will consist of mitigation plantings of the same species within the City of Walnut Creek at a 1:1 ratio, in accordance with the mitigation requirements under the City of Walnut Creek's Tree Protection Ordinance.

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List and Definitions of Abbreviated Terms

AASHTO	American Association of State Highway and Transportation Officials
ACOE	Army Corps of Engineers
ADT	Average Daily Traffic Volumes
ANSI	American National Standards Institute
BMP	Best Management Practice
BSA	Biological Study Area
Cal-IPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CIDH	Cast-In-Drilled-Hole
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
EFH	Essential Fish Habitat
FESA	Federal Endangered Species Act
HTL	High Tide Line
IPaC	Information for Planning and Consultation
MBTA	Migratory Bird Treaty Act
NWP	Nationwide Permit
OHWM	Ordinary High Water Mark
PCN	Preconstruction Notification
RWQCB	Regional Water Quality Control Board
TPZ	Tree Protection Zone
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1. Introduction

1.1 Project Purpose and Need

The existing bridge over Las Trampas Creek at South Main Street is a reinforced concrete, T-beam bridge built in 1919. The bridge was widened on the south side with a reinforced concrete, T-beam superstructure in 1950 and on the north side with a reinforced concrete, slab superstructure in 1956. The bridge is supported by bent-style abutments and is approximately 131 feet long and 73 feet wide.

The existing bridge has been classified as "Structurally Deficient and Functionally Obsolete" with an overall sufficiency rating of 47.4. There are numerous cracks with efflorescence in the soffit and regions of severe spalling with exposed, rusted rebar. In addition, the bridge does not have adequate clear width for current and projected Average Daily Traffic (ADT) volumes. South Main Street is functionally classified as a major collector per the California Road System (CRS) Maps and is considered part of the Federal Aid Highway System. The ADT is currently estimated to be approximately 9,000 vehicles per day (calculated by Fehr & Peers based on unpublished data) and future ADT (2030) is projected to be 18,750 vehicles per day (calculated by Fehr and Peers based on data from Appendix G of the Broadway Plaza Environmental Impact Report [ESA 2012]). In the Walnut Creek Pedestrian Master Plan, this section of South Main Street forms the edge of the Pedestrian Retail District and falls within the Core Area Zone (Fehr and Peers 2016).

The purpose of the proposed project is to replace the bridge to meet current design standards for safety reasons and to ensure that the bridge will support current and future traffic volumes along this important thoroughfare.

1.2 Project Description

The Las Trampas Creek Bridge is located on South Main Street, approximately 0.1 mile south of Olympic Boulevard, in the City of Walnut Creek, Contra Costa County, California (Figure 1). The BSA is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is ½ block north of the Kaiser Permanente Hospital. It is located in T1N, R2W in an unsectioned area of Contra Costa County and is shown on the Walnut Creek United States Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 2).

The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants, and the new Agora at South Main apartments and retail space. Driveway access to these features is currently located on all four corners of the bridge. Numerous utilities are mounted on both sides of and underneath the bridge and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

The proposed project will include slight realignments of the roadway approaches between the intersections of Botelho Drive and Broadway Plaza. The roadway edges will conform to the existing sidewalks and driveways with as minimal impact as possible. The proposed vertical profile is planned to be similar to the existing to minimize cut/fill requirements adjacent to the proposed bridge. Based upon recommended American Association of State Highway and Transportation Officials (AASHTO) guidelines and Contra Costa County standards, 12-foot-wide travel lanes and 8-foot-wide shoulders will be provided. In addition, 10-foot-wide sidewalks will be proposed, in accordance with the City of Walnut Creek's Core Area Zone design guidelines. The clear roadway width of the proposed bridge will be approximately 100 feet to accommodate the two 12-foot-wide traffic lanes in each direction, two 8-foot-wide shoulders, two 10-foot-wide sidewalks, a 4-foot to 5-foot-wide median, and left turn pockets approaching the intersections of Botelho Drive and Broadway Plaza.

The preferred alternative is a two-span bridge with a center pier aligned with the existing nose wall of the adjacent downstream culvert structure. The abutments will be just behind Piers 2 and 5 of the existing bridge, providing a total bridge length of 104 feet. Viable superstructure types include a cast-in-place, post-tensioned concrete slab or a precast, prestressed voided concrete slab. Large-diameter, cast-in-drilled-hole (CIDH) concrete piles will be used to support the bridge structure in order to minimize vibration impacts to adjacent structures and utilities.

The new bridge will be constructed over the course of two construction seasons beginning in 2019 and will be staged to maintain use of the bridge and avoid the high impacts on nearby roads that would result from road closures and detours. Each construction season is anticipated to begin in January and end in December; all in-water work will be completed between June 1 and October 15 each year. During the first season, the west portion of the bridge will be removed (currently carrying southbound traffic) and vehicular and pedestrian traffic directed to the east half of the bridge (currently carrying northbound traffic). During the second season of construction, pedestrian and vehicular traffic will be redirected to the new half of the bridge while construction is completed. During each season of construction, traffic lanes along South Main Street will be reconfigured to align with the detours on either side of the bridge.

The existing bridge deck will be saw-cut to remove a portion of the bridge superstructure, substructure, and foundation. A total of two abutments and four piers will be removed. Piers 2 and 5 are located near the top of the channel slope and feature reinforced concrete columns with pier walls enclosing the abutments. Piers 3 and 4 are located near the bottom of the channel. Each pier has a total of seven footings. The project will also include the removal of the concrete-lined streambed and concrete-filled sand bags embedded in the banks adjacent to the bridge.

Demolition of Piers 2 and 5 will include partial removal of up to 48 timber piles and 20 precast concrete piles to a depth of 3 feet below original grade and full removal of up to 16 timber piles if they are found to be in conflict with the new cast-in-drilled-hole concrete abutment piles, and demolition of the fourteen 6-foot-wide by 8-foot-long by 2-foot-thick footings. Demolition of Piers 3 and 4 will include removal of up to 32 timber piles and 20 precast concrete piles to a depth of 3 feet below channel grade and demolition of the fourteen 6-foot-wide by 6-foot-long by 2-foot-thick footings. Demolition of abutments 1 and 6 will include removal of the fourteen 6-foot-wide by 6-foot-long by 2-foot-thick footings.

The construction of the new bridge will include the installation of two 110-foot-wide by 5-foot-thick by 6-foot-deep abutments with multiple 4- to 6-foot-diameter CIDH concrete piles up to 120 feet deep, a central pier with multiple 4- to 6-foot-diameter CIDH concrete piles up to 120 feet deep, and two new roadway approaches in largely the same alignment as the existing approaches. A new concrete streambed and banks will also be constructed, along with new sidewalks, driveways, street signs, traffic signals, and a median associated with the new bridge and realigned roadway. Utilities will need to be relocated as part of the project, including electrical, telephone, cable, and water lines.

The project will require temporarily diverting stream flow around the work site through a pipe. Downstream flow will be maintained at all times. Temporary shoring will likely be required to construct the new abutments and the pier within the channel. Temporary shoring will consist of sheet piles or CIDH soldier piles. The CIDH pile installation at the center pier would also require a temporary work pad to be constructed in the channel to provide adequate width for the contractor's equipment (e.g., drill rig, pile oscillator, crane, excavator). An earthen ramp will be constructed to provide access to equipment entering the channel for both the existing bridge removal and the center pier construction. The ramp will likely be adjacent to the southwest corner of the bridge; trees will be removed in this area to allow for the necessary access to the creek bed.

Staging for construction will occur entirely within existing paved areas (i.e., parking lots in the vicinity of the BSA).

2. Study Methods

2.1 Regulatory Requirements

2.1.1 Federal Endangered Species Act

The United States Fish and Wildlife Service (USFWS) has jurisdiction over federally listed threatened and endangered plant and animal species. The Federal Endangered Species Act (FESA) protects listed species from harm or “take,” broadly defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” Any such activity can be defined as a “take” even if it is unintentional or accidental. Listed plant species are typically provided less protection than listed animals.

An endangered species is one that is considered in danger of becoming extinct throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. Federal agencies involved in authorizing permits for projects that may result in take of federally listed species (e.g., United States Army Corps of Engineers [ACOE]) are required under Section 7 of the FESA to consult with the USFWS prior to issuing such permits. Any activity that could result in take of a federally listed species, and is not authorized as part of a Section 7 consultation, requires a FESA Section 10 take permit from the USFWS.

2.1.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act was amended in 1996 to define Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Under the act, EFH must be designated in every fishery management plan. The act also requires consultation with the National Marine Fisheries Service for projects that include a federal action or federal funding and may adversely modify EFH.

2.1.3 Clean Water Act

The ACOE is responsible, under Section 404 of the Clean Water Act, for regulating the discharge of fill material into waters of the United States and their lateral limits, as defined in 33 CFR 328.3(a), including streams that are tributaries to navigable waters and their adjacent wetlands. The lateral limits of jurisdiction for a non-tidal stream are measured at the line of the ordinary high water mark (OHWM) (33 CFR 328.3[e]) or the limit of adjacent wetlands (33 CFR 328.3[b]). The lateral limits of jurisdiction in tidal waters extends to the high tide line (HTL) (33 CFR 328.4[b]). Any permanent extension of the limits of an existing water of the United States, whether natural or man-made, results in a similar extension of ACOE jurisdiction (33 CFR 328.5).

Waters of the United States fall into two broad categories: wetlands and other waters. Other waters include water bodies and watercourses such as rivers, streams, lakes, springs, ponds, coastal waters, and estuaries. Wetlands include marshes, wet meadows, seeps, floodplains, basins, and other areas experiencing extended seasonal soil saturation. Seasonally or intermittently inundated features, such as seasonal ponds, ephemeral streams, and tidal marshes, are categorized as wetlands if they have hydric soils and support wetland plant communities. Seasonally inundated water bodies or watercourses that do not exhibit wetland characteristics are classified as other waters of the United States.

Other waters that cannot trace a continuous hydrologic connection to a navigable water of the United States are not tributary to waters of the United States and are termed "isolated waters". Wetlands that are not adjacent to other waters are termed "isolated wetlands". ("Adjacent" means bordering, contiguous, or neighboring, and includes wetlands separated from other waters by man-made dikes or barriers, natural river berms, beach dunes, etc.) Isolated wetlands and waters are jurisdictional if their use, degradation, or destruction could affect interstate or foreign commerce (33 CFR 328.3[a]). The ACOE may or may not take jurisdiction over isolated wetlands depending on the specific circumstances.

In general, a Section 404 permit must be obtained from the ACOE before filling or grading wetlands or other waters of the United States. Specific projects may qualify for authorization under a Nationwide Permit (NWP). The purpose of the NWP program is to streamline the evaluation and approval process throughout the United States for certain types of activities that have only minimal impacts on the aquatic environment. Many NWPs require the applicant to submit a preconstruction notification (PCN) to the appropriate ACOE office and to obtain a project-specific authorization. The ACOE is required to consult with the USFWS under Section 7 of the FESA if the permitted activity may result in the take of federally listed species. The as Trampas Bridge Replacement Project is located within the San Francisco ACOE jurisdiction.

All ACOE permits require state water quality certification under Section 401 of the Clean Water Act. This regulatory program is administered by the Regional Water Quality Control Board (RWQCB). Projects that propose to fill wetlands or other waters of the United States must apply for water quality certification from the RWQCB. The RWQCB has adopted a policy requiring mitigation for any loss of wetlands, streams, or other waters of the United States. The Las Trampas Bridge Replacement Project is located within the San Francisco Bay RWQCB jurisdiction.

2.1.4 Porter-Cologne Water Quality Control Act

Under this Act (California Water Code Sections 13000–14920), the RWQCB is authorized to regulate the discharge of waste that could affect the quality of waters of the State. Therefore, even if a project does not require a federal permit, it may still require review and approval by the RWQCB (e.g., for impacts to isolated wetlands and other waters). When reviewing applications, the RWQCB focuses on ensuring that projects do not adversely affect the “beneficial uses” associated with waters of the State. In most cases, the RWQCB seeks to protect these beneficial uses by requiring the integration of water quality control measures into projects that will require discharge into waters of the State. For most construction projects, the RWQCB requires the use of construction and post-construction Best Management Practices (BMPs).

2.1.5 Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) prohibits the taking, hunting, killing, selling, purchasing, etc. of migratory birds, parts of migratory birds, or their eggs and nests. As used in the MBTA, the term “take” is defined as “to pursue, hunt, shoot, capture, collect, kill, or attempt to pursue, hunt, shoot, capture, collect, or kill, unless the context otherwise requires.” Most bird species native to the United States are covered by this act.

2.1.6 California Endangered Species Act

The California Department of Fish and Wildlife (CDFW) has jurisdiction over state listed endangered, threatened, and rare plant and animal species under the California Endangered Species Act (CESA). In addition, species proposed for listing under CESA are protected by its provisions. The CDFW also maintains lists of Species of Special Concern, defined as species that appear to be vulnerable to extinction because of declining populations, limited ranges, and/or continuing threats. Species of Special Concern are not afforded legal protection under CESA. In addition, the CDFW maintains a list of special animals. In general, this list includes those species that are at risk or are of the greatest conservation need. The Las Trampas Bridge Replacement Project is located within the CDFW Region 3 jurisdiction.

2.1.7 California Fish and Game Code

The CDFW is also responsible for enforcing the California Fish and Game Code, which contains several provisions potentially relevant to construction projects. Section 1602 of the California Fish and Game Code governs the issuance of Lake and Streambed Alteration Agreements by the CDFW. Lake and Streambed Alteration Agreements are required whenever project activities will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated as such by the CDFW.

Section 5901 of the California Fish and Game Code states that it is unlawful to construct or maintain in any stream, any device or contrivance that prevents, impedes, or tends to prevent or impede, the passing of fish up and down stream.

The California Fish and Game Code also lists animal species designated as Fully Protected or Protected, which may not be taken or possessed without a permit from the California Fish and Game Commission and/or the CDFW. These take permits do not allow “incidental take” and are more restrictive than the take allowed under Section 2081 of the CESA. Fully Protected species are listed in Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code, while Protected amphibians and reptiles are listed in Chapter 5, Sections 41 and 42.

Section 3503 of the California Fish and Game Code prohibits the take, possession, or needless destruction of the nest or eggs of any bird. Subsection 3503.5 specifically prohibits the take, possession, or destruction of any birds in the orders Falconiformes (hawks and eagles) or Strigiformes (owls) and their nests. These provisions, along with the federal MBTA, essentially serve to protect nesting native birds. Non-native species, including European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock pigeon (*Columba livia*), are not afforded any protection under the MBTA or California Fish and Game Code.

2.1.8 City of Walnut Creek Tree Preservation Ordinance

The City of Walnut Creek's Tree preservation Ordinance regulates the removal of any tree or multi-stemmed plant (dead or alive) with a trunk circumference of 28 inches (diameter of 9 inches) or more measured at 4.5 feet above the natural grade, and designates coast live oak and valley oak as highly protected trees. A tree removal permit granted from the City of Walnut Creek's Public Services Director is required for the removal of any protected tree growing within the city limits.

2.2 Studies Required

2.2.1 Literature Search

LSA obtained information regarding federally listed plant and animal species that may occur in the project vicinity from the following sources:

- *Information for Planning and Consultation* (IPaC) website maintained by the USFWS based on the project location (USFWS 2017);

- *California Natural Diversity Data Base* (CNDDB) for records of special-status species occurrences within 5 miles of the Biological Study Area (BSA) (CDFW 2017); and

- California Native Plant Society (CNPS) *Inventory of Rare and Endangered Vascular Plants of California* for the Walnut Creek, Benicia, Vine Hill, Clayton, Diablo, Honker Bay, Briones Valley, Oakland East, and Las Trampas Ridge USGS 7.5-minute quadrangles (CNPS 2017).

For the purposes of this NES, special-status species are defined as follows:

- Species that are listed, formally proposed for listing, or designated as candidates for listing as threatened or endangered under the FESA;

- Species that are listed or designated as candidates for listing as rare, threatened, or endangered under the CESA;
- Plant species assigned California Rare Plant Ranks 1A, 1B, 2A, 2B, and 3 by the CNPS;
- Animal species designated as Species of Special Concern or Fully Protected by the CDFW.

All species lists are provided in Appendix A.

2.2.2 Field Reviews

Based on a review of the above sources and maps and aerial photographs of the project vicinity, LSA identified the special-status plant and animal species with potential to occur in the area in preparation for the field survey.

2.2.3 Survey Methods

2.2.3.1 General Survey

A general survey of the site was conducted on September 15, 2017 in order to (1) document land cover types occurring at the site, (2) identify natural resources potentially affected by the proposed project, and (3) determine what additional preconstruction surveys and/or avoidance and minimization measures may be needed prior to or during construction. The general survey was conducted by traversing the BSA by foot and mapping the extent of the plant communities present at the site and potential sensitive species habitat on aerial photos. A general plant and animal survey was also completed.

2.2.3.2 Tree Survey

All trees within the project footprint measuring 28 inches in circumference (9 inches in diameter) and greater were surveyed on September 15, 2017. Trees of this size or larger are protected under the City of Walnut Creek's municipal code. The survey procedure consisted of the following steps: (1) identify each live tree to species, (2) position each tree on a project map, and (3) measure the trunk diameter of each tree at a point 4.5 feet above the natural grade (Diameter at Breast Height [DBH]).

2.2.3.3 Special-Status Plant Survey

An assessment of special-status plant habitat was conducted along with the general survey on September 15, 2017. The purpose of the survey was to assess whether habitats present on site can support special-status plants and whether protocol-level surveys are warranted.

2.2.3.4 Special-Status Animal Survey

A special-status animal survey was conducted along with the general survey on September 15, 2017. The survey focused on identifying and evaluating potentially suitable habitat for special-status species known to occur in the project vicinity and specific habitat features that could suggest past or current utilization by those species.

2.2.3.5 Jurisdictional Wetland Delineation

A delineation of potentially jurisdictional waters within the BSA was conducted on September 15, 2017. Potentially jurisdictional areas were delineated using the routine determination method described in the ACOE *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region, Version 2.0* (ACOE 2008). Areas within the BSA that met the ACOE criteria for wetlands and other waters of the United States, as well as potentially jurisdictional waters of the State of California were mapped using a GPS unit. The findings and conclusions of the jurisdictional delineation will be submitted to the ACOE for verification. The findings and conclusions should be considered preliminary until verified by the ACOE.

2.3 Personnel and Survey Dates

Table A: Personnel and Survey Dates

Personnel	Survey Date	Purpose of Survey
Jennifer Roth	September 15, 2017	Habitat mapping and special-status animal assessment.
Tim O’Donnell	September 15, 2017	Special-status animal assessment and wetland delineation.
Tim Milliken	September 15, 2017	Special-status plant assessment and tree survey.

Jennifer Roth has over 20 years of experience as a wildlife biologist and is experienced in wildlife surveys, biological resource assessments, mitigation plans, construction monitoring, and regulatory compliance and permitting.

Tim O’Donnell has 14 years of experience in biological resource assessments, special-status species surveys, habitat restoration, construction monitoring, jurisdictional determinations, and regulatory compliance and permitting.

Tim Milliken is a botanist with over 20 years of experience conducting surveys for rare plants, noxious weeds, trees, and non-vascular plants (lichens and bryophytes) in California. He is also an International Society of Arboriculture Certified Arborist (WE-5539A) with 18 years of experience as a consulting arborist. He is familiar with local tree ordinances in the San Francisco Bay Area counties.

2.4 Agency Coordination and Professional Contacts

There have not been any discussions with the regulatory agencies to date.

2.5 Limitations That May Influence Results

No problems or limitations were encountered during the research, fieldwork, or document preparation that influenced the results presented herein.

3. Results: Environmental Setting

3.1 Description of the Existing Biological and Physical Conditions

3.1.1. Study Area

The BSA coincides with the boundaries of the maximum project footprint (Figure 3). The project footprint extends along 770 linear feet of South Main Street and includes needed conform areas at Botelho Drive and Broadway Plaza. The project footprint also extends upstream for 190 linear feet and downstream for 30 linear feet between the existing bridge and the box culvert. The BSA includes all trees adjacent to the road and bridge that may be affected by the proposed project. The surrounding area is urban development, so no additional buffer around the proposed project footprint is necessary.

3.1.2. Physical Conditions

The BSA consists primarily of paved roadway and adjacent sidewalks in downtown Walnut Creek. The surrounding area consists of urban development and landscaping. The bridge crosses Las Trampas Creek, a concrete-lined channel with a double-barrel, concrete, box culvert located approximately 30 feet downstream of the bridge and a drop structure and energy dissipaters located approximately 80 feet and 50 feet upstream, respectively. Tice Creek enters Las Trampas Creek approximately 120 feet upstream of the bridge.

3.1.3. Biological Conditions

3.1.3.1. Land Cover Types

There are four land cover types in the BSA, urban, landscaping, willow thickets, and stream, as described below. The majority of the BSA is urban and associated landscaping, so no specific classification system was used in designating land cover types. The second edition of *A Manual of California Vegetation* (Sawyer et al. 2009) was used in describing the willow thickets.

Urban. Urban areas within the BSA are those where vegetation has been cleared and altered for residential or commercial development, parking, and city streets. These areas are largely covered by cement or pavement and do not contain native habitats. There are 2.27 acres of urban area in the BSA.

Landscaping. Landscaped areas occur adjacent to Las Trampas Creek and along South Main Street. This land cover type includes native and non-native species purposely planted as landscaping within hardscape elements such as sidewalk planting strips and parking lots. This land cover type is common within urban settings and compliments buildings, roads, parking lots, and buffer areas around these features. Although some native trees along Las Trampas Creek may predate the surrounding developments, they are included here because they occur with planted trees and no longer represent a distinct natural vegetation community. Trees and shrubs present on the site include blackwood acacia (*Acacia melanoxylon*), deodara cedar

(*Cedrus deodara*), little-leaf fig (*Ficus microcarpa*), ginkgo (*Ginkgo biloba*), black walnut (*Juglans hindsii*), crape myrtle (*Lagerstroemia indica*), glossy privet (*Ligustrum lucidum*), sweetgum (*Liquidambar styraciflua*), London plane (*Platanus x hispanica*), cherry plum (*Prunus cerasifera*), almond (*Prunus dulcis*), evergreen pear (*Pyrus kawakamii*), coast live oak (*Quercus agrifolia*), evergreen oak (*Quercus ilex*), valley oak (*Quercus lobata*), Shumard's oak (*Quercus shumardii*), Himalayan blackberry (*Rubus armeniacus*), Pennsylvania blackberry (*Rubus pennsylvanicus*), and coast redwood (*Sequoia sempervirens*).

Coast live oak and valley oak are species native to the Walnut Creek area. Herbaceous vegetation (both native and non-native) occurs within non-maintained areas adjacent to the creek channel and includes mugwort (*Artemisia douglasii*), rip gut brome (*Bromus diandrus*), Italian thistle (*Carduus pycnocephalus*), goose grass (*Galium aparine*), and Canary ivy (*Hedera canariensis*). There is 0.69 acre of landscaping in the BSA.

Willow Thicket. There is a small area of willow thicket located immediately upstream of the bridge. This natural vegetation community consists of one multi-stemmed sandbar willow (*Salix exigua*) tree and one multi-stemmed red willow (*Salix laevigata*) tree. This land cover type is a combination of the sandbar willow thickets [*Salix exigua* Shrubland Alliance] and red willow thickets [*Salix laevigata* Woodland Alliance] descriptions presented in the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009). Herbaceous wetland vegetation and tree seedlings occur along the edge of the willow thicket, including tall flat sedge (*Cyperus eragrosits*), willowherb (*Epilobium ciliatum*), Oregon ash (*Fraxinus latifolia*), iris leaf rush (*Juncus xiphioides*), scarlet pimpernel (*Lysimachia arvensis*), apple mint (*Mentha californicus*), California bulrush (*Schoenoplectus californicus*), and cattails (*Typha* sp.). Other species observed in association with the willow thicket include stinkwort (*Dittrichia graveolens*), Melaleuca (*Melaleuca sp.*), and smilo grass (*Stipa miliacea* var. *miliacea*). There is 0.02 acre of willow thicket in the BSA.

Stream. Las Trampas Creek is a concrete-lined channel at this location, with some areas of sediment or gravel deposition. There is a drop structure with energy dissipaters 80 feet and 50 feet upstream of the bridge, respectively. A large pool occurs between the drop structure and the energy dissipaters. The banks between the bridge and the box culvert downstream of the bridge and between the bridge and the drop structure upstream of the bridge are steep and are lined with concrete bags. The banks have been replaced by vertical concrete walls upstream of the drop structure. Tice Creek enters Las Trampas Creek 120 feet upstream of the bridge. There is 0.34 acre of stream in the BSA.

3.1.3.2. Wildlife

The BSA has relatively limited value as wildlife habitat due to limited availability of natural habitats and its position within a highly urbanized environment. However, trees within the BSA provide bird nesting, foraging, and movement habitat, and Las Trampas Creek provides marginal habitat for aquatic species. The bridge itself also provides nesting habitat for black phoebes (*Sayornis nigricans*) and cliff swallows (*Petrochelidon pyrrhonota*). Species seen during the general survey on September 15, 2017 were Canada goose (*Branta Canadensis*), mallard (*Anas platyrhynchos*), rock pigeon, black phoebe, California scrub jay (*Aphelocoma californica*), and river otter (*Lontra canadensis*). Old cliff swallow nests were seen on the bridge structure.

3.1.3.3. Habitat Connectivity

Las Trampas Creek originates on Las Trampas Peak and flows north and east to its confluence with San Ramon Creek downstream of the project site. The two creeks combine to form Walnut Creek, which enters Suisun Bay east of Carquinez Strait. Despite having a connection to Suisun Bay, Las Trampas Creek does not provide habitat for anadromous fishes due to drop structures located just downstream of the Bancroft Road Bridge and between Willow Pass Road and Highway 242. Las Trampas Creek does provide a movement corridor for other wildlife species such as river otter and western pond turtle (*Actinemys marmorata*). Tice Creek enters Las Trampas Creek upstream of the project site. The remainder of the BSA occurs within a highly urbanized environment and has limited value as wildlife habitat. However, the trees along the creek and South Main Street do provide foraging and movement habitat for migratory birds.

3.2 Regional Species and Habitats and Natural Communities of Concern

Based on background research and the surveys conducted on September 15, 2017 the potential for special-status species to occur within the BSA was evaluated based on the presence of suitable habitat, the proximity of known species occurrences, and knowledge of the species' range and mobility. All species identified on USFWS, CNDDB, and CNPS lists are discussed in Tables B and C. Species requiring specific habitats not present in the BSA and project vicinity (e.g., inland dunes; vernal pools; tidal salt marsh; brackish marsh) were eliminated from consideration and are not discussed further. Salmonids were also eliminated from consideration based on migration barriers present downstream of the project site. There is no habitat for special-status plant species in the BSA or project vicinity. One animal species (western pond turtle) warranted further consideration given the presence of suitable habitat in the BSA and is briefly discussed in Chapter 4.

Table B: Special-Status Plant Species Potentially Occurring in the Biological Study Area and Project Vicinity

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Amsinckia lunaris	Bent-flowered fiddleneck	--/--/1B	Valley and foothill grassland, coastal bluff scrub, cismontane woodland. Elevation: 3-500 m. Blooms: March-June	Absent	The BSA does not contain grassland, scrub, or woodland habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Arctostaphylos auriculata	Mt. Diablo manzanita	--/--/1B	Chaparral (sandstone), cismontane woodland. Elevation: 135-650 m. Blooms: January-March	Absent	The BSA does not contain chaparral or woodland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Arctostaphylos pallida	Pallid manzanita	FT/SE/1B	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub. Associated with sandy or gravelly siliceous shale. Elevation: 185-465 Blooms: December-March	Absent	The BSA does not contain forested, chaparral, woodland, or scrub habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Arctostaphylos manzanita ssp. *laevigata*	Contra Costa manzanita	--/--/1B	Chaparral (rocky). Elevation: 500-1,100 m. Blooms: January-April	Absent	The BSA does not contain chaparral habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Astragalus tener var. *tener*	Alkali milk-vetch	--/--/1B	Mesic alkaline and adobe clay soils in valley and foothill grassland, adjacent to vernal pools. Elevation: 1-60 m. Blooms: March-June	Absent	The BSA does not contain grassland habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Atriplex cordulata var. *cordulata*	Heartscale	--/--/1B	Saline or alkaline soils in chenopod scrub, meadows, and seeps. Sandy soils in valley and foothill grassland. Elevation: 0-560 m. Blooms: April-October	Absent	The BSA does not contain scrub or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Balsamorhiza macrolepis	Big-scale balsamroot	--/--/1B	Chaparral, cismontane woodland, valley and foothill grassland. Elevation: 90-1,555 Blooms: March-June	Absent	The BSA does not contain chaparral, woodland, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Blepharizonia plumosa	Big tarplant	--/--/1B	Valley and foothill grassland with clay to clay loam soils. Elevation: 50-505 m. Blooms: July-October	Absent	The BSA does not contain grassland habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
California macrophylla (syn. = *Erodium macrophyllum*)	Round-leaved filaree	--/--/1B	Grassy openings in cismontane woodland, valley and foothill grassland with clay soils. Elevation: 15-1,200 m. Blooms: March-May	Absent	The BSA does not contain woodland or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Calochortus pulchellus	Mt. Diablo fairy-lantern	--/--/1B	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland, on wooded and brushy slopes. Elevation: 30-840 m. Blooms: April-June	Absent	The BSA does not contain chaparral, woodland, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Campanula exigua	Chaparral harebell	--/--/1B	Chaparral (rocky, usually serpentine). Elevation: 275-1,250 m. Blooms: May-June	Absent	The BSA does not contain chaparral habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Centromadia parryi subsp. *congdonii*	Congdon's tarplant	--/--/1B	Grazed and un-grazed annual grassland. Alkaline or saline soils sometimes described as heavy white clay (saline clay soil). Elevation: 1-230 m. Blooms: May-October (Nov.)	Absent	The BSA does not contain grassland habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Chloropyron molle ssp. molle	Soft bird's-beak	FE/SR/1B	Coastal salt marshes, typically in the marsh/upland transition zone Elevation: 0-3 m. Blooms: July-November	Absent	The BSA does not contain salt marsh habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Chorizanthe robusta var. robusta	Robust spineflower	FE/--/1B	Chaparral, openings in cismontane woodland, coastal dunes, and coastal scrub. Associated with sandy or gravelly soils. Elevation: 3-300 m. Blooms: April-September	Absent	The BSA does not contain chaparral, woodland, dune, or scrub habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Cicuta maculata var. bolanderi	Bolander's water-hemlock	--/--/2B	Coastal, fresh, or brackish marshes and swamps. Elevation: 0-200 m. Blooms: July-September	Absent	The BSA does not contain marsh habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Cirsium andrewsii	Franciscan thistle	--/--/1B	Broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub. Mesic and sometimes serpentine soils. Elevation: 0-150 m. Blooms: March-July	Absent	The BSA does not contain forested, scrub, or coastal prairie habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Clarkia franciscana	Presidio clarkia	FE/SE/1B	Coastal scrub, serpentine soils in valley and foothill grassland. Elevation: 25-335 m. Blooms: May-July	Absent	The BSA does not contain scrub or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Cordylanthus nidularius	Mt. Diablo bird's-beak	--/SR/1B	Chaparral (serpentine). Elevation: 600-800 m. Blooms: July-August	Absent	The BSA does not contain chaparral habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Delphinium californicum ssp. *interius*	Hospital Canyon larkspur	--/--/1B	Within and beside chaparral, grassy openings of cismontane woodland, sometimes mesic areas in above habitats. Elevation: 230-1,095 m. Blooms: April-June	Absent	The BSA does not contain chaparral or woodland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Dirca occidentalis	Western leatherwood	--/--/1B	Broadleaved upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian forest, and riparian woodland on brushy slopes, mesic sites. Elevation: 30-395 m. Blooms: January-March (April)	Absent	The BSA does not contain forested, chaparral, or woodland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Eriastrum ertterae	Lime Ridge Eriastrum	--/--/1B	Openings or edges in chaparral, alkaline, semi-alkaline, or sandy soils. Elevation: 200-290 m. Blooms: June-July	Absent	The BSA does not contain chaparral habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Eriogonum luteolum var. caninum	Tiberon buckwheat	--/--/1B	Sandy to gravelly serpentine soils in chaparral, cismontane woodland, coastal prairie, and valley and foothill grassland. Elevation: 0-700 m. Blooms: May-September	Absent	The BSA does not contain chaparral, woodland, coastal prairie, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Eriogonum truncatum	Mt. Diablo buckwheat	--/--/1B, no-take	Openings with bare soil in chaparral, coastal scrub, or valley and foothill grassland with dry exposed clay or sandy substrates. Elevation: 3-350 m. Blooms: April-November	Absent	The BSA does not contain chaparral, coastal scrub, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Eryngium jepsonii	Jepson's coyote-thistle	--/--/1B	Valley and foothill grassland, vernal pools. Associated with clay soils. Elevation: 3-300 m. Blooms: April-August	Absent	The BSA does not contain grassland or vernal pool habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Erysimum capitatum var. angustatum	Contra Costa wallflower	FE/SE/1B	Sand dunes in the San Joaquin River delta. Elevation: 3-20 m Blooms: March-July	Absent	The BSA is outside of the known range and does not contain suitable habitat for this species.
Extriplex joaquinana	San Joaquin spearscale	--/--/1B	Wet, alkaline sparse grassland areas, alkaline pools. Elevation: 1-835 m. Blooms: April-October	Absent	The BSA does not contain grassland habitats or alkaline soils or pools. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Fissidens pauperculus	Minute pocket grass	--/--/1B	North Coast coniferous forest. Damp soils. Elevation: 10-1024 m. Blooms: N/A	Absent	The BSA does not contain appropriate habitat or climatic conditions/microclimates for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Fritillaria liliacea	Fragrant fritillary	--/--/1B	Coastal scrub, valley and foothill grassland, and coastal prairie. Often on serpentine soils. Other various soils reported, though usually clay. Elevation: 3-410 m. Blooms: February-April	Absent	The BSA does not contain coastal scrub, grassland, or coastal prairie habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Gilia millefoliata	Dark-eyed gilia	--/--/1B	Coastal dunes. Elevation: 2-30 m. Blooms: April-July	Absent	The BSA does not contain coastal dune habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Grimmia torenii	Toren's grimmia	--/--/1B	Chaparral, cismontane woodland, lower montane coniferous forest. Associated with rocky areas, boulders, and rock walls. Elevation: 325-1160 Blooms: N/A	Absent	The BSA does not contain chaparral, woodland, or forested habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Helianthella castanea	Diablo helianthella	--/--/1B	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland, usually within rocky azonal soils. Elevation: 60–300 m. Blooms: April-June	Absent	The BSA does not contain chaparral, woodland, coastal scrub, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Hesperolinon breweri	Brewer's western flax	--/--/1B	Serpentine chaparral, cismontane woodland, and valley and foothill grassland. Elevation: 30-900 m. Blooms: May-July	Absent	The BSA does not contain chaparral, woodland, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Hoita strobilina	Loma Prieta Hoita	--/--/1B	Serpentine, mesic soils in chaparral, cismontane woodland, and riparian woodland. Elevation: 30-860 m. Blooms: May-July (Aug.-Oct.)	Absent	The BSA does not contain chaparral or woodland, habitats or appropriate soils for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Holocarpha macradenia	Santa Cruz tarplant	FT/SE/1B	Coastal prairie, coastal scrub, and valley and foothill grassland. Sandy (often clay) soils. Elevation: 10-220 m. Blooms: June-October	Absent	The BSA does not contain coastal prairie, coastal scrub, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Horkelia cuneata var. sericea	Kellogg's Horkelia	--/--/1B	Sandy or gravelly openings in closed-cone coniferous forest, chaparral, coastal dunes, and coastal scrub. Elevation: 10-200 m. Blooms: April-September	Absent	The BSA does not contain chaparral, coastal dune, coastal scrub, or forested habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Isocoma arguta	Carquinez goldenbush	--/--/1B	Valley and foothill grassland. Associated with alkaline soils. Elevation: 1-20 m. Blooms: August-December	Absent	The BSA does not contain grassland habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Juglans hindsii	Northern California black walnut	--/--/1B	Riparian forest/woodland. Elevation: 0-440 m. Blooms: April-May	Absent	Native trees, including black walnut, occur along Las Trampas Creek, but all were likely planted during development of surrounding areas.
Lasthenia conjugens	Contra Costa goldfields	FE/--/1B, no-take	Valley and foothill grassland and cismontane woodland in vernal pools, swales, and moist depressions (alkaline). Extirpated from most of its range; extremely endangered. Elevation: 0-470 m. Blooms: March-June	Absent	The BSA is outside of the known range of this species and does not contain grassland, woodland, or vernal pool habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Lathyrus jepsonii var. jepsonii	Delta tule pea	--/--/1B	Tidally influenced freshwater and brackish marshes in the Napa River and the Sacramento-San Joaquin river delta. Elevation: 0-5 m. Blooms: May-September	Absent	The BSA is outside of the known range of this species and does not contain appropriate tidal habitat.
Lilaeopsis masonii	Mason's lilaeopsis	--/SR/1B	Regularly flooded tidal zones, including mud banks and flats along creek banks, sloughs, and rivers; freshwater marshes; brackish marshes; and riparian scrub. Elevation: 0-10 m. Blooms: April-November	Absent	The BSA does not contain appropriate tidal habitat for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Limosella australis	Delta mudwort	--/--/2B	Mud banks in freshwater or brackish marshes and swamps, riparian scrub. Elevation: 0-3 m. Blooms: May-August	Absent	The BSA does not contain appropriate marsh habitat for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Malacothamnus hallii	Hall's bush-mallow	--/--/1B	Chaparral, coastal scrub. Some populations on serpentine. Elevation: 10-760 m. Blooms: May-September (Oct.)	Absent	The BSA does not contain chaparral or coastal scrub habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Meconella oregana	Oregon Meconella	--/--/1B	Coastal prairie and coastal scrub. Elevation: 250-620 m. Blooms: March-April	Absent	The BSA does not contain coastal prairie or scrub habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Micropus amphibolus	Mt. Diablo cottonweed	--/--/3	Rocky areas in broadleafed upland forest, chaparral, cismontane woodland, and valley and foothill grassland. Elevation: 45-825 m. Blooms: March-May	Absent	The BSA does not contain chaparral, woodland, grassland, or forested habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Monardella antonina spp. antonina	San Antonio Hills Monardella	--/--/3	Chaparral and cismontane woodland. Elevation: 320-1,000 m. Blooms: June-August	Absent	The BSA does not contain chaparral or woodland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Monolopia gracilens	Woodland woolythreads	--/--/1B	Openings in broadleaf upland forest, chaparral, cismontane woodland, North Coast coniferous forest, and valley and foothill grassland/serpentine. Elevation: 100-1,200 m. Blooms: March-July	Absent	The BSA does not contain chaparral, woodland, grassland, or forested habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Navarretia gowenii	Lime Ridge Navarretia	--/--/1B	Chaparral, clay and serpentine soils. Elevation: 180-305 Blooms: May-June	Absent	The BSA does not contain chaparral habitat or appropriate soils for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Navarretia nigelliformis ssp. radians	Shining Navarretia	--/--/1B	Cismontane woodland, valley and foothill grassland, vernal pools. Sometimes associated with clay soils. Elevation: 65-1,000 m. Blooms: (Mar.) April-July	Absent	The BSA does not contain woodland, grassland, or vernal pool habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Oenothera deltoides ssp. *howellii*	Antioch Dunes evening-primrose	FE/CE/1B	Interior sand dunes Elevation: 0-30 m. Blooms: March – September	Absent	The BSA does not contain sand dune habitat. Also, the geographic range associated with this species is specific to the unique sand dune habitat near the city of Antioch.
Phacelia phacelioides	Mt. Diablo phacelia	--/--/1B	Chaparral and cismontane woodland. Rocky areas. Strong indicator of serpentine soils. Elevation: 500-1,370 m. Blooms: April-May	Absent	The BSA does not contain appropriate habitat or soils for this species. Also, the geographic range associated with this species consists of open rocky slopes at an elevation much higher than the BSA.
Plagiobothrys diffusus	San Francisco popcornflower	--/SE/1B	Coastal prairie and valley and foothill grassland. Elevation: 60-360 m. Blooms: March-June	Absent	The BSA does not contain coastal prairie or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Polygonum marinense	Marin knotweed	--/--/3	Coastal salt or brackish marshes and swamps. Elevation: 0-10 m. Blooms: (Apr.) May-August (Oct.)	Absent	The BSA does not contain appropriate habitat for this species.
Sanicula maritima	Adobe sanicle	--/SR/1B	Clay or serpentine soils in chaparral, coastal prairie, meadows and seeps, and valley and foothill grassland. Elevation: 30-240 m. Blooms: February-May	Absent	The BSA does not contain chaparral, coastal prairie, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Sanicula saxatilis	Rock sanicle	--/SR/1B	Rocky ridges or tallus, broadleaved upland forest, chaparral, valley and foothill grassland. Elevation: 620-1,175 m. Blooms: April-May	Absent	The BSA does not contain appropriate habitat for this species. The geographic range associated with this species consists of open rocky slopes at an elevation much higher than the BSA.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Senecio aphanactis	Chaparral ragwort	--/--/2B	Occurs in drying alkaline flats in cismontane woodland and coastal scrub. Elevation: 20-575 m. Blooms: January-April	Absent	The BSA does not contain appropriate habitat for this species.
Streptanthus albidus ssp. *peramoenus*	Most beautiful jewel-flower	--/--/1B	Chaparral, cismontane woodland, valley and foothill grassland, serpentine soils. Elevation: 95-1,000 m. Blooms: March-October	Absent	The BSA does not contain chaparral, woodland, or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Streptanthus hispidus	Mt. Diablo jewel-flower	--/--/1B	Chaparral, valley and foothill grassland/rocky. Elevation: 365-1,200 m. Blooms: March-June	Absent	The BSA does not contain chaparral or grassland habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Stuckenia filiformis ssp. *alpine*	Slender-leaved pondweed	--/--/2B	Shallow, freshwater marshes and swamps Elevation: 300-2150 m. Blooms: May-July	Absent	The BSA does not contain appropriate habitat for this species.
Symphyotrichum lentum	Suisun Marsh aster	--/--/1B	Brackish and freshwater marshes and swamps. Elevation: 0-3 m. Blooms: (Apr.) May-November	Absent	The BSA does not contain appropriate habitat for this species.
Trifolium hydrophilum	Saline clover	--/--/1B	Marshes and swamps, valley and foothill grassland (mesic and alkaline soils), and vernal pools. Elevation: 0-300 m. Blooms: April-June	Absent	The BSA does not contain appropriate habitat for this species. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Triquetrella californica	Coastal Triquetrella	--/--/1B	Coastal bluff scrub, coastal scrub. Elevation: 10-100 m. Blooms: N/A	Absent	The BSA does not contain coastal scrub habitat. The creek and adjacent uplands are mostly covered in concrete or asphalt.
Tropidocarpum capparideum	Caper-fruited Tropidocarpum	--/--/1B, no-take	Alkaline clay soils in grassland and oak woodland (valley and foothill grassland). Elevation: 1-455 m. Blooms March-April	Absent	The BSA does not contain grassland or oak woodland habitat. There are oaks present at the site, but the creek and adjacent uplands are mostly covered in concrete or asphalt.

Scientific Name	Common Name	Status (F/S/CRPR)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Viburnum ellipticum	Oval-leaved Viburnum	--/--/2B	Chaparral, cismontane woodland, and lower montane coniferous forest. Elevation: 215-1,400 m. Blooms May-June	Present	The BSA does not contain chaparral, woodland, or forested habitats. The creek and adjacent uplands are mostly covered in concrete or asphalt.

***Status Codes**
FE = Federally listed as endangered
FT = Federally listed as threatened
FSC = Federal Species of Concern
SE = State-listed as endangered
ST = State Threatened
SR = State Rare
SSC = State Species of Special Concern
CRPR = California Rare Plant Rank

California Rare Plant Ranks

1A = California Rare Plant Rank 1A: Plants presumed expirated in California and either rare or extinct elsewhere.

1B = California Rare Plant Rank 1B: Plants rare, threatened, or endangered in California and elsewhere

2B = California Rare Plant Rank 2B: Plants rare, threatened or endangered in California but more common elsewhere

3 = California Rare Plant Rank 3: Plants about which more information is needed – a review list

Table C: Special-Status Animal Species Potentially Occurring in the Biological Study Area and Project Vicinity

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Invertebrates					
Branchinecta lynchi	Vernal pool fairy shrimp	FT/--/--	Vernal pools, alkali pools, stock ponds, ponds in vernal swales. Ponding duration can be as little as 6-7 weeks in winter or 3 weeks in spring.	Absent	Vernal pools and other similar features are absent from the BSA and project vicinity. Watercourses are not suitable habitat.
Callophrys mossii bayensis	San Bruno elfin butterfly	FE/--/--	Coastal mountainous areas with grassy ground cover within fog belt. Associated with host plant *Sedum spathulifolium*.	Absent	The BSA is not located within the fog belt and is not known for supporting the host plant of this species.
Speyeria callippe callippe	Callippe silverspot butterfly	FE/--/--	Grassland habitats, especially hilltops and ridges. Currently only known to occur on San Bruno Mountain and Sign Hill near South San Francisco (San Mateo County), in the hills near Pleasanton (Alameda County), at Sears Point (Sonoma County), and in the hills between Vallejo and Cordelia. Host plant is *Viola pedunculata*.	Absent	The BSA is not located near a known population, does not contain grassland habitat, and does not support the host plant of this species.
Fish					
Hypomesus transpacificus	Delta smelt	FT/SE/--	Sacramento-San Joaquin Delta at salinities less than 2 ppm. Generally not found in smaller freshwater streams.	Absent	Suitable habitat not present in the BSA or project vicinity.
Oncorhynchus mykiss	Central California Coast steelhead	FT/--/--	Clear, cool riffles with gravel or cobble substrate for spawning; clear, cool riffles and pools as rearing habitat.	Present	Two drop structures in Walnut Creek, downstream of the BSA, prohibit salmonids from moving upstream into Las Trampas Creek. The BSA and vicinity are, therefore, outside the known range of this species. This species is not addressed further in this NES.

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Oncorhynchus mykiss	Central Valley steelhead	FT/--/--	Clear, cool riffles with gravel or cobble substrate for spawning; clear, cool riffles and pools as rearing habitat.	Present	Two drop structures in Walnut Creek, downstream of the BSA, prohibit salmonids from moving upstream into Las Trampas Creek. The BSA and vicinity are, therefore, outside the known range of this species. This species is not addressed further in this NES.
Amphibians					
Ambystoma californiense	California tiger salamander – Central Valley DPS	FT/ST/SSC	Grassland, oak woodland, ruderal, and seasonal pool habitats. Seasonal ponds and vernal pools are necessary for breeding. Adults use mammal burrows and other underground retreats as aestivation habitat.	Absent	The BSA does not contain suitable breeding, aestivation, or movement habitat for this species. The nearest CNDDB occurrence is 0.41 mile from the project site. However, the observation is from a museum specimen collected in 1938. CTS are considered extirpated from this location and two other locations that occur within 5 miles of the project site.

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Rana draytonii	California red-legged frog	FT/--/SSC	Creeks, ponds, marshes. Prefers aquatic habitat with deep (2 feet or deeper) areas and undercut banks, emergent aquatic vegetation, and bank cover. Does not occur in brackish water.	Absent	The BSA does not contain suitable breeding habitat for this species. The creek channel and banks are lined with concrete. There are no undercut banks and little emergent aquatic vegetation and bank cover. The nearest known breeding location is a stock pond 2.88 miles from the project site. There is one breeding record for Las Trampas Creek, but it is well upstream of the BSA (7.26 miles along the creek) in habitat described as "perennial creek with a riparian woodland overstory". The lower reaches of Las Trampas Creek are also likely inhabited by non-native, predatory fishes that typically preclude the presence of California red-legged frog breeding populations. In addition, individuals are highly unlikely to use the BSA as a movement corridor due to the poor quality of the habitat upstream of the BSA. The channel upstream of the BSA is also concrete-lined and devoid of vegetation along some reaches, greatly diminishing their value as movement habitat and exposing individuals to increased predation by birds, raccoons, and other terrestrial predators. There are no records of this species in the lower reaches of Las Trampas or Walnut creeks, and they appear to be absent from most urbanized, lowland reaches of creeks draining to San Francisco Bay in Contra Costa, Alameda, and Santa Clara counties (Jennings et al. 1997, USFWS 2002). The surrounding urban development is extensive and precludes individuals from moving overland from breeding sites in the surrounding hills.

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Reptiles					
Actinemys marmorata	Western pond turtle	--/--/SSC	Ponds, marshes, rivers, streams, and irrigation ditches with aquatic vegetation.	Present	The BSA provides marginal aquatic movement habitat for this species. There is no upland habitat for this species in the project vicinity. The nearest known occurrence is located 4.98 miles from the BSA at a cattle pond in Mount Diablo State Park.
Masticophis lateralis euryxanthus	Alameda whipsnake	FT/ST/--	Chaparral, rocky outcrops, south facing slopes and ravines within valley-foothill grassland with shrubs and oak trees in Alameda and Contra Costa counties.	Absent	There is no chaparral, rocky, or grassland habitat within the BSA.
Thamnophis gigas	Giant garter snake	FT/ST/--	Agricultural wetlands and other waterways such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands primarily within the Sacramento Valley.	Absent	The BSA and project vicinity are outside the known range of this species and do not contain suitable slow-flowing wetland/stream habitat. There are no CNDDB records within 5 miles of the project site.
Birds					
Athene cunicularia	Burrowing owl	--/--/SSC	Open habitats (e.g., grasslands, agricultural areas) with mammal burrows or other features (e.g., culverts, pipes, and debris piles) suitable for nesting and roosting.	Absent	No mammal burrows or other features suitable for nesting or roosting were observed along Las Trampas Creek. The surrounding area is composed entirely of urban development. There are no nearby open grassland or agricultural areas. The only known occurrence within the project vicinity is in grassland habitat 3.74 miles away.
Falco peregrinus anatum	Peregrine falcon	--/--/FP	Nests on cliffs, transmission towers, skyscrapers.	Absent	Peregrine falcons have been known to nest on tall buildings in urban areas. However, the bridge itself does not provide nesting habitat nor is there nesting habitat within the project footprint. There are no known pairs nesting in the City of Walnut Creek. The nearest CNDDB location is 3.87 miles away.

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Rallus longirostris obsoletus	California clapper rail	FE/SE/FP	Saltwater and brackish marshes often crossed by tidal sloughs in San Francisco Bay. Closely associated with pickleweed.	Absent	No suitable habitat present within the BSA or project vicinity. There are no CNDDB records within 5 miles of the project site.
Sternula antillarum browni	California least tern	FE/SE/FP	Coastal estuaries, lagoons, tidal flats, salt flats.	Absent	No suitable habitat present within the BSA or project vicinity. There are no CNDDB records within 5 miles of the project site.
Mammals					
Antrozous pallidus	Pallid bat	--/--/SSC	Found in a variety of open habitats where it forages for large arthropods on the ground or on vegetation. Roosts in rock crevices, expansion joints under bridges, buildings, mines, and hollow trees. Also uses the underside of bridges for night roosts.	Absent	The existing bridge does not provide the small crevices that pallid bats generally use for day roosts. The underside of the bridge does provide potential night roosting habitat and was examined for evidence of use by bats during the site assessment. No guano deposits, discarded insect parts, or urine staining that would have indicated bat use were seen. In addition, the BSA and vicinity do not provide high-quality foraging habitat. Pallid bats typically forage on the ground in open areas. The BSA is located in a dense urban environment and is not likely to be used for foraging. This species is unlikely to use the site, and is not addressed further in this NES.

Scientific Name	Common Name	Status (F/S/CDFW)*	General Habitat Description	Habitat Present/ Absent in BSA	Rationale
Corynorhinus townsendii townsendii	Townsend's big-eared bat	--/--/SLC	Typically roosts in open areas of abandoned buildings, caves, and mines. Forages along wooded habitat edges, often gleaning insects from trees or shrubs.	Absent	Townsend's big-eared bats generally use large, cavernous areas for roosting and open areas nearby for foraging. The BSA and project vicinity do not contain suitable roosting habitat for this species, and it is unlikely to forage in the project vicinity due to the surrounding urban environment. Lack of suitable roosting and foraging habitat make it unlikely that this species uses the site, and it is not addressed further in this NES.
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	--/--/SSC	Grasslands, scrub, and wooded areas. Nests are often located in dense brush near logs, exposed roots, or cavities in trees.	Absent	The BSA and project vicinity do not contain suitable habitat for this species. There is little to no understory in the landscaped area near the creek. The nearest CNDDB occurrence is 2.69 miles from the project site.

***Status Codes**
FE = federally endangered
FT = federally threatened
ST = State threatened
FP = State fully protected
SLC = State-listed candidate
SSC = State species of special concern

4. Results: Biological Resources, Discussion of Impacts & Mitigation

4.1 Habitats and Natural Communities of Special Concern

4.1.1. Waters of the United States

4.1.1.1. Survey Results

Potentially jurisdictional waters within the BSA include 0.33 acre of stream and 0.01 acre of culvert, for a total of 0.34 acre of other waters of the United States (Figure 3). No wetland characteristics were observed along the banks of Las Trampas Creek or elsewhere within the BSA. The wetland delineation is included in Appendix B.

4.1.1.2. Project Impacts

There will be approximately 0.25 acre of temporary impacts to jurisdictional waters and approximately 0.01 acre of permanent impacts. Temporary impacts are based on a temporary disturbance area of 135 feet by 80 feet for bridge demolition and replacement. Permanent impacts are based on the approximate area to be filled for installation of the central bent.

4.1.1.3. Avoidance and Minimization

The grading footprint of the project has been minimized to the maximum extent practicable in order to avoid jurisdictional features. Additionally, the following avoidance and minimization measures will be used to protect the portions of the stream not included in project impacts:

- Prior to the start of construction, all portions of the stream to be avoided by the project will be temporarily staked in the field by a qualified biologist.
- Prior to the start of construction, construction personnel will be trained by a qualified biologist on all required avoidance and minimization measures as well as permit requirements.
- Trash generated by the project will be promptly and properly removed from the site.
- All refueling of construction and maintenance vehicles will occur in paved areas away from the top of bank of the creek.
- Hazardous material absorbent pads and similar materials will be available on site in the event of a spill that could potentially impact jurisdictional waters.
- If the work area needs to be dewatered during project construction, water will be allowed to flow around the work area to maintain downstream flow.
- Water pumped from the work area will be allowed to settle to reduce turbidity prior to being released back into the creek.

- Appropriate erosion-control measures (e.g., fiber rolls, filter fences) will be used on site if needed to reduce siltation and runoff of contaminants into the stream. Filter fences and mesh will be of material that will not entrap reptiles and amphibians.
- Fiber rolls used for erosion control will be certified as free of noxious weed seed and will not contain plastics of any kind.
- If disturbed areas are to be seeded for erosion control after construction, seed mixtures will not contain invasive, nonnative species; they will be composed only of native species or sterile nonnative species.
- Herbicides will not be applied within 100 feet of the creek unless specifically approved by regulatory agencies. If approved, herbicides that have been approved by the Environmental Protection Agency for use in or adjacent to aquatic habitats may be used as long as label instructions are followed and applications avoid or minimize impacts on covered species and their habitats. Herbicide drift should be minimized by applying the herbicide as close to the target area as possible.

4.1.1.4. Compensatory Mitigation

Compensation for impacts to jurisdictional waters will be achieved through one of the following options: (1) purchase of mitigation credits from one or more mitigation banks approved by the ACOE, RWQCB, and CDFW that include the project site within their service areas; (2) purchase and preservation of an approved, off-site parcel with establishment of a conservation easement, development of a management plan, and provision of a perpetual endowment sufficient to cover management of protected lands; or (3) a combination of the above two approaches.

4.1.2. Tree Removals

4.1.2.1 Survey Results

A total of 52 trees were surveyed within the BSA. The trees included a mix of native and non-native trees along Las Trampas Creek and South Main Street, including landscaping above the top of bank and willows in the creek channel upstream of the bridge (Figure 3; Table D).

Table D: Summary of Trees Observed in the BSA

Tree #	Scientific Name	Common name	Circumference	Diameter	Height	Remove/Retain
1	*Platanus x hispanica*	London plane	57	18	45	Retain
2	*Ginkgo biloba*	Ginkgo	28	9	35	Retain
3	*Platanus x hispanica*	London plane	31	10	35	Remove
4	*Quercus lobata*	Valley oak	94	30	45	Remove
5	*Quercus agrifolia*	Coast live oak	28	9	15	Remove
6	*Quercus agrifolia*	Coast live oak	38	12	15	Remove
7	*Quercus lobata*	Valley oak	38	12	12	Remove
8	*Quercus agrifolia*	Coast live oak	28	9	8	Remove
9	*Quercus lobata*	Valley oak	113	36	45	Remove
10	*Prunus dulcis*	Almond	31	10	15	Remove
11	*Salix exigua*	Sandbar willow	28	9	12	Remove
12	*Salix laevigata*	Red willow	25	8	15	Remove
13	*Quercus agrifolia*	Coast live oak	31	10	25	Remove
14	*Acacia melanoxylon*	Blackwood acacia	57	18	40	Retain
15	*Quercus lobata*	Valley oak	38	12	40	Retain
16	*Cedrus deodara*	Deodara cedar	75	24	70	Retain
17	*Quercus lobata*	Valley oak	94	30	35	Retain
18	*Quercus agrifolia*	Coast live oak	28	9	25	Retain
19	*Quercus lobata*	Valley oak	75	24	30	Retain
20	*Quercus agrifolia*	Coast live oak	38	12	25	Retain
21	*Quercus agrifolia*	Coast live oak	75	24	30	Retain
22	*Acacia melanoxylon*	Blackwood acacia	28	9	30	Retain
23	*Acacia melanoxylon*	Blackwood acacia	94	30	40	Retain
24	*Cedrus deodara*	Deodara cedar	57	18	60	Retain
25	*Quercus agrifolia*	Coast live oak	44	14	25	Remove
26	*Quercus shumardii*	Shumard's oak	63	20	45	Retain
27	*Quercus shumardii*	Shumard's oak	44	14	40	Retain

Tree #	Scientific Name	Common name	Circumference	Diameter	Height	Remove/Retain
28	*Quercus shumardii*	Shumard's oak	44	14	40	Retain
29	*Ficus microcarpa*	Little-leaf fig	31	10	40	Retain
30	*Prunus cerasifera*	Cherry plum	31	10	25	Retain
31	*Liquidambar styraciflua*	Sweetgum	44	14	45	Retain
32	*Liquidambar styraciflua*	Sweetgum	44	14	45	Retain
33	*Sequoia sempervirens*	Coast redwood	69	22	100	Retain
34	*Sequoia sempervirens*	Coast redwood	69	22	100	Retain
35	*Sequoia sempervirens*	Coast redwood	63	20	100	Remove
36	*Sequoia sempervirens*	Coast redwood	69	22	100	Remove
37	*Sequoia sempervirens*	Coast redwood	75	24	100	Remove
38	*Juglans hindsii*	Black walnut	44	14	30	Retain
39	*Quercus ilex*	Evergreen oak	31	10	35	Remove
40	*Juglans hindsii*	Black walnut	38	12	25	Remove
41	*Lagerstroemia indica*	Crape myrtle	44	14	15	Retain
42	*Lagerstroemia indica*	Crape myrtle	44	14	15	Retain
43	*Platanus x hispanica*	London plane	38	12	35	Retain
44	*Platanus x hispanica*	London plane	38	12	35	Retain
45	*Pyrus kawakamii*	Evergreen pear	28	9	20	Retain
46	*Pyrus kawakamii*	Evergreen pear	nd*	nd*	nd*	Retain
47	*Pyrus kawakamii*	Evergreen pear	nd*	nd*	nd*	Retain
48	*Quercus shumardii*	Shumard’s oak	nd*	nd*	nd*	Remove
49	*Quercus shumardii*	Shumard’s oak	nd*	nd*	nd*	Retain
50	*Quercus shumardii*	Shumard’s oak	nd*	nd*	nd*	Retain
51	*Quercus shumardii*	Shumard’s oak	nd*	nd*	nd*	Retain
52	*Quercus shumardii*	Shumard’s oak	nd*	nd*	nd*	Retain

*n.d. = no data. An additional site visit was conducted on February 16, 2018 to identify trees that were not originally included in the BSA; no measurements were taken.

4.1.2.2 Project Impacts

A total of 18 trees, consisting of 1 London plane, 3 valley oaks, 5 coast live oaks, 1 almond, 1 sandbar willow, 1 red willow, 3 coast redwoods, 1 black walnut, 1 evergreen oak, and 1 Shumard's oak will require removal as a result of the project (Table D, Figure 3).

The 3 valley oaks, 5 coast live oaks, 1 almond, 1 sandbar willow and 1 red willow would be removed at the beginning of construction season 1. These trees need to be removed to establish access for construction equipment down the creek banks into the creek bed, to allow for existing bridge demolition, and to allow for the reconstruction of the creek banks.

The 3 coast redwoods, 1 black walnut, and 1 evergreen oak would be removed at the beginning of construction season 2. These trees need to be removed to establish access for construction equipment to the creek banks, to allow for existing bridge demolition, and to allow for the reconstruction of the creek banks.

The 1 London plane would be removed at some point during construction to allow for the demolition and reconstruction of the sidewalk. The 1 Shumard's oak would be removed to allow for removal and replacement of the median at the south end of the BSA.

4.1.2.3 Avoidance and Minimization Efforts

The following measures are designed to avoid and minimize impacts to trees. These measures also comply with requirements under Title 3, Chapter 8 of the City of Walnut Creek's Tree Preservation Ordinance.

- **Tree Avoidance.** The project will retain as many existing trees as possible on the project site.

- **Tree Protection Fencing.** Tree protection fencing will be used during construction to prevent direct damage to trees that will not be removed during construction (avoided trees). The fencing will consist of a 6-foot-high chain link fence (or other material approved by the City of Walnut Creek). The fence will be installed around the dripline of each retained tree. All fence sections will be clearly marked with a sign stating "This is a Tree Protection Zone (TPZ) and no one is allowed to disturb this area". The sign will list contact information for the contractor and the arborist, and clearly state that a violation of the TPZ will result in a stop work order.

- **Construction Monitoring.** The existing ground within the dripline of any tree will not be cut, filled, or compacted unless otherwise approved by the City of Walnut Creek. Mechanical excavation within the dripline of any tree, when permitted, will be conducted in a manner that minimizes root damage and will be monitored by a certified arborist.

- **Storage of Construction Equipment and Materials.** No oil, gasoline, chemicals, liquid waste, solid waste, heavy construction machinery, or other construction materials will be stored or allowed to stand within the dripline of any avoided tree. No equipment will be washed within the dripline of any avoided tree.

- **Trimming.** Pruning of any retained tree will be consistent with good pruning practices as outlined in the International Society of Arboriculture's Tree Pruning Guidelines and the American National Standards Institute for tree work (ANSI A-300).

4.1.2.4 Compensatory Mitigation

Compensatory mitigation for loss of trees will consist of mitigation plantings of the same species within the City of Walnut Creek at a 1:1 ratio, in accordance with the mitigation requirements under the City of Walnut Creek's Tree Protection Ordinance.

4.2 Special-Status Plant Species

The BSA is located within a densely populated urban area, and the channel of Las Trampas Creek is lined with concrete. There is no habitat for special-status plants within the BSA.

4.3 Special-Status Animal Species

4.3.1 Western Pond Turtle

Western pond turtle is a California Species of Special Concern. Threats to western pond turtles include habitat loss and the introduction of non-native predators and competitors.

Western pond turtles occupy permanent and intermittent ponds and creeks (Ernst and Lovich 2009). These turtles generally prefer deep (greater than 2 feet), quiet pools along streams, but they also occur in ponds, including constructed ranch ponds. Important habitat features include basking sites and suitable aquatic hiding areas such as undercut banks, logs, rocks, aquatic vegetation, and/or mud and leaf-litter.

Another important element of suitable habitat is the presence of nearby upland nesting areas. Turtles nest on grassy, sunny slopes adjacent to aquatic habitat (Bury et al. 2012). Most nest sites occur within 16 feet to 263 feet of the water, but nests have been found up to 1,640 feet from the water's edge. Nesting typically occurs between May and July when females leave aquatic habitats in search of nest sites. Clutch size ranges from 1 to 13 eggs, and incubation lasts for 94 to 122 days. In Central California, hatchling turtles may emerge in the fall of the year they hatch or may overwinter in the nest, emerging the following spring.

4.3.1.1 Survey Results

Western pond turtle is known to occur in the project vicinity (CDFW 2017). There is one CNDDB occurrence record within 5 miles of the project site, 4.98 miles away at a cattle pond in Mount Diablo State Park (Occurrence #326).

No western pond turtles were observed during the general survey conducted on September 15, 2017, and the BSA does not provide upland habitat for this species. However, Las Trampas Creek does provide marginal movement habitat for western pond turtles that occur in the vicinity of the project site.

4.3.1.2 Project Impacts

There will be approximately 0.25 acre of temporary impacts and approximately 0.01 acre of permanent impacts to western pond turtle aquatic habitat. Therefore, the project ***may affect, is not likely to adversely affect*** this species due to the loss of habitat.

4.3.1.3 Avoidance and Minimization Efforts

A qualified biologist will conduct a pre-construction survey for western pond turtles on the first day of work immediately prior to the start of work to ensure that no individuals are present. On all subsequent days prior to the start of work, a designated construction monitor, trained by the qualified biologist, will inspect the work area for western pond turtles. If a western pond turtle is observed in the immediate work area in these instances, no work will commence along the bank until the turtle has moved out of harm's way or the qualified biologist has arrived at the site and relocated the turtle.

4.3.1.4 Compensatory Mitigation

Impacts to western pond turtle will be minimal and largely due to temporary disturbance during construction. The removal of the existing bridge will compensate for the minor loss of movement habitat associated with construction of the proposed bridge. No compensatory mitigation for impacts to western pond turtle is necessary given the relatively small project footprint and the marginal nature of the habitat.

5. Conclusions & Regulatory Determination

5.1 Federal Endangered Species Act Consultation Summary

The USFWS species list was obtained through the IPaC website on September 12, 2017. All federally listed species were evaluated for their potential to occur on site (Tables B and C). The proposed project will have ***no effect*** on federally listed plant or animal species. There is no critical habitat for any listed species within the BSA.

5.2 Essential Fish Habitat Consultation Summary

The BSA and project vicinity do not provide EFH for salmon. Suitable spawning habitat may occur upstream of the project site. However, two drop structures in Walnut Creek, downstream of the BSA, prohibit salmonids from moving upstream into Las Trampas Creek and through the BSA.

5.3 Wetlands and Other Waters Consultation Summary

A delineation study was conducted within the BSA on September 15, 2017 following the methods outlined in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* ("Arid West Supplement" (ACOE 2008). A delineation report has been prepared for review by the ACOE and is included in Appendix B. An ACOE Section 404 permit and a RWQCB Section 401 Certification may be required as a result of placement of fill during implementation of the bridge replacement project.

5.4 Migratory Bird Treaty Act and California Fish and Game Code (Breeding Birds)

Most existing vegetation within the BSA has at least some potential to support nests of native birds protected under the MBTA and California Fish and Game Code. In addition, cliff swallow nests were seen under the bridge during the general plant and animal survey conducted on September 15, 2017. The swallows likely return to the bridge to nest each year and are likely to be present at the time of construction. To reduce the likelihood of birds establishing nests in the construction zone, vegetation in the project vicinity may be removed prior to the start of the nesting season (February 15). Similarly, potential nest trees that will be eliminated as part of the project and old, inactive swallow nests on the bridge may be removed prior to the start of the nesting season. Swallows may also be prevented from nesting on the bridge through the installation of netting or other exclusionary measures if they are installed prior to the start of nesting.

Construction activities during the nesting season (February 15–August 31), including any removal of vegetation in the project vicinity, will be conducted in a manner that avoids direct impacts to nesting birds via a preconstruction survey. Buffers for songbird nests are generally on the order of 50 to 100 feet, with the precise distance determined by the biologist conducting the preconstruction survey based on nest site characteristics and the acclimation of the nesting birds to disturbance. Thus, the project is not expected to result in direct impacts to nesting birds.

5.5 California Endangered Species Act Consultation Summary

The proposed project will not impact state listed plant or animal species.

5.6 California Fish and Game Code Section 1602 Summary

A delineation study was conducted within the BSA on September 15, 2017 that identified potentially jurisdictional features in the BSA. A Lake and Streambed Alteration Agreement may be required as a result of modifications to Las Trampas Creek during implementation of the bridge replacement project.

5.7 California Fish and Game Code Section 5901 Summary

The proposed Las Trampas Creek Bridge will not present a barrier to fish passage.

5.8 Invasive Species

There are two species within the BSA that are rated by the California Invasive Plant Council (Cal-IPC) as highly invasive based on their negative impacts on ecological processes and their potential for dispersal: Himalayan blackberry (*Rubus armeniacus*) and Canary ivy (*Hedera canariensis*). Other invasive species with limited to moderate Cal-IPC ratings present in the BSA are: Blackwood acacia (*Acacia melanoxylon*; limited), ripgut brome (*Bromus diandrus*; moderate), Italian thistle (*Carduus* pycnocephalus; moderate), Glossy privet (*Ligustrum lucidum*; limited), and cherry plum (*Prunus cerasifera*; limited).

To avoid further introduction of invasive species into the BSA during project construction or the spread of invasive species to other locations, contract specifications will include, at a minimum, the following measures:

- All earthmoving equipment to be used during project construction will be thoroughly cleaned before arriving at and leaving the project site.
- All vegetation removed during project activities will be properly disposed of off-site.

6. References

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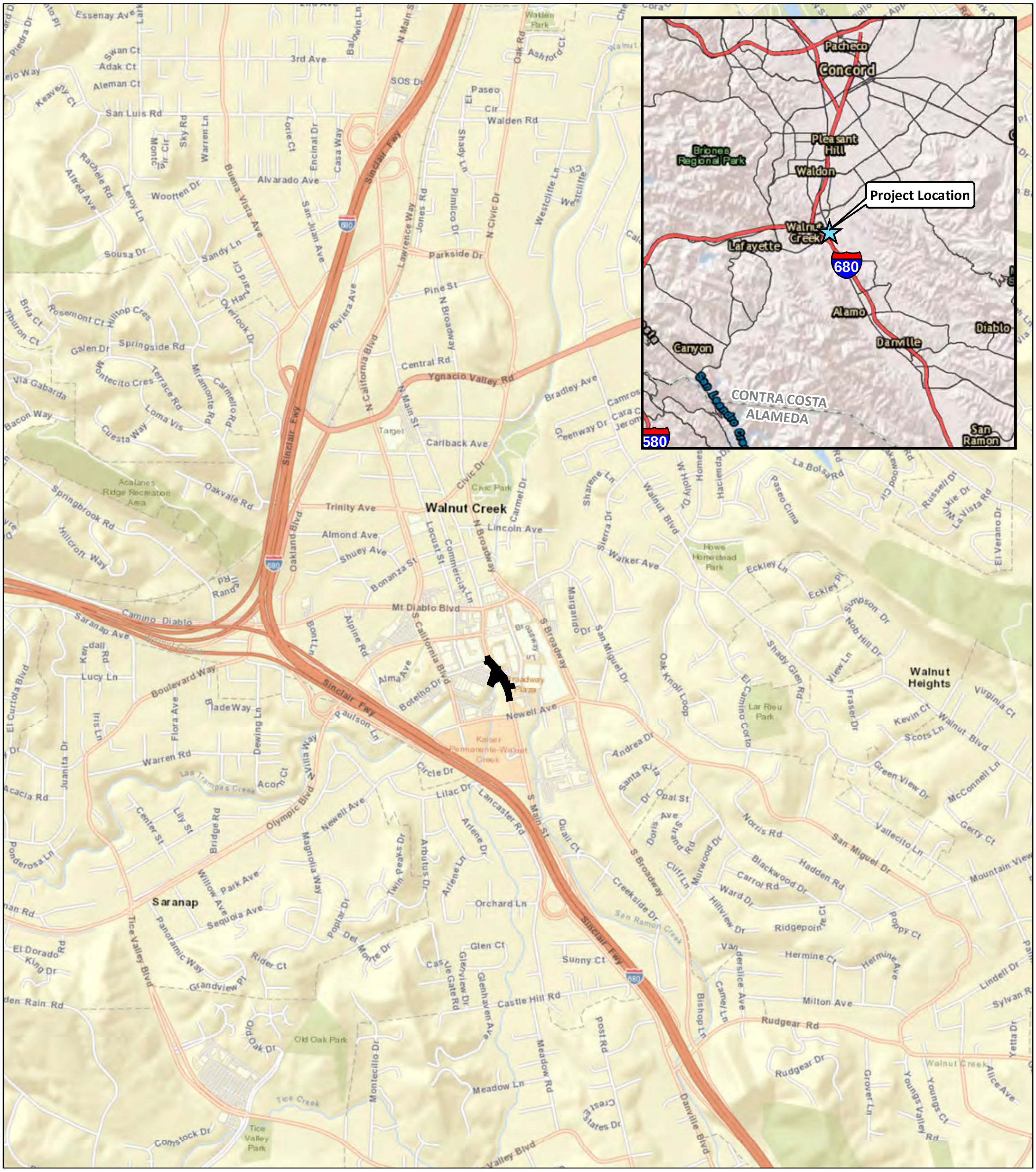
_____. 2017. Information for Planning and Consultation (IPaC) Online Database. Sacramento Fish and Wildlife Office, Sacramento, California. Available at https://ecos.fws.gov/ipac/ [Accessed September 12, 2017].



LEGEND

Biological Study Area (BSA) (2.79 ac)

Caltrans

N

0 1000 2000
FEET

FIGURE 1

Las Trampas Creek Bridge at
South Main Street Replacement Project
Contra Costa County, California; Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Study Vicinity Map

SOURCE: ESRI World Street Map (4/2008)

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FIGURE 2

LEGEND

Biological Study Area (2.79 ac)

USGS 7.5' Quad Boundaries

N

0 1000 2000

FEET

Las Trampas Creek Bridge at
South Main Street Replacement Project
Contra Costa County, California; Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Study Location Map

SOURCE: USGS 7.5-minute topographic quadrangle Walnut Creek, Calif. (1993, ed. 1997)

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Summary of Trees Observed within the BSA

Tree No.	Common name	Tree No.	Common name	Tree No.	Common name
1	London plane	19	Valley oak	36	Coast redwood
2	Ginkgo	20	Coast live oak	37	Coast redwood
3	London plane	21	Coast live oak	38	Black walnut
4	Valley oak	22	Blackwood acacia	39	Evergreen oak
5	Coast live oak	23	Blackwood acacia	40	Black walnut
6	Coast live oak	24	Deodara cedar	41	Crape myrtle
7	Valley oak	25	Coast live oak	42	Crape myrtle
8	Coast live oak	26	Shumard's oak	43	London plane
9	Valley oak	27	Shumard's oak	44	London plane
10	Almond	28	Shumard's oak	45	Evergreen pear
11	Sandbar willow	29	Little-leaf fig	46	Evergreen pear
12	Red willow	30	Cherry plum	47	Evergreen pear
13	Coast live oak	31	Sweetgum	48	Shumard's oak
14	Blackwood acacia	32	Sweetgum	49	Shumard's oak
15	Valley oak	33	Coast redwood	50	Shumard's oak
16	Deodara cedar	34	Coast redwood	51	Shumard's oak
17	Valley oak	35	Coast redwood	52	Shumard's oak
18	Coast live oak				

Caltrans

Biological Study Area (BSA) (3.17 ac)
Weir
Non-Jurisdictional Feature
Top of Bank

Potentially Jurisdictional Waters of the U.S.
Culvert (0.011 ac)
Ordinary High Water (0.333 ac)
Stream (0.344 ac)

Tree Survey
To Be Retained
To Be Removed

Land Cover Types in the BSA
Landscaping (0.686 ac)
Willow Scrub (0.015 ac)
Urban (2.266 ac)

N

0 25 50
FEET

FIGURE 3

Las Trampas Creek Bridge at South Main Street Replacement Project
Contra Costa County, California; Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Land Cover Types and Impacts

SOURCE: Google Earth Aerial Imagery (03/2017); Mapping - LSA (10/2017)

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Appendix A – IPaC, CNDDB, and CNPS Species Lists

IPaC **U.S. Fish & Wildlife Service**

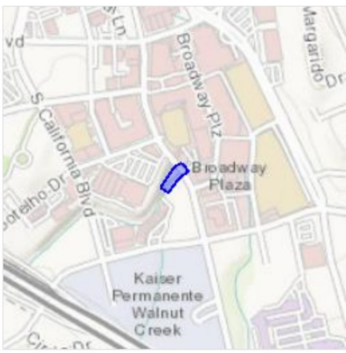
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Contra Costa County, California



Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) *Masticophis lateralis euryxanthus* There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened

California Tiger Salamander Ambystoma californiense | Threatened

There is **final designated** critical habitat for this species. Your location is outside the critical habitat.

https://ecos.fws.gov/ecp/species/2076

Fishes

NAME	STATUS
Delta Smelt Hypomesus transpacificus There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/321	Threatened
Steelhead Oncorhynchus (=Salmo) mykiss There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/1007	Threatened

Insects

NAME	STATUS
Callippe Silverspot Butterfly Speyeria callippe callippe There is **proposed** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/3779	Endangered
San Bruno Elfin Butterfly Callophrys mossii bayensis There is **proposed** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/3394	Endangered

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
Antioch Dunes Evening-primrose Oenothera deltoides ssp. howellii There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5970	Endangered
Contra Costa Goldfields Lasthenia conjugens There is **final designated** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/7058	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured. Any person or organization who plans or conducts activities that

CNDDB - 5 Miles from Survey Limit - September 2017 Data

Common Name	Scientific Name
Non-vascular Plant	
Slender Silver Moss	*Anomobryum julaceum*
Plants - Dicots	
Antioch Dunes Evening-primrose	*Oenothera deltoides ssp. howellii*
Bent-flowered Fiddleneck	*Amsinckia lunaris*
Big Tarplant	*Blepharizonia plumosa*
Congdon's Tarplant	*Centromadia parryi ssp. congdonii*
Contra Costa Goldfields	*Lasthenia conjugens*
Contra Costa Manzanita	*Arctostaphylos manzanita ssp. laevigata*
Diablo Helianthella	*Helianthella castanea*
Hall's Bush-mallow	*Malacothamnus hallii*
Hospital Canyon Larkspur	*Delphinium californicum ssp. interius*
Jepson's Coyote-thistle	*Eryngium jepsonii*
Lime Ridge Eriastrum	*Eriastrum ertterae*
Lime Ridge Navarretia	*Navarretia gowenii*
Loma Prieta Hoita	*Hoita strobilina*
Most Beautiful Jewelflower	*Streptanthus albidus ssp. peramoenus*
Mt. Diablo Jewelflower	*Streptanthus hispidus*
Mt. Diablo Manzanita	*Arctostaphylos auriculata*
Northern California Black Walnut	*Juglans hindsii*
Oval-leaved Viburnum	*Viburnum ellipticum*
San Joaquin Spearscale	*Extriplex joaquinana*
Woodland Woollythreads	*Monolopia gracilens*
Plants - Monocots	
Fragrant Fritillary	*Fritillaria liliacea*
Mt. Diablo Fairy-lantern	*Calochortus pulchellus*
Slender-leaved Pondweed	*Stuckenia filiformis ssp. alpina*
Amphibians	
California Red-legged Frog	*Rana draytonii*
California Tiger Salamander	*Ambystoma californiense*
Birds	
American Peregrine Falcon	*Falco peregrinus anatum*
Burrowing Owl	*Athene cunicularia*
Prairie Falcon	*Falco mexicanus*
Mammals	
Hoary Bat	*Lasiurus cinereus*
Pallid Bat	*Antrozous pallidus*
San Francisco Dusky-footed Woodrat	*Neotoma fuscipes annectens*
Townsend's Big-eared Bat	*Corynorhinus townsendii*
Reptiles	
Alameda Whipsnake	*Masticophis lateralis euryxanthus*
Western Pond Turtle	*Emys marmorata*
Insects	
Antioch Efferian Robberfly	*Efferia antiochi*
Obscure Bumble Bee	*Bombus caliginosus*
Western Bumble Bee	*Bombus occidentalis*
Terrestrial Communities	
Serpentine Bunchgrass	Serpentine Bunchgrass

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants - 7th edition interface

v7-16aug 8-16-17

Status: search results - Tue, Sep. 12, 2017 19:21 ET c

{QUADS_123} =~ m/465A|482C|482D|464B|464C|481C|465B|465C|465D/ Search

Tip: Words meant to be searched as a unit should be wrapped in quotes, e.g., "coastal dunes".
[all tips and help.][search history]

Your Quad Selection: Walnut Creek (465A) 3712281, Benicia (482C) 3812212, Vine Hill (482D) 3812211, Clayton (464B) 3712188, Diablo (464C) 3712178, Honker Bay (481C) 3812118, Briones Valley (465B) 3712282, Oakland East (465C) 3712272, Las Trampas Ridge (465D) 3712271

Hits 1 to 50 of 63

Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Amsinckia lunaris**	bent-flowered fiddleneck	Boraginaceae	List 1B.2
		1	**Arctostaphylos auriculata**	Mt. Diablo manzanita	Ericaceae	List 1B.3
		1	**Arctostaphylos manzanita ssp. laevigata**	Contra Costa manzanita	Ericaceae	List 1B.2
		1	**Arctostaphylos pallida**	pallid manzanita	Ericaceae	List 1B.1
		1	**Astragalus tener var. tener**	alkali milk-vetch	Fabaceae	List 1B.2
		1	**Atriplex cordulata var. cordulata**	heartscale	Chenopodiaceae	List 1B.2
		1	**Balsamorhiza macrolepis**	big-scale balsamroot	Asteraceae	List 1B.2
		1	**Blepharizonia plumosa**	big tarplant	Asteraceae	List 1B.1
		1	**California macrophylla**	round-leaved filaree	Geraniaceae	List 1B.2
		1	**Calochortus pulchellus**	Mt. Diablo fairy-lantern	Liliaceae	List 1B.2
		1	**Campanula exigua**	chaparral harebell	Campanulaceae	List 1B.2
		1	**Centromadia parryi ssp. congdonii**	Congdon's tarplant	Asteraceae	List 1B.1
		1	**Chloropyron molle ssp. molle**	soft bird's-beak	Orobanchaceae	List 1B.2
		1	**Chorizanthe robusta var. robusta**	robust spineflower	Polygonaceae	List 1B.1
		1	**Cicuta maculata var. bolanderi**	Bolander's water-hemlock	Apiaceae	List 2B.1
		1	**Cirsium andrewsii**	Franciscan thistle	Asteraceae	List 1B.2
		1	**Clarkia franciscana**	Presidio clarkia	Onagraceae	List 1B.1
		1	**Cordylanthus nidularius**	Mt. Diablo bird's-beak	Orobanchaceae	List 1B.1

		1	**Delphinium californicum ssp. interius**	Hospital Canyon larkspur	Ranunculaceae	List 1B.2
		1	**Dirca occidentalis**	western leatherwood	Thymelaeaceae	List 1B.2
		1	**Eriastrum ertterae**	Lime Ridge eriastrum	Polemoniaceae	List 1B.1
		1	**Eriogonum luteolum var. caninum**	Tiburon buckwheat	Polygonaceae	List 1B.2
		1	**Eriogonum truncatum**	Mt. Diablo buckwheat	Polygonaceae	List 1B.1
		1	**Eryngium jepsonii**	Jepson's coyote thistle	Apiaceae	List 1B.2
		1	**Erysimum capitatum var. angustatum**	Contra Costa wallflower	Brassicaceae	List 1B.1
		1	**Extriplex joaquinana**	San Joaquin spearscale	Chenopodiaceae	List 1B.2
		1	**Fissidens pauperculus**	minute pocket moss	Fissidentaceae	List 1B.2
		1	**Fritillaria liliacea**	fragrant fritillary	Liliaceae	List 1B.2
		1	**Gilia millefoliata**	dark-eyed gilia	Polemoniaceae	List 1B.2
		1	**Grimmia torenii**	Toren's grimmia	Grimmiaceae	List 1B.3
		1	**Helianthella castanea**	Diablo helianthella	Asteraceae	List 1B.2
		1	**Hesperolinon breweri**	Brewer's western flax	Linaceae	List 1B.2
		1	**Hoita strobilina**	Loma Prieta hoita	Fabaceae	List 1B.1
		1	**Holocarpha macradenia**	Santa Cruz tarplant	Asteraceae	List 1B.1
		1	**Horkelia cuneata var. sericea**	Kellogg's horkelia	Rosaceae	List 1B.1
		1	**Isocoma arguta**	Carquinez goldenbush	Asteraceae	List 1B.1
		1	**Juglans hindsii**	Northern California black walnut	Juglandaceae	List 1B.1
		1	**Lasthenia conjugens**	Contra Costa goldfields	Asteraceae	List 1B.1
		1	**Lathyrus jepsonii var. jepsonii**	Delta tule pea	Fabaceae	List 1B.2
		1	**Lilaeopsis masonii**	Mason's lilaeopsis	Apiaceae	List 1B.1
		1	**Limosella australis**	Delta mudwort	Scrophulariaceae	List 2B.1
		1	**Malacothamnus hallii**	Hall's bush-mallow	Malvaceae	List 1B.2
		1	**Meconella oregana**	Oregon meconella	Papaveraceae	List 1B.1
		1	**Micropus amphibolus**	Mt. Diablo cottonweed	Asteraceae	List 3.2
		1	**Monardella antonina ssp. antonina**	San Antonio Hills monardella	Lamiaceae	List 3
		1	**Monolopia gracilens**	woodland woolythreads	Asteraceae	List 1B.2
		1	**Navarretia gowenii**	Lime Ridge navarretia	Polemoniaceae	List 1B.1
		1	**Navarretia nigelliformis ssp.**	shining navarretia	Polemoniaceae	List

			radians			1B.2
		1	**Oenothera deltoides ssp. howellii**	Antioch Dunes evening-primrose	Onagraceae	List 1B.1
		1	**Phacelia phacelioides**	Mt. Diablo phacelia	Hydrophyllaceae	List 1B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

For more results click below:

CNPS California Native Plant Society

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v7-16aug 8-16-17

Status: search results - Fri, Sep. 22, 2017 14:10 ET c

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Tip: +DNT Jun Jul returns Del Norte taxa with those blooming both months listed first.[all tips and help.] [search history]

Your Quad Selection: Walnut Creek (465A) 3712281, Benicia (482C) 3812212, Vine Hill (482D) 3812211, Clayton (464B) 3712188, Diablo (464C) 3712178, Honker Bay (481C) 3812118, Briones Valley (465B) 3712282, Oakland East (465C) 3712272, Las Trampas Ridge (465D) 3712271

Hits 51 to 63 of 63

Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Plagiobothrys diffusus**	San Francisco popcornflower	Boraginaceae	List 1B.1
		1	**Polygonum marinense**	Marin knotweed	Polygonaceae	List 3.1
		1	**Sanicula maritima**	adobe sanicle	Apiaceae	List 1B.1
		1	**Sanicula saxatilis**	rock sanicle	Apiaceae	List 1B.2
		1	**Senecio aphanactis**	chaparral ragwort	Asteraceae	List 2B.2
		1	**Streptanthus albidus ssp. peramoenus**	most beautiful jewelflower	Brassicaceae	List 1B.2
		1	**Streptanthus hispidus**	Mt. Diablo jewelflower	Brassicaceae	List 1B.3
		1	**Stuckenia filiformis ssp. alpina**	slender-leaved pondweed	Potamogetonaceae	List 2B.2
		1	**Symphyotrichum lentum**	Suisun Marsh aster	Asteraceae	List 1B.2
		1	**Trifolium hydrophilum**	saline clover	Fabaceae	List 1B.2
		1	**Triquetrella californica**	coastal triquetrella	Pottiaceae	List 1B.2
		1	**Tropidocarpum capparideum**	caper-fruited tropidocarpum	Brassicaceae	List 1B.1
		1	**Viburnum ellipticum**	oval-leaved viburnum	Adoxaceae	List 2B.3

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

For more results click below:

Appendix B – Wetland Delineation

BERKELEY
CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

December 27, 2017

Katerina Galacatos, South Branch Chief
Regulatory Division
U.S. Army Corps of Engineers
1455 Market Street, 16th Floor
San Francisco, CA 94103-1398

Subject: Request for Verification of Jurisdictional Delineation
Las Trampas Creek Bridge Project, Walnut Creek, California

Dear Ms. Galacatos:

On behalf of the City of Walnut Creek, LSA Associates, Inc. (LSA) is requesting verification of the extent of U.S. Army Corps of Engineers (ACOE) jurisdiction under Section 404 of the Clean Water Act for the above-referenced project site. This letter presents the results of a delineation performed by LSA of the potential extent of waters of the United States, including wetlands, on this site.

The proposed project will replace the existing five-lane bridge over Las Trampas Creek on South Main Street in the City of Walnut Creek, Contra Costa County, California. The existing bridge is Structurally Deficient due to multiple cracks and spalls with exposed rebar in the soffit. Additionally, the bridge is Functionally Obsolete due to inadequate clear width for current and future Average Daily Traffic volumes. The project will replace the existing concrete-reinforced "T"-beam bridge (built in 1919 and widened in 1950 and 1956) with a new five-lane bridge that will be widened an additional 20 feet to accommodate 10-foot-wide shoulders.

SITE DESCRIPTION

The approximately 2.5-acre site is located on South Main Street approximately 0.1 mile south of Olympic Boulevard. The site includes the South Main Street Bridge crossing at Las Trampas Creek and extends approximately 340 feet along Las Trampas Creek. Tice Creek exits a culvert from the south and runs parallel to Las Trampas Creek for approximately 60 feet before converging into Las Trampas Creek.

The site is situated within the Walnut Creek, California 7.5-minute United States Geological Survey quadrangle, and is centered at approximately 37°53'41.16'' North Latitude and -122°03'32.79'' West Longitude. Figures 1 and 2 depict the regional location and project site location, respectively. Figure 3 depicts the Potential Waters of the United States. The project site is completely surrounded by downtown Walnut Creek development.

157 Park Place, Pt. Richmond, California 94801 510.236.6810 www.lsa.net

Soils

The soils in the majority of the study site are mapped by the United States Department of Agriculture as Clear Lake clay, 0 to 15 percent slopes (Map Unit Symbol Cc) (Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx [Accessed October 5, 2017]). However, the extents of Las Trampas Creek and Tice Creek at the site are concrete lined, with small gravel bars in Las Trampas Creek adjacent to the South Main Street Bridge on the south side.

Vegetation

The creek is lined with vertical concrete walls from the southern boundary to a weir located approximately 80 feet south of the existing bridge. The banks between the weir and the bridge and between the bridge and a culvert to the north of the bridge are steep and are lined with concrete sacks. The banks underneath the bridge are steep and lined with concrete. A small willow thicket is located on a gravel bar on the western creek bank south of the South Main Street Bridge. Ornamental plantings occur in the developed areas along the tops of the banks.

*Landscaped/Developed (Ornamental Plantings in Developed Areas).*Trees and shrubs present in the ornamental planting areas along the creek banks include blackwood acacia (*Acacia melanoxylon*), glossy privet (*Ligustrum lucidum*), sweetgum (*Liquidambar styraciflua*), cherry plum (*Prunus cerasifera*), coast live oak (*Quercus agrifolia*), evergreen oak (*Quercus ilex*), Shumard's oak (*Quercus shumardii*), Himalayan blackberry (*Rubus armeniacus*) and Pennsylvania blackberry (*Rubus pennsylvanicus*). Herbaceous vegetation (both native and non-native) occurs within non-maintained areas adjacent to the creek channel, including mugwort (*Artemisia douglasii*), rip gut brome (*Bromus diandrus*), Italian thistle (*Carduus pycnocephalus*), goose grass (*Galium aparine*), and Canary ivy (*Hedera canariensis*).

Willow Thickets. This natural vegetation community also occurs within the Las Trampas Creek channel and consists of one multi-stemmed sandbar willow (*Salix exigua*) tree and one multi-stemmed red willow (*Salix laevigata*) tree. Herbaceous wetland vegetation and tree seedlings occur along the edge of the willow thicket, including tall flat sedge (*Cyperus eragrosits*), willowherb (*Epilobium ciliatum*), Oregon ash (*Fraxinus latifolia*), iris leaf rush (*Juncus xiphioides*), scarlet pimpernel (*Lysimachia arvensis*), apple mint (*Mentha californicus*), California bulrush (*Schoenoplectus californicus*), and cattails (*Typha* sp.). Other species observed in association with the willow thicket include stinkwort (*Dittrichia graveolens*), Melaleuca (*Melaleuca sp.*), and smilo grass (*Stipa miliacea* var. *miliacea*).

Hydrology

Tice Creek merges into Las Trampas Creek, which flows north and drops over an approximately 10-foot weir (Figure 3 and Photograph 1). At the time of the initial survey on September 15, 2017, Las Trampas Creek was flowing north at approximately 15-20 cubic feet per second (CFS) (visual observation). Las Trampas Creek flows into a culvert under downtown Walnut Creek (the city) and into Walnut Creek. Walnut Creek flows northwest into Suisun Bay, a navigable water of the United States. No rainfall occurred in this region during the summer months preceding the initial survey.

METHODS

The field investigation of potentially jurisdictional wetlands was conducted using the routine determination method provided in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the revised procedures in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Arid West Supplement; ACOE 2008). (The project site is near the boundary of the Western Mountains, Valleys, and Coast Region, but within the Arid West Region.) This methodology entails examination of specific sample points within potential wetlands for hydrophytic vegetation, hydric soils, and wetland hydrology. By the federal definition, all three parameters must be present for an area to be considered a wetland.

Hydrophytic plant species are listed by the National Wetland Plant List (2016 NWPL Viewer v3.2). The National List identifies five categories of plants according to their frequency of occurrence in wetlands. The categories are:

- Obligate wetland plants (OBL) — Plants that occur almost always in wetlands
- Facultative wetland plants (FACW) — Plants that usually occur in wetlands
- Facultative plants (FAC) — Plants that are equally likely to occur in wetlands or non-wetlands
- Facultative upland plants (FACU) — Plants that usually occur in uplands
- Obligate upland plants (UPL) — Plants that occur almost always in non-wetlands

An area is generally considered to have hydrophytic vegetation when more than 50 percent of the dominant species in each stratum (tree, shrub, and herb) are in the obligate wetland, facultative wetland, or facultative categories.

Hydric soils are defined by criteria set forth by the National Technical Committee for Hydric Soils (NTCHS). These criteria are given in the Wetland Delineation Manual Supplement and are based on depth and duration of soil saturation. Hydric soils are commonly identified in the field by using indirect indicators of saturated soil, technically known as redoximorphic features. These features are caused by anaerobic, reduced soil conditions that are brought about by prolonged soil saturation. The most common redoximorphic features are distinguished by soil color, which is strongly influenced by the frequency and duration of soil saturation. Hydric soils tend to have dark (low chroma) colors that are often accompanied by reddish mottles (iron mottles), reddish stains on root channels (oxidized rhizospheres), or gray colors (gleying). The Arid West Supplement contains descriptions of numerous federally recognized hydric soil indicators.

Under natural conditions, development of hydrophytic vegetation and hydric soils are dependent on a third characteristic, wetland hydrology. This criterion is met if the area experiences inundation or soil saturation at the surface for a period equal to at least five (5) percent of the growing season (about 14 days in the region of the project site) in a year of median rainfall. In most cases, this criterion can only be measured directly by monitoring the site through an entire wet season. In practice, the hydrological status of a particular area is usually evaluated using indirect indicators. Some of the indicators that are commonly used to identify wetland hydrology include biotic crusts and oxidized rhizospheres around roots. The Arid West Supplement gives thorough descriptions of numerous federally recognized indicators of wetland hydrology.

FIELD METHODS

LSA senior biologist Tim O'Donnell investigated the site on September 15, 2017. Potentially jurisdictional boundaries were mapped using a global positioning system (GPS) receiver with sub-meter accuracy and an electronic range-finder. The ordinary high water mark was calculated partly by following vertical concrete walls and by following the upper limits of sediment deposits and scour lines. The ordinary high water area of the channel was measured using an electronic range-finder at multiple locations under, upstream, and downstream of the bridge. The mapping was correlated with surveyor's elevation contour mapping of the site.

A follow-up visit was conducted by LSA senior biologist Mike Trueblood on December 5, 2017 in order to collect a wetland sample point in the in-channel willow thicket. The willow thicket was not accessible at the time of the second visit. One sample point was, therefore, taken 60 feet upstream of the willow thicket in what appeared to be similar soil conditions along the edge of the channel. A copy of the wetland data form is attached.

OBSERVATIONS

At the South Main Street crossing, Las Trampas Creek is a steep-sided, concrete-lined channel incised approximately 20 feet below the bridge roadway and adjacent land surface. The bank and bed material is concrete; small gravel bars occur downstream of the approximately 10–foot-tall vertical weir and concrete-lined drop pool (Figure 3 and Photograph 1).

Potential Wetlands

Wetland vegetation was observed along the edge of the willow thicket just upstream of the bridge. It was not possible to obtain a wetland sample point at this location, but a sample point taken upstream of the thicket indicates that there are wetland soils present at the site. However, the willow thicket was not mapped as permanent wetland due to the nature of the site. The vegetation occurs on sediments deposited on top of the concrete-lined channel and is likely scoured out frequently by high winter flows through the channel, making persistence of a wetland at that location unlikely. The willow thicket is included in non-wetland waters below.

Non-Wetland Waters

The area of non-wetland waters within the Las Trampas Creek and Tice Creek ordinary high water lines is approximately 14,375 sq. ft. (0.33 acre). The area of non-wetland waters in the culvert to the north is approximately 435 sq. ft. (0.01 acre). Therefore, the total area of non-wetland waters at the study site is approximately 14,810 sq. ft. (0.34 acre).

No other evidence of potential waters of the United States was observed at the site.

CONCLUSIONS

Potential Clean Water Act Section 404 jurisdictional features identified at the Las Trampas Creek Bridge project site consist of the ordinary high water areas of Las Trampas and Tice creeks and the culvert to the north of the bridge. These areas were delineated as non-wetland waters, with a total approximate area of 0.34 acre. No potential permanent wetlands were identified at the site.

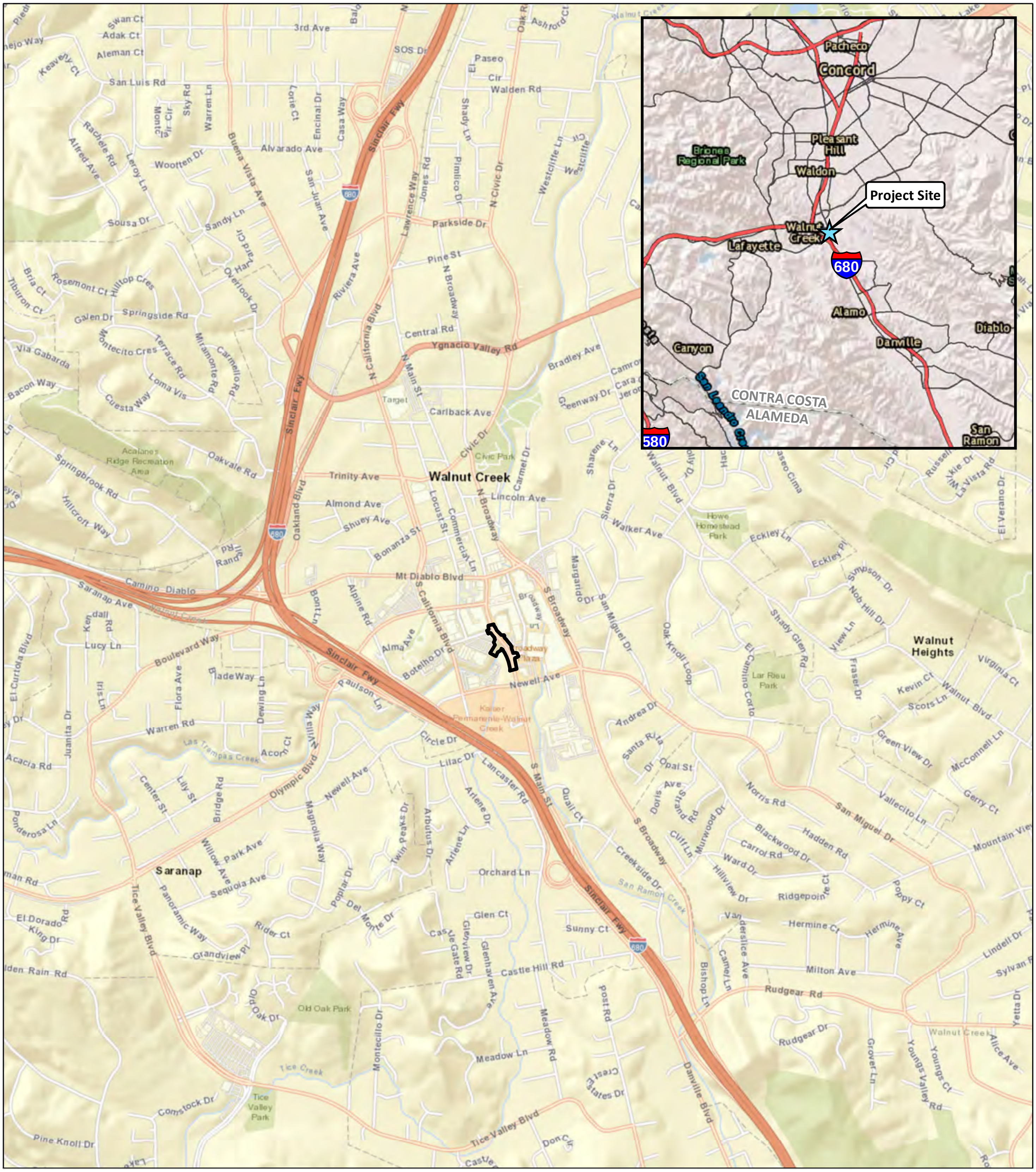
The findings and conclusions presented in this report, including the location and extent of waters subject to regulatory jurisdiction, represent the professional opinion of LSA. These findings and conclusions should be considered preliminary until verified by the ACOE.

Sincerely,

LSA ASSOCIATES, INC.

Mike Trueblood
Senior Biologist

Attachments: Figure 1: Regional Location
Figure 2: Project Location
Figure 3: Delineation Map
Photograph 1
Wetland Data Form



LEGEND

Project Area

0 1000 2000
FEET

FIGURE 1

Las Trampas Creek Bridge at South Main Street Replacement Project in the City of Walnut Creek
Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Study Vicinity Map

SOURCE: ESRI World Street Map (4/2008)

I:\Qce1702\GIS\Reports\Cultural\Fig1_Regional.mxd (10/6/2017)

LEGEND

Project Area

USGS 7.5' Quad Boundaries

N

0 0.1625 0.325
FEET

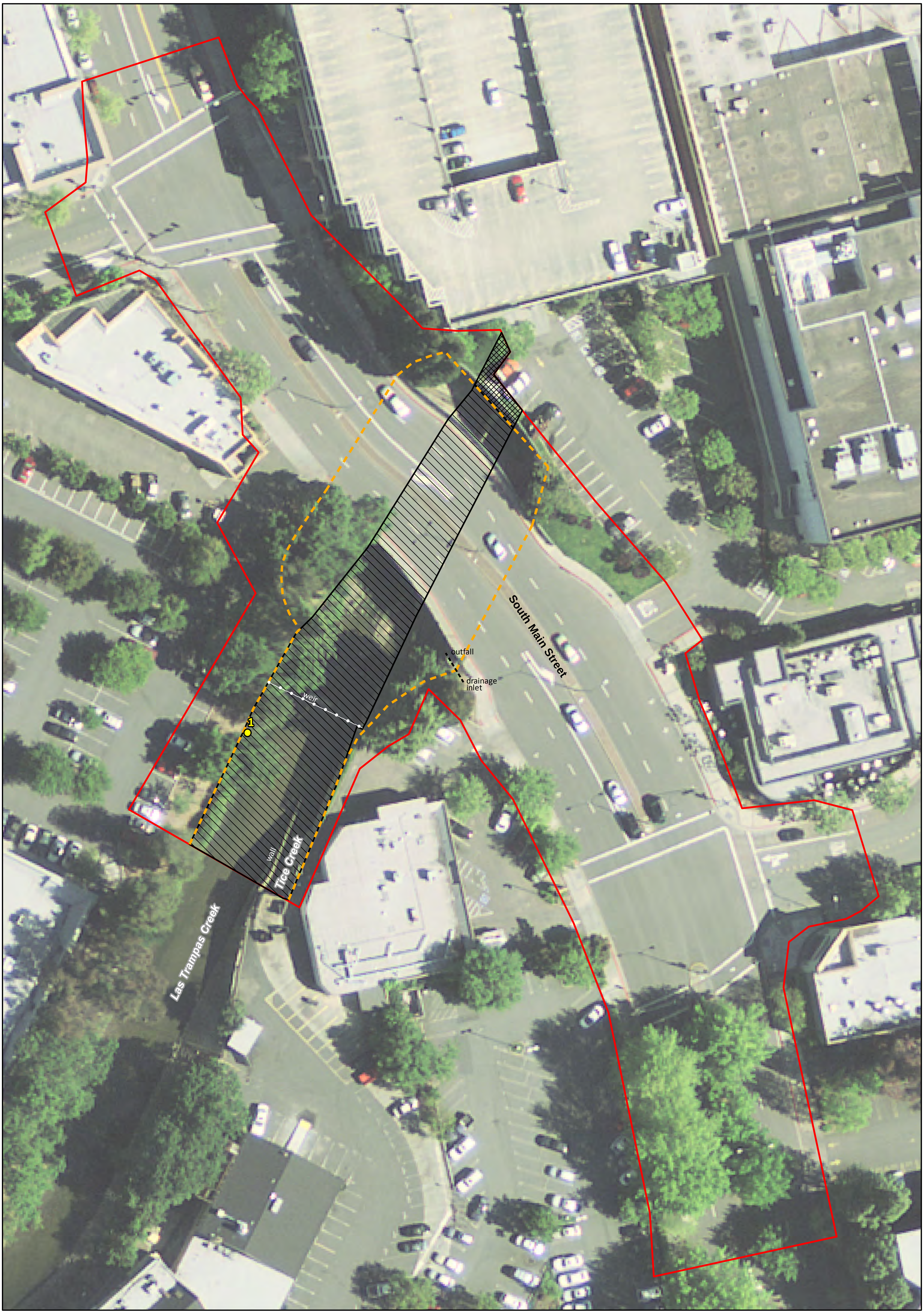
FIGURE 2

Las Trampas Creek Bridge at South Main Street
Replacement Project in the City of Walnut Creek
Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Study Location Map

SOURCE: USGS 7.5-minute topographic quadrangle Walnut Creek, Calif. (1993, ed. 1997)

I:\Qce1702\GIS\Reports\Cultural\Fig2_Location.mxd (10/6/2017)



LSA

LEGEND

Delineation Study Area

Top of Bank

Non-jurisdictional Feature

Weir

Data Point

Potential Waters of the United States

Other Waters

Ordinary High Water (0.33 ac.)

Culvert (0.01 ac.)

N

0 25 50

FEET

FIGURE 3

Las Trampas Creek Bridge at South Main Street
Replacement Project in the City of Walnut Creek
Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Potential Waters of the United States

SOURCE: USGS Orthoimagery (04/2011).

\\ptr11\images\QCE1702\GIS\Maps\Delineation\Figure 3_Potential Waters of the US.mxd (12/27/2017)

PHOTOGRAPHS

Photograph 1: View of Las Trampas Creek and confluence of Tice Creek (exiting culvert in top left of photograph) looking south from the South Main Street Bridge. Below the approximately 10-foot-high weir, two small gravel bars occur.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Las Trampas Creek Bridge City/County: Walnut Creek Sampling Date: 12/5/17

Applicant/Owner: City of Walnut Creek State: CA Sampling Point: 1

Investigator(s): Mike Trueblood Section, Township, Range: Sec 35 T.1.N R.2.W

Landform (hillslope, terrace, etc.): Urban Concrete Local relief (concave, convex, none): ______ Slope (%): 0

Subregion (LRR): ______ Lat: 37°53'41.16" Long: -122° 03'32.79" Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ✓, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland?	Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____		
Wetland Hydrology Present?	Yes ✓ No ____		

Remarks: Though indicators point to wetlands, these sediment deposits likely scour out anually and are very dynamic in structure and location. These vegetated deposits do not function as healty wetlands.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1. Salix exigua	50	Y	Obl
2. Salix laevigata	30	Y	Facw
3.			
4.			
	80 = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: ______)			
1. Typha latifolia	20	Y	Obl
2. Ludwigia peploides	20	Y	Obl
3.			
4.			
5.			
6.			
7.			
8.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9"	10YR 3/1	100						mucky sandy silt
9"								concrete

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ✓ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: concrete

Depth (inches): 9"

Hydric Soil Present? Yes ✓ No ___

Remarks:

vertical bank boxed channel. Vegetation growing in sediment deposits along the vertical bank edge. Likely scoured out annually. No natural soils present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (inches): < 1"

Water Table Present? Yes ✓ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX C

CULTURAL RESOURCES STUDIES

Confidential – Not for Public Use

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APPENDIX D

COMMUNITY IMPACTS AND LAND USE MEMORANDUM

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LSA

CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

MEMORANDUM

DATE: January 3, 2022

TO: Robert Kroepfl, Caltrans District 4

FROM: Kat Hughes, Senior Environmental Planner

SUBJECT: Technical Memo: Community Impact Analysis (CIA) Memorandum
South Main Street over Las Trampas Creek Bridge (Bridge No. 28C0075)
Replacement - Federal Project No.: BRLS-5225 (026)

INTRODUCTION

The City of Walnut Creek is proposing to remove a structurally deficient bridge that will be replaced by a new bridge on a realigned and widened roadway along South Main Street. The City acquired funding through the Highway Bridge Program (HBP); therefore, the California Department of Transportation (Caltrans), on behalf of the Federal Highway Administration (FHWA), is acting as the NEPA lead agency as federal funds are involved.

This memorandum is intended to evaluate community impacts associated with the demolition of the existing bridge along South Main Street (this action is referred to as the "proposed Project" throughout the remainder of this memorandum). The proposed Project is located in downtown Walnut Creek on South Main Street between Botelho Drive to the north and Broadway Plaza to the south and Newell Avenue approximately 400-ft further south, at Latitude 37.894754 degrees and Longitude -122.059153 degrees. Figure 1: Regional Location and Figure 2: Project Vicinity, as attached, shows the location of the Project site on a regional and local basis, respectively. As discussed below, potential impacts resulting from implementation of the proposed project would occur during the construction period. There would be no adverse operation-period impacts.

PROJECT DESCRIPTION

Existing Conditions

South Main Street is a five-lane arterial road that runs from Mt. Diablo Boulevard (where it turns into N. Main Street) to I-680 in the City of Walnut Creek in Contra Costa County. There is currently a five-lane bridge being used to cross over Las Trampas Creek. The bridge has been determined to be Structurally Deficient due to multiple cracks and spalls with exposed rebar in the soffit and Functionally Obsolete due to inadequate clear width for current and future Average Daily Traffic (ADT). The purpose of this project is to replace the structurally deficient bridge and realign and widen the existing roadway to allow adequate capacity for current and future ADT.

The City of Walnut Creek is proposing to replace the five-span reinforced concrete "T"-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek. The bridge is located on South Main Street approximately 0.1 miles south of Olympic Boulevard.

The project site is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Broadway Plaza and is ½ block north of the Kaiser Permanente Hospital. The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants and the new Agora at South Main apartments and retail space. Access driveways to these features are located on all four corners of the bridge. Numerous utilities are mounted on both sides, underneath the bridge, and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

South Main Street provides a north-south connection through the City with a curved alignment and generally flat roadway profile grade. Adjacent intersections at Botelho Drive and Broadway Plaza are signal controlled.

The existing bridge is a reinforced concrete "T"-beam bridge built in 1919. In 1950, the bridge was widened on the south side with a reinforced concrete "T"-beam superstructure and in 1956; the bridge was widened on the south side again with a reinforced concrete slab superstructure. The existing structure is approximately 131'± long on bent style abutments.

The existing bridge section is approximately 74.5 feet to 81 feet wide including sidewalks, and does not provide shoulders on either side. The existing north approach roadway clear width is approximately 62.7 feet wide, which includes five traffic lanes and a 4.2 foot raised median. The south approach roadway is approximately 69.9 feet wide, which includes five 12-foot traffic lanes, and 6-foot wide raised median. The difference between the two approaches is the parking lane on the south approach. The cross-slope varies from approximately 3 percent at the Botelho Drive intersection to 5 percent at the Broadway Plaza intersection.

Proposed Project

The existing bridge would be replaced with a new 2-span precast-prestressed voided concrete slab bridge in a single stage by closing South Main Street. The proposed bridge would be 104 feet long and 102.5 feet wide including barriers, two 10-foot sidewalks in compliance with Walnut Creek Pedestrian Master Plan design guidelines for the Core Area Zone, and one 4-foot-wide median. The bridge would convey vehicular traffic on four 12-foot through lanes and a varying width left turn lane, in compliance with American Association of State Highway and Transportation Officials guidelines and Contra Costa County standards.

The proposed roadway approaches are planned to be slightly realigned from their existing condition between the intersections at of Botelho Drive and Broadway Plaza. Under the HBP guidelines, local agencies are reimbursed for up to 200 feet of approach roadway on each side of the bridge (for on system bridges) unless longer approaches can be justified to provide the minimum horizontal and vertical conforms. Roadway approaches are anticipated to be less than 200 feet long on either side of the proposed bridge. The roadway edges would conform to the existing sidewalks and driveways with as minimal an impact as possible.

The proposed clear roadway width at the proposed bridge will be approximately 100 feet. This will provide for two 12-foot traffic lanes in each direction, two 8-foot shoulders, a 4-foot raised median and 10-foot wide sidewalks on each side of the bridge and accommodate the left turn pockets approaching the intersections of Botelho Drive and Broadway Plaza.

Traffic Management

The South Main Street over Las Trampas Creek bridge would be closed for the duration of construction activities. Vehicles, pedestrians, bicyclists, and public transit could use parallel roads such as South California Boulevard, Broadway Plaza or South Broadway to detour around the project site. Additionally, traffic measures from the Traffic Impact Assessment and Traffic Management Plan will be implemented to minimize impacts to the community during the closure.

Right-of-Way and Construction Staging Areas

County assessor maps do not show any in-fee right-of-way for the road. It is assumed the road is on a prescriptive easement which would include the maintained width of the road. It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements will be minimized by maintaining the existing roadway alignment. Some right-of-way acquisition may be required to accommodate the realignment of the existing roads and associated impacts.

Potential staging areas are the parking lots directly adjacent to the project site (see Figure 3). These lots include the Ross shopping center parking lot which has direct access onto Main Street and the Chase Bank parking lot. These lots may potentially provide a few parking spaces for equipment storage/ job trailers.

Utilities

Utilities at the project site include underground electrical, telephone, cable and water. Several conduits including 15 four-inch AT&T ducts are mounted on the downstream side of the bridge. Additional conduits including a 4-inch PG&E ducts are mounted on the upstream side of the bridge. These side-mounted conduits will likely be relocated to the sidewalks of the proposed bridge. The as-built plans also show a 12-inch-diameter water line that runs roughly down the centerline of the bridge and is mounted on the columns below the bridge. Several utility manholes and vaults occupy the areas on both sides of the bridge. Adjacent fire sprinklers valves are located at the northwest corner of the bridge. Other infrastructures at the site that may be impacted by the project include City street lighting, fire hydrants, and privately owned landscape and irrigation systems. The northbound travel lanes also have traffic signal detector loops for the adjacent intersection at Botelho Drive and Broadway Plaza.

Construction of the bridge will involve excavation for and construction of concrete abutments and piers. Large Diameter cast-in-drilled-hole (CIDH) CIDH concrete piles will likely be used to minimize vibration impact to adjacent structures and utilities. Construction of the roadway approaches will involve the removal of existing pavement, retaining walls and fences and the placement of fill material, aggregate base, hot mix asphalt pavement, soldier pile and concrete retaining walls, and new guardrails. Vegetation removal along the slopes adjacent to the bridge will be necessary, including removal of fourteen trees, consisting of 1 London plane, 2 valley oaks, 3 coast live oaks, 1 arroyo willow, 1 red willow, 3 coast redwoods, 2 black walnuts, and 1 evergreen oak.

Proposed Structure

Las Trampas Creek is a concrete lined channel with a double barrel concrete box culvert located approximately 30 feet downstream of the bridge with a drop structure and energy dissipaters upstream. The creek drains a watershed of approximately 27.2 square miles at the South Main Street bridge crossing. Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) includes detailed flood information for Las Trampas Creek. It has peak discharges for the creek at the nearest location to the project site at the confluence of San Ramon Creek and Las Trampas Creek, which is approximately 1,485 feet downstream of the project site. According to FEMA, the 100-Year Storm peak discharges are 9,000 cubic feet per second and the 50-Year Storm peak discharges are 8,090 cubic feet per second. Based on FEMA's information for the creek, the 100-year flood elevation at the existing bridge is 146.4 feet (NAVD 88) which means the channel flows completely full at the bridge and downstream culvert with no available freeboard.

The Caltrans criteria for the hydraulic design of bridges is that they be designed to pass the 2 percent probability of annual exceedance flow (50-year design discharge) or the flood of record, whichever is greater, with adequate freeboard to pass anticipated drift. Two feet of freeboard is commonly used in bridge designs. The bridge should also be designed to pass the 1 percent probability of annual exceedance flow (100-year design discharge, or base flood). No freeboard is added to the base flood.

Contra Costa County Flood Control and Water Conservation District require bridges to be designed to pass the 100-year water surface elevation or the 50-year water surface elevation plus freeboard. Usually 1-foot freeboard is required under bridges to allow for floating debris. However, if a chance of floating debris from upstream exists, additional freeboard may be required.

STUDY AREA DEFINITION

For purposes of analysis in this CIA Memorandum, a Study Area has been identified that includes an area of adequate size to address commercial and residential conditions in the vicinity of the proposed Project. In order to consistently evaluate the proposed Project, the Study Area is limited to the area where direct and indirect adverse effects may occur. The proposed Project site, adjacent land parcels, and potential staging areas are included in the Study Area. The parcels that are included in the Project Study Area are: APN 183-011-001 (0.3 acre); APN 183-011-019 (0.4 acre); APN 183-011-024 (2.55 acres); APN 183-020-007 (0.28 acre); APN 183-020-009 (0.07 acre); APN 183-020-018 (2.03 acres); APN 183-020-024 (2.98 acres); APN 183-093-023 (0.13 acre); APN 183-093-031 (0.28 acre); APN 183-040-003 (1.3 of 24.22 acres); APN 184-440-004 (0.17 acre); APN 184-440-022 (2.38 acres); APN 184-440-023 (0.57 acre); APN 184-070-011 (2.99 acres); APN 184-070-013 (0.38

acre); APN 184-070-016 (0.5 acre); APN 184-070-017 (1.3 acres); APN 184-070-023 (2.52 acres); APN 184-070-024 (2.14 acres); APN 184-070-027 (1.94 acres); APN 184-080-015 (0.75 of 1.2 acre); APN 184-080-018 (0.27 acre); and APN 184-080-020 (0.27 acre). Figure 3: CIA Study Area, as attached, shows the extent of the CIA Study Area.

ENVIRONMENTAL SETTING/AFFECTED ENVIRONMENT

Public Outreach/Public Input

The City of Walnut Creek will provide public outreach as well as opportunities for public input as appropriate throughout the project, including posting information about the project and contact details on the City's website, http://www.walnut-creek.org/departments/public-works. The City will present the proposed Project to the City Transportation Commission, where comments from the public will be heard.

Land Use Designations/Zoning Designations

The Project Study Area contains the proposed Project site as well as nineteen (19) adjacent parcels that could potentially be indirectly or directly affected due to Project implementation. According to the City of Walnut Creek General Plan 2025 Land Use Map (2017), land use designations in the Study Area include Mixed-Use Commercial (density varies) and Pedestrian Retail. South Main Street is identified as a Major Road (see Figure 4: Land Use in the Project Area).

Temporary Construction Staging Areas

The CIA Study Area includes parcels potentially affected by the contractor staging areas. These parcels include the Ross shopping center parking lot (Lot 1) which has direct access onto South Main Street, and the Chase Bank parking lot (Lot 2), the Newell Promenade parking lot (Lot 3), the Trader Joe's parking lot (Lot 4), a vacant commercial lot on South California Boulevard (Lot 5), the Kaiser Hospital parking lot (Lot 6), and the Las Lomas High School student parking lot (Lot 7). These other lots may potentially provide a few parking spaces for equipment storage/job trailers. These parking lots are primarily associated with shopping centers and businesses in the area.

Parcel Access

Access to the parcels in the Study Area occurs via South California Boulevard, Botelho Drive, Locust Street, South Main Street, Newell Avenue, Broadway Plaza, Olympic Boulevard, and Capwell Lane.

The closure of South Main Street between Botelho Drive and Broadway Plaza would affect four driveways. Throughout construction, access to the Walnut Creek Parking Garage will not be restricted but vehicles exiting the parking garage will lose the ability to turn left onto South Main Street.

The driveway to Gott's Roadside parking lot from South Main Street will be closed to the public. Access for delivery, garbage or other maintenance vehicles could be arranged with the contractor, with prior notice. This driveway also acts as an access point for the Ross department store parking lot. Access to the parking would still be possible through Botelho Drive.

The uncontrolled intersection between Broadway Lane and South Main Street will be closed for the duration of construction. Vehicles could still access the businesses and parking lots using the Broadway Lane and Broadway Plaza intersection.

Access to the parking lot at the intersection of Broadway Plaza and South Main Street serving Agora would not be restricted but drivers will lose the ability to turn left onto South Main Street.

ENVIRONMENTAL CONSEQUENCES AND PROJECT IMPACTS

Land Use and Zoning Changes

Implementation of the proposed Project would replace the existing bridge along South Main Street. The Project would not require land use or zoning changes on surrounding parcels. Adverse effects would not occur to land use and zoning designations with implementation of the proposed Project.

South Main Street is functionally classified as a major collector per the California Road System (CRS) Maps and is considered part of the Federal Aid Highway System. Based on the available data, the ADT for South Main Street is between 9,000 and 18,498 vehicles per day.[1] In the 2016 Walnut Creek Pedestrian Master Plan, this section of South Main Street forms the edge of the Pedestrian Retail District and falls within the Core Area Zone.

Partial Right of Way Acquisition

According to Caltrans right of way maps and other recorded maps within the project area, there is an existing right of way which encompasses the bridge as well as South Main Street to the North and South of the existing bridge. It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements will be minimized by maintaining the existing roadway alignment. Some right-of-way acquisition may be required to accommodate the realignment of the existing roads and associated impacts.

Parcel Access

Implementation of the proposed Project is anticipated to require temporary construction staging areas. Potential sites have been identified, and include parking lots adjacent to the project site. These lots include the Ross shopping center parking lot which has direct access onto South Main Street, the Chase Bank parking lot, the Newell Promenade parking lot, the Trader Joe's parking lot, a vacant commercial lot on South California Boulevard, the Kaiser Hospital parking lot, and the Las Lomas High School student parking lot. These lots may potentially provide a few parking spaces for equipment storage/ job trailers.

Though the staging areas for construction of the proposed project could limit or block access to parking in the lots adjacent to the project site, pedestrian access would be maintained in order to

---

[1] Fehr & Peers. 2018. *Focused Transportation Impact Assessment for the Las Trampas Creek Bridge Replacement Project in Walnut Creek, California*. March 15, 2018. Caltrans. 2017. *South Main Street over Las Trampas Bridge Inspection Report*.

allow restaurants and other businesses to operate uninterrupted. There are additional parking lots and structures as well as street parking in the immediate project vicinity, so residents, business and restaurant customers, and business and restaurant employees would continue to have access. While a temporary reduction in parking in the area could adversely affect users and businesses in the area, development and implementation of the Traffic Management Plan would communicate any closures and alternate parking areas to area users and businesses and would therefore minimize effects.

Throughout construction, closure of South Main Street between Botelho Drive and Broadway Plaza would affect access to the Walnut Creek Parking Garage entry, Gott's Roadside entry driveway, the Broadway Lane entry driveway, and the Agora apartments parking entry. Access to the Walnut Creek Parking Garage and the Agora parking lot would not be restricted; however, drivers would lose the ability to turn left out of either driveway onto South Main Street. Broadway Lane and Gott's Roadside entry driveways will both be closed to the public, but access to the businesses and restaurants would still be available for employees and customers.

Closure of South Main Street during construction would also require pedestrian, bicycle, transit, and vehicle detours for the duration of construction activities. Travelers could use parallel roads such as South California Boulevard, Broadway Plaza or South Broadway to detour around the project site.

Construction will require one season to build. The season is anticipated to begin in February and end in late November or early December. During construction, traffic lanes along South Main Street north of Botelho Drive and south of Broadway Plaza would be reconfigured to align with the detour around South Main Street over the bridge.

With implementation of the following avoidance and minimization measures, adverse effects due to temporary reductions in parking and parcel access would not occur during project construction or operation.

AVOIDANCE AND MINIMIZATION MEASURES

The following minimization measures are suggested to reduce potential adverse effects associated with proposed Project implementation:

- To minimize potential land use impacts and as part of the scope and design of the proposed Project, all private lands temporarily utilized for construction staging and access shall be restored to their pre-construction conditions to accommodate their current uses.

- A Traffic Management Plan shall be developed and implemented to minimize and avoid adverse effects to parcel access and area parking.

- Notification to nearby parcel owners shall be utilized to convey Project information such as construction schedule and temporary parking and traffic impacts.

ATTACHMENTS

LEGEND

☆ Project Location

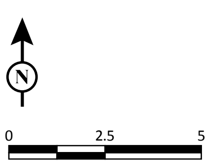

FIGURE 1

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Regional Location

SOURCE: ESRI World Street Map (2017)

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LEGEND

Project Area

USGS 7.5' Quad Boundaries

N

0 1000 2000
FEET

FIGURE 2

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Project Vicinity

SOURCE: USGS 7.5-minute topographic quadrangle Walnut Creek, Calif. (1993, ed. 1997)

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FIGURE 3

LEGEND

- CIA Study Area (30.59 ac)
- Area of Potential Effects (9.23 ac)
- Potential Staging Area
- Parcel

0 100 200
FEET

Las Trampas Creek Bridge at
South Main Street Replacement Project
Contra Costa County, California; Caltrans District 4
Federal Project No. BRLA - 5225 (026)

CIA Study Area

SOURCE: Metro Maxar Aerial Imagery (11/2019); Mapping - LSA (01/2022)

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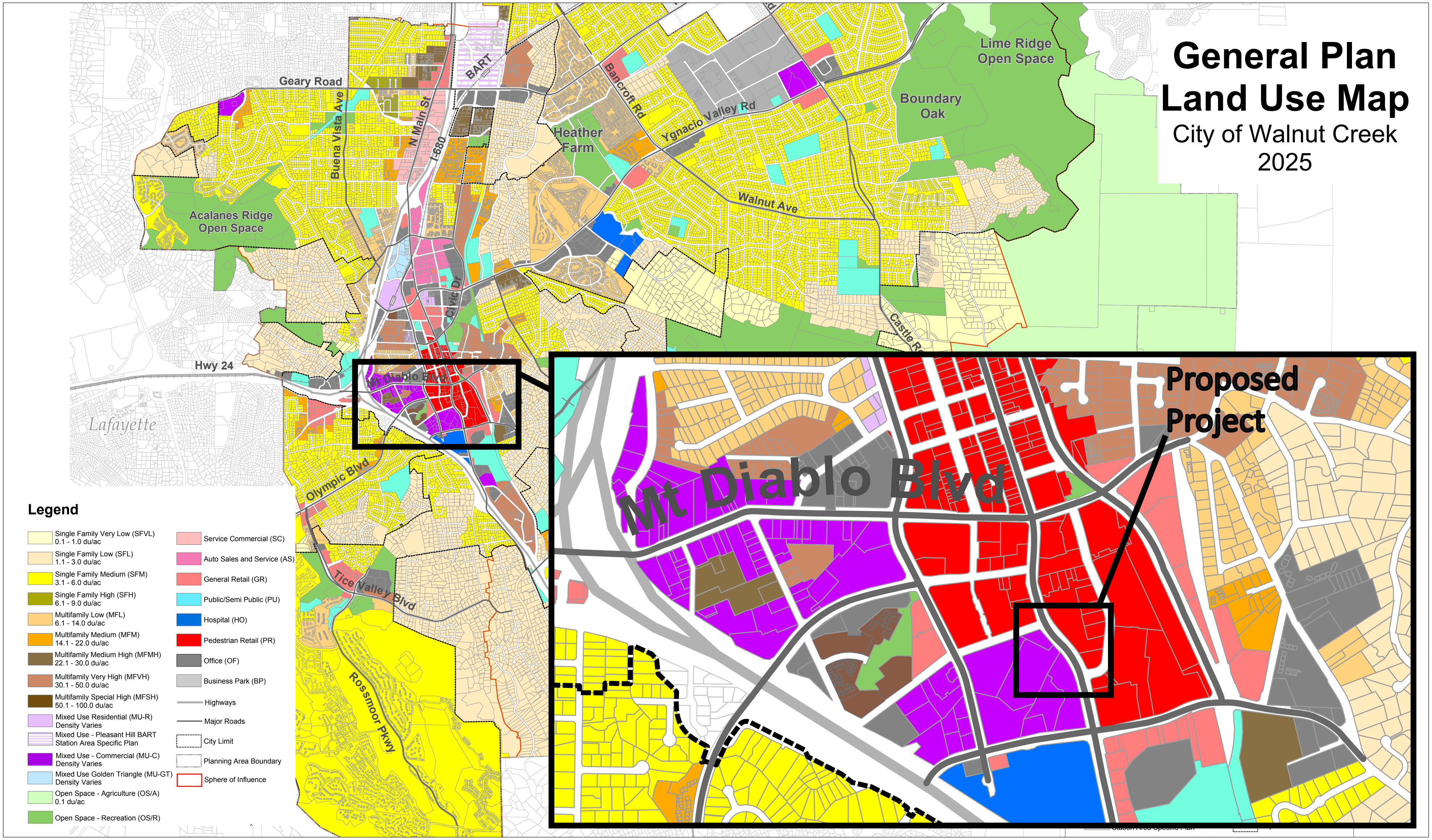

FIGURE 4

Las Trampas Creek Bridge at
South Main Street Bridge Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA-5225 (026)

Land Use in the Project Area

SOURCE: LSA (2017), City of Walnut Creek (2017).

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APPENDIX E

PRELIMINARY FOUNDATION REPORT

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PRELIMINARY FOUNDATION REPORT
LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
CITY OF WALNUT CREEK, CALIFORNIA
FEDERAL PROJECT #BRLS5225(026)

Prepared for:

QUINCY ENGINEERING

2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597
Tel. (925) 989-7100

Prepared by:

WRECO

7807 Laguna Blvd., Suite 400
Elk Grove, CA 95758
Tel. (916) 513-7428

WRECO Project No. P17043
July 2019

PRELIMINARY FOUNDATION REPORT
LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
CITY OF WALNUT CREEK, CALIFORNIA
FEDERAL PROJECT #BRLS5225(026)

CITY OF WALNUT CREEK

Prepared for:

QUINCY ENGINEERING

2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597
Tel. (925) 989-7100

Prepared by:

WRECO

7807 Laguna Blvd., Suite 400
Elk Grove, CA 95758
Tel. (916) 513-7428

WRECO Project No. P17043
July 2019

WRECO

July 26, 2019

Quincy Engineering, Inc.
2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597
Tel. (925) 989-7100

Attention: Robert Ferguson, PE
Project Manager

Subject: Preliminary Foundation Report
Las Trampas Creek Bridge on South Main Street
City of Walnut Creek, California
Federal Project No. BRLS5225(026)
WRECO Project No. 17043

WRECO is pleased to submit our Preliminary Foundation Report for the Las Trampas Creek Bridge on South Main Street Project. This report was conducted and prepared in general conformance with the scope of work prepared by WRECO for the subject project.

We would like to thank Quincy Engineering and the City of Walnut Creek for the opportunity to prepare this Preliminary Foundation Report.

If you have any questions or wish to discuss this report in greater detail, please contact us at (916) 513-7428.

Sincerely,
WRECO

REGISTERED PROFESSIONAL ENGINEER DAVID A. KITZMANN C 81410 CIVIL STATE OF CALIFORNIA

Franklin Taber

REGISTERED PROFESSIONAL ENGINEER FRANKLIN P. TABER No. 816 GEOTECHNICAL STATE OF CALIFORNIA

David Kitzmann, PE, CEG
Senior Engineering Geologist

Franklin Taber PE, GE
Senior Geotechnical Engineer

Distribution: Addressee, P17043-file

PROFESSIONAL GEOLOGIST DAVID A. KITZMANN NO. 2412 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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PRELIMINARY FOUNDATION REPORT
LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
CITY OF WALNUT CREEK, CALIFORNIA

1 INTRODUCTION

The purpose of the Las Trampas Creek Bridge on South Main Street Project (Project) is to replace the existing five-lane Structurally Deficient and Functionally Obsolete bridge (Caltrans BIRIS, 2015) with a new five-lane bridge structure. This Project is funded by the Federal Highway Bridge Program (HBP) and the City of Walnut Creek (City).

1.1 Scope of Work

WRECO's Scope of Work for the proposed Project consisted of the following:

- Performed a literature search for readily available published geologic and geohazard information at and in the near vicinity of the Project site.
- Obtained copies of readily available previous studies performed at or in the near vicinity of the Project site.
- Obtained available copies of California Department of Transportation (Caltrans 28C0075) Bridge Inspection Reports.
- Visited the site and marked out in white paint the proposed boring locations and called USA North Dig Alert a minimum of 72 hours prior to the start of the field investigation work to identify potential underground utility conflicts.
- Paid all fees and obtained a well construction/destruction (boring) permits from the Contra Costa County Department of Environmental Health to perform borings at the Project site.
- Obtained an encroachment permit to perform work within the City's right-of-way (at no cost).
- Prepared a Preliminary Foundation Report in general accordance with the Caltrans *Foundation Reports for Bridges, February 2018*.

This report includes a general project description, a project summary and description of the proposed improvements, a description of the geotechnical work performed, and the Log of Test Borings (LOTB). This report also provides the following information:

- Regional and local site geology discussion and a description of the subsurface soil and groundwater conditions as noted by WRECO.
- Preliminary geologic profile and engineering soil parameters for the design of the proposed bridge foundations.
- A preliminary seismic study providing the peak ground acceleration (PGA) and the design response spectrum (ARS Curve) data.
- A preliminary corrosion evaluation to determine the potential corrosivity of the site soils with respect to buried concrete and steel associated with the construction of the proposed foundation selection.
- A summary and discussion of the available as-built information as it pertains to the proposed foundation selection.

- A discussion of the preliminary foundation recommendations for the proposed bridges taking into account the preliminary loading demands, site soil conditions, environmental constraints, scour, and cost.
- Other recommendations with regard to construction considerations.

2 PROJECT DESCRIPTION

2.1 Project Location

The City is proposing to replace the five-span reinforced concrete "T"-beam/slab bridge structure (Existing Bridge No. 28C0075) over Las Trampas Creek on South Main Street. The Project site is located in the South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is ½-block north of the Kaiser Permanente Hospital.

The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants, and the new Agora at South Main apartments and retail space. Driveway access to these features are located on all four corners of the bridge. Numerous utilities are mounted on both sides and underneath the bridge and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

Las Trampas Creek is a concrete-lined channel with a double-barrel concrete box culvert located approximately 30 feet (ft) downstream of the downstream face of the existing bridge. There is a drop structure approximately 80 ft upstream of the existing bridge upstream face, and 10 energy dissipaters (concrete baffles) approximately 50 ft upstream of the existing bridge face. There are concrete-filled sand bags covering the slopes on both sides of the channel upstream of the existing bridge.

The Project can be seen in relation to the surrounding natural and manmade features on Figure 1, Vicinity Map, which is included in Appendix I of this report.

2.2 Existing and Proposed Bridges

The existing bridge is five-span and approximately 131-ft-long with a total width of approximately 73 feet (Caltrans, 2015). The original bridge was built in 1919 and consists of a five-span (Bents 2 and 4 are continuous) reinforced concrete "T" girder (4) with a reinforced concrete deck. Bents 3 and 4 are reinforced concrete three-column bents with reinforced concrete infill walls on individual reinforced concrete pile caps founded on timber piles. Bents 2 and 5 are reinforced concrete pier walls on three buried reinforced concrete columns on individual reinforced concrete pile caps founded on timber piles. The abutments are bent style footings founded on spread footings and both end spans are enclosed.

The first left side widening occurred in 1950. The left side was constructed to match the original bridge built in 1919. Each bent was constructed on single-column bents on reinforced concrete pile caps founded on timber piles.

The second left-side widening occurred in 1956. Five-span reinforced concrete slab on reinforced concrete three-column bents were constructed. This widening was founded on reinforced concrete piles with infill walls at Bents 2 and 5.

Based on the Advanced Planning Study for Bridge Alternative 2A and 2B provided by Quincy Engineering (QEI) dated November 7, 2017, two replacement bridge alternatives are being studied. All alternatives are 103 ft, 6 inches wide and will accommodate five 12-ft travel lanes, two 8-ft shoulders, two 10-ft sidewalks, a 4-ft wide raised concrete median, and two concrete barrier rails on either side of the bridge deck. The proposed bridge will be raised to accommodate hydraulic clearance and increased bridge depth with a minimum soffit elev. 145.6. All four alternatives are roughly centered on the existing alignment.

The preferred alternative is a two 104-ft length cast-in-place (CIP) post tension (PT) concrete slab or voided slab PC/PS spans. The proposed abutments are located just within the limits and partially overlap the existing Abutment 1 and Abutment 6. A central multi-column bent is shown between the existing Pier 3 and Pier 4.

All elevations referenced within this report are based on the North American Datum of 1983 (NAD 83) for horizontal reference with vertical reference to North American Vertical Datum 1988 (NAVD 88) and GEOID 99 model of the United States unless otherwise noted.

3 EXCEPTIONS TO POLICY AND PROCEDURES

No exceptions to policy were taken in preparation of this Preliminary Foundation Report.

4 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

For this study, WRECO prepared and executed a subsurface exploration program for the proposed bridge to better characterize the subsurface soil and groundwater conditions. For the subsurface characterization, WRECO oversaw drilling and sampling of three exploratory borings of August-September 2017 and three additional exploratory borings / cone penetration tests in October-November 2018. The borings were completed by Geo-Ex Subsurface Exploration under the supervision of WRECO geologists.

Borings R-17-001 and A-17-001 A, B, C were advanced on August 2, 2017 using a CME-75 truck mounted drill rig. Boring A-17-001 was attempted three times using a 6-inch diameter hand auger to clear potential utility conflicts but terminated at 3-ft in depth at each location due to an unknown buried obstruction. This boring was abandoned due to the unknown obstruction and drilling was rescheduled to allow boring in the southbound lanes further from the obstruction. Boring R-17-003 was completed on September 5, 2017, also using a CME-75 truck mounted drill rig.

In boring R-17-001, 4-inch diameter continuous flight augers were used to advance the boring until groundwater was encountered, then drilling (elev. 123) continued to a total depth of 80.1 ft (elev. 69.3) using mud rotary drilling methods.

In boring R-17-003, 4-inch continuous flight augers were used to advance the boring until groundwater was encountered (elev. 118), then mud rotary drilling was used to advance the boring to the rock surface (elev. 81.6). Rock core was then recovered using 2.5-inch inside diameter (ID) HQ-wireline diamond coring equipment to a total depth of 86.8 ft (elev. 62.8).

Boring R-18-001 was advanced through the bridge deck into the channel near existing Bent 4. This boring encountered the bridge deck consisting of 9” concrete, then was extended approximately 25ft to the channel liner. The channel liner was cored and 6-inch diameter casing was advanced to approximately 9 ft below the channel to create a seal. The boring was completed through the casing using 6 inch diameter mud rotary to bottom of boring.

In each boring, bulk soil samples were collected from the near surface and soil samples at depth were collected from the borings at selected intervals. Soil sampling was performed using split barrel drive samplers which were advanced using a 140-pound auto-trip hammer, free falling 30-inches, in general conformance with the Standard Penetration Test (ASTM D1586). Soil samples were collected from the 1.375-inch ID split spoon sampler driven without liners and a 2.5-inch ID split barrel/Modified California sampler fitted with three, 6-inch brass or stainless-steel sleeve liners.

Sampler penetration resistance was recorded to provide a field measure of soil consistency and can be correlated to soil strength and bearing characteristics. The field blow counts were recorded as the number of hammer blows required to drive the sampler the final 12-inches of an 18-inch drive. For samples that meet refusal (more than 50 blows per 6 inches of drive) the number of blows and the distance advanced were recorded. The uncorrected field blow counts and sampling methods by depth are shown on the Log of Test Borings (LOTB) in Appendix II.

The borings were logged and the earth materials were classified by an on-site WRECO geologist as drilling progressed using the procedures in the *2010 Caltrans Soil and Rock Logging, Classification, and Presentation Manual*. Where diamond coring was used to advance the boring, the recovered cores were logged as to percent recovery, Rock Quality Designation (RQD), grain size, weathering, hardness, and fracture density. Selected portions of recovered soil and rock samples were retained in sealed containers for laboratory testing and reference.

The two CPT soundings were performed by Geo-Ex Subsurface Exploration on October 30, 2018. These CPT soundings were performed in accordance with American Standard and Testing Materials (ASTM) Test Method D5778 and were advanced (pushed) using a 30-ton CPT truck rig and a 15 cm^2 cone. The cone recorded the following parameters on a 5-centimeter (2.5-inch) depth sampling intervals:

- Cone Tip Resistance (qc)
- Sleeve Resistance (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Cone Penetration Speed

The above parameters were recorded and viewed in real time on a monitor inside the truck and stored on a flash drive for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. The corrected Cone Tip Resistances (qc) and Sleeve Resistances (fs) are presented on the LOTBs, which are included in Appendix II of this report.

The borings were backfilled with neat cement grout to near existing ground surface (±6 inches) and backfilled with quickset concrete dyed black. It is understood that these areas will be saw cut and replaced with hot mix asphalt patches in the future by the City.

Borings A-17-001A, B, C and R-17-001 were located in the field by project surveyors and included on topographic datum provided electronically to WRECO by Quincy Engineering. Boring R-17-003, CPT-18-001, CPT-18-002 and R-18-003 were located in the field with respect to existing site features and then referenced to project datum provided by Quincy Engineering. The details and locations of test borings are shown on the LOTB in Appendix II.

Table 1. Subsurface Investigation Summary

Boring ID	Completion Date	Drill Rig Type/ Hammer Type	Hammer Efficiency (%)	Approx. Surface Elevation (feet)	Boring Depth (feet)
R-17-001	8/2/2017	CME-75 Truck Rig/ Automatic	72	149.4	80.1
R-17-003	9/6/2017	CME-75 Truck Rig/ Automatic	72	149.6	86.8
A-17-001A	8/3/2017	CME-75 Truck Rig	--	149.1	3.0
A-17-001B	8/3/2017	CME-75 Truck Rig	--	149.0	3.0
A-17-001C	8/3/2017	CME-75 Truck Rig	--	149.2	3.0
CPT-18-001	10/30/2018	CPT	--	149.6	53.1
CPT-18-002	10/30/2018	CPT	--	150.8	53.8
R-18-003	11/1/2018	CME-55 Truck Rig	77.3	149.3	63.2

Notes:
1. -- indicates not applicable
2. Boring A-17-001 was attempted in three individual locations due to buried obstruction and is denoted by A-17-001A, B and C.
3. Borings R-17-001, A-17-001A, B and C elevations were surveyed in the field and provided to WRECO.
4. Boring R-17-003, R-18-001, CPT-18-002 and CPT-18-003 elevations were estimated from project datum.

5 LABORATORY TESTING PROGRAM

Laboratory soil testing for this study included the determination of grain size distribution, plasticity index, and corrosive potential (i.e. sulfate and chloride content, pH, and resistivity) of the samples collected from borings R-17-001, R-17-003 and R-18-003. A summary of the laboratory testing is shown in Table 2 and copies of the laboratory test results are included in Appendix III. Results of the corrosive potential to buried steel and concrete testing are discussed further in Section 9.

Table 2. Laboratory Test Summary

Boring ID	Sample Depth/Interval (feet)	Test	Test Standard
R-17-001	5.0 – 6.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	20.0 – 21.5	Atterberg Limits, Corrosive Potential	ASTM D4318, CTM 643, CTM 417, CTM 422
	25.0 – 26.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	45.0 – 46.5	Grain Size Distribution	ASTM D6913
R-17-003	11.5 – 13.0	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	20.0 – 21.5	Corrosive Potential	CTM 643, CTM 417, CTM 422
	30.0 – 31.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	60.0 – 61.5	Grain Size Distribution	ASTM D691
R-18-003	36.0-37.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	56.0-57.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	76.0-77.5	Grain Size Distribution, Atterberg Limits	ASTM D6913, D4318
	81.0-82.5	Corrosive Potential	CTM 643, CTM 417, CTM 422

Notes:
ASTM: American Society for Testing and Materials
CTM: California Test Method

6 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Regional Geology

The subject site is located within the Coast Ranges Geomorphic Province of California. This province extends along the majority of the California coast and is bounded by the Great Valley to the east, the Pacific Ocean to the west, the Transverse Range Mountains to the south and the Klamath Mountains border to the north. The Coast Ranges are northwest-trending mountain ranges and valleys subparallel to the San Andreas Fault System. The coastline is uplifted, terraced, and wave-cut. The Coast Ranges are composed chiefly of thick Mesozoic and Cenozoic sedimentary strata. The northern and southern ranges are separated by a depression containing the San Francisco Bay.

6.2 Site Geology

The Geologic Map of the Walnut Creek Quadrangle (Dibblee, 2005) depicts the Project site as underlain by Quaternary-aged alluvium (Qa) labeled as surficial sediments described as alluvial gravel, sand, and clay of valley areas. Nearby the Project site are surficial outcroppings of Miocene-aged Monterey Formation (Tms/Tmc). The Tms unit is described as sandstone, light gray to tan, medium grained, arkosic and the Tmc unit is described as clay shale/siltstone, gray, vaguely bedded, argillaceous to sandy, includes fine grained sandstone.

Topography at the site is generally flat. Based on the surficial geology, a syncline is located approximately a mile east of the site. A nonactive fault known as the Calaveras Fault is located half a mile west of the site.

The Project site can be seen in relation to the published geology on Figure 2, Geologic Map, which is included in Appendix I of this report.

6.3 Subsurface Conditions

The earth materials encountered in the borings are considered consistent with the published geologic mapping. In general, the earth materials can be separated into two units relavent to our proposed foundation recommendations. The following is a generalized summary of the soil/rock and groundwater conditions encountered in the borings at this site. Borings A-17-001 A, B, and C were terminated within the existing pavement section/roadway fill due to an unidentified concrete obstruction.

Table 3. Summary Earth Units

Boring	R-17-001	CPT-18-001	R-18-003	CPT-18-002	R-17-003
top hole elev.	149.4	149.6	149.3	150.8	149.6
	12" asphalt concrete	xx	9" Concrete/air/ elev. 121-4" concrete	xx	3" asphalt concrete/8" aggregate base
Unit 1	Sandy lean Clay, PP=0.5-1.0 tsf, medium stiff	Clay, Clay & Silt Clay, Su peak=1±tsf; stiff	Lean Clay with Sand, PP=0.5-1.0 tsf, medium stiff	Clay, Clay & Silty Clay, Silty Sand & Sandy Silt, Su peak=0.9±tsf, stiff	Sandy lean Clay, Clay with Sand, PP=1.0-1.5 tsf, stiff
elev.	111	112	103	114	93
Unit 2	Silty Sand/Sand with Silt, medium dense; elev. 90 dense	Silty Sand & Sandy Silt, Clay & Silty Clay, Clay, Su peak=2.3±tsf, hard	Sandy Silt, Silty Clay, Silty Sand, medium dense-dense	Clay, Clay & Silty Clay, Silty Sand & Sandy Silt, Sand & Silty Sand, Su peak=1.6±tsf, very stiff	Sand with Clay, medium dense
elev.	87	xx	76	xx	82
Unit 3 – Decomposed Sedimentary Rock	Sand with Silt, very dense	xx	Silty Sand, very dense	xx	Sedimentary Rock - Sandstone, Rec.=92%, RQD=14%
bottom elev.	69.3	95.8	63.0	97.7	62.8

Refer to the LOTB drawing in Appendix II, which provides more specific soil/rock descriptions and boring details.

6.4 Groundwater

Groundwater levels measured in the exploratory borings during subsurface exploration conducted between August and September 2017 are shown in Table 4. Due to restricted work hours, the borings were not left open to develop a static groundwater surface. Groundwater elevations are where groundwater was first encountered, except in Boring R-17-001 where a pause in the drilling allowed the partial stabilization of the groundwater surface in the borehole resulting in a 3-ft rise in measured elevation. Groundwater measurements in Boring R-18-001 were not possible due to the use of mud-rotary drilling techniques throughout.

Table 4. Groundwater

Boring ID	Date Measured	Groundwater		Notes
		Depth (Feet)	Elevation (Feet)	
R-17-001	08/02/2017	24.5	124.9	Measured during drilling.
		21.5	127.9	Measured 25 minutes after first encountered.
R-17-003	09/06/2017	18.0	131.6	Measured during drilling.

Groundwater levels nearby the Project site were reviewed on California's State Water Resources Control Board Geotracker online database. Groundwater monitoring has occurred at 1305 South Main Street, which is located immediately west of the existing south abutment. Groundwater monitoring last occurred in August 2012 at three groundwater wells on the property. Groundwater levels were measured at approximately 16 feet below ground surface.

Groundwater is expected to fluctuate due to changes in precipitation, irrigation, pumping in nearby wells, and other factors.

7 AS-BUILT FOUNDATION DATA

As-built plans of the 1950 and 1956 widening were available for WRECO's review. The As-built plans were prepared by California Department of Public Works Division of Highways (now Caltrans) and provided some foundation information. Table 5 presents a summary of the 1950 As-built data and Table 6 presents a summary of the 1956 As-built data. Note the elevation datum for the As-built plans differs from that being used for design resulting in elevations approximately 3 ft lower than that shown on current plans.

Table 5. Summary of 1950 As-built Data

Support Location	Foundation Type	Footing Pressure/ Design Load **	Bottom of Footing Elevation (ft)*		Pile Tip Elevation (ft)*	
			1950	NAVD 88	1950	NAVD 88
Abut 1	Spread Footing	2.5 tsf	Not Shown		--	
Bent 2	Timber Pile	20 ton	Not Shown		Not Shown	
Bent 3	Timber Pile	20 ton	116.9	119.9	99.0	102.0
Bent 4	Timber Pile	20 ton	116.5	119.5	96.9	99.9
Bent 5	Timber Pile	20 ton	119.2	122.2	103.5	106.5
Abut 6	Spread Footing	2.5 tsf	130.7	133.7	--	

-- indicates not applicable.
* Datum used is approximately 3 feet lower than current design datum.
**Allowable Strength Design method

Table 6. Summary of 1956 As-built Data

Support Location	Foundation Type	Footing Pressure/ Design Load	Bottom of Footing Elevation (ft)*		Estimated Pile Tip Elevation (ft)*	
			1956	NAVD 88	1956	NAVD 88
Abut 1	Spread Footing	Not shown	135.0 to 130.7	138.0 to 133.7	--	
Bent 2	Precast Concrete Pile**	Not shown	128.0	131.0	90.0	93.0
Bent 3	Precast Concrete Pile**	Not shown	115.0	118.0	90.0	93.0
Bent 4	Precast Concrete Pile**	Not shown	116.0	119.0	90.5	93.5
Bent 5	Precast Concrete Pile**	Not shown	133.0	136.0	103.0	106.0
Abut 6	Spread Footing	Not shown	130.0 to 130.7	133.0 to 133.7	--	

-- indicates not applicable.
* Datum used is approximately 3 feet lower than current design datum.
** ASD=30-35 ton?

The As-built plans show three column bents supported by four precast concrete piles at the inside column and three piles at each outside column for a total of ten piles at each bent location. Copies of the As-built plans are included in Appendix II.

8 SCOUR EVALUATION

The Las Trampas Creek channel is lined with reinforced concrete and no scour is expected.

9 CORROSION EVALUATION

The Caltrans *Corrosion Guidelines*, Version 3.0 dated March 2018, state the following definition of corrosive soils:

“For structural elements, the Department considers a site to be corrosive if one or more of the following conditions exists for the representative soil and/or water samples taken at the site:

- *Chloride concentration is 500 ppm or greater,*
- *Sulfate Concentration is 1500 ppm or greater,*
- *pH is 5.5 or less.”*

In addition to the conditions listed above, *The California Amendments to AASHTO LRFD BDS*, 6th Edition, Section 10.7.5 considers a site corrosive if the additional condition listed below exists for the representative soil and/or water samples taken at the site:

- Minimum resistivity of 1000 ohm-cm or less.

WRECO performed corrosive potential testing for this study on recovered representative soil samples and the results are presented in Table 7 below:

Table 7. Soil Corrosion Test Summary

Boring ID	Depth (feet)	Elevation (feet)	Minimum Resistivity (ohm-cm)	Soil pH	Chloride Content (ppm)	Sulfate Content (ppm)
R-17-001	20.0 – 21.5	129.4 – 127.9	1,100	7.03	4.2	7.7
R-17-003	20.0 – 21.5	129.6 – 128.1	430	7.32	12.5	488.7
R-18-003	80.0 – 81.5	78.0 – 76.5	1,290	7.90	14.5	92.9

Based on the results of the tested samples, the site soils are considered corrosive to buried metal and concrete as defined by Caltrans *Corrosion Guidelines*.

The following mitigation measures should be considered as prudent engineering practice. For concrete, the use of mineral admixtures (such as fly ash, silica fume, metakaolin, etc.), a reduced water content, and increased cementitious material content generally result in a high-density, durable concrete which is more resistant to corrosion. According to the California Amendments to the LRFD BDS – Sixth Edition, Table 5.12.3-1 Minimum Concrete cover (inches) for 75-year Design Life, the maximum water-to-cementitious material ratio shall not exceed 0.40 and a minimum of 3-inches clear cover shall be provided for all reinforcing bars where the concrete is cast against the surrounding soils.

We also recommend the use of a minimum of 675 pounds per cubic yard of cementitious material and Type II Modified or Type V cement with 25-percent mineral admixtures be used on all locations where the concrete is to remain in permanent contact with the surrounding soils. Using *Figure 855.3A, Minimum Thickness of Metal Pipe for 50 Years of Maintenance Free Service Life* from the Caltrans *Highway Design Manual* (2018), the minimum corrugated metal pipe thickness should be 8-gauge and constructed of galvanized steel. This minimum thickness is based upon corrosion assessment only and the pipe section should be checked structurally to determine the minimum thickness based upon the proposed loading requirements.

For additional guidance to help mitigate the corrosion of the reinforced concrete due to chlorides, sulfates, and acids, refer to Caltrans *Bridge Memo to Designer* 10-5.

10 PRELIMINARY SEISMIC RECOMMENDATIONS

10.1 Potential Seismic Hazards

The Project is located in a seismically active area of California. Potential geologic and potential seismic hazards for the site include seismic shaking (ground motion), subsidence, and seismically induced settlement.

10.2 Ground Surface Rupture

The AP mapping shows an active fault trace approximately 3.5 miles to the northeast of the Project site. The mapped fault trace runs roughly north-northwest to south-southeast. Active faulting has not been mapped as occurring across or immediately adjacent to the Project site. Surface rupture, due to faulting within the Project site, is not expected to occur unless some unknown fault was to rupture.

10.3 Ground Motion

A preliminary seismic study was performed to develop seismic design parameters for the proposed bridge design. Following the Caltrans Seismic Design Criteria (SDC) Version 2.0, (Caltrans, 2019), Memos to Designer (MTD) Section 20, and design tools outlined in the Caltrans *Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendation, November 2012*, a seismic analysis was performed for this structure to develop seismic design parameters and to identify potential seismic hazards such as liquefaction or lateral spreading.

Based on the available subsurface information and Standard Penetration Test correlations for determining shear wave velocity, the average shear wave velocity (V_{S30}) for the upper 100 feet of soil is estimated to be 240 meters/second (m/s).

The Design Response Spectrum was determined using the Caltrans ARS Online (Version 2.3.09) web tool. Based on Caltrans ARS Online, the nearest deterministic seismic sources are the Calaveras (No) 2011 Community Fault Model (CFM), Contra Costa Shear Zone (connector) 2011 CFM, and the Mount Diablo Thrust, which are described in Table 8 below.

Table 8. Fault Data

Fault Name	Calaveras (No) 2011 CFM	Contra Costa Shear Zone (connector) 2011 CFM	Mount Diablo Thrust
Fault Identification Number (FID)	130	117	129
Fault Rupture Distance from site (R_{RUP})	3.5 miles (5.6 kilometers)	2.8 miles (4.5 kilometers)	5.2 miles (8.4 kilometers)
Fault Rupture Direction from site	South	Northwest	Southeast
Maximum Moment Magnitude (M_{max})	6.9	6.5	6.6
Fault Type	Strike-Slip	Strike-Slip	Reverse
Dip Angle (degree)	90	90	38
Dip Direction	Vertical	Vertical	East

WRECO compared the deterministic response spectrum for the controlling seismic sources identified above to the Caltrans minimum deterministic spectrum that assumes a maximum moment magnitude 6.5, vertical strike-slip event occurring at 7.5 miles from the site. We then compared the deterministic results with the probabilistic response spectrum based on data from the 2008 United States Geological Survey (USGS) National Seismic Hazard Map for a 5% in 50-year probability of exceedance (975-year return period).

Caltrans structure design practice also requires an increase to spectra due to fault proximity (near-fault factor) or when the site is located over a deep sedimentary basin (basin factor). The near-fault adjustment factor is applied to locations with a site-to-rupture plane distance (R_{rup}) of 25 km (15.5

miles) or less to the causative fault. The near-fault factor increase applies to the site; the basin factor increase does not.

Based on the preliminary analysis above, the peak ground acceleration (PGA) at the site was determined to be 0.69g (g is the acceleration due to gravity) using the probabilistic response spectrum. A copy of the preliminary Seismic Design Data sheet and preliminary seismic analysis are included in Appendix IV.1.

10.4 Liquefaction Evaluation

Due to the seismically active nature of the proposed Project site, both liquefaction potential and dynamic settlement were evaluated for the proposed site's soils. Liquefaction is the process in which the seismic shear waves cause an increase in the pore water pressure in a cohesionless (sand and some non-cohesive silts) soil strata. This increase in pore water pressure reduces the effective stress confining the soil. The reduction in effective stress causes a reduction in the shear modulus of the soil, which in turn, results in increased soil deformation.

Also associated with liquefaction is a loss in bearing strength. In the case of full liquefaction, when the increase in pore water pressure reduces the confining stress to zero, the soil experiences a full loss of strength and undergoes large viscous deformations. Lateral spreading (large lateral deformation) is possible when liquefaction occurs in ground even with minimal slope.

Additionally, included with liquefaction analyses are settlement analyses. Cohesionless soils which are in a loose to medium-dense state when subjected to seismic shear waves compact in place, similar to being compacted with a vibratory roller. The energy of the seismic event reorganizes the grains to a denser state and subsequently causes a reduction in the overall volume resulting in settlement of the soils.

Primary factors that can trigger liquefaction are moderate to strong ground shaking, relatively clean and loose granular soils, and saturated soil conditions. Liquefaction is generally limited to the upper 50 feet of ground surface due to the increasing overburden pressure with depth. However, dynamic settlement is known to occur at any depth in loose sands, as loose sands tend to settle and densify during dynamic shaking.

A liquefaction evaluation was performed for the proposed structure using the subsurface soil and groundwater conditions discussed in Sections 6.3 and 6.4. As discussed previously, the Project site (Unit 1 and Unit 2) is generally underlain by medium stiff to hard clay and medium dense to dense sand, silty sand and sandy silt, very stiff-hard silty clay and clay overlying weathered sandstone. To simulate a seismic event occurring during this condition, the groundwater level in the evaluation was set to elev. 131.

According to Boulanger and Idriss (Liquefaction Susceptibility Criteria for Silts and Clays, 2006), "For practical purposes, fine-grained soils can confidently be expected to exhibit clay-like behavior if they have a PI $\geq$ 7." Laboratory test results performed for this study indicate the Plasticity Index (PI) of selected soils tested for this Project ranged from non-plastic to 28. For our liquefaction model, the clay layer encountered below the existing roadway section, was set to not liquefy.

The preliminary liquefaction evaluation was performed with the program borings Liquefy Pro (Version 5.9a) and CPT'S with CLiq (GeoLogismiki Version 1.7, 2007). The analysis accounted for a design seismic event with earthquake magnitude of 6.5 and PGA of 0.69g, as reported in Section 10.3.

Table 9. Seismic Vertical Settlements

Borings	Elevation			Vertical Settlements (inches)
R-17-001	124.4	to	110.4	2.0
CPT-18-001	112.1	to	111.1	0.7
	101.6	to	99.2	1.0
R-18-003	85.0	to	81.0	1.0
CPT-18-002	113.5	to	112.0	0.8
	102.9	to	101.5	0.7
R-17-003	94.4	to	89.1	1.2

The liquefaction results indicate approximately 1-2 inches of settlement of the ground, which may impose downdrag forces on the piles. This liquefaction appears constrained to thin, discontinuous, layers (lenses) or more sandy material. At CPT-18-001 the Liquefaction Potential Index (LPI) equals 3.12 and for CPT-18-002 LPI equals 2.95. LPI of 5 or less are considered to have a low liquefaction risk. Therefore, while there is a risk of liquefaction at the site the risk of liquefaction to affect this site are considered low. The results of the liquefaction evaluation are included in Appendix IV.2.

10.5 Seismic Slope Stability

No indications of slope instability were observed at the site during site reviews or during the subsurface investigation performed at the site.

The stability of the existing channel banks was investigated for dynamic (earthquake) conditions using the GeoStudios 2012 program published by Geoslope. A horizontal seismic coefficient of 0.2g was used for this analysis. For the purpose of the slope stability analysis, we have estimated shear strength loss ranging from 56% to 70% of the initial shear strength (Idriss & Boulanger, 2008). For the two sand layers susceptible to liquefaction a shear strength of 183 psf and 400 psf where selected for the upper and lower layer respectively. A factor of safety (FS) of 1.1 was calculated for the north bank. The south bank has nearly identical soil profile and cross-section and therefore, would have similar FS and was not modeled for this preliminary stage of design.

Caltrans screening criteria for embankment stability requires a FS greater than 1.1 at 0.20g horizon acceleration. Therefore, this site is not considered prone to seismic slope instability.

10.6 Lateral Spreading

Lateral spread, characterized by incremental flow-failure within sensitive soils on sloping ground or a free face, is capable of producing horizontal ground displacement during a seismic event. The lateral spreading potential was evaluated using the CLiq v.2.2.1.14 program distributed by

GeoLogismiki. The lateral displacement was calculated as approximately 34 inches at CPT-18-001 and 26 inches at CPT-18-002.

10.7 Other Seismic Hazards

The site has no known history of subsidence, rock falls/landslides, or embankment failures due to seismic activity and none were observed during our limited field observations and our review of available published seismic hazards for the Project area.

11 PRELIMINARY FOUNDATION RECOMMENDATIONS

11.1 Discussion and Conclusions

The geotechnical conditions that will require consideration for bridge design and support include the following:

- Presence of groundwater,
- Extensive soft to medium stiff cohesive soils (Unit 1 - PP=0.5-1.4 tsf and s_u=0.9-1 tsf),
- Potentially liquefiable soils as deep as approximate elev. 99 at Abutment 1, approximately elev. 81 feet at Pier 2, and approximate elev. 97 at Abutment 3,
- Downdrag potential at Abutment 1, Pier 2 and Abutment 3,
- Construction noise/vibrations for nearby residents and businesses,
- Numerous underground utilities and unidentified buried obstructions,
- Potential interference between old and new foundation elements, and
- Potential disturbance of bearing materials due to removal of existing bridge foundations.

Given the above, the preferred foundation type at each support location is 24-inch or greater diameter cast-in-drilled-hole (CIDH) concrete piles founded in the Unit 3 (weathered rock) layer encountered at the site. Special installation measures are expected to be required for construction below groundwater of CIDH piles that included the use of temporary (or permanent) casing, slurry drilling methods, and installation of inspection tubes for gamma-gamma and/or cross-hole sonic testing Protection of the channel liner during construction likely will require the use of permanent casing from 10-15 ft below the liner to the liner surface. .

Due to the extensive soft clay, potential liquefiable sand layers and the necessary pile lengths larger-diameter piles are likely to be required to ensure an adequate diameter-to-length ratio and to resist potential lateral loads. CIDH piles on the order of 4 feet diameter at the abutments and 6 feet in diameter at the pier is anticipated.

Alternatively, driven precast concrete or steel pipe (displacement type) piles are also considered feasible to achieve foundation support through significant end bearing within the very dense sand/weathered rock below elev 87.0 and elev 81.6 at Abutment 1 and Abutment 2, respectively. However, driven displacement piles would present vibration and noise concerns in the congested city center area and may not be desirable. Driven piling may require battering to provide sufficient lateral capacity, though battering generally should not be used where significant downdrag may occur.

Shallow foundations (spread footings) are not recommended due to the depth required to achieve suitably firm and secure bearing materials.

The following preliminary foundation recommendations were provided in accordance with the 2012 AASHTO LRFD BDS (6th Edition) with CA Amendments.

11.2 Deep Foundations

WRECO completed a preliminary capacity analysis for abutments 4-foot diameter CIDH piles and pier 6-foot diameter CIDH piles. The CIDH pile analysis was performed using the program SHAFT by Ensoft, Inc. Potentially liquefiable layers were taken into account during the pile capacity analysis. Following the latest Caltrans practice capacity due to end bearing for the CIDH piles was neglected due to the presence of groundwater.

The effects of downdrag will need to be accounted for during design. The poorly graded sand/silty sand soils above the weathered sedimentary rock have liquefiable potential which may result in loss of strength and settlement of overlying layers resulting in additional load being imparted on constructed piles. Several factors influence this potential load increase including subsurface conditions, height of embankments adjacent to abutments, and pile type.

The following Table 10 provides preliminary ultimate pile capacity and preliminary pile lengths. Preliminary tip elevations are the lowest elevation anticipated to be required to obtain the specified capacity. Pile type and tip elevations will require further analysis and these values should not be relied upon for final design.

Table 10. Preliminary Pile Data Table

Support	Pile Type	Preliminary Pile Cutoff Elevation	Preliminary LRFD Capacity (kips)	Preliminary Tip Elevation
			Strength	
			Compression (φ=0.7)	
Abutment 1	48" Dia. CIDH	132.0	740	75
Pier 2	72" Dia. CIDH	117.0	1100	61
Abutment 3	48" Dia. CIDH	138.5	740	69
Note: Preliminary Pile Cutoff Elevations estimated from Preliminary General Plans 11/7/2017.				

Copies of the preliminary pile capacity analyses are provided in Appendix IV.3. Lateral pile and pile settlement analyses will need to be evaluated as part of design, suitable input parameters for use with the lateral pile analysis software LPILE are provided in Appendix IV.4.

11.3 Approach Fill Settlement

At this time, fills of less than 5 feet height are anticipated above existing grade along the approaches. As this is a minor fill no appreciable settlement is expected and the vast majority of settlement to be completed during construction.

12 CONSTRUCTION CONSIDERATIONS

All excavation and backfill work shall be performed in accordance with Section 19, Earthwork, of the Caltrans *Standard Specifications* (2018 or latest edition).

12.1 Excavation and Shoring

Borings R-17-001, R-17-003 and R-18-003 were advanced to their completion depths through soil and rock without difficulty. However, an unidentified obstruction was identified approximately 3 feet below existing grade during three attempts (borings A-17-001A, A-17-001B, A-17-001C) to advance a boring near the existing east abutment. The obstruction appeared to be made of concrete. This obstruction should be identified prior to the start of excavation work for the replacement structure to determine the type and extent of the obstruction.

Existing site soils appear to be consistent with Cal OSHA Type C soil classification. The Contractor is responsible for design and construction of excavation sloping and shoring in accordance with Cal OSHA requirements. Open excavations above groundwater can be expected to require laying back to 1.5H:1V or flatter. Construction of the center support would require excavation below groundwater and would likely require cofferdam construction and a concrete seal course to control seepage and support the open excavation.

12.2 Groundwater

Excavation below groundwater would be expected to encounter extensive seepage. Any nuisance water encountered is anticipated to be controlled by pumping and diversion of surface water. CIDH pile excavation would be expected to require slurry drilling methods and temporary casing to control seepage. Construction of a center support is expected to require casing to control groundwater.

12.3 Deep Foundations

Based on the subsurface conditions encountered at the site, the borings identified layers of medium dense sands below groundwater surface which have a high probability of caving. For CIDH excavation, the use of temporary casing and/or slurry drilling methods may be required to prevent caving of the excavation and reduce the chance of soil intrusion and other anomalies in the CIDH pile concrete.

Pile driving and/or drilling appears feasible with conventional foundation construction equipment. The soil at the site were penetrated with auger and rotary drilling equipment without difficulty. The weathered rock was penetrated with difficulty with mud-rotary exploration drilling equipment. However isolated harder zones may exist with the weathered sedimentary rock unit which may require coring buckets, downhole hammers, or other methods to advance. Drilling likely will require casing, possibly full depth to top of rock, to control caving and seepage.

The condition of structures in the near vicinity of the proposed driving should be documented prior to the start of construction activities. Vibrations should be monitored during construction to allow halting of construction activities before damaging vibration levels are reached and to allow for remedial actions to be implemented.

Several of the alternatives have supports that partially overlap existing foundations. Advancing new piles through the existing piles and/or removing he existing piles is not advisable. Existing precast concrete piles would preclude driving or drilling of new piles if encountered. Removal of the existing piles would disturb the soils within the depth of embedment and negatively affect the capacity of new piles installed through the disturbed zone. For this reason, it is recommended to place new piles outside of the area occupied by the existing piles.

12.4 Existing Structures and Utilities

The proposed bridge replacement structure is to be located at approximately the same alignment as existing. There may be potential conflict between the existing abutment and pier support piles as well as the reinforced concrete channel lining. If possible, locate new bridge foundations clear of existing foundations (minimum 1 to 3 ft away) and leave existing foundation elements in place (cut off below ground surface) to minimize disturbance of bearing materials for new foundations. For the piers, the existing concrete lining should not be disturbed and the foundations cut off flush or above the bottom of channel.

Existing underground utilities within South Main Street and utilities attached to the existing bridge structure will be an impediment to construction equipment and may need to be temporarily relocated and/or de-energized during construction. An unidentified obstruction was encountered during the geotechnical investigation within the roadway which may be an abandoned utility or other structure.

13 LIMITATIONS

This Preliminary Foundation Report was performed in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made as to the conclusions and professional recommendations made in this preliminary report.

This Preliminary Foundation Report is intended for use with the Las Trampas Creek Bridge On South Main Street Project located in City of Walnut Creek, Contra Costa County, California, and any changes in the design or location of the proposed new improvements, however slight, should be brought to our attention so that we may determine how they may affect our conclusions and recommendations. The conclusions and recommendations contained in this report are based upon the data relating only to this specific project and locations discussed herein.

14 REFERENCES

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Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Walnut Creek quadrangle, Contra Costa County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-149, scale 1:24,000.

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15 REPORT COPY LIST

This Preliminary Foundation Report was prepared for Quincy Engineering Inc. for use in planning and design of the proposed Las Trampas Creek Bridge on South Main Street Project.

Appendix I. Site Maps

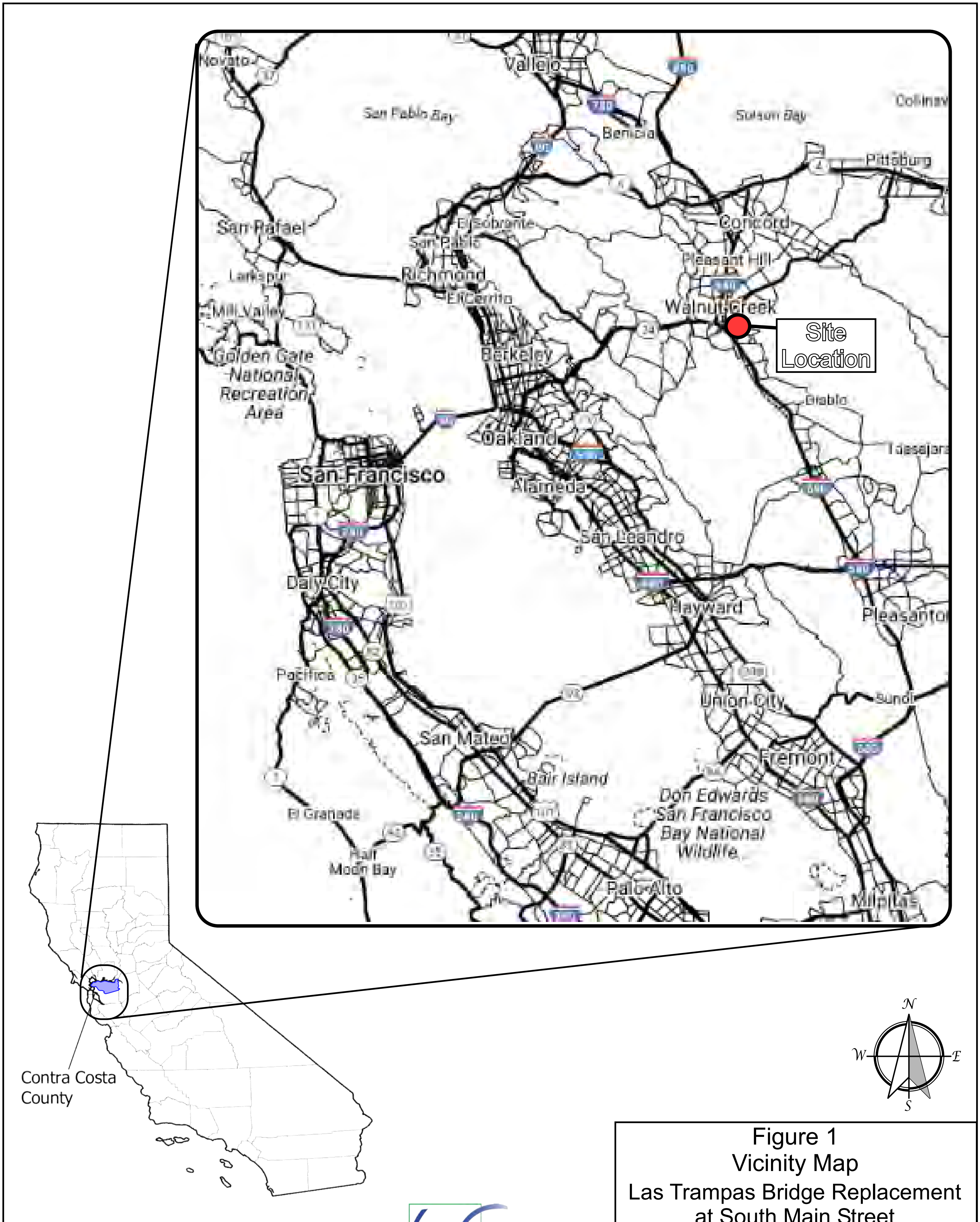
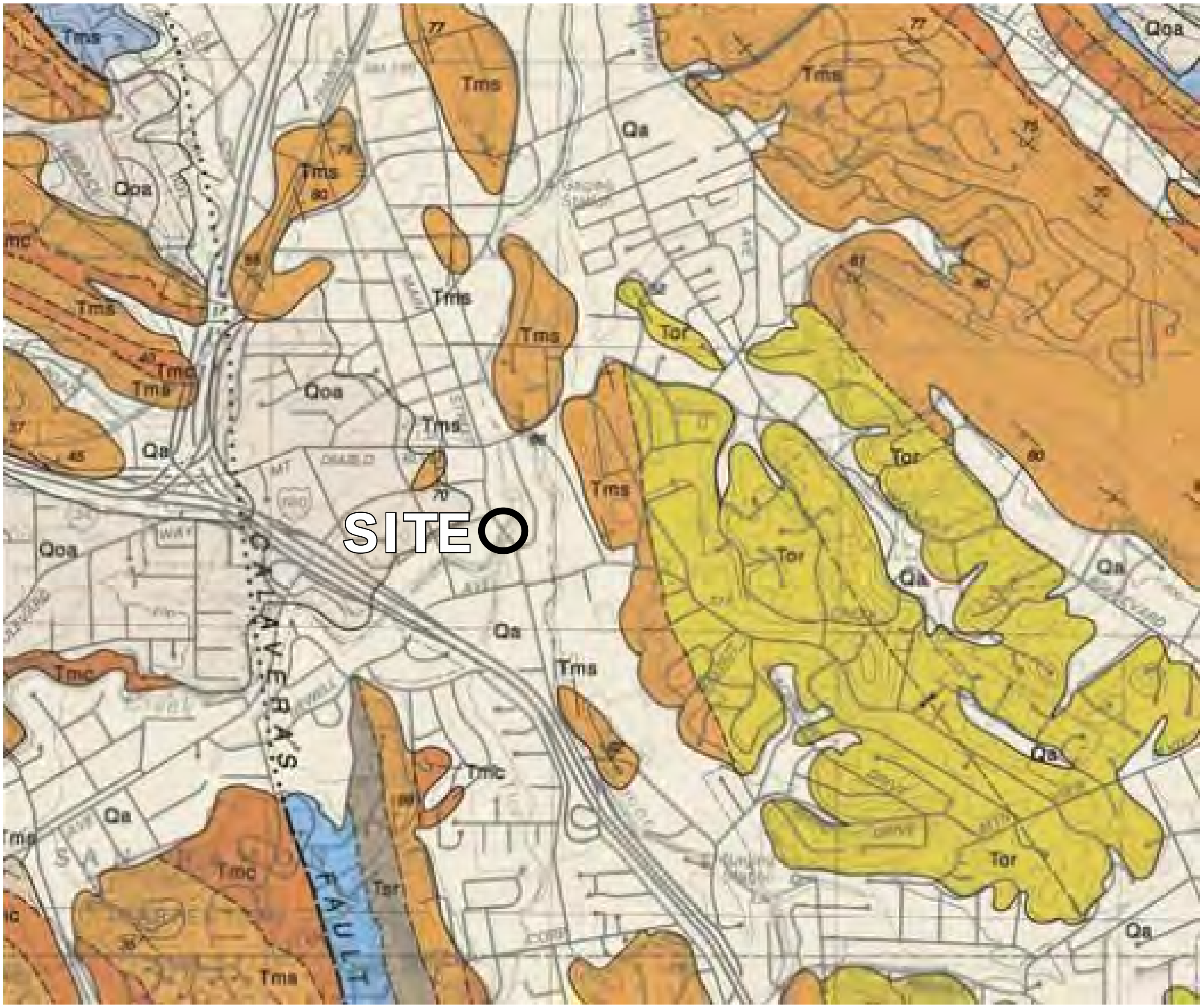


Figure 1
Vicinity Map
Las Trampas Bridge Replacement at South Main Street

City of Walnut Creek, California

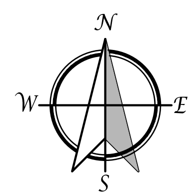
WRECO Project No. P17043

WRECO



LEGEND

Qa	Qa	Alluvial gravel, sand and clay of valley areas
Qoa		Older Surficial Sediments - Dissected terrace deposits, undeformed
	Qoa	Alluvial gravel and sand, gray-brown
Tb, Tot, Tor		Orinda Formation - Terrestrial clastic, weakly lithified, age Pliocene to late Miocene
	Tor	Pebble conglomerate of mostly Franciscan detritus, sandstone and claystone, interbedded, gray, stream-laid
	Tb	Basalt
	Tot	Tuff breccia, gray-white, rhyolitic, massive to vaguely bedded
Tbr, Tmc, Tms		Monterey Formation - Marine biogenic and clastic, lithified, age late to middle Miocene
	Tbr	Sandstone, light gray to tan, medium grained, arkosic
	Tms	Sandstone, light gray to tan, madium grained, basal unit locally called Sobrante
	Tmc	Clay shale/siltstone, gray, vaguely bedded, argillaceous to sandy, includes fine grained sandstone



Map reference: Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Walnut Creek quadrangle, Contra Costa County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-149, scale 1:24,000.

WRECO

Figure 2
Geologic Map
Las Trampas Bridge Replacement at South Main Street

City of Walnut Creek, California
WRECO Project No. P17043

LEGEND:

R-18-003 APPROXIMATE BORING LOCATION

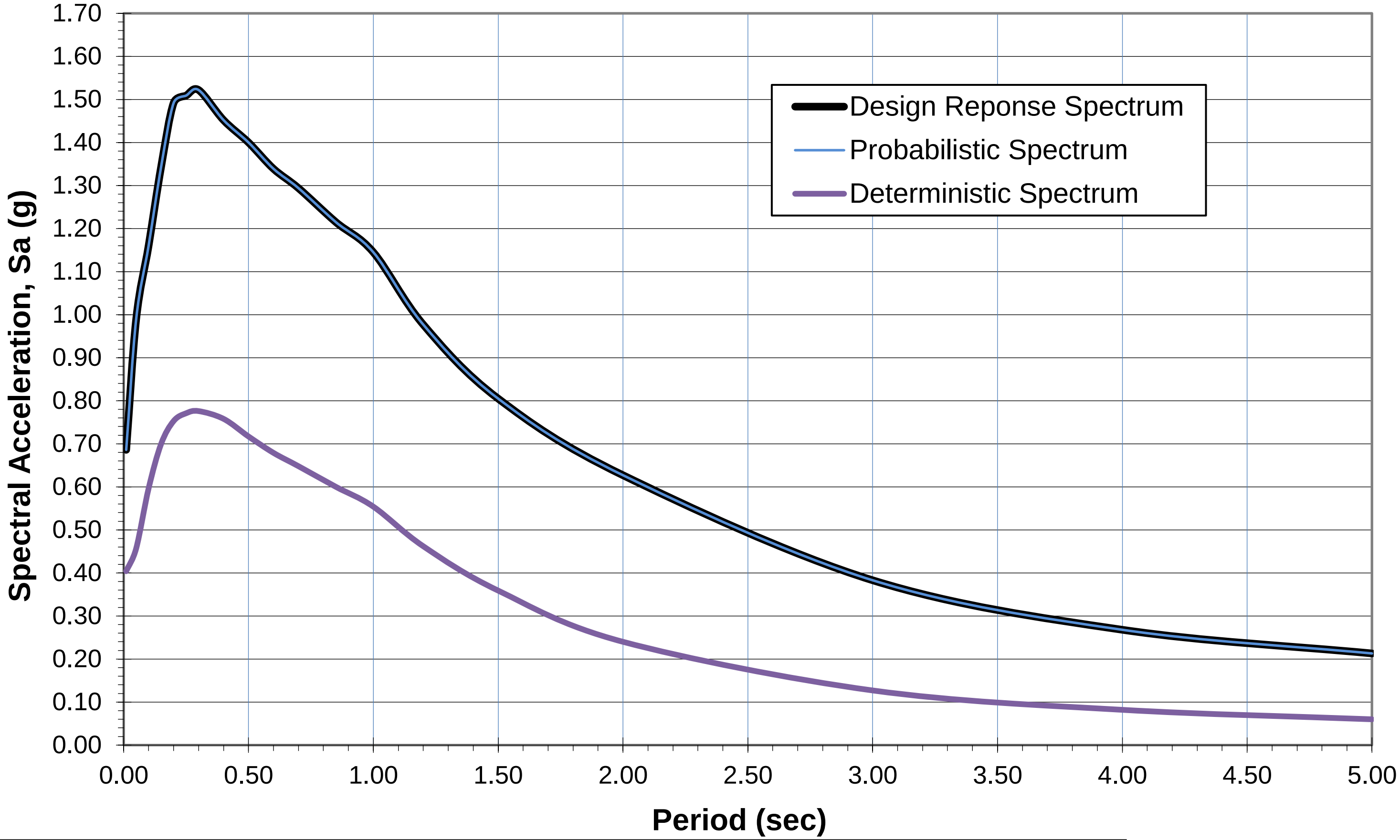
A A' CROSS SECTION LINE

PLAN
1"=20'

0 20 ft 40 ft
SCALE

NOTE: All locations are approximate and are referenced from existing site features. Electronic media for plan view provided by Quincy Engineering, Inc. on 10/24/2018.

WRECO	7807 LAGUNA BLVD SUITE 400 ELK GROVE, CA 95758
CITY OF WALNUT CREEK	
Las Trampas Creek Bridge Replacement Project South Main Street	
Location of Field Tests	
P17043	Figure - 3



SITE INFORMATION

Latitude: 37.894823
Longitude: -122.059178

DESIGN RESPONSE SPECTRA	
Period (seconds)	**Spectral Accelerations (g)**
0.01	0.69
0.05	0.99
0.10	1.16
0.15	1.34
0.20	1.49
0.25	1.51
0.30	1.52
0.40	1.45
0.50	1.40
0.60	1.34
0.70	1.29
0.85	1.22
1.00	1.15
1.20	0.98
1.50	0.81
2.00	0.63
3.00	0.38
4.00	0.27
5.00	0.21

For Design Engineer:

SEISMIC DESIGN: Caltrans Seismic Design Criteria (SDC), Version 2.0 dated April 2019

SEISMIC LOADING: (a) Soil Profile: Type D, Stiff soil. V_{S30} = 240 meters/second.
(b) Moment Magnitude: Mmax: 6.6, Mount Diablo Thrust
(c) Peak Ground Acceleration: 0.69g.

(Caltrans Memo to Designers 1-47 - August 2010)

Reference: Caltrans ARS Online, v2.3.09

WRECO

FIGURE 4

Preliminary Design Response Spectrum (ARS Curve)

Las Trampas Creek Bridge

City of Walnut Creek

WRECO Proejct No. P17043

Appendix II. Log of Test Borings (LOTB), CPT's & As-Built Plans

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	CR			

CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

REGISTERED GEOLOGIST DAVID A. KITZMANN No. 2412 Exp. 12/31/2019 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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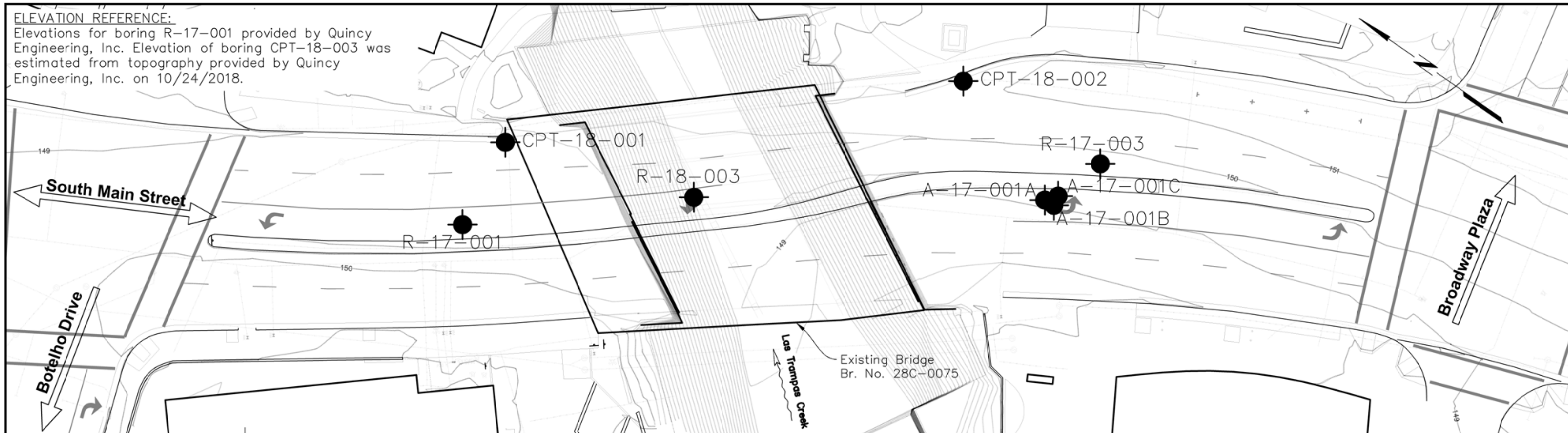
WRECO
7807 LAGUNA BLVD., SUITE 400
ELK GROVE, CA 95758 WRECO JOB NO: P17043

QUINCY ENGINEERING, INC.
2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597

Notes:

1. Field classification of soils was in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010 Edition).
2. 1.4" samples were taken using a 1.375" split barrel sampler per Standard Penetration Test (SPT) performed in accordance with ASTM D 1557–11. 2.4" samples were taken using a 2.49" split barrel sampler per Modified California Split Barrel Test performed in accordance with ASTM D 3550.
3. 1.4" and 2.4" samples were taken with an automated hammer system consisting of a hammer automated of a hammer weight 140 lbs. free falling a distance of 30". Autohammer energy ratio (ETR) measurements indicate an ETR=72%.
4. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586–11. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.5 ft "seating drive" interval penetration. Material characteristics shown in () where estimated.
5. The blow counts shown on the logs are the raw blow counts which have not been corrected for hammer energy, sample size, overburden, or any other correction factor. The apparent density of granular soil is on a corrected Standard Penetration Test N60 value.
6. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheet reflects the fluid level in the borings on the specified date. The groundwater surface elevation is subject to seasonal fluctations and may occur at higher or lower elevations depending on the conditions at any particular time.
7. Boring locations were measurements in the field based on site existing features and topographic survey by Quincy Engineering, Inc. Electronic media for plan view provided by Quincy Engineering, Inc. on 10/24/2018.



PLAN
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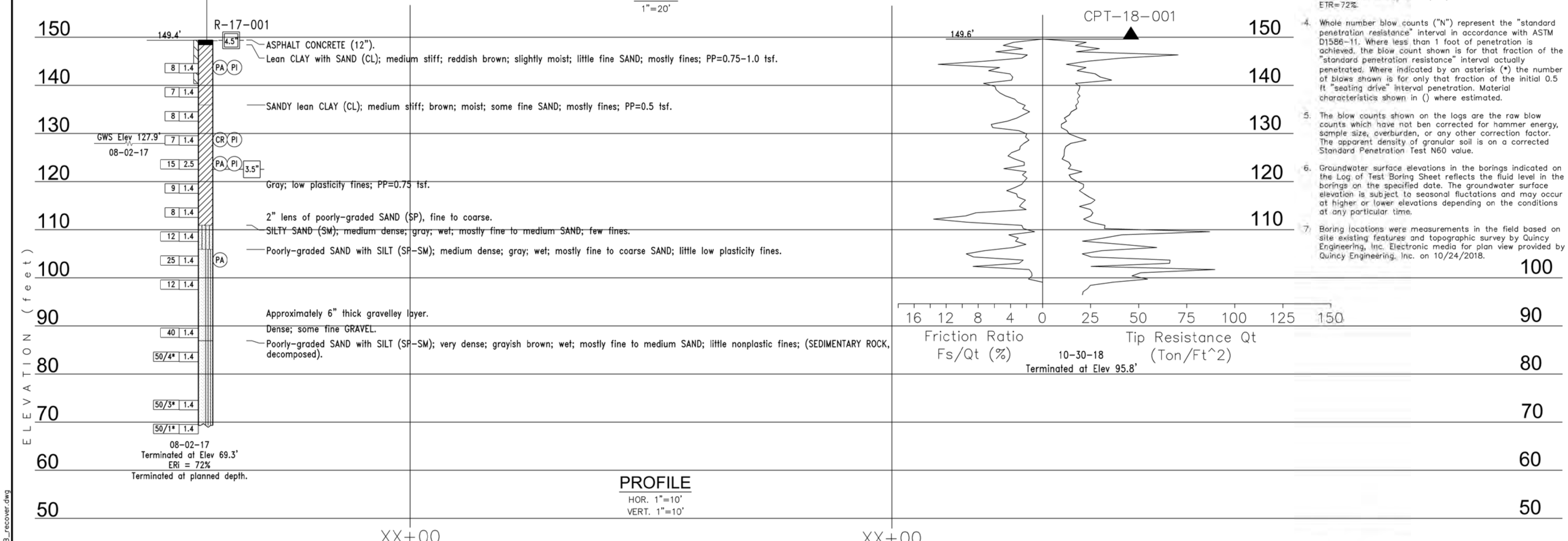

PROFILE
HOR. 1"=10'
VERT. 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR: DAVID A. KITZMANN	DRAWN BY: O. RAGABO / CHECKED BY: F.P.T.	FIELD INVESTIGATION BY: O. ADAH, D. LUKASHOV	DATE: 10–30–18, 08–02–17

PREPARED FOR THE CITY OF WALNUT CREEK ENGINEERING DEPARTMENT

DAVID A. KITZMANN
PROJECT ENGINEER

BRIDGE NO. XXX–XXXX
POST MILE XX.XX

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
LOG OF TEST BORINGS

CU XXXXXX
EA XXXXXX

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET XX OF XX

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1/30/2019 OR_LOTB_recover.dwg

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ELEVATION REFERENCE:
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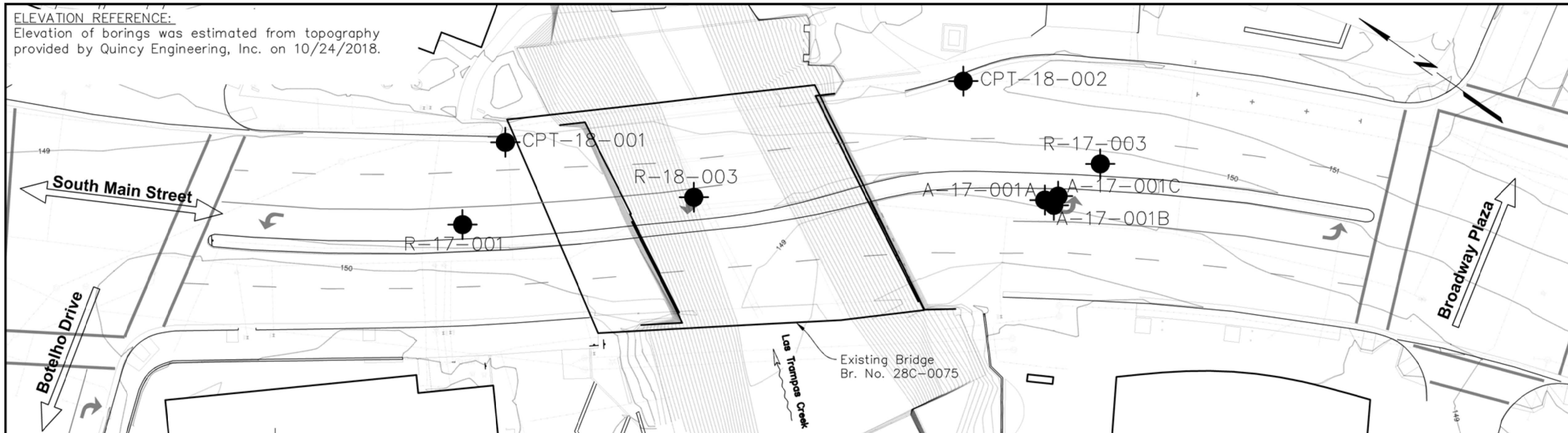

PLAN
1"=20'

PROFILE
HOR. 1"=10'
VERT. 1"=10'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	CR			

CERTIFIED ENGINEERING GEOLOGIST DATE

REGISTERED GEOLOGIST DAVID A. KITZMANN No. 2412 Exp. 12/31/2019 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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7807 LAGUNA BLVD., SUITE 400
ELK GROVE, CA 95758
WRECO JOB NO: P17043

QUINCY ENGINEERING, INC.
2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597

Notes:

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7. Boring locations were measurements in the field based on site existing features and topographic survey by Quincy Engineering, Inc. Electronic media for plan view provided by Quincy Engineering, Inc. on 10/24/2018.

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR DAVID A. KITZMANN	DRAWN BY: O. RAGABO / CHECKED BY: F.P.T.	FIELD INVESTIGATION BY: O. ADAH	DATE: 10-30-18 to 11-01-18

PREPARED FOR THE
CITY OF WALNUT CREEK
ENGINEERING DEPARTMENT

DAVID A. KITZMANN
PROJECT ENGINEER

BRIDGE NO. XXX-XXXX
POST MILE XX.XX

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
LOG OF TEST BORINGS

CU XXXXXX
EA XXXXXX

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET XX OF XX

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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1/30/2019 OR_LOTB_recover.dwg

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	CR			

CERTIFIED ENGINEERING GEOLOGIST   DATE

PLANS APPROVAL DATE

REGISTERED GEOLOGIST DAVID A. KITZMANN No. 2412 Exp. 12/31/2019 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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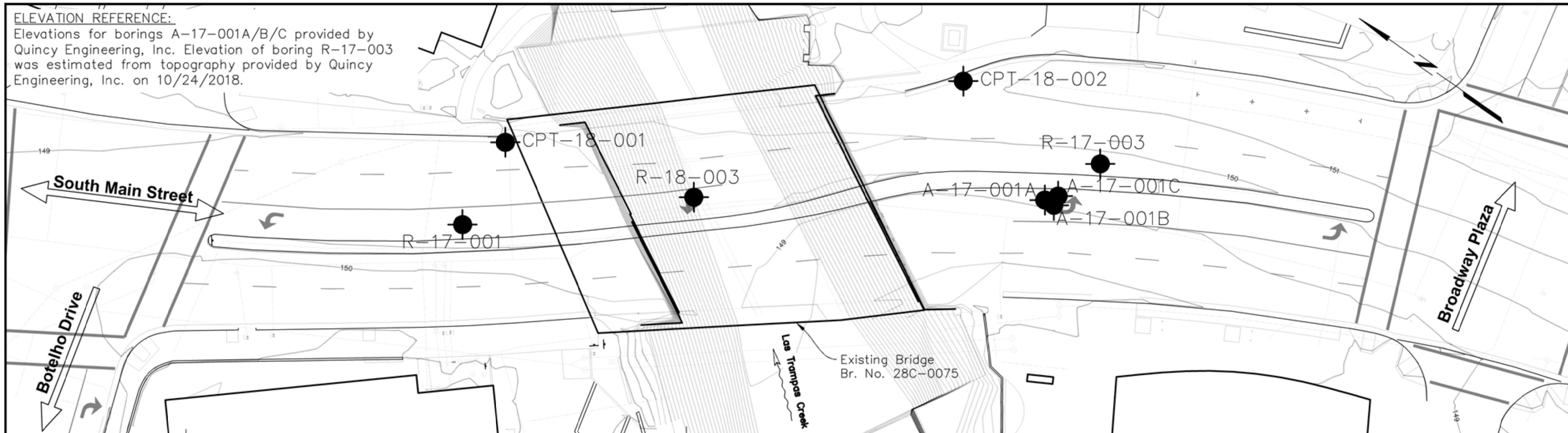
ELK GROVE, CA 95758   WRECO JOB NO: P17043

QUINCY ENGINEERING, INC.
2950 Buskirk Avenue, Suite 122
Walnut Creek, CA 94597

ELEVATION REFERENCE:
Elevations for borings A-17-001A/B/C provided by Quincy Engineering, Inc. Elevation of boring R-17-003 was estimated from topography provided by Quincy Engineering, Inc. on 10/24/2018.



PLAN
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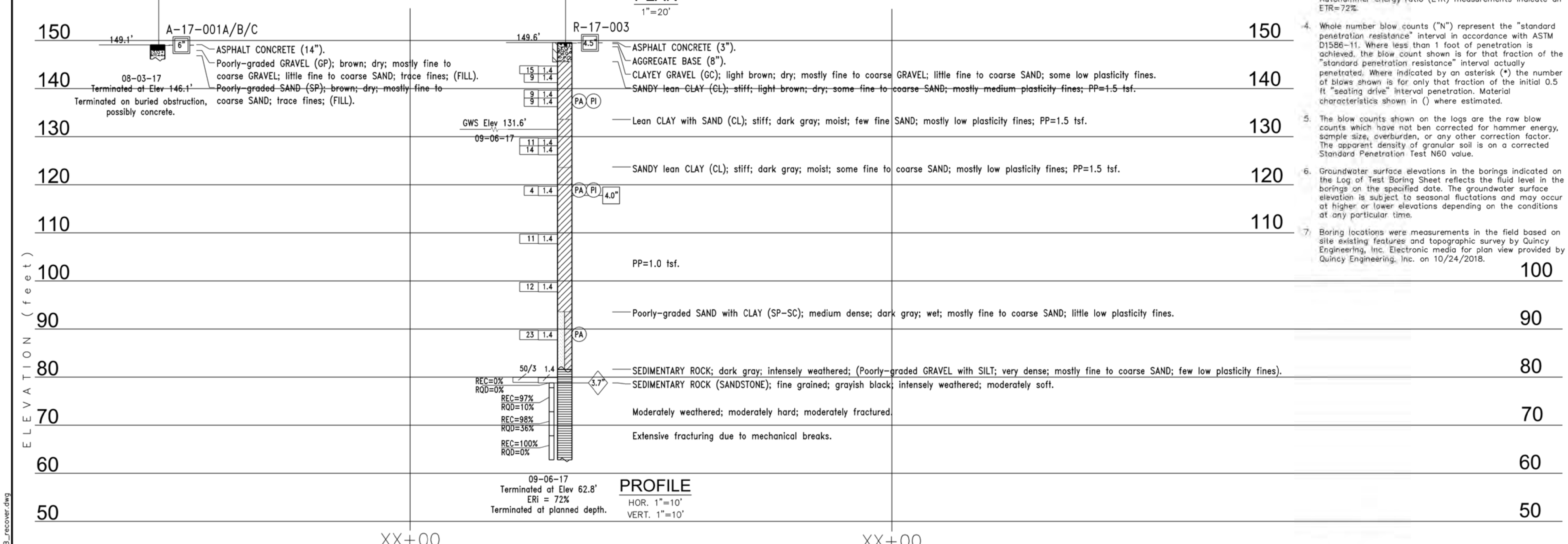

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ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR DAVID A. KITZMANN	DRAWN BY: O. RAGABO / CHECKED BY: F.P.T.	FIELD INVESTIGATION BY: D. LUKASHOV	DATE: 08-03-17 & 09-06-17

PREPARED FOR THE CITY OF WALNUT CREEK ENGINEERING DEPARTMENT

DAVID A. KITZMANN
PROJECT ENGINEER

BRIDGE NO. XXX-XXXX
POST MILE XX.XX

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET
LOG OF TEST BORINGS

CU XXXXXX
EA XXXXXX

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)   SHEET XX   OF XX

FILE => $REQUEST

1/30/2019   OR_LOTB_recover.dwg

USERNAME => $USER   DATE PLOTTED => $DATE   TIME PLOTTED => $TIME

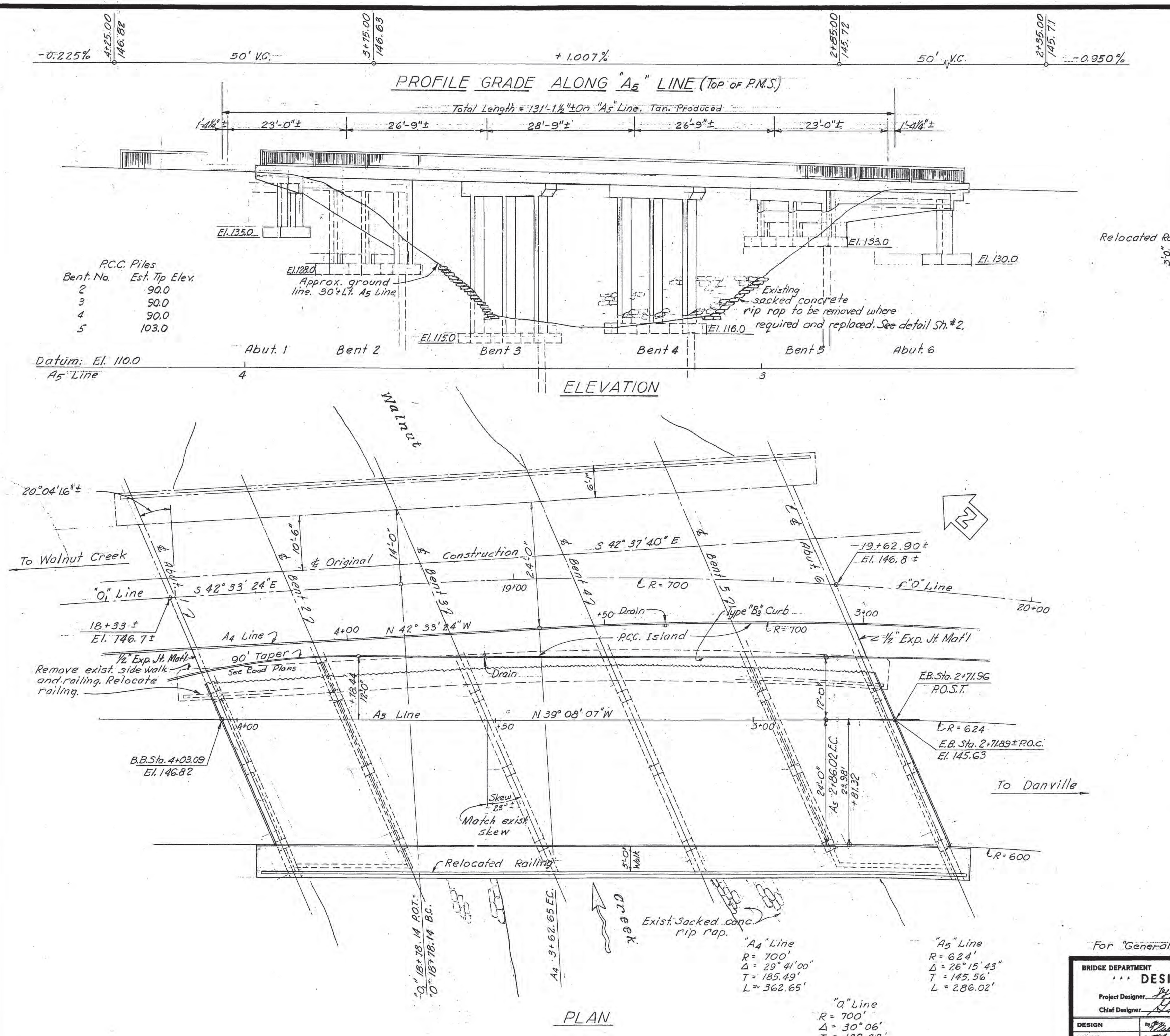
FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			15	27

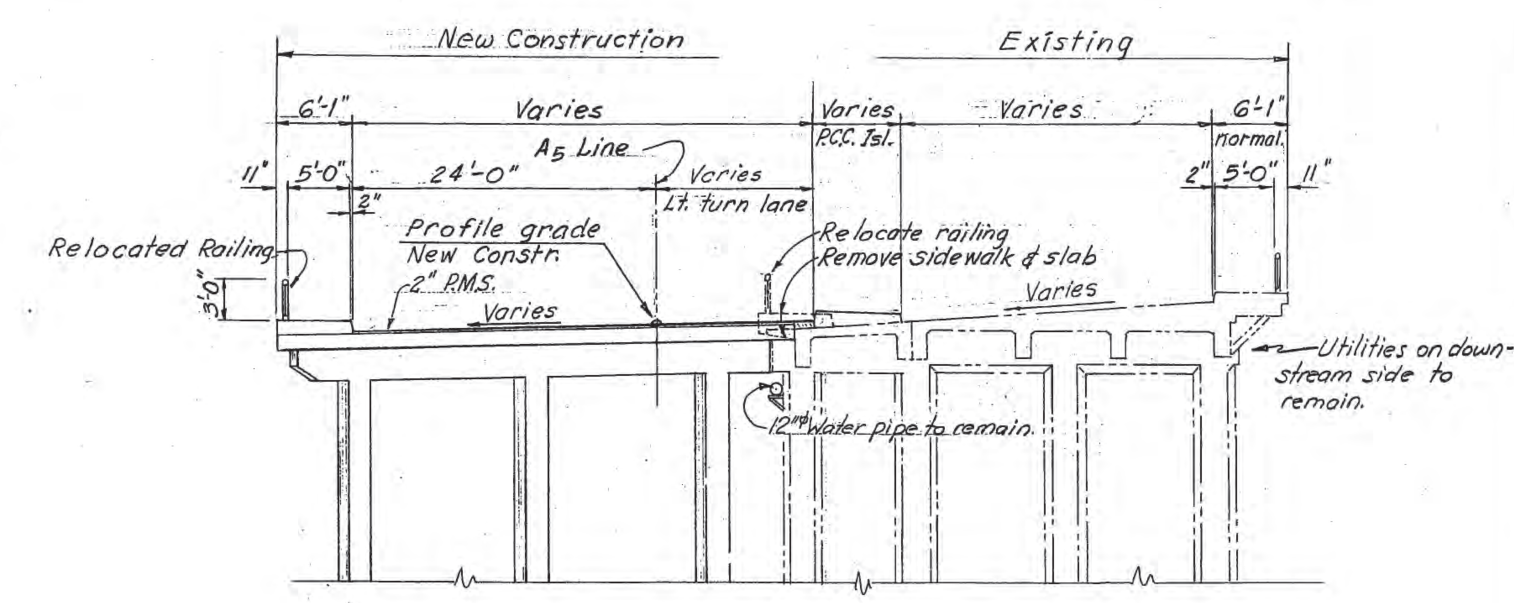
DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	107	W.C.	~~1~~	~~13~~

ASSISTANT STATE HIGHWAY ENGINEER — CIVIL ENGINEER LICENSE 1414

DATE APPROVED April 23, 1956

STATE HIGHWAY ENGINEER — CIVIL ENGINEER—LICENSE 2864





APPROXIMATE QUANTITIES

REMOVING CONCRETE	40 C.Y.
STRUCTURE EXCAVATION	450 C.Y.
STRUCTURE BACKFILL	300 C.Y.
CLASS A CONCRETE (STRUCTURE)	435 C.Y.
BAR REINFORCING STEEL	75,000 LBS.
CONCRETE PILING	1,200 L.F.
DRIVING PILES	40
SACKED CONCRETE RIPRAP	80 C.Y.
REMOVING AND RESETTING EXISTING STEEL BRIDGE RAILING	138 L.F.
TEMPORARY TIMBER RAILING	500 L.F.
PORTABLE TIMBER BARRICADES	6
PLANT-MIXED SURFACING	75 TONS

INDEX TO PLANS

For "General Notes" see "Foundation Plan."

BRIDGE DEPARTMENT
*** DESIGN SECTION *** 9

Project Designer
Chief Designer

	By	Checked
DESIGN	11-55	C.F. Stewart 11-55
DETAILS	11-55	C.F. Stewart 11-55
QUANTITIES	Zeppe 12/55	H. Mook 12-55
SPECIFICATIONS	A.D.D. 1-56	Plans and Specs. Compared

Approval Recommended by — Engineer of Design — Civil and Structural Engr. License No. 5434

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING BRIDGE ACROSS WALNUT CREEK
LOCATED ABOUT 0.2 MILE SOUTH OF ROUTE 75
IN THE CITY OF WALNUT CREEK, CONTRA COSTA COUNTY

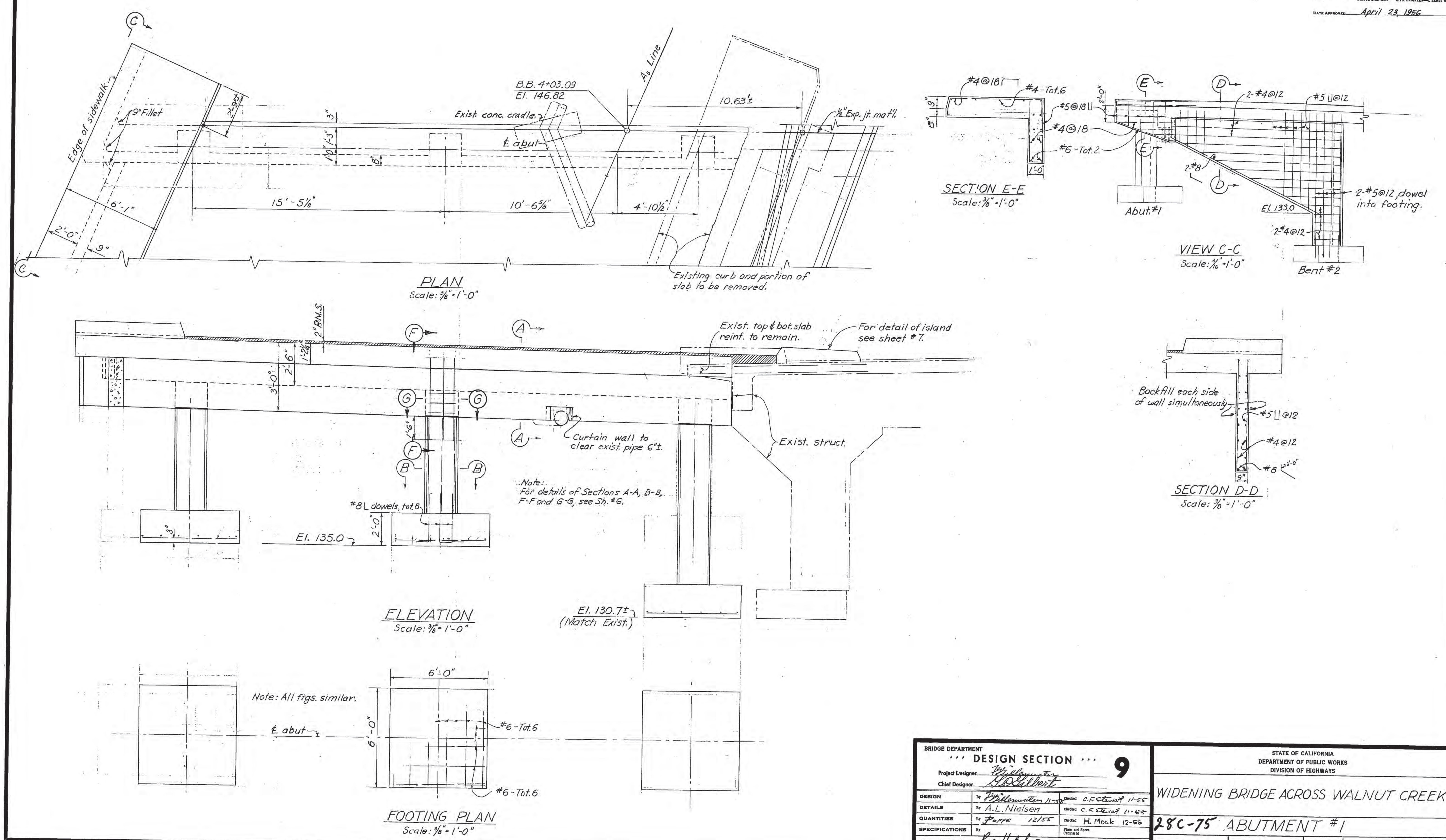
28C-75 GENERAL PLAN

SCALE 1" = 10'-0" | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-11

PREL. DRAWING No. P-2409 | 17 | 18 | 19 | 28 | 35 | 42

14

141



FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			17	27

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	107	WI.C.	~~3~~	~~18~~

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5585

DATE APPROVED April 23, 1956

BRIDGE DEPARTMENT
DESIGN SECTION 9
Project Designer
Chief Designer G.D. Gilbert

DESIGN	By	Checked C.F. Stewart 11-55	
DETAILS	By A.L. Nielsen	Checked C.F. Stewart 11-55	
QUANTITIES	By Poppe 12/55	Checked H. Mock 12-55	
SPECIFICATIONS	By	Plans and Specs. Compared	

Approval Recommended by — Engineer of Design — Civil and Structural Engr. License No. 5439

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

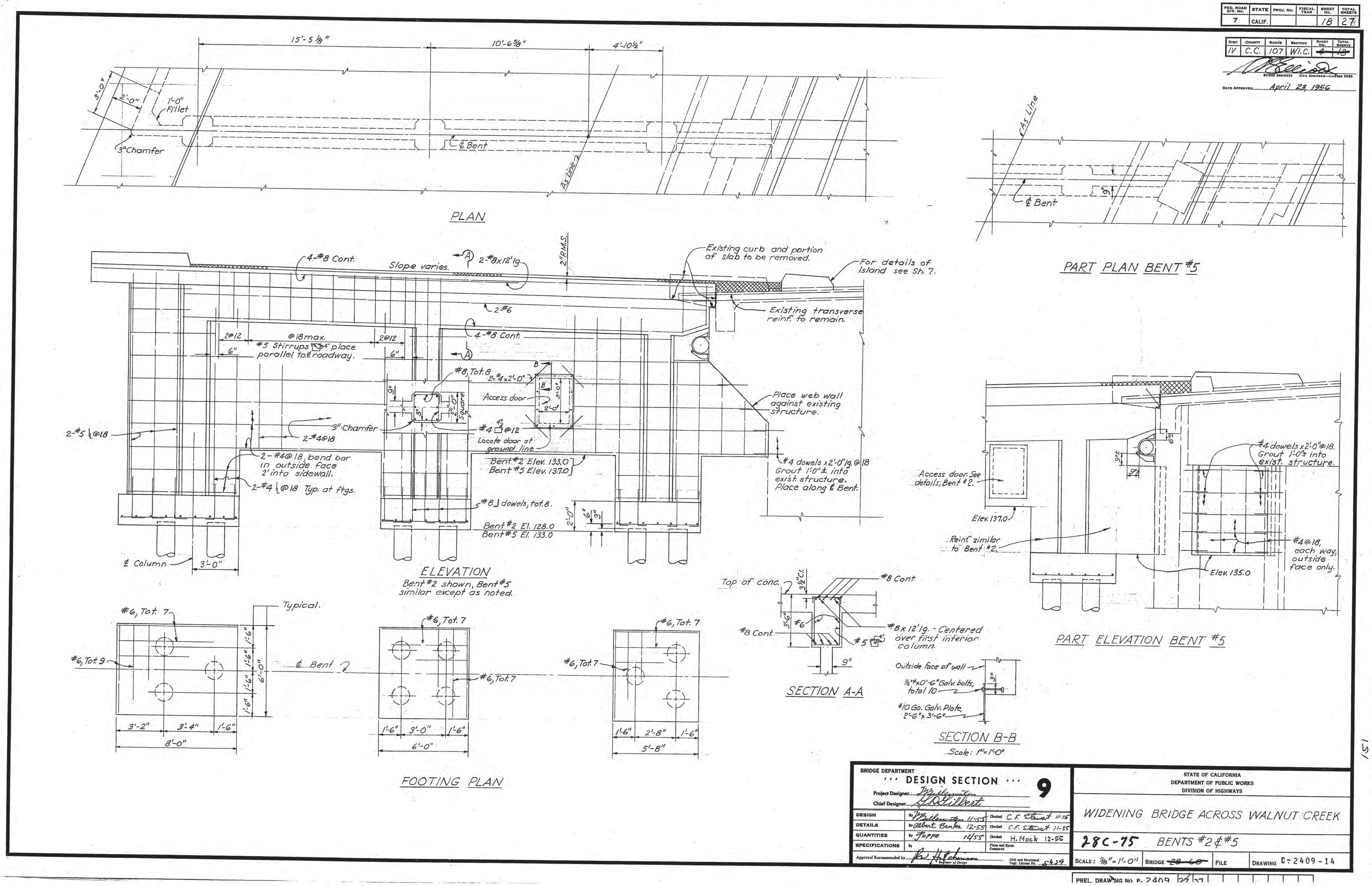
WIDENING BRIDGE ACROSS WALNUT CREEK

28C-75 ABUTMENT #1

SCALE As noted | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-13

PREL. DRAWING No. P-2409

16


FED. ROAD DIV. No. 7 | STATE CALIF. | PROJ. No. | FISCAL YEAR | SHEET No. 18 | TOTAL SHEETS 27
DIST. IV | COUNTY C.C. | ROUTE 107 | SECTION Wl.C. | SHEET No. 4 | TOTAL SHEETS 13
BRIDGE ENGINEER CIVIL ENGINEER—LICENSE 5385
DATE APPROVED April 23, 1956
15'-5 1/8"
10'-6 5/8"
4'-10 1/2"
3'-0"
2'-0"
1'-0" Fillet
3" Chamfer
℄ Bent
As Line 2
PLAN
As Line
℄ Bent
PART PLAN BENT #5
4-#8 Cont.
Slope varies.
2-#8 x 12' lg.
2" R.M.S.
Existing curb and portion of slab to be removed.
For details of island see Sh. 7.
Existing transverse reinf. to remain.
2-#6
2@12
@18 max.
#5 Stirrups, place parallel to ℄ roadway.
4-#8 Cont.
#8, Tot. 8
2-#4 x 2'-0"
Access door
3'-0" Square
#4 @12
3" Chamfer
2-#4@18
Locate door at ground line
Place web wall against existing structure.
2-#5 @18
2-#4@18, bend bar in outside face 2' into sidewall.
2-#4 @18 Typ. at ftgs.
Bent #2 Elev. 133.0
Bent #5 Elev. 137.0
#8 dowels, tot. 8.
#4 dowels x 2'-0" lg. @18 Grout 1'-0"± into exist. structure. Place along ℄ Bent.
Bent #2 El. 128.0
Bent #5 El. 133.0
℄ Column
3'-0"
ELEVATION
Bent #2 shown, Bent #5 similar except as noted.
Access door. See details, Bent #2.
Elev. 137.0
Reinf. similar to Bent #2.
#4 dowels x 2'-0" @18. Grout 1'-0"± into exist. structure.
#4@18, each way, outside face only.
Elev. 135.0
PART ELEVATION BENT #5
Top of conc.
#8 Cont.
#8 x 12' lg. Centered over first interior column.
#5
9"
SECTION A-A
Outside face of wall
1/2" x 0'-6" Galv. bolts, total 10
#10 Ga. Galv. Plate, 2'-6" x 3'-6"
SECTION B-B
Scale: 1" = 1'-0"
Typical.
#6, Tot. 7
#6, Tot. 9
℄ Bent
1'-6"
6'-0"
3'-2"
3'-4"
1'-6"
8'-0"
#6, Tot. 7
#6, Tot. 7
1'-6"
3'-0"
1'-6"
6'-0"
#6, Tot. 7
#6, Tot. 7
1'-6"
2'-8"
1'-6"
5'-8"
FOOTING PLAN
BRIDGE DEPARTMENT
DESIGN SECTION 9
Project Designer
Chief Designer
DESIGN — Checked C.F. Stewart 11-55
DETAILS — Albert Banks 12-55 — Checked C.F. Stewart 11-55
QUANTITIES — Poppe 12/55 — Checked H. Mock 12-55
SPECIFICATIONS — Plans and Spec. Compared
Approval Recommended by — Engineer of Design — Civil and Structural Engr. License No. 5429
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
WIDENING BRIDGE ACROSS WALNUT CREEK
28C-75 BENTS #2 & #5
SCALE: 3/8" = 1'-0" | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-14
PREL. DRAWING No. P-2409
151

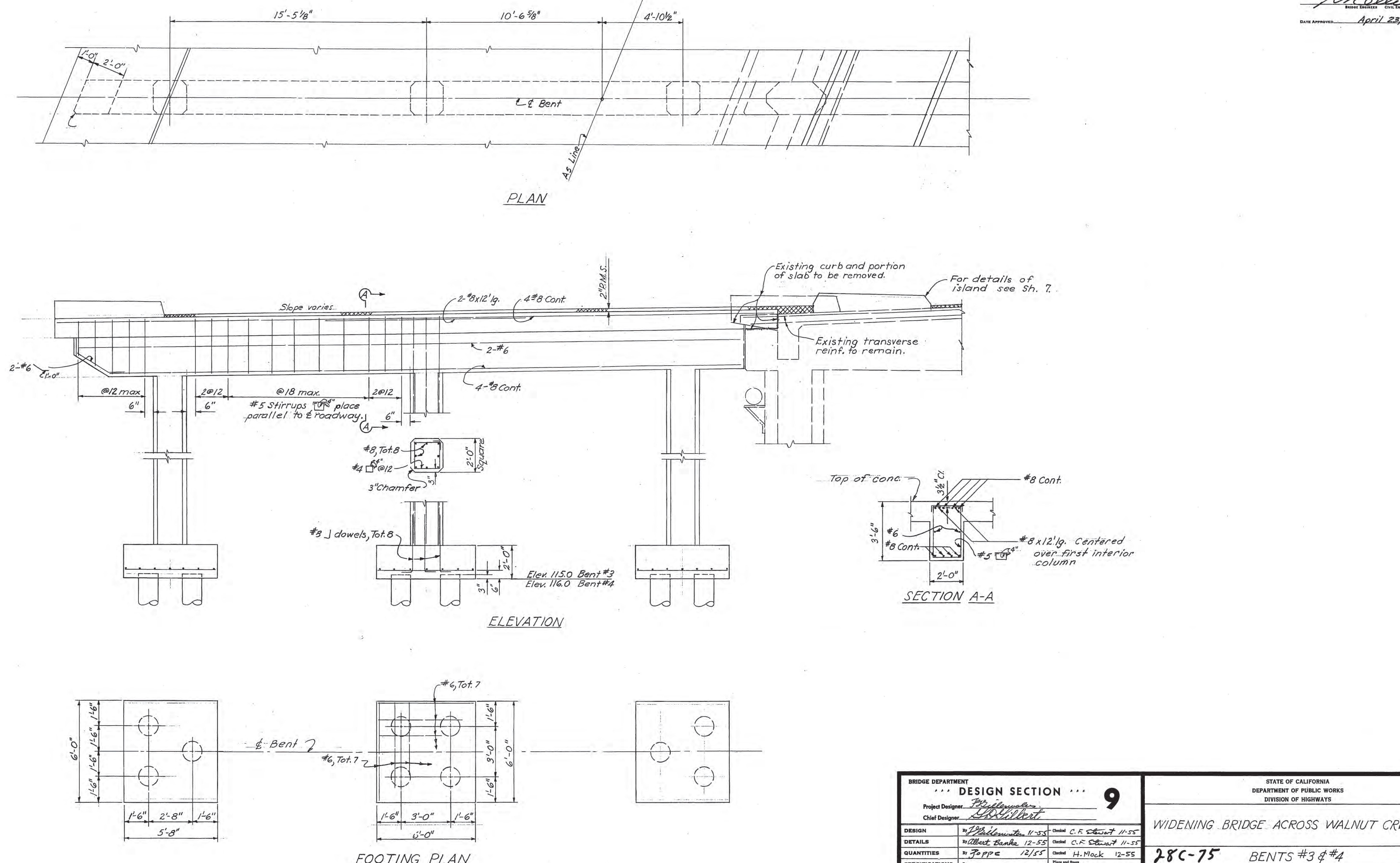
17

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			19	27

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	107	WI.C.	~~5~~	~~13~~

BRIDGE ENGINEER CIVIL ENGINEER—LICENSE 5585

DATE APPROVED April 23, 1956



152

BRIDGE DEPARTMENT

*** DESIGN SECTION *** 9

Project Designer F. Zillenwater

Chief Designer G. D. Gilbert

DESIGN	By J. Zillenwater 11-55	Checked C. F. Stewart 11-55
DETAILS	By Albert Banke 12-55	Checked C. F. Stewart 11-55
QUANTITIES	By Zoppe 12/55	Checked H. Mock 12-55
SPECIFICATIONS	By	Plans and Specs. Compared

Approval Recommended by R. W. Hutchinson, Engineer of Design — Civil and Structural Engr. License No. 5439

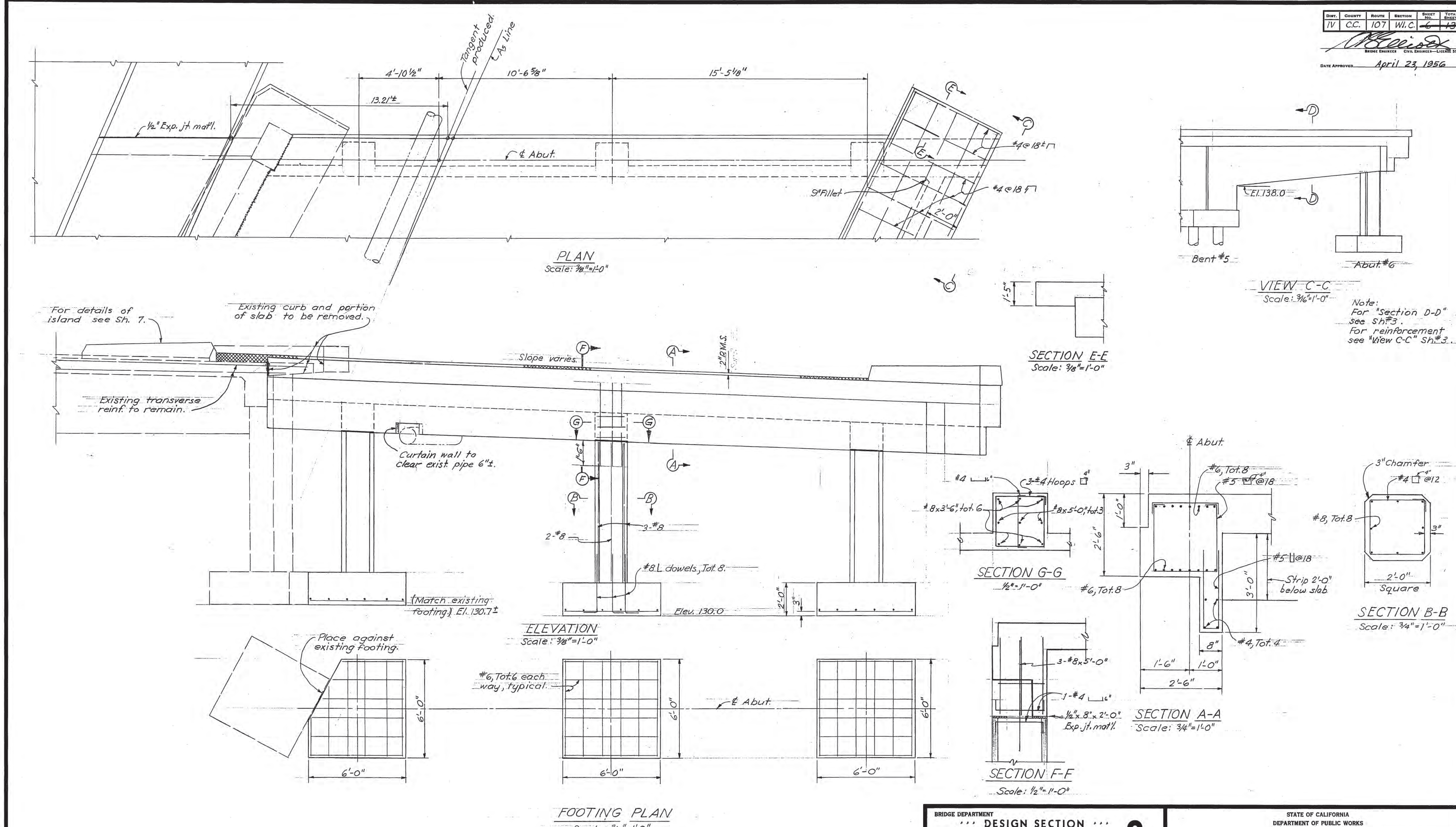
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING BRIDGE ACROSS WALNUT CREEK

28C-75 BENTS #3 & #4

SCALE: 3/8"=1'-0" | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-15

PREL. DRAWING No. P-2409 | ~~22~~ | 38



FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			20	27

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	107	Wl.C.	~~6~~	~~13~~

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5595

DATE APPROVED April 23, 1956

BRIDGE DEPARTMENT
*** DESIGN SECTION *** 9
Project Designer
Chief Designer G.D. Gilbert

DESIGN	By	Checked	C.F. Stewart 11-55
DETAILS	By Albert Banks 12-55	Checked	C.F. Stewart 11-55
QUANTITIES	By Poppe 12/55	Checked	H. Mock 12-55
SPECIFICATIONS	By	Plans and Specs. Compared	

Approval Recommended by: — Engineer of Bridges — Civil and Structural Engr. License No. 5439

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING BRIDGE ACROSS WALNUT CREEK

28C-75 ABUTMENT #6

SCALE: As Noted | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-16

PREL. DRAWING No. P- 2409 ~~31~~ ~~44~~

153

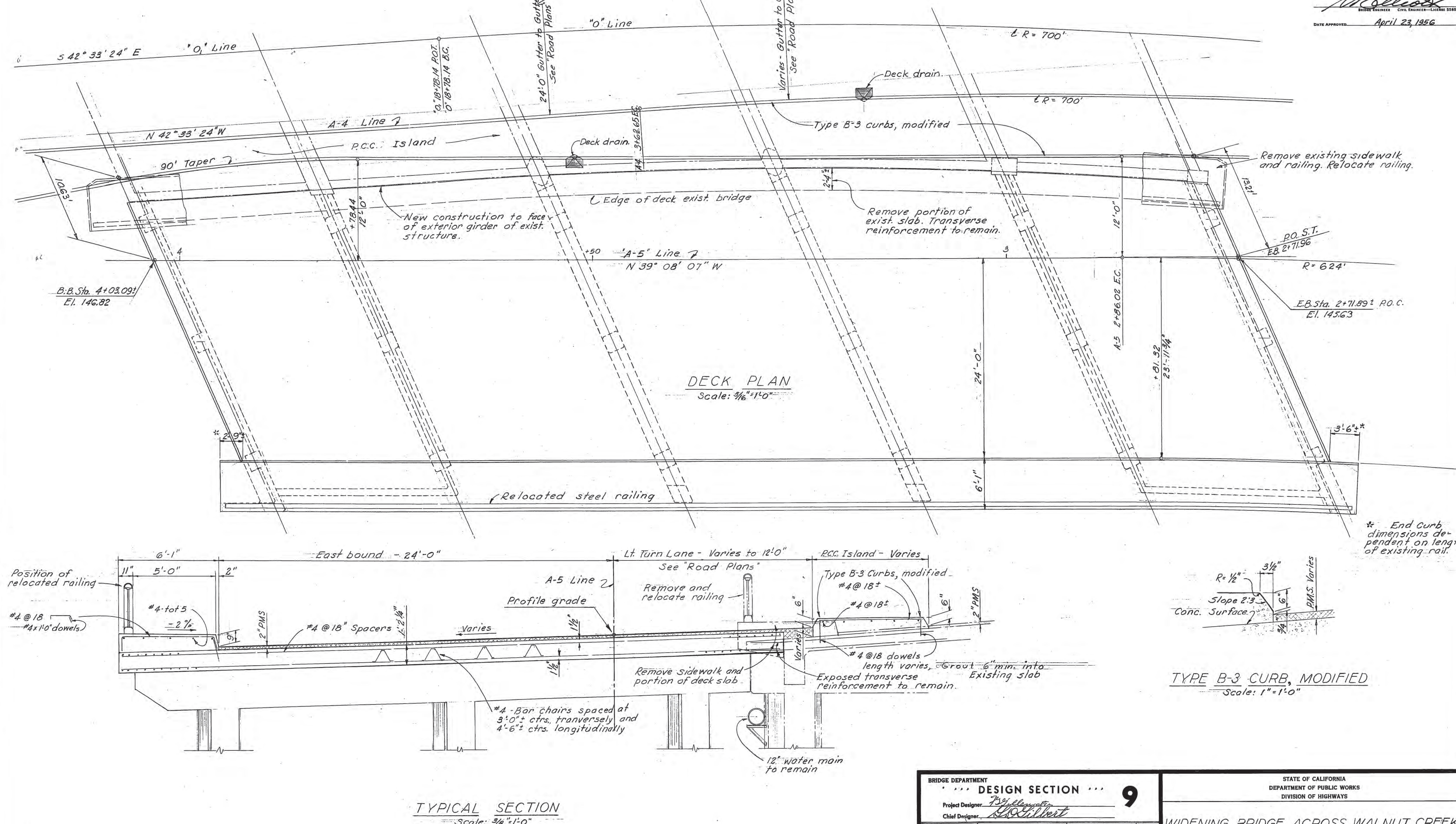
9

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			21	27

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	107	Wl.C	~~7~~	13

BRIDGE ENGINEER CIVIL ENGINEER—LICENSE 5585

DATE APPROVED April 23, 1956



BRIDGE DEPARTMENT
DESIGN SECTION 9
Project Designer
Chief Designer G.O. Gilbert

	By	Checked
DESIGN	11-55	C.F. Stewart 11-55
DETAILS	H. Mock 11-55	C.F. Stewart 11-55
QUANTITIES	Poppe 12/55	H. Mock 12-55
SPECIFICATIONS		Plans and Specs. Compared

Approval Recommended by — Engineer of Design — Civil and Structural Engr. License No. 5239

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING BRIDGE ACROSS WALNUT CREEK

28C-75 DECK DETAILS

SCALE As Noted | BRIDGE | FILE | DRAWING C-2409-17

PREL. DRAWING No. P-2409 | 24 | 32 | 39 | 45

154

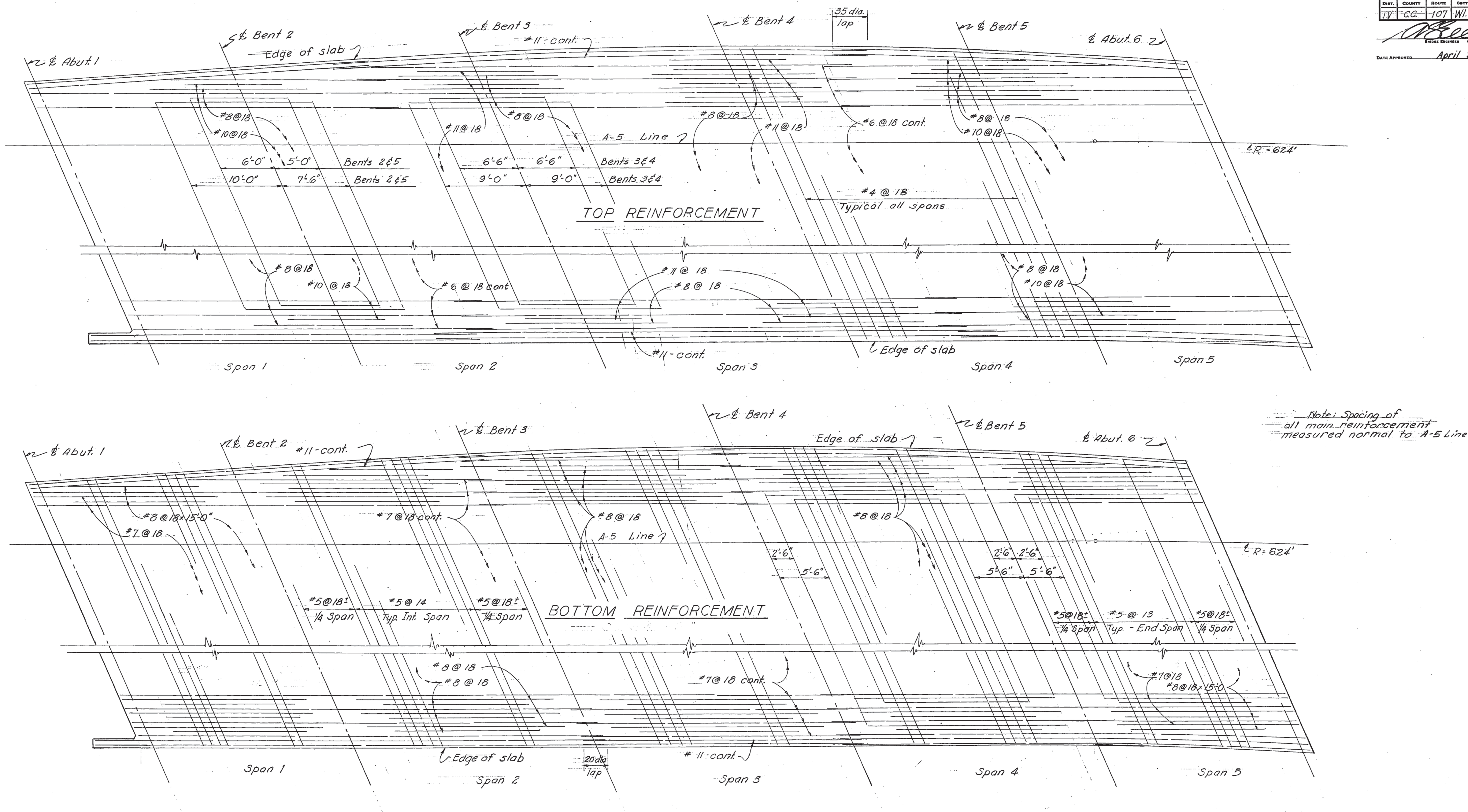
20

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			22	27

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	CC	107	Wl.C.	8	12

BRIDGE ENGINEER CIVIL ENGINEER—LICENSE

DATE APPROVED April 23, 1956



BRIDGE DEPARTMENT

... DESIGN SECTION ... **9**

Project Designer

Chief Designer G. D. Gilbert

	By	Checked
DESIGN		C. F. Stewart 11-55
DETAILS	H. Mock - 11-55	C. F. Stewart 11-55
QUANTITIES	Poppe 12/55	H. Mock 12-55
SPECIFICATIONS		Plans and Spec. Compared

Approval Recommended by ... Engineer of Design — Civil and Structural Engr. License No. 5439

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING BRIDGE ACROSS WALNUT CREEK

28C-75 SLAB REINFORCEMENT

SCALE 3/16" = 1'-0" | BRIDGE ~~28-60~~ | FILE | DRAWING C=2409-18

PREL. DRAWING No. P-2409 | 23 | 46

155

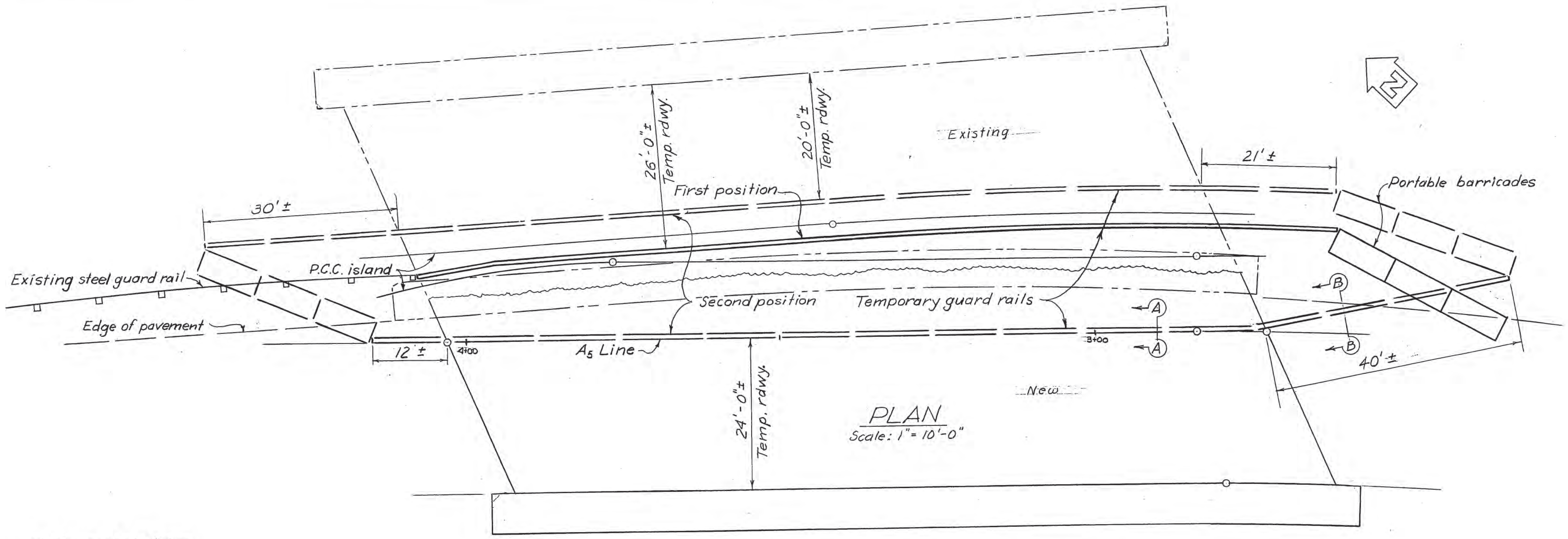
21

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CALIF.			23	27

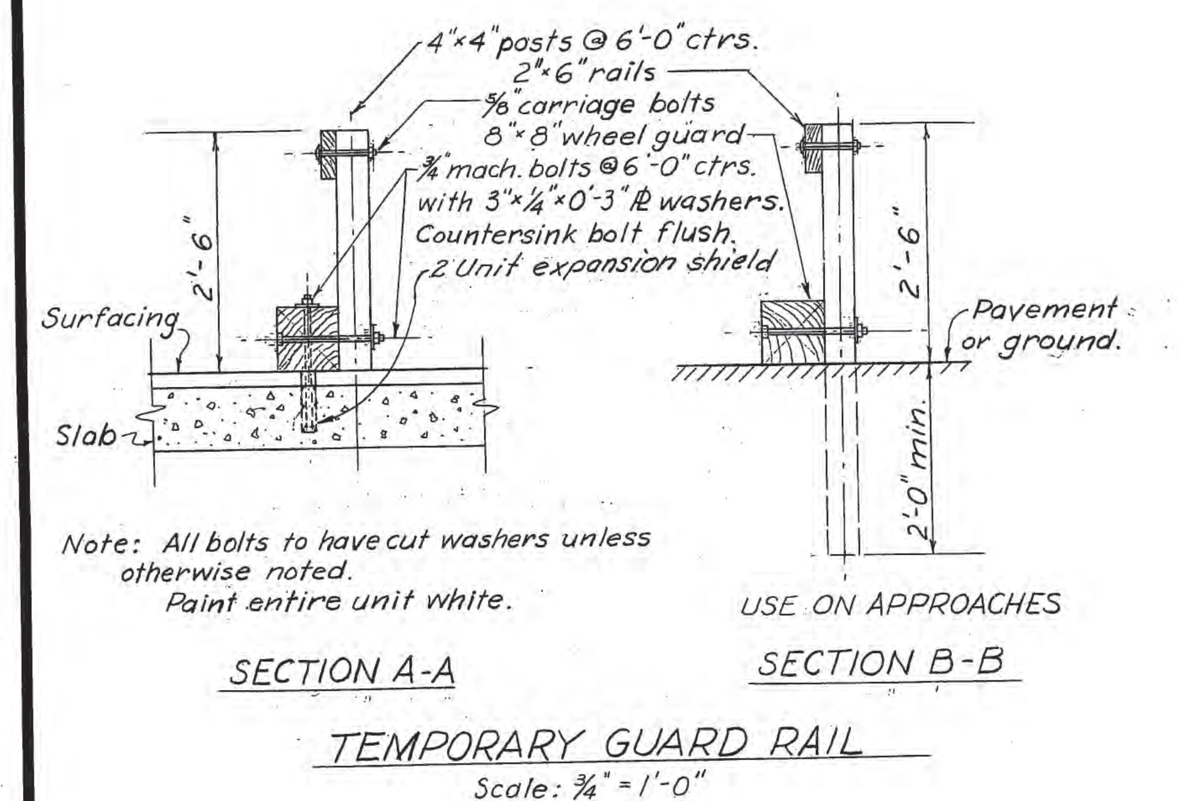
DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C	107	W.I.C.	9	15

BRIDGE ENGINEER CIVIL ENGINEER—LICENSE 5585

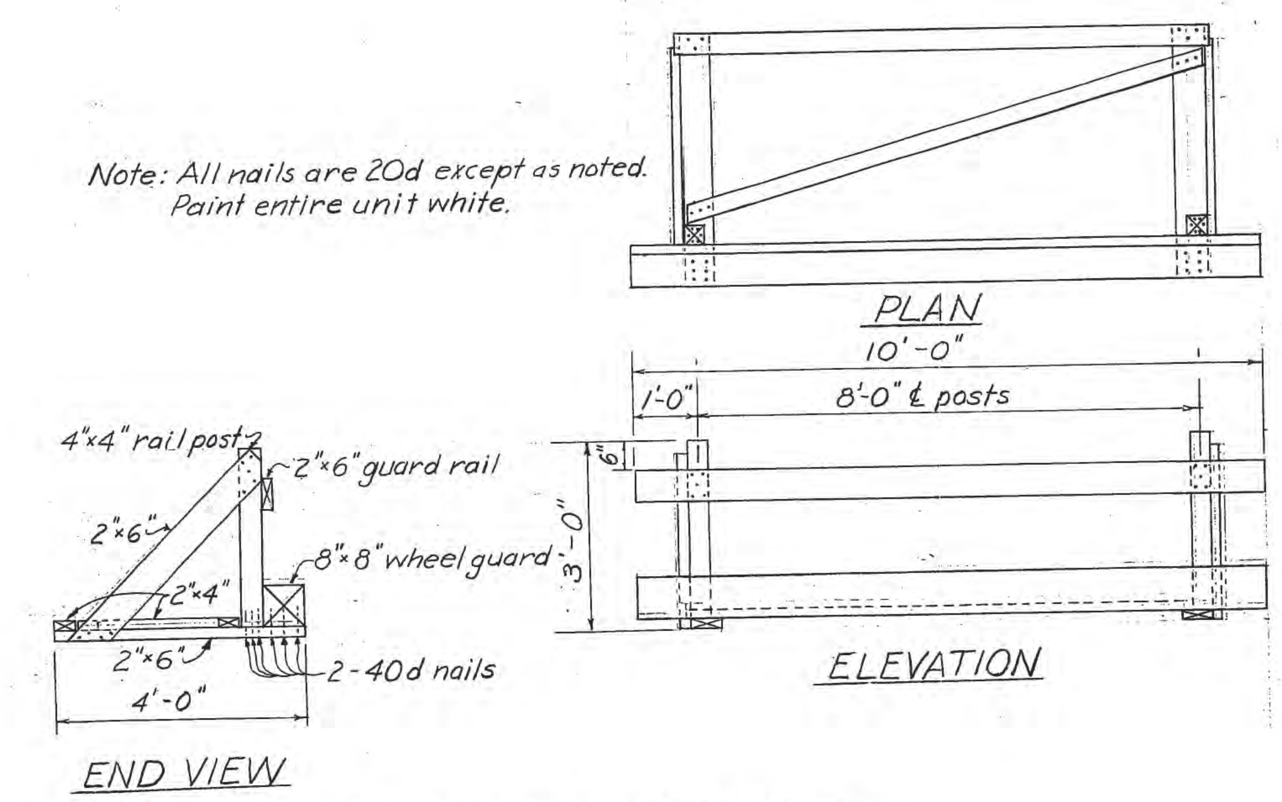
DATE APPROVED April 23, 1956



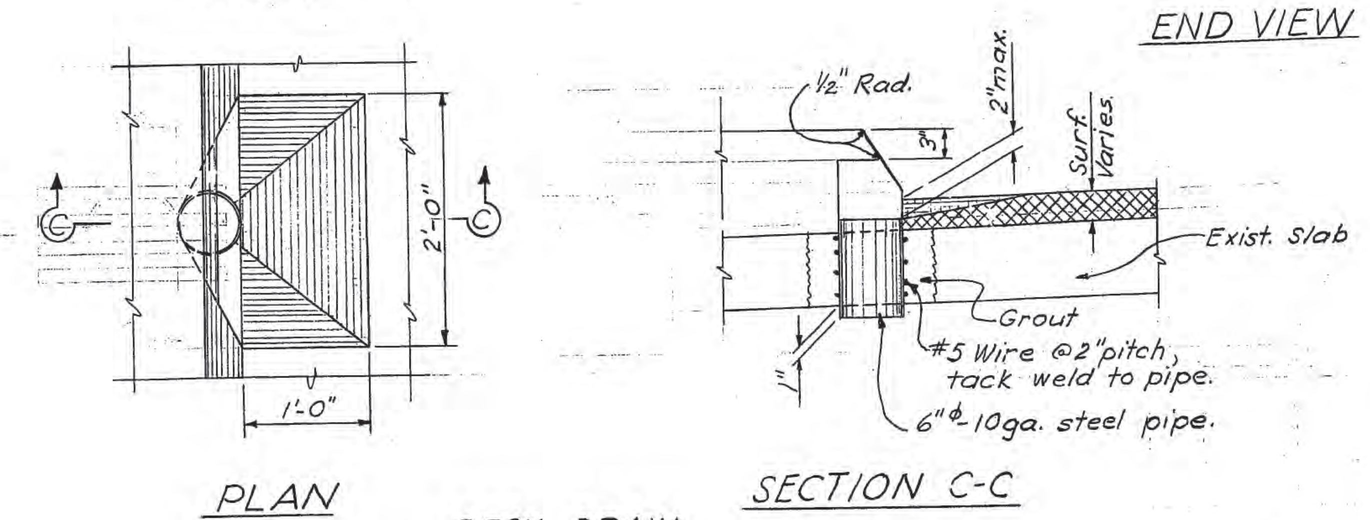
PLAN
Scale: 1" = 10'-0"



TEMPORARY GUARD RAIL
Scale: 3/4" = 1'-0"



PORTABLE BARRICADE
Scale: 1/2" = 1'-0"
6 required



DECK DRAIN
Scale: 1" = 1'-0"
2 Required.

CONSTRUCTION SEQUENCE

1. PLACE TEMPORARY RAILING IN FIRST POSITION.
2. REMOVE AND SALVAGE STEEL RAILING, REMOVE WALK, AND DECK SLAB TO FACE OF EXTERIOR GIRDER. TRANSVERSE SLAB REINFORCING TO REMAIN.
3. CONSTRUCT NEW WIDENING ON LEFT WITH SURFACING.
4. PLACE TEMPORARY RAILING AND BARRICADES IN SECOND POSITION AND CONSTRUCT ISLAND.
5. PLACE REMAINING PAVING.

BRIDGE DEPARTMENT
··· DESIGN SECTION ··· 9
Project Designer
Chief Designer

	By	Checked
DESIGN	11-55	C. F. Stewart 11-55
DETAILS	A.L. Nielsen	C. F. Stewart 11-55
QUANTITIES	Poppe 12/55	H. Mock 12-55
SPECIFICATIONS		Plans and Specs. Compared

Approval Recommended by — Engineer of Design — Civil and Structural Engr. License No. 5439

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

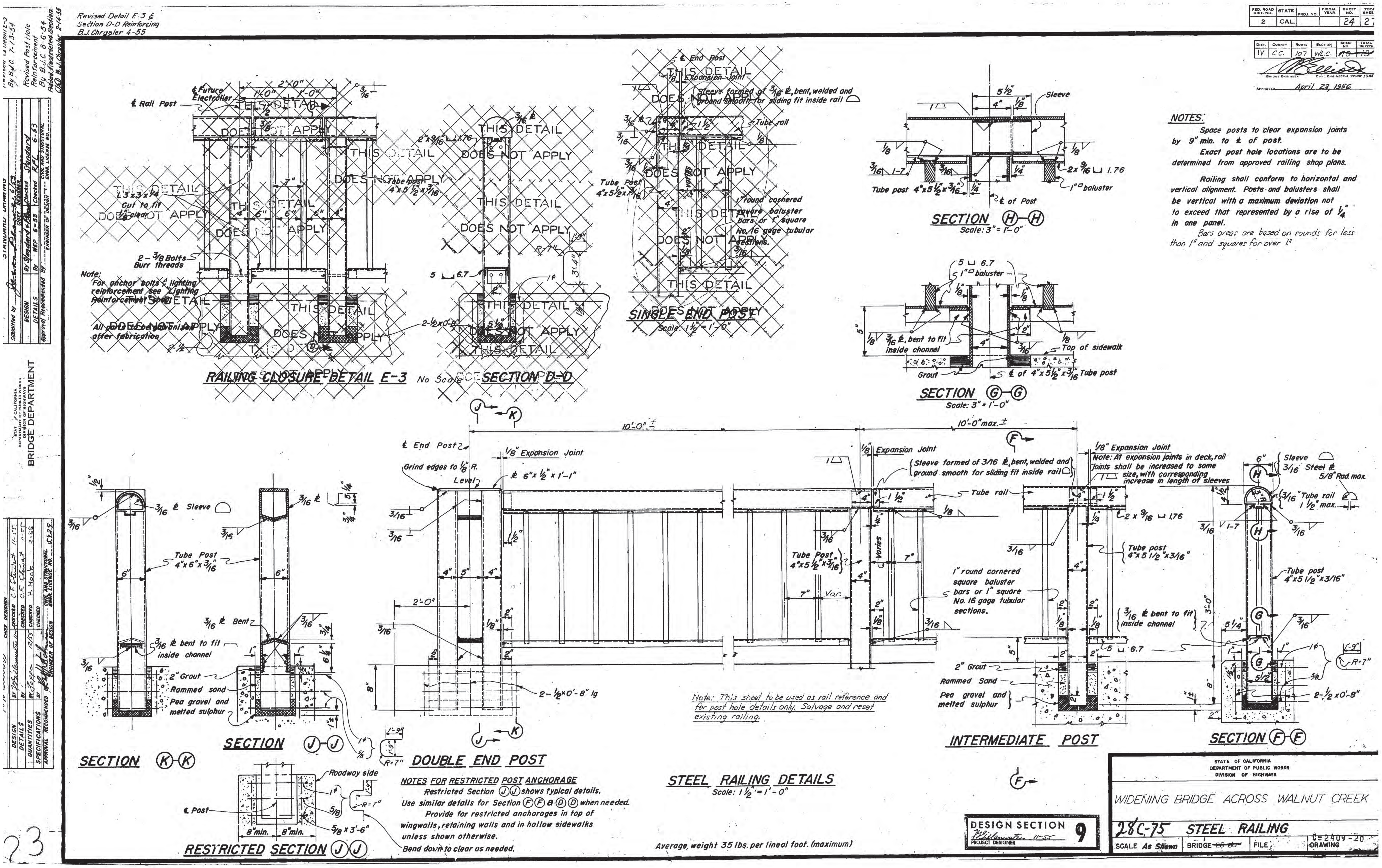
WIDENING BRIDGE ACROSS WALNUT CREEK

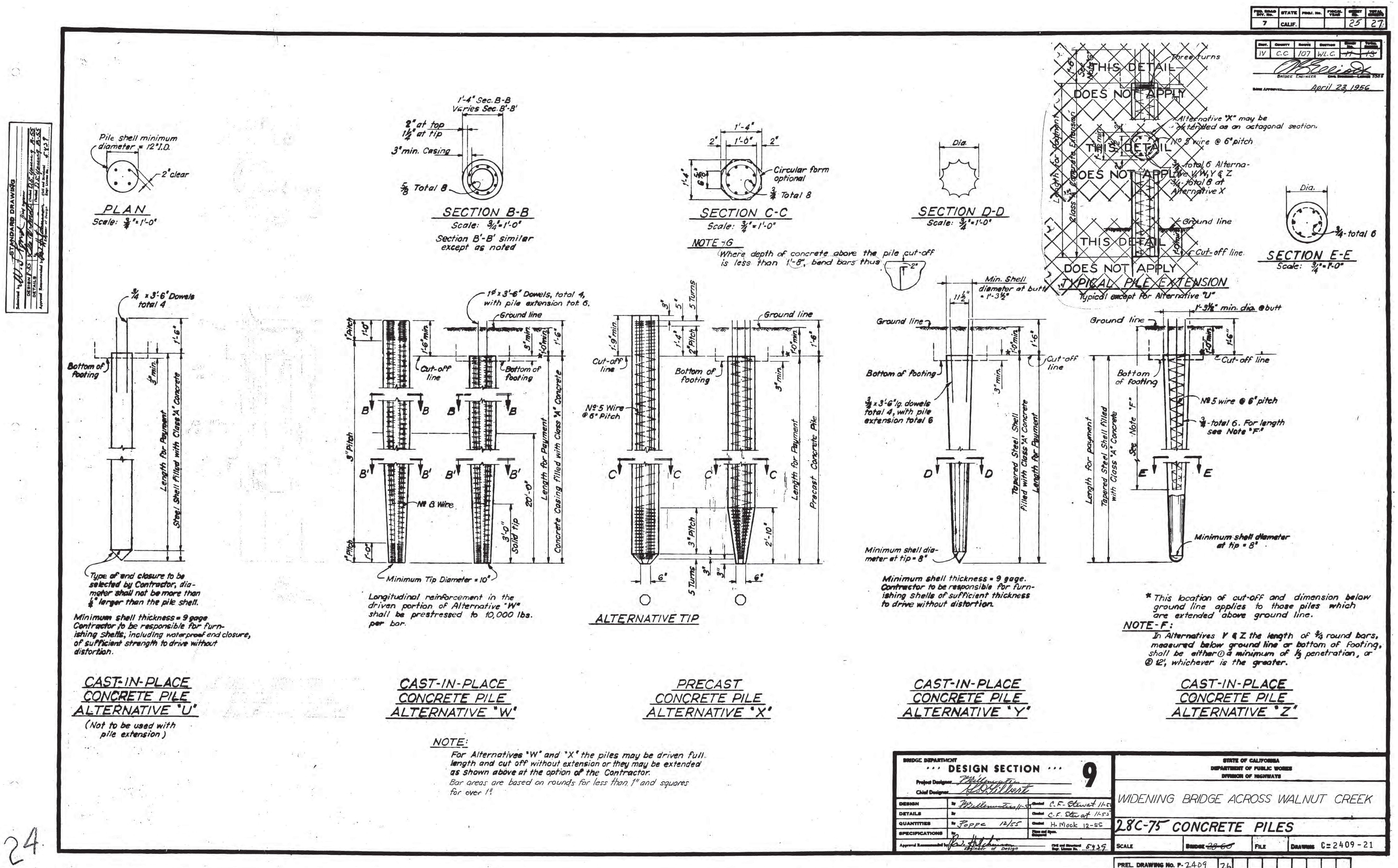
28C-75 MISCELLANEOUS DETAILS

SCALE As noted | BRIDGE ~~28-60~~ | FILE | DRAWING C-2409-19

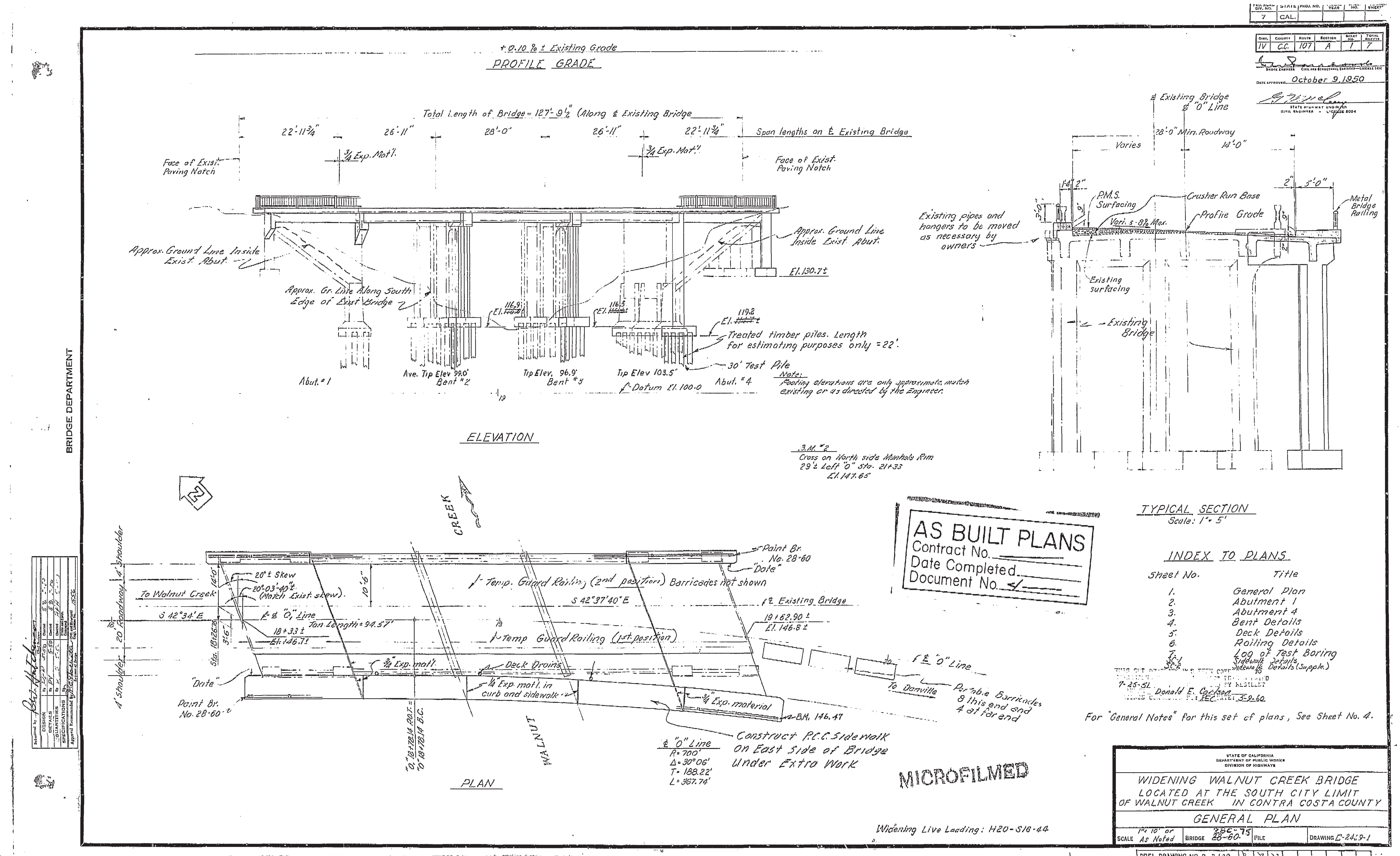
PREL. DRAWING No. P-2409 | 21 | 23 | 41

22


Revised Detail E-3 & Section D-D Reinforcing B.J.Chrysler 4-55
NOTES:
Space posts to clear expansion joints by 9" min. to ℄ of post.
Exact post hole locations are to be determined from approved railing shop plans.
Railing shall conform to horizontal and vertical alignment. Posts and balusters shall be vertical with a maximum deviation not to exceed that represented by a rise of 1/4 in one panel.
Bars areas are based on rounds for less than 1" and squares for over 1".
April 23, 1956
BRIDGE ENGINEER
RAILING CLOSURE DETAIL E-3 No Scale
SECTION D-D
SINGLE END POST Scale: 1 1/2" = 1'-0"
SECTION H-H Scale: 3" = 1'-0"
SECTION G-G Scale: 3" = 1'-0"
THIS DETAIL DOES NOT APPLY
SECTION K-K
SECTION J-J
DOUBLE END POST
INTERMEDIATE POST
SECTION F-F
RESTRICTED SECTION J-J
NOTES FOR RESTRICTED POST ANCHORAGE
Restricted Section J-J shows typical details.
Use similar details for Section F-F & D-D when needed.
Provide for restricted anchorages in top of wingwalls, retaining walls and in hollow sidewalks unless shown otherwise.
Bend down to clear as needed.
STEEL RAILING DETAILS Scale: 1 1/2" = 1'-0"
Note: This sheet to be used as rail reference and for post hole details only. Salvage and reset existing railing.
Average weight 35 lbs. per lineal foot. (maximum)
DESIGN SECTION 9
PROJECT DESIGNER
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
WIDENING BRIDGE ACROSS WALNUT CREEK
28C-75 STEEL RAILING
SCALE As Shown
BRIDGE DEPARTMENT

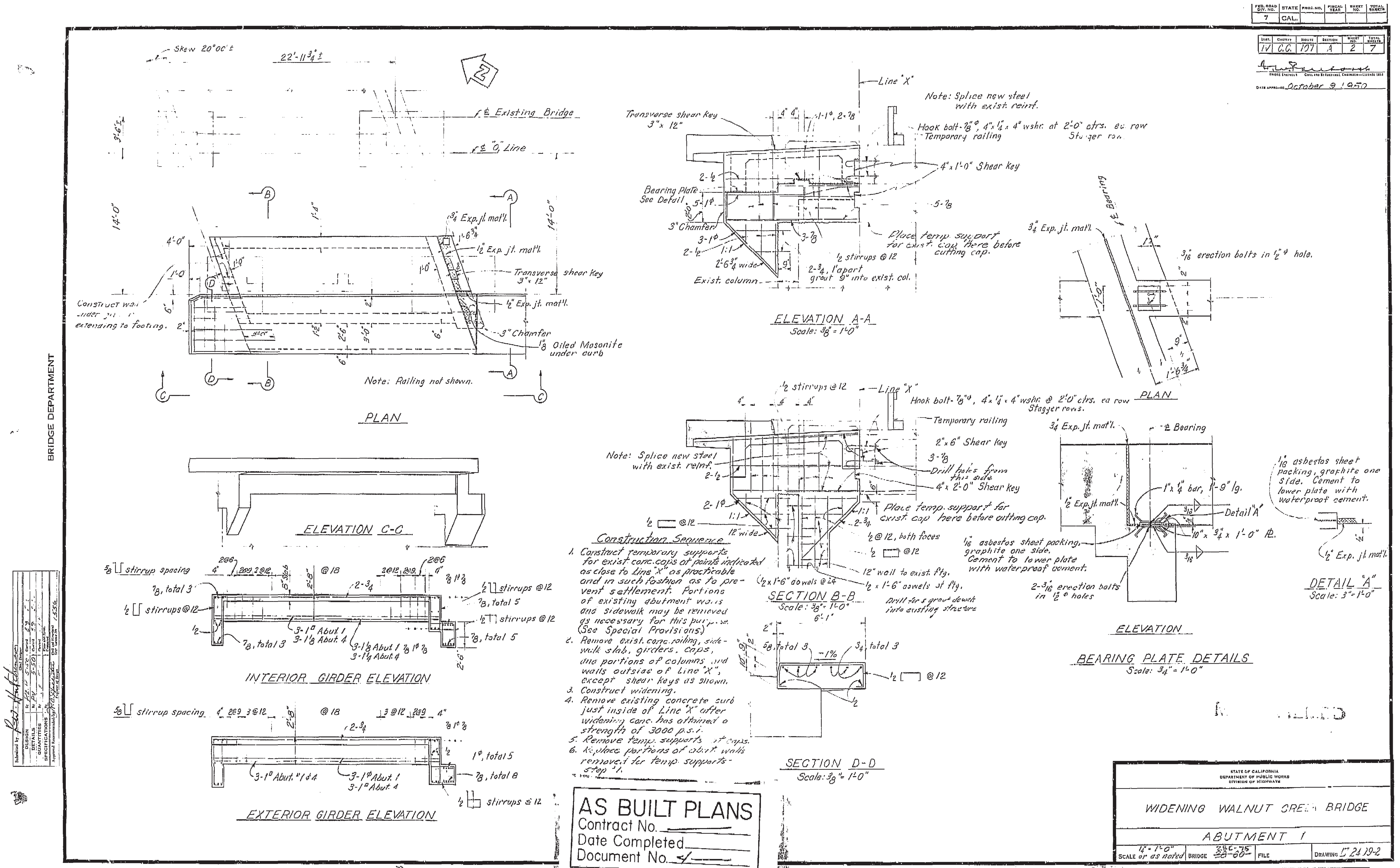

7 CALIF. 25 27
IV C.C. 107 W.L.C.
BRIDGE ENGINEER
April 23, 1956
STANDARD DRAWING
Pile shell minimum diameter = 12" I.D.
2" clear
PLAN
Scale: 3/4" = 1'-0"
1'-4" Sec. B-B
Varies Sec. B'-B'
2" at top
1½" at tip
3" min. Casing
5/8 Total 8
SECTION B-B
Scale: 3/4" = 1'-0"
Section B'-B' similar except as noted
1'-4"
1'-0"
Circular form optional
3/4 Total 8
SECTION C-C
Scale: 3/4" = 1'-0"
NOTE - G
Where depth of concrete above the pile cut-off is less than 1'-8", bend bars thus
Dia.
SECTION D-D
Scale: 3/4" = 1'-0"
THIS DETAIL DOES NOT APPLY
Three turns
Alternative "X" may be extended as an octagonal section.
Nº 5 wire @ 6" pitch
3/4 - total 6 Alternative V, W, Y & Z
3/4 - total 8 at Alternative X
Ground line
Cut-off line
TYPICAL PILE EXTENSION
Typical except for Alternative "U"
Dia.
3/4 - total 6
SECTION E-E
Scale: 3/4" = 1'-0"
3/4 x 3'-6" Dowels total 4
Bottom of Footing
Length for Payment
Steel Shell Filled with Class "A" Concrete
Type of end closure to be selected by Contractor, diameter shall not be more than ¼" larger than the pile shell.
Minimum shell thickness = 9 gage. Contractor to be responsible for furnishing shells, including waterproof end closure, of sufficient strength to drive without distortion.
1ϕ x 3'-6" Dowels, total 4, with pile extension tot. 6.
Ground line
Cut-off line
Bottom of footing
3" Pitch
Nº 6 Wire
Solid tip
Minimum Tip Diameter = 10"
Length for Payment
Concrete Casing Filled with Class "A" Concrete
Longitudinal reinforcement in the driven portion of Alternative "W" shall be prestressed to 10,000 lbs. per bar.
5 Turns
Cut-off line
Nº 5 Wire @ 6" Pitch
Bottom of footing
Length for Payment
Precast Concrete Pile
ALTERNATIVE TIP
Min. Shell diameter at butt = 1'-3½"
Ground line
Cut-off line
Bottom of footing
3/4 x 3'-6" lg. dowels total 4, with pile extension total 6
Tapered Steel Shell Filled with Class "A" Concrete
Length for Payment
Minimum shell diameter at tip = 8"
Minimum shell thickness = 9 gage. Contractor to be responsible for furnishing shells of sufficient thickness to drive without distortion.
1'-3½" min. dia. @ butt
Ground line
Cut-off line
Bottom of footing
Nº 5 wire @ 6" pitch
3/4 - total 6. For length see Note "F"
Length for payment
Tapered Steel Shell Filled with Class "A" Concrete
See Note "F"
Minimum shell diameter at tip = 8"
* This location of cut-off and dimension below ground line applies to those piles which are extended above ground line.
NOTE - F:
In Alternatives Y & Z the length of 3/4 round bars, measured below ground line or bottom of footing, shall be either ① a minimum of ⅓ penetration, or ② 12', whichever is the greater.
CAST-IN-PLACE CONCRETE PILE ALTERNATIVE "U"
(Not to be used with pile extension)
CAST-IN-PLACE CONCRETE PILE ALTERNATIVE "W"
PRECAST CONCRETE PILE ALTERNATIVE "X"
CAST-IN-PLACE CONCRETE PILE ALTERNATIVE "Y"
CAST-IN-PLACE CONCRETE PILE ALTERNATIVE "Z"
NOTE:
For Alternatives "W" and "X" the piles may be driven full length and cut off without extension or they may be extended as shown above at the option of the Contractor.
Bar areas are based on rounds for less than 1" and squares for over 1".
BRIDGE DEPARTMENT
DESIGN SECTION 9
Project Designer
Chief Designer
DESIGN
DETAILS
QUANTITIES Poppe 12/55
SPECIFICATIONS
Checked C. F. Stewart
Checked C. F. Stewart
Checked H. Mock 12-55
Engineer of Design
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
WIDENING BRIDGE ACROSS WALNUT CREEK
28C-75 CONCRETE PILES
SCALE
BRIDGE 28-60
FILE
DRAWING C=2409-21
PREL. DRAWING No. P-2409 26

24



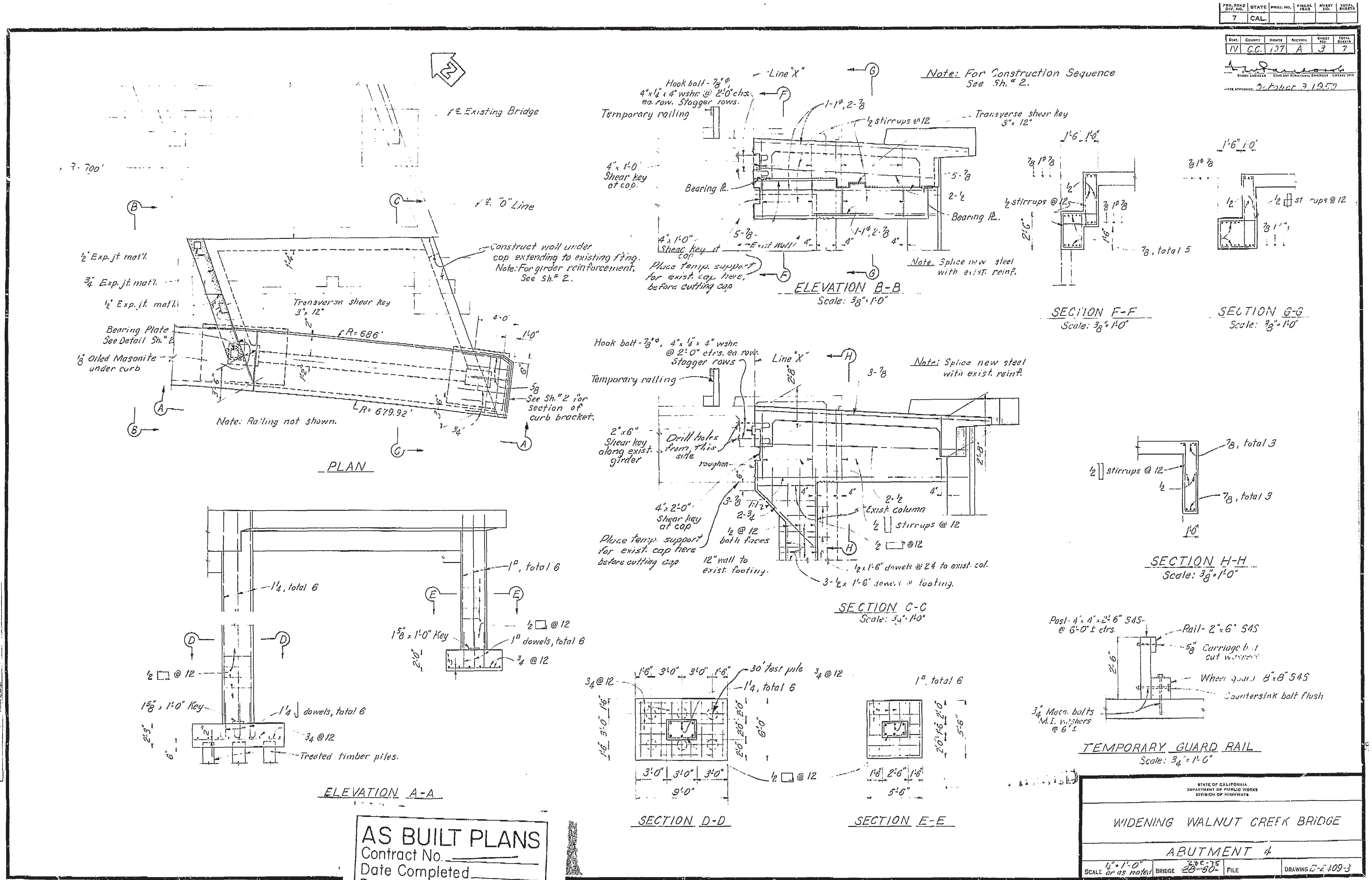
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

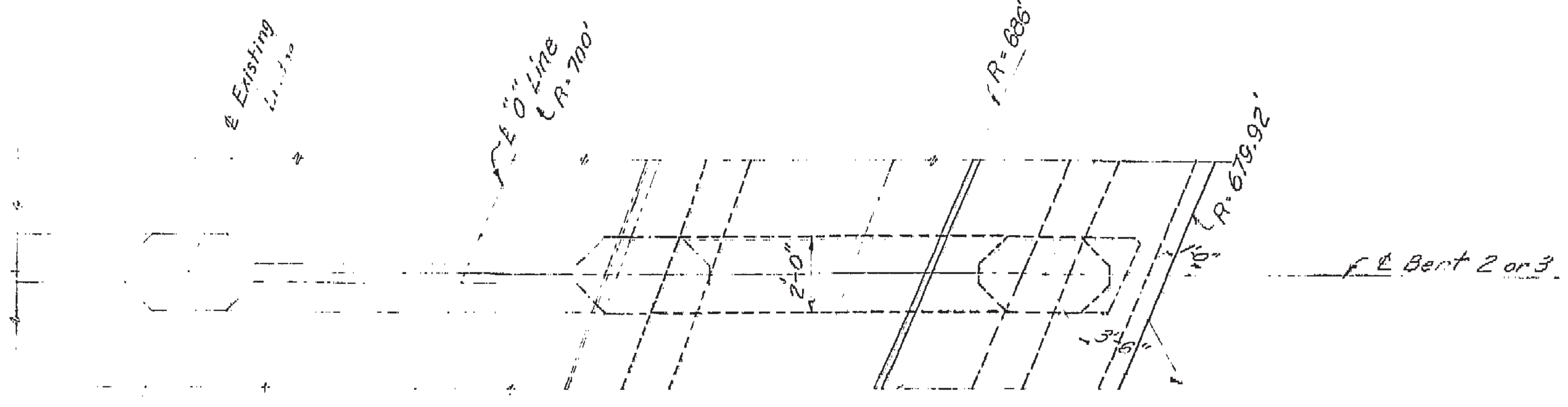
DATE 3/13/73 SIGNATURE TITLE



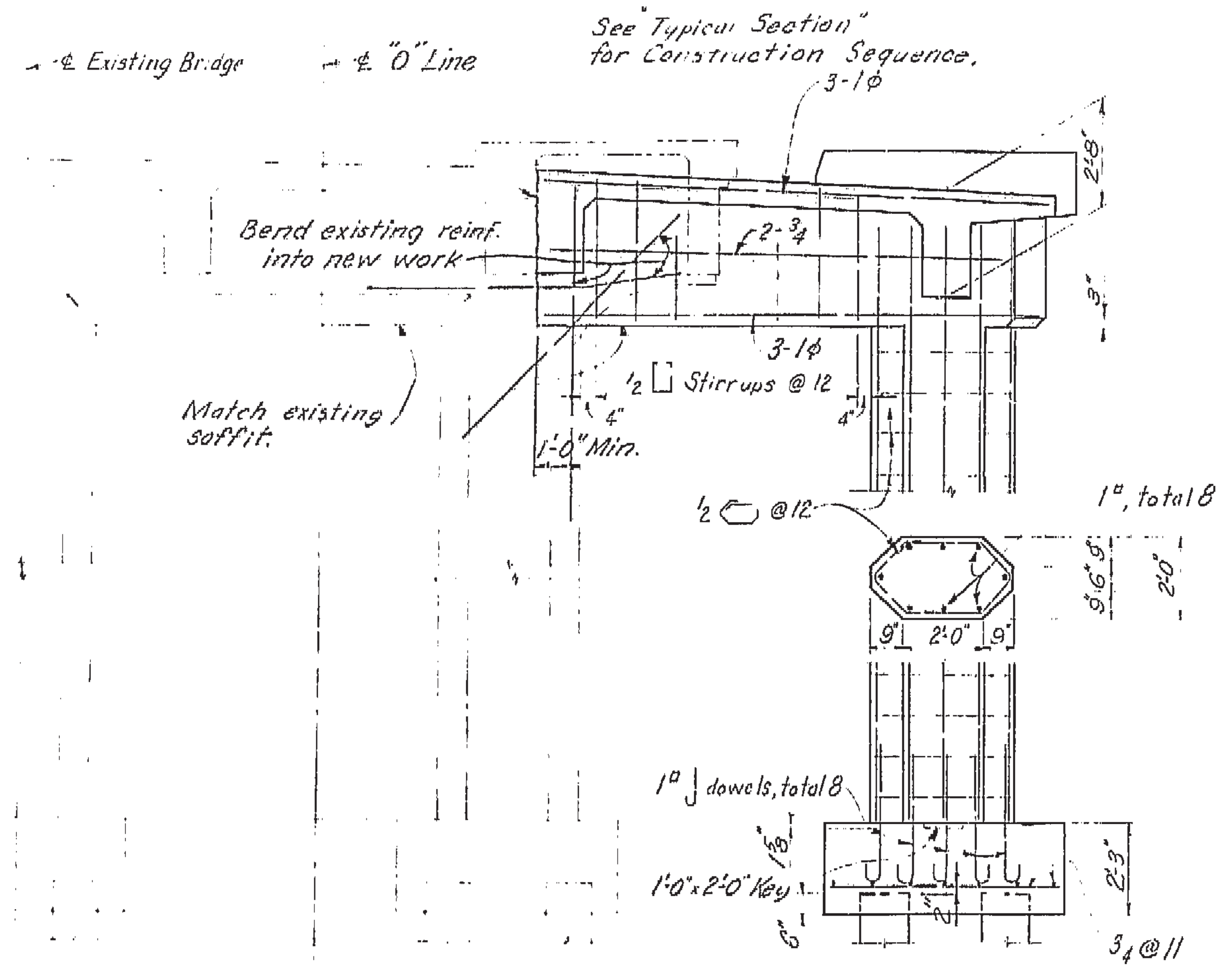
AS BUILT PLANS
Contract No. ________
Date Completed ________
Document No. ________

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

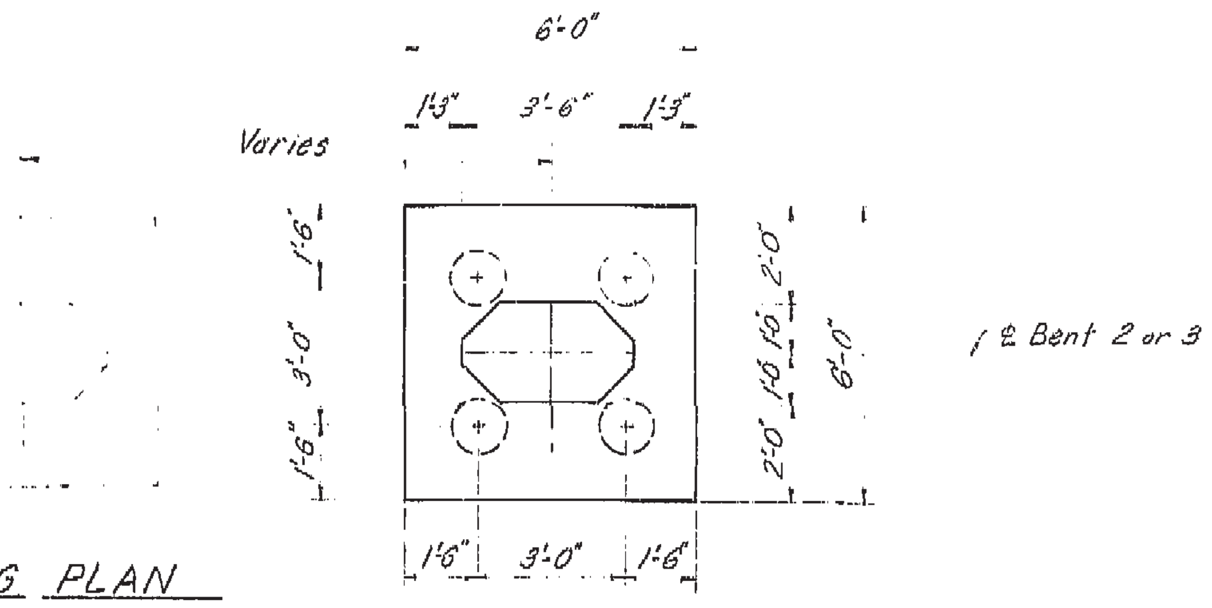
DATE 3/13/73 SIGNATURE ________ TITLE ________



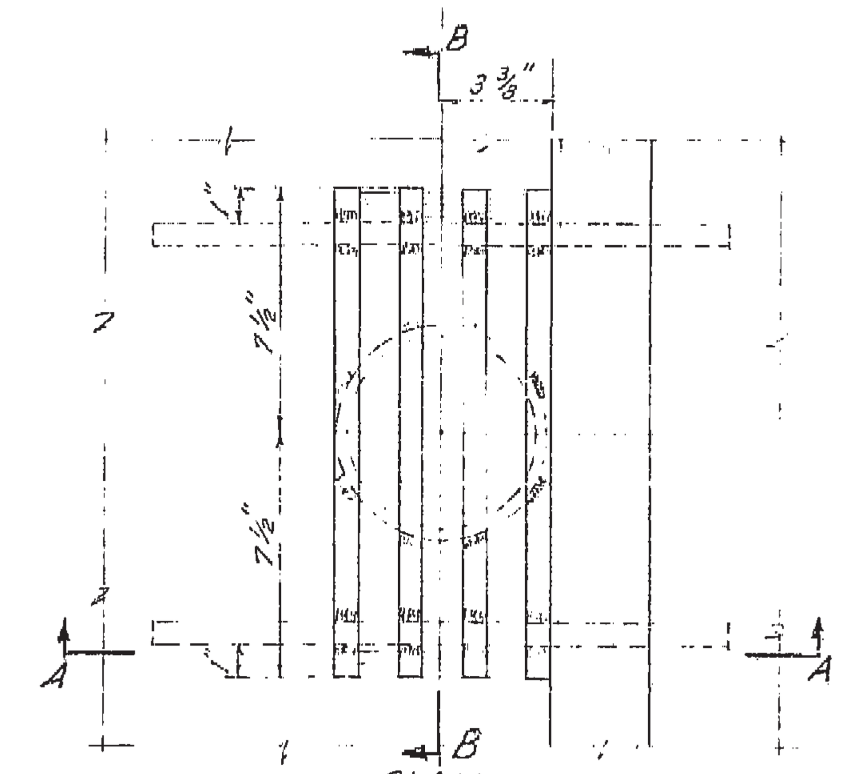
PLAN



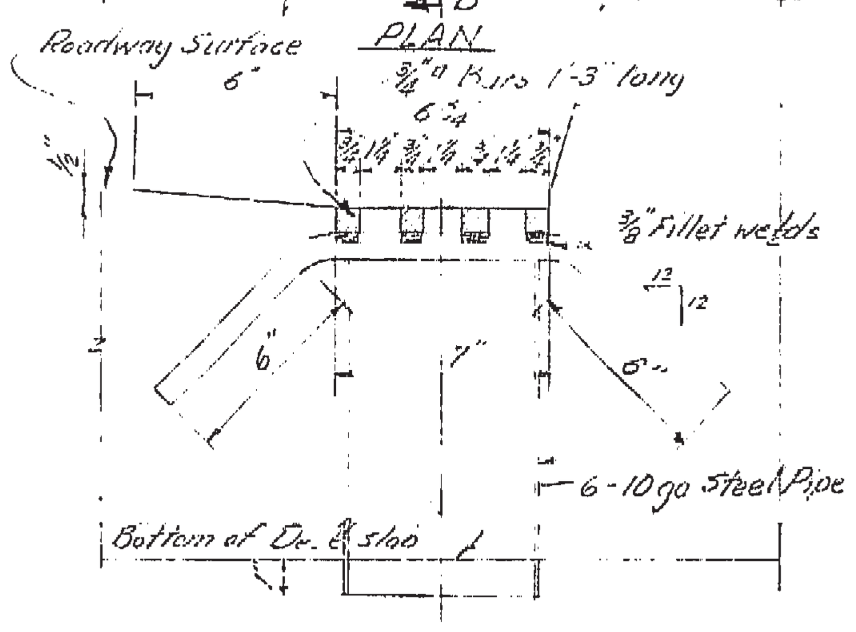
ELEVATION



FOOTING PLAN

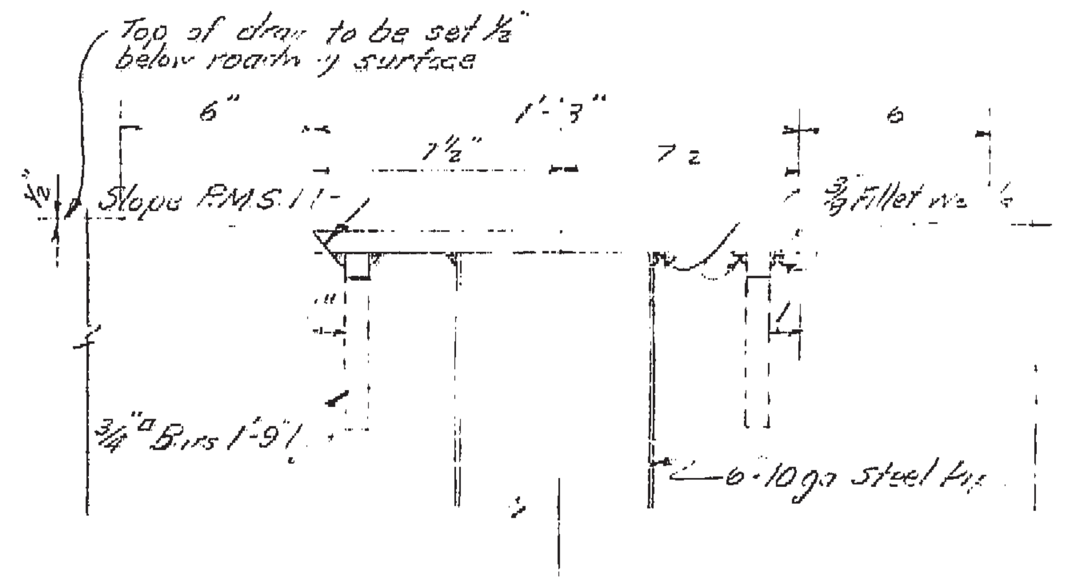


PLAN



SECTION A-A

DRAIN DETAIL
Scale 3" = 1'-0"



SECTION B-B

Note: Drains to be galvanized after all welding is completed.

GENERAL NOTES

Specifications:
Design: A.A.S.H.O dated 1949 with subsequent revisions and Bridge Department Supplement dated 1949.

Construction: Standard Specifications, Division of Highways, dated January 1949 and the Special Provisions.

Live Loading: H20-S12-44 for widening.

Unit Stresses: f_s = 20,000 p.s.i.; f_c = 1000 p.s.i.; n = 10.

Footing Pressure: 2 1/2 tons per sq. ft.

Pile Loading: 20 tons.

Reinforcement: Embedment is clear to outside of bar and is 2" to main reinforcement, except as noted. Hooks shall conform to the Manual of Standard Practice, A.C.I. Backing for hooks is four diameters, except as noted. Bar areas are based on rounds for less than 1" and squares for over 1". Bar deformations shall conform to A.S.T.M. A305-49. Bars in the top of thick slabs and girder stems having more than 12" of concrete under the bars shall be lapped 35 diameters and all other bars lapped 20 diameters where spliced.

Contractor shall verify all dependent dimensions in the field before ordering materials.

FED. ROAD DIV. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
IV	C.C.	75	A	4	7

BRIDGE ENGINEER — CIVIL AND STRUCTURAL ENGINEER
DATE APPROVED October 9, 1950

BRIDGE DEPARTMENT

DESIGN	
DETAILS	
QUANTITIES	
SPECIFICATIONS	

AS BUILT PLANS
Contract No. ____
Date Completed ____
Document No. 4

MICROFILMED

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING WALNUT CREEK BRIDGE

BENT DETAILS

SCALE 3/8" = 1'-0" | BRIDGE 28-60 | FILE | DRAWING 409-4

PREL. DRAWING NO. P 2409

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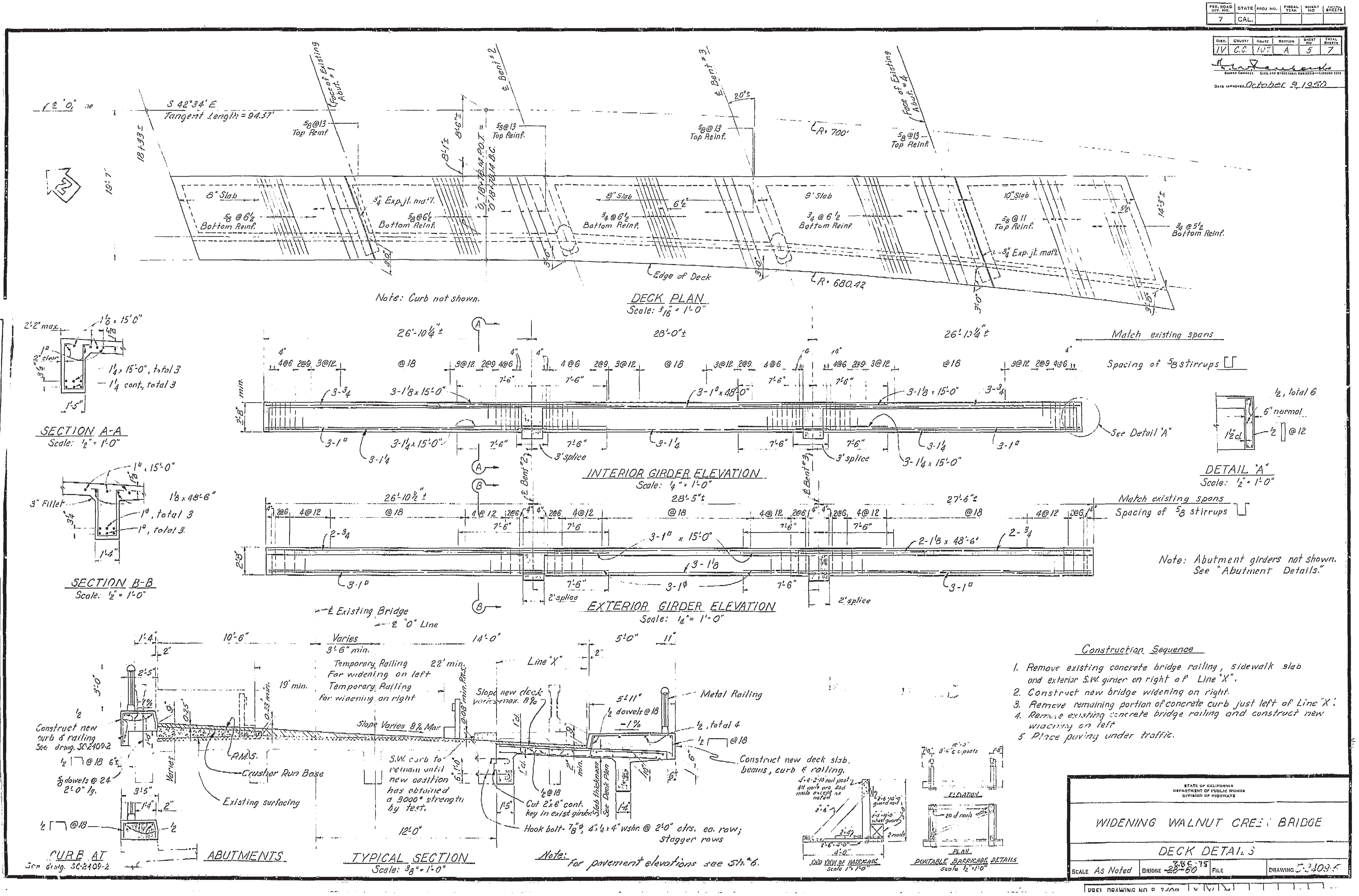
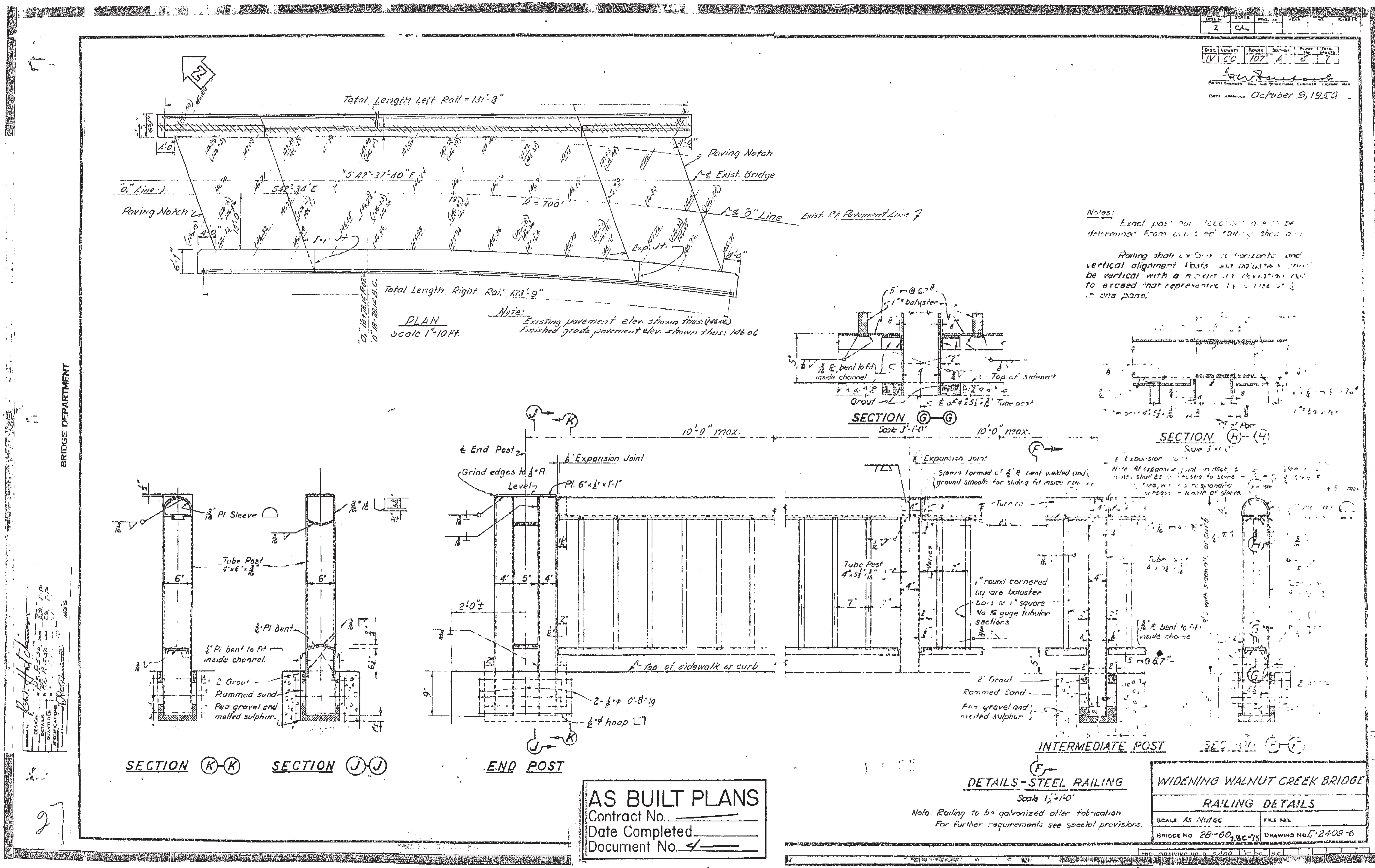
DATE 3/13/73 SIGNATURE ____ TITLE ____



AS BUILT PLANS
Contract No. ______
Date Completed ______
Document No. ______

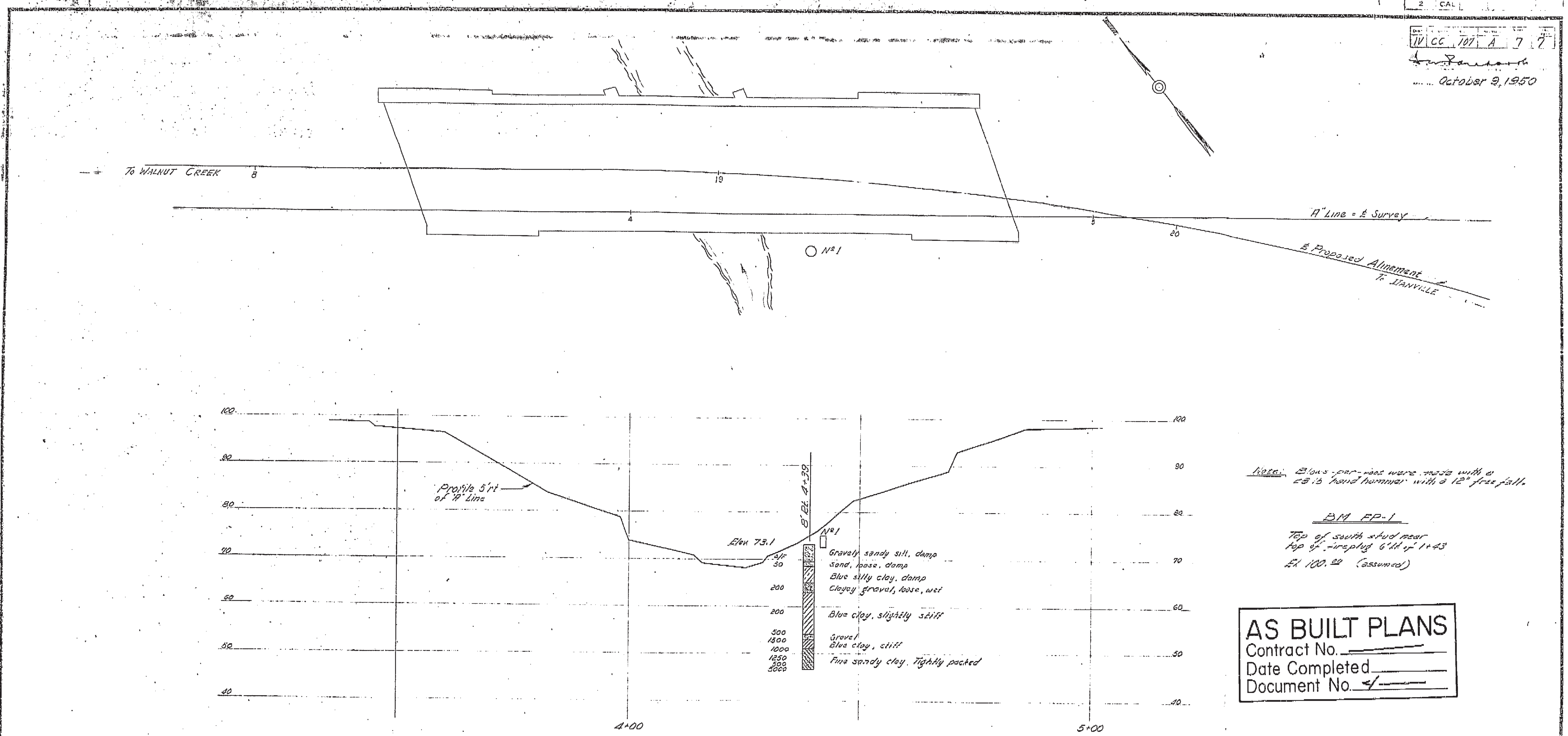
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 3/13/72 SIGNATURE [signature] TITLE SR. DMO.



AS BUILT PLANS
Contract No. ______
Date Completed ______
Document No. 4

Classification of Material Based on Standard Grade Size Limits

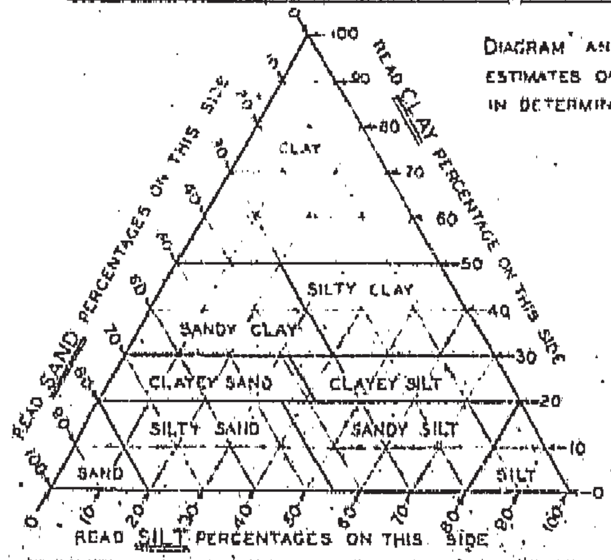


Diagram and table showing the basis for estimates of grade size distribution used in determination class names.

Grouping Used in Triangular Classification			
Class Name	Percentage of Size Present		
	Sand	Silt	Clay
Sand	80-100	0-20	0-20
Silty Sand	45-80	0-55	0-20
Sandy Silt	0-45	35-80	0-20
Silt	0-20	80-100	0-20
Clayey Sand	38-80	0-42	20-30
Clayey Silt	0-38	32-80	20-30
Sandy Clay	30-70	0-40	30-50
Silty Clay	0-30	20-70	30-50
Clay	0-50	0-50	50-100

If gravel is present in appreciable amounts the term "Gravelly" may be added to the class name, vis. "Gravelly sand". The terms "Coarse", "Medium" and "Fine" when used to describe Gravel, Sand and Silt refer to Standard Grade Size limits.

Legend of Boring Operations

- Plan of any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Penetrometer driven
- 2" Sampler boring
- 2" to 5" Auger boring
- 6" to 20" Auger boring
- Casing driven
- Jet boring
- (S) Sample taken

The appropriate boring symbols designating the method of operation are shown at the upper right-hand corner of the respective boring. Where tool changes were made during the boring operation symbols are shown at the point of change.

Legend of Earth Materials

- Gravel — G
- Sand — S
- Silt — Si
- Clay — C
- Silty Sand — Si S
- Clayey Sand — C S
- Sandy Silt — S Si
- Clayey Silt — C Si
- Sandy Clay — SC
- Silty Clay — Si C
- Peat and Organic Clay — O
- Sandstone — SS
- Shale — Sh
- Broken Rock (Fragments) — Br
- Rock — R

Abbreviations

El 69.4	Elevation of ground at test hole
bpf	Blows per foot — (see note above)
P	Pulled pipe
M	Moisture as % dry weight
El 64.3 at 6-12-49	Elevation of ground water and date

Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

MICROFILMED

WALNUT CREEK BR. WIDENING

LOG OF TEST BORINGS

Scale 1" = 10'

Bridge No. 28-60

File No.

Drawing No. U-2409-7

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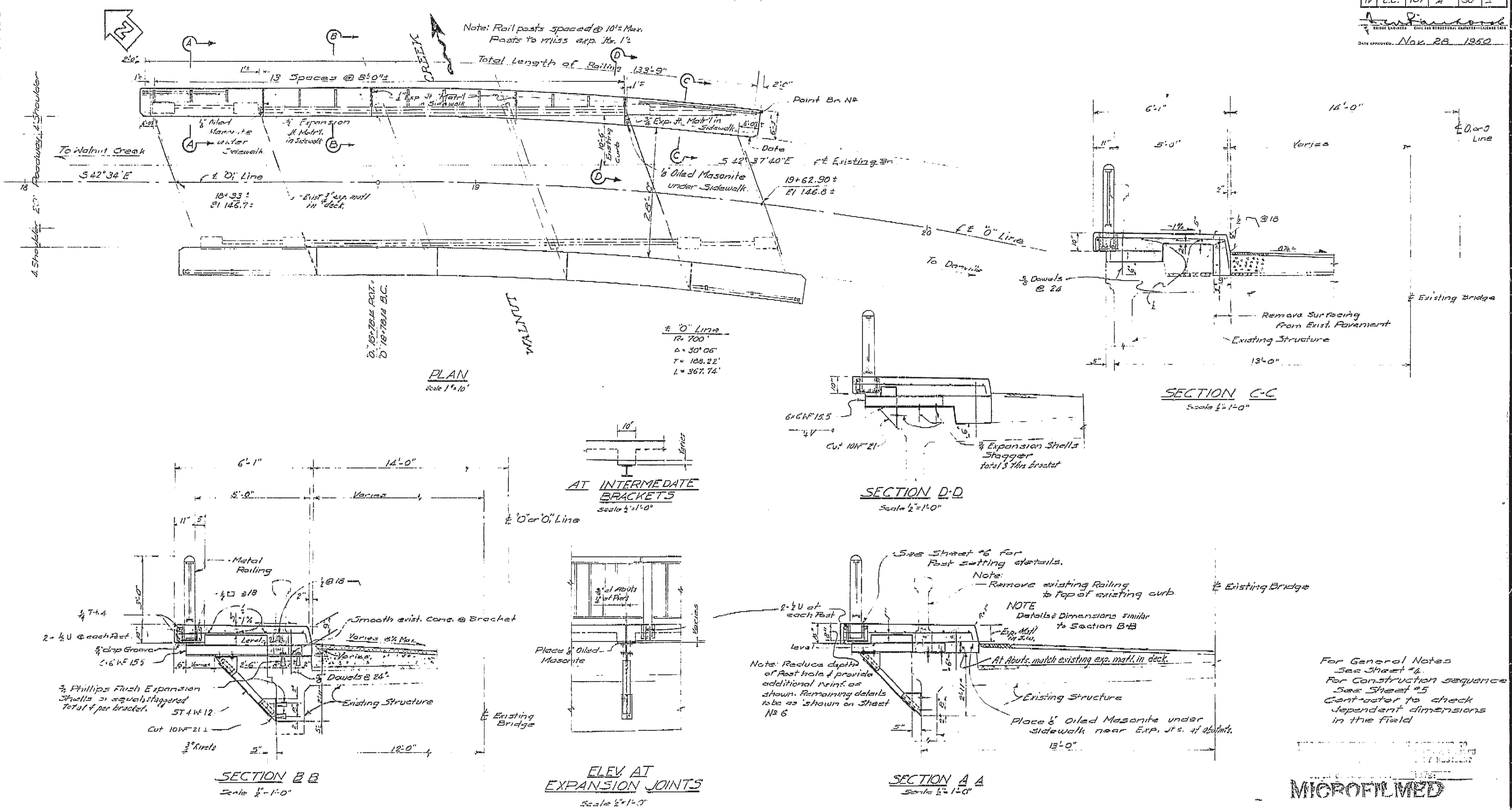
DATE 3/13/77 SIGNATURE James E. ___ TITLE Sr. DMR.



DIV. NO.	STATE	PROJ. NO.	YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
IV	C.C.	107	A		

BRIDGE ENGINEER

DATE APPROVED Nov. 28, 1950

BRIDGE DEPARTMENT

For General Notes See Sheet #4.
For Construction sequence See Sheet #5
Contractor to check dependent dimensions in the field

MICROFILMED

Dimension Corrected ~ R&P ~ 11-20-51

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WIDENING WALNUT CREEK BRIDGE
LOCATION - SOUTH CITY LIMITS OF WALNUT CREEK IN CONTRA COSTA COUNTY

SIDEWALK DETAILS

SCALE As Noted | BRIDGE 28-60 | FILE | DRAWING SC-2409-1

AS BUILT PLANS
Contract No.
Date Completed
Document No. 4

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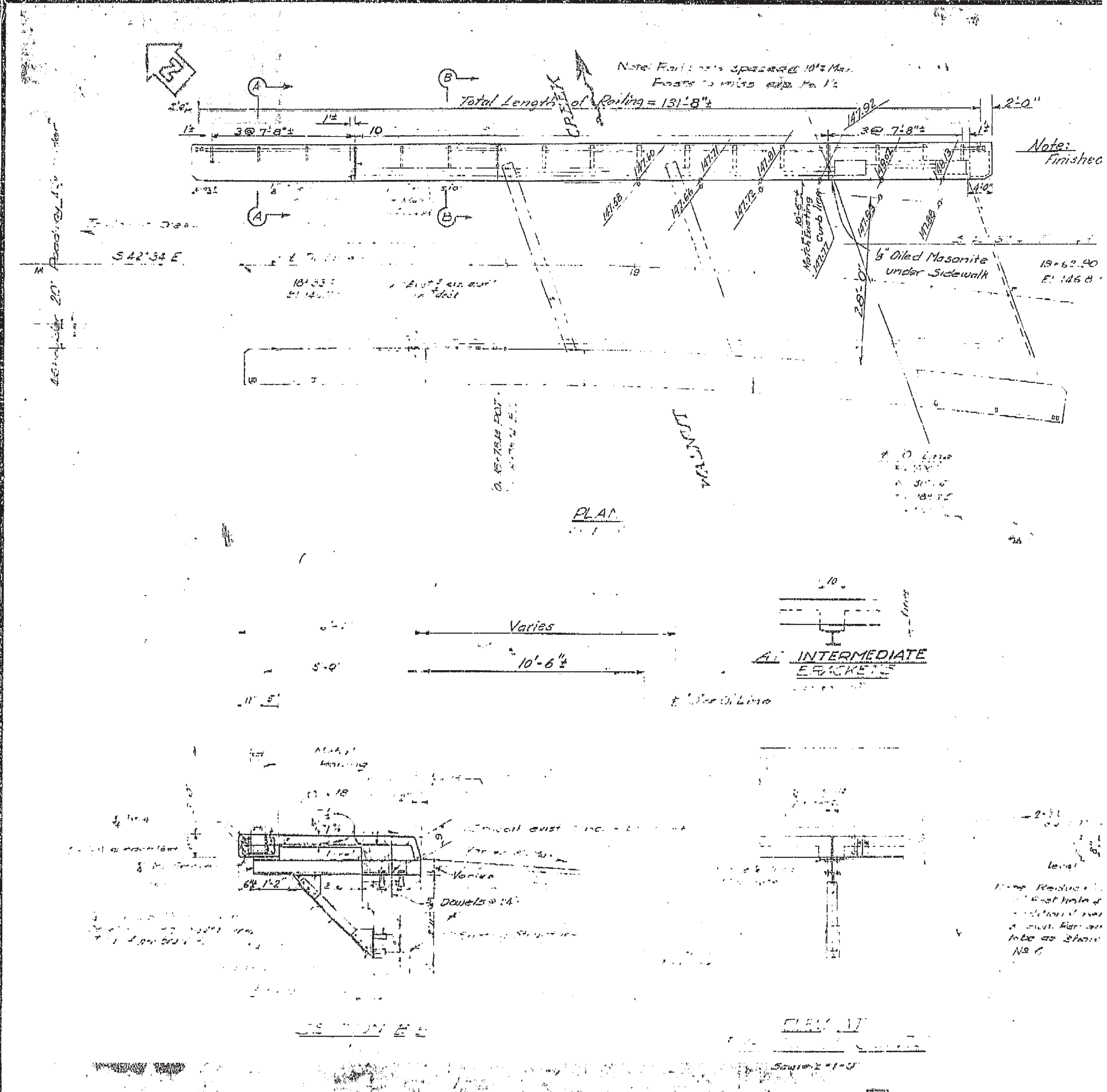
DATE ______ SIGNATURE ______ TITLE ______

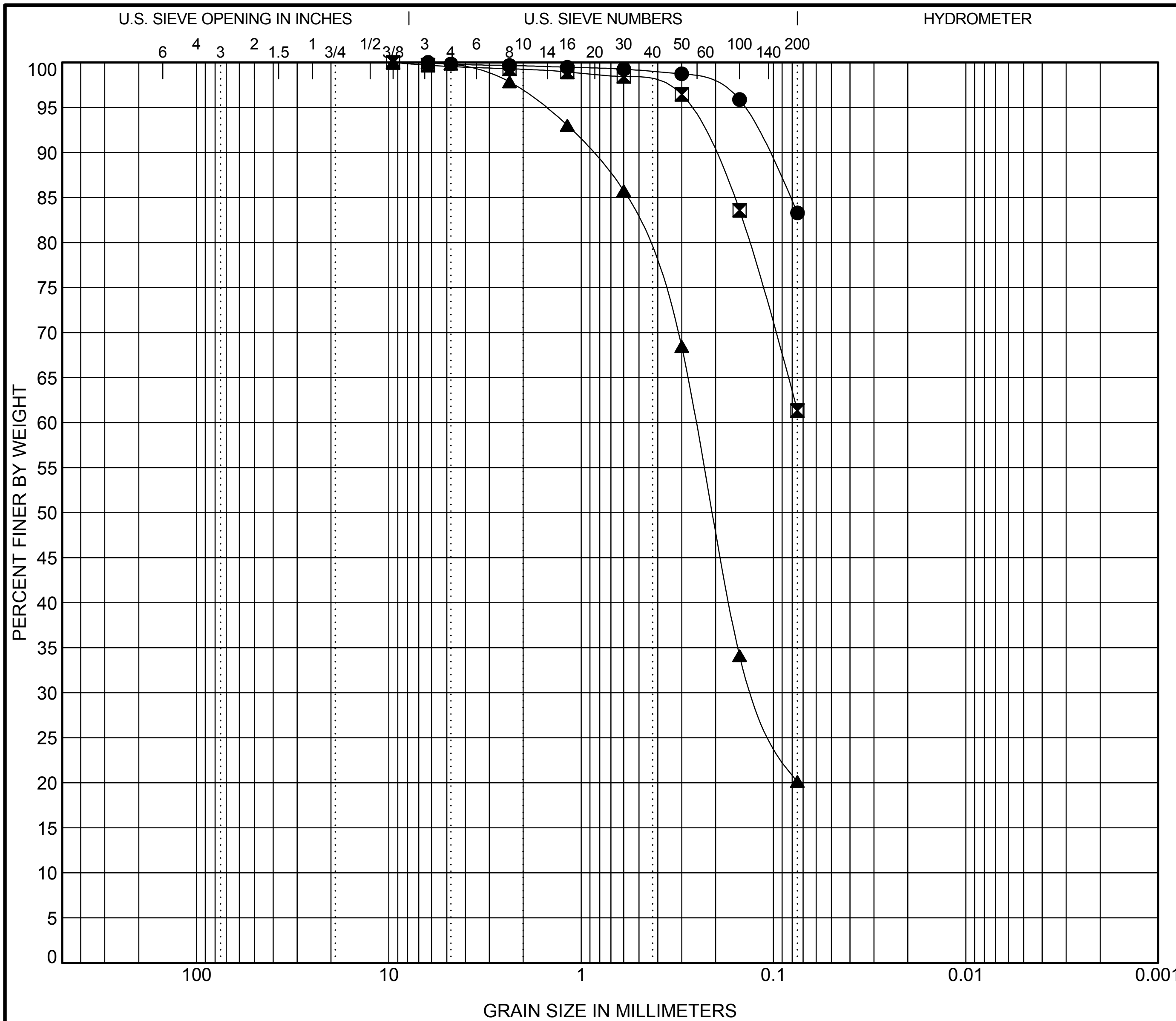
BRIDGE DEPARTMENT



AS BUILT PLA
Contract No.
Date Completed
Document No.

I HERE
UNDER
AUTHOR
DATE

Appendix III. Laboratory Test Results



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**R-17-001**	**5.0**	**LEAN CLAY with SAND (CL)**	**42**	**18**	**24**		
⊠	**R-17-001**	**25.0**	**SANDY LEAN CLAY (CL)**	**35**	**17**	**18**		
▲	**R-17-001**	**45.0**						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-17-001**	**5.0**	**6.25**				**0.2**	**16.5**	**83.3**	
⊠	**R-17-001**	**25.0**	**9.5**				**0.4**	**38.2**	**61.3**	
▲	**R-17-001**	**45.0**	**9.5**	**0.253**	**0.122**		**0.2**	**79.7**	**20.1**	

WRECO
8331 Sierra College Blvd.
Suite 208
Roseville, CA 95661
(916) 757-6150

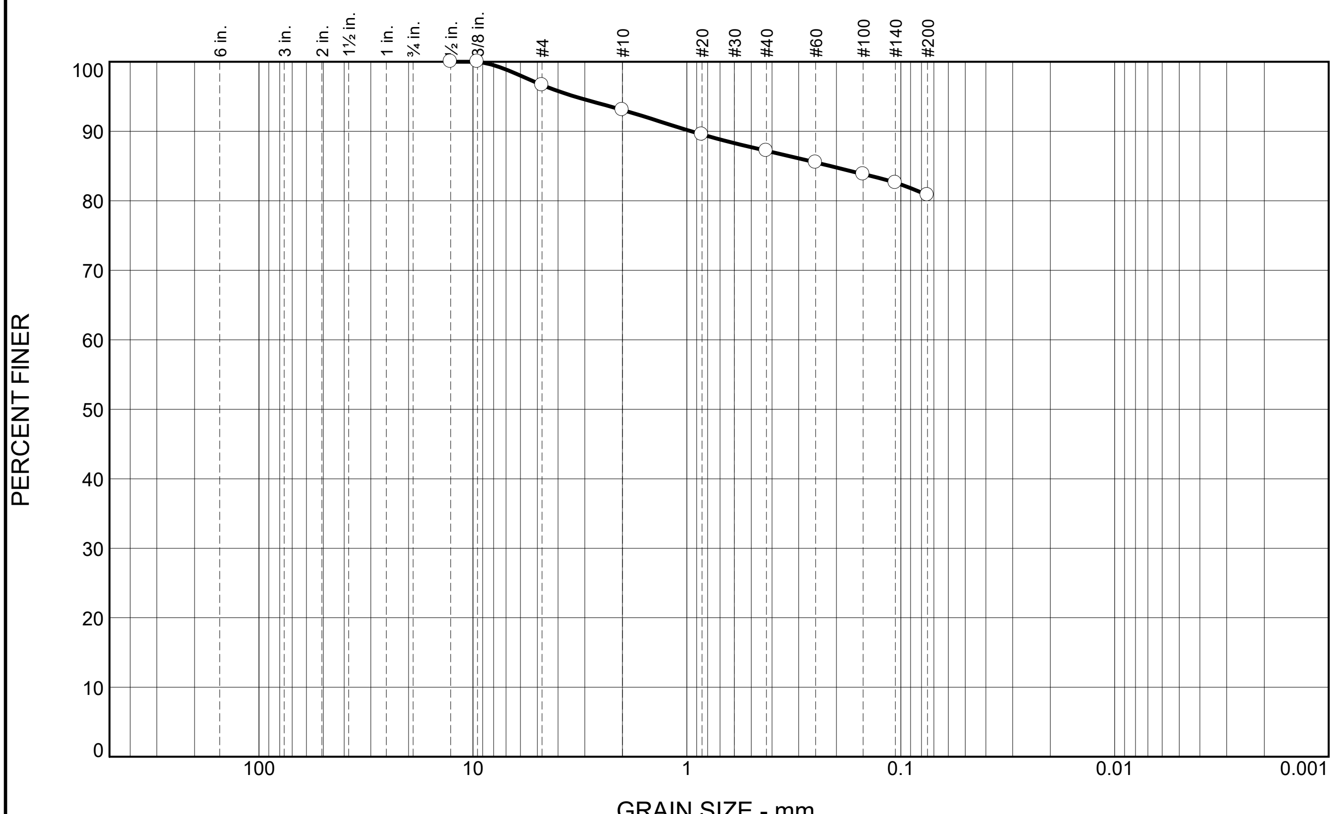
GRAIN SIZE DISTRIBUTION

DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Contra Costa**			**P17043**

PROJECT OR BRIDGE NAME
Las Trampas Creek Bridge Replacement Project

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	A. Kahn	**8-3-17**	**1 of 1**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	3.5	5.9	6.4	80.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	100.0		
#4	96.6		
#10	93.1		
#20	89.5		
#40	87.2		
#60	85.5		
#100	83.8		
#140	82.6		
#200	80.8		

* (no specification provided)

Material Description

Lean CLAY with SAND, very dark gray

Atterberg Limits

PL= 17 LL= 45 PI= 28

Coefficients

D_{90}= 0.9562 D_{85}= 0.2143 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(22)

Remarks

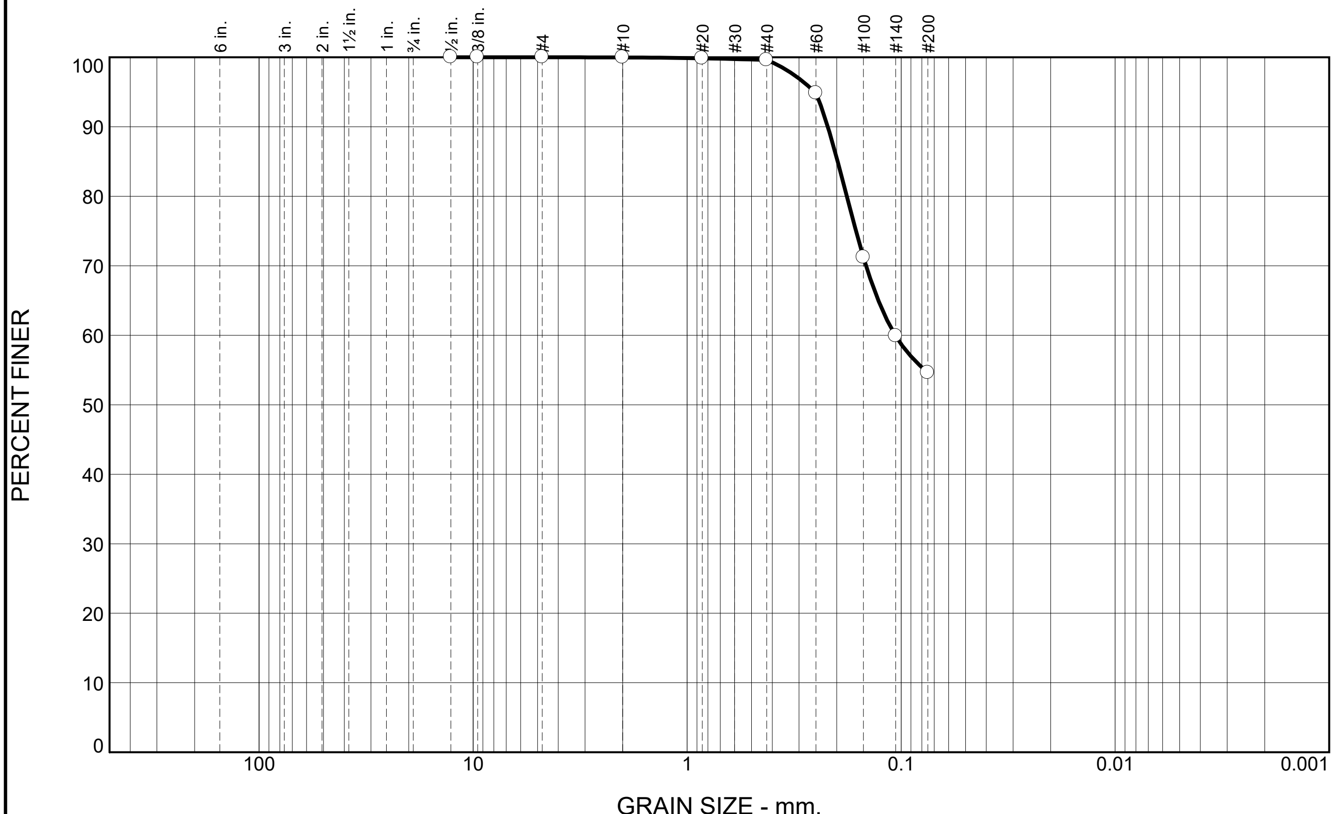
Source of Sample: P17043 Las Trampas **Depth:** 11.0'
Sample Number: R-18-001, S-1 **Date:** 11/6/18

Blackburn Consulting

W. Sacramento, CA

Client: WRECO
Project: WRECO Lab Testing
Project No: 3390.X **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	45.0	54.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.6		
#60	94.8		
#100	71.2		
#140	59.9		
#200	54.6		

* (no specification provided)

Material Description

SANDY SILT, black

Atterberg Limits

PL= 21 LL= 23 PI= 2

Coefficients

D_{90}= 0.2201 D_{85}= 0.1980 D_{60}= 0.1065
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

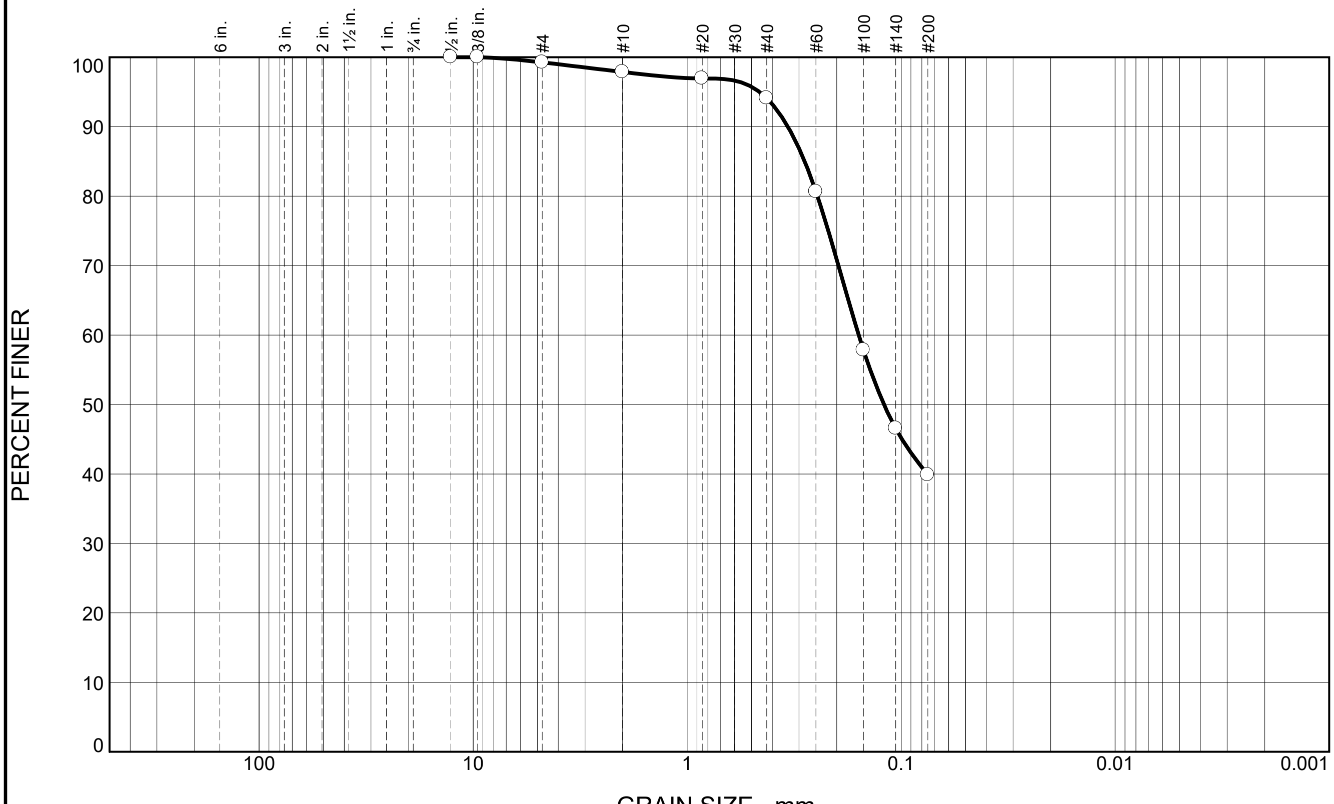
Source of Sample: P17043 Las Trampas **Depth:** 31.0'
Sample Number: A-18-001, S-5 **Date:** 11/6/18

Blackburn Consulting

W. Sacramento, CA

Client: WRECO
Project: WRECO Lab Testing
Project No: 3390.X **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	1.3	3.8	54.3	39.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	100.0		
#4	99.2		
#10	97.9		
#20	96.9		
#40	94.1		
#60	80.6		
#100	57.8		
#140	46.6		
#200	39.8		

* (no specification provided)

Material Description

SILTY SAND, very dark gray

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.3383 D_{85}= 0.2824 D_{60}= 0.1579
D_{50}= 0.1203 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

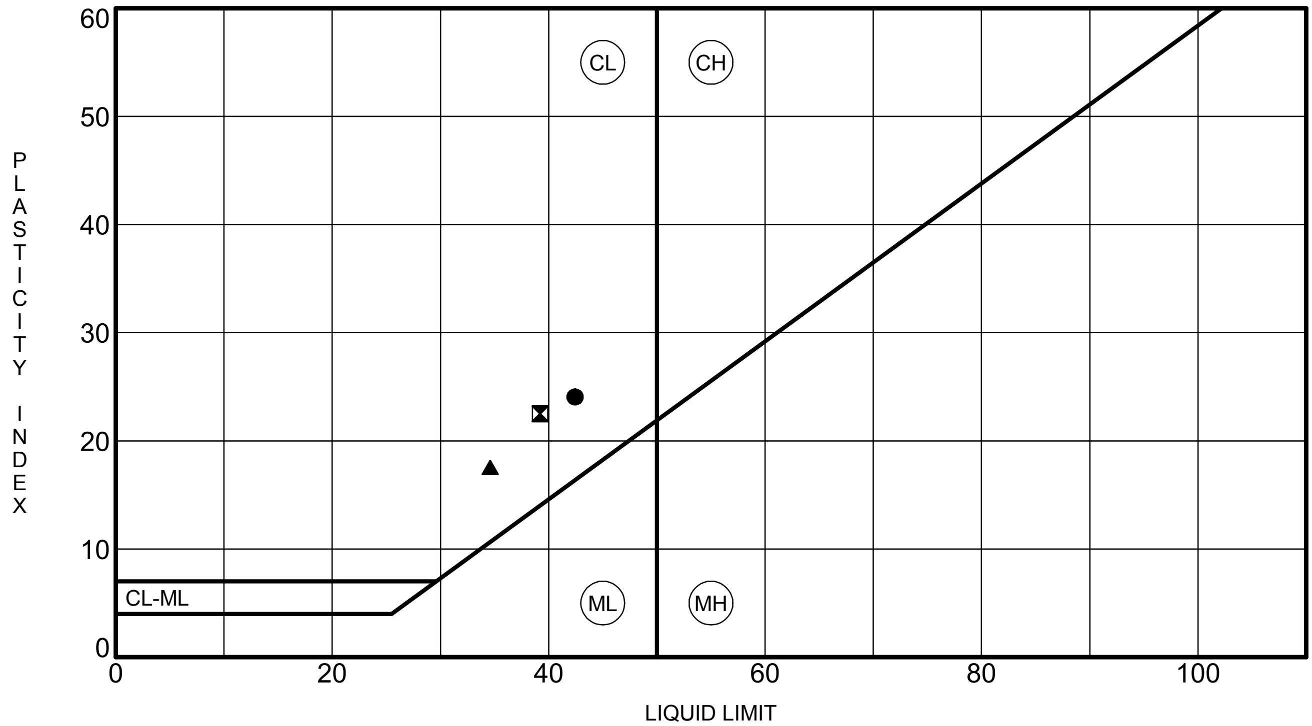
Source of Sample: P17043 Las Trampas **Depth:** 51.0'
Sample Number: R-18-001, S-9

Date: 11/9/18

Blackburn Consulting

W. Sacramento, CA

Client: WRECO
Project: WRECO Lab Testing
Project No: 3390.X **Figure**



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**R-17-001**	**5.0**	**42**	**18**	**24**	**83**	**LEAN CLAY with SAND (CL)**
⧗	**R-17-001**	**20.0**	**39**	**17**	**22**		
▲	**R-17-001**	**25.0**	**35**	**17**	**18**	**61**	**SANDY LEAN CLAY (CL)**

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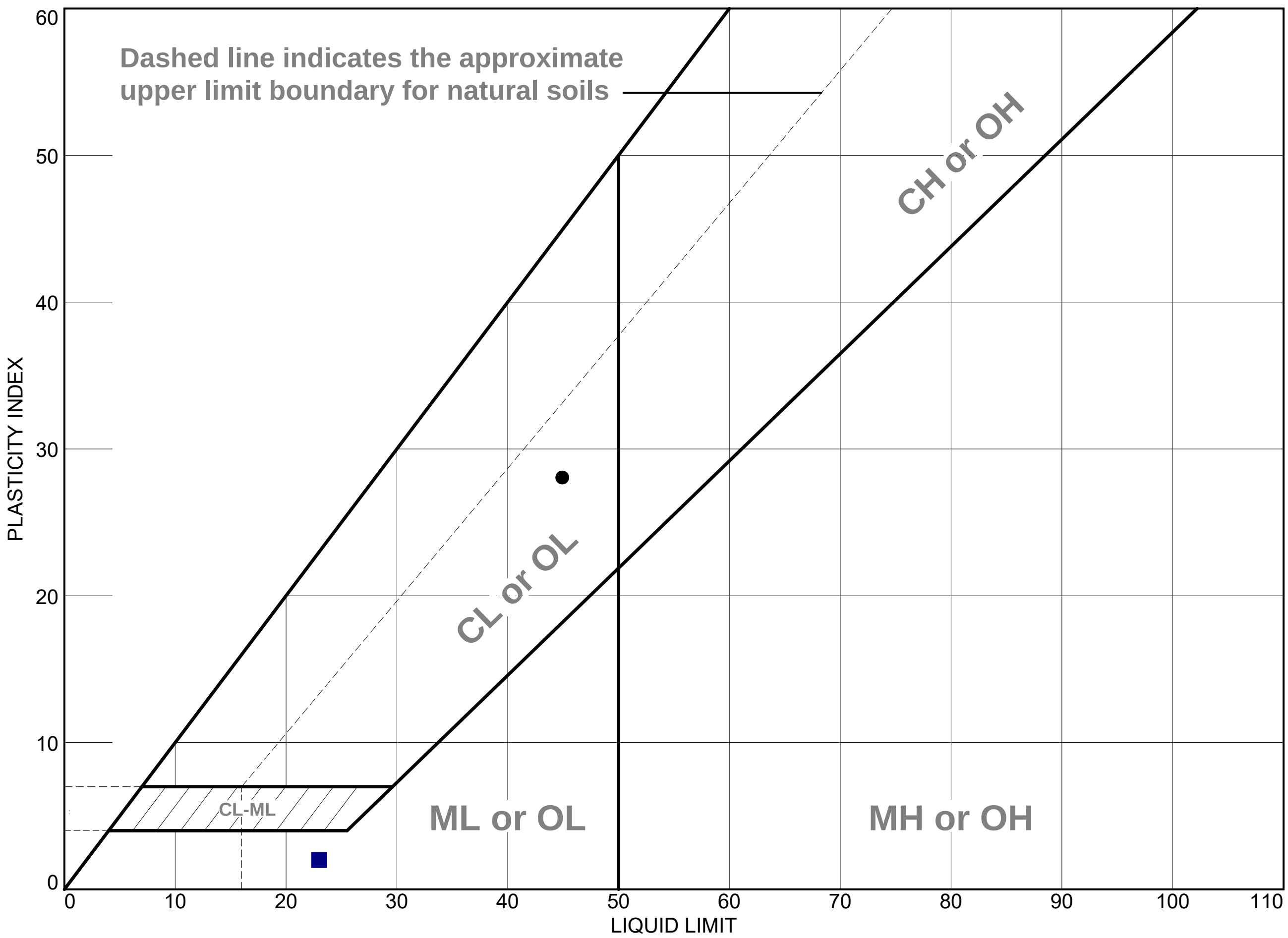
ATTERBERG LIMITS RESULTS

DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Contra Costa**			**P17043**

PROJECT OR BRIDGE NAME
Las Trampas Creek Bridge Replacement Project

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	A. Kahn	**8-3-17**	**1 of 1**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLAY with SAND, very dark gray	45	17	28	87.2	80.8	CL
■	SANDY SILT, black	23	21	2	99.6	54.6	ML
▲	SILTY SAND, very dark gray	NP	NP	NP	94.1	39.8	SM

Project No. 3390.X **Client:** WRECO

Project: WRECO Lab Testing

●**Source:** P17043 Las Trampas **Depth:** 11.0' **Sample No.:** R-18-001, S-1
■**Source:** P17043 Las Trampas **Depth:** 31.0' **Sample No.:** R-18-001, S-5
▲**Source:** P17043 Las Trampas **Depth:** 51.0' **Sample No.:** R-18-001, S-9

Remarks:

Blackburn Consulting

W. Sacramento, CA

Figure

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 08/23/2017
Date Submitted 08/16/2017

To: Ray Downes
WRECO
8331 Sierra College Blvd. 208
Roseville, CA 95661

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : P17043-LAS TRAMPAS Site ID : R-17-001 S-5@20.
Thank you for your business.

* For future reference to this analysis please use SUN # 75030-156596.

EVALUATION FOR SOIL CORROSION

Soil pH	7.03		
Minimum Resistivity	1.10 ohm-cm (x1000)		
Chloride	4.2 ppm	00.00042	%
Sulfate	7.7 ppm	00.00077	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 11/14/2018
Date Submitted 11/07/2018

To: Orion Adah
WRECO
8331 Sierra College Blvd. 208
Roseville, CA 95661

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager \

The reported analysis was requested for the following location:
Location : P17043 LAS TRAMPAS Site ID : A18-001 S-10@56.
Thank you for your business.

* For future reference to this analysis please use SUN # 78457-164073.

EVALUATION FOR SOIL CORROSION

Soil pH	7.90	
Minimum Resistivity	1.29 ohm-cm (x1000)	
Chloride	14.5 ppm	00.00145 %
Sulfate	92.9 ppm	00.00929 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Appendix IV. Analyses and Calculations

Appendix IV.1 Preliminary Seismic Analysis

Project Name: Las Trampas Creek Bridge | **Completed By:** A. Kahn | on 09/20/17
Project Number: P17043 | **Checked By:** | on

Estimating Average Small Strain Shear Wave Velocity (VS30) for Top 100FT
Ref: Caltrans Geotechnical Services Design Manual Version 1.0 (Aug 2009)

Boring Number: R-17-001

1 m = 3.28084 ft

COHESIONLESS — Using SPT (1) Sykora (1987), ER = 72; Using CPT (2) Mayne (2007)

Layer	Method Used	Depth to Top (FT)	Depth To Bottom (FT)	SPT (1) N_{ave}	SPT (1) N_{60}	SPT (1) V_S (m/s)	SPT (1) V_S (m/s) Confined	CPT (2) q_{t_ave} (MPa)	CPT (2) Effective Overburden	CPT (2) V_S (m/s)	CPT (2) V_S (m/s) Confined
1	3	0	8	0	0	1	1	0	0	1	1
2	3	8	14	0	0	1	1	0	0	1	1
3	3	14	18	0	0	1	1	0	0	1	1
4	3	18	23	0	0	1	1	0	0	1	1
5	3	23	28	0	0	1	1	0	0	1	1
6	3	28	33	0	0	1	1	0	0	1	1
7	3	33	38	0	0	1	1	0	0	1	1
8	1	38	43	12	14.4	217.816705	217.81671	0	0	1	1
9	1	43	48	25	30	269.482908	269.48291	0	0	1	1
10	1	48	55	12	14.4	217.816705	217.81671	0	0	1	1
11	1	55	63	40	48	308.83465	308.83465	0	0	1	1
12	1	63	73	70	84	363.251198	363.2512	0	0	1	1
13	1	73	80.1	70	84	363.251198	363.2512	0	0	1	1
14	0	0	0	0	0	1	1	0	0	1	1
15	0	0	0	0	0	1	1	0	0	1	1
16	0	0	0	0	0	1	1	0	0	1	1
17	0	0	0	0	0	1	1	0	0	1	1
18	0	0	0	0	0	1	1	0	0	1	1
19	0	0	0	0	0	1	1	0	0	1	1
20	0	0	0	0	0	1	1	0	0	1	1

COHESIVE — Using SPT (3) Ohta and Goto (1978), ER = 72; Using S_u (4) Dickenson (1994); Using CPT (5) Mayne and Rix (1995)

Layer	SPT (3) N_{ave}	SPT (3) N_{60}	SPT (3) V_S (m/s)	SPT (3) V_S (m/s) Confined	S_u (4) S_u (psf)	S_u (4) V_S (m/s)	S_u (4) V_S (m/s) Confined	CPT (5) q_{t_ave} (kPa)	CPT (5) V_S (m/s)	CPT (5) V_S (m/s) Confined
1	8	9.6	184.5509	184.55087	0	1	1	0	1	1
2	7	8.4	176.5244	176.524414	0	1	1	0	1	1
3	8	9.6	184.5509	184.55087	0	1	1	0	1	1
4	7	8.4	176.5244	176.524414	0	1	1	0	1	1
5	10	12	198.7866	198.786612	0	1	1	0	1	1
6	9	10.8	191.9331	191.933104	0	1	1	0	1	1
7	8	9.6	184.5509	184.55087	0	1	1	0	1	1
8	0	0	1	1	0	1	1	0	1	1
9	0	0	1	1	0	1	1	0	1	1
10	0	0	1	1	0	1	1	0	1	1
11	0	0	1	1	0	1	1	0	1	1
12	0	0	1	1	0	1	1	0	1	1
13	0	0	1	1	0	1	1	0	1	1
14	0	0	1	1	0	1	1	0	1	1
15	0	0	1	1	0	1	1	0	1	1
16	0	0	1	1	0	1	1	0	1	1
17	0	0	1	1	0	1	1	0	1	1
18	0	0	1	1	0	1	1	0	1	1
19	0	0	1	1	0	1	1	0	1	1
20	0	0	1	1	0	1	1	0	1	1

YOUNG SEDIMENTARY ROCK — Using SPT (6) Imai & Tonouchi (1982), ER = 72

Layer	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined
1	0	0	1	1
2	0	0	1	1
3	0	0	1	1
4	0	0	1	1
5	0	0	1	1
6	0	0	1	1
7	0	0	1	1
8	0	0	1	1
9	0	0	1	1
10	0	0	1	1
11	0	0	1	1
12	0	0	1	1
13	0	0	1	1
14	0	0	1	1
15	0	0	1	1
16	0	0	1	1
17	0	0	1	1
18	0	0	1	1
19	0	0	1	1
20	0	0	1	1

Enter Total Depth = 80.1

Method Numbering Key

- 0 = Layer Not Used
- 1 = Cohesionless Using SPT
- 2 = Cohesionless Using CPT
- 3 = Cohesive Using SPT
- 4 = Cohesive Using S_u
- 5 = Cohesive Using CPT
- 6 = Sedimentary Rock Using SPT

Layer	Depth to Top (FT)	Depth To Bottom (FT)	V_S (m/s)	V_S (ft/s)	D/V_S (sec)
1	0	8	184.55087	605.4819	0.013212617
2	8	14	176.52441	579.1483	0.01036004
3	14	18	184.55087	605.4819	0.006606309
4	18	23	176.52441	579.1483	0.008633367
5	23	28	198.78661	652.187	0.007666512
6	28	33	191.9331	629.7018	0.007940267
7	33	38	184.55087	605.4819	0.008257886
8	38	43	217.81671	714.6217	0.006996709
9	43	48	269.48291	884.1303	0.005655275
10	48	55	217.81671	714.6217	0.009795392
11	55	63	308.83465	1013.237	0.007895487
12	63	73	363.2512	1191.769	0.008390888
13	73	80.1	363.2512	1191.769	0.00595753
14	0	0	1	3.28084	0
15	0	0	1	3.28084	0
16	0	0	1	3.28084	0
17	0	0	1	3.28084	0
18	0	0	1	3.28084	0
19	0	0	1	3.28084	0
20	0	0	1	3.28084	0

RESULTS

V_{Sd} = 746.0304 ft/sec

V_{Sd} = 227.39 m/sec

OR

Feet to meters conversion:	
1-foot = 0.3048 meters	

***ESTIMATING VS30 FOR SITES WITH SUBSURFACE INFO <100 ft (30 m)**

V_{S30} = [1.45 - (0.015 * d)]* $V_{S(d)}$

d = depth in ***"meters"*** to bottom of known soil column

$V_{S(d)}$ = Time averaged velocity (m/sec) for known soil column

Vs30 = 246.4414 m/sec

Other Rocks

Review Studies by:

1. Fumal (1978) - Correlated shear wave velociy to weathering, hardness, fracture spacing, and lithology based on data from 27 sites in San Francisco, CA.
2. Fumal and Tinsley (1985) - extended the 1978 study to include 84 sites in Los Angelas, CA

Note: In the absense of in-situ measurements of V_S, the V_{S30} for competent rocks in California should be limited to 760 m/sec

WRECO

Project Name: Las Trampas Creek Bridge **Completed By:** A. Kahn **on** 09/20/17
Project Number: P17043 **Checked By:** ____ **on** ____

Estimating Average Small Strain Shear Wave Velocity (VS30) for Top 100FT
Ref: Caltrans Geotechnical Services Design Manual Version 1.0 (Aug 2009)

Boring Number: R-17-003

1 m = 3.28084 ft

				COHESIONLESS							
				Using SPT (1) Sykora (1987) ER = 72				Using CPT (2) Mayne (2007)			
Layer	Method Used	Depth to Top (FT)	Depth To Bottom (FT)	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (MPa)	Effective Overburden	V_S (m/s)	V_S (m/s) Confined
1	3	0	6.5	0	0	1	1	0	0	1	1
2	3	6.5	9	0	0	1	1	0	0	1	1
3	3	9	11.5	0	0	1	1	0	0	1	1
4	3	11.5	16	0	0	1	1	0	0	1	1
5	3	16	21.5	0	0	1	1	0	0	1	1
6	3	21.5	26	0	0	1	1	0	0	1	1
7	3	26	36	0	0	1	1	0	0	1	1
8	3	36	46	0	0	1	1	0	0	1	1
9	3	46	56	0	0	1	1	0	0	1	1
10	1	56	68	23	27.6	263.044785	263.04478	0	0	1	1
11	1	68	86.8	70	84	363.251198	363.2512	0	0	1	1
12	0	0	0	0	0	1	1	0	0	1	1
13	0	0	0	0	0	1	1	0	0	1	1
14	0	0	0	0	0	1	1	0	0	1	1
15	0	0	0	0	0	1	1	0	0	1	1
16	0	0	0	0	0	1	1	0	0	1	1
17	0	0	0	0	0	1	1	0	0	1	1
18	0	0	0	0	0	1	1	0	0	1	1
19	0	0	0	0	0	1	1	0	0	1	1
20	0	0	0	0	0	1	1	0	0	1	1
	Enter Total Depth =		86.8								

	COHESIVE										YOUNG SEDIMENTARY ROCK			
	Using SPT (3) Ohta and Goto (1978) ER = 72				Using S_u (4) Dickenson (1994)			Using CPT (5) Mayne and Rix (1995)			Using SPT (6) Imai & Tonouchi (1982) ER = 72			
Layer	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	S_u (psf)	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (kPa)	V_S (m/s)	V_S (m/s) Confined	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined
1	15	18	227.5231	227.523113	0	1	1	0	1	1	0	0	1	1
2	9	10.8	191.9331	191.933104	0	1	1	0	1	1	0	0	1	1
3	9	10.8	191.9331	191.933104	0	1	1	0	1	1	0	0	1	1
4	9	10.8	191.9331	191.933104	0	1	1	0	1	1	0	0	1	1
5	11	13.2	205.1969	205.196947	0	1	1	0	1	1	0	0	1	1
6	14	16.8	222.3554	222.355444	0	1	1	0	1	1	0	0	1	1
7	4	4.8	146.512	146.51197	0	1	1	0	1	1	0	0	1	1
8	11	13.2	205.1969	205.196947	0	1	1	0	1	1	0	0	1	1
9	12	14.4	211.2295	211.229459	0	1	1	0	1	1	0	0	1	1
10	0	0	1	1	0	1	1	0	1	1	0	0	1	1
11	0	0	1	1	0	1	1	0	1	1	0	0	1	1
12	0	0	1	1	0	1	1	0	1	1	0	0	1	1
13	0	0	1	1	0	1	1	0	1	1	0	0	1	1
14	0	0	1	1	0	1	1	0	1	1	0	0	1	1
15	0	0	1	1	0	1	1	0	1	1	0	0	1	1
16	0	0	1	1	0	1	1	0	1	1	0	0	1	1
17	0	0	1	1	0	1	1	0	1	1	0	0	1	1
18	0	0	1	1	0	1	1	0	1	1	0	0	1	1
19	0	0	1	1	0	1	1	0	1	1	0	0	1	1
20	0	0	1	1	0	1	1	0	1	1	0	0	1	1

Method Numbering Key

- 0 = Layer Not Used
- 1 = Cohesionless Using SPT
- 2 = Cohesionless Using CPT
- 3 = Cohesive Using SPT
- 4 = Cohesive Using S_u
- 5 = Cohesive Using CPT
- 6 = Sedimentary Rock Using SPT

Layer	Depth to Top (FT)	Depth To Bottom (FT)	V_S (m/s)	V_S (ft/s)	D/V_S (sec)
1	0	6.5	227.52311	746.4669	0.008707687
2	6.5	9	191.9331	629.7018	0.003970133
3	9	11.5	191.9331	629.7018	0.003970133
4	11.5	16	191.9331	629.7018	0.00714624
5	16	21.5	205.19695	673.2183	0.008169712
6	21.5	26	222.35544	729.5126	0.006168502
7	26	36	146.51197	480.6823	0.020803761
8	36	46	205.19695	673.2183	0.014854022
9	46	56	211.22946	693.01	0.014429805
10	56	68	263.04478	863.0078	0.013904857
11	68	86.8	363.2512	1191.769	0.015774869
12	0	0	1	3.28084	0
13	0	0	1	3.28084	0
14	0	0	1	3.28084	0
15	0	0	1	3.28084	0
16	0	0	1	3.28084	0
17	0	0	1	3.28084	0
18	0	0	1	3.28084	0
19	0	0	1	3.28084	0
20	0	0	1	3.28084	0

RESULTS

V_{Sd} = 736.2189 ft/sec

V_{Sd} = 224.4 m/sec

OR

Feet to meters conversion:	
1-foot = 0.3048 meters	

***ESTIMATING VS30 FOR SITES WITH SUBSURFACE INFO <100 ft (30 m)**

$V_{S30} = [1.45 - (0.015 * d)] * V_{S(d)}$

d = depth in ***"meters"*** to bottom of known soil column

$V_{S(d)}$ = Time averaged velocity (m/sec) for known soil column

Vs30 = 236.3264 m/sec

Other Rocks
Review Studies by:

1. Fumal (1978) - Correlated shear wave velociy to weathering, hardness, fracture spacing, and lithology based on data from 27 sites in San Francisco, CA.
2. Fumal and Tinsley (1985) - extended the 1978 study to include 84 sites in Los Angelas, CA

Note: In the absense of in-situ measurements of V_S, the V_{S30} for competent rocks in California should be limited to 760 m/sec

WRECO

Project Name: Las Trampas **Completed By:** D. Brown **on** 12/18/2018
Project Number: P17043 **Checked By:** ________ **on** ________

Estimating Average Small Strain Shear Wave Velocity (VS30) for Top 100FT
Ref: Caltrans Geotechnical Services Design Manual Version 1.0 (Aug 2009)

Boring Number: R-18-001

1 m = 3.28084 ft

				COHESIONLESS								COHESIVE										YOUNG SEDIMENTARY ROCK			
				Using SPT (1) Sykora (1987) ER = 77				Using CPT (2) Mayne (2007)				Using SPT (3) Ohta and Goto (1978) ER = 77				Using S_u (4) Dickenson (1994)			Using CPT (5) Mayne and Rix (1995)			Using SPT (6) Imai & Tonouchi (1982) ER = 70			
Layer	Method Used	Depth to Top (FT)	Depth To Bottom (FT)	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (MPa)	Effective Overburden	V_S (m/s)	V_S (m/s) Confined	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	S_u (psf)	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (kPa)	V_S (m/s)	V_S (m/s) Confined	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined
1	3	0	11	0	0	1	1	0	0	1	1	10	12.8333333	203.281	203.281015	0	1	1	0	1	1	0	0	1	1
2	3	11	16	0	0	1	1	0	0	1	1	13	16.6833333	221.8401	221.840052	0	1	1	0	1	1	0	0	1	1
3	3	16	21	0	0	1	1	0	0	1	1	8	10.2666667	188.7234	188.723415	0	1	1	0	1	1	0	0	1	1
4	1	21	26	26	33.36666667	277.924466	277.92447	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
5	1	26	31	21	26.95	261.23304	261.23304	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
6	1	31	36	32	41.06666667	295.173934	295.17393	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
7	1	36	41	34	43.63333333	300.409315	300.40932	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
8	3	41	46	0	0	1	1	0	0	1	1	18	23.1	247.2308	247.230795	0	1	1	0	1	1	0	0	1	1
9	1	46	51	30	38.5	289.700786	289.70079	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
10	1	51	56	100	128.3333333	410.756561	380	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
11	1	56	61	100	128.3333333	410.756561	380	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
12	1	61	62.5	100	128.3333333	410.756561	380	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
13	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
14	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
15	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
16	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
17	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
18	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
19	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1
20	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1

Enter Total Depth = 62.5

Method Numbering Key

- 0 = Layer Not Used
- 1 = Cohesionless Using SPT
- 2 = Cohesionless Using CPT
- 3 = Cohesive Using SPT
- 4 = Cohesive Using S_u
- 5 = Cohesive Using CPT
- 6 = Sedimentary Rock Using SPT

Layer	Depth to Top (FT)	Depth To Bottom (FT)	V_S (m/s)	V_S (ft/s)	D/V_S (sec)
1	0	11	203.28102	666.93247	0.016493424
2	11	16	221.84005	727.82169	0.006869814
3	16	21	188.72342	619.17131	0.00807531
4	21	26	277.92447	911.82568	0.005483504
5	26	31	261.23304	857.06378	0.005833872
6	31	36	295.17393	968.41842	0.005163058
7	36	41	300.40932	985.59487	0.005073078
8	41	46	247.2308	811.12466	0.006164281
9	46	51	289.70079	950.4619	0.0052606
10	51	56	380	1246.7192	0.004010526
11	56	61	380	1246.7192	0.004010526
12	61	62.5	380	1246.7192	0.001203158
13	0	0	1	3.2808399	0
14	0	0	1	3.2808399	0
15	0	0	1	3.2808399	0
16	0	0	1	3.2808399	0
17	0	0	1	3.2808399	0
18	0	0	1	3.2808399	0
19	0	0	1	3.2808399	0
20	0	0	1	3.2808399	0

RESULTS Vs(d)

V_{Sd} = 848.7103 ft/sec

V_{Sd} = 258.69 m/sec

OR

Feet to meters conversion:	
1-foot = 0.3048 meters	

***ESTIMATING VS30 FOR SITES WITH SUBSURFACE INFO <100 ft (30 m)**

V_{S30} = [1.45 - (0.015 * d)]* $V_{S(d)}$

d = depth in ***meters*** to bottom of known soil column

$V_{S(d)}$ = Time averaged velocity (m/sec) for known soil column

Vs30 = 301.1762 m/sec

Other Rocks
Review Studies by:

1 Fumal (1978) - Correlated shear wave velociy to weathering, hardness, fracture spacing, and lithology based on data from 27 sites in San Francisco, CA.

2 Fumal and Tinsley (1985) - extended the 1978 study to include 84 sites in Los Angelas, CA

Note: In the absense of in-situ measurements of V_S, the V_{S30} for competent rocks in California should be limited to 760 m/sec

WRECO

Project Name: Las Trampas Creek Bridge **Completed By:** FPT **on** 3/14/2018
Project Number: P17043 **Checked By:** **on**

Estimating Average Small Strain Shear Wave Velocity (VS30) for Top 100FT
Ref: Caltrans Geotechnical Services Design Manual Version 1.0 (Aug 2009)

Boring Number: CPT-18-001

1 m = 3.28084 ft

				COHESIONLESS							
				Using SPT (1) Sykora (1987) ER = 72				Using CPT (2) Mayne (2007)			
Layer	Method Used	Depth to Top (FT)	Depth To Bottom (FT)	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (MPa)	Effective Overburden	V_S (m/s)	V_S (m/s) Confined
1	4	0	5	0	0	1	1	0	0	1	1
2	4	5	10	0	0	1	1	0	0	1	1
3	4	10	15	0	0	1	1	0	0	1	1
4	4	15	20	0	0	1	1	0	0	1	1
5	4	20	25	0	0	1	1	0	0	1	1
6	4	25	30	0	0	1	1	0	0	1	1
7	4	30	35	0	0	1	1	0	0	1	1
8	4	35	40	0	0	1	1	0	0	1	1
9	4	40	45	0	0	1	1	0	0	1	1
10	4	45	50	0	0	1	1	0	0	1	1
11	0	0	0	0	0	1	1	0	0	1	1
12	0	0	0	0	0	1	1	0	0	1	1
13	0	0	0	0	0	1	1	0	0	1	1
14	0	0	0	0	0	1	1	0	0	1	1
15	0	0	0	0	0	1	1	0	0	1	1
16	0	0	0	0	0	1	1	0	0	1	1
17	0	0	0	0	0	1	1	0	0	1	1
18	0	0	0	0	0	1	1	0	0	1	1
19	0	0	0	0	0	1	1	0	0	1	1
20	0	0	0	0	0	1	1	0	0	1	1
	Enter Total Depth =		50								

	COHESIVE										YOUNG SEDIMENTARY ROCK			
	Using SPT (3) Ohta and Goto (1978) ER = 60				Using S_u (4) Dickenson (1994)			Using CPT (5) Mayne and Rix (1995)			Using SPT (6) Imai & Tonouchi (1982) ER = 72			
Layer	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	S_u (psf)	V_S (m/s)	V_S (m/s) Confined	q_{t_ave} (kPa)	V_S (m/s)	V_S (m/s) Confined	N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined
1	9	9	180.6269	180.626943	2000	197.4089	197.40893	0	1	1	0	0	1	1
2	8	8	173.6796	173.679573	3322	251.2132	251.21315	0	1	1	0	0	1	1
3	7	7	166.1259	166.125929	2511	219.9403	219.94026	0	1	1	0	0	1	1
4	5	5	148.5172	148.517212	1340	163.2121	163.21209	0	1	1	0	0	1	1
5	5	5	148.5172	148.517212	1178	153.5223	153.52233	0	1	1	0	0	1	1
6	6	6	157.8135	157.813497	1357	164.1924	164.19237	0	1	1	0	0	1	1
7	7	7	166.1259	166.125929	1743	184.9242	184.92423	0	1	1	0	0	1	1
8	11	11	193.1095	193.109456	4515	290.6297	290.62969	0	1	1	0	0	1	1
9	15	15	214.1205	214.120459	4220	281.4498	281.44981	0	1	1	0	0	1	1
10	19	19	231.6566	231.656625	6760	352.0483	310	0	1	1	0	0	1	1
11	0	0	1	1	0	1	1	0	1	1	0	0	1	1
12	0	0	1	1	0	1	1	0	1	1	0	0	1	1
13	0	0	1	1	0	1	1	0	1	1	0	0	1	1
14	0	0	1	1	0	1	1	0	1	1	0	0	1	1
15	0	0	1	1	0	1	1	0	1	1	0	0	1	1
16	0	0	1	1	0	1	1	0	1	1	0	0	1	1
17	0	0	1	1	0	1	1	0	1	1	0	0	1	1
18	0	0	1	1	0	1	1	0	1	1	0	0	1	1
19	0	0	1	1	0	1	1	0	1	1	0	0	1	1
20	0	0	1	1	0	1	1	0	1	1	0	0	1	1

Method Numbering Key

- **0 = Layer Not Used**
- **1 = Cohesionless Using SPT**
- **2 = Cohesionless Using CPT**
- **3 = Cohesive Using SPT**
- **4 = Cohesive Using S_u**
- **5 = Cohesive Using CPT**
- **6 = Sedimentary Rock Using SPT**

Layer	Depth to Top (FT)	Depth To Bottom (FT)	V_S (m/s)	V_S (ft/s)	D/V_S (sec)
1	0	5	197.40893	647.6671	0.007720015
2	5	10	251.21315	824.1901	0.006066561
3	10	15	219.94026	721.5888	0.006929154
4	15	20	163.21209	535.4727	0.009337543
5	20	25	153.52233	503.6822	0.009926894
6	25	30	164.19237	538.6889	0.009281795
7	30	35	184.92423	606.7068	0.008241213
8	35	40	290.62969	953.5095	0.005243786
9	40	45	281.44981	923.3918	0.00541482
10	45	50	310	1017.06	0.004916129
11	0	0	1	3.28084	0
12	0	0	1	3.28084	0
13	0	0	1	3.28084	0
14	0	0	1	3.28084	0
15	0	0	1	3.28084	0
16	0	0	1	3.28084	0
17	0	0	1	3.28084	0
18	0	0	1	3.28084	0
19	0	0	1	3.28084	0
20	0	0	1	3.28084	0

RESULTS

V_{Sd} = 684.2013 **ft/sec**

V_{Sd} = 208.54 **m/sec**

OR

Feet to meters conversion:
1-foot = 0.3048 meters

***ESTIMATING VS30 FOR SITES WITH SUBSURFACE INFO <100 ft (30 m)**

$V_{S30} = [1.45 - (0.015 * d)] * V_{S(d)}$

d = depth in *"meters"* to bottom of known soil column

$V_{S(d)}$ = Time averaged velocity (m/sec) for known soil column

Vs30 = 254.7163 m/sec

Other Rocks
Review Studies by:

1. Fumal (1978) - Correlated shear wave velociy to weathering, hardness, fracture spacing, and lithology based on data from 27 sites in San Francisco, CA.
2. Fumal and Tinsley (1985) - extended the 1978 study to include 84 sites in Los Angelas, CA

Note: In the absense of in-situ measurements of V_S, the V_{S30} for competent rocks in California should be limited to 760 m/sec

WRECO

Project Name: Las Trampas Creek Bridge **Completed By:** FPT **on** 3/14/2018
Project Number: P17043 **Checked By:** **on**

Estimating Average Small Strain Shear Wave Velocity (VS30) for Top 100FT
Ref: Caltrans Geotechnical Services Design Manual Version 1.0 (Aug 2009)

Boring Number: CPT-18-002

1 m = 3.28084 ft

Layer	Method Used	Depth to Top (FT)	Depth To Bottom (FT)	COHESIONLESS: Using SPT (1) Sykora (1987), ER = 72: N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	Using CPT (2) Mayne (2007): q_{t_ave} (MPa)	Effective Overburden	V_S (m/s)	V_S (m/s) Confined
1	4	0	5	0	0	1	1	0	0	1	1
2	4	5	10	0	0	1	1	0	0	1	1
3	4	10	15	0	0	1	1	0	0	1	1
4	4	15	20	0	0	1	1	0	0	1	1
5	4	20	25	0	0	1	1	0	0	1	1
6	4	25	30	0	0	1	1	0	0	1	1
7	4	30	35	0	0	1	1	0	0	1	1
8	4	35	40	0	0	1	1	0	0	1	1
9	4	40	45	0	0	1	1	0	0	1	1
10	4	45	52	0	0	1	1	0	0	1	1
11	0	0	0	0	0	1	1	0	0	1	1
12	0	0	0	0	0	1	1	0	0	1	1
13	0	0	0	0	0	1	1	0	0	1	1
14	0	0	0	0	0	1	1	0	0	1	1
15	0	0	0	0	0	1	1	0	0	1	1
16	0	0	0	0	0	1	1	0	0	1	1
17	0	0	0	0	0	1	1	0	0	1	1
18	0	0	0	0	0	1	1	0	0	1	1
19	0	0	0	0	0	1	1	0	0	1	1
20	0	0	0	0	0	1	1	0	0	1	1
	Enter Total Depth =		50								

Layer	COHESIVE: Using SPT (3) Ohta and Goto (1978), ER = 60: N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined	Using S_u (4) Dickenson (1994): S_u (psf)	V_S (m/s)	V_S (m/s) Confined	Using CPT (5) Mayne and Rix (1995): q_{t_ave} (kPa)	V_S (m/s)	V_S (m/s) Confined
1	0	0	1	1	2093	201.7172	201.7172	0	1	1
2	0	0	1	1	2093	201.7172	201.7172	0	1	1
3	0	0	1	1	1377	165.3374	165.33743	0	1	1
4	0	0	1	1	2295	210.7411	210.74114	0	1	1
5	0	0	1	1	2535	220.9363	220.9363	0	1	1
6	0	0	1	1	1671	181.2556	181.25557	0	1	1
7	0	0	1	1	2018	198.2509	198.25087	0	1	1
8	0	0	1	1	4100	277.6194	277.61944	0	1	1
9	0	0	1	1	2703	227.7741	227.77414	0	1	1
10	0	0	1	1	2888	235.0505	235.05052	0	1	1
11	0	0	1	1	0	1	1	0	1	1
12	0	0	1	1	0	1	1	0	1	1
13	0	0	1	1	0	1	1	0	1	1
14	0	0	1	1	0	1	1	0	1	1
15	0	0	1	1	0	1	1	0	1	1
16	0	0	1	1	0	1	1	0	1	1
17	0	0	1	1	0	1	1	0	1	1
18	0	0	1	1	0	1	1	0	1	1
19	0	0	1	1	0	1	1	0	1	1
20	0	0	1	1	0	1	1	0	1	1

Layer	YOUNG SEDIMENTARY ROCK: Using SPT (6) Imai & Tonouchi (1982), ER = 72: N_{ave}	N_{60}	V_S (m/s)	V_S (m/s) Confined
1	0	0	1	1
2	0	0	1	1
3	0	0	1	1
4	0	0	1	1
5	0	0	1	1
6	0	0	1	1
7	0	0	1	1
8	0	0	1	1
9	0	0	1	1
10	0	0	1	1
11	0	0	1	1
12	0	0	1	1
13	0	0	1	1
14	0	0	1	1
15	0	0	1	1
16	0	0	1	1
17	0	0	1	1
18	0	0	1	1
19	0	0	1	1
20	0	0	1	1

Method Numbering Key

- 0 = Layer Not Used
- 1 = Cohesionless Using SPT
- 2 = Cohesionless Using CPT
- 3 = Cohesive Using SPT
- 4 = Cohesive Using S_u
- 5 = Cohesive Using CPT
- 6 = Sedimentary Rock Using SPT

Layer	Depth to Top (FT)	Depth To Bottom (FT)	V_S (m/s)	V_S (ft/s)	D/V_S (sec)
1	0	5	201.7172	661.8018	0.007555132
2	5	10	201.7172	661.8018	0.007555132
3	10	15	165.33743	542.4456	0.009217514
4	15	20	210.74114	691.4079	0.007231621
5	20	25	220.9363	724.8566	0.006897916
6	25	30	181.25557	594.6705	0.008408017
7	30	35	198.25087	650.4294	0.00768723
8	35	40	277.61944	910.825	0.005489529
9	40	45	227.77414	747.2905	0.006690838
10	45	52	235.05052	771.1631	0.009077198
11	0	0	1	3.28084	0
12	0	0	1	3.28084	0
13	0	0	1	3.28084	0
14	0	0	1	3.28084	0
15	0	0	1	3.28084	0
16	0	0	1	3.28084	0
17	0	0	1	3.28084	0
18	0	0	1	3.28084	0
19	0	0	1	3.28084	0
20	0	0	1	3.28084	0

RESULTS

V_{Sd} = 659.5425 ft/sec

V_{Sd} = 201.03 m/sec

OR

Feet to meters conversion:	
1-foot = 0.3048 meters	

***ESTIMATING VS30 FOR SITES WITH SUBSURFACE INFO <100 ft (30 m)**

V_{S30} = [1.45 - (0.015 * d)]* $V_{S(d)}$

d = depth in ***"meters"*** to bottom of known soil column

$V_{S(d)}$ = Time averaged velocity (m/sec) for known soil column

Vs30 = 245.5363 m/sec

Other Rocks

Review Studies by:

1. Fumal (1978) - Correlated shear wave velociy to weathering, hardness, fracture spacing, and lithology based on data from 27 sites in San Francisco, CA.
2. Fumal and Tinsley (1985) - extended the 1978 study to include 84 sites in Los Angelas, CA

Note: In the absense of in-situ measurements of V_S, the V_{S30} for competent rocks in California should be limited to 760 m/sec

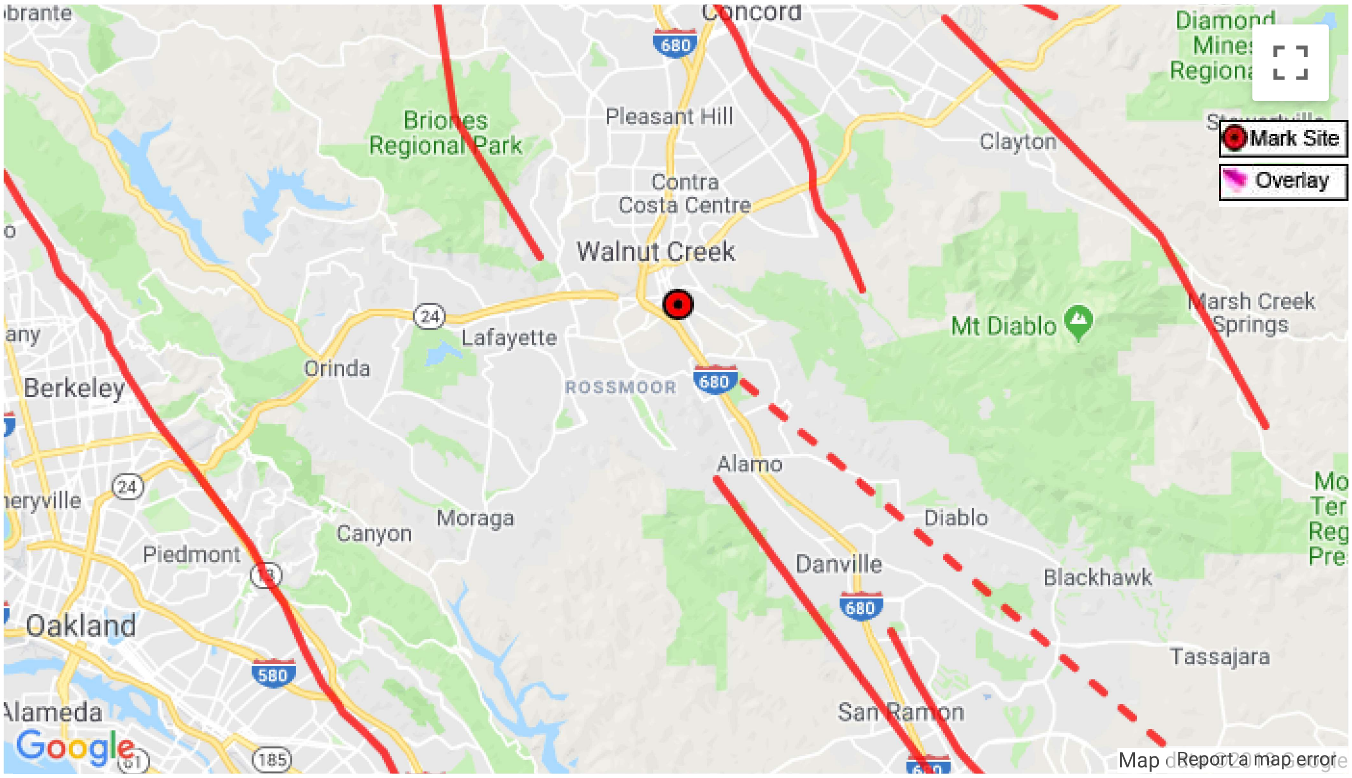
WRECO

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.3.09)

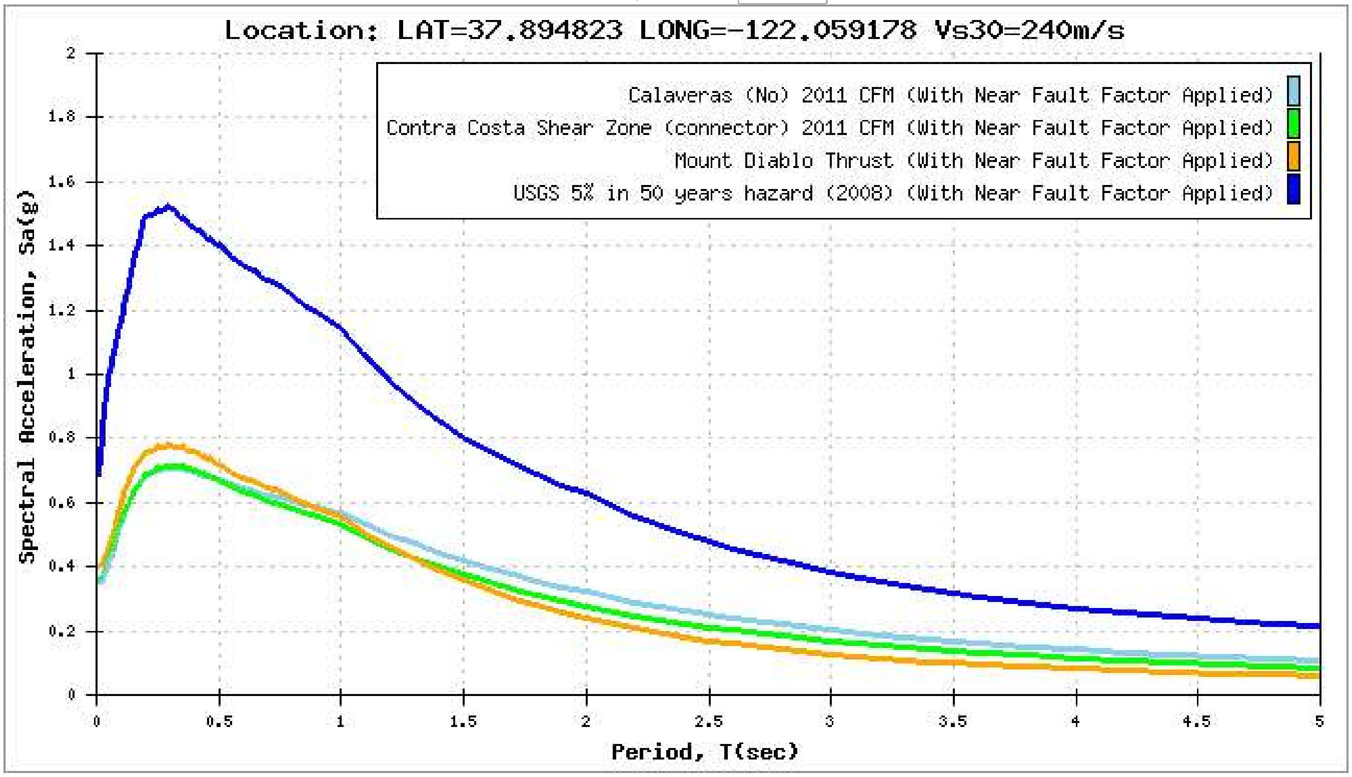
This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION



Latitude: 37.894823 **Longitude:** -122.059178 ***V*S30:** 240 m/s Calculate

CALCULATED SPECTRA Display Curves: 3 ▼



Tabular Data | Envelope Only | Hide Near Fault | Axis Scale | Show Basin

Apply Near Fault Adjustment To:
NOTE: Caltrans SDC requires application of a Near Fault Adjustment factor for sites less than 25 km (Rrup) from the causative fault.

☑ Deterministic Spectrum Using

5.63 Km Calaveras (No) 2011 CFM
4.46 Km Contra Costa Shear Zone (connector) 2011 CFM
8.41 Km Mount Diablo Thrust

☑ Probabilistic Spectrum Using

4.46 Km (Recommend Performing Deaggregation To Verify)

◉ Show Spectrum with Adjustment Only
○ Show Spectrum with and without near fault Adjustment

OK

This application is being updated for digital accessibility and will continue to function while updates are in progress.

SITE DATA (ARS Online Version 2.3.09)

Shear Wave Velocity, V_{S30}:	240 m/s
Latitude:	37.894823
Longitude:	-122.059178
Depth to Vs = 1.0 km/s:	N/A
Depth to Vs = 2.5 km/s:	N/A

DETERMINISTIC

Calaveras (No) 2011 CFM

Fault ID:	130
Maximum Magnitude (MMax):	6.9
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	11.30 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	5.63 km
Rjb:	5.63 km
Rx:	2.14 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.352	1.000	1.000	0.352
0.05	0.410	1.000	1.000	0.410
0.1	0.536	1.000	1.000	0.536
0.15	0.627	1.000	1.000	0.627
0.2	0.681	1.000	1.000	0.681
0.25	0.702	1.000	1.000	0.702
0.3	0.707	1.000	1.000	0.707
0.4	0.695	1.000	1.000	0.695
0.5	0.669	1.000	1.000	0.669
0.6	0.620	1.000	1.040	0.645
0.7	0.579	1.000	1.080	0.625
0.85	0.522	1.000	1.140	0.595
1	0.473	1.000	1.200	0.567
1.2	0.416	1.000	1.200	0.499
1.5	0.350	1.000	1.200	0.420
2	0.268	1.000	1.200	0.321
3	0.168	1.000	1.200	0.202
4	0.117	1.000	1.200	0.141
5	0.089	1.000	1.200	0.106

Contra Costa Shear Zone (connector) 2011 CFM

Fault ID:	117

Maximum Magnitude (MMax):	6.5
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	12.90 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	4.46 km
Rjb:	4.46 km
Rx:	2.77 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.359	1.000	1.000	0.359
0.05	0.418	1.000	1.000	0.418
0.1	0.539	1.000	1.000	0.539
0.15	0.627	1.000	1.000	0.627
0.2	0.683	1.000	1.000	0.683
0.25	0.706	1.000	1.000	0.706
0.3	0.713	1.000	1.000	0.713
0.4	0.702	1.000	1.000	0.702
0.5	0.668	1.000	1.000	0.668
0.6	0.610	1.000	1.040	0.634
0.7	0.562	1.000	1.080	0.607
0.85	0.497	1.000	1.140	0.567
1	0.442	1.000	1.200	0.531
1.2	0.381	1.000	1.200	0.457
1.5	0.312	1.000	1.200	0.375
2	0.232	1.000	1.200	0.278
3	0.140	1.000	1.200	0.169
4	0.096	1.000	1.200	0.115
5	0.071	1.000	1.200	0.085

Mount Diablo Thrust

Fault ID:	129
Maximum Magnitude (MMax):	6.6
Fault Type:	Rev
Fault Dip:	38 Deg
Dip Direction:	E
Bottom of Rupture Plane:	16.00 km
Top of Rupture Plane(Ztor):	8.00 km
Rrup	8.41 km
Rjb:	2.57 km
Rx:	0.40 km
Fnorm:	0
Frev:	1

Period	SA(Base	Basin	Near Fault	SA(Final

	Spectrum)	Factor	Factor(Applied)	Spectrum)
0.01	0.404	1.000	1.000	0.404
0.05	0.457	1.000	1.000	0.457
0.1	0.597	1.000	1.000	0.597
0.15	0.700	1.000	1.000	0.700
0.2	0.753	1.000	1.000	0.753
0.25	0.771	1.000	1.000	0.771
0.3	0.776	1.000	1.000	0.776
0.4	0.758	1.000	1.000	0.758
0.5	0.717	1.000	1.000	0.717
0.6	0.653	1.000	1.040	0.679
0.7	0.600	1.000	1.080	0.648
0.85	0.526	1.000	1.140	0.600
1	0.462	1.000	1.200	0.554
1.2	0.385	1.000	1.200	0.462
1.5	0.299	1.000	1.200	0.359
2	0.200	1.000	1.200	0.240
3	0.105	1.000	1.200	0.127
4	0.068	1.000	1.200	0.082
5	0.050	1.000	1.200	0.060

PROBABILISTIC

Probabilistic Model
USGS Seismic Hazard Map(2008) 975 Year Return Period

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.686	1.000	1.000	0.686
0.05	0.990	1.000	1.000	0.990
0.1	1.161	1.000	1.000	1.161
0.15	1.344	1.000	1.000	1.344
0.2	1.492	1.000	1.000	1.492
0.25	1.509	1.000	1.000	1.509
0.3	1.522	1.000	1.000	1.522
0.4	1.452	1.000	1.000	1.452
0.5	1.400	1.000	1.000	1.400
0.6	1.287	1.000	1.040	1.339
0.7	1.198	1.000	1.080	1.294
0.85	1.066	1.000	1.140	1.215
1	0.954	1.000	1.200	1.145
1.2	0.814	1.000	1.200	0.977
1.5	0.671	1.000	1.200	0.805
2	0.522	1.000	1.200	0.627
3	0.319	1.000	1.200	0.383
4	0.224	1.000	1.200	0.268
5	0.177	1.000	1.200	0.213

MINIMUM DETERMINISTIC SPECTRUM

Period	SA
0.01	0.225
0.05	0.269
0.1	0.387
0.15	0.466
0.2	0.492
0.25	0.490
0.3	0.481
0.4	0.447
0.5	0.405
0.6	0.358
0.7	0.322
0.85	0.277
1	0.242
1.2	0.204
1.5	0.164
2	0.118
3	0.070
4	0.048
5	0.036

Envelope Data

Period	SA
0.01	0.686
0.05	0.990
0.1	1.161
0.15	1.344
0.2	1.492
0.25	1.509
0.3	1.522
0.4	1.452
0.5	1.400
0.6	1.339
0.7	1.294
0.85	1.215
1	1.145
1.2	0.977
1.5	0.805
2	0.627
3	0.383
4	0.268
5	0.213

Appendix IV.2 Preliminary Liquefaction Evaluation

TABLE OF CONTENTS

WRECO
7807 Laguna Blvd., Suite 400
Elk Grove, CA 95758

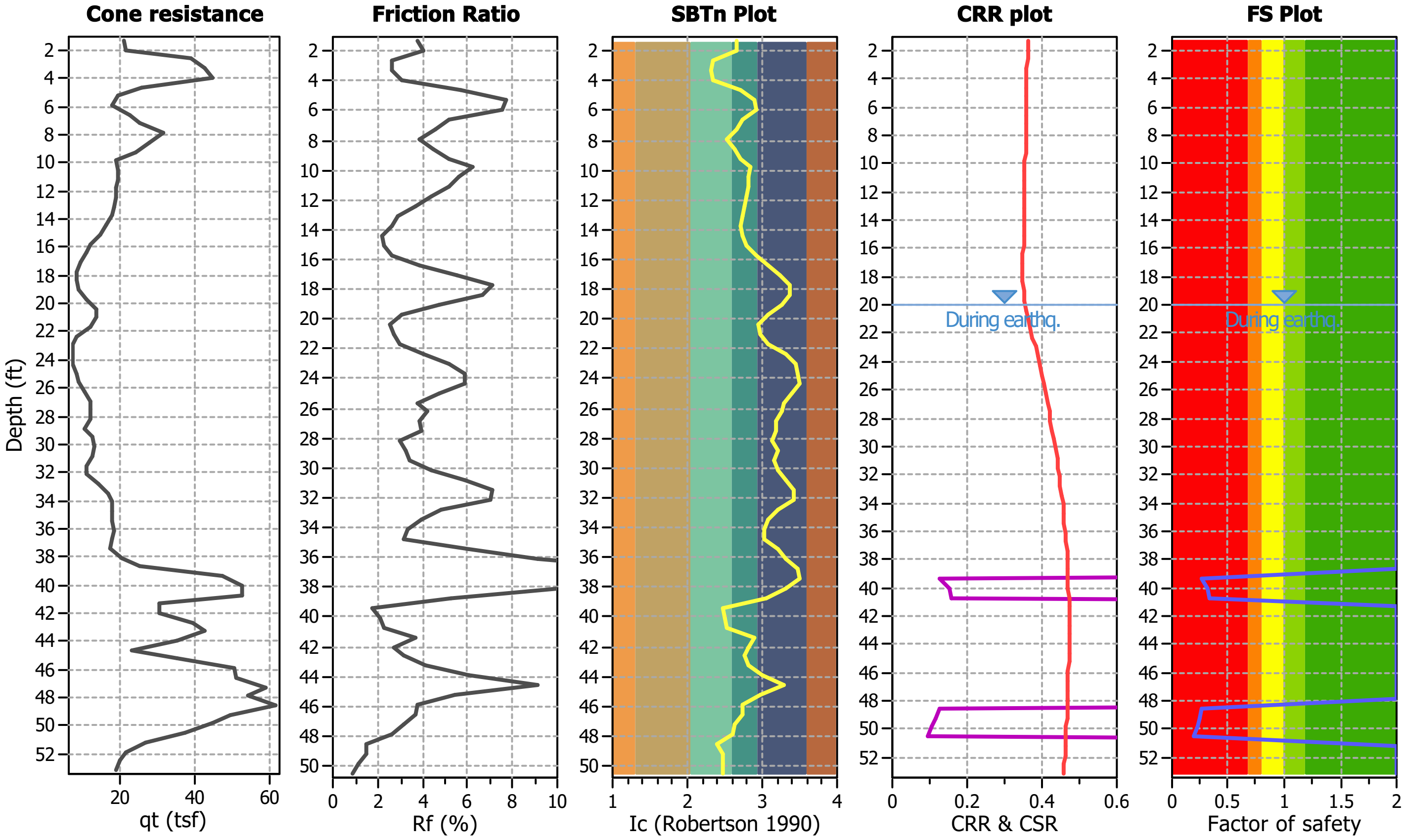
LIQUEFACTION ANALYSIS REPORT

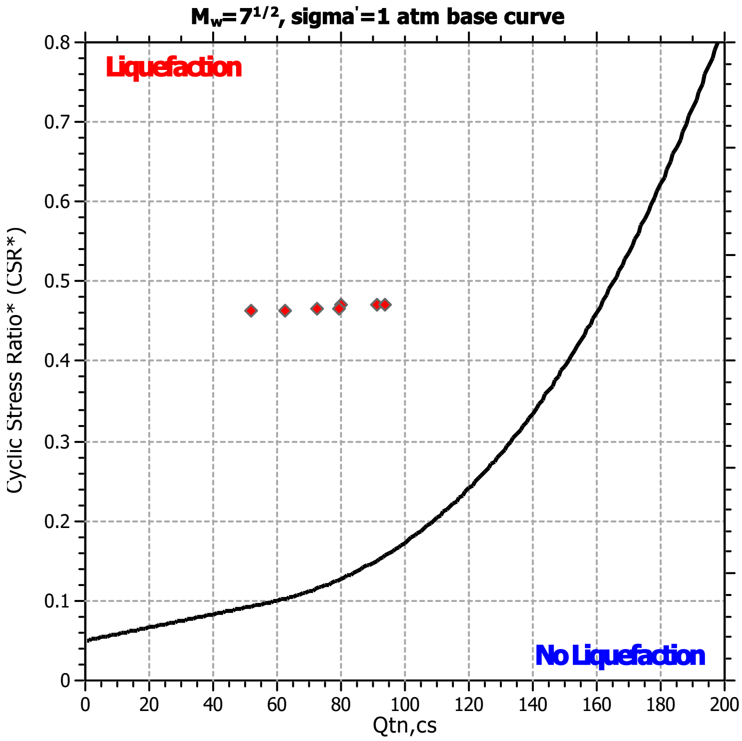
Project title : Las Trampas Bridge **Location : 1-CPT-02**

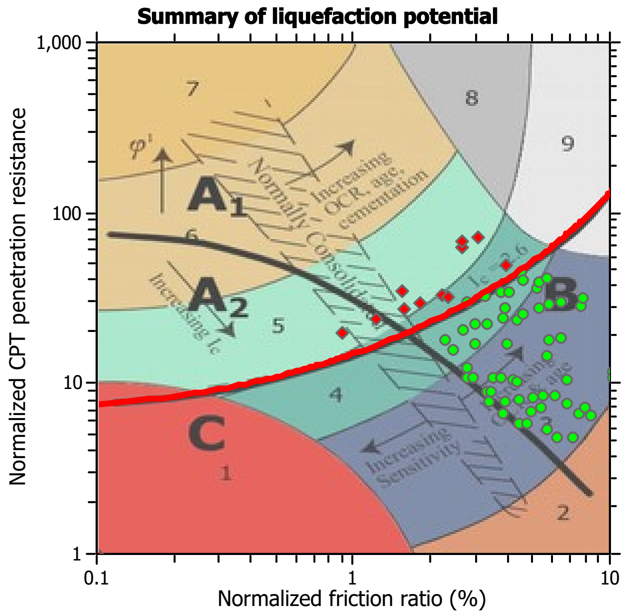
CPT file : CPT 1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

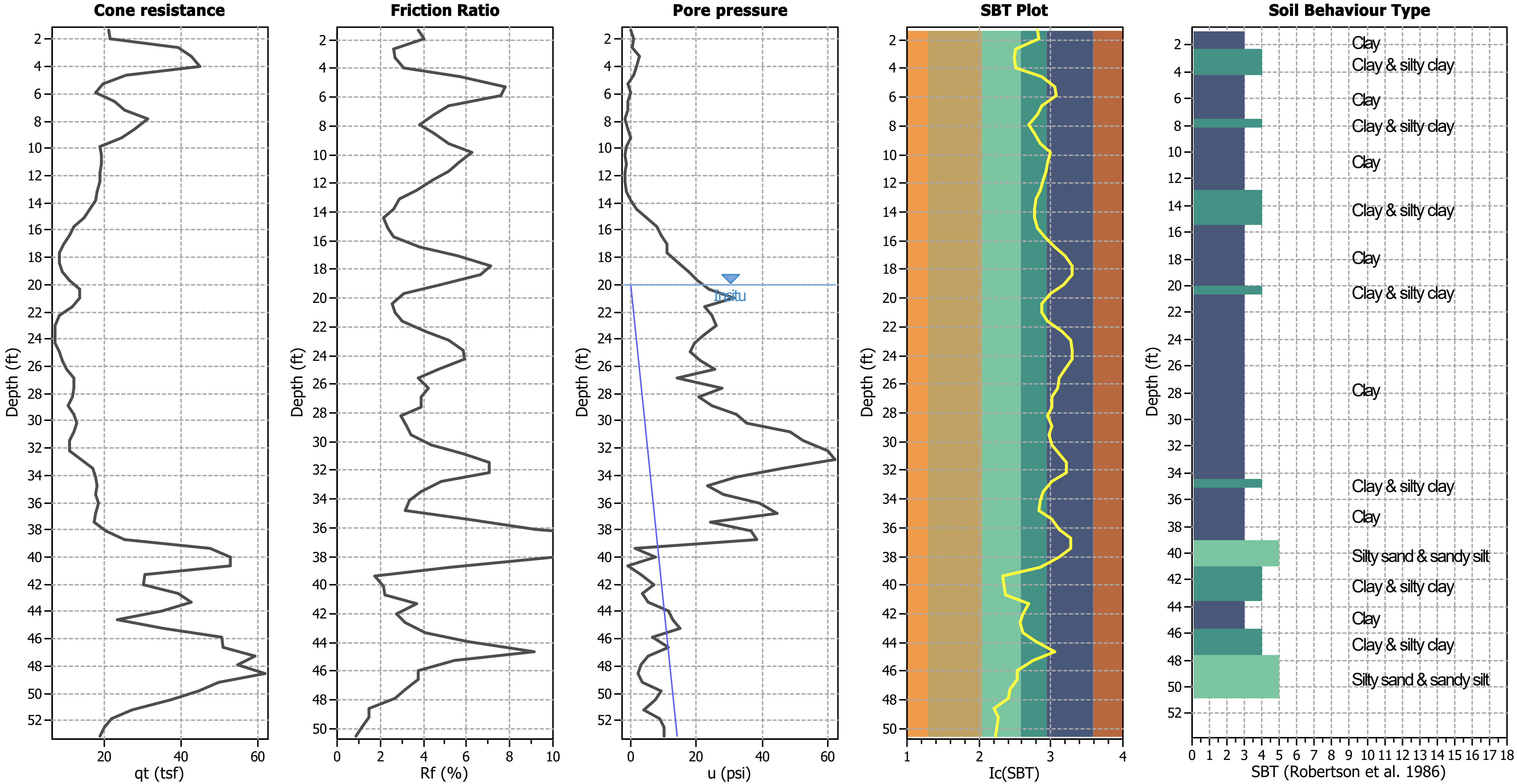






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



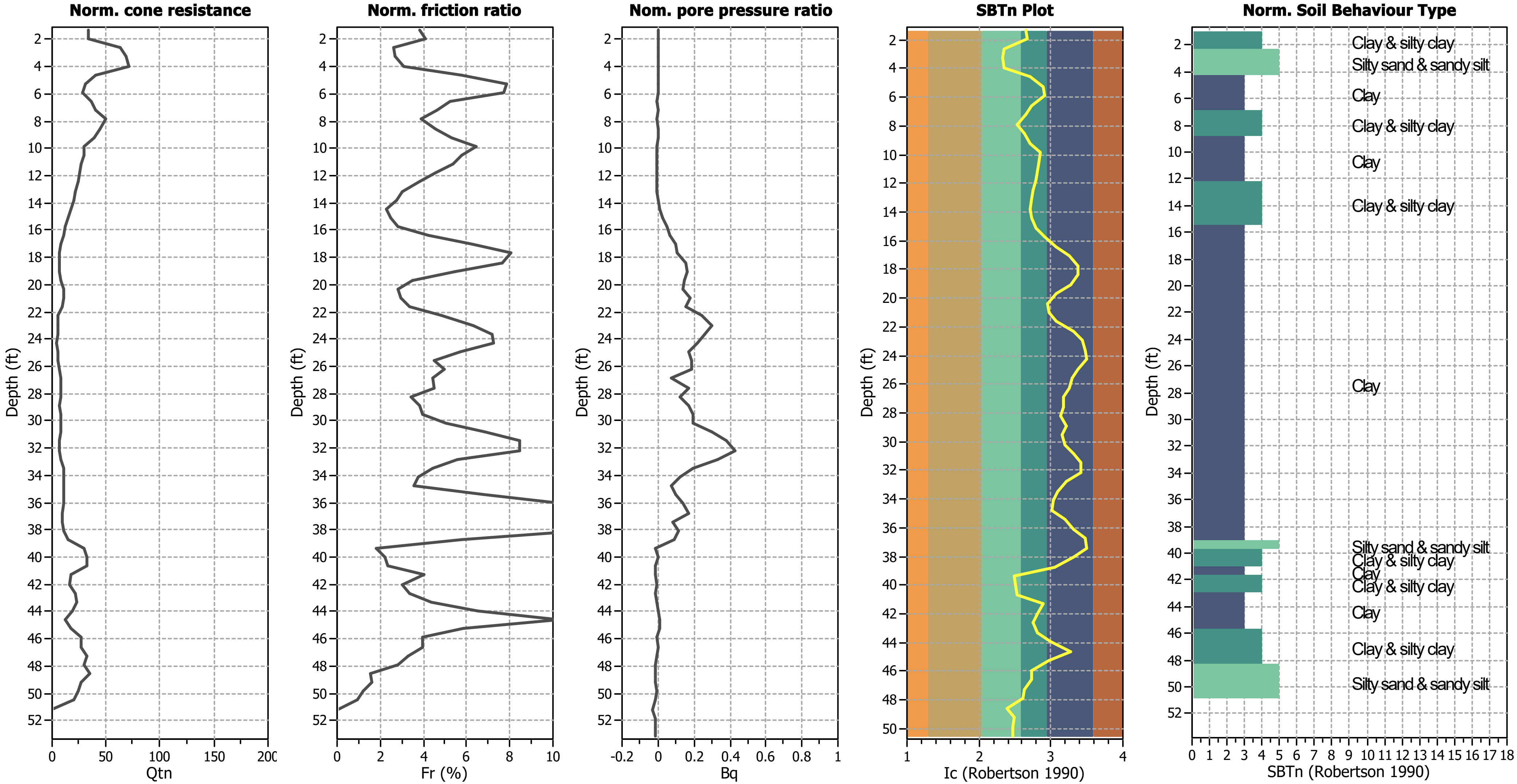
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



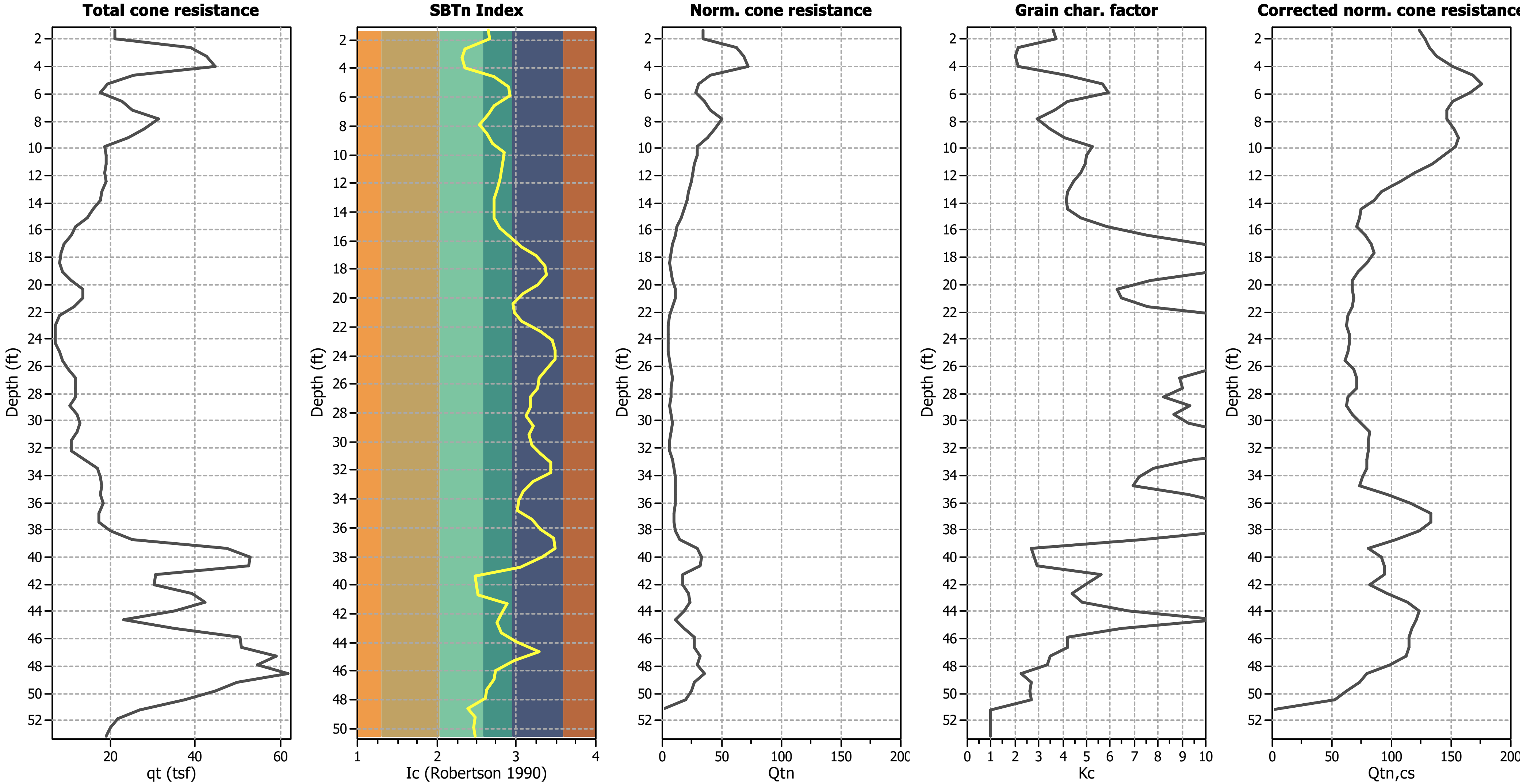
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

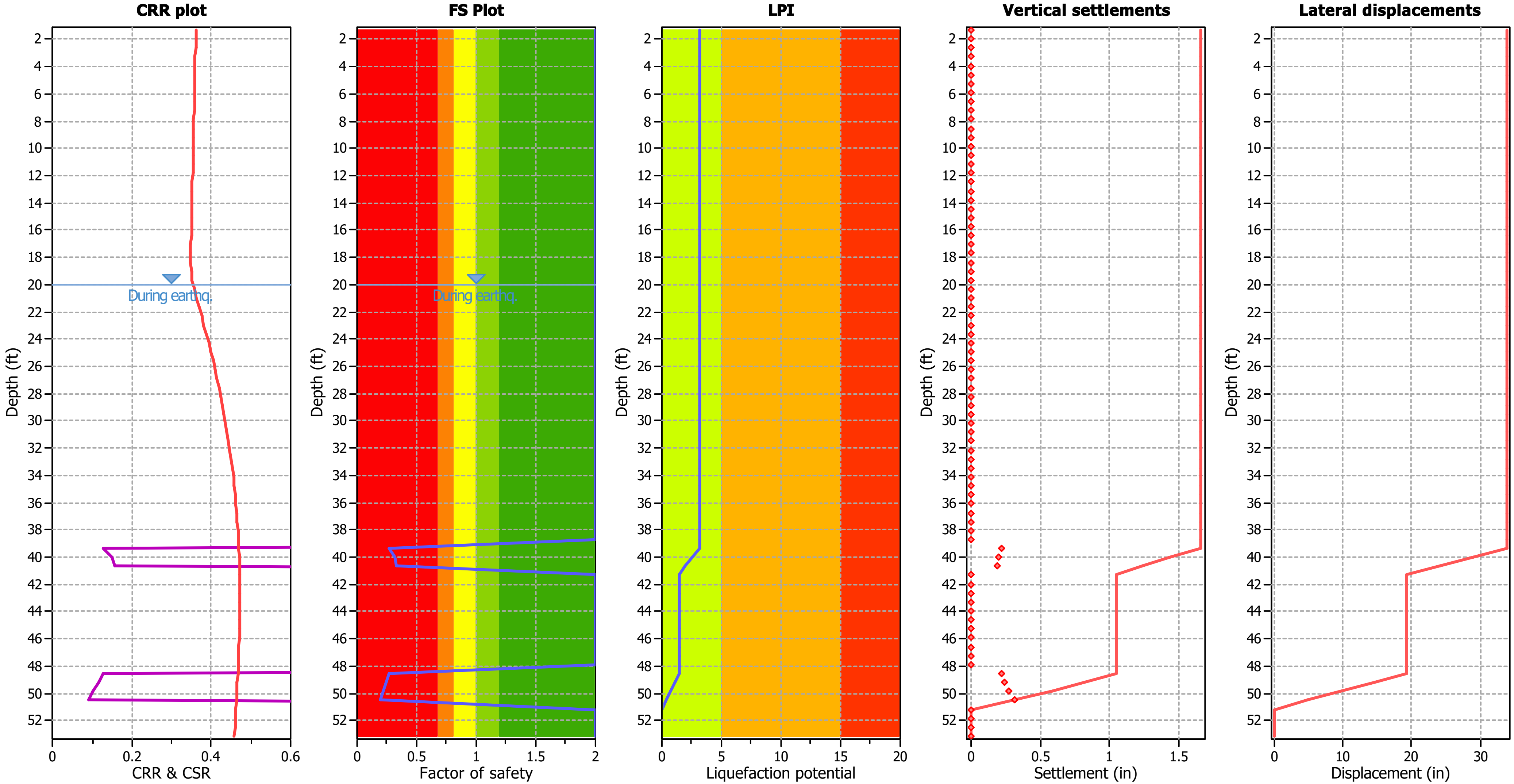
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

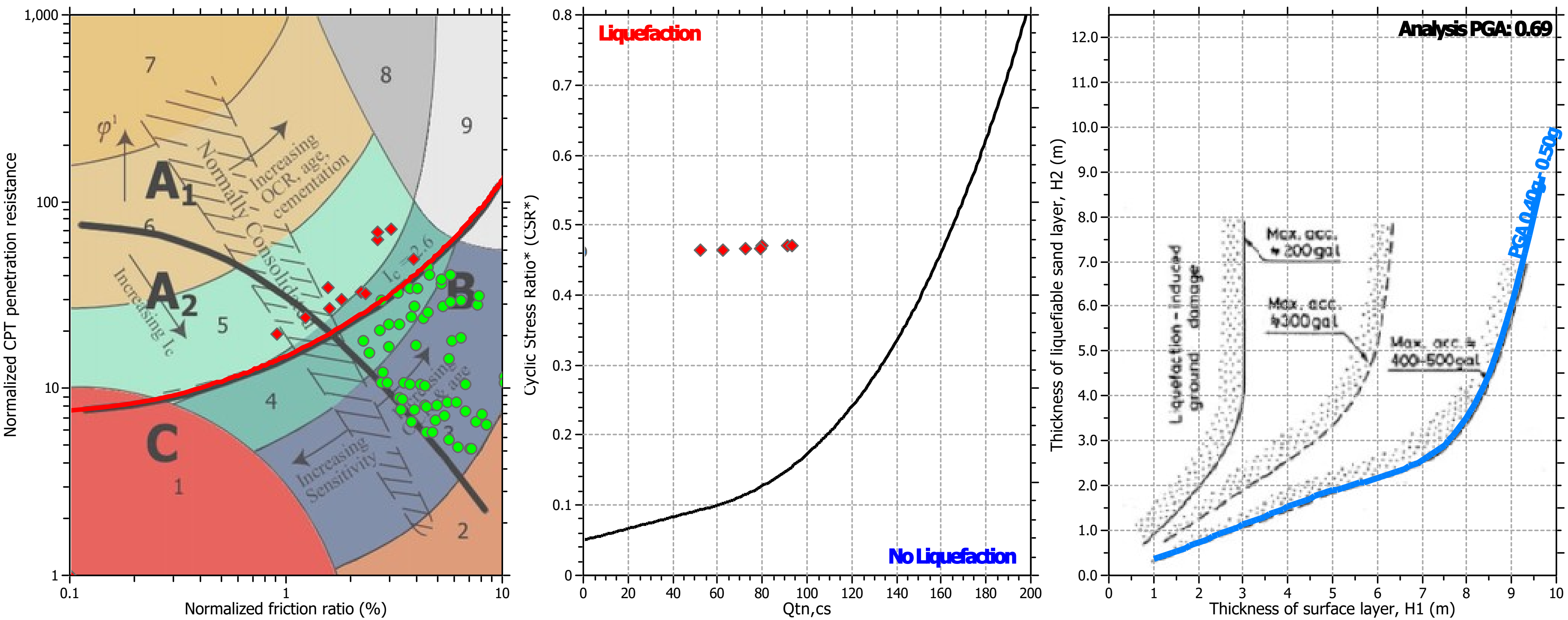
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

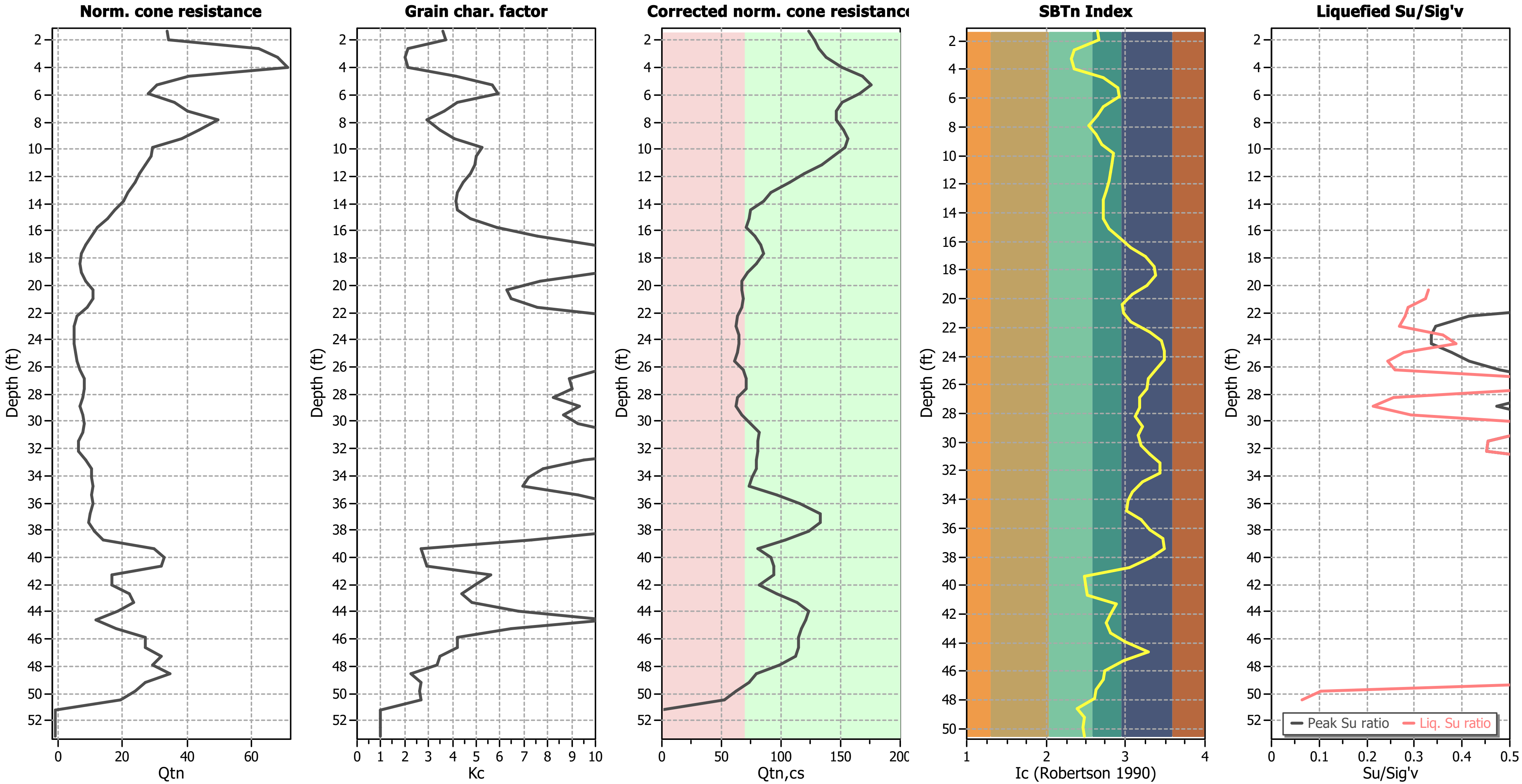
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	1.31	17.03	0.84	-0.01	37.62	116.10
2	1.97	29.52	0.73	1.07	38.60	116.67
3	2.63	17.46	1.02	0.42	24.26	119.43
4	3.28	70.05	1.33	2.82	23.30	120.37
5	3.94	40.63	1.06	1.76	24.47	121.83
6	4.59	23.36	1.71	1.11	41.52	120.95
7	5.25	12.53	1.62	-0.59	51.94	120.55
8	5.91	22.60	1.21	0.28	53.42	119.44
9	6.56	18.08	1.21	-0.87	41.87	119.10
10	7.22	27.67	1.12	-0.88	37.97	119.16
11	7.87	30.31	1.11	-1.37	32.29	120.06
12	8.53	36.24	1.39	-0.88	36.44	120.04
13	9.19	17.12	1.26	0.15	41.00	119.78
14	9.84	19.78	1.15	-1.26	49.11	118.58
15	10.50	19.38	1.10	-1.57	47.35	118.00
16	11.16	18.36	0.97	-1.09	47.01	117.41
17	11.81	19.87	0.90	-1.57	45.78	116.09
18	12.47	18.35	0.63	-1.42	43.68	114.87
19	13.12	18.97	0.58	-1.24	41.88	112.62
20	13.78	17.17	0.37	0.27	41.54	111.67
21	14.44	17.38	0.44	1.95	41.78	109.38
22	15.09	13.93	0.24	5.20	45.66	108.92
23	15.75	12.45	0.34	7.88	52.83	107.89
24	16.40	9.55	0.37	9.44	63.30	109.76
25	17.06	10.31	0.55	11.18	76.63	110.89
26	17.72	7.64	0.63	10.97	86.92	111.72
27	18.37	6.86	0.61	14.82	88.00	110.87
28	19.03	9.30	0.38	17.54	78.47	109.26
29	19.69	9.72	0.27	20.32	64.17	108.31
30	20.34	13.22	0.38	23.80	55.68	108.83
31	21.00	16.53	0.38	31.21	56.62	109.35
32	21.65	10.20	0.34	22.62	63.52	108.68
33	22.31	7.30	0.34	24.59	81.70	107.46
34	22.97	6.31	0.33	25.90	93.54	107.81
35	23.62	6.92	0.44	22.34	97.40	108.72
36	24.28	7.33	0.49	19.58	97.72	108.88
37	24.93	6.69	0.35	18.02	88.34	108.37
38	25.59	9.50	0.31	21.34	80.15	107.57
39	26.25	9.62	0.34	25.69	78.14	109.82
40	26.90	10.64	0.65	14.14	70.93	110.80
41	27.56	15.01	0.42	27.71	71.59	110.85
42	28.22	9.66	0.35	20.87	67.34	108.65
43	28.87	9.91	0.29	24.93	73.53	108.26
44	29.53	11.15	0.40	32.42	69.78	109.95
45	30.18	14.32	0.56	35.27	73.23	112.31
46	30.84	11.67	0.73	48.40	82.13	113.95
47	31.50	8.76	0.86	52.35	91.92	114.13
48	32.15	9.76	0.70	59.80	92.00	114.23

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	32.81	11.84	0.75	62.04	74.49	113.90
50	33.47	18.12	0.58	46.43	64.62	114.14
51	34.12	18.79	0.65	32.11	61.04	113.47
52	34.78	14.56	0.55	23.53	59.82	113.19
53	35.43	19.31	0.51	28.27	72.97	117.86
54	36.09	18.41	2.18	39.13	81.88	121.27
55	36.75	16.25	2.41	44.65	95.78	123.96
56	37.40	16.56	2.91	24.15	97.75	124.11
57	38.06	17.84	2.36	36.70	82.67	122.81
58	38.71	24.88	0.84	38.18	61.83	120.20
59	39.37	31.96	0.77	1.36	29.91	118.25
60	40.03	85.39	0.85	7.70	30.80	120.79
61	40.68	41.40	1.74	-0.82	31.86	121.18
62	41.34	31.09	0.96	3.42	51.49	119.54
63	42.00	19.33	0.70	7.30	47.03	117.26
64	42.65	40.17	0.84	3.56	43.29	120.80
65	43.31	58.28	2.18	5.58	46.36	123.50
66	43.96	28.76	2.23	11.46	58.50	124.46
67	44.62	18.09	1.97	13.02	79.78	123.46
68	45.28	22.31	2.18	15.15	56.95	123.71
69	45.93	64.91	1.60	6.86	42.03	124.53
70	46.59	63.76	1.92	11.62	41.85	124.57
71	47.24	24.19	2.19	5.38	36.45	124.78
72	47.90	89.10	1.48	3.15	35.54	122.75
73	48.56	50.51	0.68	2.44	26.01	119.74
74	49.21	45.74	0.60	3.78	30.01	117.63
75	49.87	52.81	0.94	9.50	29.31	114.70
76	50.53	35.10	0.00	7.55	29.69	110.65
77	51.18	24.02	0.00	4.27	N/A	87.36
78	51.84	21.73	0.00	8.96	N/A	87.36
79	52.49	19.14	0.00	10.18	N/A	87.36
80	53.15	18.73	0.00	10.46	N/A	87.36

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	1.31	0.08	0.00	0.08	1.00	0.448	1.24	0.362	1.00	1.00	2.000	No
2	1.97	0.11	0.00	0.11	1.00	0.447	1.24	0.361	1.00	1.00	2.000	No
3	2.63	0.15	0.00	0.15	1.00	0.447	1.24	0.361	1.00	1.00	2.000	No
4	3.28	0.19	0.00	0.19	0.99	0.446	1.24	0.360	1.00	1.00	2.000	No
5	3.94	0.23	0.00	0.23	0.99	0.445	1.24	0.360	1.00	1.00	2.000	No
6	4.59	0.27	0.00	0.27	0.99	0.445	1.24	0.359	1.00	1.00	2.000	No
7	5.25	0.31	0.00	0.31	0.99	0.444	1.24	0.359	1.00	1.00	2.000	No
8	5.91	0.35	0.00	0.35	0.99	0.443	1.24	0.358	1.00	1.00	2.000	No
9	6.56	0.39	0.00	0.39	0.99	0.443	1.24	0.358	1.00	1.00	2.000	No
10	7.22	0.43	0.00	0.43	0.99	0.442	1.24	0.357	1.00	1.00	2.000	No
11	7.87	0.47	0.00	0.47	0.98	0.441	1.24	0.357	1.00	1.00	2.000	No
12	8.53	0.51	0.00	0.51	0.98	0.441	1.24	0.356	1.00	1.00	2.000	No
13	9.19	0.55	0.00	0.55	0.98	0.440	1.24	0.355	1.00	1.00	2.000	No
14	9.84	0.59	0.00	0.59	0.98	0.439	1.24	0.355	1.00	1.00	2.000	No
15	10.50	0.63	0.00	0.63	0.98	0.439	1.24	0.354	1.00	1.00	2.000	No
16	11.16	0.66	0.00	0.66	0.98	0.438	1.24	0.354	1.00	1.00	2.000	No
17	11.81	0.70	0.00	0.70	0.98	0.437	1.24	0.353	1.00	1.00	2.000	No
18	12.47	0.74	0.00	0.74	0.97	0.437	1.24	0.353	1.00	1.00	2.000	No
19	13.12	0.78	0.00	0.78	0.97	0.436	1.24	0.352	1.00	1.00	2.000	No
20	13.78	0.81	0.00	0.81	0.97	0.436	1.24	0.352	1.00	1.00	2.000	No
21	14.44	0.85	0.00	0.85	0.97	0.435	1.24	0.351	1.00	1.00	2.000	No
22	15.09	0.88	0.00	0.88	0.97	0.434	1.24	0.351	1.00	1.00	2.000	No
23	15.75	0.92	0.00	0.92	0.97	0.434	1.24	0.350	1.00	1.00	2.000	No
24	16.40	0.96	0.00	0.96	0.97	0.433	1.24	0.350	1.00	1.00	2.000	No
25	17.06	0.99	0.00	0.99	0.96	0.432	1.24	0.349	1.00	1.00	2.000	No
26	17.72	1.03	0.00	1.03	0.96	0.432	1.24	0.349	1.00	1.00	2.000	No
27	18.37	1.07	0.00	1.07	0.96	0.431	1.24	0.348	1.00	1.00	2.000	No
28	19.03	1.10	0.00	1.10	0.96	0.430	1.24	0.348	0.99	1.00	2.000	No
29	19.69	1.14	0.00	1.14	0.96	0.430	1.24	0.347	0.98	1.00	2.000	No
30	20.34	1.17	0.01	1.16	0.96	0.433	1.24	0.350	0.98	1.00	0.357	No
31	21.00	1.21	0.03	1.18	0.95	0.439	1.24	0.355	0.98	1.00	0.364	No
32	21.65	1.24	0.05	1.19	0.95	0.446	1.24	0.360	0.97	1.00	0.370	No
33	22.31	1.28	0.07	1.21	0.95	0.452	1.24	0.365	0.97	1.00	0.376	No
34	22.97	1.31	0.09	1.22	0.95	0.458	1.24	0.370	0.97	1.00	0.382	No
35	23.62	1.35	0.11	1.24	0.95	0.463	1.24	0.374	0.96	1.00	0.388	No
36	24.28	1.39	0.13	1.25	0.94	0.469	1.24	0.379	0.96	1.00	0.394	No
37	24.93	1.42	0.15	1.27	0.94	0.474	1.24	0.383	0.96	1.00	0.399	No
38	25.59	1.46	0.17	1.28	0.94	0.479	1.24	0.387	0.96	1.00	0.404	No
39	26.25	1.49	0.19	1.30	0.94	0.483	1.24	0.391	0.95	1.00	0.409	No
40	26.90	1.53	0.22	1.31	0.93	0.488	1.24	0.394	0.95	1.00	0.414	No
41	27.56	1.57	0.24	1.33	0.93	0.492	1.24	0.398	0.95	1.00	0.419	No
42	28.22	1.60	0.26	1.35	0.93	0.496	1.24	0.401	0.95	1.00	0.424	No
43	28.87	1.64	0.28	1.36	0.93	0.500	1.24	0.404	0.94	1.00	0.428	No
44	29.53	1.67	0.30	1.38	0.92	0.503	1.24	0.407	0.94	1.00	0.432	No
45	30.18	1.71	0.32	1.39	0.92	0.507	1.24	0.409	0.94	1.00	0.436	No
46	30.84	1.75	0.34	1.41	0.92	0.510	1.24	0.412	0.94	1.00	0.440	No
47	31.50	1.78	0.36	1.43	0.91	0.512	1.24	0.414	0.93	1.00	0.443	No
48	32.15	1.82	0.38	1.44	0.91	0.515	1.24	0.416	0.93	1.00	0.447	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	32.81	1.86	0.40	1.46	0.90	0.517	1.24	0.418	0.93	1.00	0.450	No
50	33.47	1.90	0.42	1.48	0.90	0.519	1.24	0.419	0.93	1.00	0.453	No
51	34.12	1.93	0.44	1.49	0.90	0.521	1.24	0.421	0.92	1.00	0.456	No
52	34.78	1.97	0.46	1.51	0.89	0.522	1.24	0.422	0.92	1.00	0.458	No
53	35.43	2.01	0.48	1.53	0.89	0.523	1.24	0.423	0.92	1.00	0.460	No
54	36.09	2.05	0.50	1.55	0.88	0.524	1.24	0.424	0.92	1.00	0.462	No
55	36.75	2.09	0.52	1.57	0.88	0.525	1.24	0.424	0.91	1.00	0.464	No
56	37.40	2.13	0.54	1.59	0.87	0.525	1.24	0.424	0.91	1.00	0.466	No
57	38.06	2.17	0.56	1.61	0.87	0.525	1.24	0.425	0.91	1.00	0.467	No
58	38.71	2.21	0.58	1.63	0.86	0.525	1.24	0.425	0.91	1.00	0.469	No
59	39.37	2.25	0.60	1.65	0.86	0.525	1.24	0.424	0.90	1.00	0.470	No
60	40.03	2.29	0.62	1.66	0.85	0.525	1.24	0.424	0.90	1.00	0.471	No
61	40.68	2.33	0.65	1.68	0.84	0.524	1.24	0.424	0.90	1.00	0.471	No
62	41.34	2.37	0.67	1.70	0.84	0.523	1.24	0.423	0.90	1.00	0.472	No
63	42.00	2.41	0.69	1.72	0.83	0.523	1.24	0.422	0.89	1.00	0.472	No
64	42.65	2.45	0.71	1.74	0.83	0.521	1.24	0.421	0.89	1.00	0.472	No
65	43.31	2.49	0.73	1.76	0.82	0.520	1.24	0.420	0.89	1.00	0.472	No
66	43.96	2.53	0.75	1.78	0.81	0.518	1.24	0.419	0.89	1.00	0.472	No
67	44.62	2.57	0.77	1.80	0.81	0.517	1.24	0.417	0.88	1.00	0.472	No
68	45.28	2.61	0.79	1.82	0.80	0.515	1.24	0.416	0.88	1.00	0.471	No
69	45.93	2.65	0.81	1.84	0.79	0.513	1.24	0.414	0.88	1.00	0.471	No
70	46.59	2.69	0.83	1.86	0.79	0.511	1.24	0.413	0.88	1.00	0.470	No
71	47.24	2.73	0.85	1.88	0.78	0.508	1.24	0.411	0.88	1.00	0.469	No
72	47.90	2.77	0.87	1.90	0.77	0.506	1.24	0.409	0.87	1.00	0.468	No
73	48.56	2.81	0.89	1.92	0.77	0.504	1.24	0.407	0.87	1.00	0.467	No
74	49.21	2.85	0.91	1.94	0.76	0.502	1.24	0.405	0.87	1.00	0.466	No
75	49.87	2.89	0.93	1.96	0.75	0.499	1.24	0.404	0.87	1.00	0.465	No
76	50.53	2.92	0.95	1.97	0.75	0.497	1.24	0.402	0.87	1.00	0.464	No
77	51.18	2.95	0.97	1.98	0.74	0.495	1.24	0.400	0.87	1.00	0.462	No
78	51.84	2.98	0.99	1.99	0.73	0.494	1.24	0.399	0.87	1.00	0.461	No
79	52.49	3.01	1.01	2.00	0.73	0.492	1.24	0.398	0.86	1.00	0.460	No
80	53.15	3.04	1.03	2.00	0.72	0.490	1.24	0.396	0.86	1.00	0.459	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	1.31	21.20	2.65	3.80	0.88	33.94	3.62	122.73	4.000	No	Yes	2.00
2	1.97	21.34	2.66	4.07	0.89	34.11	3.75	127.74	4.000	No	Yes	2.00
3	2.63	39.03	2.35	2.65	0.77	62.46	2.11	131.50	4.000	No	No	2.00
4	3.28	42.74	2.32	2.67	0.76	68.35	2.02	137.91	4.000	No	No	2.00
5	3.94	44.71	2.35	3.08	0.77	71.45	2.12	151.77	4.000	No	No	2.00
6	4.59	25.52	2.72	5.79	0.91	40.56	4.14	168.02	4.000	No	Yes	2.00
7	5.25	19.50	2.90	7.88	0.98	30.83	5.69	175.42	4.000	No	Yes	2.00
8	5.91	17.73	2.92	7.73	0.99	27.92	5.92	165.37	4.000	No	Yes	2.00
9	6.56	22.78	2.73	5.26	0.91	35.97	4.19	150.76	4.000	No	Yes	2.00
10	7.22	25.34	2.65	4.60	0.89	40.02	3.66	146.58	4.000	No	Yes	2.00
11	7.87	31.39	2.54	3.90	0.84	49.68	2.95	146.74	4.000	No	No	2.00
12	8.53	27.88	2.62	4.58	0.87	43.98	3.46	152.32	4.000	No	Yes	2.00
13	9.19	24.37	2.71	5.31	0.91	38.27	4.07	155.82	4.000	No	Yes	2.00
14	9.84	18.75	2.85	6.45	0.96	29.18	5.25	153.21	4.000	No	Yes	2.00
15	10.50	19.15	2.82	5.80	0.95	28.87	4.99	143.96	4.000	No	Yes	2.00
16	11.16	19.18	2.82	5.35	0.95	27.24	4.93	134.40	4.000	No	Yes	2.00
17	11.81	18.84	2.80	4.59	0.94	25.22	4.75	119.84	4.000	No	Yes	2.00
18	12.47	19.04	2.76	3.84	0.93	24.10	4.45	107.23	4.000	No	Yes	2.00
19	13.12	18.15	2.73	3.02	0.91	21.79	4.19	91.37	4.000	No	Yes	2.00
20	13.78	17.84	2.72	2.72	0.91	20.46	4.15	84.82	4.000	No	Yes	2.00
21	14.44	16.20	2.72	2.28	0.91	17.73	4.18	74.11	4.000	No	Yes	2.00
22	15.09	14.66	2.79	2.47	0.94	15.40	4.74	72.92	4.000	No	Yes	2.00
23	15.75	12.08	2.91	2.82	0.99	12.11	5.83	70.57	4.000	No	Yes	2.00
24	16.40	10.91	3.07	4.22	1.00	10.41	7.55	78.58	4.000	No	Yes	2.00
25	17.06	9.32	3.25	6.21	1.00	8.39	9.90	83.08	4.000	No	Yes	2.00
26	17.72	8.45	3.37	8.07	1.00	7.21	11.81	85.08	4.000	No	Yes	2.00
27	18.37	8.14	3.38	7.62	1.00	6.64	12.01	79.73	4.000	No	Yes	2.00
28	19.03	8.88	3.27	5.40	1.00	7.06	10.24	72.30	4.000	No	Yes	2.00
29	19.69	11.04	3.08	3.47	1.00	8.71	7.70	67.10	4.000	No	Yes	2.00
30	20.34	13.52	2.96	2.79	1.00	10.62	6.28	66.76	4.000	No	Yes	2.00
31	21.00	13.69	2.97	2.95	1.00	10.60	6.44	68.23	4.000	No	Yes	2.00
32	21.65	11.72	3.07	3.38	1.00	8.78	7.59	66.66	4.000	No	Yes	2.00
33	22.31	8.29	3.31	4.80	1.00	5.80	10.83	62.87	4.000	No	Yes	2.00
34	22.97	7.19	3.44	6.30	1.00	4.81	13.06	62.78	4.000	No	Yes	2.00
35	23.62	7.18	3.48	7.20	1.00	4.71	13.79	64.97	4.000	No	Yes	2.00
36	24.28	7.27	3.49	7.26	1.00	4.69	13.86	65.04	4.000	No	Yes	2.00
37	24.93	8.12	3.38	5.72	1.00	5.29	12.07	63.80	4.000	No	Yes	2.00
38	25.59	8.92	3.29	4.47	1.00	5.81	10.55	61.33	4.000	No	Yes	2.00
39	26.25	10.21	3.26	4.97	1.00	6.72	10.18	68.38	4.000	No	Yes	2.00
40	26.90	12.08	3.17	4.44	1.00	8.03	8.88	71.30	4.000	No	Yes	2.00
41	27.56	12.07	3.18	4.49	1.00	7.90	9.00	71.07	4.000	No	Yes	2.00
42	28.22	11.88	3.13	3.42	1.00	7.64	8.25	63.02	4.000	No	Yes	2.00
43	28.87	10.62	3.21	3.85	1.00	6.60	9.35	61.68	4.000	No	Yes	2.00
44	29.53	12.24	3.16	3.93	1.00	7.68	8.68	66.63	4.000	No	Yes	2.00
45	30.18	12.94	3.20	5.02	1.00	8.06	9.29	74.92	4.000	No	Yes	2.00
46	30.84	12.24	3.31	6.84	1.00	7.44	10.91	81.23	4.000	No	Yes	2.00
47	31.50	10.83	3.42	8.47	1.00	6.35	12.75	80.89	4.000	No	Yes	2.00
48	32.15	10.96	3.43	8.47	1.00	6.33	12.76	80.78	4.000	No	Yes	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	32.81	14.05	3.22	5.58	1.00	8.35	9.52	79.45	4.000	No	Yes	2.00
50	33.47	16.92	3.09	4.40	1.00	10.17	7.78	79.14	4.000	No	Yes	2.00
51	34.12	17.65	3.04	3.78	1.00	10.52	7.17	75.42	4.000	No	Yes	2.00
52	34.78	17.96	3.02	3.56	1.00	10.58	6.97	73.72	4.000	No	Yes	2.00
53	35.43	17.86	3.20	6.81	1.00	10.37	9.25	95.88	4.000	No	Yes	2.00
54	36.09	18.53	3.31	10.31	1.00	10.64	10.87	115.68	4.000	No	Yes	2.00
55	36.75	17.59	3.47	16.12	1.00	9.88	13.48	133.29	4.000	No	Yes	2.00
56	37.40	17.39	3.49	16.77	1.00	9.61	13.86	133.16	4.000	No	Yes	2.00
57	38.06	20.24	3.32	11.27	1.00	11.23	11.01	123.69	4.000	No	Yes	2.00
58	38.71	25.26	3.05	5.75	1.00	14.16	7.30	103.44	4.000	No	Yes	2.00
59	39.37	47.64	2.48	1.81	0.82	29.84	2.68	80.04	0.128	No	No	0.27
60	40.03	52.96	2.50	2.21	0.83	32.89	2.78	91.49	0.151	No	No	0.32
61	40.68	52.68	2.53	2.35	0.84	32.23	2.90	93.59	0.156	No	No	0.33
62	41.34	30.65	2.89	4.01	0.98	16.79	5.62	94.37	4.000	No	Yes	2.00
63	42.00	30.27	2.82	3.00	0.95	16.60	4.94	81.96	4.000	No	Yes	2.00
64	42.65	39.34	2.75	3.36	0.92	22.02	4.39	96.73	4.000	No	Yes	2.00
65	43.31	42.50	2.81	4.37	0.94	23.39	4.84	113.16	4.000	No	Yes	2.00
66	43.96	35.19	3.00	6.50	1.00	18.35	6.75	123.77	4.000	No	Yes	2.00
67	44.62	23.24	3.28	10.27	1.00	11.48	10.48	120.35	4.000	No	Yes	2.00
68	45.28	35.27	2.98	5.86	1.00	17.94	6.49	116.49	4.000	No	Yes	2.00
69	45.93	50.49	2.73	3.97	0.92	27.23	4.21	114.77	4.000	No	Yes	2.00
70	46.59	51.07	2.73	3.93	0.91	27.28	4.19	114.30	4.000	No	Yes	2.00
71	47.24	59.11	2.62	3.31	0.87	32.20	3.47	111.61	4.000	No	Yes	2.00
72	47.90	54.65	2.60	2.80	0.87	29.48	3.35	98.75	4.000	No	Yes	2.00
73	48.56	61.83	2.39	1.56	0.79	34.92	2.27	79.34	0.126	No	No	0.27
74	49.21	49.76	2.48	1.58	0.82	26.96	2.69	72.59	0.116	No	No	0.25
75	49.87	44.65	2.47	1.24	0.82	23.91	2.62	62.56	0.103	No	No	0.22
76	50.53	37.41	2.48	0.91	0.82	19.58	2.66	52.02	0.093	No	No	0.20
77	51.18	27.05	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
78	51.84	21.74	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
79	52.49	20.01	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
80	53.15	19.02	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
1.31	2.00	0.00	9.80	0.66	0.00	1.97	2.00	0.00	9.70	0.66	0.00
2.63	2.00	0.00	9.60	0.66	0.00	3.28	2.00	0.00	9.50	0.66	0.00
3.94	2.00	0.00	9.40	0.66	0.00	4.59	2.00	0.00	9.30	0.66	0.00
5.25	2.00	0.00	9.20	0.66	0.00	5.91	2.00	0.00	9.10	0.66	0.00
6.56	2.00	0.00	9.00	0.66	0.00	7.22	2.00	0.00	8.90	0.66	0.00
7.87	2.00	0.00	8.80	0.66	0.00	8.53	2.00	0.00	8.70	0.66	0.00
9.19	2.00	0.00	8.60	0.66	0.00	9.84	2.00	0.00	8.50	0.66	0.00
10.50	2.00	0.00	8.40	0.66	0.00	11.16	2.00	0.00	8.30	0.66	0.00
11.81	2.00	0.00	8.20	0.66	0.00	12.47	2.00	0.00	8.10	0.66	0.00
13.12	2.00	0.00	8.00	0.66	0.00	13.78	2.00	0.00	7.90	0.66	0.00
14.44	2.00	0.00	7.80	0.66	0.00	15.09	2.00	0.00	7.70	0.66	0.00
15.75	2.00	0.00	7.60	0.66	0.00	16.40	2.00	0.00	7.50	0.66	0.00
17.06	2.00	0.00	7.40	0.66	0.00	17.72	2.00	0.00	7.30	0.66	0.00
18.37	2.00	0.00	7.20	0.66	0.00	19.03	2.00	0.00	7.10	0.66	0.00
19.69	2.00	0.00	7.00	0.66	0.00	20.34	2.00	0.00	6.90	0.66	0.00
21.00	2.00	0.00	6.80	0.66	0.00	21.65	2.00	0.00	6.70	0.66	0.00
22.31	2.00	0.00	6.60	0.66	0.00	22.97	2.00	0.00	6.50	0.66	0.00
23.62	2.00	0.00	6.40	0.66	0.00	24.28	2.00	0.00	6.30	0.66	0.00
24.93	2.00	0.00	6.20	0.66	0.00	25.59	2.00	0.00	6.10	0.66	0.00
26.25	2.00	0.00	6.00	0.66	0.00	26.90	2.00	0.00	5.90	0.66	0.00
27.56	2.00	0.00	5.80	0.66	0.00	28.22	2.00	0.00	5.70	0.66	0.00
28.87	2.00	0.00	5.60	0.66	0.00	29.53	2.00	0.00	5.50	0.66	0.00
30.18	2.00	0.00	5.40	0.66	0.00	30.84	2.00	0.00	5.30	0.66	0.00
31.50	2.00	0.00	5.20	0.66	0.00	32.15	2.00	0.00	5.10	0.66	0.00
32.81	2.00	0.00	5.00	0.66	0.00	33.47	2.00	0.00	4.90	0.66	0.00
34.12	2.00	0.00	4.80	0.66	0.00	34.78	2.00	0.00	4.70	0.66	0.00
35.43	2.00	0.00	4.60	0.66	0.00	36.09	2.00	0.00	4.50	0.66	0.00
36.75	2.00	0.00	4.40	0.66	0.00	37.40	2.00	0.00	4.30	0.66	0.00
38.06	2.00	0.00	4.20	0.66	0.00	38.71	2.00	0.00	4.10	0.66	0.00
39.37	0.27	0.73	4.00	0.66	0.58	40.03	0.32	0.68	3.90	0.66	0.53
40.68	0.33	0.67	3.80	0.66	0.51	41.34	2.00	0.00	3.70	0.66	0.00
42.00	2.00	0.00	3.60	0.66	0.00	42.65	2.00	0.00	3.50	0.66	0.00
43.31	2.00	0.00	3.40	0.66	0.00	43.96	2.00	0.00	3.30	0.66	0.00
44.62	2.00	0.00	3.20	0.66	0.00	45.28	2.00	0.00	3.10	0.66	0.00
45.93	2.00	0.00	3.00	0.66	0.00	46.59	2.00	0.00	2.90	0.66	0.00
47.24	2.00	0.00	2.80	0.66	0.00	47.90	2.00	0.00	2.70	0.66	0.00
48.56	0.27	0.73	2.60	0.66	0.38	49.21	0.25	0.75	2.50	0.66	0.38
49.87	0.22	0.78	2.40	0.66	0.37	50.53	0.20	0.80	2.30	0.66	0.37
51.18	2.00	0.00	2.20	0.66	0.00	51.84	2.00	0.00	2.10	0.66	0.00
52.49	2.00	0.00	2.00	0.66	0.00	53.15	2.00	0.00	1.90	0.66	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI

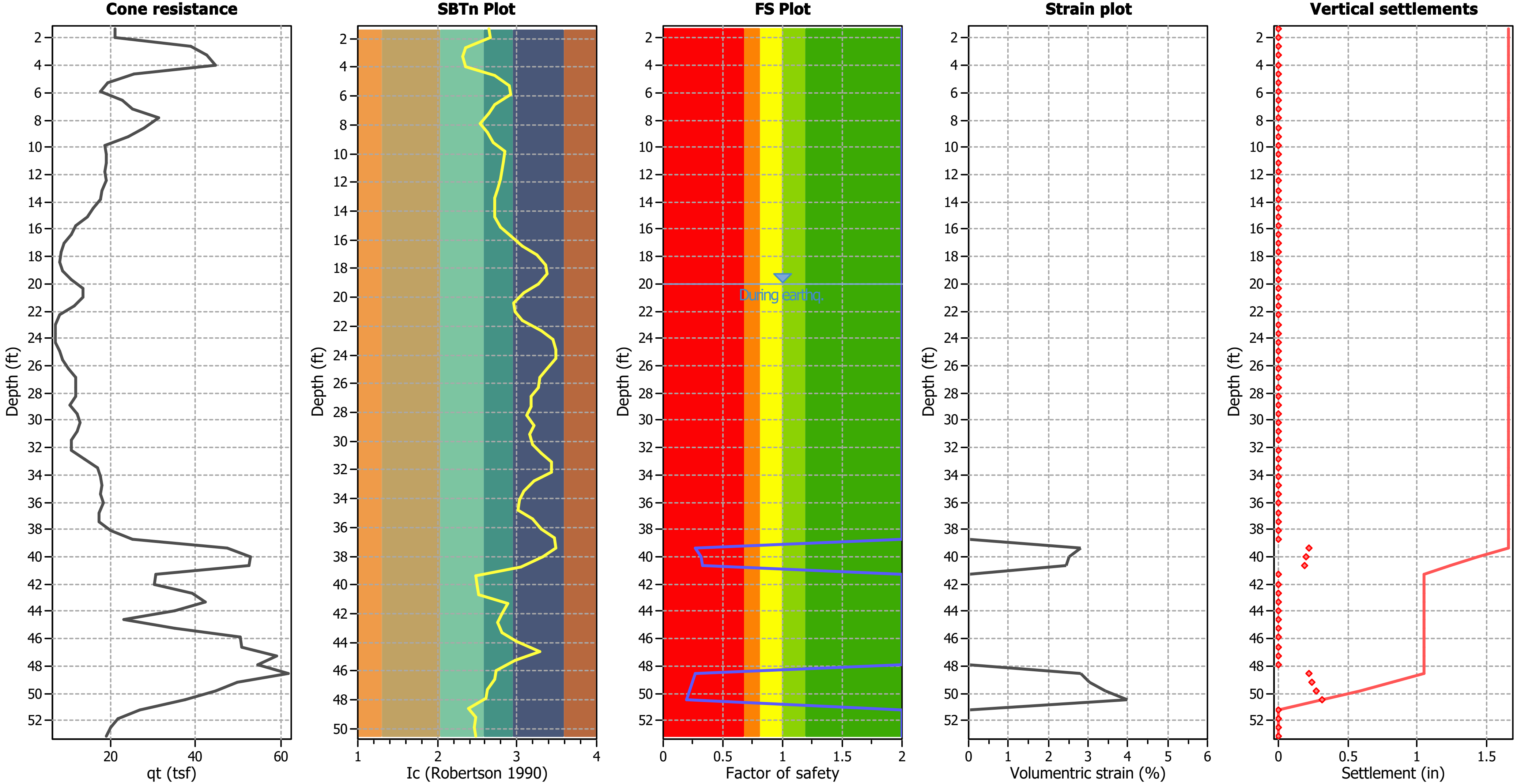
Overall liquefaction potential: 3.12

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.34	66.76	2.00	0.00	1.00	0.00	21.00	68.23	2.00	0.00	1.00	0.00
21.65	66.66	2.00	0.00	1.00	0.00	22.31	62.87	2.00	0.00	1.00	0.00
22.97	62.78	2.00	0.00	1.00	0.00	23.62	64.97	2.00	0.00	1.00	0.00
24.28	65.04	2.00	0.00	1.00	0.00	24.93	63.80	2.00	0.00	1.00	0.00
25.59	61.33	2.00	0.00	1.00	0.00	26.25	68.38	2.00	0.00	1.00	0.00
26.90	71.30	2.00	0.00	1.00	0.00	27.56	71.07	2.00	0.00	1.00	0.00
28.22	63.02	2.00	0.00	1.00	0.00	28.87	61.68	2.00	0.00	1.00	0.00
29.53	66.63	2.00	0.00	1.00	0.00	30.18	74.92	2.00	0.00	1.00	0.00
30.84	81.23	2.00	0.00	1.00	0.00	31.50	80.89	2.00	0.00	1.00	0.00
32.15	80.78	2.00	0.00	1.00	0.00	32.81	79.45	2.00	0.00	1.00	0.00
33.47	79.14	2.00	0.00	1.00	0.00	34.12	75.42	2.00	0.00	1.00	0.00
34.78	73.72	2.00	0.00	1.00	0.00	35.43	95.88	2.00	0.00	1.00	0.00
36.09	115.68	2.00	0.00	1.00	0.00	36.75	133.29	2.00	0.00	1.00	0.00
37.40	133.16	2.00	0.00	1.00	0.00	38.06	123.69	2.00	0.00	1.00	0.00
38.71	103.44	2.00	0.00	1.00	0.00	39.37	80.04	0.27	2.80	1.00	0.22
40.03	91.49	0.32	2.51	1.00	0.20	40.68	93.59	0.33	2.47	1.00	0.19
41.34	94.37	2.00	0.00	1.00	0.00	42.00	81.96	2.00	0.00	1.00	0.00
42.65	96.73	2.00	0.00	1.00	0.00	43.31	113.16	2.00	0.00	1.00	0.00
43.96	123.77	2.00	0.00	1.00	0.00	44.62	120.35	2.00	0.00	1.00	0.00
45.28	116.49	2.00	0.00	1.00	0.00	45.93	114.77	2.00	0.00	1.00	0.00
46.59	114.30	2.00	0.00	1.00	0.00	47.24	111.61	2.00	0.00	1.00	0.00
47.90	98.75	2.00	0.00	1.00	0.00	48.56	79.34	0.27	2.82	1.00	0.22
49.21	72.59	0.25	3.04	1.00	0.24	49.87	62.56	0.22	3.43	1.00	0.27
50.53	52.02	0.20	3.99	1.00	0.31	51.18	-1.00	2.00	0.00	1.00	0.00
51.84	-1.00	2.00	0.00	1.00	0.00	52.49	-1.00	2.00	0.00	1.00	0.00
53.15	-1.00	2.00	0.00	1.00	0.00						

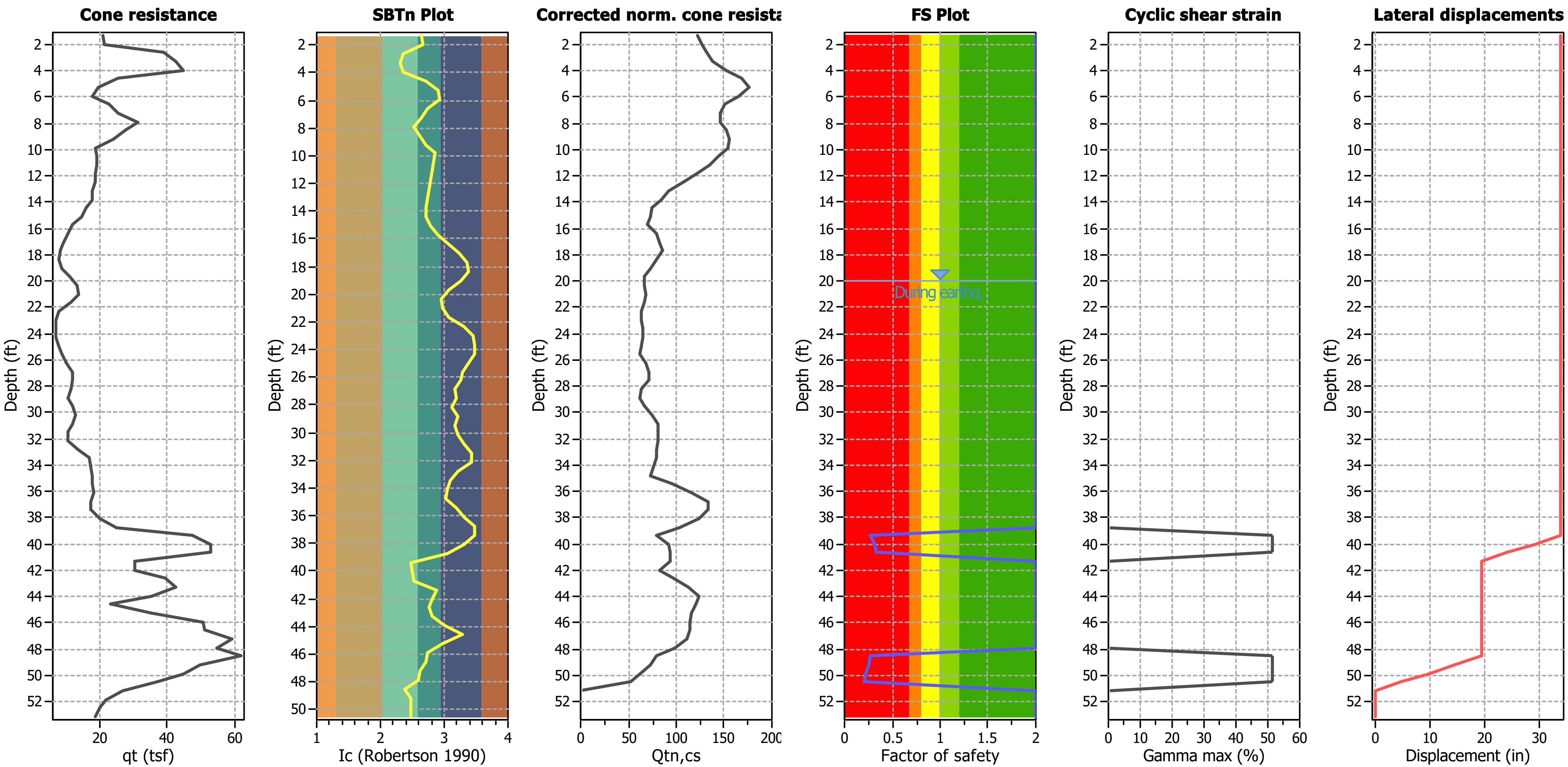
Total estimated settlement: 1.66

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

Estimation of post-earthquake lateral Displacements

Geometric parameters: Gently sloping ground without free face (Slope 1.00 %)

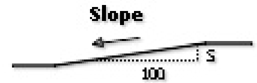


Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent clean sand normalized CPT total cone resistance

F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition

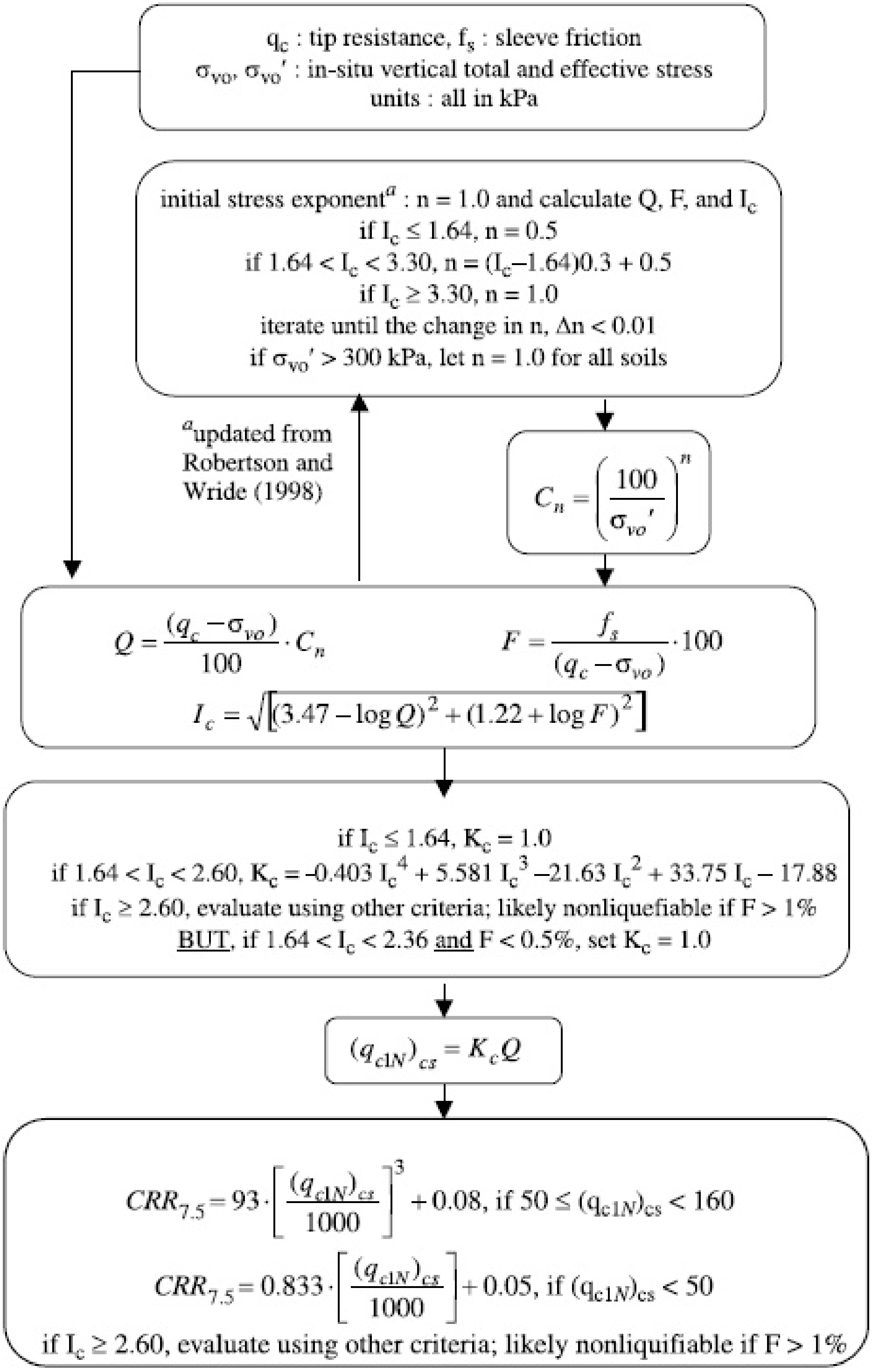


:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
20.34	13.52	10.62	2.55	66.76	2.00	0.00	0.00	0.00
21.00	13.69	10.60	2.69	68.23	2.00	0.00	0.00	0.00
21.65	11.72	8.78	3.02	66.66	2.00	0.00	0.00	0.00
22.31	8.29	5.80	4.06	62.87	2.00	0.00	0.00	0.00
22.97	7.19	4.81	5.15	62.78	2.00	0.00	0.00	0.00
23.62	7.18	4.71	5.84	64.97	2.00	0.00	0.00	0.00
24.28	7.27	4.69	5.87	65.04	2.00	0.00	0.00	0.00
24.93	8.12	5.29	4.72	63.80	2.00	0.00	0.00	0.00
25.59	8.92	5.81	3.74	61.33	2.00	0.00	0.00	0.00
26.25	10.21	6.72	4.24	68.38	2.00	0.00	0.00	0.00
26.90	12.08	8.03	3.88	71.30	2.00	0.00	0.00	0.00
27.56	12.07	7.90	3.91	71.07	2.00	0.00	0.00	0.00
28.22	11.88	7.64	2.96	63.02	2.00	0.00	0.00	0.00
28.87	10.62	6.60	3.26	61.68	2.00	0.00	0.00	0.00
29.53	12.24	7.68	3.39	66.63	2.00	0.00	0.00	0.00
30.18	12.94	8.06	4.35	74.92	2.00	0.00	0.00	0.00
30.84	12.24	7.44	5.86	81.23	2.00	0.00	0.00	0.00
31.50	10.83	6.35	7.07	80.89	2.00	0.00	0.00	0.00
32.15	10.96	6.33	7.06	80.78	2.00	0.00	0.00	0.00
32.81	14.05	8.35	4.84	79.45	2.00	0.00	0.00	0.00
33.47	16.92	10.17	3.91	79.14	2.00	0.00	0.00	0.00
34.12	17.65	10.52	3.37	75.42	2.00	0.00	0.00	0.00
34.78	17.96	10.58	3.17	73.72	2.00	0.00	0.00	0.00
35.43	17.86	10.37	6.04	95.88	2.00	0.00	0.00	0.00
36.09	18.53	10.64	9.17	115.68	2.00	0.00	0.00	0.00
36.75	17.59	9.88	14.20	133.29	2.00	0.00	0.00	0.00
37.40	17.39	9.61	14.72	133.16	2.00	0.00	0.00	0.00
38.06	20.24	11.23	10.06	123.69	2.00	0.00	0.00	0.00
38.71	25.26	14.16	5.24	103.44	2.00	2.49	0.00	0.00
39.37	47.64	29.84	1.72	80.04	0.27	27.09	51.20	4.84
40.03	52.96	32.89	2.12	91.49	0.32	30.29	51.20	4.84
40.68	52.68	32.23	2.25	93.59	0.33	29.63	51.20	4.84
41.34	30.65	16.79	3.70	94.37	2.00	8.11	0.00	0.00
42.00	30.27	16.60	2.76	81.96	2.00	7.72	0.00	0.00
42.65	39.34	22.02	3.15	96.73	2.00	17.05	0.00	0.00
43.31	42.50	23.39	4.11	113.16	2.00	19.04	0.00	0.00
43.96	35.19	18.35	6.03	123.77	2.00	11.03	0.00	0.00
44.62	23.24	11.48	9.14	120.35	2.00	0.00	0.00	0.00
45.28	35.27	17.94	5.43	116.49	2.00	10.29	0.00	0.00
45.93	50.49	27.23	3.76	114.77	2.00	24.07	0.00	0.00
46.59	51.07	27.28	3.73	114.30	2.00	24.13	0.00	0.00
47.24	59.11	32.20	3.16	111.61	2.00	29.60	0.00	0.00
47.90	54.65	29.48	2.65	98.75	2.00	26.69	0.00	0.00
48.56	61.83	34.92	1.49	79.34	0.27	32.27	51.20	4.84
49.21	49.76	26.96	1.49	72.59	0.25	23.73	51.20	4.84
49.87	44.65	23.91	1.16	62.56	0.22	19.77	51.20	4.84
50.53	37.41	19.58	0.84	52.02	0.20	13.17	51.20	4.84

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

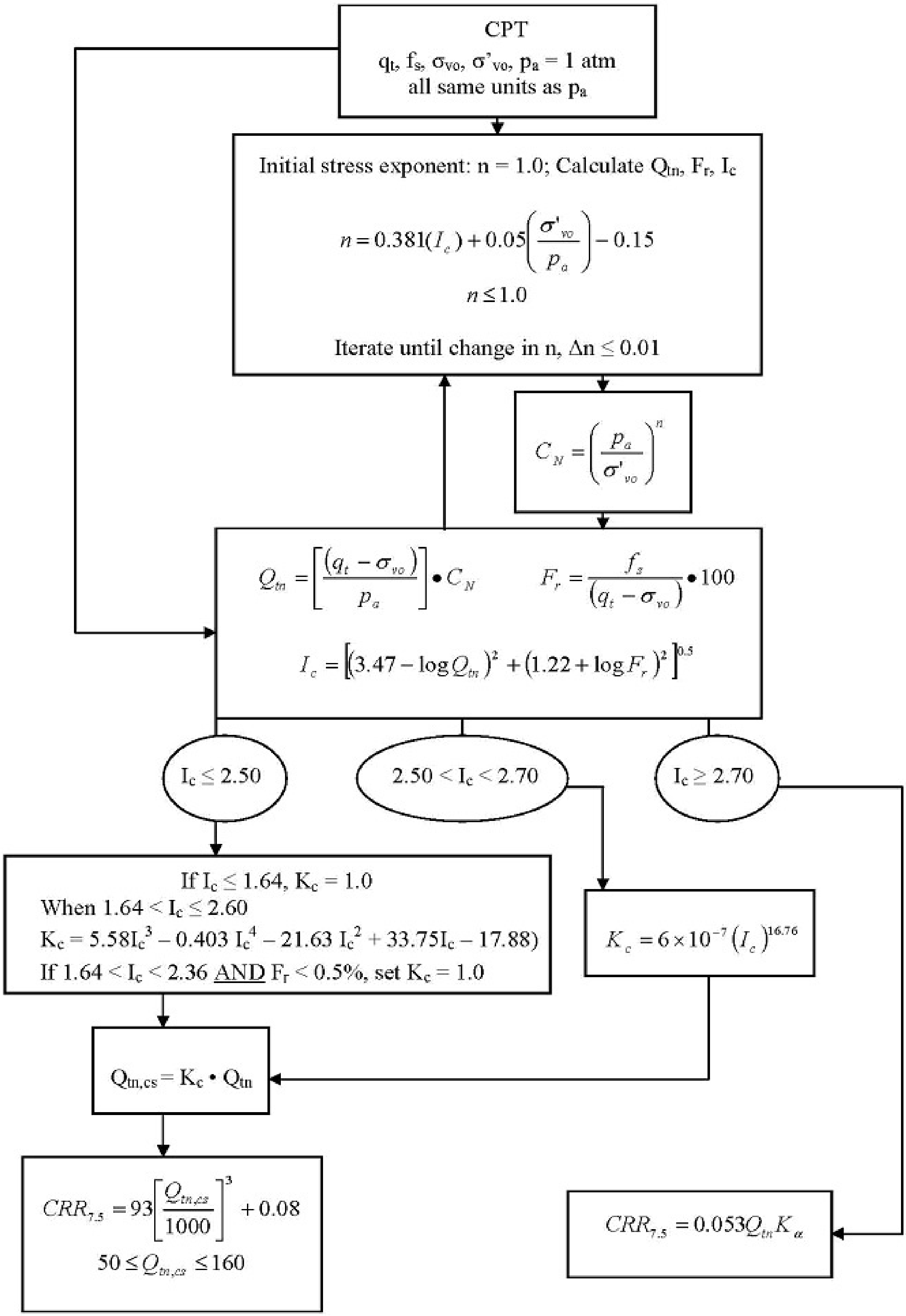
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

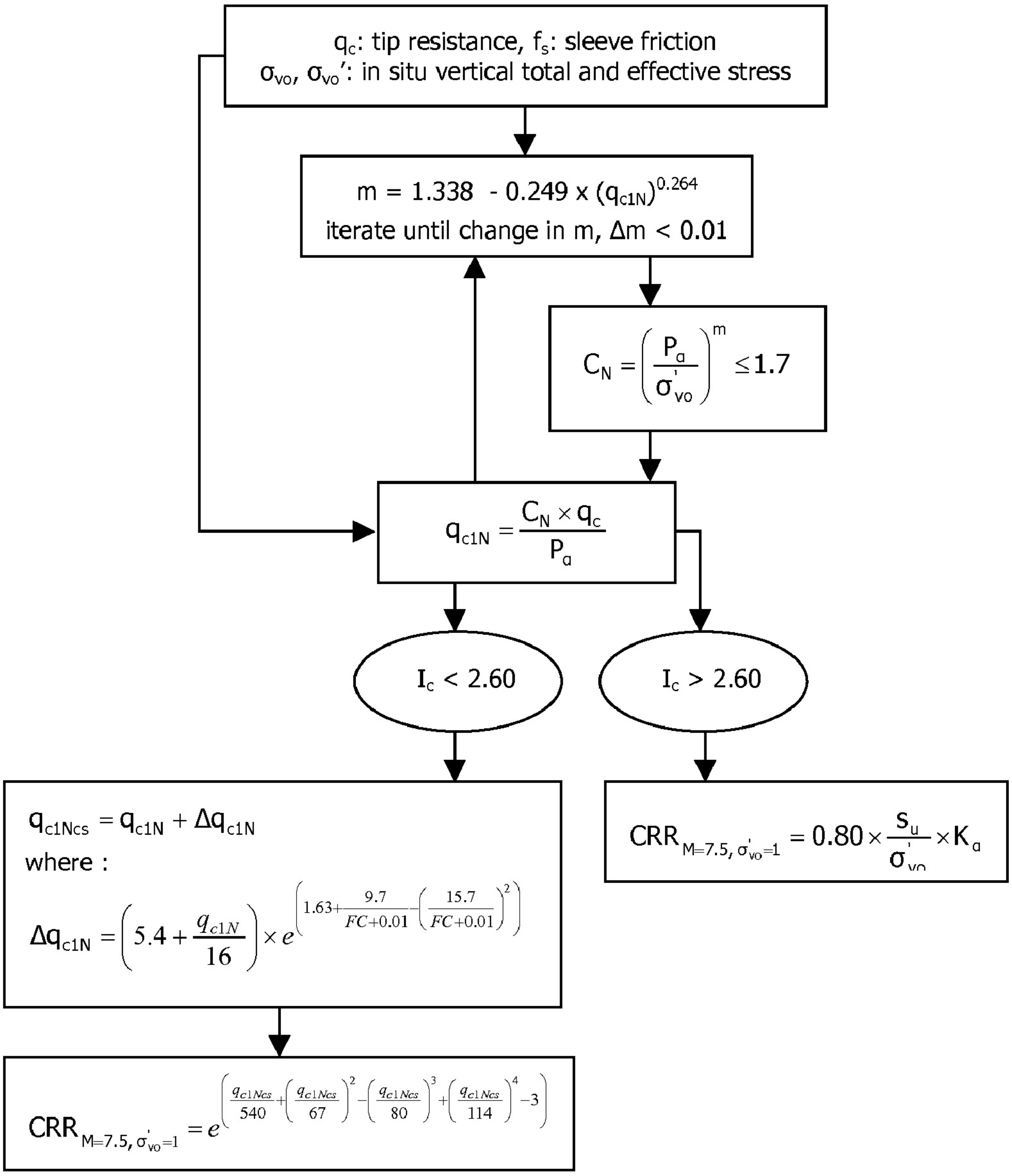
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

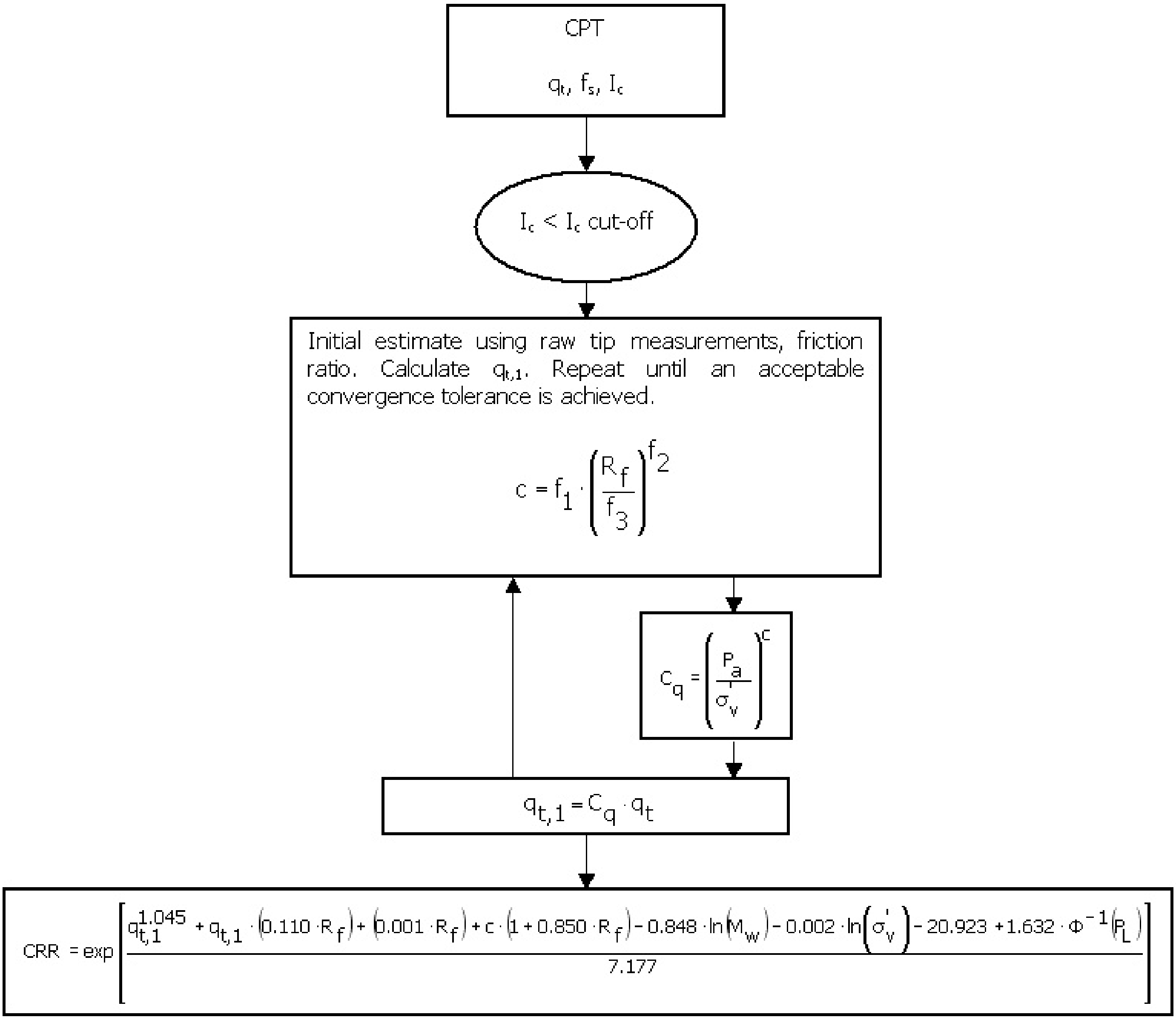


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)

$$FS_{liq} = \frac{CRR_{M=7.5,\sigma_v'=1atm}}{CSR_{M=7.5,\sigma_v'=1atm}}$$

$$CSR_{M=7.5,\sigma_v'=1atm} = 0.65\frac{\sigma_v}{\sigma_v'}\frac{a_{\max}}{g}r_d\frac{1}{MSF}\frac{1}{K_\sigma}$$

$$r_d = \exp\left[\alpha(z)+\beta(z)\cdot M\right]$$

$$\alpha(z) = -1.012 - 1.126\sin\left(\frac{z}{11.73}+5.133\right)$$

$$\beta(z) = 0.106 + 0.118\sin\left(\frac{z}{11.28}+5.142\right)$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma_v'}{P_a}\right) \le 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27\left(q_{c1Ncs}\right)^{0.264}} \le 0.3$$

$$MSF = 1 + \left(MSF_{max} - 1\right)\left(8.64\exp\left(\frac{-M}{4}\right) - 1.325\right)$$

$$MSF_{max} = 1.09 + \left(\frac{q_{c1Ncs}}{180}\right)^3 \le 2.2$$

σ_v' *and* σ_v *at start of earthquake shaking*

$$CRR_{M=7.5,\sigma_v'=1atm} = \exp\left(\frac{q_{c1Ncs}}{113} + \left(\frac{q_{c1Ncs}}{1000}\right)^2 - \left(\frac{q_{c1Ncs}}{140}\right)^3 + \left(\frac{q_{c1Ncs}}{137}\right)^4 - 2.80\right)$$

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(11.9 + \frac{q_{c1N}}{14.6}\right)\exp\left(1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right)$$

$$q_{c1N} = C_N \frac{q_c}{P_a}$$

$$C_N = \left(\frac{P_a}{\sigma_v'}\right)^m \le 1.7$$

$$m = 1.338 - 0.249\left(q_{c1Ncs}\right)^{0.264} \quad with \quad 0.264 \le m \le 0.782$$

$$FC = 80\left(I_C + C_{FC}\right) - 137 \quad with \quad 0\% \le FC \le 100\%$$

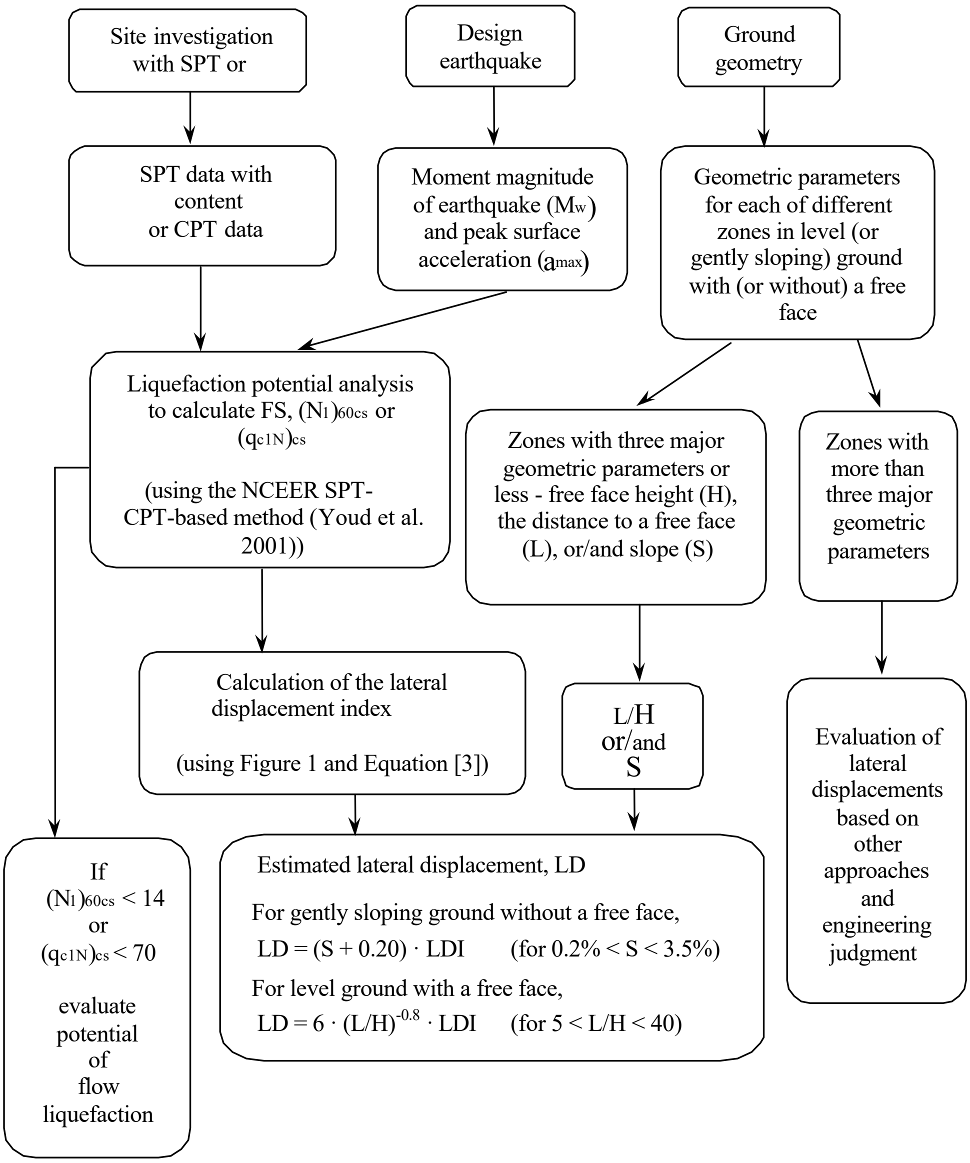
$$I_c = \left[\left(3.47 - \log(Q)\right)^2 + \left(1.22 + \log(F)\right)^2\right]^{0.5}$$

$$Q = \left(\frac{q_c - \sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma_{vc}'}\right)^n \; with\; 0.5 \le n \le 1.0 \; per \; Robertson \,\&\, Wride\,(1998)$$

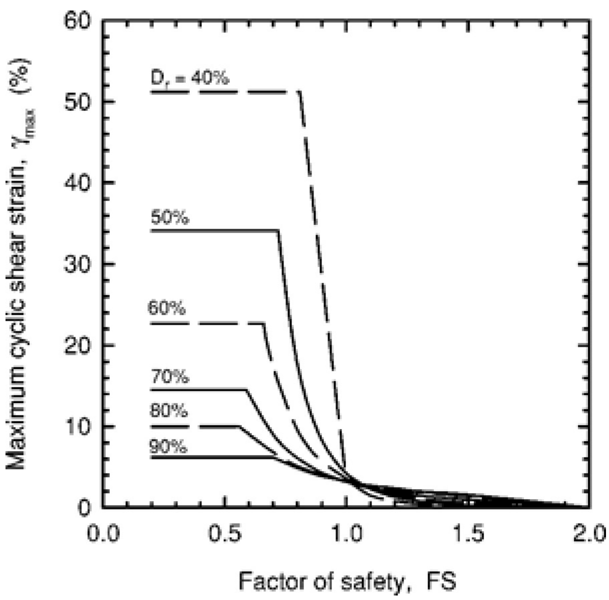
$$F = \left(\frac{f_s}{q_c - \sigma_{vc}}\right)\cdot 100\%$$

σ_v' *at time of CPT sounding*

Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



[1] Figure 1

$$LDI = \int_0^{Z_{max}} \gamma_{max} dz$$

[1] Equation [3]

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands

Average shear stress, τ_{av}

$$\tau_{av} = CSR^{*} \cdot \sigma_{v0}' = 0.65 \cdot \frac{a_{max}}{g} \cdot \sigma_{v0} \cdot \tau_{a}$$

Estimate small shear strain modulus, G_0

$$G_0 = 0.0188 \cdot \left[10^{(0.55 I_c - 1.68)}\right] \cdot (q_t - \sigma_v)$$

Estimate shear strain amplitude, γ (based on Pradel (1998))

$$\gamma = \left[\frac{1 + a \cdot e^{bR}}{1 + a}\right] \cdot R \cdot 100\ (\%)$$

$$R = \frac{\tau_{av}}{G_0} \text{ (Note } \tau_{av} \text{ and } G_0 \text{ same units)}$$

$$a = 0.0389 \cdot \left(\frac{\sigma_v}{p_a}\right) + 0.124$$

$$b = 6400 \cdot \left(\frac{\sigma_v}{p_a}\right)$$

Estimate volumetric strain in 15 cycles

$$\varepsilon_{vol(15)} = \gamma \cdot \left[\frac{(N_1)_{60,cs}}{20}\right]^{-1.20}$$

$$(N_1)_{60,cs} = \frac{Q_{tn,cs}}{8.5 \cdot \left[1 - \frac{I_c}{4.6}\right]}$$

Volumetric strain in design earthquake

$$\Sigma_{vol} = \varepsilon_{vol(15)} \cdot \left[\frac{N_c}{15}\right]^{0.45}$$

$$N_c = (M - 4)^{2.17}$$

Seismic settlement, s

$$s = 2 \cdot \int_0^{GWT} \Sigma_{vol} \cdot dz$$

Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

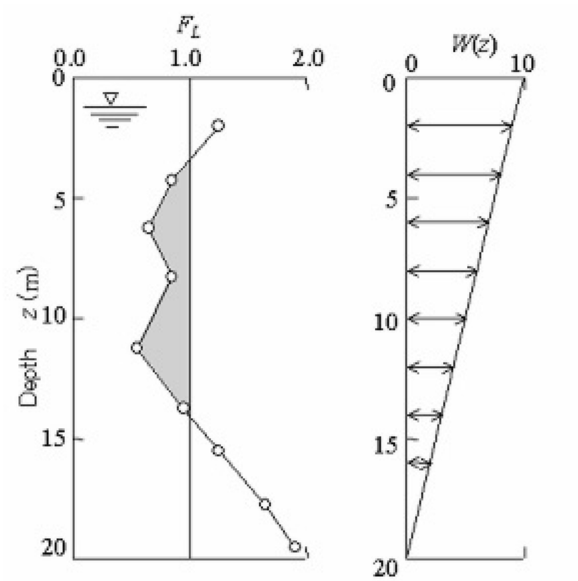
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\textbf{LPI} = \int_0^{20} (10 - 0{,}5_z) \times F_L \times d_z$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) +$$

$$4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B +$$
$$0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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TABLE OF CONTENTS

WRECO
7807 Laguna Blvd., Suite 400
Elk Grove, CA 95758

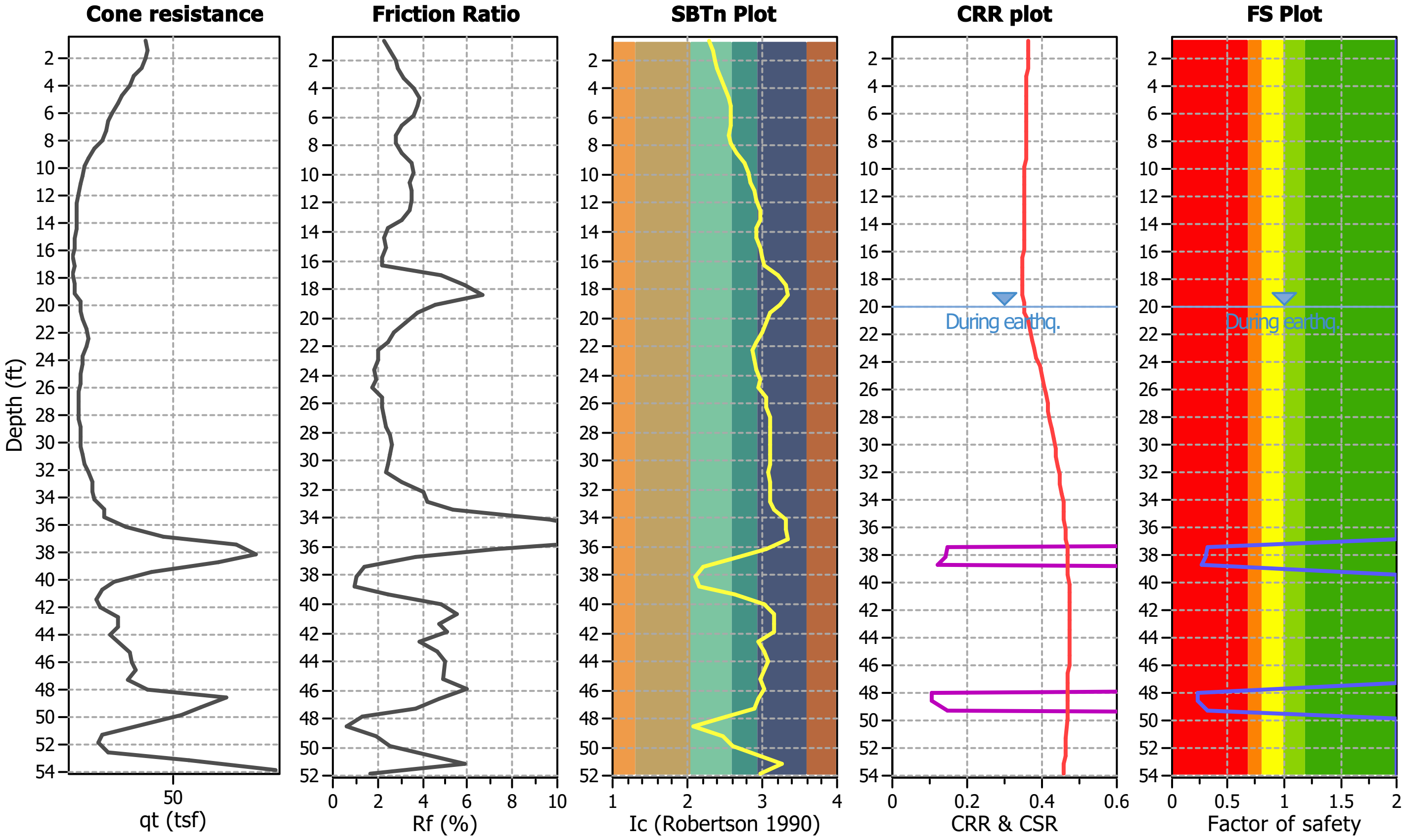
LIQUEFACTION ANALYSIS REPORT

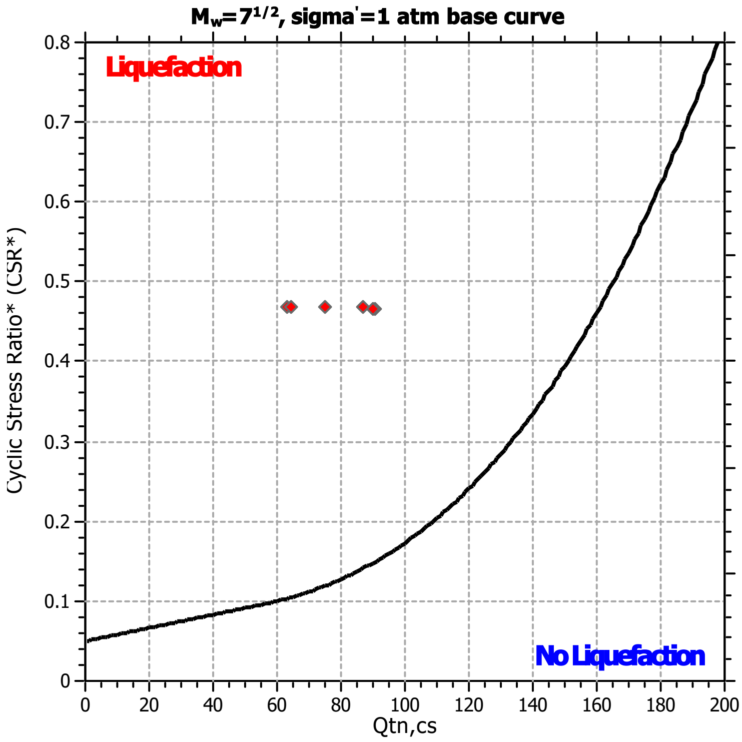
Project title : Las Trampas Bridge **Location : 1-CPT-02**

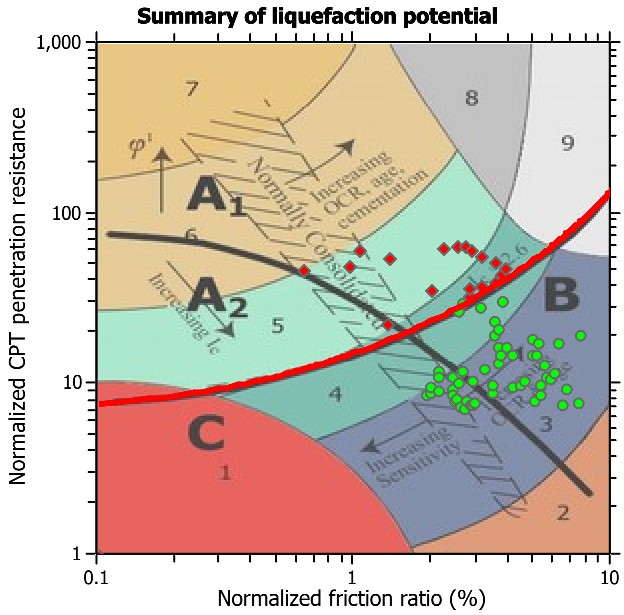
CPT file : 1 cp 02

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

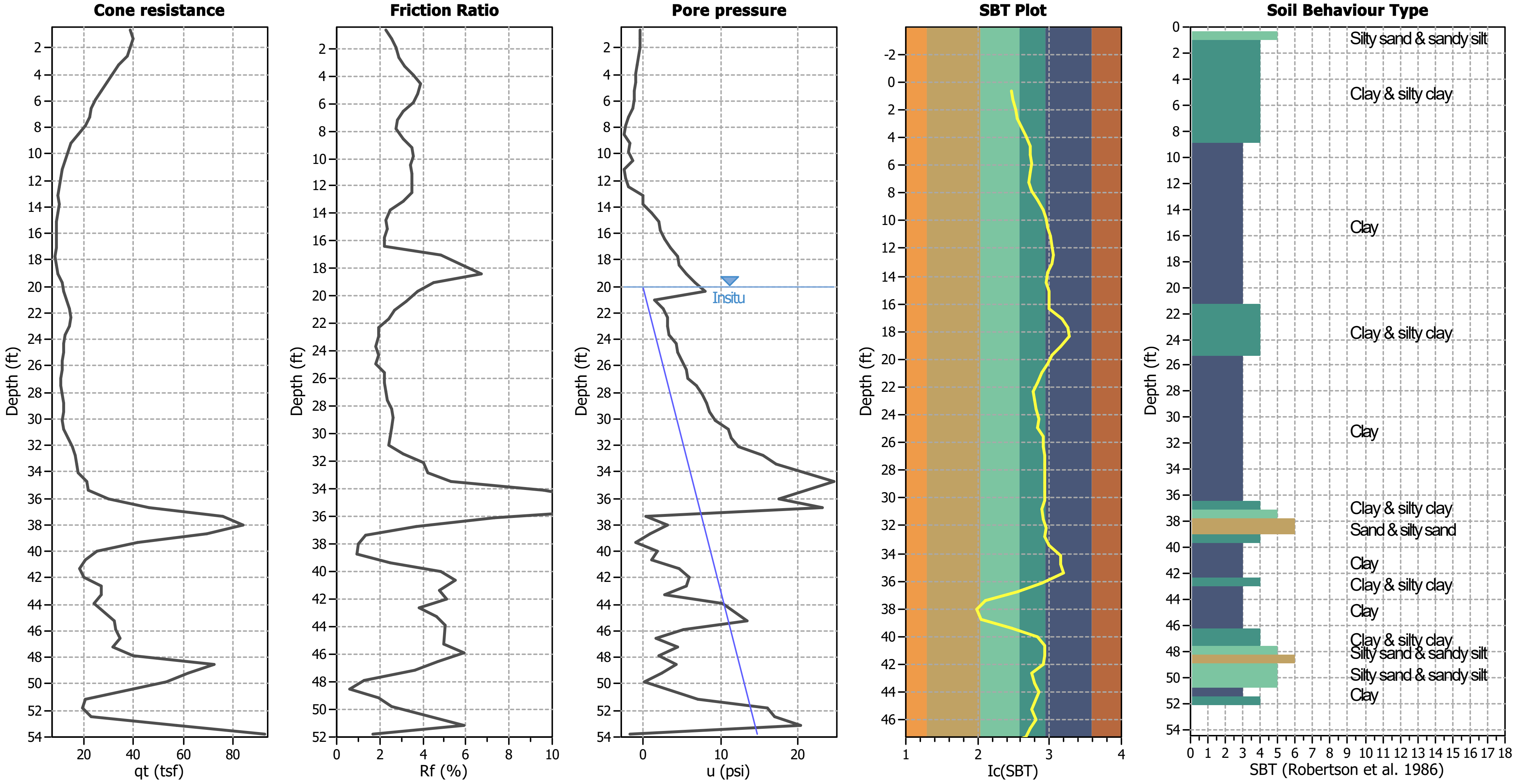






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



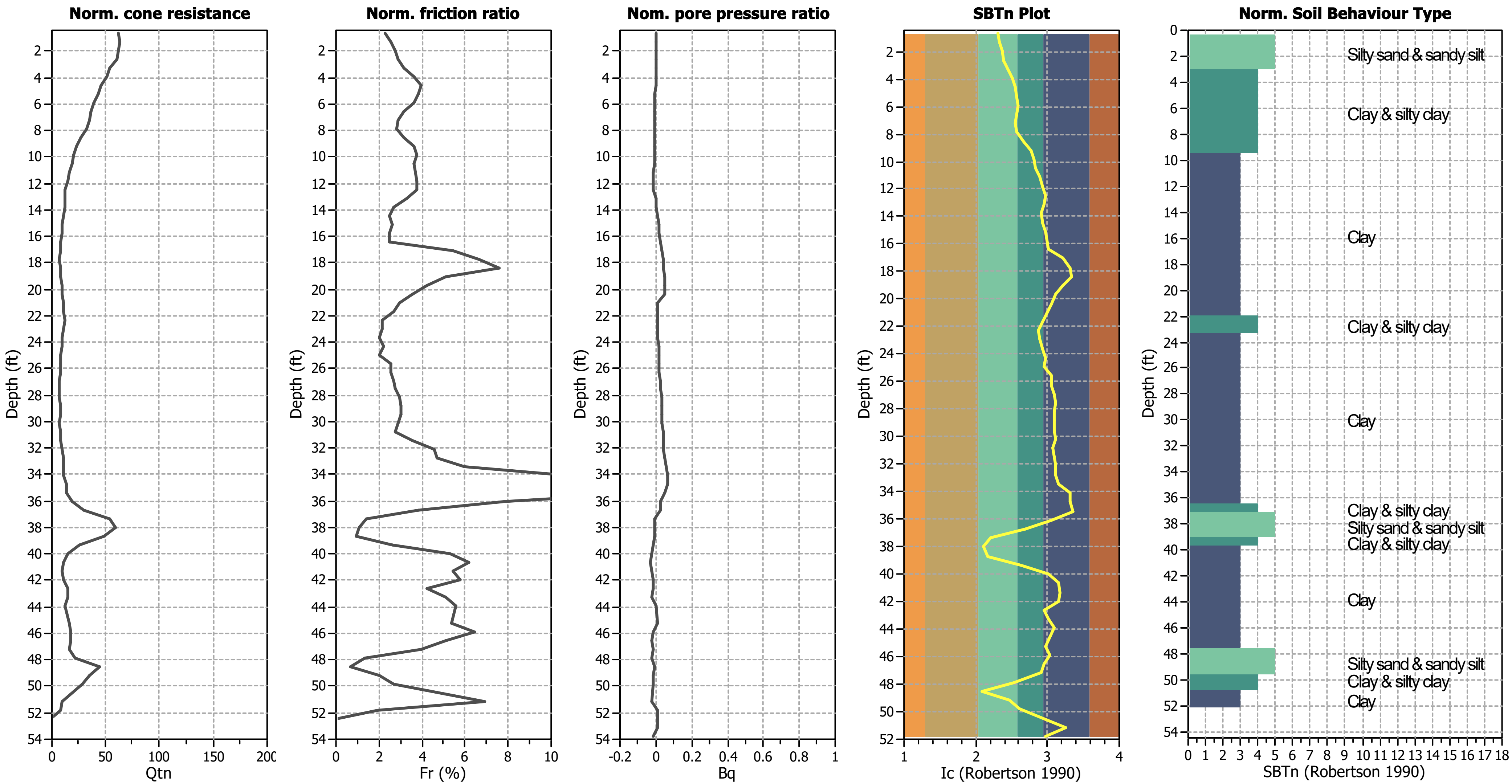
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normalized)



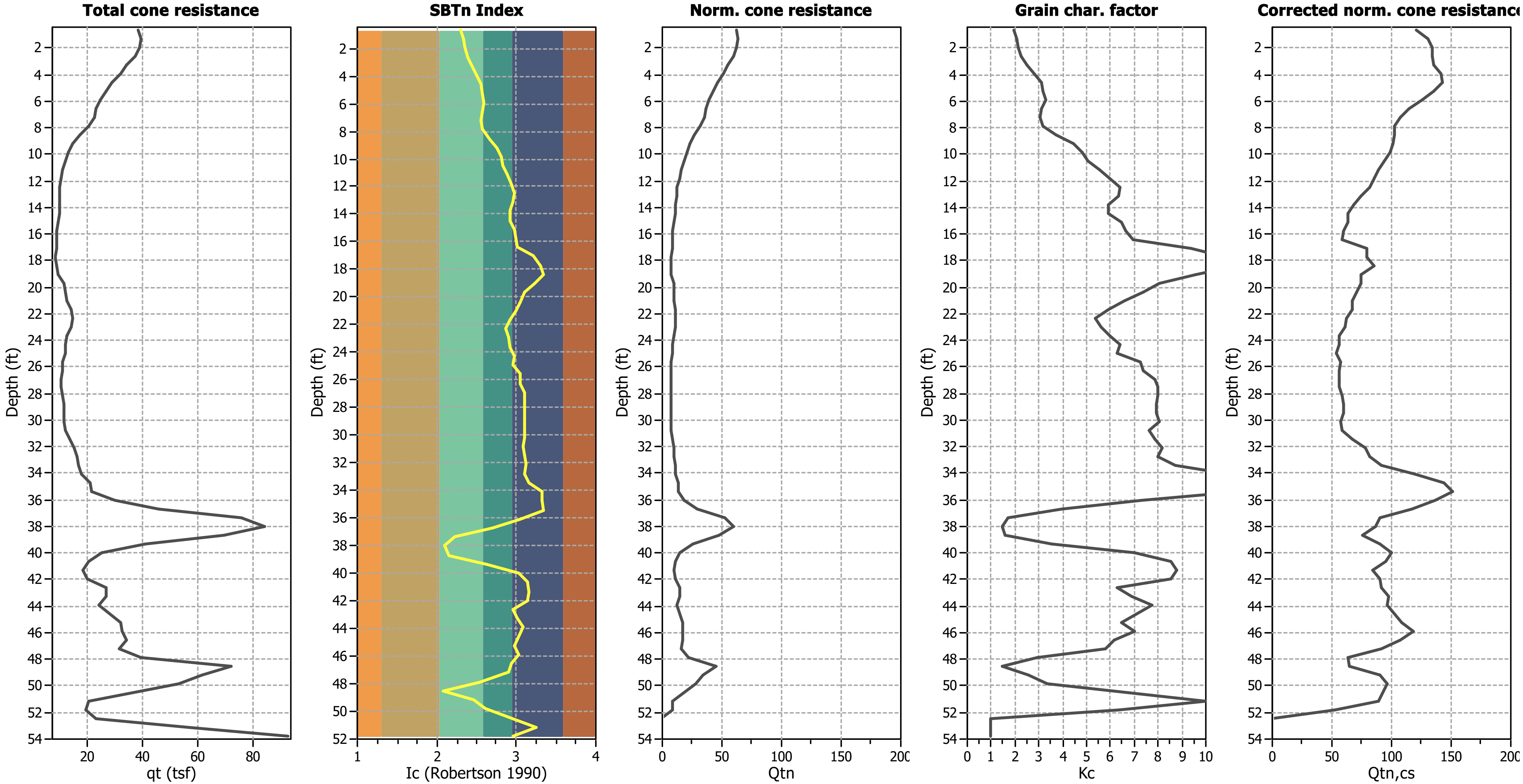
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

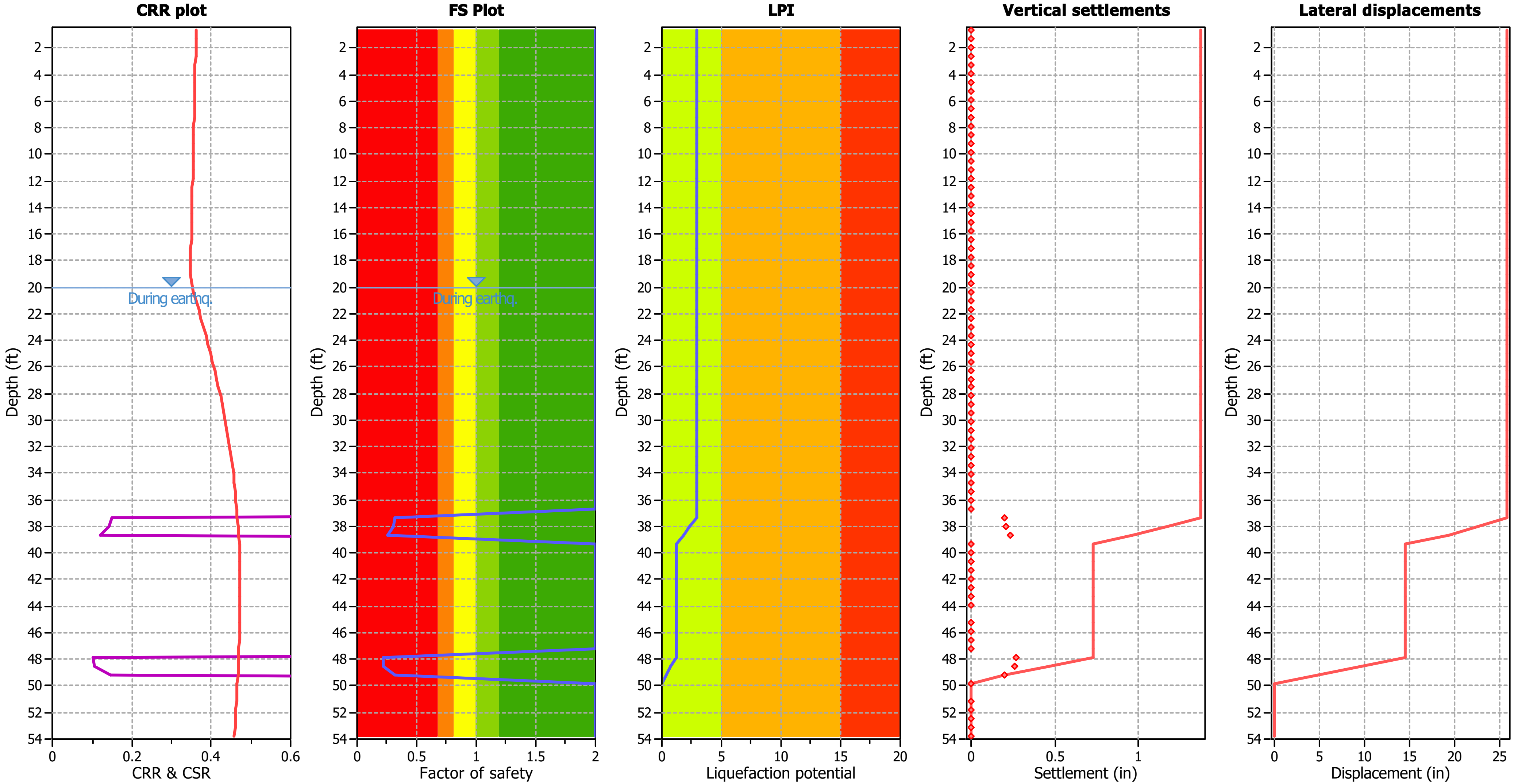
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

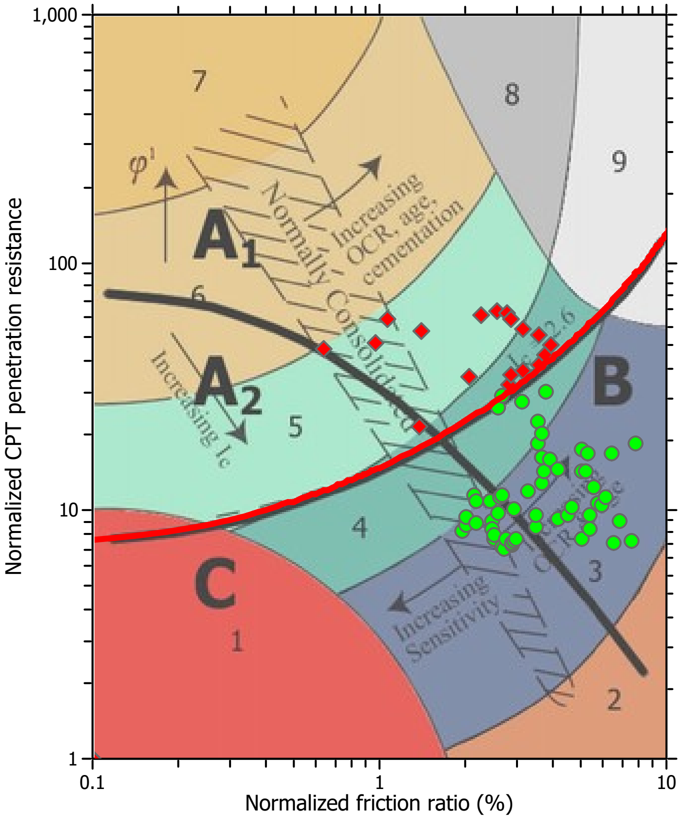
F.S. color scheme

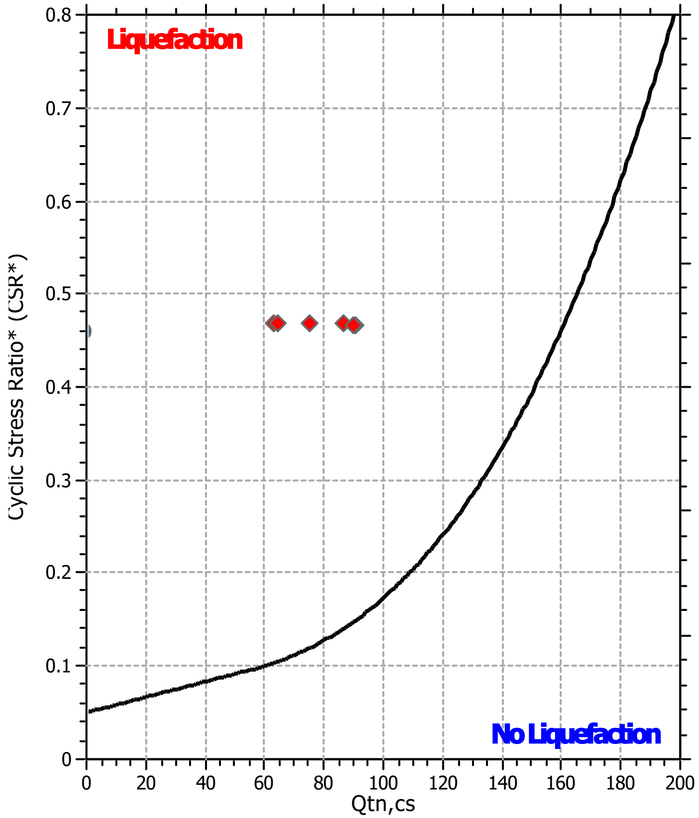
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

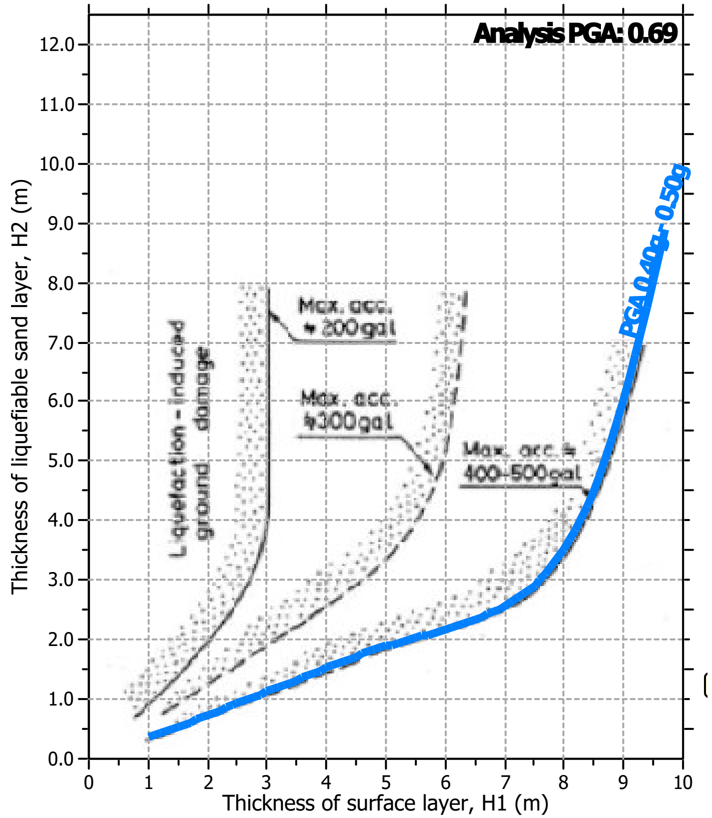
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



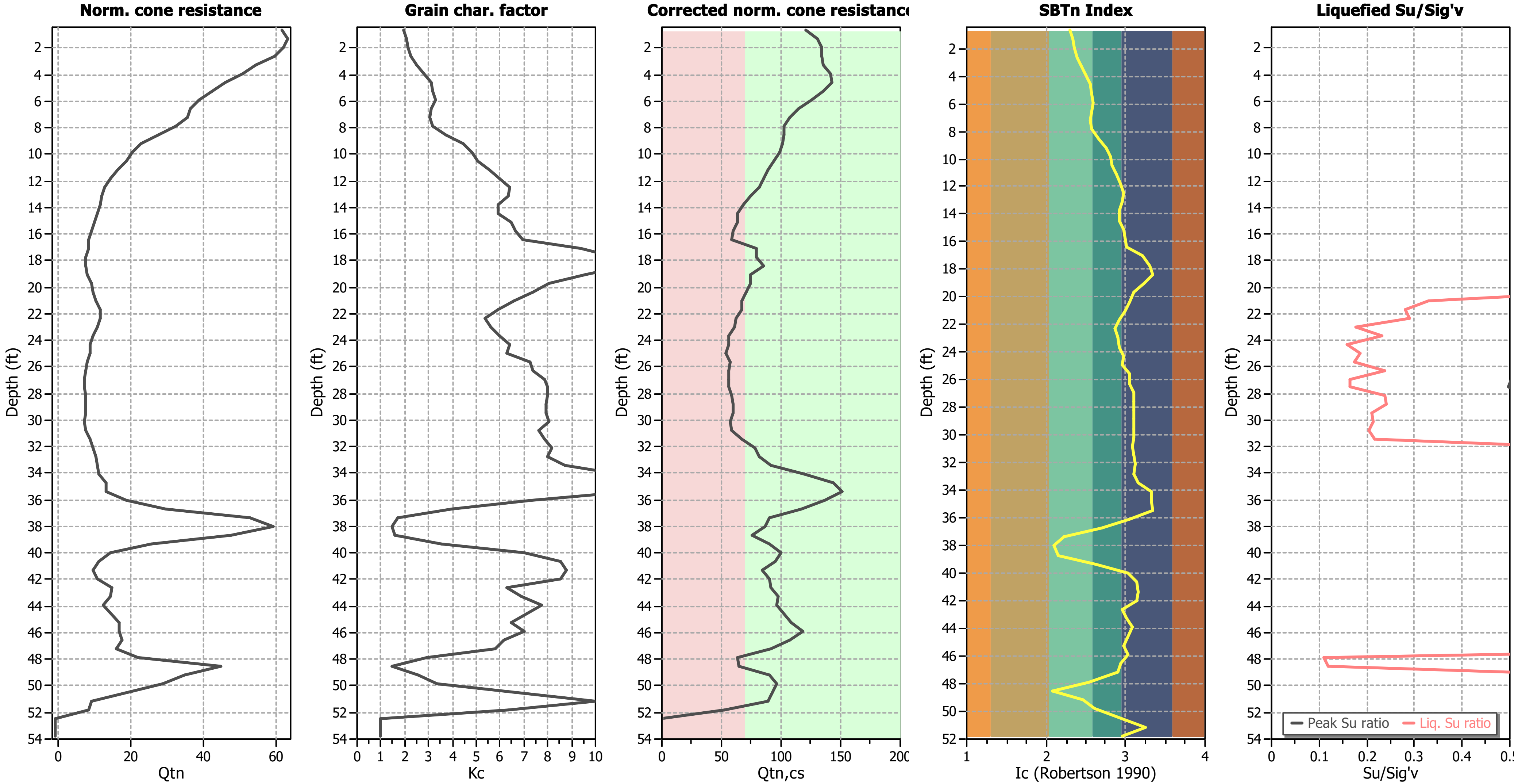




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.66	38.03	0.74	-0.37	22.57	118.15
2	1.31	39.48	1.12	-0.52	23.68	119.30
3	1.97	41.00	1.16	-0.47	24.89	119.70
4	2.63	35.80	0.94	-0.70	25.80	119.60
5	3.28	35.28	1.11	-0.75	28.20	119.37
6	3.94	31.02	1.16	-0.98	30.92	119.66
7	4.59	29.08	1.15	-1.03	33.44	119.40
8	5.25	27.07	1.09	-1.15	34.10	118.32
9	5.91	24.30	0.77	-1.22	34.84	117.03
10	6.56	21.87	0.74	-1.39	33.81	115.51
11	7.22	23.27	0.64	-2.00	32.88	114.51
12	7.87	22.56	0.52	-2.26	34.35	113.51
13	8.53	15.74	0.55	-2.50	38.46	112.71
14	9.19	14.41	0.55	-1.74	43.85	111.90
15	9.84	13.92	0.43	-1.89	46.30	111.14
16	10.50	11.70	0.44	-1.37	47.79	110.02
17	11.16	11.09	0.38	-2.49	51.10	109.32
18	11.81	10.88	0.35	-2.36	53.94	108.67
19	12.47	9.45	0.37	-1.93	56.27	107.98
20	13.12	9.30	0.30	-0.07	55.97	106.88
21	13.78	10.25	0.22	-0.07	53.38	105.54
22	14.44	9.96	0.21	1.06	53.45	104.68
23	15.09	8.79	0.23	2.06	56.76	104.53
24	15.75	8.69	0.21	2.22	57.77	103.78
25	16.40	9.11	0.16	2.67	59.75	103.44
26	17.06	7.93	0.20	3.47	73.75	109.62
27	17.72	9.91	0.96	4.42	81.82	110.16
28	18.37	6.92	0.30	4.59	84.19	111.71
29	19.03	9.37	0.52	5.46	74.95	109.36
30	19.69	11.31	0.45	6.59	66.14	110.00
31	20.34	12.99	0.32	7.96	62.37	109.29
32	21.00	11.18	0.38	1.41	57.68	108.63
33	21.65	13.97	0.33	2.64	53.53	109.03
34	22.31	17.59	0.34	3.17	49.89	107.84
35	22.97	12.63	0.21	3.14	51.59	107.32
36	23.62	11.73	0.28	3.35	53.75	105.64
37	24.28	13.24	0.19	4.23	56.50	105.74
38	24.93	10.99	0.23	4.48	55.68	105.05
39	25.59	11.57	0.22	4.93	61.58	105.99
40	26.25	10.84	0.30	5.53	62.22	105.77
41	26.90	10.55	0.21	5.79	65.25	105.57
42	27.56	9.76	0.21	6.91	65.97	105.71
43	28.22	10.84	0.31	7.54	65.73	106.84
44	28.87	12.43	0.32	8.09	65.36	107.54
45	29.53	11.23	0.28	8.45	65.64	107.35
46	30.18	10.64	0.29	9.25	66.07	106.98
47	30.84	11.87	0.28	10.99	63.80	107.25
48	31.50	13.28	0.30	11.43	65.10	110.14

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	32.15	14.69	0.66	12.35	66.80	113.24
50	32.81	16.81	0.86	15.45	65.87	114.25
51	33.47	16.53	0.52	17.07	69.99	116.36
52	34.12	16.37	1.31	20.94	82.41	121.14
53	34.78	19.10	3.26	24.64	82.66	124.45
54	35.43	26.77	2.98	21.14	85.03	125.53
55	36.09	18.33	2.42	17.46	62.00	124.32
56	36.75	44.24	1.18	23.14	40.04	123.44
57	37.40	74.58	1.46	0.28	19.55	121.07
58	38.06	108.53	0.46	3.16	15.93	120.05
59	38.71	69.26	0.69	0.80	17.61	117.44
60	39.37	30.11	0.80	-0.93	36.99	119.49
61	40.03	24.35	1.57	1.74	59.99	119.63
62	40.68	21.78	1.29	1.05	69.05	118.57
63	41.34	15.63	0.54	4.68	70.36	116.28
64	42.00	17.03	0.76	5.85	69.04	117.76
65	42.65	27.36	1.77	5.61	55.60	118.61
66	43.31	36.40	0.59	2.74	59.38	119.87
67	43.96	16.46	1.36	10.17	64.42	119.38
68	45.28	18.74	1.66	13.43	56.82	122.18
69	45.93	61.18	1.77	5.19	60.27	123.62
70	46.59	17.89	2.38	1.53	54.80	122.41
71	47.24	23.89	0.69	4.46	52.43	119.73
72	47.90	53.02	0.38	2.08	31.94	114.23
73	48.56	41.35	0.44	4.15	15.45	114.81
74	49.21	122.38	0.52	2.46	29.01	121.65
75	49.87	21.00	2.64	0.16	35.62	122.26
76	51.18	16.32	0.94	7.06	77.14	118.92
77	51.84	23.21	0.00	15.96	56.16	109.01
78	52.49	17.31	0.00	16.96	N/A	87.36
79	53.15	28.06	0.00	20.41	N/A	87.36
80	53.81	124.86	0.00	-1.74	N/A	87.36

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_c: Measured cone resistance (tsf)
f_s: Sleeve friction resistance (tsf)
u: Pore pressure (tsf)
Fines content: Percentage of fines in soil (%)
Unit weight: Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR*	Belongs to transition
1	0.66	0.04	0.00	0.04	1.00	0.449	1.24	0.362	1.00	1.00	2.000	No
2	1.31	0.08	0.00	0.08	1.00	0.448	1.24	0.362	1.00	1.00	2.000	No
3	1.97	0.12	0.00	0.12	1.00	0.447	1.24	0.361	1.00	1.00	2.000	No
4	2.63	0.16	0.00	0.16	1.00	0.447	1.24	0.361	1.00	1.00	2.000	No
5	3.28	0.20	0.00	0.20	0.99	0.446	1.24	0.360	1.00	1.00	2.000	No
6	3.94	0.23	0.00	0.23	0.99	0.445	1.24	0.360	1.00	1.00	2.000	No
7	4.59	0.27	0.00	0.27	0.99	0.445	1.24	0.359	1.00	1.00	2.000	No
8	5.25	0.31	0.00	0.31	0.99	0.444	1.24	0.359	1.00	1.00	2.000	No
9	5.91	0.35	0.00	0.35	0.99	0.443	1.24	0.358	1.00	1.00	2.000	No
10	6.56	0.39	0.00	0.39	0.99	0.443	1.24	0.358	1.00	1.00	2.000	No
11	7.22	0.43	0.00	0.43	0.99	0.442	1.24	0.357	1.00	1.00	2.000	No
12	7.87	0.46	0.00	0.46	0.98	0.441	1.24	0.357	1.00	1.00	2.000	No
13	8.53	0.50	0.00	0.50	0.98	0.441	1.24	0.356	1.00	1.00	2.000	No
14	9.19	0.54	0.00	0.54	0.98	0.440	1.24	0.355	1.00	1.00	2.000	No
15	9.84	0.57	0.00	0.57	0.98	0.439	1.24	0.355	1.00	1.00	2.000	No
16	10.50	0.61	0.00	0.61	0.98	0.439	1.24	0.354	1.00	1.00	2.000	No
17	11.16	0.65	0.00	0.65	0.98	0.438	1.24	0.354	1.00	1.00	2.000	No
18	11.81	0.68	0.00	0.68	0.98	0.437	1.24	0.353	1.00	1.00	2.000	No
19	12.47	0.72	0.00	0.72	0.97	0.437	1.24	0.353	1.00	1.00	2.000	No
20	13.12	0.75	0.00	0.75	0.97	0.436	1.24	0.352	1.00	1.00	2.000	No
21	13.78	0.79	0.00	0.79	0.97	0.436	1.24	0.352	1.00	1.00	2.000	No
22	14.44	0.82	0.00	0.82	0.97	0.435	1.24	0.351	1.00	1.00	2.000	No
23	15.09	0.86	0.00	0.86	0.97	0.434	1.24	0.351	1.00	1.00	2.000	No
24	15.75	0.89	0.00	0.89	0.97	0.434	1.24	0.350	1.00	1.00	2.000	No
25	16.40	0.92	0.00	0.92	0.97	0.433	1.24	0.350	1.00	1.00	2.000	No
26	17.06	0.96	0.00	0.96	0.96	0.432	1.24	0.349	1.00	1.00	2.000	No
27	17.72	1.00	0.00	1.00	0.96	0.432	1.24	0.349	1.00	1.00	2.000	No
28	18.37	1.03	0.00	1.03	0.96	0.431	1.24	0.348	1.00	1.00	2.000	No
29	19.03	1.07	0.00	1.07	0.96	0.430	1.24	0.348	1.00	1.00	2.000	No
30	19.69	1.10	0.00	1.10	0.96	0.430	1.24	0.347	0.99	1.00	2.000	No
31	20.34	1.14	0.01	1.13	0.96	0.433	1.24	0.350	0.99	1.00	0.355	No
32	21.00	1.18	0.03	1.14	0.95	0.440	1.24	0.355	0.98	1.00	0.362	No
33	21.65	1.21	0.05	1.16	0.95	0.446	1.24	0.361	0.98	1.00	0.368	No
34	22.31	1.25	0.07	1.17	0.95	0.452	1.24	0.366	0.98	1.00	0.375	No
35	22.97	1.28	0.09	1.19	0.95	0.459	1.24	0.371	0.97	1.00	0.381	No
36	23.62	1.32	0.11	1.20	0.95	0.464	1.24	0.375	0.97	1.00	0.387	No
37	24.28	1.35	0.13	1.22	0.94	0.470	1.24	0.380	0.97	1.00	0.392	No
38	24.93	1.39	0.15	1.23	0.94	0.475	1.24	0.384	0.97	1.00	0.398	No
39	25.59	1.42	0.17	1.25	0.94	0.480	1.24	0.388	0.96	1.00	0.403	No
40	26.25	1.46	0.19	1.26	0.94	0.485	1.24	0.392	0.96	1.00	0.408	No
41	26.90	1.49	0.22	1.27	0.93	0.490	1.24	0.396	0.96	1.00	0.413	No
42	27.56	1.52	0.24	1.29	0.93	0.494	1.24	0.400	0.96	1.00	0.418	No
43	28.22	1.56	0.26	1.30	0.93	0.499	1.24	0.403	0.95	1.00	0.423	No
44	28.87	1.59	0.28	1.32	0.93	0.503	1.24	0.406	0.95	1.00	0.427	No
45	29.53	1.63	0.30	1.33	0.92	0.506	1.24	0.409	0.95	1.00	0.431	No
46	30.18	1.67	0.32	1.35	0.92	0.510	1.24	0.412	0.95	1.00	0.435	No
47	30.84	1.70	0.34	1.36	0.92	0.513	1.24	0.414	0.94	1.00	0.439	No
48	31.50	1.74	0.36	1.38	0.91	0.516	1.24	0.417	0.94	1.00	0.443	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	32.15	1.77	0.38	1.39	0.91	0.518	1.24	0.419	0.94	1.00	0.446	No
50	32.81	1.81	0.40	1.41	0.90	0.521	1.24	0.421	0.94	1.00	0.450	No
51	33.47	1.85	0.42	1.43	0.90	0.523	1.24	0.422	0.93	1.00	0.453	No
52	34.12	1.89	0.44	1.45	0.90	0.524	1.24	0.424	0.93	1.00	0.456	No
53	34.78	1.93	0.46	1.47	0.89	0.526	1.24	0.425	0.93	1.00	0.458	No
54	35.43	1.97	0.48	1.49	0.89	0.527	1.24	0.426	0.92	1.00	0.460	No
55	36.09	2.01	0.50	1.51	0.88	0.528	1.24	0.426	0.92	1.00	0.463	No
56	36.75	2.05	0.52	1.53	0.88	0.528	1.24	0.427	0.92	1.00	0.465	No
57	37.40	2.09	0.54	1.55	0.87	0.529	1.24	0.427	0.92	1.00	0.466	No
58	38.06	2.13	0.56	1.57	0.87	0.529	1.24	0.427	0.91	1.00	0.468	No
59	38.71	2.17	0.58	1.59	0.86	0.529	1.24	0.427	0.91	1.00	0.469	No
60	39.37	2.21	0.60	1.60	0.86	0.529	1.24	0.427	0.91	1.00	0.470	No
61	40.03	2.25	0.62	1.62	0.85	0.528	1.24	0.427	0.91	1.00	0.471	No
62	40.68	2.29	0.65	1.64	0.84	0.528	1.24	0.427	0.90	1.00	0.472	No
63	41.34	2.33	0.67	1.66	0.84	0.527	1.24	0.426	0.90	1.00	0.473	No
64	42.00	2.36	0.69	1.68	0.83	0.526	1.24	0.425	0.90	1.00	0.473	No
65	42.65	2.40	0.71	1.70	0.83	0.525	1.24	0.424	0.90	1.00	0.473	No
66	43.31	2.44	0.73	1.72	0.82	0.524	1.24	0.423	0.89	1.00	0.473	No
67	43.96	2.48	0.75	1.73	0.81	0.522	1.24	0.422	0.89	1.00	0.473	No
68	45.28	2.56	0.79	1.77	0.80	0.519	1.24	0.419	0.89	1.00	0.472	No
69	45.93	2.60	0.81	1.79	0.79	0.517	1.24	0.418	0.89	1.00	0.472	No
70	46.59	2.64	0.83	1.81	0.79	0.515	1.24	0.416	0.88	1.00	0.471	No
71	47.24	2.68	0.85	1.83	0.78	0.513	1.24	0.414	0.88	1.00	0.470	No
72	47.90	2.72	0.87	1.85	0.77	0.511	1.24	0.413	0.88	1.00	0.469	No
73	48.56	2.76	0.89	1.87	0.77	0.509	1.24	0.411	0.88	1.00	0.468	No
74	49.21	2.80	0.91	1.89	0.76	0.506	1.24	0.409	0.88	1.00	0.467	No
75	49.87	2.84	0.93	1.91	0.75	0.504	1.24	0.407	0.87	1.00	0.466	No
76	51.18	2.92	0.97	1.94	0.74	0.499	1.24	0.403	0.87	1.00	0.463	No
77	51.84	2.95	0.99	1.96	0.73	0.496	1.24	0.401	0.87	1.00	0.462	No
78	52.49	2.98	1.01	1.97	0.73	0.495	1.24	0.400	0.87	1.00	0.461	No
79	53.15	3.01	1.03	1.97	0.72	0.493	1.24	0.398	0.87	1.00	0.460	No
80	53.81	3.04	1.05	1.98	0.71	0.491	1.24	0.397	0.87	1.00	0.459	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.66	38.51	2.30	2.26	0.75	61.81	1.95	120.71	4.000	No	No	2.00
2	1.31	39.50	2.33	2.56	0.76	63.33	2.05	129.96	4.000	No	No	2.00
3	1.97	38.75	2.36	2.77	0.78	62.07	2.16	134.31	4.000	No	No	2.00
4	2.63	37.35	2.39	2.88	0.78	59.76	2.25	134.59	4.000	No	No	2.00
5	3.28	34.02	2.44	3.16	0.81	54.35	2.50	135.68	4.000	No	No	2.00
6	3.94	31.78	2.51	3.61	0.83	50.68	2.79	141.65	4.000	No	No	2.00
7	4.59	29.04	2.56	3.94	0.85	46.22	3.09	142.86	4.000	No	No	2.00
8	5.25	26.80	2.57	3.79	0.86	42.56	3.17	134.96	4.000	No	No	2.00
9	5.91	24.40	2.59	3.61	0.86	38.63	3.26	126.04	4.000	No	No	2.00
10	6.56	23.12	2.57	3.16	0.85	36.53	3.14	114.54	4.000	No	No	2.00
11	7.22	22.54	2.55	2.86	0.85	35.53	3.02	107.44	4.000	No	No	2.00
12	7.87	20.49	2.58	2.84	0.86	32.18	3.20	103.00	4.000	No	No	2.00
13	8.53	17.54	2.66	3.15	0.89	27.37	3.73	102.03	4.000	No	Yes	2.00
14	9.19	14.66	2.76	3.61	0.93	22.69	4.47	101.48	4.000	No	Yes	2.00
15	9.84	13.32	2.81	3.73	0.94	20.48	4.83	98.89	4.000	No	Yes	2.00
16	10.50	12.21	2.83	3.62	0.95	18.53	5.05	93.61	4.000	No	Yes	2.00
17	11.16	11.19	2.89	3.72	0.97	16.12	5.56	89.63	4.000	No	Yes	2.00
18	11.81	10.44	2.93	3.77	0.99	14.26	6.01	85.64	4.000	No	Yes	2.00
19	12.47	9.86	2.97	3.73	1.00	12.74	6.38	81.32	4.000	No	Yes	2.00
20	13.12	9.66	2.96	3.32	1.00	11.84	6.33	74.96	4.000	No	Yes	2.00
21	13.78	9.84	2.92	2.70	0.99	11.47	5.92	67.84	4.000	No	Yes	2.00
22	14.44	9.68	2.92	2.47	0.99	10.76	5.93	63.77	4.000	No	Yes	2.00
23	15.09	9.17	2.97	2.62	1.00	9.72	6.46	62.81	4.000	No	Yes	2.00
24	15.75	8.90	2.99	2.48	1.00	9.00	6.63	59.64	4.000	No	Yes	2.00
25	16.40	8.62	3.02	2.49	1.00	8.33	6.95	57.94	4.000	No	Yes	2.00
26	17.06	9.03	3.21	5.44	1.00	8.42	9.38	78.98	4.000	No	Yes	2.00
27	17.72	8.31	3.31	6.64	1.00	7.35	10.86	79.80	4.000	No	Yes	2.00
28	18.37	8.80	3.34	7.59	1.00	7.53	11.30	85.03	4.000	No	Yes	2.00
29	19.03	9.28	3.22	5.12	1.00	7.69	9.60	73.81	4.000	No	Yes	2.00
30	19.69	11.32	3.11	4.20	1.00	9.25	8.04	74.39	4.000	No	Yes	2.00
31	20.34	11.90	3.06	3.56	1.00	9.53	7.39	70.47	4.000	No	Yes	2.00
32	21.00	12.77	2.99	2.95	1.00	10.13	6.61	66.98	4.000	No	Yes	2.00
33	21.65	14.28	2.92	2.66	0.99	11.28	5.94	67.00	4.000	No	Yes	2.00
34	22.31	14.77	2.87	2.16	0.97	11.55	5.37	62.05	4.000	No	Yes	2.00
35	22.97	14.03	2.89	2.17	0.98	10.75	5.63	60.55	4.000	No	Yes	2.00
36	23.62	12.58	2.93	2.03	0.99	9.37	5.98	56.01	4.000	No	Yes	2.00
37	24.28	12.04	2.97	2.20	1.00	8.78	6.42	56.36	4.000	No	Yes	2.00
38	24.93	12.00	2.96	2.02	1.00	8.62	6.29	54.15	4.000	No	Yes	2.00
39	25.59	11.21	3.05	2.54	1.00	7.85	7.26	57.01	4.000	No	Yes	2.00
40	26.25	11.06	3.05	2.53	1.00	7.62	7.37	56.18	4.000	No	Yes	2.00
41	26.90	10.47	3.10	2.68	1.00	7.05	7.89	55.57	4.000	No	Yes	2.00
42	27.56	10.48	3.11	2.73	1.00	6.95	8.01	55.67	4.000	No	Yes	2.00
43	28.22	11.12	3.10	2.93	1.00	7.33	7.97	58.45	4.000	No	Yes	2.00
44	28.87	11.62	3.10	3.03	1.00	7.60	7.91	60.10	4.000	No	Yes	2.00
45	29.53	11.56	3.10	2.99	1.00	7.45	7.95	59.24	4.000	No	Yes	2.00
46	30.18	11.38	3.11	2.92	1.00	7.21	8.03	57.91	4.000	No	Yes	2.00
47	30.84	12.08	3.08	2.78	1.00	7.62	7.64	58.21	4.000	No	Yes	2.00
48	31.50	13.45	3.09	3.53	1.00	8.50	7.86	66.81	4.000	No	Yes	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	32.15	15.11	3.12	4.55	1.00	9.57	8.16	78.01	4.000	No	Yes	2.00
50	32.81	16.23	3.11	4.72	1.00	10.21	8.00	81.64	4.000	No	Yes	2.00
51	33.47	16.83	3.16	5.99	1.00	10.48	8.71	91.31	4.000	No	Yes	2.00
52	34.12	17.63	3.32	10.77	1.00	10.87	10.97	119.18	4.000	No	Yes	2.00
53	34.78	21.07	3.32	13.14	1.00	13.03	11.01	143.46	4.000	No	Yes	2.00
54	35.43	21.70	3.35	14.62	1.00	13.25	11.45	151.70	4.000	No	Yes	2.00
55	36.09	30.08	3.05	7.82	1.00	18.59	7.33	136.26	4.000	No	Yes	2.00
56	36.75	45.91	2.69	3.85	0.90	29.73	3.94	117.12	4.000	No	Yes	2.00
57	37.40	75.91	2.22	1.40	0.72	53.02	1.71	90.58	0.149	No	No	0.32
58	38.06	84.14	2.10	1.06	0.68	59.39	1.46	86.83	0.141	No	No	0.30
59	38.71	69.31	2.16	0.97	0.70	47.85	1.57	75.10	0.119	No	No	0.25
60	39.37	41.25	2.63	2.61	0.88	25.58	3.54	90.45	4.000	No	Yes	2.00
61	40.03	25.42	3.02	5.27	1.00	14.27	6.99	99.82	4.000	No	Yes	2.00
62	40.68	20.62	3.15	6.19	1.00	11.17	8.55	95.45	4.000	No	Yes	2.00
63	41.34	18.20	3.17	5.44	1.00	9.57	8.78	83.98	4.000	No	Yes	2.00
64	42.00	20.08	3.15	5.78	1.00	10.56	8.55	90.27	4.000	No	Yes	2.00
65	42.65	27.00	2.96	4.23	1.00	14.50	6.27	90.93	4.000	No	Yes	2.00
66	43.31	26.83	3.01	5.08	1.00	14.22	6.89	98.00	4.000	No	Yes	2.00
67	43.96	23.99	3.09	5.60	1.00	12.41	7.74	96.08	4.000	No	Yes	2.00
68	45.28	32.26	2.98	5.38	1.00	16.75	6.47	108.38	4.000	No	Yes	2.00
69	45.93	32.70	3.03	6.44	1.00	16.78	7.04	118.16	4.000	No	Yes	2.00
70	46.59	34.37	2.94	5.09	1.00	17.53	6.14	107.70	4.000	No	Yes	2.00
71	47.24	31.64	2.91	3.98	0.98	15.96	5.77	92.03	4.000	No	Yes	2.00
72	47.90	39.47	2.53	1.37	0.84	21.76	2.91	63.37	0.104	No	No	0.22
73	48.56	72.29	2.09	0.64	0.67	44.92	1.43	64.37	0.105	No	No	0.22
74	49.21	61.61	2.46	2.04	0.81	34.75	2.58	89.75	0.147	No	No	0.32
75	49.87	53.28	2.61	2.71	0.87	28.61	3.36	96.12	4.000	No	Yes	2.00
76	51.18	20.29	3.25	6.88	1.00	8.95	10.00	89.43	4.000	No	Yes	2.00
77	51.84	19.14	2.97	1.94	1.00	8.27	6.36	52.63	4.000	No	Yes	2.00
78	52.49	23.12	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
79	53.15	56.91	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
80	53.81	92.67	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI
0.66	2.00	0.00	9.90	0.66	0.00
1.97	2.00	0.00	9.70	0.66	0.00
3.28	2.00	0.00	9.50	0.66	0.00
4.59	2.00	0.00	9.30	0.66	0.00
5.91	2.00	0.00	9.10	0.66	0.00
7.22	2.00	0.00	8.90	0.66	0.00
8.53	2.00	0.00	8.70	0.66	0.00
9.84	2.00	0.00	8.50	0.66	0.00
11.16	2.00	0.00	8.30	0.66	0.00
12.47	2.00	0.00	8.10	0.66	0.00
13.78	2.00	0.00	7.90	0.66	0.00
15.09	2.00	0.00	7.70	0.66	0.00
16.40	2.00	0.00	7.50	0.66	0.00
17.72	2.00	0.00	7.30	0.66	0.00
19.03	2.00	0.00	7.10	0.66	0.00
20.34	2.00	0.00	6.90	0.66	0.00
21.65	2.00	0.00	6.70	0.66	0.00
22.97	2.00	0.00	6.50	0.66	0.00
24.28	2.00	0.00	6.30	0.66	0.00
25.59	2.00	0.00	6.10	0.66	0.00
26.90	2.00	0.00	5.90	0.66	0.00
28.22	2.00	0.00	5.70	0.66	0.00
29.53	2.00	0.00	5.50	0.66	0.00
30.84	2.00	0.00	5.30	0.66	0.00
32.15	2.00	0.00	5.10	0.66	0.00
33.47	2.00	0.00	4.90	0.66	0.00
34.78	2.00	0.00	4.70	0.66	0.00
36.09	2.00	0.00	4.50	0.66	0.00
37.40	0.32	0.68	4.30	0.66	0.59
38.71	0.25	0.75	4.10	0.66	0.61
40.03	2.00	0.00	3.90	0.66	0.00
41.34	2.00	0.00	3.70	0.66	0.00
42.65	2.00	0.00	3.50	0.66	0.00
43.96	2.00	0.00	3.30	0.66	0.00
45.93	2.00	0.00	3.00	0.66	0.00
47.24	2.00	0.00	2.80	0.66	0.00
48.56	0.22	0.78	2.60	0.66	0.40
49.87	2.00	0.00	2.40	0.66	0.00
51.84	2.00	0.00	2.10	0.66	0.00
53.15	2.00	0.00	1.90	0.66	0.00
1.31	2.00	0.00	9.80	0.66	0.00
2.63	2.00	0.00	9.60	0.66	0.00
3.94	2.00	0.00	9.40	0.66	0.00
5.25	2.00	0.00	9.20	0.66	0.00
6.56	2.00	0.00	9.00	0.66	0.00
7.87	2.00	0.00	8.80	0.66	0.00
9.19	2.00	0.00	8.60	0.66	0.00
10.50	2.00	0.00	8.40	0.66	0.00
11.81	2.00	0.00	8.20	0.66	0.00
13.12	2.00	0.00	8.00	0.66	0.00
14.44	2.00	0.00	7.80	0.66	0.00
15.75	2.00	0.00	7.60	0.66	0.00
17.06	2.00	0.00	7.40	0.66	0.00
18.37	2.00	0.00	7.20	0.66	0.00
19.69	2.00	0.00	7.00	0.66	0.00
21.00	2.00	0.00	6.80	0.66	0.00
22.31	2.00	0.00	6.60	0.66	0.00
23.62	2.00	0.00	6.40	0.66	0.00
24.93	2.00	0.00	6.20	0.66	0.00
26.25	2.00	0.00	6.00	0.66	0.00
27.56	2.00	0.00	5.80	0.66	0.00
28.87	2.00	0.00	5.60	0.66	0.00
30.18	2.00	0.00	5.40	0.66	0.00
31.50	2.00	0.00	5.20	0.66	0.00
32.81	2.00	0.00	5.00	0.66	0.00
34.12	2.00	0.00	4.80	0.66	0.00
35.43	2.00	0.00	4.60	0.66	0.00
36.75	2.00	0.00	4.40	0.66	0.00
38.06	0.30	0.70	4.20	0.66	0.59
39.37	2.00	0.00	4.00	0.66	0.00
40.68	2.00	0.00	3.80	0.66	0.00
42.00	2.00	0.00	3.60	0.66	0.00
43.31	2.00	0.00	3.40	0.66	0.00
45.28	2.00	0.00	3.10	1.31	0.00
46.59	2.00	0.00	2.90	0.66	0.00
47.90	0.22	0.78	2.70	0.66	0.42
49.21	0.32	0.68	2.50	0.66	0.34
51.18	2.00	0.00	2.20	1.31	0.00
52.49	2.00	0.00	2.00	0.66	0.00
53.81	2.00	0.00	1.80	0.66	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI

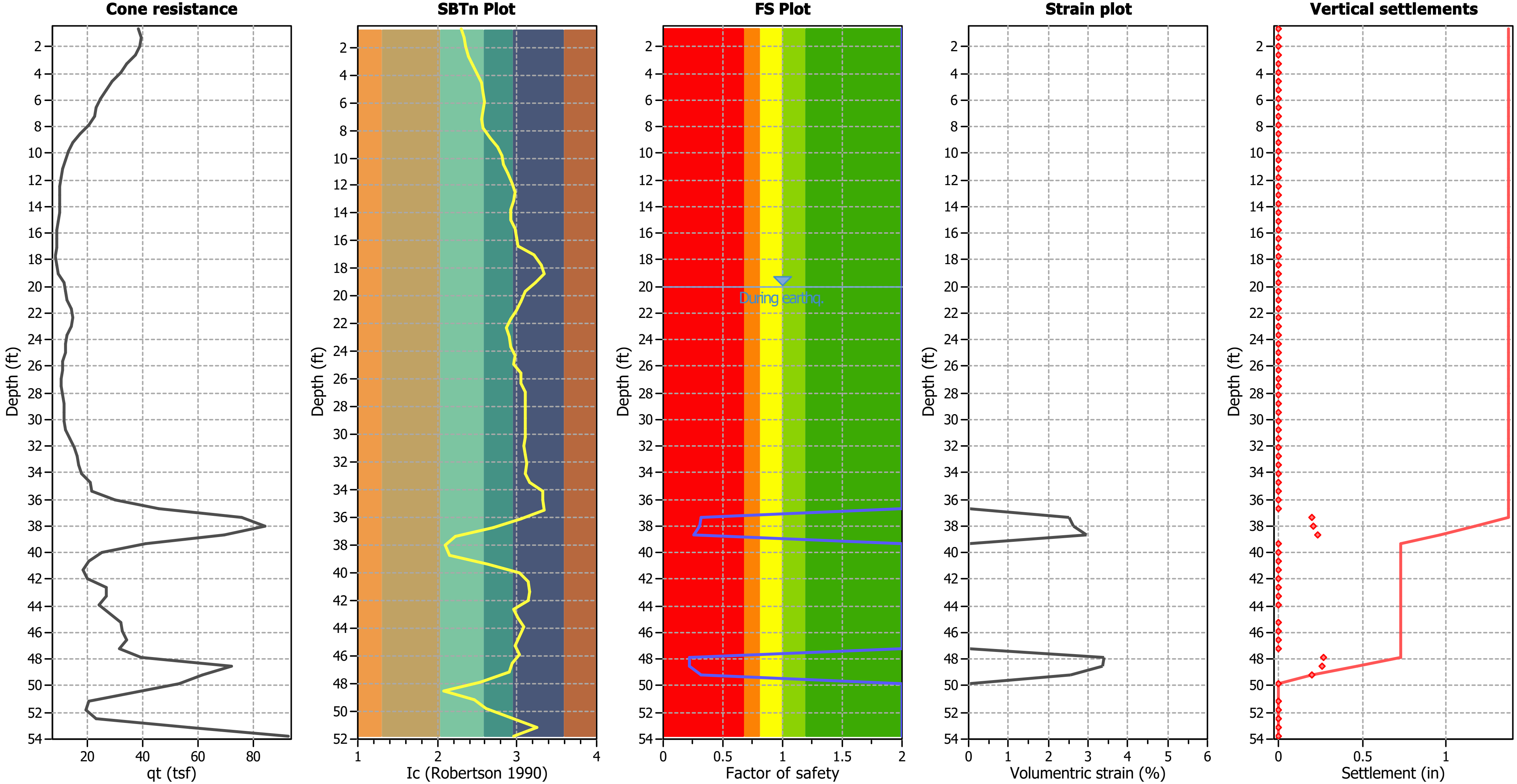
Overall liquefaction potential: 2.95

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.34	70.47	2.00	0.00	1.00	0.00	21.00	66.98	2.00	0.00	1.00	0.00
21.65	67.00	2.00	0.00	1.00	0.00	22.31	62.05	2.00	0.00	1.00	0.00
22.97	60.55	2.00	0.00	1.00	0.00	23.62	56.01	2.00	0.00	1.00	0.00
24.28	56.36	2.00	0.00	1.00	0.00	24.93	54.15	2.00	0.00	1.00	0.00
25.59	57.01	2.00	0.00	1.00	0.00	26.25	56.18	2.00	0.00	1.00	0.00
26.90	55.57	2.00	0.00	1.00	0.00	27.56	55.67	2.00	0.00	1.00	0.00
28.22	58.45	2.00	0.00	1.00	0.00	28.87	60.10	2.00	0.00	1.00	0.00
29.53	59.24	2.00	0.00	1.00	0.00	30.18	57.91	2.00	0.00	1.00	0.00
30.84	58.21	2.00	0.00	1.00	0.00	31.50	66.81	2.00	0.00	1.00	0.00
32.15	78.01	2.00	0.00	1.00	0.00	32.81	81.64	2.00	0.00	1.00	0.00
33.47	91.31	2.00	0.00	1.00	0.00	34.12	119.18	2.00	0.00	1.00	0.00
34.78	143.46	2.00	0.00	1.00	0.00	35.43	151.70	2.00	0.00	1.00	0.00
36.09	136.26	2.00	0.00	1.00	0.00	36.75	117.12	2.00	0.00	1.00	0.00
37.40	90.58	0.32	2.53	1.00	0.20	38.06	86.83	0.30	2.62	1.00	0.21
38.71	75.10	0.25	2.96	1.00	0.23	39.37	90.45	2.00	0.00	1.00	0.00
40.03	99.82	2.00	0.00	1.00	0.00	40.68	95.45	2.00	0.00	1.00	0.00
41.34	83.98	2.00	0.00	1.00	0.00	42.00	90.27	2.00	0.00	1.00	0.00
42.65	90.93	2.00	0.00	1.00	0.00	43.31	98.00	2.00	0.00	1.00	0.00
43.96	96.08	2.00	0.00	1.00	0.00	45.28	108.38	2.00	0.00	1.00	0.00
45.93	118.16	2.00	0.00	1.00	0.00	46.59	107.70	2.00	0.00	1.00	0.00
47.24	92.03	2.00	0.00	1.00	0.00	47.90	63.37	0.22	3.40	1.00	0.27
48.56	64.37	0.22	3.35	1.00	0.26	49.21	89.75	0.32	2.55	1.00	0.20
49.87	96.12	2.00	0.00	1.00	0.00	51.18	89.43	2.00	0.00	1.00	0.00
51.84	52.63	2.00	0.00	1.00	0.00	52.49	-1.00	2.00	0.00	1.00	0.00
53.15	-1.00	2.00	0.00	1.00	0.00	53.81	-1.00	2.00	0.00	1.00	0.00

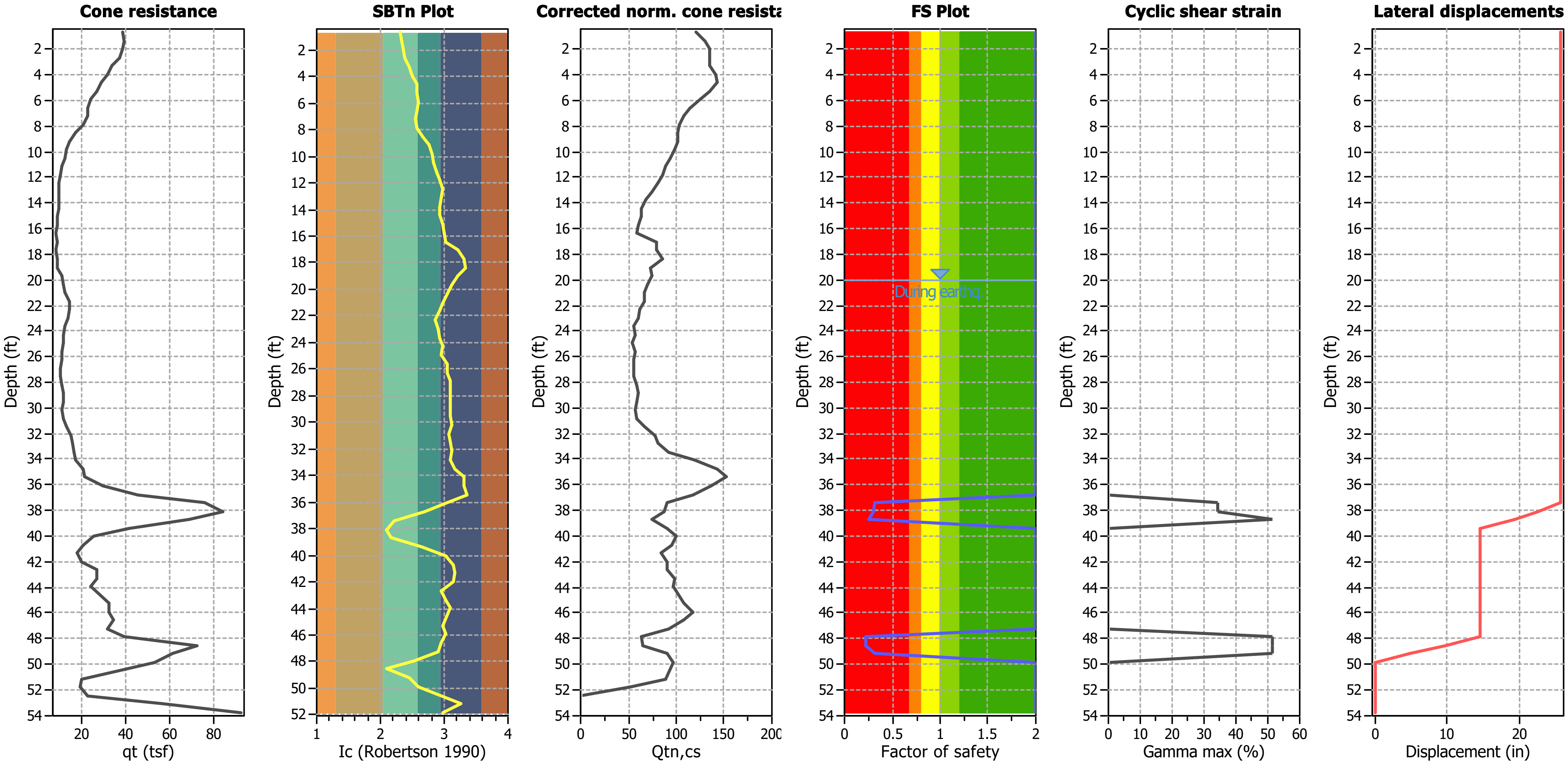
Total estimated settlement: 1.37

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

Estimation of post-earthquake lateral Displacements

Geometric parameters: Gently sloping ground without free face (Slope 1.00 %)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent clean sand normalized CPT total cone resistance

F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

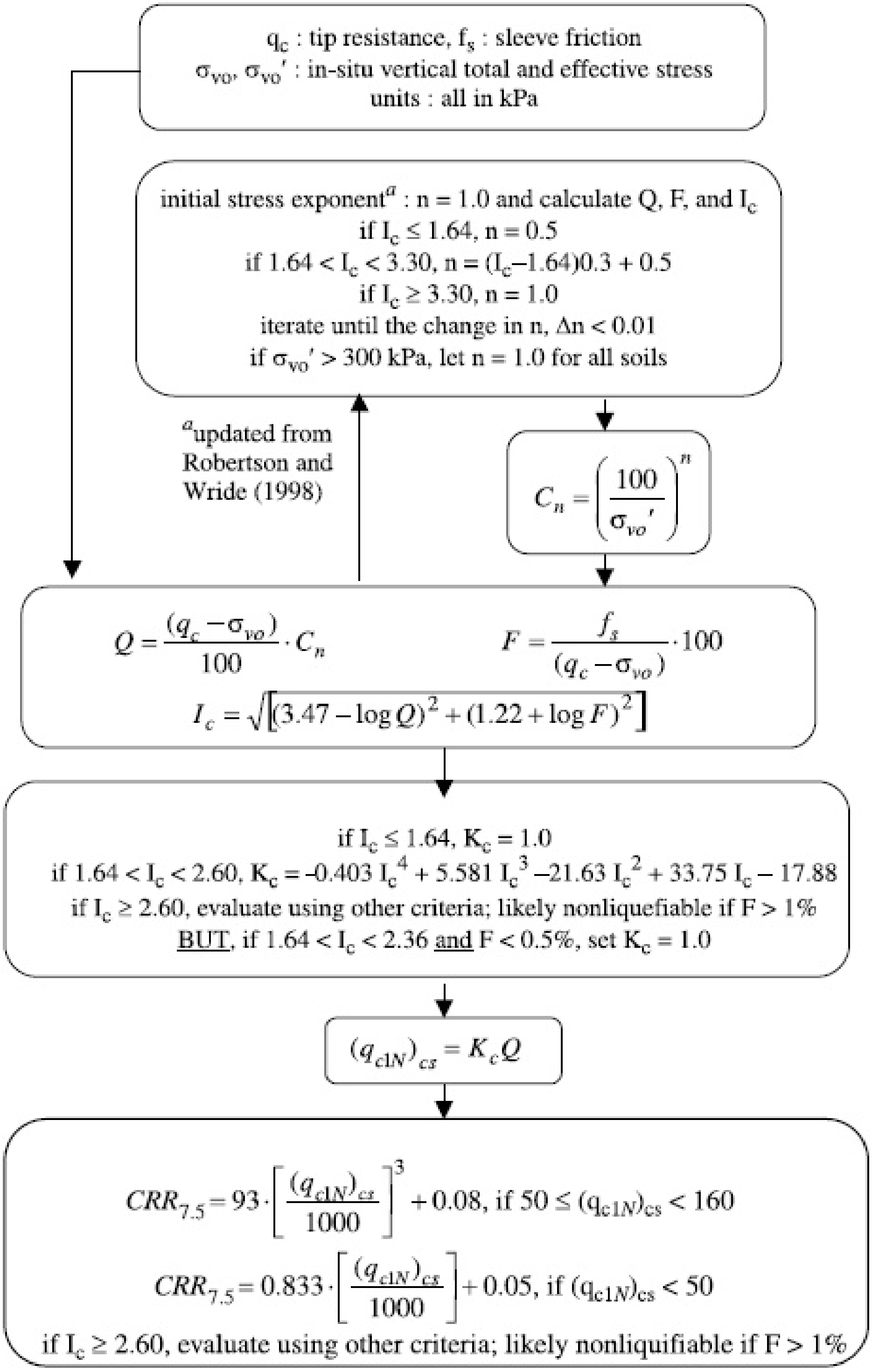
Surface condition

:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
20.34	11.90	9.53	3.22	70.47	2.00	0.00	0.00	0.00
21.00	12.77	10.13	2.68	66.98	2.00	0.00	0.00	0.00
21.65	14.28	11.28	2.44	67.00	2.00	0.00	0.00	0.00
22.31	14.77	11.55	1.98	62.05	2.00	0.00	0.00	0.00
22.97	14.03	10.75	1.97	60.55	2.00	0.00	0.00	0.00
23.62	12.58	9.37	1.82	56.01	2.00	0.00	0.00	0.00
24.28	12.04	8.78	1.95	56.36	2.00	0.00	0.00	0.00
24.93	12.00	8.62	1.78	54.15	2.00	0.00	0.00	0.00
25.59	11.21	7.85	2.22	57.01	2.00	0.00	0.00	0.00
26.25	11.06	7.62	2.19	56.18	2.00	0.00	0.00	0.00
26.90	10.47	7.05	2.30	55.57	2.00	0.00	0.00	0.00
27.56	10.48	6.95	2.34	55.67	2.00	0.00	0.00	0.00
28.22	11.12	7.33	2.52	58.45	2.00	0.00	0.00	0.00
28.87	11.62	7.60	2.62	60.10	2.00	0.00	0.00	0.00
29.53	11.56	7.45	2.57	59.24	2.00	0.00	0.00	0.00
30.18	11.38	7.21	2.49	57.91	2.00	0.00	0.00	0.00
30.84	12.08	7.62	2.39	58.21	2.00	0.00	0.00	0.00
31.50	13.45	8.50	3.07	66.81	2.00	0.00	0.00	0.00
32.15	15.11	9.57	4.01	78.01	2.00	0.00	0.00	0.00
32.81	16.23	10.21	4.20	81.64	2.00	0.00	0.00	0.00
33.47	16.83	10.48	5.33	91.31	2.00	0.00	0.00	0.00
34.12	17.63	10.87	9.62	119.18	2.00	0.00	0.00	0.00
34.78	21.07	13.03	11.94	143.46	2.00	0.00	0.00	0.00
35.43	21.70	13.25	13.30	151.70	2.00	0.28	0.00	0.00
36.09	30.08	18.59	7.30	136.26	2.00	11.46	0.00	0.00
36.75	45.91	29.73	3.68	117.12	2.00	26.97	0.00	0.00
37.40	75.91	53.02	1.36	90.58	0.32	46.06	34.10	3.23
38.06	84.14	59.39	1.03	86.83	0.30	49.80	34.10	3.22
38.71	69.31	47.85	0.94	75.10	0.25	42.67	51.20	4.84
39.37	41.25	25.58	2.47	90.45	2.00	22.01	0.00	0.00
40.03	25.42	14.27	4.81	99.82	2.00	2.74	0.00	0.00
40.68	20.62	11.17	5.50	95.45	2.00	0.00	0.00	0.00
41.34	18.20	9.57	4.75	83.98	2.00	0.00	0.00	0.00
42.00	20.08	10.56	5.10	90.27	2.00	0.00	0.00	0.00
42.65	27.00	14.50	3.86	90.93	2.00	3.26	0.00	0.00
43.31	26.83	14.22	4.62	98.00	2.00	2.61	0.00	0.00
43.96	23.99	12.41	5.02	96.08	2.00	0.00	0.00	0.00
45.28	32.26	16.75	4.96	108.38	2.00	8.03	0.00	0.00
45.93	32.70	16.78	5.93	118.16	2.00	8.09	0.00	0.00
46.59	34.37	17.53	4.70	107.70	2.00	9.53	0.00	0.00
47.24	31.64	15.96	3.64	92.03	2.00	6.43	0.00	0.00
47.90	39.47	21.76	1.28	63.37	0.22	16.66	51.20	4.84
48.56	72.29	44.92	0.62	64.37	0.22	40.58	51.20	4.84
49.21	61.61	34.75	1.95	89.75	0.32	32.11	51.20	4.84
49.87	53.28	28.61	2.57	96.12	2.00	25.69	0.00	0.00
51.18	20.29	8.95	5.90	89.43	2.00	0.00	0.00	0.00
51.84	19.14	8.27	1.64	52.63	2.00	0.00	0.00	0.00

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

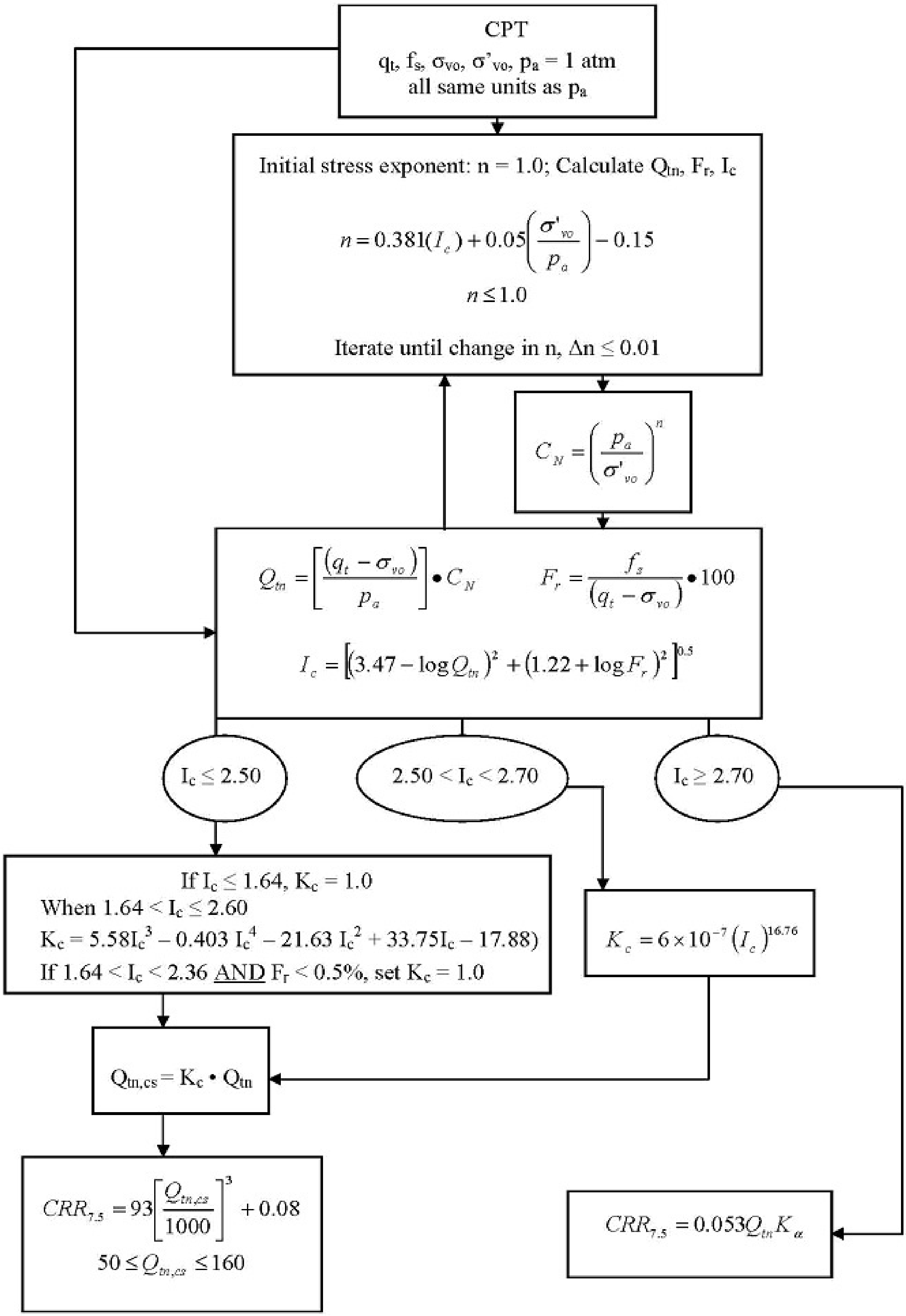
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

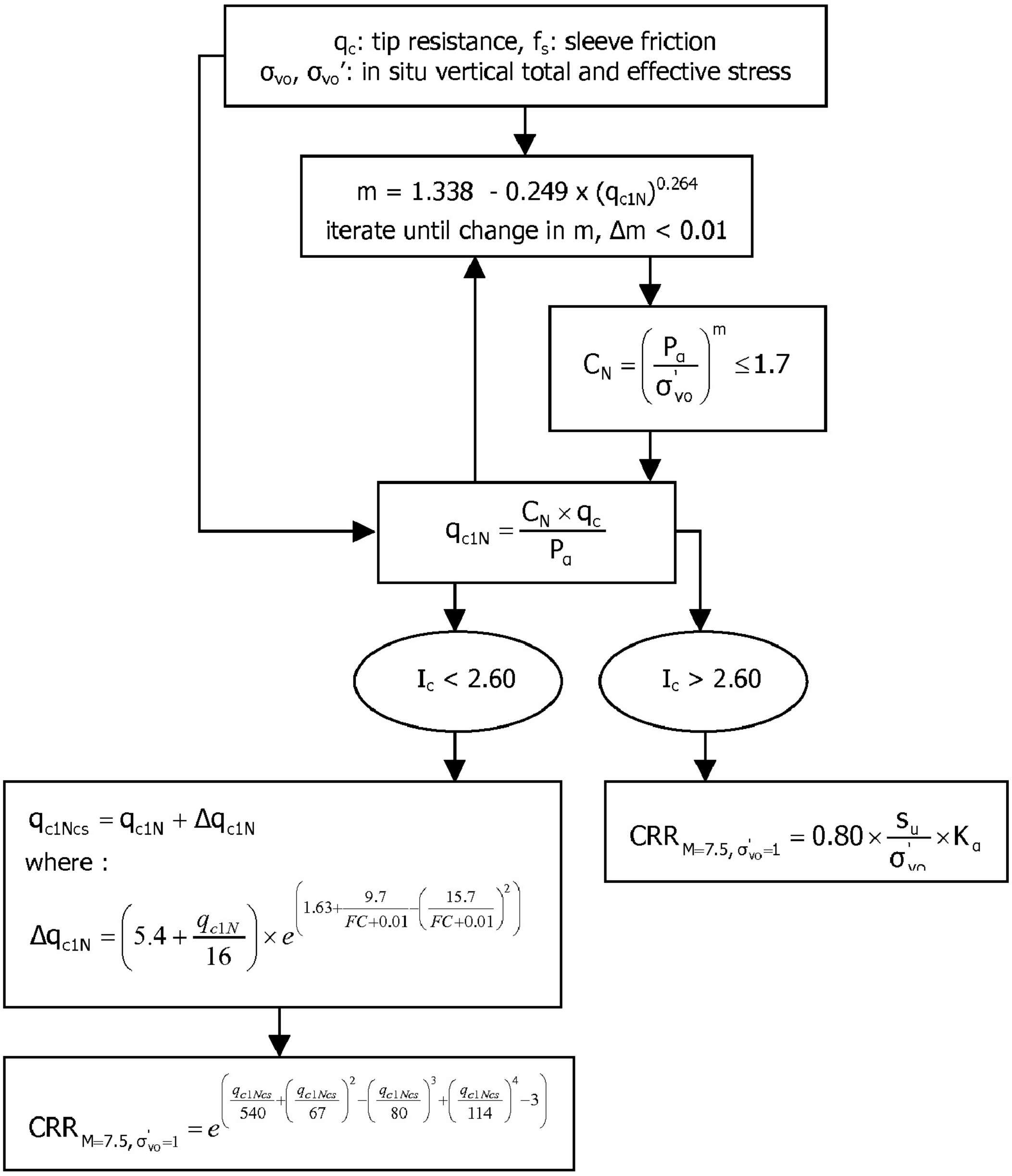
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)

CPT

q_t, f_s, I_c

$I_c < I_c$ cut-off

Initial estimate using raw tip measurements, friction ratio. Calculate $q_{t,1}$. Repeat until an acceptable convergence tolerance is achieved.

$$c = f_1 \cdot \left(\frac{R_f}{f_3}\right)^{f_2}$$

$$C_q = \left(\frac{P_a}{\sigma'_v}\right)^{c}$$

$$q_{t,1} = C_q \cdot q_t$$

$$CRR = \exp\left[\frac{q_{t,1}^{1.045} + q_{t,1} \cdot (0.110 \cdot R_f) + (0.001 \cdot R_f) + c \cdot (1 + 0.850 \cdot R_f) - 0.848 \cdot \ln(M_w) - 0.002 \cdot \ln(\sigma'_v) - 20.923 + 1.632 \cdot \Phi^{-1}(P_L)}{7.177}\right]$$

Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)

$$FS_{liq}=\frac{CRR_{M=7.5,\sigma_v'=1atm}}{CSR_{M=7.5,\sigma_v'=1atm}}$$

$$CSR_{M=7.5,\sigma_v'=1atm}=0.65\frac{\sigma_v}{\sigma_v'}\frac{a_{\max}}{g}r_d\frac{1}{MSF}\frac{1}{K_\sigma}$$

$$r_d=\exp\left[\alpha(z)+\beta(z)\cdot M\right]$$

$$\alpha(z)=-1.012-1.126\sin\left(\frac{z}{11.73}+5.133\right)$$

$$\beta(z)=0.106+0.118\sin\left(\frac{z}{11.28}+5.142\right)$$

$$K_\sigma=1-C_\sigma\ln\left(\frac{\sigma_v'}{P_a}\right)\le 1.1$$

$$C_\sigma=\frac{1}{37.3-8.27\left(q_{c1Ncs}\right)^{0.264}}\le 0.3$$

$$MSF=1+\left(MSF_{max}-1\right)\left(8.64\exp\left(\frac{-M}{4}\right)-1.325\right)$$

$$MSF_{max}=1.09+\left(\frac{q_{c1Ncs}}{180}\right)^3\le 2.2$$

σ_v' and σ_v at start of earthquake shaking

$$CRR_{M=7.5,\sigma_v'=1atm}=\exp\left(\frac{q_{c1Ncs}}{113}+\left(\frac{q_{c1Ncs}}{1000}\right)^2-\left(\frac{q_{c1Ncs}}{140}\right)^3+\left(\frac{q_{c1Ncs}}{137}\right)^4-2.80\right)$$

$$q_{c1Ncs}=q_{c1N}+\Delta q_{c1N}$$

$$\Delta q_{c1N}=\left(11.9+\frac{q_{c1N}}{14.6}\right)\exp\left(1.63-\frac{9.7}{FC+2}-\left(\frac{15.7}{FC+2}\right)^2\right)$$

$$q_{c1N}=C_{N\sigma}\frac{q_c}{P_a}$$

$$C_{N\sigma}=\left(\frac{P_a}{\sigma_v'}\right)^m\le 1.7$$

$$m=1.338-0.249\left(q_{c1Ncs}\right)^{0.264}\quad with\quad 0.264\le m\le 0.782$$

$$FC=80\left(I_C+C_{FC}\right)-137\quad with\quad 0\%\le FC\le 100\%$$

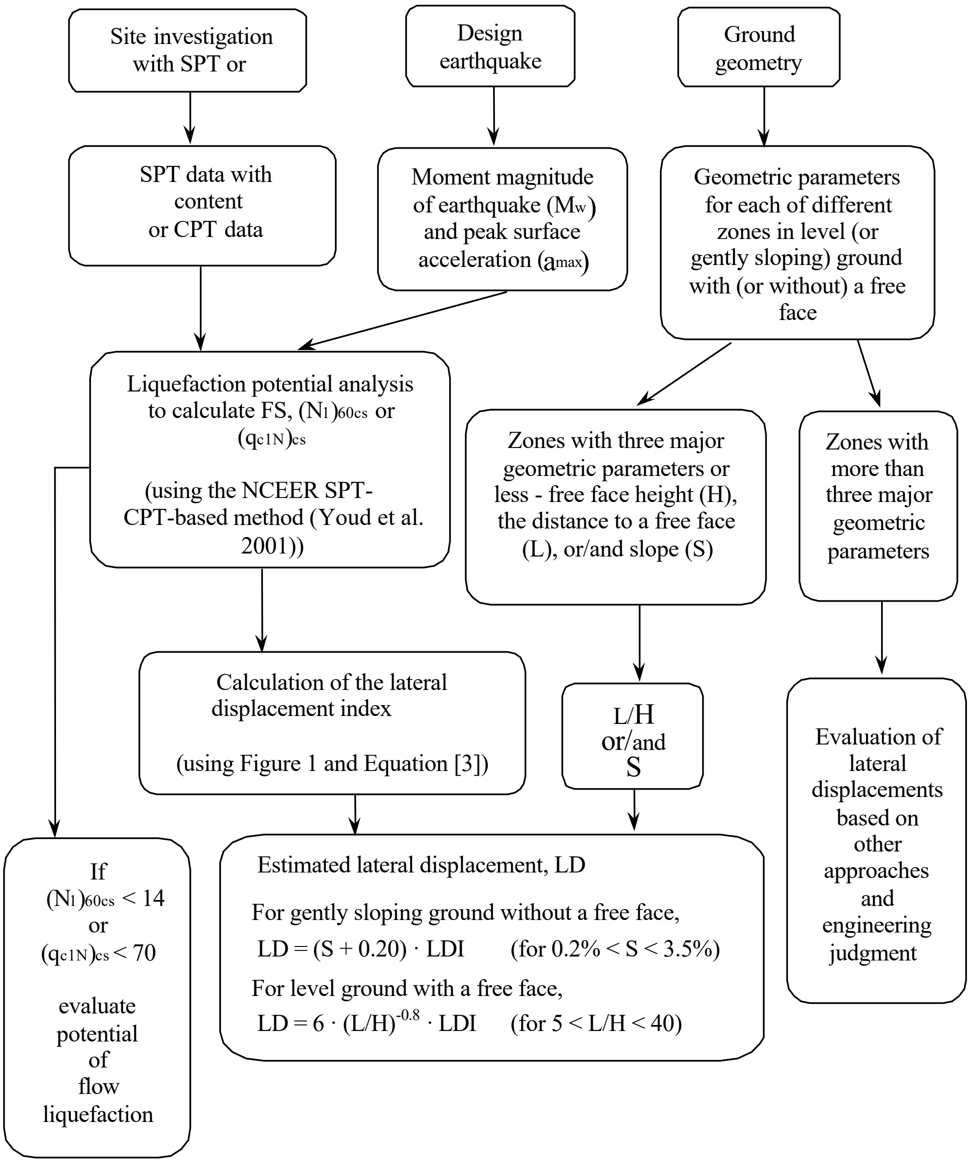
$$I_c=\left[\left(3.47-\log(Q)\right)^2+\left(1.22+\log(F)\right)^2\right]^{0.5}$$

$$Q=\left(\frac{q_c-\sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma_{vc}'}\right)^n\ with\ 0.5\le n\le 1.0\ per\ Robertson\ \&\ Wride\ (1998)$$

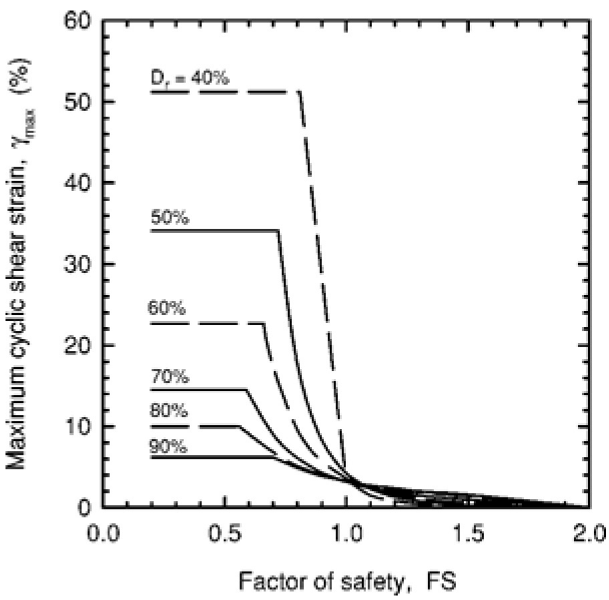
$$F=\left(\frac{f_s}{q_c-\sigma_{vc}}\right)\cdot 100\%$$

σ_v' at time of CPT sounding

Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



[1] **Figure 1**

$$LDI = \int_0^{Z_{max}} \gamma_{max}\, dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands

Average shear stress, τ_{av}

$$\tau_{av} = CSR^{*} \cdot \sigma_{v0}' = 0.65 \cdot \frac{a_{max}}{g} \cdot \sigma_{v0} \cdot r_d$$

Estimate small shear strain modulus, G_0

$$G_0 = 0.0188 \cdot \left[10^{(0.55 I_c - 1.68)}\right] \cdot (q_t - \sigma_v)$$

Estimate shear strain amplitude, γ (based on Pradel (1998))

$$\gamma = \left[\frac{1 + a \cdot e^{bR}}{1 + a}\right] \cdot R \cdot 100\ (\%)$$

$$R = \frac{\tau_{av}}{G_0} \text{ (Note } \tau_{av} \text{ and } G_0 \text{ same units)}$$

$$a = 0.0389 \cdot \left(\frac{\sigma_v}{p_a}\right) + 0.124$$

$$b = 6400 \cdot \left(\frac{\sigma_v}{p_a}\right)$$

Estimate volumetric strain in 15 cycles

$$\varepsilon_{vol(15)} = \gamma \cdot \left[\frac{(N_1)_{60,cs}}{20}\right]^{-1.20}$$

$$(N_1)_{60,cs} = \frac{Q_{tn,cs}}{8.5 \cdot \left[1 - \frac{I_c}{4.6}\right]}$$

Volumetric strain in design earthquake

$$\Sigma_{vol} = \varepsilon_{vol(15)} \cdot \left[\frac{N_c}{15}\right]^{0.45}$$

$$N_c = (M - 4)^{2.17}$$

Seismic settlement, s

$$s = 2 \cdot \int_0^{GWT} \Sigma_{vol} \cdot dz$$

Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

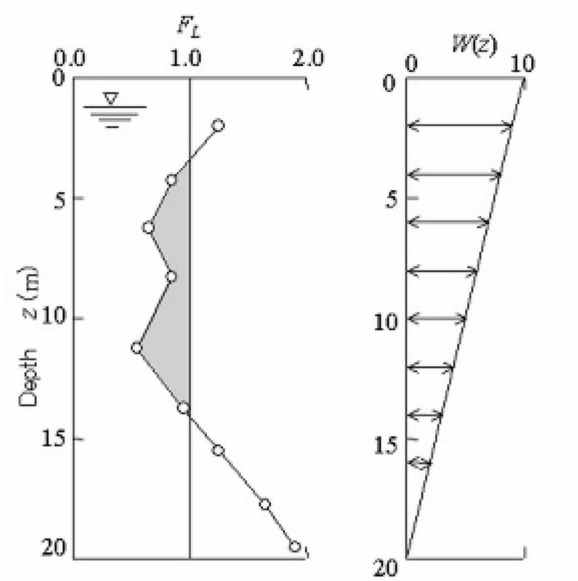
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\textbf{LPI} = \int_0^{20} (10 - 0{,}5_z) \times F_L \times d_z$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) +$$

$$4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B +$$
$$0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z}\, dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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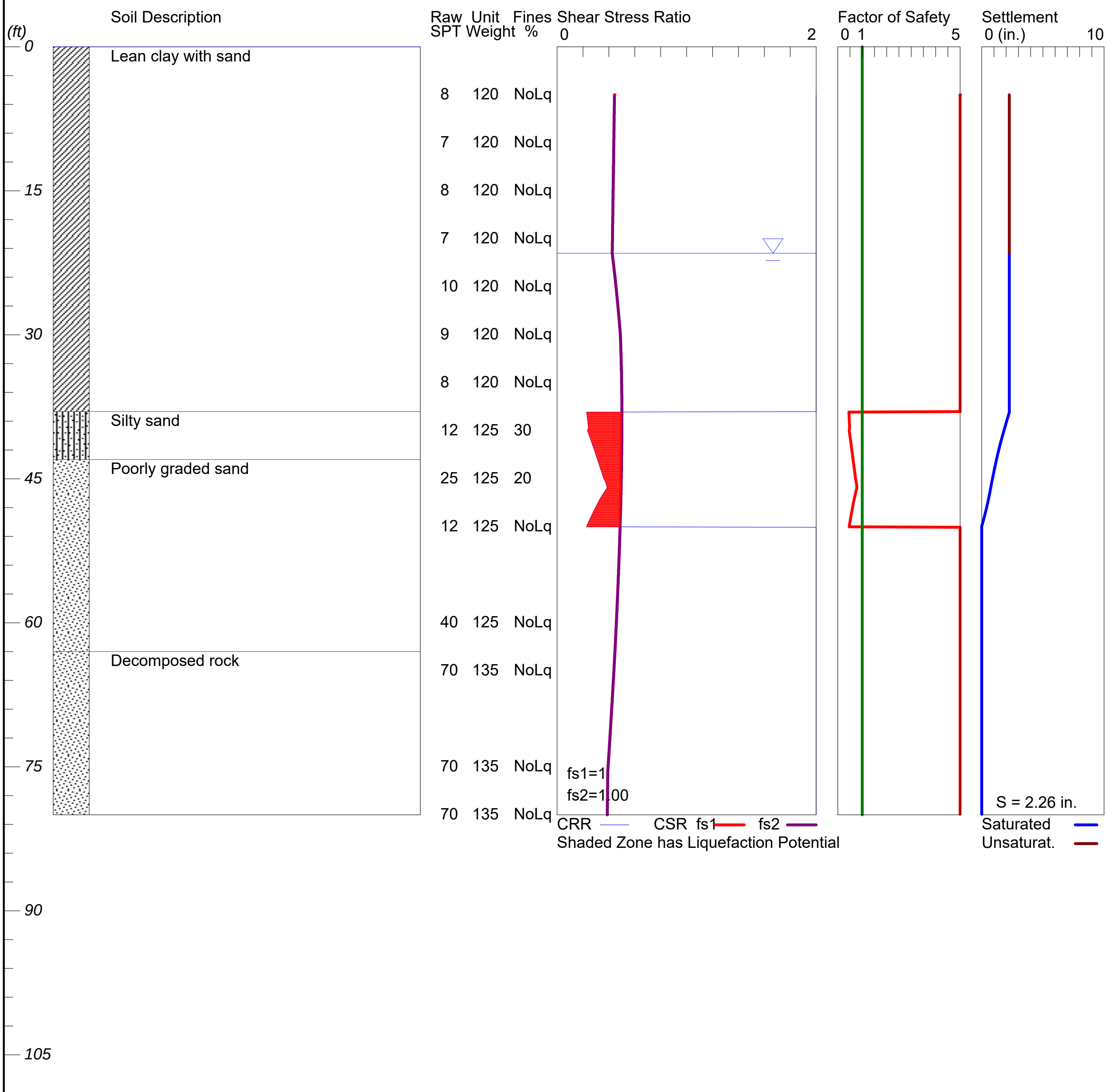
LIQUEFACTION ANALYSIS

Las Trampas Creek Bridge

Hole No.=R-17-001 Water Depth=21.5 ft Surface Elev.=149.4 Magnitude=6.5
Acceleration=0.69g



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                              LIQUEFACTION ANALYSIS SUMMARY
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        Font: Courier New, Regular, Size 8 is recommended for this report.
        Licensed to ,   9/29/2017       11:31:20 AM

        Input File Name: C:\Users\amanda_kahn\Desktop\R_17_001_ABK_092017.liq
        Title:  Las Trampas Creek Bridge
        Subtitle:  Replacement Project

        Surface Elev.=149.4
        Hole No.=R-17-001
        Depth of Hole= 80.00 ft
        Water Table during Earthquake= 21.50 ft
        Water Table during In-Situ Testing= 21.50 ft
        Max. Acceleration= 0.69 g
        Earthquake Magnitude= 6.50

 Input Data:
        Surface Elev.=149.4
        Hole No.=R-17-001
        Depth of Hole=80.00 ft
        Water Table during Earthquake= 21.50 ft
        Water Table during In-Situ Testing= 21.50 ft
        Max. Acceleration=0.69 g
        Earthquake Magnitude=6.50
        No-Liquefiable Soils:   CL, OL are Non-Liq. Soil

        1. SPT or BPT Calculation.
        2. Settlement Analysis Method: Tokimatsu/Seed
        3. Fines Correction for Liquefaction: Idriss/Seed
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1
        7. Borehole Diameter,                                        Cb= 1
        8. Sampling Method,                                          Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1
           Plot two CSR (fs1=1, fs2=User)
        10. Use Curve Smoothing: Yes*
        * Recommended Options

        In-Situ Test Data:
```

Depth ft	SPT	gamma pcf	Fines %
5.00	8.00	120.00	NoLiq
10.00	7.00	120.00	NoLiq
15.00	8.00	120.00	NoLiq
20.00	7.00	120.00	NoLiq
25.00	10.00	120.00	NoLiq
30.00	9.00	120.00	NoLiq
35.00	8.00	120.00	NoLiq
40.00	12.00	125.00	30.00
45.00	25.00	125.00	20.00
50.00	12.00	125.00	NoLiq
60.00	40.00	125.00	NoLiq
65.00	70.00	135.00	NoLiq
75.00	70.00	135.00	NoLiq
80.00	70.00	135.00	NoLiq

Liquefy.sum

```
Output Results:
        Settlement of Saturated Sands=2.26 in.
        Settlement of Unsaturated Sands=0.00 in.
        Total Settlement of Saturated and Unsaturated Sands=2.26 in.
        Differential Settlement=1.129 to 1.490 in.
```

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
5.00	2.00	0.44	5.00	2.26	0.00	2.26
5.05	2.00	0.44	5.00	2.26	0.00	2.26
5.10	2.00	0.44	5.00	2.26	0.00	2.26
5.15	2.00	0.44	5.00	2.26	0.00	2.26
5.20	2.00	0.44	5.00	2.26	0.00	2.26
5.25	2.00	0.44	5.00	2.26	0.00	2.26
5.30	2.00	0.44	5.00	2.26	0.00	2.26
5.35	2.00	0.44	5.00	2.26	0.00	2.26
5.40	2.00	0.44	5.00	2.26	0.00	2.26
5.45	2.00	0.44	5.00	2.26	0.00	2.26
5.50	2.00	0.44	5.00	2.26	0.00	2.26
5.55	2.00	0.44	5.00	2.26	0.00	2.26
5.60	2.00	0.44	5.00	2.26	0.00	2.26
5.65	2.00	0.44	5.00	2.26	0.00	2.26
5.70	2.00	0.44	5.00	2.26	0.00	2.26
5.75	2.00	0.44	5.00	2.26	0.00	2.26
5.80	2.00	0.44	5.00	2.26	0.00	2.26
5.85	2.00	0.44	5.00	2.26	0.00	2.26
5.90	2.00	0.44	5.00	2.26	0.00	2.26
5.95	2.00	0.44	5.00	2.26	0.00	2.26
6.00	2.00	0.44	5.00	2.26	0.00	2.26
6.05	2.00	0.44	5.00	2.26	0.00	2.26
6.10	2.00	0.44	5.00	2.26	0.00	2.26
6.15	2.00	0.44	5.00	2.26	0.00	2.26
6.20	2.00	0.44	5.00	2.26	0.00	2.26
6.25	2.00	0.44	5.00	2.26	0.00	2.26
6.30	2.00	0.44	5.00	2.26	0.00	2.26
6.35	2.00	0.44	5.00	2.26	0.00	2.26
6.40	2.00	0.44	5.00	2.26	0.00	2.26
6.45	2.00	0.44	5.00	2.26	0.00	2.26
6.50	2.00	0.44	5.00	2.26	0.00	2.26
6.55	2.00	0.44	5.00	2.26	0.00	2.26

6.60	2.00	0.44	5.00	2.26	0.00	2.26
6.65	2.00	0.44	5.00	2.26	0.00	2.26
6.70	2.00	0.44	5.00	2.26	0.00	2.26
6.75	2.00	0.44	5.00	2.26	0.00	2.26
6.80	2.00	0.44	5.00	2.26	0.00	2.26
6.85	2.00	0.44	5.00	2.26	0.00	2.26
6.90	2.00	0.44	5.00	2.26	0.00	2.26
6.95	2.00	0.44	5.00	2.26	0.00	2.26
7.00	2.00	0.44	5.00	2.26	0.00	2.26
7.05	2.00	0.44	5.00	2.26	0.00	2.26
7.10	2.00	0.44	5.00	2.26	0.00	2.26
7.15	2.00	0.44	5.00	2.26	0.00	2.26
7.20	2.00	0.44	5.00	2.26	0.00	2.26
7.25	2.00	0.44	5.00	2.26	0.00	2.26
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7.45	2.00	0.44	5.00	2.26	0.00	2.26
7.50	2.00	0.44	5.00	2.26	0.00	2.26
7.55	2.00	0.44	5.00	2.26	0.00	2.26
7.60	2.00	0.44	5.00	2.26	0.00	2.26
7.65	2.00	0.44	5.00	2.26	0.00	2.26
7.70	2.00	0.44	5.00	2.26	0.00	2.26
7.75	2.00	0.44	5.00	2.26	0.00	2.26
7.80	2.00	0.44	5.00	2.26	0.00	2.26
7.85	2.00	0.44	5.00	2.26	0.00	2.26
7.90	2.00	0.44	5.00	2.26	0.00	2.26
7.95	2.00	0.44	5.00	2.26	0.00	2.26
8.00	2.00	0.44	5.00	2.26	0.00	2.26
8.05	2.00	0.44	5.00	2.26	0.00	2.26
8.10	2.00	0.44	5.00	2.26	0.00	2.26
8.15	2.00	0.44	5.00	2.26	0.00	2.26
8.20	2.00	0.44	5.00	2.26	0.00	2.26
8.25	2.00	0.44	5.00	2.26	0.00	2.26
8.30	2.00	0.44	5.00	2.26	0.00	2.26
8.35	2.00	0.44	5.00	2.26	0.00	2.26
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8.45	2.00	0.44	5.00	2.26	0.00	2.26
8.50	2.00	0.44	5.00	2.26	0.00	2.26
8.55	2.00	0.44	5.00	2.26	0.00	2.26
8.60	2.00	0.44	5.00	2.26	0.00	2.26
8.65	2.00	0.44	5.00	2.26	0.00	2.26
8.70	2.00	0.44	5.00	2.26	0.00	2.26
8.75	2.00	0.44	5.00	2.26	0.00	2.26
8.80	2.00	0.44	5.00	2.26	0.00	2.26
8.85	2.00	0.44	5.00	2.26	0.00	2.26
8.90	2.00	0.44	5.00	2.26	0.00	2.26
8.95	2.00	0.44	5.00	2.26	0.00	2.26
9.00	2.00	0.44	5.00	2.26	0.00	2.26
9.05	2.00	0.44	5.00	2.26	0.00	2.26
9.10	2.00	0.44	5.00	2.26	0.00	2.26
9.15	2.00	0.44	5.00	2.26	0.00	2.26
9.20	2.00	0.44	5.00	2.26	0.00	2.26
9.25	2.00	0.44	5.00	2.26	0.00	2.26

9.30	2.00	0.44	5.00	2.26	0.00	2.26
9.35	2.00	0.44	5.00	2.26	0.00	2.26
9.40	2.00	0.44	5.00	2.26	0.00	2.26
9.45	2.00	0.44	5.00	2.26	0.00	2.26
9.50	2.00	0.44	5.00	2.26	0.00	2.26
9.55	2.00	0.44	5.00	2.26	0.00	2.26
9.60	2.00	0.44	5.00	2.26	0.00	2.26
9.65	2.00	0.44	5.00	2.26	0.00	2.26
9.70	2.00	0.44	5.00	2.26	0.00	2.26
9.75	2.00	0.44	5.00	2.26	0.00	2.26
9.80	2.00	0.44	5.00	2.26	0.00	2.26
9.85	2.00	0.44	5.00	2.26	0.00	2.26
9.90	2.00	0.44	5.00	2.26	0.00	2.26
9.95	2.00	0.44	5.00	2.26	0.00	2.26
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10.05	2.00	0.44	5.00	2.26	0.00	2.26
10.10	2.00	0.44	5.00	2.26	0.00	2.26
10.15	2.00	0.44	5.00	2.26	0.00	2.26
10.20	2.00	0.44	5.00	2.26	0.00	2.26
10.25	2.00	0.44	5.00	2.26	0.00	2.26
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10.40	2.00	0.44	5.00	2.26	0.00	2.26
10.45	2.00	0.44	5.00	2.26	0.00	2.26
10.50	2.00	0.44	5.00	2.26	0.00	2.26
10.55	2.00	0.44	5.00	2.26	0.00	2.26
10.60	2.00	0.44	5.00	2.26	0.00	2.26
10.65	2.00	0.44	5.00	2.26	0.00	2.26
10.70	2.00	0.44	5.00	2.26	0.00	2.26
10.75	2.00	0.44	5.00	2.26	0.00	2.26
10.80	2.00	0.44	5.00	2.26	0.00	2.26
10.85	2.00	0.44	5.00	2.26	0.00	2.26
10.90	2.00	0.44	5.00	2.26	0.00	2.26
10.95	2.00	0.44	5.00	2.26	0.00	2.26
11.00	2.00	0.44	5.00	2.26	0.00	2.26
11.05	2.00	0.44	5.00	2.26	0.00	2.26
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11.15	2.00	0.44	5.00	2.26	0.00	2.26
11.20	2.00	0.44	5.00	2.26	0.00	2.26
11.25	2.00	0.44	5.00	2.26	0.00	2.26
11.30	2.00	0.44	5.00	2.26	0.00	2.26
11.35	2.00	0.44	5.00	2.26	0.00	2.26
11.40	2.00	0.44	5.00	2.26	0.00	2.26
11.45	2.00	0.44	5.00	2.26	0.00	2.26
11.50	2.00	0.44	5.00	2.26	0.00	2.26
11.55	2.00	0.44	5.00	2.26	0.00	2.26
11.60	2.00	0.44	5.00	2.26	0.00	2.26
11.65	2.00	0.44	5.00	2.26	0.00	2.26
11.70	2.00	0.44	5.00	2.26	0.00	2.26
11.75	2.00	0.44	5.00	2.26	0.00	2.26
11.80	2.00	0.44	5.00	2.26	0.00	2.26
11.85	2.00	0.44	5.00	2.26	0.00	2.26
11.90	2.00	0.44	5.00	2.26	0.00	2.26
11.95	2.00	0.44	5.00	2.26	0.00	2.26

12.00	2.00	0.44	5.00	2.26	0.00	2.26
12.05	2.00	0.44	5.00	2.26	0.00	2.26
12.10	2.00	0.44	5.00	2.26	0.00	2.26
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12.25	2.00	0.44	5.00	2.26	0.00	2.26
12.30	2.00	0.44	5.00	2.26	0.00	2.26
12.35	2.00	0.44	5.00	2.26	0.00	2.26
12.40	2.00	0.44	5.00	2.26	0.00	2.26
12.45	2.00	0.44	5.00	2.26	0.00	2.26
12.50	2.00	0.44	5.00	2.26	0.00	2.26
12.55	2.00	0.44	5.00	2.26	0.00	2.26
12.60	2.00	0.44	5.00	2.26	0.00	2.26
12.65	2.00	0.44	5.00	2.26	0.00	2.26
12.70	2.00	0.44	5.00	2.26	0.00	2.26
12.75	2.00	0.44	5.00	2.26	0.00	2.26
12.80	2.00	0.44	5.00	2.26	0.00	2.26
12.85	2.00	0.44	5.00	2.26	0.00	2.26
12.90	2.00	0.44	5.00	2.26	0.00	2.26
12.95	2.00	0.43	5.00	2.26	0.00	2.26
13.00	2.00	0.43	5.00	2.26	0.00	2.26
13.05	2.00	0.43	5.00	2.26	0.00	2.26
13.10	2.00	0.43	5.00	2.26	0.00	2.26
13.15	2.00	0.43	5.00	2.26	0.00	2.26
13.20	2.00	0.43	5.00	2.26	0.00	2.26
13.25	2.00	0.43	5.00	2.26	0.00	2.26
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13.45	2.00	0.43	5.00	2.26	0.00	2.26
13.50	2.00	0.43	5.00	2.26	0.00	2.26
13.55	2.00	0.43	5.00	2.26	0.00	2.26
13.60	2.00	0.43	5.00	2.26	0.00	2.26
13.65	2.00	0.43	5.00	2.26	0.00	2.26
13.70	2.00	0.43	5.00	2.26	0.00	2.26
13.75	2.00	0.43	5.00	2.26	0.00	2.26
13.80	2.00	0.43	5.00	2.26	0.00	2.26
13.85	2.00	0.43	5.00	2.26	0.00	2.26
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13.95	2.00	0.43	5.00	2.26	0.00	2.26
14.00	2.00	0.43	5.00	2.26	0.00	2.26
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14.15	2.00	0.43	5.00	2.26	0.00	2.26
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14.25	2.00	0.43	5.00	2.26	0.00	2.26
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14.65	2.00	0.43	5.00	2.26	0.00	2.26

14.70	2.00	0.43	5.00	2.26	0.00	2.26
14.75	2.00	0.43	5.00	2.26	0.00	2.26
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14.85	2.00	0.43	5.00	2.26	0.00	2.26
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14.95	2.00	0.43	5.00	2.26	0.00	2.26
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15.15	2.00	0.43	5.00	2.26	0.00	2.26
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15.25	2.00	0.43	5.00	2.26	0.00	2.26
15.30	2.00	0.43	5.00	2.26	0.00	2.26
15.35	2.00	0.43	5.00	2.26	0.00	2.26
15.40	2.00	0.43	5.00	2.26	0.00	2.26
15.45	2.00	0.43	5.00	2.26	0.00	2.26
15.50	2.00	0.43	5.00	2.26	0.00	2.26
15.55	2.00	0.43	5.00	2.26	0.00	2.26
15.60	2.00	0.43	5.00	2.26	0.00	2.26
15.65	2.00	0.43	5.00	2.26	0.00	2.26
15.70	2.00	0.43	5.00	2.26	0.00	2.26
15.75	2.00	0.43	5.00	2.26	0.00	2.26
15.80	2.00	0.43	5.00	2.26	0.00	2.26
15.85	2.00	0.43	5.00	2.26	0.00	2.26
15.90	2.00	0.43	5.00	2.26	0.00	2.26
15.95	2.00	0.43	5.00	2.26	0.00	2.26
16.00	2.00	0.43	5.00	2.26	0.00	2.26
16.05	2.00	0.43	5.00	2.26	0.00	2.26
16.10	2.00	0.43	5.00	2.26	0.00	2.26
16.15	2.00	0.43	5.00	2.26	0.00	2.26
16.20	2.00	0.43	5.00	2.26	0.00	2.26
16.25	2.00	0.43	5.00	2.26	0.00	2.26
16.30	2.00	0.43	5.00	2.26	0.00	2.26
16.35	2.00	0.43	5.00	2.26	0.00	2.26
16.40	2.00	0.43	5.00	2.26	0.00	2.26
16.45	2.00	0.43	5.00	2.26	0.00	2.26
16.50	2.00	0.43	5.00	2.26	0.00	2.26
16.55	2.00	0.43	5.00	2.26	0.00	2.26
16.60	2.00	0.43	5.00	2.26	0.00	2.26
16.65	2.00	0.43	5.00	2.26	0.00	2.26
16.70	2.00	0.43	5.00	2.26	0.00	2.26
16.75	2.00	0.43	5.00	2.26	0.00	2.26
16.80	2.00	0.43	5.00	2.26	0.00	2.26
16.85	2.00	0.43	5.00	2.26	0.00	2.26
16.90	2.00	0.43	5.00	2.26	0.00	2.26
16.95	2.00	0.43	5.00	2.26	0.00	2.26
17.00	2.00	0.43	5.00	2.26	0.00	2.26
17.05	2.00	0.43	5.00	2.26	0.00	2.26
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17.25	2.00	0.43	5.00	2.26	0.00	2.26
17.30	2.00	0.43	5.00	2.26	0.00	2.26
17.35	2.00	0.43	5.00	2.26	0.00	2.26

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17.65	2.00	0.43	5.00	2.26	0.00	2.26
17.70	2.00	0.43	5.00	2.26	0.00	2.26
17.75	2.00	0.43	5.00	2.26	0.00	2.26
17.80	2.00	0.43	5.00	2.26	0.00	2.26
17.85	2.00	0.43	5.00	2.26	0.00	2.26
17.90	2.00	0.43	5.00	2.26	0.00	2.26
17.95	2.00	0.43	5.00	2.26	0.00	2.26
18.00	2.00	0.43	5.00	2.26	0.00	2.26
18.05	2.00	0.43	5.00	2.26	0.00	2.26
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18.15	2.00	0.43	5.00	2.26	0.00	2.26
18.20	2.00	0.43	5.00	2.26	0.00	2.26
18.25	2.00	0.43	5.00	2.26	0.00	2.26
18.30	2.00	0.43	5.00	2.26	0.00	2.26
18.35	2.00	0.43	5.00	2.26	0.00	2.26
18.40	2.00	0.43	5.00	2.26	0.00	2.26
18.45	2.00	0.43	5.00	2.26	0.00	2.26
18.50	2.00	0.43	5.00	2.26	0.00	2.26
18.55	2.00	0.43	5.00	2.26	0.00	2.26
18.60	2.00	0.43	5.00	2.26	0.00	2.26
18.65	2.00	0.43	5.00	2.26	0.00	2.26
18.70	2.00	0.43	5.00	2.26	0.00	2.26
18.75	2.00	0.43	5.00	2.26	0.00	2.26
18.80	2.00	0.43	5.00	2.26	0.00	2.26
18.85	2.00	0.43	5.00	2.26	0.00	2.26
18.90	2.00	0.43	5.00	2.26	0.00	2.26
18.95	2.00	0.43	5.00	2.26	0.00	2.26
19.00	2.00	0.43	5.00	2.26	0.00	2.26
19.05	2.00	0.43	5.00	2.26	0.00	2.26
19.10	2.00	0.43	5.00	2.26	0.00	2.26
19.15	2.00	0.43	5.00	2.26	0.00	2.26
19.20	2.00	0.43	5.00	2.26	0.00	2.26
19.25	2.00	0.43	5.00	2.26	0.00	2.26
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19.45	2.00	0.43	5.00	2.26	0.00	2.26
19.50	2.00	0.43	5.00	2.26	0.00	2.26
19.55	2.00	0.43	5.00	2.26	0.00	2.26
19.60	2.00	0.43	5.00	2.26	0.00	2.26
19.65	2.00	0.43	5.00	2.26	0.00	2.26
19.70	2.00	0.43	5.00	2.26	0.00	2.26
19.75	2.00	0.43	5.00	2.26	0.00	2.26
19.80	2.00	0.43	5.00	2.26	0.00	2.26
19.85	2.00	0.43	5.00	2.26	0.00	2.26
19.90	2.00	0.43	5.00	2.26	0.00	2.26
19.95	2.00	0.43	5.00	2.26	0.00	2.26
20.00	2.00	0.43	5.00	2.26	0.00	2.26
20.05	2.00	0.43	5.00	2.26	0.00	2.26

20.10	2.00	0.43	5.00	2.26	0.00	2.26
20.15	2.00	0.43	5.00	2.26	0.00	2.26
20.20	2.00	0.43	5.00	2.26	0.00	2.26
20.25	2.00	0.43	5.00	2.26	0.00	2.26
20.30	2.00	0.43	5.00	2.26	0.00	2.26
20.35	2.00	0.43	5.00	2.26	0.00	2.26
20.40	2.00	0.43	5.00	2.26	0.00	2.26
20.45	2.00	0.43	5.00	2.26	0.00	2.26
20.50	2.00	0.43	5.00	2.26	0.00	2.26
20.55	2.00	0.43	5.00	2.26	0.00	2.26
20.60	2.00	0.43	5.00	2.26	0.00	2.26
20.65	2.00	0.43	5.00	2.26	0.00	2.26
20.70	2.00	0.43	5.00	2.26	0.00	2.26
20.75	2.00	0.43	5.00	2.26	0.00	2.26
20.80	2.00	0.43	5.00	2.26	0.00	2.26
20.85	2.00	0.43	5.00	2.26	0.00	2.26
20.90	2.00	0.43	5.00	2.26	0.00	2.26
20.95	2.00	0.43	5.00	2.26	0.00	2.26
21.00	2.00	0.43	5.00	2.26	0.00	2.26
21.05	2.00	0.43	5.00	2.26	0.00	2.26
21.10	2.00	0.43	5.00	2.26	0.00	2.26
21.15	2.00	0.43	5.00	2.26	0.00	2.26
21.20	2.00	0.43	5.00	2.26	0.00	2.26
21.25	2.00	0.43	5.00	2.26	0.00	2.26
21.30	2.00	0.43	5.00	2.26	0.00	2.26
21.35	2.00	0.43	5.00	2.26	0.00	2.26
21.40	2.00	0.43	5.00	2.26	0.00	2.26
21.45	2.00	0.43	5.00	2.26	0.00	2.26
21.50	2.00	0.43	5.00	2.26	0.00	2.26
21.55	2.00	0.43	5.00	2.26	0.00	2.26
21.60	2.00	0.43	5.00	2.26	0.00	2.26
21.65	2.00	0.43	5.00	2.26	0.00	2.26
21.70	2.00	0.43	5.00	2.26	0.00	2.26
21.75	2.00	0.43	5.00	2.26	0.00	2.26
21.80	2.00	0.43	5.00	2.26	0.00	2.26
21.85	2.00	0.43	5.00	2.26	0.00	2.26
21.90	2.00	0.43	5.00	2.26	0.00	2.26
21.95	2.00	0.43	5.00	2.26	0.00	2.26
22.00	2.00	0.43	5.00	2.26	0.00	2.26
22.05	2.00	0.43	5.00	2.26	0.00	2.26
22.10	2.00	0.43	5.00	2.26	0.00	2.26
22.15	2.00	0.43	5.00	2.26	0.00	2.26
22.20	2.00	0.43	5.00	2.26	0.00	2.26
22.25	2.00	0.43	5.00	2.26	0.00	2.26
22.30	2.00	0.43	5.00	2.26	0.00	2.26
22.35	2.00	0.43	5.00	2.26	0.00	2.26
22.40	2.00	0.43	5.00	2.26	0.00	2.26
22.45	2.00	0.43	5.00	2.26	0.00	2.26
22.50	2.00	0.43	5.00	2.26	0.00	2.26
22.55	2.00	0.43	5.00	2.26	0.00	2.26
22.60	2.00	0.44	5.00	2.26	0.00	2.26
22.65	2.00	0.44	5.00	2.26	0.00	2.26
22.70	2.00	0.44	5.00	2.26	0.00	2.26
22.75	2.00	0.44	5.00	2.26	0.00	2.26

22.80	2.00	0.44	5.00	2.26	0.00	2.26
22.85	2.00	0.44	5.00	2.26	0.00	2.26
22.90	2.00	0.44	5.00	2.26	0.00	2.26
22.95	2.00	0.44	5.00	2.26	0.00	2.26
23.00	2.00	0.44	5.00	2.26	0.00	2.26
23.05	2.00	0.44	5.00	2.26	0.00	2.26
23.10	2.00	0.44	5.00	2.26	0.00	2.26
23.15	2.00	0.44	5.00	2.26	0.00	2.26
23.20	2.00	0.44	5.00	2.26	0.00	2.26
23.25	2.00	0.44	5.00	2.26	0.00	2.26
23.30	2.00	0.44	5.00	2.26	0.00	2.26
23.35	2.00	0.44	5.00	2.26	0.00	2.26
23.40	2.00	0.44	5.00	2.26	0.00	2.26
23.45	2.00	0.44	5.00	2.26	0.00	2.26
23.50	2.00	0.44	5.00	2.26	0.00	2.26
23.55	2.00	0.44	5.00	2.26	0.00	2.26
23.60	2.00	0.44	5.00	2.26	0.00	2.26
23.65	2.00	0.44	5.00	2.26	0.00	2.26
23.70	2.00	0.44	5.00	2.26	0.00	2.26
23.75	2.00	0.45	5.00	2.26	0.00	2.26
23.80	2.00	0.45	5.00	2.26	0.00	2.26
23.85	2.00	0.45	5.00	2.26	0.00	2.26
23.90	2.00	0.45	5.00	2.26	0.00	2.26
23.95	2.00	0.45	5.00	2.26	0.00	2.26
24.00	2.00	0.45	5.00	2.26	0.00	2.26
24.05	2.00	0.45	5.00	2.26	0.00	2.26
24.10	2.00	0.45	5.00	2.26	0.00	2.26
24.15	2.00	0.45	5.00	2.26	0.00	2.26
24.20	2.00	0.45	5.00	2.26	0.00	2.26
24.25	2.00	0.45	5.00	2.26	0.00	2.26
24.30	2.00	0.45	5.00	2.26	0.00	2.26
24.35	2.00	0.45	5.00	2.26	0.00	2.26
24.40	2.00	0.45	5.00	2.26	0.00	2.26
24.45	2.00	0.45	5.00	2.26	0.00	2.26
24.50	2.00	0.45	5.00	2.26	0.00	2.26
24.55	2.00	0.45	5.00	2.26	0.00	2.26
24.60	2.00	0.45	5.00	2.26	0.00	2.26
24.65	2.00	0.45	5.00	2.26	0.00	2.26
24.70	2.00	0.45	5.00	2.26	0.00	2.26
24.75	2.00	0.45	5.00	2.26	0.00	2.26
24.80	2.00	0.45	5.00	2.26	0.00	2.26
24.85	2.00	0.45	5.00	2.26	0.00	2.26
24.90	2.00	0.45	5.00	2.26	0.00	2.26
24.95	2.00	0.45	5.00	2.26	0.00	2.26
25.00	2.00	0.46	5.00	2.26	0.00	2.26
25.05	2.00	0.46	5.00	2.26	0.00	2.26
25.10	2.00	0.46	5.00	2.26	0.00	2.26
25.15	2.00	0.46	5.00	2.26	0.00	2.26
25.20	2.00	0.46	5.00	2.26	0.00	2.26
25.25	2.00	0.46	5.00	2.26	0.00	2.26
25.30	2.00	0.46	5.00	2.26	0.00	2.26
25.35	2.00	0.46	5.00	2.26	0.00	2.26
25.40	2.00	0.46	5.00	2.26	0.00	2.26
25.45	2.00	0.46	5.00	2.26	0.00	2.26

25.50	2.00	0.46	5.00	2.26	0.00	2.26
25.55	2.00	0.46	5.00	2.26	0.00	2.26
25.60	2.00	0.46	5.00	2.26	0.00	2.26
25.65	2.00	0.46	5.00	2.26	0.00	2.26
25.70	2.00	0.46	5.00	2.26	0.00	2.26
25.75	2.00	0.46	5.00	2.26	0.00	2.26
25.80	2.00	0.46	5.00	2.26	0.00	2.26
25.85	2.00	0.46	5.00	2.26	0.00	2.26
25.90	2.00	0.46	5.00	2.26	0.00	2.26
25.95	2.00	0.46	5.00	2.26	0.00	2.26
26.00	2.00	0.46	5.00	2.26	0.00	2.26
26.05	2.00	0.46	5.00	2.26	0.00	2.26
26.10	2.00	0.46	5.00	2.26	0.00	2.26
26.15	2.00	0.46	5.00	2.26	0.00	2.26
26.20	2.00	0.46	5.00	2.26	0.00	2.26
26.25	2.00	0.46	5.00	2.26	0.00	2.26
26.30	2.00	0.46	5.00	2.26	0.00	2.26
26.35	2.00	0.46	5.00	2.26	0.00	2.26
26.40	2.00	0.47	5.00	2.26	0.00	2.26
26.45	2.00	0.47	5.00	2.26	0.00	2.26
26.50	2.00	0.47	5.00	2.26	0.00	2.26
26.55	2.00	0.47	5.00	2.26	0.00	2.26
26.60	2.00	0.47	5.00	2.26	0.00	2.26
26.65	2.00	0.47	5.00	2.26	0.00	2.26
26.70	2.00	0.47	5.00	2.26	0.00	2.26
26.75	2.00	0.47	5.00	2.26	0.00	2.26
26.80	2.00	0.47	5.00	2.26	0.00	2.26
26.85	2.00	0.47	5.00	2.26	0.00	2.26
26.90	2.00	0.47	5.00	2.26	0.00	2.26
26.95	2.00	0.47	5.00	2.26	0.00	2.26
27.00	2.00	0.47	5.00	2.26	0.00	2.26
27.05	2.00	0.47	5.00	2.26	0.00	2.26
27.10	2.00	0.47	5.00	2.26	0.00	2.26
27.15	2.00	0.47	5.00	2.26	0.00	2.26
27.20	2.00	0.47	5.00	2.26	0.00	2.26
27.25	2.00	0.47	5.00	2.26	0.00	2.26
27.30	2.00	0.47	5.00	2.26	0.00	2.26
27.35	2.00	0.47	5.00	2.26	0.00	2.26
27.40	2.00	0.47	5.00	2.26	0.00	2.26
27.45	2.00	0.47	5.00	2.26	0.00	2.26
27.50	2.00	0.47	5.00	2.26	0.00	2.26
27.55	2.00	0.47	5.00	2.26	0.00	2.26
27.60	2.00	0.47	5.00	2.26	0.00	2.26
27.65	2.00	0.47	5.00	2.26	0.00	2.26
27.70	2.00	0.47	5.00	2.26	0.00	2.26
27.75	2.00	0.47	5.00	2.26	0.00	2.26
27.80	2.00	0.47	5.00	2.26	0.00	2.26
27.85	2.00	0.48	5.00	2.26	0.00	2.26
27.90	2.00	0.48	5.00	2.26	0.00	2.26
27.95	2.00	0.48	5.00	2.26	0.00	2.26
28.00	2.00	0.48	5.00	2.26	0.00	2.26
28.05	2.00	0.48	5.00	2.26	0.00	2.26
28.10	2.00	0.48	5.00	2.26	0.00	2.26
28.15	2.00	0.48	5.00	2.26	0.00	2.26

28.20	2.00	0.48	5.00	2.26	0.00	2.26
28.25	2.00	0.48	5.00	2.26	0.00	2.26
28.30	2.00	0.48	5.00	2.26	0.00	2.26
28.35	2.00	0.48	5.00	2.26	0.00	2.26
28.40	2.00	0.48	5.00	2.26	0.00	2.26
28.45	2.00	0.48	5.00	2.26	0.00	2.26
28.50	2.00	0.48	5.00	2.26	0.00	2.26
28.55	2.00	0.48	5.00	2.26	0.00	2.26
28.60	2.00	0.48	5.00	2.26	0.00	2.26
28.65	2.00	0.48	5.00	2.26	0.00	2.26
28.70	2.00	0.48	5.00	2.26	0.00	2.26
28.75	2.00	0.48	5.00	2.26	0.00	2.26
28.80	2.00	0.48	5.00	2.26	0.00	2.26
28.85	2.00	0.48	5.00	2.26	0.00	2.26
28.90	2.00	0.48	5.00	2.26	0.00	2.26
28.95	2.00	0.48	5.00	2.26	0.00	2.26
29.00	2.00	0.48	5.00	2.26	0.00	2.26
29.05	2.00	0.48	5.00	2.26	0.00	2.26
29.10	2.00	0.48	5.00	2.26	0.00	2.26
29.15	2.00	0.48	5.00	2.26	0.00	2.26
29.20	2.00	0.48	5.00	2.26	0.00	2.26
29.25	2.00	0.48	5.00	2.26	0.00	2.26
29.30	2.00	0.48	5.00	2.26	0.00	2.26
29.35	2.00	0.48	5.00	2.26	0.00	2.26
29.40	2.00	0.49	5.00	2.26	0.00	2.26
29.45	2.00	0.49	5.00	2.26	0.00	2.26
29.50	2.00	0.49	5.00	2.26	0.00	2.26
29.55	2.00	0.49	5.00	2.26	0.00	2.26
29.60	2.00	0.49	5.00	2.26	0.00	2.26
29.65	2.00	0.49	5.00	2.26	0.00	2.26
29.70	2.00	0.49	5.00	2.26	0.00	2.26
29.75	2.00	0.49	5.00	2.26	0.00	2.26
29.80	2.00	0.49	5.00	2.26	0.00	2.26
29.85	2.00	0.49	5.00	2.26	0.00	2.26
29.90	2.00	0.49	5.00	2.26	0.00	2.26
29.95	2.00	0.49	5.00	2.26	0.00	2.26
30.00	2.00	0.49	5.00	2.26	0.00	2.26
30.05	2.00	0.49	5.00	2.26	0.00	2.26
30.10	2.00	0.49	5.00	2.26	0.00	2.26
30.15	2.00	0.49	5.00	2.26	0.00	2.26
30.20	2.00	0.49	5.00	2.26	0.00	2.26
30.25	2.00	0.49	5.00	2.26	0.00	2.26
30.30	2.00	0.49	5.00	2.26	0.00	2.26
30.35	2.00	0.49	5.00	2.26	0.00	2.26
30.40	2.00	0.49	5.00	2.26	0.00	2.26
30.45	2.00	0.49	5.00	2.26	0.00	2.26
30.50	2.00	0.49	5.00	2.26	0.00	2.26
30.55	2.00	0.49	5.00	2.26	0.00	2.26
30.60	2.00	0.49	5.00	2.26	0.00	2.26
30.65	2.00	0.49	5.00	2.26	0.00	2.26
30.70	2.00	0.49	5.00	2.26	0.00	2.26
30.75	2.00	0.49	5.00	2.26	0.00	2.26
30.80	2.00	0.49	5.00	2.26	0.00	2.26
30.85	2.00	0.49	5.00	2.26	0.00	2.26

30.90	2.00	0.49	5.00	2.26	0.00	2.26
30.95	2.00	0.49	5.00	2.26	0.00	2.26
31.00	2.00	0.49	5.00	2.26	0.00	2.26
31.05	2.00	0.49	5.00	2.26	0.00	2.26
31.10	2.00	0.49	5.00	2.26	0.00	2.26
31.15	2.00	0.49	5.00	2.26	0.00	2.26
31.20	2.00	0.49	5.00	2.26	0.00	2.26
31.25	2.00	0.49	5.00	2.26	0.00	2.26
31.30	2.00	0.49	5.00	2.26	0.00	2.26
31.35	2.00	0.49	5.00	2.26	0.00	2.26
31.40	2.00	0.49	5.00	2.26	0.00	2.26
31.45	2.00	0.49	5.00	2.26	0.00	2.26
31.50	2.00	0.49	5.00	2.26	0.00	2.26
31.55	2.00	0.49	5.00	2.26	0.00	2.26
31.60	2.00	0.49	5.00	2.26	0.00	2.26
31.65	2.00	0.49	5.00	2.26	0.00	2.26
31.70	2.00	0.49	5.00	2.26	0.00	2.26
31.75	2.00	0.49	5.00	2.26	0.00	2.26
31.80	2.00	0.49	5.00	2.26	0.00	2.26
31.85	2.00	0.49	5.00	2.26	0.00	2.26
31.90	2.00	0.49	5.00	2.26	0.00	2.26
31.95	2.00	0.49	5.00	2.26	0.00	2.26
32.00	2.00	0.49	5.00	2.26	0.00	2.26
32.05	2.00	0.49	5.00	2.26	0.00	2.26
32.10	2.00	0.49	5.00	2.26	0.00	2.26
32.15	2.00	0.49	5.00	2.26	0.00	2.26
32.20	2.00	0.49	5.00	2.26	0.00	2.26
32.25	2.00	0.49	5.00	2.26	0.00	2.26
32.30	2.00	0.49	5.00	2.26	0.00	2.26
32.35	2.00	0.49	5.00	2.26	0.00	2.26
32.40	2.00	0.49	5.00	2.26	0.00	2.26
32.45	2.00	0.49	5.00	2.26	0.00	2.26
32.50	2.00	0.49	5.00	2.26	0.00	2.26
32.55	2.00	0.49	5.00	2.26	0.00	2.26
32.60	2.00	0.49	5.00	2.26	0.00	2.26
32.65	2.00	0.49	5.00	2.26	0.00	2.26
32.70	2.00	0.49	5.00	2.26	0.00	2.26
32.75	2.00	0.50	5.00	2.26	0.00	2.26
32.80	2.00	0.50	5.00	2.26	0.00	2.26
32.85	2.00	0.50	5.00	2.26	0.00	2.26
32.90	2.00	0.50	5.00	2.26	0.00	2.26
32.95	2.00	0.50	5.00	2.26	0.00	2.26
33.00	2.00	0.50	5.00	2.26	0.00	2.26
33.05	2.00	0.50	5.00	2.26	0.00	2.26
33.10	2.00	0.50	5.00	2.26	0.00	2.26
33.15	2.00	0.50	5.00	2.26	0.00	2.26
33.20	2.00	0.50	5.00	2.26	0.00	2.26
33.25	2.00	0.50	5.00	2.26	0.00	2.26
33.30	2.00	0.50	5.00	2.26	0.00	2.26
33.35	2.00	0.50	5.00	2.26	0.00	2.26
33.40	2.00	0.50	5.00	2.26	0.00	2.26
33.45	2.00	0.50	5.00	2.26	0.00	2.26
33.50	2.00	0.50	5.00	2.26	0.00	2.26
33.55	2.00	0.50	5.00	2.26	0.00	2.26

33.60	2.00	0.50	5.00	2.26	0.00	2.26
33.65	2.00	0.50	5.00	2.26	0.00	2.26
33.70	2.00	0.50	5.00	2.26	0.00	2.26
33.75	2.00	0.50	5.00	2.26	0.00	2.26
33.80	2.00	0.50	5.00	2.26	0.00	2.26
33.85	2.00	0.50	5.00	2.26	0.00	2.26
33.90	2.00	0.50	5.00	2.26	0.00	2.26
33.95	2.00	0.50	5.00	2.26	0.00	2.26
34.00	2.00	0.50	5.00	2.26	0.00	2.26
34.05	2.00	0.50	5.00	2.26	0.00	2.26
34.10	2.00	0.50	5.00	2.26	0.00	2.26
34.15	2.00	0.50	5.00	2.26	0.00	2.26
34.20	2.00	0.50	5.00	2.26	0.00	2.26
34.25	2.00	0.50	5.00	2.26	0.00	2.26
34.30	2.00	0.50	5.00	2.26	0.00	2.26
34.35	2.00	0.50	5.00	2.26	0.00	2.26
34.40	2.00	0.50	5.00	2.26	0.00	2.26
34.45	2.00	0.50	5.00	2.26	0.00	2.26
34.50	2.00	0.50	5.00	2.26	0.00	2.26
34.55	2.00	0.50	5.00	2.26	0.00	2.26
34.60	2.00	0.50	5.00	2.26	0.00	2.26
34.65	2.00	0.50	5.00	2.26	0.00	2.26
34.70	2.00	0.50	5.00	2.26	0.00	2.26
34.75	2.00	0.50	5.00	2.26	0.00	2.26
34.80	2.00	0.50	5.00	2.26	0.00	2.26
34.85	2.00	0.50	5.00	2.26	0.00	2.26
34.90	2.00	0.50	5.00	2.26	0.00	2.26
34.95	2.00	0.50	5.00	2.26	0.00	2.26
35.00	2.00	0.50	5.00	2.26	0.00	2.26
35.05	2.00	0.50	5.00	2.26	0.00	2.26
35.10	2.00	0.50	5.00	2.26	0.00	2.26
35.15	2.00	0.50	5.00	2.26	0.00	2.26
35.20	2.00	0.50	5.00	2.26	0.00	2.26
35.25	2.00	0.50	5.00	2.26	0.00	2.26
35.30	2.00	0.50	5.00	2.26	0.00	2.26
35.35	2.00	0.50	5.00	2.26	0.00	2.26
35.40	2.00	0.50	5.00	2.26	0.00	2.26
35.45	2.00	0.50	5.00	2.26	0.00	2.26
35.50	2.00	0.50	5.00	2.26	0.00	2.26
35.55	2.00	0.50	5.00	2.26	0.00	2.26
35.60	2.00	0.50	5.00	2.26	0.00	2.26
35.65	2.00	0.50	5.00	2.26	0.00	2.26
35.70	2.00	0.50	5.00	2.26	0.00	2.26
35.75	2.00	0.50	5.00	2.26	0.00	2.26
35.80	2.00	0.50	5.00	2.26	0.00	2.26
35.85	2.00	0.50	5.00	2.26	0.00	2.26
35.90	2.00	0.50	5.00	2.26	0.00	2.26
35.95	2.00	0.50	5.00	2.26	0.00	2.26
36.00	2.00	0.50	5.00	2.26	0.00	2.26
36.05	2.00	0.50	5.00	2.26	0.00	2.26
36.10	2.00	0.50	5.00	2.26	0.00	2.26
36.15	2.00	0.50	5.00	2.26	0.00	2.26
36.20	2.00	0.50	5.00	2.26	0.00	2.26
36.25	2.00	0.50	5.00	2.26	0.00	2.26

36.30	2.00	0.50	5.00	2.26	0.00	2.26
36.35	2.00	0.50	5.00	2.26	0.00	2.26
36.40	2.00	0.50	5.00	2.26	0.00	2.26
36.45	2.00	0.50	5.00	2.26	0.00	2.26
36.50	2.00	0.50	5.00	2.26	0.00	2.26
36.55	2.00	0.50	5.00	2.26	0.00	2.26
36.60	2.00	0.50	5.00	2.26	0.00	2.26
36.65	2.00	0.50	5.00	2.26	0.00	2.26
36.70	2.00	0.50	5.00	2.26	0.00	2.26
36.75	2.00	0.50	5.00	2.26	0.00	2.26
36.80	2.00	0.50	5.00	2.26	0.00	2.26
36.85	2.00	0.50	5.00	2.26	0.00	2.26
36.90	2.00	0.50	5.00	2.26	0.00	2.26
36.95	2.00	0.50	5.00	2.26	0.00	2.26
37.00	2.00	0.50	5.00	2.26	0.00	2.26
37.05	2.00	0.50	5.00	2.26	0.00	2.26
37.10	2.00	0.50	5.00	2.26	0.00	2.26
37.15	2.00	0.50	5.00	2.26	0.00	2.26
37.20	2.00	0.50	5.00	2.26	0.00	2.26
37.25	2.00	0.50	5.00	2.26	0.00	2.26
37.30	2.00	0.50	5.00	2.26	0.00	2.26
37.35	2.00	0.50	5.00	2.26	0.00	2.26
37.40	2.00	0.50	5.00	2.26	0.00	2.26
37.45	2.00	0.50	5.00	2.26	0.00	2.26
37.50	2.00	0.50	5.00	2.26	0.00	2.26
37.55	2.00	0.50	5.00	2.26	0.00	2.26
37.60	2.00	0.50	5.00	2.26	0.00	2.26
37.65	2.00	0.50	5.00	2.26	0.00	2.26
37.70	2.00	0.50	5.00	2.26	0.00	2.26
37.75	2.00	0.50	5.00	2.26	0.00	2.26
37.80	2.00	0.50	5.00	2.26	0.00	2.26
37.85	2.00	0.50	5.00	2.26	0.00	2.26
37.90	2.00	0.50	5.00	2.26	0.00	2.26
37.95	2.00	0.50	5.00	2.26	0.00	2.26
38.00	2.00	0.50	5.00	2.26	0.00	2.26
38.05	0.23	0.50	0.45*	2.26	0.00	2.26
38.10	0.23	0.50	0.46*	2.25	0.00	2.25
38.15	0.23	0.50	0.46*	2.23	0.00	2.23
38.20	0.23	0.50	0.46*	2.22	0.00	2.22
38.25	0.23	0.50	0.46*	2.21	0.00	2.21
38.30	0.23	0.50	0.46*	2.20	0.00	2.20
38.35	0.23	0.50	0.46*	2.19	0.00	2.19
38.40	0.23	0.50	0.46*	2.18	0.00	2.18
38.45	0.23	0.50	0.46*	2.16	0.00	2.16
38.50	0.23	0.50	0.46*	2.15	0.00	2.15
38.55	0.23	0.50	0.46*	2.14	0.00	2.14
38.60	0.23	0.50	0.46*	2.13	0.00	2.13
38.65	0.23	0.50	0.47*	2.12	0.00	2.12
38.70	0.23	0.50	0.47*	2.11	0.00	2.11
38.75	0.23	0.50	0.47*	2.10	0.00	2.10
38.80	0.23	0.50	0.47*	2.08	0.00	2.08
38.85	0.23	0.50	0.47*	2.07	0.00	2.07
38.90	0.24	0.50	0.47*	2.06	0.00	2.06
38.95	0.24	0.50	0.47*	2.05	0.00	2.05

39.00	0.24	0.50	0.47*	2.04	0.00	2.04
39.05	0.24	0.50	0.47*	2.03	0.00	2.03
39.10	0.24	0.50	0.47*	2.02	0.00	2.02
39.15	0.24	0.50	0.47*	2.00	0.00	2.00
39.20	0.24	0.50	0.48*	1.99	0.00	1.99
39.25	0.24	0.50	0.48*	1.98	0.00	1.98
39.30	0.24	0.50	0.48*	1.97	0.00	1.97
39.35	0.24	0.50	0.48*	1.96	0.00	1.96
39.40	0.24	0.50	0.48*	1.95	0.00	1.95
39.45	0.24	0.50	0.48*	1.94	0.00	1.94
39.50	0.24	0.50	0.48*	1.93	0.00	1.93
39.55	0.24	0.50	0.48*	1.91	0.00	1.91
39.60	0.24	0.50	0.48*	1.90	0.00	1.90
39.65	0.24	0.50	0.48*	1.89	0.00	1.89
39.70	0.24	0.50	0.48*	1.88	0.00	1.88
39.75	0.24	0.50	0.48*	1.87	0.00	1.87
39.80	0.24	0.50	0.48*	1.86	0.00	1.86
39.85	0.24	0.50	0.47*	1.85	0.00	1.85
39.90	0.24	0.50	0.47*	1.84	0.00	1.84
39.95	0.24	0.50	0.47*	1.82	0.00	1.82
40.00	0.23	0.50	0.47*	1.81	0.00	1.81
40.05	0.24	0.50	0.47*	1.80	0.00	1.80
40.10	0.24	0.50	0.47*	1.79	0.00	1.79
40.15	0.24	0.50	0.48*	1.78	0.00	1.78
40.20	0.24	0.50	0.48*	1.77	0.00	1.77
40.25	0.24	0.50	0.48*	1.76	0.00	1.76
40.30	0.24	0.50	0.49*	1.75	0.00	1.75
40.35	0.24	0.50	0.49*	1.73	0.00	1.73
40.40	0.25	0.50	0.49*	1.72	0.00	1.72
40.45	0.25	0.50	0.49*	1.71	0.00	1.71
40.50	0.25	0.50	0.50*	1.70	0.00	1.70
40.55	0.25	0.50	0.50*	1.69	0.00	1.69
40.60	0.25	0.50	0.50*	1.68	0.00	1.68
40.65	0.25	0.50	0.50*	1.67	0.00	1.67
40.70	0.25	0.50	0.51*	1.66	0.00	1.66
40.75	0.25	0.50	0.51*	1.65	0.00	1.65
40.80	0.26	0.50	0.51*	1.64	0.00	1.64
40.85	0.26	0.50	0.52*	1.63	0.00	1.63
40.90	0.26	0.50	0.52*	1.61	0.00	1.61
40.95	0.26	0.50	0.52*	1.60	0.00	1.60
41.00	0.26	0.50	0.52*	1.59	0.00	1.59
41.05	0.26	0.50	0.53*	1.58	0.00	1.58
41.10	0.26	0.50	0.53*	1.57	0.00	1.57
41.15	0.27	0.50	0.53*	1.56	0.00	1.56
41.20	0.27	0.50	0.53*	1.55	0.00	1.55
41.25	0.27	0.50	0.54*	1.54	0.00	1.54
41.30	0.27	0.50	0.54*	1.53	0.00	1.53
41.35	0.27	0.50	0.54*	1.52	0.00	1.52
41.40	0.27	0.50	0.54*	1.51	0.00	1.51
41.45	0.27	0.50	0.55*	1.50	0.00	1.50
41.50	0.27	0.50	0.55*	1.49	0.00	1.49
41.55	0.28	0.50	0.55*	1.48	0.00	1.48
41.60	0.28	0.50	0.55*	1.47	0.00	1.47
41.65	0.28	0.50	0.56*	1.46	0.00	1.46

41.70	0.28	0.50	0.56*	1.45	0.00	1.45
41.75	0.28	0.50	0.56*	1.44	0.00	1.44
41.80	0.28	0.50	0.57*	1.43	0.00	1.43
41.85	0.28	0.50	0.57*	1.42	0.00	1.42
41.90	0.28	0.50	0.57*	1.41	0.00	1.41
41.95	0.29	0.50	0.57*	1.40	0.00	1.40
42.00	0.29	0.50	0.58*	1.39	0.00	1.39
42.05	0.29	0.50	0.58*	1.38	0.00	1.38
42.10	0.29	0.50	0.58*	1.37	0.00	1.37
42.15	0.29	0.50	0.58*	1.36	0.00	1.36
42.20	0.29	0.50	0.59*	1.35	0.00	1.35
42.25	0.29	0.50	0.59*	1.34	0.00	1.34
42.30	0.29	0.50	0.59*	1.34	0.00	1.34
42.35	0.30	0.50	0.59*	1.33	0.00	1.33
42.40	0.30	0.50	0.60*	1.32	0.00	1.32
42.45	0.30	0.50	0.60*	1.31	0.00	1.31
42.50	0.30	0.50	0.60*	1.30	0.00	1.30
42.55	0.30	0.50	0.60*	1.29	0.00	1.29
42.60	0.30	0.50	0.61*	1.28	0.00	1.28
42.65	0.30	0.50	0.61*	1.27	0.00	1.27
42.70	0.30	0.50	0.61*	1.26	0.00	1.26
42.75	0.31	0.50	0.61*	1.25	0.00	1.25
42.80	0.31	0.50	0.62*	1.24	0.00	1.24
42.85	0.31	0.50	0.62*	1.23	0.00	1.23
42.90	0.31	0.50	0.62*	1.23	0.00	1.23
42.95	0.31	0.50	0.62*	1.22	0.00	1.22
43.00	0.31	0.50	0.63*	1.21	0.00	1.21
43.05	0.31	0.50	0.63*	1.20	0.00	1.20
43.10	0.31	0.50	0.63*	1.19	0.00	1.19
43.15	0.32	0.50	0.63*	1.18	0.00	1.18
43.20	0.32	0.50	0.64*	1.17	0.00	1.17
43.25	0.32	0.50	0.64*	1.16	0.00	1.16
43.30	0.32	0.50	0.64*	1.16	0.00	1.16
43.35	0.32	0.50	0.64*	1.15	0.00	1.15
43.40	0.32	0.50	0.65*	1.14	0.00	1.14
43.45	0.32	0.50	0.65*	1.13	0.00	1.13
43.50	0.32	0.50	0.65*	1.12	0.00	1.12
43.55	0.33	0.50	0.65*	1.11	0.00	1.11
43.60	0.33	0.50	0.66*	1.10	0.00	1.10
43.65	0.33	0.50	0.66*	1.10	0.00	1.10
43.70	0.33	0.50	0.66*	1.09	0.00	1.09
43.75	0.33	0.50	0.66*	1.08	0.00	1.08
43.80	0.33	0.50	0.67*	1.07	0.00	1.07
43.85	0.33	0.50	0.67*	1.06	0.00	1.06
43.90	0.33	0.50	0.67*	1.05	0.00	1.05
43.95	0.34	0.50	0.67*	1.04	0.00	1.04
44.00	0.34	0.50	0.68*	1.04	0.00	1.04
44.05	0.34	0.50	0.68*	1.03	0.00	1.03
44.10	0.34	0.50	0.68*	1.02	0.00	1.02
44.15	0.34	0.50	0.68*	1.01	0.00	1.01
44.20	0.34	0.50	0.69*	1.00	0.00	1.00
44.25	0.34	0.50	0.69*	1.00	0.00	1.00
44.30	0.34	0.50	0.69*	0.99	0.00	0.99
44.35	0.34	0.50	0.69*	0.98	0.00	0.98

44.40	0.35	0.50	0.70*	0.97	0.00	0.97
44.45	0.35	0.50	0.70*	0.96	0.00	0.96
44.50	0.35	0.50	0.70*	0.95	0.00	0.95
44.55	0.35	0.50	0.70*	0.95	0.00	0.95
44.60	0.35	0.50	0.71*	0.94	0.00	0.94
44.65	0.35	0.50	0.71*	0.93	0.00	0.93
44.70	0.35	0.50	0.71*	0.92	0.00	0.92
44.75	0.35	0.50	0.71*	0.92	0.00	0.92
44.80	0.36	0.50	0.72*	0.91	0.00	0.91
44.85	0.36	0.50	0.72*	0.90	0.00	0.90
44.90	0.36	0.50	0.72*	0.89	0.00	0.89
44.95	0.36	0.50	0.73*	0.88	0.00	0.88
45.00	0.36	0.50	0.73*	0.88	0.00	0.88
45.05	0.36	0.50	0.73*	0.87	0.00	0.87
45.10	0.37	0.50	0.74*	0.86	0.00	0.86
45.15	0.37	0.50	0.74*	0.85	0.00	0.85
45.20	0.37	0.50	0.75*	0.85	0.00	0.85
45.25	0.37	0.50	0.75*	0.84	0.00	0.84
45.30	0.37	0.50	0.75*	0.83	0.00	0.83
45.35	0.37	0.50	0.76*	0.82	0.00	0.82
45.40	0.38	0.50	0.76*	0.81	0.00	0.81
45.45	0.38	0.50	0.76*	0.81	0.00	0.81
45.50	0.38	0.49	0.76*	0.80	0.00	0.80
45.55	0.38	0.49	0.77*	0.79	0.00	0.79
45.60	0.38	0.49	0.77*	0.79	0.00	0.79
45.65	0.38	0.49	0.77*	0.78	0.00	0.78
45.70	0.38	0.49	0.77*	0.77	0.00	0.77
45.75	0.38	0.49	0.77*	0.76	0.00	0.76
45.80	0.38	0.49	0.78*	0.76	0.00	0.76
45.85	0.38	0.49	0.78*	0.75	0.00	0.75
45.90	0.39	0.49	0.78*	0.74	0.00	0.74
45.95	0.39	0.49	0.78*	0.73	0.00	0.73
46.00	0.38	0.49	0.78*	0.73	0.00	0.73
46.05	0.38	0.49	0.77*	0.72	0.00	0.72
46.10	0.38	0.49	0.77*	0.71	0.00	0.71
46.15	0.38	0.49	0.76*	0.70	0.00	0.70
46.20	0.37	0.49	0.76*	0.70	0.00	0.70
46.25	0.37	0.49	0.75*	0.69	0.00	0.69
46.30	0.37	0.49	0.75*	0.68	0.00	0.68
46.35	0.37	0.49	0.74*	0.67	0.00	0.67
46.40	0.36	0.49	0.74*	0.67	0.00	0.67
46.45	0.36	0.49	0.73*	0.66	0.00	0.66
46.50	0.36	0.49	0.73*	0.65	0.00	0.65
46.55	0.36	0.49	0.72*	0.64	0.00	0.64
46.60	0.35	0.49	0.72*	0.64	0.00	0.64
46.65	0.35	0.49	0.71*	0.63	0.00	0.63
46.70	0.35	0.49	0.71*	0.62	0.00	0.62
46.75	0.35	0.49	0.70*	0.61	0.00	0.61
46.80	0.34	0.49	0.70*	0.60	0.00	0.60
46.85	0.34	0.49	0.69*	0.60	0.00	0.60
46.90	0.34	0.49	0.69*	0.59	0.00	0.59
46.95	0.34	0.49	0.69*	0.58	0.00	0.58
47.00	0.34	0.49	0.68*	0.57	0.00	0.57
47.05	0.33	0.49	0.68*	0.56	0.00	0.56

47.10	0.33	0.49	0.67*	0.55	0.00	0.55
47.15	0.33	0.49	0.67*	0.55	0.00	0.55
47.20	0.33	0.49	0.67*	0.54	0.00	0.54
47.25	0.33	0.49	0.66*	0.53	0.00	0.53
47.30	0.32	0.49	0.66*	0.52	0.00	0.52
47.35	0.32	0.49	0.65*	0.51	0.00	0.51
47.40	0.32	0.49	0.65*	0.50	0.00	0.50
47.45	0.32	0.49	0.65*	0.50	0.00	0.50
47.50	0.32	0.49	0.64*	0.49	0.00	0.49
47.55	0.31	0.49	0.64*	0.48	0.00	0.48
47.60	0.31	0.49	0.63*	0.47	0.00	0.47
47.65	0.31	0.49	0.63*	0.46	0.00	0.46
47.70	0.31	0.49	0.63*	0.45	0.00	0.45
47.75	0.31	0.49	0.62*	0.44	0.00	0.44
47.80	0.30	0.49	0.62*	0.43	0.00	0.43
47.85	0.30	0.49	0.61*	0.43	0.00	0.43
47.90	0.30	0.49	0.61*	0.42	0.00	0.42
47.95	0.30	0.49	0.61*	0.41	0.00	0.41
48.00	0.30	0.49	0.60*	0.40	0.00	0.40
48.05	0.29	0.49	0.60*	0.39	0.00	0.39
48.10	0.29	0.49	0.60*	0.38	0.00	0.38
48.15	0.29	0.49	0.59*	0.37	0.00	0.37
48.20	0.29	0.49	0.59*	0.36	0.00	0.36
48.25	0.29	0.49	0.59*	0.35	0.00	0.35
48.30	0.28	0.49	0.58*	0.34	0.00	0.34
48.35	0.28	0.49	0.58*	0.33	0.00	0.33
48.40	0.28	0.49	0.57*	0.32	0.00	0.32
48.45	0.28	0.49	0.57*	0.31	0.00	0.31
48.50	0.28	0.49	0.57*	0.30	0.00	0.30
48.55	0.28	0.49	0.56*	0.29	0.00	0.29
48.60	0.27	0.49	0.56*	0.29	0.00	0.29
48.65	0.27	0.49	0.56*	0.28	0.00	0.28
48.70	0.27	0.49	0.55*	0.27	0.00	0.27
48.75	0.27	0.49	0.55*	0.26	0.00	0.26
48.80	0.27	0.49	0.55*	0.25	0.00	0.25
48.85	0.27	0.49	0.54*	0.24	0.00	0.24
48.90	0.26	0.49	0.54*	0.23	0.00	0.23
48.95	0.26	0.49	0.54*	0.22	0.00	0.22
49.00	0.26	0.49	0.53*	0.20	0.00	0.20
49.05	0.26	0.49	0.53*	0.19	0.00	0.19
49.10	0.26	0.49	0.53*	0.18	0.00	0.18
49.15	0.25	0.49	0.52*	0.17	0.00	0.17
49.20	0.25	0.49	0.52*	0.16	0.00	0.16
49.25	0.25	0.49	0.52*	0.15	0.00	0.15
49.30	0.25	0.49	0.51*	0.14	0.00	0.14
49.35	0.25	0.49	0.51*	0.13	0.00	0.13
49.40	0.25	0.49	0.50*	0.12	0.00	0.12
49.45	0.24	0.49	0.50*	0.11	0.00	0.11
49.50	0.24	0.49	0.50*	0.10	0.00	0.10
49.55	0.24	0.49	0.49*	0.09	0.00	0.09
49.60	0.24	0.49	0.49*	0.08	0.00	0.08
49.65	0.24	0.49	0.49*	0.07	0.00	0.07
49.70	0.24	0.49	0.48*	0.06	0.00	0.06
49.75	0.23	0.49	0.48*	0.04	0.00	0.04

49.80	0.23	0.49	0.48*	0.03	0.00	0.03
49.85	0.23	0.49	0.47*	0.02	0.00	0.02
49.90	0.23	0.49	0.47*	0.01	0.00	0.01
49.95	0.23	0.49	0.47*	0.00	0.00	0.00
50.00	0.23	0.49	0.46*	0.00	0.00	0.00
50.05	2.00	0.49	5.00	0.00	0.00	0.00
50.10	2.00	0.49	5.00	0.00	0.00	0.00
50.15	2.00	0.49	5.00	0.00	0.00	0.00
50.20	2.00	0.49	5.00	0.00	0.00	0.00
50.25	2.00	0.49	5.00	0.00	0.00	0.00
50.30	2.00	0.49	5.00	0.00	0.00	0.00
50.35	2.00	0.49	5.00	0.00	0.00	0.00
50.40	2.00	0.49	5.00	0.00	0.00	0.00
50.45	2.00	0.49	5.00	0.00	0.00	0.00
50.50	2.00	0.49	5.00	0.00	0.00	0.00
50.55	2.00	0.49	5.00	0.00	0.00	0.00
50.60	2.00	0.49	5.00	0.00	0.00	0.00
50.65	2.00	0.49	5.00	0.00	0.00	0.00
50.70	2.00	0.48	5.00	0.00	0.00	0.00
50.75	2.00	0.48	5.00	0.00	0.00	0.00
50.80	2.00	0.48	5.00	0.00	0.00	0.00
50.85	2.00	0.48	5.00	0.00	0.00	0.00
50.90	2.00	0.48	5.00	0.00	0.00	0.00
50.95	2.00	0.48	5.00	0.00	0.00	0.00
51.00	2.00	0.48	5.00	0.00	0.00	0.00
51.05	2.00	0.48	5.00	0.00	0.00	0.00
51.10	2.00	0.48	5.00	0.00	0.00	0.00
51.15	2.00	0.48	5.00	0.00	0.00	0.00
51.20	2.00	0.48	5.00	0.00	0.00	0.00
51.25	2.00	0.48	5.00	0.00	0.00	0.00
51.30	2.00	0.48	5.00	0.00	0.00	0.00
51.35	2.00	0.48	5.00	0.00	0.00	0.00
51.40	2.00	0.48	5.00	0.00	0.00	0.00
51.45	2.00	0.48	5.00	0.00	0.00	0.00
51.50	2.00	0.48	5.00	0.00	0.00	0.00
51.55	2.00	0.48	5.00	0.00	0.00	0.00
51.60	2.00	0.48	5.00	0.00	0.00	0.00
51.65	2.00	0.48	5.00	0.00	0.00	0.00
51.70	2.00	0.48	5.00	0.00	0.00	0.00
51.75	2.00	0.48	5.00	0.00	0.00	0.00
51.80	2.00	0.48	5.00	0.00	0.00	0.00
51.85	2.00	0.48	5.00	0.00	0.00	0.00
51.90	2.00	0.48	5.00	0.00	0.00	0.00
51.95	2.00	0.48	5.00	0.00	0.00	0.00
52.00	2.00	0.48	5.00	0.00	0.00	0.00
52.05	2.00	0.48	5.00	0.00	0.00	0.00
52.10	2.00	0.48	5.00	0.00	0.00	0.00
52.15	2.00	0.48	5.00	0.00	0.00	0.00
52.20	2.00	0.48	5.00	0.00	0.00	0.00
52.25	2.00	0.48	5.00	0.00	0.00	0.00
52.30	2.00	0.48	5.00	0.00	0.00	0.00
52.35	2.00	0.48	5.00	0.00	0.00	0.00
52.40	2.00	0.48	5.00	0.00	0.00	0.00
52.45	2.00	0.48	5.00	0.00	0.00	0.00

52.50	2.00	0.48	5.00	0.00	0.00	0.00
52.55	2.00	0.48	5.00	0.00	0.00	0.00
52.60	2.00	0.48	5.00	0.00	0.00	0.00
52.65	2.00	0.48	5.00	0.00	0.00	0.00
52.70	2.00	0.48	5.00	0.00	0.00	0.00
52.75	2.00	0.48	5.00	0.00	0.00	0.00
52.80	2.00	0.48	5.00	0.00	0.00	0.00
52.85	2.00	0.48	5.00	0.00	0.00	0.00
52.90	2.00	0.48	5.00	0.00	0.00	0.00
52.95	2.00	0.48	5.00	0.00	0.00	0.00
53.00	2.00	0.48	5.00	0.00	0.00	0.00
53.05	2.00	0.48	5.00	0.00	0.00	0.00
53.10	2.00	0.48	5.00	0.00	0.00	0.00
53.15	2.00	0.48	5.00	0.00	0.00	0.00
53.20	2.00	0.48	5.00	0.00	0.00	0.00
53.25	2.00	0.48	5.00	0.00	0.00	0.00
53.30	2.00	0.48	5.00	0.00	0.00	0.00
53.35	2.00	0.48	5.00	0.00	0.00	0.00
53.40	2.00	0.48	5.00	0.00	0.00	0.00
53.45	2.00	0.48	5.00	0.00	0.00	0.00
53.50	2.00	0.48	5.00	0.00	0.00	0.00
53.55	2.00	0.48	5.00	0.00	0.00	0.00
53.60	2.00	0.48	5.00	0.00	0.00	0.00
53.65	2.00	0.48	5.00	0.00	0.00	0.00
53.70	2.00	0.48	5.00	0.00	0.00	0.00
53.75	2.00	0.48	5.00	0.00	0.00	0.00
53.80	2.00	0.48	5.00	0.00	0.00	0.00
53.85	2.00	0.48	5.00	0.00	0.00	0.00
53.90	2.00	0.48	5.00	0.00	0.00	0.00
53.95	2.00	0.48	5.00	0.00	0.00	0.00
54.00	2.00	0.48	5.00	0.00	0.00	0.00
54.05	2.00	0.48	5.00	0.00	0.00	0.00
54.10	2.00	0.48	5.00	0.00	0.00	0.00
54.15	2.00	0.48	5.00	0.00	0.00	0.00
54.20	2.00	0.48	5.00	0.00	0.00	0.00
54.25	2.00	0.48	5.00	0.00	0.00	0.00
54.30	2.00	0.48	5.00	0.00	0.00	0.00
54.35	2.00	0.48	5.00	0.00	0.00	0.00
54.40	2.00	0.48	5.00	0.00	0.00	0.00
54.45	2.00	0.48	5.00	0.00	0.00	0.00
54.50	2.00	0.48	5.00	0.00	0.00	0.00
54.55	2.00	0.47	5.00	0.00	0.00	0.00
54.60	2.00	0.47	5.00	0.00	0.00	0.00
54.65	2.00	0.47	5.00	0.00	0.00	0.00
54.70	2.00	0.47	5.00	0.00	0.00	0.00
54.75	2.00	0.47	5.00	0.00	0.00	0.00
54.80	2.00	0.47	5.00	0.00	0.00	0.00
54.85	2.00	0.47	5.00	0.00	0.00	0.00
54.90	2.00	0.47	5.00	0.00	0.00	0.00
54.95	2.00	0.47	5.00	0.00	0.00	0.00
55.00	2.00	0.47	5.00	0.00	0.00	0.00
55.05	2.00	0.47	5.00	0.00	0.00	0.00
55.10	2.00	0.47	5.00	0.00	0.00	0.00
55.15	2.00	0.47	5.00	0.00	0.00	0.00

55.20	2.00	0.47	5.00	0.00	0.00	0.00
55.25	2.00	0.47	5.00	0.00	0.00	0.00
55.30	2.00	0.47	5.00	0.00	0.00	0.00
55.35	2.00	0.47	5.00	0.00	0.00	0.00
55.40	2.00	0.47	5.00	0.00	0.00	0.00
55.45	2.00	0.47	5.00	0.00	0.00	0.00
55.50	2.00	0.47	5.00	0.00	0.00	0.00
55.55	2.00	0.47	5.00	0.00	0.00	0.00
55.60	2.00	0.47	5.00	0.00	0.00	0.00
55.65	2.00	0.47	5.00	0.00	0.00	0.00
55.70	2.00	0.47	5.00	0.00	0.00	0.00
55.75	2.00	0.47	5.00	0.00	0.00	0.00
55.80	2.00	0.47	5.00	0.00	0.00	0.00
55.85	2.00	0.47	5.00	0.00	0.00	0.00
55.90	2.00	0.47	5.00	0.00	0.00	0.00
55.95	2.00	0.47	5.00	0.00	0.00	0.00
56.00	2.00	0.47	5.00	0.00	0.00	0.00
56.05	2.00	0.47	5.00	0.00	0.00	0.00
56.10	2.00	0.47	5.00	0.00	0.00	0.00
56.15	2.00	0.47	5.00	0.00	0.00	0.00
56.20	2.00	0.47	5.00	0.00	0.00	0.00
56.25	2.00	0.47	5.00	0.00	0.00	0.00
56.30	2.00	0.47	5.00	0.00	0.00	0.00
56.35	2.00	0.47	5.00	0.00	0.00	0.00
56.40	2.00	0.47	5.00	0.00	0.00	0.00
56.45	2.00	0.47	5.00	0.00	0.00	0.00
56.50	2.00	0.47	5.00	0.00	0.00	0.00
56.55	2.00	0.47	5.00	0.00	0.00	0.00
56.60	2.00	0.47	5.00	0.00	0.00	0.00
56.65	2.00	0.47	5.00	0.00	0.00	0.00
56.70	2.00	0.47	5.00	0.00	0.00	0.00
56.75	2.00	0.47	5.00	0.00	0.00	0.00
56.80	2.00	0.47	5.00	0.00	0.00	0.00
56.85	2.00	0.47	5.00	0.00	0.00	0.00
56.90	2.00	0.47	5.00	0.00	0.00	0.00
56.95	2.00	0.47	5.00	0.00	0.00	0.00
57.00	2.00	0.47	5.00	0.00	0.00	0.00
57.05	2.00	0.47	5.00	0.00	0.00	0.00
57.10	2.00	0.47	5.00	0.00	0.00	0.00
57.15	2.00	0.47	5.00	0.00	0.00	0.00
57.20	2.00	0.47	5.00	0.00	0.00	0.00
57.25	2.00	0.47	5.00	0.00	0.00	0.00
57.30	2.00	0.47	5.00	0.00	0.00	0.00
57.35	2.00	0.47	5.00	0.00	0.00	0.00
57.40	2.00	0.47	5.00	0.00	0.00	0.00
57.45	2.00	0.47	5.00	0.00	0.00	0.00
57.50	2.00	0.47	5.00	0.00	0.00	0.00
57.55	2.00	0.47	5.00	0.00	0.00	0.00
57.60	2.00	0.47	5.00	0.00	0.00	0.00
57.65	2.00	0.47	5.00	0.00	0.00	0.00
57.70	2.00	0.47	5.00	0.00	0.00	0.00
57.75	2.00	0.47	5.00	0.00	0.00	0.00
57.80	2.00	0.47	5.00	0.00	0.00	0.00
57.85	2.00	0.46	5.00	0.00	0.00	0.00

57.90	2.00	0.46	5.00	0.00	0.00	0.00
57.95	2.00	0.46	5.00	0.00	0.00	0.00
58.00	2.00	0.46	5.00	0.00	0.00	0.00
58.05	2.00	0.46	5.00	0.00	0.00	0.00
58.10	2.00	0.46	5.00	0.00	0.00	0.00
58.15	2.00	0.46	5.00	0.00	0.00	0.00
58.20	2.00	0.46	5.00	0.00	0.00	0.00
58.25	2.00	0.46	5.00	0.00	0.00	0.00
58.30	2.00	0.46	5.00	0.00	0.00	0.00
58.35	2.00	0.46	5.00	0.00	0.00	0.00
58.40	2.00	0.46	5.00	0.00	0.00	0.00
58.45	2.00	0.46	5.00	0.00	0.00	0.00
58.50	2.00	0.46	5.00	0.00	0.00	0.00
58.55	2.00	0.46	5.00	0.00	0.00	0.00
58.60	2.00	0.46	5.00	0.00	0.00	0.00
58.65	2.00	0.46	5.00	0.00	0.00	0.00
58.70	2.00	0.46	5.00	0.00	0.00	0.00
58.75	2.00	0.46	5.00	0.00	0.00	0.00
58.80	2.00	0.46	5.00	0.00	0.00	0.00
58.85	2.00	0.46	5.00	0.00	0.00	0.00
58.90	2.00	0.46	5.00	0.00	0.00	0.00
58.95	2.00	0.46	5.00	0.00	0.00	0.00
59.00	2.00	0.46	5.00	0.00	0.00	0.00
59.05	2.00	0.46	5.00	0.00	0.00	0.00
59.10	2.00	0.46	5.00	0.00	0.00	0.00
59.15	2.00	0.46	5.00	0.00	0.00	0.00
59.20	2.00	0.46	5.00	0.00	0.00	0.00
59.25	2.00	0.46	5.00	0.00	0.00	0.00
59.30	2.00	0.46	5.00	0.00	0.00	0.00
59.35	2.00	0.46	5.00	0.00	0.00	0.00
59.40	2.00	0.46	5.00	0.00	0.00	0.00
59.45	2.00	0.46	5.00	0.00	0.00	0.00
59.50	2.00	0.46	5.00	0.00	0.00	0.00
59.55	2.00	0.46	5.00	0.00	0.00	0.00
59.60	2.00	0.46	5.00	0.00	0.00	0.00
59.65	2.00	0.46	5.00	0.00	0.00	0.00
59.70	2.00	0.46	5.00	0.00	0.00	0.00
59.75	2.00	0.46	5.00	0.00	0.00	0.00
59.80	2.00	0.46	5.00	0.00	0.00	0.00
59.85	2.00	0.46	5.00	0.00	0.00	0.00
59.90	2.00	0.46	5.00	0.00	0.00	0.00
59.95	2.00	0.46	5.00	0.00	0.00	0.00
60.00	2.00	0.46	5.00	0.00	0.00	0.00
60.05	2.00	0.46	5.00	0.00	0.00	0.00
60.10	2.00	0.46	5.00	0.00	0.00	0.00
60.15	2.00	0.46	5.00	0.00	0.00	0.00
60.20	2.00	0.46	5.00	0.00	0.00	0.00
60.25	2.00	0.46	5.00	0.00	0.00	0.00
60.30	2.00	0.46	5.00	0.00	0.00	0.00
60.35	2.00	0.46	5.00	0.00	0.00	0.00
60.40	2.00	0.46	5.00	0.00	0.00	0.00
60.45	2.00	0.46	5.00	0.00	0.00	0.00
60.50	2.00	0.46	5.00	0.00	0.00	0.00
60.55	2.00	0.46	5.00	0.00	0.00	0.00

60.60	2.00	0.46	5.00	0.00	0.00	0.00
60.65	2.00	0.46	5.00	0.00	0.00	0.00
60.70	2.00	0.46	5.00	0.00	0.00	0.00
60.75	2.00	0.46	5.00	0.00	0.00	0.00
60.80	2.00	0.45	5.00	0.00	0.00	0.00
60.85	2.00	0.45	5.00	0.00	0.00	0.00
60.90	2.00	0.45	5.00	0.00	0.00	0.00
60.95	2.00	0.45	5.00	0.00	0.00	0.00
61.00	2.00	0.45	5.00	0.00	0.00	0.00
61.05	2.00	0.45	5.00	0.00	0.00	0.00
61.10	2.00	0.45	5.00	0.00	0.00	0.00
61.15	2.00	0.45	5.00	0.00	0.00	0.00
61.20	2.00	0.45	5.00	0.00	0.00	0.00
61.25	2.00	0.45	5.00	0.00	0.00	0.00
61.30	2.00	0.45	5.00	0.00	0.00	0.00
61.35	2.00	0.45	5.00	0.00	0.00	0.00
61.40	2.00	0.45	5.00	0.00	0.00	0.00
61.45	2.00	0.45	5.00	0.00	0.00	0.00
61.50	2.00	0.45	5.00	0.00	0.00	0.00
61.55	2.00	0.45	5.00	0.00	0.00	0.00
61.60	2.00	0.45	5.00	0.00	0.00	0.00
61.65	2.00	0.45	5.00	0.00	0.00	0.00
61.70	2.00	0.45	5.00	0.00	0.00	0.00
61.75	2.00	0.45	5.00	0.00	0.00	0.00
61.80	2.00	0.45	5.00	0.00	0.00	0.00
61.85	2.00	0.45	5.00	0.00	0.00	0.00
61.90	2.00	0.45	5.00	0.00	0.00	0.00
61.95	2.00	0.45	5.00	0.00	0.00	0.00
62.00	2.00	0.45	5.00	0.00	0.00	0.00
62.05	2.00	0.45	5.00	0.00	0.00	0.00
62.10	2.00	0.45	5.00	0.00	0.00	0.00
62.15	2.00	0.45	5.00	0.00	0.00	0.00
62.20	2.00	0.45	5.00	0.00	0.00	0.00
62.25	2.00	0.45	5.00	0.00	0.00	0.00
62.30	2.00	0.45	5.00	0.00	0.00	0.00
62.35	2.00	0.45	5.00	0.00	0.00	0.00
62.40	2.00	0.45	5.00	0.00	0.00	0.00
62.45	2.00	0.45	5.00	0.00	0.00	0.00
62.50	2.00	0.45	5.00	0.00	0.00	0.00
62.55	2.00	0.45	5.00	0.00	0.00	0.00
62.60	2.00	0.45	5.00	0.00	0.00	0.00
62.65	2.00	0.45	5.00	0.00	0.00	0.00
62.70	2.00	0.45	5.00	0.00	0.00	0.00
62.75	2.00	0.45	5.00	0.00	0.00	0.00
62.80	2.00	0.45	5.00	0.00	0.00	0.00
62.85	2.00	0.45	5.00	0.00	0.00	0.00
62.90	2.00	0.45	5.00	0.00	0.00	0.00
62.95	2.00	0.45	5.00	0.00	0.00	0.00
63.00	2.00	0.45	5.00	0.00	0.00	0.00
63.05	2.00	0.45	5.00	0.00	0.00	0.00
63.10	2.00	0.45	5.00	0.00	0.00	0.00
63.15	2.00	0.45	5.00	0.00	0.00	0.00
63.20	2.00	0.45	5.00	0.00	0.00	0.00
63.25	2.00	0.45	5.00	0.00	0.00	0.00

63.30	2.00	0.45	5.00	0.00	0.00	0.00
63.35	2.00	0.45	5.00	0.00	0.00	0.00
63.40	2.00	0.45	5.00	0.00	0.00	0.00
63.45	2.00	0.44	5.00	0.00	0.00	0.00
63.50	2.00	0.44	5.00	0.00	0.00	0.00
63.55	2.00	0.44	5.00	0.00	0.00	0.00
63.60	2.00	0.44	5.00	0.00	0.00	0.00
63.65	2.00	0.44	5.00	0.00	0.00	0.00
63.70	2.00	0.44	5.00	0.00	0.00	0.00
63.75	2.00	0.44	5.00	0.00	0.00	0.00
63.80	2.00	0.44	5.00	0.00	0.00	0.00
63.85	2.00	0.44	5.00	0.00	0.00	0.00
63.90	2.00	0.44	5.00	0.00	0.00	0.00
63.95	2.00	0.44	5.00	0.00	0.00	0.00
64.00	2.00	0.44	5.00	0.00	0.00	0.00
64.05	2.00	0.44	5.00	0.00	0.00	0.00
64.10	2.00	0.44	5.00	0.00	0.00	0.00
64.15	2.00	0.44	5.00	0.00	0.00	0.00
64.20	2.00	0.44	5.00	0.00	0.00	0.00
64.25	2.00	0.44	5.00	0.00	0.00	0.00
64.30	2.00	0.44	5.00	0.00	0.00	0.00
64.35	2.00	0.44	5.00	0.00	0.00	0.00
64.40	2.00	0.44	5.00	0.00	0.00	0.00
64.45	2.00	0.44	5.00	0.00	0.00	0.00
64.50	2.00	0.44	5.00	0.00	0.00	0.00
64.55	2.00	0.44	5.00	0.00	0.00	0.00
64.60	2.00	0.44	5.00	0.00	0.00	0.00
64.65	2.00	0.44	5.00	0.00	0.00	0.00
64.70	2.00	0.44	5.00	0.00	0.00	0.00
64.75	2.00	0.44	5.00	0.00	0.00	0.00
64.80	2.00	0.44	5.00	0.00	0.00	0.00
64.85	2.00	0.44	5.00	0.00	0.00	0.00
64.90	2.00	0.44	5.00	0.00	0.00	0.00
64.95	2.00	0.44	5.00	0.00	0.00	0.00
65.00	2.00	0.44	5.00	0.00	0.00	0.00
65.05	2.00	0.44	5.00	0.00	0.00	0.00
65.10	2.00	0.44	5.00	0.00	0.00	0.00
65.15	2.00	0.44	5.00	0.00	0.00	0.00
65.20	2.00	0.44	5.00	0.00	0.00	0.00
65.25	2.00	0.44	5.00	0.00	0.00	0.00
65.30	2.00	0.44	5.00	0.00	0.00	0.00
65.35	2.00	0.44	5.00	0.00	0.00	0.00
65.40	2.00	0.44	5.00	0.00	0.00	0.00
65.45	2.00	0.44	5.00	0.00	0.00	0.00
65.50	2.00	0.44	5.00	0.00	0.00	0.00
65.55	2.00	0.44	5.00	0.00	0.00	0.00
65.60	2.00	0.44	5.00	0.00	0.00	0.00
65.65	2.00	0.44	5.00	0.00	0.00	0.00
65.70	2.00	0.44	5.00	0.00	0.00	0.00
65.75	2.00	0.44	5.00	0.00	0.00	0.00
65.80	2.00	0.44	5.00	0.00	0.00	0.00
65.85	2.00	0.44	5.00	0.00	0.00	0.00
65.90	2.00	0.43	5.00	0.00	0.00	0.00
65.95	2.00	0.43	5.00	0.00	0.00	0.00

66.00	2.00	0.43	5.00	0.00	0.00	0.00
66.05	2.00	0.43	5.00	0.00	0.00	0.00
66.10	2.00	0.43	5.00	0.00	0.00	0.00
66.15	2.00	0.43	5.00	0.00	0.00	0.00
66.20	2.00	0.43	5.00	0.00	0.00	0.00
66.25	2.00	0.43	5.00	0.00	0.00	0.00
66.30	2.00	0.43	5.00	0.00	0.00	0.00
66.35	2.00	0.43	5.00	0.00	0.00	0.00
66.40	2.00	0.43	5.00	0.00	0.00	0.00
66.45	2.00	0.43	5.00	0.00	0.00	0.00
66.50	2.00	0.43	5.00	0.00	0.00	0.00
66.55	2.00	0.43	5.00	0.00	0.00	0.00
66.60	2.00	0.43	5.00	0.00	0.00	0.00
66.65	2.00	0.43	5.00	0.00	0.00	0.00
66.70	2.00	0.43	5.00	0.00	0.00	0.00
66.75	2.00	0.43	5.00	0.00	0.00	0.00
66.80	2.00	0.43	5.00	0.00	0.00	0.00
66.85	2.00	0.43	5.00	0.00	0.00	0.00
66.90	2.00	0.43	5.00	0.00	0.00	0.00
66.95	2.00	0.43	5.00	0.00	0.00	0.00
67.00	2.00	0.43	5.00	0.00	0.00	0.00
67.05	2.00	0.43	5.00	0.00	0.00	0.00
67.10	2.00	0.43	5.00	0.00	0.00	0.00
67.15	2.00	0.43	5.00	0.00	0.00	0.00
67.20	2.00	0.43	5.00	0.00	0.00	0.00
67.25	2.00	0.43	5.00	0.00	0.00	0.00
67.30	2.00	0.43	5.00	0.00	0.00	0.00
67.35	2.00	0.43	5.00	0.00	0.00	0.00
67.40	2.00	0.43	5.00	0.00	0.00	0.00
67.45	2.00	0.43	5.00	0.00	0.00	0.00
67.50	2.00	0.43	5.00	0.00	0.00	0.00
67.55	2.00	0.43	5.00	0.00	0.00	0.00
67.60	2.00	0.43	5.00	0.00	0.00	0.00
67.65	2.00	0.43	5.00	0.00	0.00	0.00
67.70	2.00	0.43	5.00	0.00	0.00	0.00
67.75	2.00	0.43	5.00	0.00	0.00	0.00
67.80	2.00	0.43	5.00	0.00	0.00	0.00
67.85	2.00	0.43	5.00	0.00	0.00	0.00
67.90	2.00	0.43	5.00	0.00	0.00	0.00
67.95	2.00	0.43	5.00	0.00	0.00	0.00
68.00	2.00	0.43	5.00	0.00	0.00	0.00
68.05	2.00	0.43	5.00	0.00	0.00	0.00
68.10	2.00	0.43	5.00	0.00	0.00	0.00
68.15	2.00	0.43	5.00	0.00	0.00	0.00
68.20	2.00	0.43	5.00	0.00	0.00	0.00
68.25	2.00	0.42	5.00	0.00	0.00	0.00
68.30	2.00	0.42	5.00	0.00	0.00	0.00
68.35	2.00	0.42	5.00	0.00	0.00	0.00
68.40	2.00	0.42	5.00	0.00	0.00	0.00
68.45	2.00	0.42	5.00	0.00	0.00	0.00
68.50	2.00	0.42	5.00	0.00	0.00	0.00
68.55	2.00	0.42	5.00	0.00	0.00	0.00
68.60	2.00	0.42	5.00	0.00	0.00	0.00
68.65	2.00	0.42	5.00	0.00	0.00	0.00

68.70	2.00	0.42	5.00	0.00	0.00	0.00
68.75	2.00	0.42	5.00	0.00	0.00	0.00
68.80	2.00	0.42	5.00	0.00	0.00	0.00
68.85	2.00	0.42	5.00	0.00	0.00	0.00
68.90	2.00	0.42	5.00	0.00	0.00	0.00
68.95	2.00	0.42	5.00	0.00	0.00	0.00
69.00	2.00	0.42	5.00	0.00	0.00	0.00
69.05	2.00	0.42	5.00	0.00	0.00	0.00
69.10	2.00	0.42	5.00	0.00	0.00	0.00
69.15	2.00	0.42	5.00	0.00	0.00	0.00
69.20	2.00	0.42	5.00	0.00	0.00	0.00
69.25	2.00	0.42	5.00	0.00	0.00	0.00
69.30	2.00	0.42	5.00	0.00	0.00	0.00
69.35	2.00	0.42	5.00	0.00	0.00	0.00
69.40	2.00	0.42	5.00	0.00	0.00	0.00
69.45	2.00	0.42	5.00	0.00	0.00	0.00
69.50	2.00	0.42	5.00	0.00	0.00	0.00
69.55	2.00	0.42	5.00	0.00	0.00	0.00
69.60	2.00	0.42	5.00	0.00	0.00	0.00
69.65	2.00	0.42	5.00	0.00	0.00	0.00
69.70	2.00	0.42	5.00	0.00	0.00	0.00
69.75	2.00	0.42	5.00	0.00	0.00	0.00
69.80	2.00	0.42	5.00	0.00	0.00	0.00
69.85	2.00	0.42	5.00	0.00	0.00	0.00
69.90	2.00	0.42	5.00	0.00	0.00	0.00
69.95	2.00	0.42	5.00	0.00	0.00	0.00
70.00	2.00	0.42	5.00	0.00	0.00	0.00
70.05	2.00	0.42	5.00	0.00	0.00	0.00
70.10	2.00	0.42	5.00	0.00	0.00	0.00
70.15	2.00	0.42	5.00	0.00	0.00	0.00
70.20	2.00	0.42	5.00	0.00	0.00	0.00
70.25	2.00	0.42	5.00	0.00	0.00	0.00
70.30	2.00	0.42	5.00	0.00	0.00	0.00
70.35	2.00	0.42	5.00	0.00	0.00	0.00
70.40	2.00	0.42	5.00	0.00	0.00	0.00
70.45	2.00	0.41	5.00	0.00	0.00	0.00
70.50	2.00	0.41	5.00	0.00	0.00	0.00
70.55	2.00	0.41	5.00	0.00	0.00	0.00
70.60	2.00	0.41	5.00	0.00	0.00	0.00
70.65	2.00	0.41	5.00	0.00	0.00	0.00
70.70	2.00	0.41	5.00	0.00	0.00	0.00
70.75	2.00	0.41	5.00	0.00	0.00	0.00
70.80	2.00	0.41	5.00	0.00	0.00	0.00
70.85	2.00	0.41	5.00	0.00	0.00	0.00
70.90	2.00	0.41	5.00	0.00	0.00	0.00
70.95	2.00	0.41	5.00	0.00	0.00	0.00
71.00	2.00	0.41	5.00	0.00	0.00	0.00
71.05	2.00	0.41	5.00	0.00	0.00	0.00
71.10	2.00	0.41	5.00	0.00	0.00	0.00
71.15	2.00	0.41	5.00	0.00	0.00	0.00
71.20	2.00	0.41	5.00	0.00	0.00	0.00
71.25	2.00	0.41	5.00	0.00	0.00	0.00
71.30	2.00	0.41	5.00	0.00	0.00	0.00
71.35	2.00	0.41	5.00	0.00	0.00	0.00

71.40	2.00	0.41	5.00	0.00	0.00	0.00
71.45	2.00	0.41	5.00	0.00	0.00	0.00
71.50	2.00	0.41	5.00	0.00	0.00	0.00
71.55	2.00	0.41	5.00	0.00	0.00	0.00
71.60	2.00	0.41	5.00	0.00	0.00	0.00
71.65	2.00	0.41	5.00	0.00	0.00	0.00
71.70	2.00	0.41	5.00	0.00	0.00	0.00
71.75	2.00	0.41	5.00	0.00	0.00	0.00
71.80	2.00	0.41	5.00	0.00	0.00	0.00
71.85	2.00	0.41	5.00	0.00	0.00	0.00
71.90	2.00	0.41	5.00	0.00	0.00	0.00
71.95	2.00	0.41	5.00	0.00	0.00	0.00
72.00	2.00	0.41	5.00	0.00	0.00	0.00
72.05	2.00	0.41	5.00	0.00	0.00	0.00
72.10	2.00	0.41	5.00	0.00	0.00	0.00
72.15	2.00	0.41	5.00	0.00	0.00	0.00
72.20	2.00	0.41	5.00	0.00	0.00	0.00
72.25	2.00	0.41	5.00	0.00	0.00	0.00
72.30	2.00	0.41	5.00	0.00	0.00	0.00
72.35	2.00	0.41	5.00	0.00	0.00	0.00
72.40	2.00	0.41	5.00	0.00	0.00	0.00
72.45	2.00	0.41	5.00	0.00	0.00	0.00
72.50	2.00	0.41	5.00	0.00	0.00	0.00
72.55	2.00	0.41	5.00	0.00	0.00	0.00
72.60	2.00	0.41	5.00	0.00	0.00	0.00
72.65	2.00	0.40	5.00	0.00	0.00	0.00
72.70	2.00	0.40	5.00	0.00	0.00	0.00
72.75	2.00	0.40	5.00	0.00	0.00	0.00
72.80	2.00	0.40	5.00	0.00	0.00	0.00
72.85	2.00	0.40	5.00	0.00	0.00	0.00
72.90	2.00	0.40	5.00	0.00	0.00	0.00
72.95	2.00	0.40	5.00	0.00	0.00	0.00
73.00	2.00	0.40	5.00	0.00	0.00	0.00
73.05	2.00	0.40	5.00	0.00	0.00	0.00
73.10	2.00	0.40	5.00	0.00	0.00	0.00
73.15	2.00	0.40	5.00	0.00	0.00	0.00
73.20	2.00	0.40	5.00	0.00	0.00	0.00
73.25	2.00	0.40	5.00	0.00	0.00	0.00
73.30	2.00	0.40	5.00	0.00	0.00	0.00
73.35	2.00	0.40	5.00	0.00	0.00	0.00
73.40	2.00	0.40	5.00	0.00	0.00	0.00
73.45	2.00	0.40	5.00	0.00	0.00	0.00
73.50	2.00	0.40	5.00	0.00	0.00	0.00
73.55	2.00	0.40	5.00	0.00	0.00	0.00
73.60	2.00	0.40	5.00	0.00	0.00	0.00
73.65	2.00	0.40	5.00	0.00	0.00	0.00
73.70	2.00	0.40	5.00	0.00	0.00	0.00
73.75	2.00	0.40	5.00	0.00	0.00	0.00
73.80	2.00	0.40	5.00	0.00	0.00	0.00
73.85	2.00	0.40	5.00	0.00	0.00	0.00
73.90	2.00	0.40	5.00	0.00	0.00	0.00
73.95	2.00	0.40	5.00	0.00	0.00	0.00
74.00	2.00	0.40	5.00	0.00	0.00	0.00
74.05	2.00	0.40	5.00	0.00	0.00	0.00

74.10	2.00	0.40	5.00	0.00	0.00	0.00
74.15	2.00	0.40	5.00	0.00	0.00	0.00
74.20	2.00	0.40	5.00	0.00	0.00	0.00
74.25	2.00	0.40	5.00	0.00	0.00	0.00
74.30	2.00	0.40	5.00	0.00	0.00	0.00
74.35	2.00	0.40	5.00	0.00	0.00	0.00
74.40	2.00	0.40	5.00	0.00	0.00	0.00
74.45	2.00	0.40	5.00	0.00	0.00	0.00
74.50	2.00	0.40	5.00	0.00	0.00	0.00
74.55	2.00	0.40	5.00	0.00	0.00	0.00
74.60	2.00	0.40	5.00	0.00	0.00	0.00
74.65	2.00	0.40	5.00	0.00	0.00	0.00
74.70	2.00	0.40	5.00	0.00	0.00	0.00
74.75	2.00	0.40	5.00	0.00	0.00	0.00
74.80	2.00	0.39	5.00	0.00	0.00	0.00
74.85	2.00	0.39	5.00	0.00	0.00	0.00
74.90	2.00	0.39	5.00	0.00	0.00	0.00
74.95	2.00	0.39	5.00	0.00	0.00	0.00
75.00	2.00	0.39	5.00	0.00	0.00	0.00
75.05	2.00	0.39	5.00	0.00	0.00	0.00
75.10	2.00	0.39	5.00	0.00	0.00	0.00
75.15	2.00	0.39	5.00	0.00	0.00	0.00
75.20	2.00	0.39	5.00	0.00	0.00	0.00
75.25	2.00	0.39	5.00	0.00	0.00	0.00
75.30	2.00	0.39	5.00	0.00	0.00	0.00
75.35	2.00	0.39	5.00	0.00	0.00	0.00
75.40	2.00	0.39	5.00	0.00	0.00	0.00
75.45	2.00	0.39	5.00	0.00	0.00	0.00
75.50	2.00	0.39	5.00	0.00	0.00	0.00
75.55	2.00	0.39	5.00	0.00	0.00	0.00
75.60	2.00	0.39	5.00	0.00	0.00	0.00
75.65	2.00	0.39	5.00	0.00	0.00	0.00
75.70	2.00	0.39	5.00	0.00	0.00	0.00
75.75	2.00	0.39	5.00	0.00	0.00	0.00
75.80	2.00	0.39	5.00	0.00	0.00	0.00
75.85	2.00	0.39	5.00	0.00	0.00	0.00
75.90	2.00	0.39	5.00	0.00	0.00	0.00
75.95	2.00	0.39	5.00	0.00	0.00	0.00
76.00	2.00	0.39	5.00	0.00	0.00	0.00
76.05	2.00	0.39	5.00	0.00	0.00	0.00
76.10	2.00	0.39	5.00	0.00	0.00	0.00
76.15	2.00	0.39	5.00	0.00	0.00	0.00
76.20	2.00	0.39	5.00	0.00	0.00	0.00
76.25	2.00	0.39	5.00	0.00	0.00	0.00
76.30	2.00	0.39	5.00	0.00	0.00	0.00
76.35	2.00	0.39	5.00	0.00	0.00	0.00
76.40	2.00	0.39	5.00	0.00	0.00	0.00
76.45	2.00	0.39	5.00	0.00	0.00	0.00
76.50	2.00	0.39	5.00	0.00	0.00	0.00
76.55	2.00	0.39	5.00	0.00	0.00	0.00
76.60	2.00	0.39	5.00	0.00	0.00	0.00
76.65	2.00	0.39	5.00	0.00	0.00	0.00
76.70	2.00	0.39	5.00	0.00	0.00	0.00
76.75	2.00	0.39	5.00	0.00	0.00	0.00

76.80	2.00	0.39	5.00	0.00	0.00	0.00
76.85	2.00	0.39	5.00	0.00	0.00	0.00
76.90	2.00	0.39	5.00	0.00	0.00	0.00
76.95	2.00	0.39	5.00	0.00	0.00	0.00
77.00	2.00	0.39	5.00	0.00	0.00	0.00
77.05	2.00	0.39	5.00	0.00	0.00	0.00
77.10	2.00	0.39	5.00	0.00	0.00	0.00
77.15	2.00	0.39	5.00	0.00	0.00	0.00
77.20	2.00	0.39	5.00	0.00	0.00	0.00
77.25	2.00	0.39	5.00	0.00	0.00	0.00
77.30	2.00	0.39	5.00	0.00	0.00	0.00
77.35	2.00	0.39	5.00	0.00	0.00	0.00
77.40	2.00	0.39	5.00	0.00	0.00	0.00
77.45	2.00	0.39	5.00	0.00	0.00	0.00
77.50	2.00	0.39	5.00	0.00	0.00	0.00
77.55	2.00	0.39	5.00	0.00	0.00	0.00
77.60	2.00	0.39	5.00	0.00	0.00	0.00
77.65	2.00	0.39	5.00	0.00	0.00	0.00
77.70	2.00	0.39	5.00	0.00	0.00	0.00
77.75	2.00	0.39	5.00	0.00	0.00	0.00
77.80	2.00	0.39	5.00	0.00	0.00	0.00
77.85	2.00	0.39	5.00	0.00	0.00	0.00
77.90	2.00	0.39	5.00	0.00	0.00	0.00
77.95	2.00	0.39	5.00	0.00	0.00	0.00
78.00	2.00	0.39	5.00	0.00	0.00	0.00
78.05	2.00	0.39	5.00	0.00	0.00	0.00
78.10	2.00	0.39	5.00	0.00	0.00	0.00
78.15	2.00	0.39	5.00	0.00	0.00	0.00
78.20	2.00	0.39	5.00	0.00	0.00	0.00
78.25	2.00	0.39	5.00	0.00	0.00	0.00
78.30	2.00	0.39	5.00	0.00	0.00	0.00
78.35	2.00	0.39	5.00	0.00	0.00	0.00
78.40	2.00	0.39	5.00	0.00	0.00	0.00
78.45	2.00	0.39	5.00	0.00	0.00	0.00
78.50	2.00	0.39	5.00	0.00	0.00	0.00
78.55	2.00	0.39	5.00	0.00	0.00	0.00
78.60	2.00	0.39	5.00	0.00	0.00	0.00
78.65	2.00	0.39	5.00	0.00	0.00	0.00
78.70	2.00	0.39	5.00	0.00	0.00	0.00
78.75	2.00	0.39	5.00	0.00	0.00	0.00
78.80	2.00	0.39	5.00	0.00	0.00	0.00
78.85	2.00	0.39	5.00	0.00	0.00	0.00
78.90	2.00	0.39	5.00	0.00	0.00	0.00
78.95	2.00	0.39	5.00	0.00	0.00	0.00
79.00	2.00	0.39	5.00	0.00	0.00	0.00
79.05	2.00	0.39	5.00	0.00	0.00	0.00
79.10	2.00	0.39	5.00	0.00	0.00	0.00
79.15	2.00	0.39	5.00	0.00	0.00	0.00
79.20	2.00	0.39	5.00	0.00	0.00	0.00
79.25	2.00	0.39	5.00	0.00	0.00	0.00
79.30	2.00	0.39	5.00	0.00	0.00	0.00
79.35	2.00	0.39	5.00	0.00	0.00	0.00
79.40	2.00	0.39	5.00	0.00	0.00	0.00
79.45	2.00	0.39	5.00	0.00	0.00	0.00

79.50	2.00	0.39	5.00	0.00	0.00	0.00
79.55	2.00	0.39	5.00	0.00	0.00	0.00
79.60	2.00	0.39	5.00	0.00	0.00	0.00
79.65	2.00	0.39	5.00	0.00	0.00	0.00
79.70	2.00	0.39	5.00	0.00	0.00	0.00
79.75	2.00	0.39	5.00	0.00	0.00	0.00
79.80	2.00	0.39	5.00	0.00	0.00	0.00
79.85	2.00	0.39	5.00	0.00	0.00	0.00
79.90	2.00	0.39	5.00	0.00	0.00	0.00
79.95	2.00	0.39	5.00	0.00	0.00	0.00
80.00	2.00	0.39	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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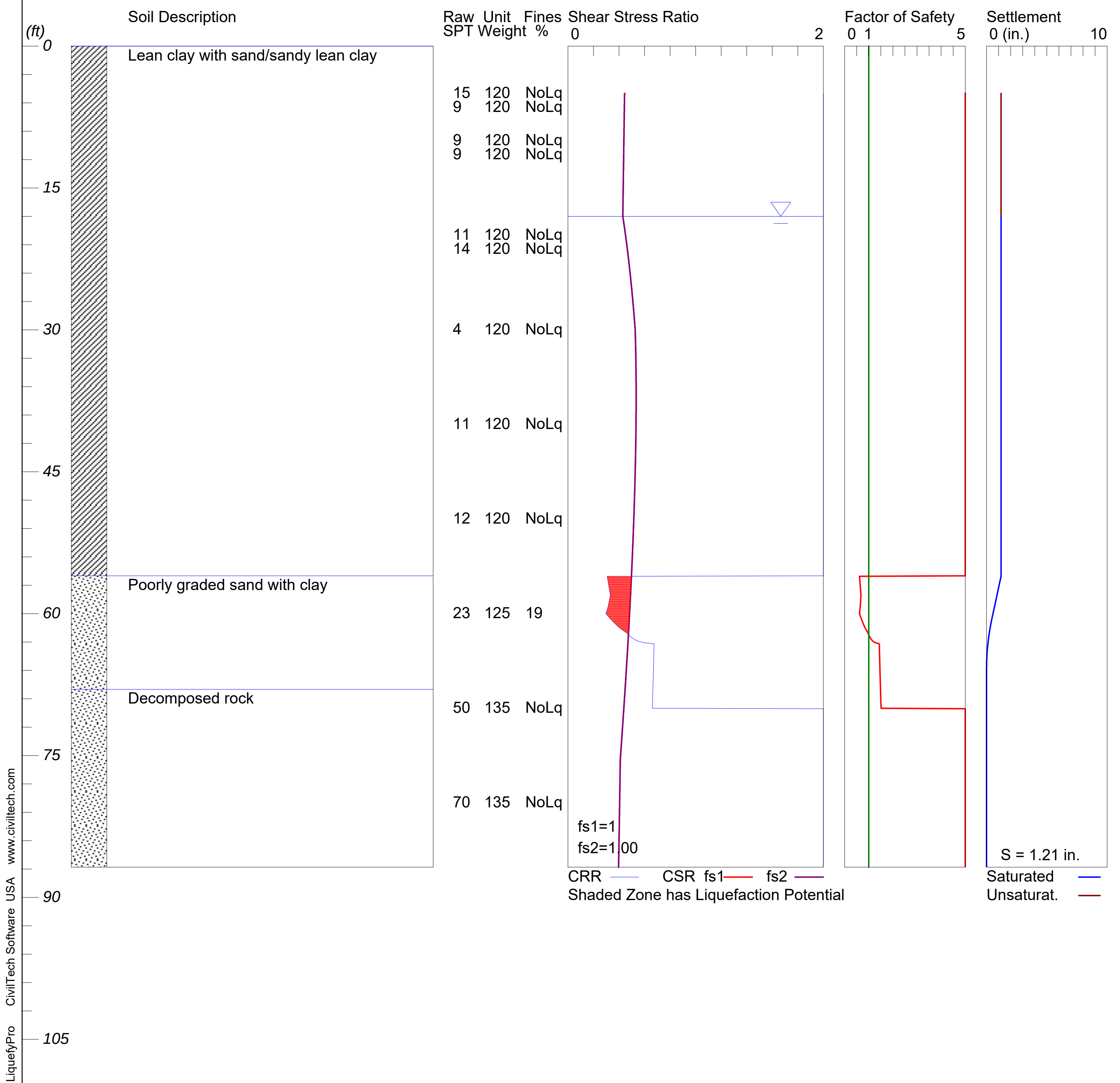
1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

LIQUEFACTION ANALYSIS
Las Trampas Creek Bridge

Hole No.=R-17-003   Water Depth=18 ft   Surface Elev.=149.6

Magnitude=6.5
Acceleration=0.69g



CivilTech Corporation

Replacement Project

Plate A-1

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: C:\Users\amanda_kahn\Desktop\R_17_003_ABK_092017.liq
Title: Las Trampas Creek Bridge
Subtitle: Replacement Project

Surface Elev.=149.6
Hole No.=R-17-003
Depth of Hole= 86.80 ft
Water Table during Earthquake= 18.00 ft
Water Table during In-Situ Testing= 18.00 ft
Max. Acceleration= 0.69 g
Earthquake Magnitude= 6.50

Input Data:
Surface Elev.=149.6
Hole No.=R-17-003
Depth of Hole=86.80 ft
Water Table during Earthquake= 18.00 ft
Water Table during In-Situ Testing= 18.00 ft
Max. Acceleration=0.69 g
Earthquake Magnitude=6.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio,   Ce = 1
7. Borehole Diameter,   Cb= 1
8. Sampling Method,   Cs= 1
9. User request factor of safety (apply to CSR) ,   User= 1
   Plot two CSR (fs1=1, fs2=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
5.00	15.00	120.00	NoLiq
6.50	9.00	120.00	NoLiq
10.00	9.00	120.00	NoLiq
11.50	9.00	120.00	NoLiq
20.00	11.00	120.00	NoLiq
21.50	14.00	120.00	NoLiq
30.00	4.00	120.00	NoLiq
40.00	11.00	120.00	NoLiq
50.00	12.00	120.00	NoLiq
60.00	23.00	125.00	19.00
70.00	50.00	135.00	NoLiq
80.00	70.00	135.00	NoLiq

Output Results:
Settlement of Saturated Sands=1.21 in.
Settlement of Unsaturated Sands=0.00 in.
Total Settlement of Saturated and Unsaturated Sands=1.21 in.
Differential Settlement=0.603 to 0.796 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
5.00	2.00	0.44	5.00	1.21	0.00	1.21
5.05	2.00	0.44	5.00	1.21	0.00	1.21
5.10	2.00	0.44	5.00	1.21	0.00	1.21
5.15	2.00	0.44	5.00	1.21	0.00	1.21
5.20	2.00	0.44	5.00	1.21	0.00	1.21
5.25	2.00	0.44	5.00	1.21	0.00	1.21
5.30	2.00	0.44	5.00	1.21	0.00	1.21
5.35	2.00	0.44	5.00	1.21	0.00	1.21
5.40	2.00	0.44	5.00	1.21	0.00	1.21
5.45	2.00	0.44	5.00	1.21	0.00	1.21
5.50	2.00	0.44	5.00	1.21	0.00	1.21
5.55	2.00	0.44	5.00	1.21	0.00	1.21
5.60	2.00	0.44	5.00	1.21	0.00	1.21
5.65	2.00	0.44	5.00	1.21	0.00	1.21
5.70	2.00	0.44	5.00	1.21	0.00	1.21
5.75	2.00	0.44	5.00	1.21	0.00	1.21
5.80	2.00	0.44	5.00	1.21	0.00	1.21
5.85	2.00	0.44	5.00	1.21	0.00	1.21
5.90	2.00	0.44	5.00	1.21	0.00	1.21
5.95	2.00	0.44	5.00	1.21	0.00	1.21
6.00	2.00	0.44	5.00	1.21	0.00	1.21
6.05	2.00	0.44	5.00	1.21	0.00	1.21
6.10	2.00	0.44	5.00	1.21	0.00	1.21
6.15	2.00	0.44	5.00	1.21	0.00	1.21
6.20	2.00	0.44	5.00	1.21	0.00	1.21
6.25	2.00	0.44	5.00	1.21	0.00	1.21
6.30	2.00	0.44	5.00	1.21	0.00	1.21
6.35	2.00	0.44	5.00	1.21	0.00	1.21
6.40	2.00	0.44	5.00	1.21	0.00	1.21
6.45	2.00	0.44	5.00	1.21	0.00	1.21
6.50	2.00	0.44	5.00	1.21	0.00	1.21
6.55	2.00	0.44	5.00	1.21	0.00	1.21
6.60	2.00	0.44	5.00	1.21	0.00	1.21
6.65	2.00	0.44	5.00	1.21	0.00	1.21

6.70	2.00	0.44	5.00	1.21	0.00	1.21
6.75	2.00	0.44	5.00	1.21	0.00	1.21
6.80	2.00	0.44	5.00	1.21	0.00	1.21
6.85	2.00	0.44	5.00	1.21	0.00	1.21
6.90	2.00	0.44	5.00	1.21	0.00	1.21
6.95	2.00	0.44	5.00	1.21	0.00	1.21
7.00	2.00	0.44	5.00	1.21	0.00	1.21
7.05	2.00	0.44	5.00	1.21	0.00	1.21
7.10	2.00	0.44	5.00	1.21	0.00	1.21
7.15	2.00	0.44	5.00	1.21	0.00	1.21
7.20	2.00	0.44	5.00	1.21	0.00	1.21
7.25	2.00	0.44	5.00	1.21	0.00	1.21
7.30	2.00	0.44	5.00	1.21	0.00	1.21
7.35	2.00	0.44	5.00	1.21	0.00	1.21
7.40	2.00	0.44	5.00	1.21	0.00	1.21
7.45	2.00	0.44	5.00	1.21	0.00	1.21
7.50	2.00	0.44	5.00	1.21	0.00	1.21
7.55	2.00	0.44	5.00	1.21	0.00	1.21
7.60	2.00	0.44	5.00	1.21	0.00	1.21
7.65	2.00	0.44	5.00	1.21	0.00	1.21
7.70	2.00	0.44	5.00	1.21	0.00	1.21
7.75	2.00	0.44	5.00	1.21	0.00	1.21
7.80	2.00	0.44	5.00	1.21	0.00	1.21
7.85	2.00	0.44	5.00	1.21	0.00	1.21
7.90	2.00	0.44	5.00	1.21	0.00	1.21
7.95	2.00	0.44	5.00	1.21	0.00	1.21
8.00	2.00	0.44	5.00	1.21	0.00	1.21
8.05	2.00	0.44	5.00	1.21	0.00	1.21
8.10	2.00	0.44	5.00	1.21	0.00	1.21
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8.30	2.00	0.44	5.00	1.21	0.00	1.21
8.35	2.00	0.44	5.00	1.21	0.00	1.21
8.40	2.00	0.44	5.00	1.21	0.00	1.21
8.45	2.00	0.44	5.00	1.21	0.00	1.21
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8.55	2.00	0.44	5.00	1.21	0.00	1.21
8.60	2.00	0.44	5.00	1.21	0.00	1.21
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8.90	2.00	0.44	5.00	1.21	0.00	1.21
8.95	2.00	0.44	5.00	1.21	0.00	1.21
9.00	2.00	0.44	5.00	1.21	0.00	1.21
9.05	2.00	0.44	5.00	1.21	0.00	1.21
9.10	2.00	0.44	5.00	1.21	0.00	1.21
9.15	2.00	0.44	5.00	1.21	0.00	1.21
9.20	2.00	0.44	5.00	1.21	0.00	1.21
9.25	2.00	0.44	5.00	1.21	0.00	1.21
9.30	2.00	0.44	5.00	1.21	0.00	1.21
9.35	2.00	0.44	5.00	1.21	0.00	1.21

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9.90	2.00	0.44	5.00	1.21	0.00	1.21
9.95	2.00	0.44	5.00	1.21	0.00	1.21
10.00	2.00	0.44	5.00	1.21	0.00	1.21
10.05	2.00	0.44	5.00	1.21	0.00	1.21
10.10	2.00	0.44	5.00	1.21	0.00	1.21
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12.50	2.00	0.44	5.00	1.21	0.00	1.21
12.55	2.00	0.44	5.00	1.21	0.00	1.21
12.60	2.00	0.44	5.00	1.21	0.00	1.21
12.65	2.00	0.44	5.00	1.21	0.00	1.21
12.70	2.00	0.44	5.00	1.21	0.00	1.21
12.75	2.00	0.44	5.00	1.21	0.00	1.21
12.80	2.00	0.44	5.00	1.21	0.00	1.21
12.85	2.00	0.44	5.00	1.21	0.00	1.21
12.90	2.00	0.44	5.00	1.21	0.00	1.21
12.95	2.00	0.43	5.00	1.21	0.00	1.21
13.00	2.00	0.43	5.00	1.21	0.00	1.21
13.05	2.00	0.43	5.00	1.21	0.00	1.21
13.10	2.00	0.43	5.00	1.21	0.00	1.21
13.15	2.00	0.43	5.00	1.21	0.00	1.21
13.20	2.00	0.43	5.00	1.21	0.00	1.21
13.25	2.00	0.43	5.00	1.21	0.00	1.21
13.30	2.00	0.43	5.00	1.21	0.00	1.21
13.35	2.00	0.43	5.00	1.21	0.00	1.21
13.40	2.00	0.43	5.00	1.21	0.00	1.21
13.45	2.00	0.43	5.00	1.21	0.00	1.21
13.50	2.00	0.43	5.00	1.21	0.00	1.21
13.55	2.00	0.43	5.00	1.21	0.00	1.21
13.60	2.00	0.43	5.00	1.21	0.00	1.21
13.65	2.00	0.43	5.00	1.21	0.00	1.21
13.70	2.00	0.43	5.00	1.21	0.00	1.21
13.75	2.00	0.43	5.00	1.21	0.00	1.21
13.80	2.00	0.43	5.00	1.21	0.00	1.21
13.85	2.00	0.43	5.00	1.21	0.00	1.21
13.90	2.00	0.43	5.00	1.21	0.00	1.21
13.95	2.00	0.43	5.00	1.21	0.00	1.21
14.00	2.00	0.43	5.00	1.21	0.00	1.21
14.05	2.00	0.43	5.00	1.21	0.00	1.21
14.10	2.00	0.43	5.00	1.21	0.00	1.21
14.15	2.00	0.43	5.00	1.21	0.00	1.21
14.20	2.00	0.43	5.00	1.21	0.00	1.21
14.25	2.00	0.43	5.00	1.21	0.00	1.21
14.30	2.00	0.43	5.00	1.21	0.00	1.21
14.35	2.00	0.43	5.00	1.21	0.00	1.21
14.40	2.00	0.43	5.00	1.21	0.00	1.21
14.45	2.00	0.43	5.00	1.21	0.00	1.21
14.50	2.00	0.43	5.00	1.21	0.00	1.21
14.55	2.00	0.43	5.00	1.21	0.00	1.21
14.60	2.00	0.43	5.00	1.21	0.00	1.21
14.65	2.00	0.43	5.00	1.21	0.00	1.21
14.70	2.00	0.43	5.00	1.21	0.00	1.21
14.75	2.00	0.43	5.00	1.21	0.00	1.21

14.80	2.00	0.43	5.00	1.21	0.00	1.21
14.85	2.00	0.43	5.00	1.21	0.00	1.21
14.90	2.00	0.43	5.00	1.21	0.00	1.21
14.95	2.00	0.43	5.00	1.21	0.00	1.21
15.00	2.00	0.43	5.00	1.21	0.00	1.21
15.05	2.00	0.43	5.00	1.21	0.00	1.21
15.10	2.00	0.43	5.00	1.21	0.00	1.21
15.15	2.00	0.43	5.00	1.21	0.00	1.21
15.20	2.00	0.43	5.00	1.21	0.00	1.21
15.25	2.00	0.43	5.00	1.21	0.00	1.21
15.30	2.00	0.43	5.00	1.21	0.00	1.21
15.35	2.00	0.43	5.00	1.21	0.00	1.21
15.40	2.00	0.43	5.00	1.21	0.00	1.21
15.45	2.00	0.43	5.00	1.21	0.00	1.21
15.50	2.00	0.43	5.00	1.21	0.00	1.21
15.55	2.00	0.43	5.00	1.21	0.00	1.21
15.60	2.00	0.43	5.00	1.21	0.00	1.21
15.65	2.00	0.43	5.00	1.21	0.00	1.21
15.70	2.00	0.43	5.00	1.21	0.00	1.21
15.75	2.00	0.43	5.00	1.21	0.00	1.21
15.80	2.00	0.43	5.00	1.21	0.00	1.21
15.85	2.00	0.43	5.00	1.21	0.00	1.21
15.90	2.00	0.43	5.00	1.21	0.00	1.21
15.95	2.00	0.43	5.00	1.21	0.00	1.21
16.00	2.00	0.43	5.00	1.21	0.00	1.21
16.05	2.00	0.43	5.00	1.21	0.00	1.21
16.10	2.00	0.43	5.00	1.21	0.00	1.21
16.15	2.00	0.43	5.00	1.21	0.00	1.21
16.20	2.00	0.43	5.00	1.21	0.00	1.21
16.25	2.00	0.43	5.00	1.21	0.00	1.21
16.30	2.00	0.43	5.00	1.21	0.00	1.21
16.35	2.00	0.43	5.00	1.21	0.00	1.21
16.40	2.00	0.43	5.00	1.21	0.00	1.21
16.45	2.00	0.43	5.00	1.21	0.00	1.21
16.50	2.00	0.43	5.00	1.21	0.00	1.21
16.55	2.00	0.43	5.00	1.21	0.00	1.21
16.60	2.00	0.43	5.00	1.21	0.00	1.21
16.65	2.00	0.43	5.00	1.21	0.00	1.21
16.70	2.00	0.43	5.00	1.21	0.00	1.21
16.75	2.00	0.43	5.00	1.21	0.00	1.21
16.80	2.00	0.43	5.00	1.21	0.00	1.21
16.85	2.00	0.43	5.00	1.21	0.00	1.21
16.90	2.00	0.43	5.00	1.21	0.00	1.21
16.95	2.00	0.43	5.00	1.21	0.00	1.21
17.00	2.00	0.43	5.00	1.21	0.00	1.21
17.05	2.00	0.43	5.00	1.21	0.00	1.21
17.10	2.00	0.43	5.00	1.21	0.00	1.21
17.15	2.00	0.43	5.00	1.21	0.00	1.21
17.20	2.00	0.43	5.00	1.21	0.00	1.21
17.25	2.00	0.43	5.00	1.21	0.00	1.21
17.30	2.00	0.43	5.00	1.21	0.00	1.21
17.35	2.00	0.43	5.00	1.21	0.00	1.21
17.40	2.00	0.43	5.00	1.21	0.00	1.21
17.45	2.00	0.43	5.00	1.21	0.00	1.21

17.50	2.00	0.43	5.00	1.21	0.00	1.21
17.55	2.00	0.43	5.00	1.21	0.00	1.21
17.60	2.00	0.43	5.00	1.21	0.00	1.21
17.65	2.00	0.43	5.00	1.21	0.00	1.21
17.70	2.00	0.43	5.00	1.21	0.00	1.21
17.75	2.00	0.43	5.00	1.21	0.00	1.21
17.80	2.00	0.43	5.00	1.21	0.00	1.21
17.85	2.00	0.43	5.00	1.21	0.00	1.21
17.90	2.00	0.43	5.00	1.21	0.00	1.21
17.95	2.00	0.43	5.00	1.21	0.00	1.21
18.00	2.00	0.43	5.00	1.21	0.00	1.21
18.05	2.00	0.43	5.00	1.21	0.00	1.21
18.10	2.00	0.43	5.00	1.21	0.00	1.21
18.15	2.00	0.43	5.00	1.21	0.00	1.21
18.20	2.00	0.43	5.00	1.21	0.00	1.21
18.25	2.00	0.43	5.00	1.21	0.00	1.21
18.30	2.00	0.43	5.00	1.21	0.00	1.21
18.35	2.00	0.43	5.00	1.21	0.00	1.21
18.40	2.00	0.43	5.00	1.21	0.00	1.21
18.45	2.00	0.43	5.00	1.21	0.00	1.21
18.50	2.00	0.44	5.00	1.21	0.00	1.21
18.55	2.00	0.44	5.00	1.21	0.00	1.21
18.60	2.00	0.44	5.00	1.21	0.00	1.21
18.65	2.00	0.44	5.00	1.21	0.00	1.21
18.70	2.00	0.44	5.00	1.21	0.00	1.21
18.75	2.00	0.44	5.00	1.21	0.00	1.21
18.80	2.00	0.44	5.00	1.21	0.00	1.21
18.85	2.00	0.44	5.00	1.21	0.00	1.21
18.90	2.00	0.44	5.00	1.21	0.00	1.21
18.95	2.00	0.44	5.00	1.21	0.00	1.21
19.00	2.00	0.44	5.00	1.21	0.00	1.21
19.05	2.00	0.44	5.00	1.21	0.00	1.21
19.10	2.00	0.44	5.00	1.21	0.00	1.21
19.15	2.00	0.44	5.00	1.21	0.00	1.21
19.20	2.00	0.44	5.00	1.21	0.00	1.21
19.25	2.00	0.44	5.00	1.21	0.00	1.21
19.30	2.00	0.44	5.00	1.21	0.00	1.21
19.35	2.00	0.44	5.00	1.21	0.00	1.21
19.40	2.00	0.44	5.00	1.21	0.00	1.21
19.45	2.00	0.45	5.00	1.21	0.00	1.21
19.50	2.00	0.45	5.00	1.21	0.00	1.21
19.55	2.00	0.45	5.00	1.21	0.00	1.21
19.60	2.00	0.45	5.00	1.21	0.00	1.21
19.65	2.00	0.45	5.00	1.21	0.00	1.21
19.70	2.00	0.45	5.00	1.21	0.00	1.21
19.75	2.00	0.45	5.00	1.21	0.00	1.21
19.80	2.00	0.45	5.00	1.21	0.00	1.21
19.85	2.00	0.45	5.00	1.21	0.00	1.21
19.90	2.00	0.45	5.00	1.21	0.00	1.21
19.95	2.00	0.45	5.00	1.21	0.00	1.21
20.00	2.00	0.45	5.00	1.21	0.00	1.21
20.05	2.00	0.45	5.00	1.21	0.00	1.21
20.10	2.00	0.45	5.00	1.21	0.00	1.21
20.15	2.00	0.45	5.00	1.21	0.00	1.21

20.20	2.00	0.45	5.00	1.21	0.00	1.21
20.25	2.00	0.45	5.00	1.21	0.00	1.21
20.30	2.00	0.45	5.00	1.21	0.00	1.21
20.35	2.00	0.45	5.00	1.21	0.00	1.21
20.40	2.00	0.46	5.00	1.21	0.00	1.21
20.45	2.00	0.46	5.00	1.21	0.00	1.21
20.50	2.00	0.46	5.00	1.21	0.00	1.21
20.55	2.00	0.46	5.00	1.21	0.00	1.21
20.60	2.00	0.46	5.00	1.21	0.00	1.21
20.65	2.00	0.46	5.00	1.21	0.00	1.21
20.70	2.00	0.46	5.00	1.21	0.00	1.21
20.75	2.00	0.46	5.00	1.21	0.00	1.21
20.80	2.00	0.46	5.00	1.21	0.00	1.21
20.85	2.00	0.46	5.00	1.21	0.00	1.21
20.90	2.00	0.46	5.00	1.21	0.00	1.21
20.95	2.00	0.46	5.00	1.21	0.00	1.21
21.00	2.00	0.46	5.00	1.21	0.00	1.21
21.05	2.00	0.46	5.00	1.21	0.00	1.21
21.10	2.00	0.46	5.00	1.21	0.00	1.21
21.15	2.00	0.46	5.00	1.21	0.00	1.21
21.20	2.00	0.46	5.00	1.21	0.00	1.21
21.25	2.00	0.46	5.00	1.21	0.00	1.21
21.30	2.00	0.46	5.00	1.21	0.00	1.21
21.35	2.00	0.46	5.00	1.21	0.00	1.21
21.40	2.00	0.46	5.00	1.21	0.00	1.21
21.45	2.00	0.46	5.00	1.21	0.00	1.21
21.50	2.00	0.47	5.00	1.21	0.00	1.21
21.55	2.00	0.47	5.00	1.21	0.00	1.21
21.60	2.00	0.47	5.00	1.21	0.00	1.21
21.65	2.00	0.47	5.00	1.21	0.00	1.21
21.70	2.00	0.47	5.00	1.21	0.00	1.21
21.75	2.00	0.47	5.00	1.21	0.00	1.21
21.80	2.00	0.47	5.00	1.21	0.00	1.21
21.85	2.00	0.47	5.00	1.21	0.00	1.21
21.90	2.00	0.47	5.00	1.21	0.00	1.21
21.95	2.00	0.47	5.00	1.21	0.00	1.21
22.00	2.00	0.47	5.00	1.21	0.00	1.21
22.05	2.00	0.47	5.00	1.21	0.00	1.21
22.10	2.00	0.47	5.00	1.21	0.00	1.21
22.15	2.00	0.47	5.00	1.21	0.00	1.21
22.20	2.00	0.47	5.00	1.21	0.00	1.21
22.25	2.00	0.47	5.00	1.21	0.00	1.21
22.30	2.00	0.47	5.00	1.21	0.00	1.21
22.35	2.00	0.47	5.00	1.21	0.00	1.21
22.40	2.00	0.47	5.00	1.21	0.00	1.21
22.45	2.00	0.47	5.00	1.21	0.00	1.21
22.50	2.00	0.47	5.00	1.21	0.00	1.21
22.55	2.00	0.47	5.00	1.21	0.00	1.21
22.60	2.00	0.48	5.00	1.21	0.00	1.21
22.65	2.00	0.48	5.00	1.21	0.00	1.21
22.70	2.00	0.48	5.00	1.21	0.00	1.21
22.75	2.00	0.48	5.00	1.21	0.00	1.21
22.80	2.00	0.48	5.00	1.21	0.00	1.21
22.85	2.00	0.48	5.00	1.21	0.00	1.21

22.90	2.00	0.48	5.00	1.21	0.00	1.21
22.95	2.00	0.48	5.00	1.21	0.00	1.21
23.00	2.00	0.48	5.00	1.21	0.00	1.21
23.05	2.00	0.48	5.00	1.21	0.00	1.21
23.10	2.00	0.48	5.00	1.21	0.00	1.21
23.15	2.00	0.48	5.00	1.21	0.00	1.21
23.20	2.00	0.48	5.00	1.21	0.00	1.21
23.25	2.00	0.48	5.00	1.21	0.00	1.21
23.30	2.00	0.48	5.00	1.21	0.00	1.21
23.35	2.00	0.48	5.00	1.21	0.00	1.21
23.40	2.00	0.48	5.00	1.21	0.00	1.21
23.45	2.00	0.48	5.00	1.21	0.00	1.21
23.50	2.00	0.48	5.00	1.21	0.00	1.21
23.55	2.00	0.48	5.00	1.21	0.00	1.21
23.60	2.00	0.48	5.00	1.21	0.00	1.21
23.65	2.00	0.48	5.00	1.21	0.00	1.21
23.70	2.00	0.48	5.00	1.21	0.00	1.21
23.75	2.00	0.48	5.00	1.21	0.00	1.21
23.80	2.00	0.49	5.00	1.21	0.00	1.21
23.85	2.00	0.49	5.00	1.21	0.00	1.21
23.90	2.00	0.49	5.00	1.21	0.00	1.21
23.95	2.00	0.49	5.00	1.21	0.00	1.21
24.00	2.00	0.49	5.00	1.21	0.00	1.21
24.05	2.00	0.49	5.00	1.21	0.00	1.21
24.10	2.00	0.49	5.00	1.21	0.00	1.21
24.15	2.00	0.49	5.00	1.21	0.00	1.21
24.20	2.00	0.49	5.00	1.21	0.00	1.21
24.25	2.00	0.49	5.00	1.21	0.00	1.21
24.30	2.00	0.49	5.00	1.21	0.00	1.21
24.35	2.00	0.49	5.00	1.21	0.00	1.21
24.40	2.00	0.49	5.00	1.21	0.00	1.21
24.45	2.00	0.49	5.00	1.21	0.00	1.21
24.50	2.00	0.49	5.00	1.21	0.00	1.21
24.55	2.00	0.49	5.00	1.21	0.00	1.21
24.60	2.00	0.49	5.00	1.21	0.00	1.21
24.65	2.00	0.49	5.00	1.21	0.00	1.21
24.70	2.00	0.49	5.00	1.21	0.00	1.21
24.75	2.00	0.49	5.00	1.21	0.00	1.21
24.80	2.00	0.49	5.00	1.21	0.00	1.21
24.85	2.00	0.49	5.00	1.21	0.00	1.21
24.90	2.00	0.49	5.00	1.21	0.00	1.21
24.95	2.00	0.49	5.00	1.21	0.00	1.21
25.00	2.00	0.49	5.00	1.21	0.00	1.21
25.05	2.00	0.49	5.00	1.21	0.00	1.21
25.10	2.00	0.50	5.00	1.21	0.00	1.21
25.15	2.00	0.50	5.00	1.21	0.00	1.21
25.20	2.00	0.50	5.00	1.21	0.00	1.21
25.25	2.00	0.50	5.00	1.21	0.00	1.21
25.30	2.00	0.50	5.00	1.21	0.00	1.21
25.35	2.00	0.50	5.00	1.21	0.00	1.21
25.40	2.00	0.50	5.00	1.21	0.00	1.21
25.45	2.00	0.50	5.00	1.21	0.00	1.21
25.50	2.00	0.50	5.00	1.21	0.00	1.21
25.55	2.00	0.50	5.00	1.21	0.00	1.21

25.60	2.00	0.50	5.00	1.21	0.00	1.21
25.65	2.00	0.50	5.00	1.21	0.00	1.21
25.70	2.00	0.50	5.00	1.21	0.00	1.21
25.75	2.00	0.50	5.00	1.21	0.00	1.21
25.80	2.00	0.50	5.00	1.21	0.00	1.21
25.85	2.00	0.50	5.00	1.21	0.00	1.21
25.90	2.00	0.50	5.00	1.21	0.00	1.21
25.95	2.00	0.50	5.00	1.21	0.00	1.21
26.00	2.00	0.50	5.00	1.21	0.00	1.21
26.05	2.00	0.50	5.00	1.21	0.00	1.21
26.10	2.00	0.50	5.00	1.21	0.00	1.21
26.15	2.00	0.50	5.00	1.21	0.00	1.21
26.20	2.00	0.50	5.00	1.21	0.00	1.21
26.25	2.00	0.50	5.00	1.21	0.00	1.21
26.30	2.00	0.50	5.00	1.21	0.00	1.21
26.35	2.00	0.50	5.00	1.21	0.00	1.21
26.40	2.00	0.50	5.00	1.21	0.00	1.21
26.45	2.00	0.50	5.00	1.21	0.00	1.21
26.50	2.00	0.51	5.00	1.21	0.00	1.21
26.55	2.00	0.51	5.00	1.21	0.00	1.21
26.60	2.00	0.51	5.00	1.21	0.00	1.21
26.65	2.00	0.51	5.00	1.21	0.00	1.21
26.70	2.00	0.51	5.00	1.21	0.00	1.21
26.75	2.00	0.51	5.00	1.21	0.00	1.21
26.80	2.00	0.51	5.00	1.21	0.00	1.21
26.85	2.00	0.51	5.00	1.21	0.00	1.21
26.90	2.00	0.51	5.00	1.21	0.00	1.21
26.95	2.00	0.51	5.00	1.21	0.00	1.21
27.00	2.00	0.51	5.00	1.21	0.00	1.21
27.05	2.00	0.51	5.00	1.21	0.00	1.21
27.10	2.00	0.51	5.00	1.21	0.00	1.21
27.15	2.00	0.51	5.00	1.21	0.00	1.21
27.20	2.00	0.51	5.00	1.21	0.00	1.21
27.25	2.00	0.51	5.00	1.21	0.00	1.21
27.30	2.00	0.51	5.00	1.21	0.00	1.21
27.35	2.00	0.51	5.00	1.21	0.00	1.21
27.40	2.00	0.51	5.00	1.21	0.00	1.21
27.45	2.00	0.51	5.00	1.21	0.00	1.21
27.50	2.00	0.51	5.00	1.21	0.00	1.21
27.55	2.00	0.51	5.00	1.21	0.00	1.21
27.60	2.00	0.51	5.00	1.21	0.00	1.21
27.65	2.00	0.51	5.00	1.21	0.00	1.21
27.70	2.00	0.51	5.00	1.21	0.00	1.21
27.75	2.00	0.51	5.00	1.21	0.00	1.21
27.80	2.00	0.51	5.00	1.21	0.00	1.21
27.85	2.00	0.51	5.00	1.21	0.00	1.21
27.90	2.00	0.51	5.00	1.21	0.00	1.21
27.95	2.00	0.51	5.00	1.21	0.00	1.21
28.00	2.00	0.51	5.00	1.21	0.00	1.21
28.05	2.00	0.52	5.00	1.21	0.00	1.21
28.10	2.00	0.52	5.00	1.21	0.00	1.21
28.15	2.00	0.52	5.00	1.21	0.00	1.21
28.20	2.00	0.52	5.00	1.21	0.00	1.21
28.25	2.00	0.52	5.00	1.21	0.00	1.21

28.30	2.00	0.52	5.00	1.21	0.00	1.21
28.35	2.00	0.52	5.00	1.21	0.00	1.21
28.40	2.00	0.52	5.00	1.21	0.00	1.21
28.45	2.00	0.52	5.00	1.21	0.00	1.21
28.50	2.00	0.52	5.00	1.21	0.00	1.21
28.55	2.00	0.52	5.00	1.21	0.00	1.21
28.60	2.00	0.52	5.00	1.21	0.00	1.21
28.65	2.00	0.52	5.00	1.21	0.00	1.21
28.70	2.00	0.52	5.00	1.21	0.00	1.21
28.75	2.00	0.52	5.00	1.21	0.00	1.21
28.80	2.00	0.52	5.00	1.21	0.00	1.21
28.85	2.00	0.52	5.00	1.21	0.00	1.21
28.90	2.00	0.52	5.00	1.21	0.00	1.21
28.95	2.00	0.52	5.00	1.21	0.00	1.21
29.00	2.00	0.52	5.00	1.21	0.00	1.21
29.05	2.00	0.52	5.00	1.21	0.00	1.21
29.10	2.00	0.52	5.00	1.21	0.00	1.21
29.15	2.00	0.52	5.00	1.21	0.00	1.21
29.20	2.00	0.52	5.00	1.21	0.00	1.21
29.25	2.00	0.52	5.00	1.21	0.00	1.21
29.30	2.00	0.52	5.00	1.21	0.00	1.21
29.35	2.00	0.52	5.00	1.21	0.00	1.21
29.40	2.00	0.52	5.00	1.21	0.00	1.21
29.45	2.00	0.52	5.00	1.21	0.00	1.21
29.50	2.00	0.52	5.00	1.21	0.00	1.21
29.55	2.00	0.52	5.00	1.21	0.00	1.21
29.60	2.00	0.52	5.00	1.21	0.00	1.21
29.65	2.00	0.52	5.00	1.21	0.00	1.21
29.70	2.00	0.52	5.00	1.21	0.00	1.21
29.75	2.00	0.53	5.00	1.21	0.00	1.21
29.80	2.00	0.53	5.00	1.21	0.00	1.21
29.85	2.00	0.53	5.00	1.21	0.00	1.21
29.90	2.00	0.53	5.00	1.21	0.00	1.21
29.95	2.00	0.53	5.00	1.21	0.00	1.21
30.00	2.00	0.53	5.00	1.21	0.00	1.21
30.05	2.00	0.53	5.00	1.21	0.00	1.21
30.10	2.00	0.53	5.00	1.21	0.00	1.21
30.15	2.00	0.53	5.00	1.21	0.00	1.21
30.20	2.00	0.53	5.00	1.21	0.00	1.21
30.25	2.00	0.53	5.00	1.21	0.00	1.21
30.30	2.00	0.53	5.00	1.21	0.00	1.21
30.35	2.00	0.53	5.00	1.21	0.00	1.21
30.40	2.00	0.53	5.00	1.21	0.00	1.21
30.45	2.00	0.53	5.00	1.21	0.00	1.21
30.50	2.00	0.53	5.00	1.21	0.00	1.21
30.55	2.00	0.53	5.00	1.21	0.00	1.21
30.60	2.00	0.53	5.00	1.21	0.00	1.21
30.65	2.00	0.53	5.00	1.21	0.00	1.21
30.70	2.00	0.53	5.00	1.21	0.00	1.21
30.75	2.00	0.53	5.00	1.21	0.00	1.21
30.80	2.00	0.53	5.00	1.21	0.00	1.21
30.85	2.00	0.53	5.00	1.21	0.00	1.21
30.90	2.00	0.53	5.00	1.21	0.00	1.21
30.95	2.00	0.53	5.00	1.21	0.00	1.21

31.00	2.00	0.53	5.00	1.21	0.00	1.21
31.05	2.00	0.53	5.00	1.21	0.00	1.21
31.10	2.00	0.53	5.00	1.21	0.00	1.21
31.15	2.00	0.53	5.00	1.21	0.00	1.21
31.20	2.00	0.53	5.00	1.21	0.00	1.21
31.25	2.00	0.53	5.00	1.21	0.00	1.21
31.30	2.00	0.53	5.00	1.21	0.00	1.21
31.35	2.00	0.53	5.00	1.21	0.00	1.21
31.40	2.00	0.53	5.00	1.21	0.00	1.21
31.45	2.00	0.53	5.00	1.21	0.00	1.21
31.50	2.00	0.53	5.00	1.21	0.00	1.21
31.55	2.00	0.53	5.00	1.21	0.00	1.21
31.60	2.00	0.53	5.00	1.21	0.00	1.21
31.65	2.00	0.53	5.00	1.21	0.00	1.21
31.70	2.00	0.53	5.00	1.21	0.00	1.21
31.75	2.00	0.53	5.00	1.21	0.00	1.21
31.80	2.00	0.53	5.00	1.21	0.00	1.21
31.85	2.00	0.53	5.00	1.21	0.00	1.21
31.90	2.00	0.53	5.00	1.21	0.00	1.21
31.95	2.00	0.53	5.00	1.21	0.00	1.21
32.00	2.00	0.53	5.00	1.21	0.00	1.21
32.05	2.00	0.53	5.00	1.21	0.00	1.21
32.10	2.00	0.53	5.00	1.21	0.00	1.21
32.15	2.00	0.53	5.00	1.21	0.00	1.21
32.20	2.00	0.53	5.00	1.21	0.00	1.21
32.25	2.00	0.53	5.00	1.21	0.00	1.21
32.30	2.00	0.53	5.00	1.21	0.00	1.21
32.35	2.00	0.53	5.00	1.21	0.00	1.21
32.40	2.00	0.53	5.00	1.21	0.00	1.21
32.45	2.00	0.53	5.00	1.21	0.00	1.21
32.50	2.00	0.53	5.00	1.21	0.00	1.21
32.55	2.00	0.53	5.00	1.21	0.00	1.21
32.60	2.00	0.53	5.00	1.21	0.00	1.21
32.65	2.00	0.53	5.00	1.21	0.00	1.21
32.70	2.00	0.53	5.00	1.21	0.00	1.21
32.75	2.00	0.53	5.00	1.21	0.00	1.21
32.80	2.00	0.53	5.00	1.21	0.00	1.21
32.85	2.00	0.53	5.00	1.21	0.00	1.21
32.90	2.00	0.53	5.00	1.21	0.00	1.21
32.95	2.00	0.53	5.00	1.21	0.00	1.21
33.00	2.00	0.53	5.00	1.21	0.00	1.21
33.05	2.00	0.53	5.00	1.21	0.00	1.21
33.10	2.00	0.53	5.00	1.21	0.00	1.21
33.15	2.00	0.53	5.00	1.21	0.00	1.21
33.20	2.00	0.53	5.00	1.21	0.00	1.21
33.25	2.00	0.53	5.00	1.21	0.00	1.21
33.30	2.00	0.53	5.00	1.21	0.00	1.21
33.35	2.00	0.53	5.00	1.21	0.00	1.21
33.40	2.00	0.53	5.00	1.21	0.00	1.21
33.45	2.00	0.53	5.00	1.21	0.00	1.21
33.50	2.00	0.53	5.00	1.21	0.00	1.21
33.55	2.00	0.53	5.00	1.21	0.00	1.21
33.60	2.00	0.53	5.00	1.21	0.00	1.21
33.65	2.00	0.53	5.00	1.21	0.00	1.21

33.70	2.00	0.53	5.00	1.21	0.00	1.21
33.75	2.00	0.53	5.00	1.21	0.00	1.21
33.80	2.00	0.53	5.00	1.21	0.00	1.21
33.85	2.00	0.53	5.00	1.21	0.00	1.21
33.90	2.00	0.53	5.00	1.21	0.00	1.21
33.95	2.00	0.53	5.00	1.21	0.00	1.21
34.00	2.00	0.53	5.00	1.21	0.00	1.21
34.05	2.00	0.53	5.00	1.21	0.00	1.21
34.10	2.00	0.53	5.00	1.21	0.00	1.21
34.15	2.00	0.53	5.00	1.21	0.00	1.21
34.20	2.00	0.53	5.00	1.21	0.00	1.21
34.25	2.00	0.53	5.00	1.21	0.00	1.21
34.30	2.00	0.53	5.00	1.21	0.00	1.21
34.35	2.00	0.53	5.00	1.21	0.00	1.21
34.40	2.00	0.53	5.00	1.21	0.00	1.21
34.45	2.00	0.53	5.00	1.21	0.00	1.21
34.50	2.00	0.53	5.00	1.21	0.00	1.21
34.55	2.00	0.53	5.00	1.21	0.00	1.21
34.60	2.00	0.53	5.00	1.21	0.00	1.21
34.65	2.00	0.53	5.00	1.21	0.00	1.21
34.70	2.00	0.53	5.00	1.21	0.00	1.21
34.75	2.00	0.53	5.00	1.21	0.00	1.21
34.80	2.00	0.53	5.00	1.21	0.00	1.21
34.85	2.00	0.53	5.00	1.21	0.00	1.21
34.90	2.00	0.53	5.00	1.21	0.00	1.21
34.95	2.00	0.53	5.00	1.21	0.00	1.21
35.00	2.00	0.53	5.00	1.21	0.00	1.21
35.05	2.00	0.53	5.00	1.21	0.00	1.21
35.10	2.00	0.53	5.00	1.21	0.00	1.21
35.15	2.00	0.53	5.00	1.21	0.00	1.21
35.20	2.00	0.53	5.00	1.21	0.00	1.21
35.25	2.00	0.53	5.00	1.21	0.00	1.21
35.30	2.00	0.53	5.00	1.21	0.00	1.21
35.35	2.00	0.53	5.00	1.21	0.00	1.21
35.40	2.00	0.53	5.00	1.21	0.00	1.21
35.45	2.00	0.53	5.00	1.21	0.00	1.21
35.50	2.00	0.53	5.00	1.21	0.00	1.21
35.55	2.00	0.53	5.00	1.21	0.00	1.21
35.60	2.00	0.53	5.00	1.21	0.00	1.21
35.65	2.00	0.53	5.00	1.21	0.00	1.21
35.70	2.00	0.53	5.00	1.21	0.00	1.21
35.75	2.00	0.53	5.00	1.21	0.00	1.21
35.80	2.00	0.53	5.00	1.21	0.00	1.21
35.85	2.00	0.53	5.00	1.21	0.00	1.21
35.90	2.00	0.53	5.00	1.21	0.00	1.21
35.95	2.00	0.53	5.00	1.21	0.00	1.21
36.00	2.00	0.53	5.00	1.21	0.00	1.21
36.05	2.00	0.53	5.00	1.21	0.00	1.21
36.10	2.00	0.53	5.00	1.21	0.00	1.21
36.15	2.00	0.53	5.00	1.21	0.00	1.21
36.20	2.00	0.53	5.00	1.21	0.00	1.21
36.25	2.00	0.53	5.00	1.21	0.00	1.21
36.30	2.00	0.53	5.00	1.21	0.00	1.21
36.35	2.00	0.53	5.00	1.21	0.00	1.21

36.40	2.00	0.53	5.00	1.21	0.00	1.21
36.45	2.00	0.53	5.00	1.21	0.00	1.21
36.50	2.00	0.53	5.00	1.21	0.00	1.21
36.55	2.00	0.53	5.00	1.21	0.00	1.21
36.60	2.00	0.53	5.00	1.21	0.00	1.21
36.65	2.00	0.53	5.00	1.21	0.00	1.21
36.70	2.00	0.53	5.00	1.21	0.00	1.21
36.75	2.00	0.53	5.00	1.21	0.00	1.21
36.80	2.00	0.53	5.00	1.21	0.00	1.21
36.85	2.00	0.53	5.00	1.21	0.00	1.21
36.90	2.00	0.53	5.00	1.21	0.00	1.21
36.95	2.00	0.53	5.00	1.21	0.00	1.21
37.00	2.00	0.53	5.00	1.21	0.00	1.21
37.05	2.00	0.53	5.00	1.21	0.00	1.21
37.10	2.00	0.53	5.00	1.21	0.00	1.21
37.15	2.00	0.53	5.00	1.21	0.00	1.21
37.20	2.00	0.53	5.00	1.21	0.00	1.21
37.25	2.00	0.53	5.00	1.21	0.00	1.21
37.30	2.00	0.53	5.00	1.21	0.00	1.21
37.35	2.00	0.53	5.00	1.21	0.00	1.21
37.40	2.00	0.53	5.00	1.21	0.00	1.21
37.45	2.00	0.53	5.00	1.21	0.00	1.21
37.50	2.00	0.53	5.00	1.21	0.00	1.21
37.55	2.00	0.53	5.00	1.21	0.00	1.21
37.60	2.00	0.53	5.00	1.21	0.00	1.21
37.65	2.00	0.53	5.00	1.21	0.00	1.21
37.70	2.00	0.53	5.00	1.21	0.00	1.21
37.75	2.00	0.53	5.00	1.21	0.00	1.21
37.80	2.00	0.53	5.00	1.21	0.00	1.21
37.85	2.00	0.53	5.00	1.21	0.00	1.21
37.90	2.00	0.53	5.00	1.21	0.00	1.21
37.95	2.00	0.53	5.00	1.21	0.00	1.21
38.00	2.00	0.53	5.00	1.21	0.00	1.21
38.05	2.00	0.53	5.00	1.21	0.00	1.21
38.10	2.00	0.53	5.00	1.21	0.00	1.21
38.15	2.00	0.53	5.00	1.21	0.00	1.21
38.20	2.00	0.53	5.00	1.21	0.00	1.21
38.25	2.00	0.53	5.00	1.21	0.00	1.21
38.30	2.00	0.53	5.00	1.21	0.00	1.21
38.35	2.00	0.53	5.00	1.21	0.00	1.21
38.40	2.00	0.53	5.00	1.21	0.00	1.21
38.45	2.00	0.53	5.00	1.21	0.00	1.21
38.50	2.00	0.53	5.00	1.21	0.00	1.21
38.55	2.00	0.53	5.00	1.21	0.00	1.21
38.60	2.00	0.53	5.00	1.21	0.00	1.21
38.65	2.00	0.53	5.00	1.21	0.00	1.21
38.70	2.00	0.53	5.00	1.21	0.00	1.21
38.75	2.00	0.53	5.00	1.21	0.00	1.21
38.80	2.00	0.53	5.00	1.21	0.00	1.21
38.85	2.00	0.53	5.00	1.21	0.00	1.21
38.90	2.00	0.53	5.00	1.21	0.00	1.21
38.95	2.00	0.53	5.00	1.21	0.00	1.21
39.00	2.00	0.53	5.00	1.21	0.00	1.21
39.05	2.00	0.53	5.00	1.21	0.00	1.21

39.10	2.00	0.53	5.00	1.21	0.00	1.21
39.15	2.00	0.53	5.00	1.21	0.00	1.21
39.20	2.00	0.53	5.00	1.21	0.00	1.21
39.25	2.00	0.53	5.00	1.21	0.00	1.21
39.30	2.00	0.53	5.00	1.21	0.00	1.21
39.35	2.00	0.53	5.00	1.21	0.00	1.21
39.40	2.00	0.53	5.00	1.21	0.00	1.21
39.45	2.00	0.53	5.00	1.21	0.00	1.21
39.50	2.00	0.53	5.00	1.21	0.00	1.21
39.55	2.00	0.53	5.00	1.21	0.00	1.21
39.60	2.00	0.53	5.00	1.21	0.00	1.21
39.65	2.00	0.53	5.00	1.21	0.00	1.21
39.70	2.00	0.53	5.00	1.21	0.00	1.21
39.75	2.00	0.53	5.00	1.21	0.00	1.21
39.80	2.00	0.53	5.00	1.21	0.00	1.21
39.85	2.00	0.53	5.00	1.21	0.00	1.21
39.90	2.00	0.53	5.00	1.21	0.00	1.21
39.95	2.00	0.53	5.00	1.21	0.00	1.21
40.00	2.00	0.53	5.00	1.21	0.00	1.21
40.05	2.00	0.53	5.00	1.21	0.00	1.21
40.10	2.00	0.53	5.00	1.21	0.00	1.21
40.15	2.00	0.53	5.00	1.21	0.00	1.21
40.20	2.00	0.53	5.00	1.21	0.00	1.21
40.25	2.00	0.53	5.00	1.21	0.00	1.21
40.30	2.00	0.53	5.00	1.21	0.00	1.21
40.35	2.00	0.53	5.00	1.21	0.00	1.21
40.40	2.00	0.53	5.00	1.21	0.00	1.21
40.45	2.00	0.53	5.00	1.21	0.00	1.21
40.50	2.00	0.53	5.00	1.21	0.00	1.21
40.55	2.00	0.53	5.00	1.21	0.00	1.21
40.60	2.00	0.53	5.00	1.21	0.00	1.21
40.65	2.00	0.53	5.00	1.21	0.00	1.21
40.70	2.00	0.53	5.00	1.21	0.00	1.21
40.75	2.00	0.53	5.00	1.21	0.00	1.21
40.80	2.00	0.53	5.00	1.21	0.00	1.21
40.85	2.00	0.53	5.00	1.21	0.00	1.21
40.90	2.00	0.53	5.00	1.21	0.00	1.21
40.95	2.00	0.53	5.00	1.21	0.00	1.21
41.00	2.00	0.53	5.00	1.21	0.00	1.21
41.05	2.00	0.53	5.00	1.21	0.00	1.21
41.10	2.00	0.53	5.00	1.21	0.00	1.21
41.15	2.00	0.53	5.00	1.21	0.00	1.21
41.20	2.00	0.53	5.00	1.21	0.00	1.21
41.25	2.00	0.53	5.00	1.21	0.00	1.21
41.30	2.00	0.53	5.00	1.21	0.00	1.21
41.35	2.00	0.53	5.00	1.21	0.00	1.21
41.40	2.00	0.53	5.00	1.21	0.00	1.21
41.45	2.00	0.53	5.00	1.21	0.00	1.21
41.50	2.00	0.53	5.00	1.21	0.00	1.21
41.55	2.00	0.53	5.00	1.21	0.00	1.21
41.60	2.00	0.53	5.00	1.21	0.00	1.21
41.65	2.00	0.53	5.00	1.21	0.00	1.21
41.70	2.00	0.53	5.00	1.21	0.00	1.21
41.75	2.00	0.53	5.00	1.21	0.00	1.21

41.80	2.00	0.53	5.00	1.21	0.00	1.21
41.85	2.00	0.53	5.00	1.21	0.00	1.21
41.90	2.00	0.53	5.00	1.21	0.00	1.21
41.95	2.00	0.53	5.00	1.21	0.00	1.21
42.00	2.00	0.53	5.00	1.21	0.00	1.21
42.05	2.00	0.53	5.00	1.21	0.00	1.21
42.10	2.00	0.53	5.00	1.21	0.00	1.21
42.15	2.00	0.53	5.00	1.21	0.00	1.21
42.20	2.00	0.53	5.00	1.21	0.00	1.21
42.25	2.00	0.53	5.00	1.21	0.00	1.21
42.30	2.00	0.53	5.00	1.21	0.00	1.21
42.35	2.00	0.53	5.00	1.21	0.00	1.21
42.40	2.00	0.53	5.00	1.21	0.00	1.21
42.45	2.00	0.53	5.00	1.21	0.00	1.21
42.50	2.00	0.53	5.00	1.21	0.00	1.21
42.55	2.00	0.53	5.00	1.21	0.00	1.21
42.60	2.00	0.53	5.00	1.21	0.00	1.21
42.65	2.00	0.53	5.00	1.21	0.00	1.21
42.70	2.00	0.53	5.00	1.21	0.00	1.21
42.75	2.00	0.53	5.00	1.21	0.00	1.21
42.80	2.00	0.53	5.00	1.21	0.00	1.21
42.85	2.00	0.53	5.00	1.21	0.00	1.21
42.90	2.00	0.53	5.00	1.21	0.00	1.21
42.95	2.00	0.53	5.00	1.21	0.00	1.21
43.00	2.00	0.53	5.00	1.21	0.00	1.21
43.05	2.00	0.53	5.00	1.21	0.00	1.21
43.10	2.00	0.53	5.00	1.21	0.00	1.21
43.15	2.00	0.53	5.00	1.21	0.00	1.21
43.20	2.00	0.53	5.00	1.21	0.00	1.21
43.25	2.00	0.53	5.00	1.21	0.00	1.21
43.30	2.00	0.53	5.00	1.21	0.00	1.21
43.35	2.00	0.53	5.00	1.21	0.00	1.21
43.40	2.00	0.53	5.00	1.21	0.00	1.21
43.45	2.00	0.53	5.00	1.21	0.00	1.21
43.50	2.00	0.53	5.00	1.21	0.00	1.21
43.55	2.00	0.53	5.00	1.21	0.00	1.21
43.60	2.00	0.53	5.00	1.21	0.00	1.21
43.65	2.00	0.53	5.00	1.21	0.00	1.21
43.70	2.00	0.53	5.00	1.21	0.00	1.21
43.75	2.00	0.53	5.00	1.21	0.00	1.21
43.80	2.00	0.53	5.00	1.21	0.00	1.21
43.85	2.00	0.53	5.00	1.21	0.00	1.21
43.90	2.00	0.53	5.00	1.21	0.00	1.21
43.95	2.00	0.53	5.00	1.21	0.00	1.21
44.00	2.00	0.53	5.00	1.21	0.00	1.21
44.05	2.00	0.53	5.00	1.21	0.00	1.21
44.10	2.00	0.53	5.00	1.21	0.00	1.21
44.15	2.00	0.53	5.00	1.21	0.00	1.21
44.20	2.00	0.53	5.00	1.21	0.00	1.21
44.25	2.00	0.53	5.00	1.21	0.00	1.21
44.30	2.00	0.53	5.00	1.21	0.00	1.21
44.35	2.00	0.53	5.00	1.21	0.00	1.21
44.40	2.00	0.53	5.00	1.21	0.00	1.21
44.45	2.00	0.53	5.00	1.21	0.00	1.21

44.50	2.00	0.53	5.00	1.21	0.00	1.21
44.55	2.00	0.53	5.00	1.21	0.00	1.21
44.60	2.00	0.53	5.00	1.21	0.00	1.21
44.65	2.00	0.53	5.00	1.21	0.00	1.21
44.70	2.00	0.53	5.00	1.21	0.00	1.21
44.75	2.00	0.53	5.00	1.21	0.00	1.21
44.80	2.00	0.53	5.00	1.21	0.00	1.21
44.85	2.00	0.53	5.00	1.21	0.00	1.21
44.90	2.00	0.53	5.00	1.21	0.00	1.21
44.95	2.00	0.53	5.00	1.21	0.00	1.21
45.00	2.00	0.53	5.00	1.21	0.00	1.21
45.05	2.00	0.53	5.00	1.21	0.00	1.21
45.10	2.00	0.53	5.00	1.21	0.00	1.21
45.15	2.00	0.53	5.00	1.21	0.00	1.21
45.20	2.00	0.53	5.00	1.21	0.00	1.21
45.25	2.00	0.53	5.00	1.21	0.00	1.21
45.30	2.00	0.53	5.00	1.21	0.00	1.21
45.35	2.00	0.53	5.00	1.21	0.00	1.21
45.40	2.00	0.53	5.00	1.21	0.00	1.21
45.45	2.00	0.53	5.00	1.21	0.00	1.21
45.50	2.00	0.53	5.00	1.21	0.00	1.21
45.55	2.00	0.53	5.00	1.21	0.00	1.21
45.60	2.00	0.53	5.00	1.21	0.00	1.21
45.65	2.00	0.53	5.00	1.21	0.00	1.21
45.70	2.00	0.53	5.00	1.21	0.00	1.21
45.75	2.00	0.53	5.00	1.21	0.00	1.21
45.80	2.00	0.53	5.00	1.21	0.00	1.21
45.85	2.00	0.53	5.00	1.21	0.00	1.21
45.90	2.00	0.52	5.00	1.21	0.00	1.21
45.95	2.00	0.52	5.00	1.21	0.00	1.21
46.00	2.00	0.52	5.00	1.21	0.00	1.21
46.05	2.00	0.52	5.00	1.21	0.00	1.21
46.10	2.00	0.52	5.00	1.21	0.00	1.21
46.15	2.00	0.52	5.00	1.21	0.00	1.21
46.20	2.00	0.52	5.00	1.21	0.00	1.21
46.25	2.00	0.52	5.00	1.21	0.00	1.21
46.30	2.00	0.52	5.00	1.21	0.00	1.21
46.35	2.00	0.52	5.00	1.21	0.00	1.21
46.40	2.00	0.52	5.00	1.21	0.00	1.21
46.45	2.00	0.52	5.00	1.21	0.00	1.21
46.50	2.00	0.52	5.00	1.21	0.00	1.21
46.55	2.00	0.52	5.00	1.21	0.00	1.21
46.60	2.00	0.52	5.00	1.21	0.00	1.21
46.65	2.00	0.52	5.00	1.21	0.00	1.21
46.70	2.00	0.52	5.00	1.21	0.00	1.21
46.75	2.00	0.52	5.00	1.21	0.00	1.21
46.80	2.00	0.52	5.00	1.21	0.00	1.21
46.85	2.00	0.52	5.00	1.21	0.00	1.21
46.90	2.00	0.52	5.00	1.21	0.00	1.21
46.95	2.00	0.52	5.00	1.21	0.00	1.21
47.00	2.00	0.52	5.00	1.21	0.00	1.21
47.05	2.00	0.52	5.00	1.21	0.00	1.21
47.10	2.00	0.52	5.00	1.21	0.00	1.21
47.15	2.00	0.52	5.00	1.21	0.00	1.21

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47.20	2.00	0.52	5.00	1.21	0.00	1.21
47.25	2.00	0.52	5.00	1.21	0.00	1.21
47.30	2.00	0.52	5.00	1.21	0.00	1.21
47.35	2.00	0.52	5.00	1.21	0.00	1.21
47.40	2.00	0.52	5.00	1.21	0.00	1.21
47.45	2.00	0.52	5.00	1.21	0.00	1.21
47.50	2.00	0.52	5.00	1.21	0.00	1.21
47.55	2.00	0.52	5.00	1.21	0.00	1.21
47.60	2.00	0.52	5.00	1.21	0.00	1.21
47.65	2.00	0.52	5.00	1.21	0.00	1.21
47.70	2.00	0.52	5.00	1.21	0.00	1.21
47.75	2.00	0.52	5.00	1.21	0.00	1.21
47.80	2.00	0.52	5.00	1.21	0.00	1.21
47.85	2.00	0.52	5.00	1.21	0.00	1.21
47.90	2.00	0.52	5.00	1.21	0.00	1.21
47.95	2.00	0.52	5.00	1.21	0.00	1.21
48.00	2.00	0.52	5.00	1.21	0.00	1.21
48.05	2.00	0.52	5.00	1.21	0.00	1.21
48.10	2.00	0.52	5.00	1.21	0.00	1.21
48.15	2.00	0.52	5.00	1.21	0.00	1.21
48.20	2.00	0.52	5.00	1.21	0.00	1.21
48.25	2.00	0.52	5.00	1.21	0.00	1.21
48.30	2.00	0.52	5.00	1.21	0.00	1.21
48.35	2.00	0.52	5.00	1.21	0.00	1.21
48.40	2.00	0.52	5.00	1.21	0.00	1.21
48.45	2.00	0.52	5.00	1.21	0.00	1.21
48.50	2.00	0.52	5.00	1.21	0.00	1.21
48.55	2.00	0.52	5.00	1.21	0.00	1.21
48.60	2.00	0.52	5.00	1.21	0.00	1.21
48.65	2.00	0.52	5.00	1.21	0.00	1.21
48.70	2.00	0.52	5.00	1.21	0.00	1.21
48.75	2.00	0.52	5.00	1.21	0.00	1.21
48.80	2.00	0.52	5.00	1.21	0.00	1.21
48.85	2.00	0.52	5.00	1.21	0.00	1.21
48.90	2.00	0.52	5.00	1.21	0.00	1.21
48.95	2.00	0.52	5.00	1.21	0.00	1.21
49.00	2.00	0.52	5.00	1.21	0.00	1.21
49.05	2.00	0.52	5.00	1.21	0.00	1.21
49.10	2.00	0.52	5.00	1.21	0.00	1.21
49.15	2.00	0.52	5.00	1.21	0.00	1.21
49.20	2.00	0.52	5.00	1.21	0.00	1.21
49.25	2.00	0.52	5.00	1.21	0.00	1.21
49.30	2.00	0.52	5.00	1.21	0.00	1.21
49.35	2.00	0.52	5.00	1.21	0.00	1.21
49.40	2.00	0.52	5.00	1.21	0.00	1.21
49.45	2.00	0.52	5.00	1.21	0.00	1.21
49.50	2.00	0.52	5.00	1.21	0.00	1.21
49.55	2.00	0.52	5.00	1.21	0.00	1.21
49.60	2.00	0.52	5.00	1.21	0.00	1.21
49.65	2.00	0.52	5.00	1.21	0.00	1.21
49.70	2.00	0.52	5.00	1.21	0.00	1.21
49.75	2.00	0.52	5.00	1.21	0.00	1.21
49.80	2.00	0.52	5.00	1.21	0.00	1.21
49.85	2.00	0.52	5.00	1.21	0.00	1.21

49.90	2.00	0.52	5.00	1.21	0.00	1.21
49.95	2.00	0.52	5.00	1.21	0.00	1.21
50.00	2.00	0.52	5.00	1.21	0.00	1.21
50.05	2.00	0.52	5.00	1.21	0.00	1.21
50.10	2.00	0.52	5.00	1.21	0.00	1.21
50.15	2.00	0.52	5.00	1.21	0.00	1.21
50.20	2.00	0.52	5.00	1.21	0.00	1.21
50.25	2.00	0.52	5.00	1.21	0.00	1.21
50.30	2.00	0.51	5.00	1.21	0.00	1.21
50.35	2.00	0.51	5.00	1.21	0.00	1.21
50.40	2.00	0.51	5.00	1.21	0.00	1.21
50.45	2.00	0.51	5.00	1.21	0.00	1.21
50.50	2.00	0.51	5.00	1.21	0.00	1.21
50.55	2.00	0.51	5.00	1.21	0.00	1.21
50.60	2.00	0.51	5.00	1.21	0.00	1.21
50.65	2.00	0.51	5.00	1.21	0.00	1.21
50.70	2.00	0.51	5.00	1.21	0.00	1.21
50.75	2.00	0.51	5.00	1.21	0.00	1.21
50.80	2.00	0.51	5.00	1.21	0.00	1.21
50.85	2.00	0.51	5.00	1.21	0.00	1.21
50.90	2.00	0.51	5.00	1.21	0.00	1.21
50.95	2.00	0.51	5.00	1.21	0.00	1.21
51.00	2.00	0.51	5.00	1.21	0.00	1.21
51.05	2.00	0.51	5.00	1.21	0.00	1.21
51.10	2.00	0.51	5.00	1.21	0.00	1.21
51.15	2.00	0.51	5.00	1.21	0.00	1.21
51.20	2.00	0.51	5.00	1.21	0.00	1.21
51.25	2.00	0.51	5.00	1.21	0.00	1.21
51.30	2.00	0.51	5.00	1.21	0.00	1.21
51.35	2.00	0.51	5.00	1.21	0.00	1.21
51.40	2.00	0.51	5.00	1.21	0.00	1.21
51.45	2.00	0.51	5.00	1.21	0.00	1.21
51.50	2.00	0.51	5.00	1.21	0.00	1.21
51.55	2.00	0.51	5.00	1.21	0.00	1.21
51.60	2.00	0.51	5.00	1.21	0.00	1.21
51.65	2.00	0.51	5.00	1.21	0.00	1.21
51.70	2.00	0.51	5.00	1.21	0.00	1.21
51.75	2.00	0.51	5.00	1.21	0.00	1.21
51.80	2.00	0.51	5.00	1.21	0.00	1.21
51.85	2.00	0.51	5.00	1.21	0.00	1.21
51.90	2.00	0.51	5.00	1.21	0.00	1.21
51.95	2.00	0.51	5.00	1.21	0.00	1.21
52.00	2.00	0.51	5.00	1.21	0.00	1.21
52.05	2.00	0.51	5.00	1.21	0.00	1.21
52.10	2.00	0.51	5.00	1.21	0.00	1.21
52.15	2.00	0.51	5.00	1.21	0.00	1.21
52.20	2.00	0.51	5.00	1.21	0.00	1.21
52.25	2.00	0.51	5.00	1.21	0.00	1.21
52.30	2.00	0.51	5.00	1.21	0.00	1.21
52.35	2.00	0.51	5.00	1.21	0.00	1.21
52.40	2.00	0.51	5.00	1.21	0.00	1.21
52.45	2.00	0.51	5.00	1.21	0.00	1.21
52.50	2.00	0.51	5.00	1.21	0.00	1.21
52.55	2.00	0.51	5.00	1.21	0.00	1.21

52.60	2.00	0.51	5.00	1.21	0.00	1.21
52.65	2.00	0.51	5.00	1.21	0.00	1.21
52.70	2.00	0.51	5.00	1.21	0.00	1.21
52.75	2.00	0.51	5.00	1.21	0.00	1.21
52.80	2.00	0.51	5.00	1.21	0.00	1.21
52.85	2.00	0.51	5.00	1.21	0.00	1.21
52.90	2.00	0.51	5.00	1.21	0.00	1.21
52.95	2.00	0.51	5.00	1.21	0.00	1.21
53.00	2.00	0.51	5.00	1.21	0.00	1.21
53.05	2.00	0.51	5.00	1.21	0.00	1.21
53.10	2.00	0.51	5.00	1.21	0.00	1.21
53.15	2.00	0.51	5.00	1.21	0.00	1.21
53.20	2.00	0.51	5.00	1.21	0.00	1.21
53.25	2.00	0.51	5.00	1.21	0.00	1.21
53.30	2.00	0.51	5.00	1.21	0.00	1.21
53.35	2.00	0.51	5.00	1.21	0.00	1.21
53.40	2.00	0.51	5.00	1.21	0.00	1.21
53.45	2.00	0.51	5.00	1.21	0.00	1.21
53.50	2.00	0.51	5.00	1.21	0.00	1.21
53.55	2.00	0.51	5.00	1.21	0.00	1.21
53.60	2.00	0.51	5.00	1.21	0.00	1.21
53.65	2.00	0.51	5.00	1.21	0.00	1.21
53.70	2.00	0.51	5.00	1.21	0.00	1.21
53.75	2.00	0.50	5.00	1.21	0.00	1.21
53.80	2.00	0.50	5.00	1.21	0.00	1.21
53.85	2.00	0.50	5.00	1.21	0.00	1.21
53.90	2.00	0.50	5.00	1.21	0.00	1.21
53.95	2.00	0.50	5.00	1.21	0.00	1.21
54.00	2.00	0.50	5.00	1.21	0.00	1.21
54.05	2.00	0.50	5.00	1.21	0.00	1.21
54.10	2.00	0.50	5.00	1.21	0.00	1.21
54.15	2.00	0.50	5.00	1.21	0.00	1.21
54.20	2.00	0.50	5.00	1.21	0.00	1.21
54.25	2.00	0.50	5.00	1.21	0.00	1.21
54.30	2.00	0.50	5.00	1.21	0.00	1.21
54.35	2.00	0.50	5.00	1.21	0.00	1.21
54.40	2.00	0.50	5.00	1.21	0.00	1.21
54.45	2.00	0.50	5.00	1.21	0.00	1.21
54.50	2.00	0.50	5.00	1.21	0.00	1.21
54.55	2.00	0.50	5.00	1.21	0.00	1.21
54.60	2.00	0.50	5.00	1.21	0.00	1.21
54.65	2.00	0.50	5.00	1.21	0.00	1.21
54.70	2.00	0.50	5.00	1.21	0.00	1.21
54.75	2.00	0.50	5.00	1.21	0.00	1.21
54.80	2.00	0.50	5.00	1.21	0.00	1.21
54.85	2.00	0.50	5.00	1.21	0.00	1.21
54.90	2.00	0.50	5.00	1.21	0.00	1.21
54.95	2.00	0.50	5.00	1.21	0.00	1.21
55.00	2.00	0.50	5.00	1.21	0.00	1.21
55.05	2.00	0.50	5.00	1.21	0.00	1.21
55.10	2.00	0.50	5.00	1.21	0.00	1.21
55.15	2.00	0.50	5.00	1.21	0.00	1.21
55.20	2.00	0.50	5.00	1.21	0.00	1.21
55.25	2.00	0.50	5.00	1.21	0.00	1.21

55.30	2.00	0.50	5.00	1.21	0.00	1.21
55.35	2.00	0.50	5.00	1.21	0.00	1.21
55.40	2.00	0.50	5.00	1.21	0.00	1.21
55.45	2.00	0.50	5.00	1.21	0.00	1.21
55.50	2.00	0.50	5.00	1.21	0.00	1.21
55.55	2.00	0.50	5.00	1.21	0.00	1.21
55.60	2.00	0.50	5.00	1.21	0.00	1.21
55.65	2.00	0.50	5.00	1.21	0.00	1.21
55.70	2.00	0.50	5.00	1.21	0.00	1.21
55.75	2.00	0.50	5.00	1.21	0.00	1.21
55.80	2.00	0.50	5.00	1.21	0.00	1.21
55.85	2.00	0.50	5.00	1.21	0.00	1.21
55.90	2.00	0.50	5.00	1.21	0.00	1.21
55.95	2.00	0.50	5.00	1.21	0.00	1.21
56.00	2.00	0.50	5.00	1.21	0.00	1.21
56.05	0.31	0.50	0.62*	1.21	0.00	1.21
56.10	0.31	0.50	0.62*	1.20	0.00	1.20
56.15	0.31	0.50	0.62*	1.19	0.00	1.19
56.20	0.31	0.50	0.62*	1.18	0.00	1.18
56.25	0.31	0.50	0.62*	1.17	0.00	1.17
56.30	0.31	0.50	0.62*	1.16	0.00	1.16
56.35	0.31	0.50	0.63*	1.15	0.00	1.15
56.40	0.31	0.50	0.63*	1.14	0.00	1.14
56.45	0.31	0.50	0.63*	1.14	0.00	1.14
56.50	0.31	0.50	0.63*	1.13	0.00	1.13
56.55	0.31	0.50	0.63*	1.12	0.00	1.12
56.60	0.31	0.50	0.63*	1.11	0.00	1.11
56.65	0.31	0.50	0.64*	1.10	0.00	1.10
56.70	0.32	0.50	0.64*	1.09	0.00	1.09
56.75	0.32	0.49	0.64*	1.08	0.00	1.08
56.80	0.32	0.49	0.64*	1.08	0.00	1.08
56.85	0.32	0.49	0.64*	1.07	0.00	1.07
56.90	0.32	0.49	0.64*	1.06	0.00	1.06
56.95	0.32	0.49	0.64*	1.05	0.00	1.05
57.00	0.32	0.49	0.65*	1.04	0.00	1.04
57.05	0.32	0.49	0.65*	1.03	0.00	1.03
57.10	0.32	0.49	0.65*	1.02	0.00	1.02
57.15	0.32	0.49	0.65*	1.02	0.00	1.02
57.20	0.32	0.49	0.65*	1.01	0.00	1.01
57.25	0.32	0.49	0.65*	1.00	0.00	1.00
57.30	0.32	0.49	0.65*	0.99	0.00	0.99
57.35	0.32	0.49	0.66*	0.98	0.00	0.98
57.40	0.32	0.49	0.66*	0.97	0.00	0.97
57.45	0.32	0.49	0.66*	0.97	0.00	0.97
57.50	0.33	0.49	0.66*	0.96	0.00	0.96
57.55	0.33	0.49	0.66*	0.95	0.00	0.95
57.60	0.33	0.49	0.66*	0.94	0.00	0.94
57.65	0.33	0.49	0.67*	0.93	0.00	0.93
57.70	0.33	0.49	0.67*	0.92	0.00	0.92
57.75	0.33	0.49	0.67*	0.92	0.00	0.92
57.80	0.33	0.49	0.67*	0.91	0.00	0.91
57.85	0.33	0.49	0.67*	0.90	0.00	0.90
57.90	0.33	0.49	0.67*	0.89	0.00	0.89
57.95	0.33	0.49	0.67*	0.88	0.00	0.88

58.00	0.33	0.49	0.68*	0.87	0.00	0.87
58.05	0.33	0.49	0.68*	0.87	0.00	0.87
58.10	0.33	0.49	0.67*	0.86	0.00	0.86
58.15	0.33	0.49	0.67*	0.85	0.00	0.85
58.20	0.33	0.49	0.67*	0.84	0.00	0.84
58.25	0.33	0.49	0.67*	0.83	0.00	0.83
58.30	0.33	0.49	0.67*	0.83	0.00	0.83
58.35	0.33	0.49	0.67*	0.82	0.00	0.82
58.40	0.33	0.49	0.67*	0.81	0.00	0.81
58.45	0.33	0.49	0.67*	0.80	0.00	0.80
58.50	0.33	0.49	0.67*	0.79	0.00	0.79
58.55	0.32	0.49	0.67*	0.78	0.00	0.78
58.60	0.32	0.49	0.66*	0.78	0.00	0.78
58.65	0.32	0.49	0.66*	0.77	0.00	0.77
58.70	0.32	0.49	0.66*	0.76	0.00	0.76
58.75	0.32	0.49	0.66*	0.75	0.00	0.75
58.80	0.32	0.49	0.66*	0.74	0.00	0.74
58.85	0.32	0.49	0.66*	0.73	0.00	0.73
58.90	0.32	0.49	0.66*	0.73	0.00	0.73
58.95	0.32	0.49	0.66*	0.72	0.00	0.72
59.00	0.32	0.49	0.65*	0.71	0.00	0.71
59.05	0.32	0.49	0.65*	0.70	0.00	0.70
59.10	0.32	0.49	0.65*	0.69	0.00	0.69
59.15	0.32	0.49	0.65*	0.68	0.00	0.68
59.20	0.31	0.49	0.65*	0.67	0.00	0.67
59.25	0.31	0.49	0.65*	0.67	0.00	0.67
59.30	0.31	0.49	0.64*	0.66	0.00	0.66
59.35	0.31	0.49	0.64*	0.65	0.00	0.65
59.40	0.31	0.48	0.64*	0.64	0.00	0.64
59.45	0.31	0.48	0.64*	0.63	0.00	0.63
59.50	0.31	0.48	0.64*	0.62	0.00	0.62
59.55	0.31	0.48	0.64*	0.61	0.00	0.61
59.60	0.31	0.48	0.63*	0.61	0.00	0.61
59.65	0.31	0.48	0.63*	0.60	0.00	0.60
59.70	0.30	0.48	0.63*	0.59	0.00	0.59
59.75	0.30	0.48	0.63*	0.58	0.00	0.58
59.80	0.30	0.48	0.63*	0.57	0.00	0.57
59.85	0.30	0.48	0.62*	0.56	0.00	0.56
59.90	0.30	0.48	0.62*	0.55	0.00	0.55
59.95	0.30	0.48	0.62*	0.54	0.00	0.54
60.00	0.30	0.48	0.62*	0.54	0.00	0.54
60.05	0.30	0.48	0.62*	0.53	0.00	0.53
60.10	0.30	0.48	0.63*	0.52	0.00	0.52
60.15	0.31	0.48	0.64*	0.51	0.00	0.51
60.20	0.31	0.48	0.64*	0.50	0.00	0.50
60.25	0.31	0.48	0.65*	0.49	0.00	0.49
60.30	0.32	0.48	0.66*	0.48	0.00	0.48
60.35	0.32	0.48	0.66*	0.47	0.00	0.47
60.40	0.32	0.48	0.67*	0.47	0.00	0.47
60.45	0.33	0.48	0.68*	0.46	0.00	0.46
60.50	0.33	0.48	0.69*	0.45	0.00	0.45
60.55	0.33	0.48	0.69*	0.44	0.00	0.44
60.60	0.34	0.48	0.70*	0.43	0.00	0.43
60.65	0.34	0.48	0.71*	0.42	0.00	0.42

60.70	0.34	0.48	0.72*	0.42	0.00	0.42
60.75	0.35	0.48	0.72*	0.41	0.00	0.41
60.80	0.35	0.48	0.73*	0.40	0.00	0.40
60.85	0.35	0.48	0.74*	0.39	0.00	0.39
60.90	0.36	0.48	0.75*	0.39	0.00	0.39
60.95	0.36	0.48	0.75*	0.38	0.00	0.38
61.00	0.36	0.48	0.76*	0.37	0.00	0.37
61.05	0.37	0.48	0.77*	0.36	0.00	0.36
61.10	0.37	0.48	0.78*	0.36	0.00	0.36
61.15	0.38	0.48	0.79*	0.35	0.00	0.35
61.20	0.38	0.48	0.79*	0.34	0.00	0.34
61.25	0.38	0.48	0.80*	0.33	0.00	0.33
61.30	0.39	0.48	0.81*	0.33	0.00	0.33
61.35	0.39	0.48	0.82*	0.32	0.00	0.32
61.40	0.40	0.48	0.83*	0.31	0.00	0.31
61.45	0.40	0.48	0.84*	0.31	0.00	0.31
61.50	0.41	0.48	0.85*	0.30	0.00	0.30
61.55	0.41	0.48	0.86*	0.29	0.00	0.29
61.60	0.41	0.48	0.87*	0.29	0.00	0.29
61.65	0.42	0.48	0.88*	0.28	0.00	0.28
61.70	0.42	0.48	0.89*	0.27	0.00	0.27
61.75	0.43	0.48	0.90*	0.27	0.00	0.27
61.80	0.43	0.48	0.91*	0.26	0.00	0.26
61.85	0.44	0.48	0.93*	0.25	0.00	0.25
61.90	0.45	0.47	0.94*	0.25	0.00	0.25
61.95	0.45	0.47	0.95*	0.24	0.00	0.24
62.00	0.46	0.47	0.96*	0.24	0.00	0.24
62.05	0.46	0.47	0.97*	0.23	0.00	0.23
62.10	0.46	0.47	0.98*	0.22	0.00	0.22
62.15	0.47	0.47	0.99*	0.22	0.00	0.22
62.20	0.47	0.47	0.99*	0.21	0.00	0.21
62.25	0.48	0.47	1.00	0.21	0.00	0.21
62.30	0.48	0.47	1.01	0.20	0.00	0.20
62.35	0.48	0.47	1.02	0.19	0.00	0.19
62.40	0.49	0.47	1.03	0.19	0.00	0.19
62.45	0.49	0.47	1.04	0.18	0.00	0.18
62.50	0.50	0.47	1.05	0.18	0.00	0.18
62.55	0.50	0.47	1.06	0.17	0.00	0.17
62.60	0.51	0.47	1.07	0.17	0.00	0.17
62.65	0.51	0.47	1.09	0.16	0.00	0.16
62.70	0.52	0.47	1.10	0.16	0.00	0.16
62.75	0.52	0.47	1.11	0.15	0.00	0.15
62.80	0.53	0.47	1.13	0.15	0.00	0.15
62.85	0.54	0.47	1.15	0.14	0.00	0.14
62.90	0.55	0.47	1.17	0.14	0.00	0.14
62.95	0.56	0.47	1.19	0.13	0.00	0.13
63.00	0.57	0.47	1.22	0.13	0.00	0.13
63.05	0.59	0.47	1.26	0.12	0.00	0.12
63.10	0.62	0.47	1.31	0.12	0.00	0.12
63.15	0.65	0.47	1.39	0.12	0.00	0.12
63.20	0.67	0.47	1.44	0.11	0.00	0.11
63.25	0.67	0.47	1.44	0.11	0.00	0.11
63.30	0.67	0.47	1.44	0.10	0.00	0.10
63.35	0.67	0.47	1.44	0.10	0.00	0.10

63.40	0.67	0.47	1.44	0.10	0.00	0.10
63.45	0.67	0.47	1.44	0.09	0.00	0.09
63.50	0.67	0.47	1.44	0.09	0.00	0.09
63.55	0.67	0.47	1.44	0.08	0.00	0.08
63.60	0.67	0.47	1.44	0.08	0.00	0.08
63.65	0.67	0.47	1.44	0.08	0.00	0.08
63.70	0.67	0.47	1.44	0.07	0.00	0.07
63.75	0.67	0.47	1.44	0.07	0.00	0.07
63.80	0.67	0.47	1.44	0.07	0.00	0.07
63.85	0.67	0.47	1.44	0.06	0.00	0.06
63.90	0.67	0.47	1.44	0.06	0.00	0.06
63.95	0.67	0.47	1.44	0.06	0.00	0.06
64.00	0.67	0.47	1.44	0.05	0.00	0.05
64.05	0.67	0.47	1.45	0.05	0.00	0.05
64.10	0.67	0.47	1.45	0.05	0.00	0.05
64.15	0.67	0.47	1.45	0.04	0.00	0.04
64.20	0.67	0.47	1.45	0.04	0.00	0.04
64.25	0.67	0.46	1.45	0.04	0.00	0.04
64.30	0.67	0.46	1.45	0.04	0.00	0.04
64.35	0.67	0.46	1.45	0.03	0.00	0.03
64.40	0.67	0.46	1.45	0.03	0.00	0.03
64.45	0.67	0.46	1.45	0.03	0.00	0.03
64.50	0.67	0.46	1.45	0.03	0.00	0.03
64.55	0.67	0.46	1.45	0.03	0.00	0.03
64.60	0.67	0.46	1.45	0.03	0.00	0.03
64.65	0.67	0.46	1.45	0.02	0.00	0.02
64.70	0.67	0.46	1.45	0.02	0.00	0.02
64.75	0.67	0.46	1.45	0.02	0.00	0.02
64.80	0.67	0.46	1.45	0.02	0.00	0.02
64.85	0.67	0.46	1.45	0.02	0.00	0.02
64.90	0.67	0.46	1.45	0.02	0.00	0.02
64.95	0.67	0.46	1.45	0.02	0.00	0.02
65.00	0.67	0.46	1.45	0.02	0.00	0.02
65.05	0.67	0.46	1.46	0.01	0.00	0.01
65.10	0.67	0.46	1.46	0.01	0.00	0.01
65.15	0.67	0.46	1.46	0.01	0.00	0.01
65.20	0.67	0.46	1.46	0.01	0.00	0.01
65.25	0.67	0.46	1.46	0.01	0.00	0.01
65.30	0.67	0.46	1.46	0.01	0.00	0.01
65.35	0.67	0.46	1.46	0.01	0.00	0.01
65.40	0.67	0.46	1.46	0.01	0.00	0.01
65.45	0.67	0.46	1.46	0.01	0.00	0.01
65.50	0.67	0.46	1.46	0.01	0.00	0.01
65.55	0.67	0.46	1.46	0.01	0.00	0.01
65.60	0.67	0.46	1.46	0.00	0.00	0.00
65.65	0.67	0.46	1.46	0.00	0.00	0.00
65.70	0.67	0.46	1.46	0.00	0.00	0.00
65.75	0.67	0.46	1.46	0.00	0.00	0.00
65.80	0.67	0.46	1.46	0.00	0.00	0.00
65.85	0.67	0.46	1.46	0.00	0.00	0.00
65.90	0.67	0.46	1.46	0.00	0.00	0.00
65.95	0.67	0.46	1.46	0.00	0.00	0.00
66.00	0.67	0.46	1.46	0.00	0.00	0.00
66.05	0.67	0.46	1.47	0.00	0.00	0.00

66.10	0.67	0.46	1.47	0.00	0.00	0.00
66.15	0.67	0.46	1.47	0.00	0.00	0.00
66.20	0.67	0.46	1.47	0.00	0.00	0.00
66.25	0.67	0.46	1.47	0.00	0.00	0.00
66.30	0.67	0.46	1.47	0.00	0.00	0.00
66.35	0.67	0.46	1.47	0.00	0.00	0.00
66.40	0.67	0.46	1.47	0.00	0.00	0.00
66.45	0.67	0.45	1.47	0.00	0.00	0.00
66.50	0.67	0.45	1.47	0.00	0.00	0.00
66.55	0.67	0.45	1.47	0.00	0.00	0.00
66.60	0.67	0.45	1.47	0.00	0.00	0.00
66.65	0.67	0.45	1.47	0.00	0.00	0.00
66.70	0.67	0.45	1.47	0.00	0.00	0.00
66.75	0.67	0.45	1.47	0.00	0.00	0.00
66.80	0.67	0.45	1.47	0.00	0.00	0.00
66.85	0.67	0.45	1.47	0.00	0.00	0.00
66.90	0.67	0.45	1.47	0.00	0.00	0.00
66.95	0.67	0.45	1.47	0.00	0.00	0.00
67.00	0.67	0.45	1.48	0.00	0.00	0.00
67.05	0.67	0.45	1.48	0.00	0.00	0.00
67.10	0.67	0.45	1.48	0.00	0.00	0.00
67.15	0.67	0.45	1.48	0.00	0.00	0.00
67.20	0.67	0.45	1.48	0.00	0.00	0.00
67.25	0.67	0.45	1.48	0.00	0.00	0.00
67.30	0.67	0.45	1.48	0.00	0.00	0.00
67.35	0.67	0.45	1.48	0.00	0.00	0.00
67.40	0.67	0.45	1.48	0.00	0.00	0.00
67.45	0.67	0.45	1.48	0.00	0.00	0.00
67.50	0.67	0.45	1.48	0.00	0.00	0.00
67.55	0.67	0.45	1.48	0.00	0.00	0.00
67.60	0.67	0.45	1.48	0.00	0.00	0.00
67.65	0.67	0.45	1.48	0.00	0.00	0.00
67.70	0.67	0.45	1.48	0.00	0.00	0.00
67.75	0.67	0.45	1.48	0.00	0.00	0.00
67.80	0.67	0.45	1.48	0.00	0.00	0.00
67.85	0.67	0.45	1.48	0.00	0.00	0.00
67.90	0.67	0.45	1.49	0.00	0.00	0.00
67.95	0.67	0.45	1.49	0.00	0.00	0.00
68.00	0.67	0.45	1.49	0.00	0.00	0.00
68.05	0.67	0.45	1.49	0.00	0.00	0.00
68.10	0.66	0.45	1.49	0.00	0.00	0.00
68.15	0.66	0.45	1.49	0.00	0.00	0.00
68.20	0.66	0.45	1.49	0.00	0.00	0.00
68.25	0.66	0.45	1.49	0.00	0.00	0.00
68.30	0.66	0.45	1.49	0.00	0.00	0.00
68.35	0.66	0.45	1.49	0.00	0.00	0.00
68.40	0.66	0.45	1.49	0.00	0.00	0.00
68.45	0.66	0.45	1.49	0.00	0.00	0.00
68.50	0.66	0.45	1.49	0.00	0.00	0.00
68.55	0.66	0.44	1.49	0.00	0.00	0.00
68.60	0.66	0.44	1.49	0.00	0.00	0.00
68.65	0.66	0.44	1.49	0.00	0.00	0.00
68.70	0.66	0.44	1.49	0.00	0.00	0.00
68.75	0.66	0.44	1.50	0.00	0.00	0.00

68.80	0.66	0.44	1.50	0.00	0.00	0.00
68.85	0.66	0.44	1.50	0.00	0.00	0.00
68.90	0.66	0.44	1.50	0.00	0.00	0.00
68.95	0.66	0.44	1.50	0.00	0.00	0.00
69.00	0.66	0.44	1.50	0.00	0.00	0.00
69.05	0.66	0.44	1.50	0.00	0.00	0.00
69.10	0.66	0.44	1.50	0.00	0.00	0.00
69.15	0.66	0.44	1.50	0.00	0.00	0.00
69.20	0.66	0.44	1.50	0.00	0.00	0.00
69.25	0.66	0.44	1.50	0.00	0.00	0.00
69.30	0.66	0.44	1.50	0.00	0.00	0.00
69.35	0.66	0.44	1.50	0.00	0.00	0.00
69.40	0.66	0.44	1.50	0.00	0.00	0.00
69.45	0.66	0.44	1.50	0.00	0.00	0.00
69.50	0.66	0.44	1.50	0.00	0.00	0.00
69.55	0.66	0.44	1.50	0.00	0.00	0.00
69.60	0.66	0.44	1.51	0.00	0.00	0.00
69.65	0.66	0.44	1.51	0.00	0.00	0.00
69.70	0.66	0.44	1.51	0.00	0.00	0.00
69.75	0.66	0.44	1.51	0.00	0.00	0.00
69.80	0.66	0.44	1.51	0.00	0.00	0.00
69.85	0.66	0.44	1.51	0.00	0.00	0.00
69.90	0.66	0.44	1.51	0.00	0.00	0.00
69.95	0.66	0.44	1.51	0.00	0.00	0.00
70.00	0.66	0.44	1.51	0.00	0.00	0.00
70.05	2.00	0.44	5.00	0.00	0.00	0.00
70.10	2.00	0.44	5.00	0.00	0.00	0.00
70.15	2.00	0.44	5.00	0.00	0.00	0.00
70.20	2.00	0.44	5.00	0.00	0.00	0.00
70.25	2.00	0.44	5.00	0.00	0.00	0.00
70.30	2.00	0.44	5.00	0.00	0.00	0.00
70.35	2.00	0.44	5.00	0.00	0.00	0.00
70.40	2.00	0.44	5.00	0.00	0.00	0.00
70.45	2.00	0.44	5.00	0.00	0.00	0.00
70.50	2.00	0.44	5.00	0.00	0.00	0.00
70.55	2.00	0.43	5.00	0.00	0.00	0.00
70.60	2.00	0.43	5.00	0.00	0.00	0.00
70.65	2.00	0.43	5.00	0.00	0.00	0.00
70.70	2.00	0.43	5.00	0.00	0.00	0.00
70.75	2.00	0.43	5.00	0.00	0.00	0.00
70.80	2.00	0.43	5.00	0.00	0.00	0.00
70.85	2.00	0.43	5.00	0.00	0.00	0.00
70.90	2.00	0.43	5.00	0.00	0.00	0.00
70.95	2.00	0.43	5.00	0.00	0.00	0.00
71.00	2.00	0.43	5.00	0.00	0.00	0.00
71.05	2.00	0.43	5.00	0.00	0.00	0.00
71.10	2.00	0.43	5.00	0.00	0.00	0.00
71.15	2.00	0.43	5.00	0.00	0.00	0.00
71.20	2.00	0.43	5.00	0.00	0.00	0.00
71.25	2.00	0.43	5.00	0.00	0.00	0.00
71.30	2.00	0.43	5.00	0.00	0.00	0.00
71.35	2.00	0.43	5.00	0.00	0.00	0.00
71.40	2.00	0.43	5.00	0.00	0.00	0.00
71.45	2.00	0.43	5.00	0.00	0.00	0.00

71.50	2.00	0.43	5.00	0.00	0.00	0.00
71.55	2.00	0.43	5.00	0.00	0.00	0.00
71.60	2.00	0.43	5.00	0.00	0.00	0.00
71.65	2.00	0.43	5.00	0.00	0.00	0.00
71.70	2.00	0.43	5.00	0.00	0.00	0.00
71.75	2.00	0.43	5.00	0.00	0.00	0.00
71.80	2.00	0.43	5.00	0.00	0.00	0.00
71.85	2.00	0.43	5.00	0.00	0.00	0.00
71.90	2.00	0.43	5.00	0.00	0.00	0.00
71.95	2.00	0.43	5.00	0.00	0.00	0.00
72.00	2.00	0.43	5.00	0.00	0.00	0.00
72.05	2.00	0.43	5.00	0.00	0.00	0.00
72.10	2.00	0.43	5.00	0.00	0.00	0.00
72.15	2.00	0.43	5.00	0.00	0.00	0.00
72.20	2.00	0.43	5.00	0.00	0.00	0.00
72.25	2.00	0.43	5.00	0.00	0.00	0.00
72.30	2.00	0.43	5.00	0.00	0.00	0.00
72.35	2.00	0.43	5.00	0.00	0.00	0.00
72.40	2.00	0.43	5.00	0.00	0.00	0.00
72.45	2.00	0.43	5.00	0.00	0.00	0.00
72.50	2.00	0.43	5.00	0.00	0.00	0.00
72.55	2.00	0.42	5.00	0.00	0.00	0.00
72.60	2.00	0.42	5.00	0.00	0.00	0.00
72.65	2.00	0.42	5.00	0.00	0.00	0.00
72.70	2.00	0.42	5.00	0.00	0.00	0.00
72.75	2.00	0.42	5.00	0.00	0.00	0.00
72.80	2.00	0.42	5.00	0.00	0.00	0.00
72.85	2.00	0.42	5.00	0.00	0.00	0.00
72.90	2.00	0.42	5.00	0.00	0.00	0.00
72.95	2.00	0.42	5.00	0.00	0.00	0.00
73.00	2.00	0.42	5.00	0.00	0.00	0.00
73.05	2.00	0.42	5.00	0.00	0.00	0.00
73.10	2.00	0.42	5.00	0.00	0.00	0.00
73.15	2.00	0.42	5.00	0.00	0.00	0.00
73.20	2.00	0.42	5.00	0.00	0.00	0.00
73.25	2.00	0.42	5.00	0.00	0.00	0.00
73.30	2.00	0.42	5.00	0.00	0.00	0.00
73.35	2.00	0.42	5.00	0.00	0.00	0.00
73.40	2.00	0.42	5.00	0.00	0.00	0.00
73.45	2.00	0.42	5.00	0.00	0.00	0.00
73.50	2.00	0.42	5.00	0.00	0.00	0.00
73.55	2.00	0.42	5.00	0.00	0.00	0.00
73.60	2.00	0.42	5.00	0.00	0.00	0.00
73.65	2.00	0.42	5.00	0.00	0.00	0.00
73.70	2.00	0.42	5.00	0.00	0.00	0.00
73.75	2.00	0.42	5.00	0.00	0.00	0.00
73.80	2.00	0.42	5.00	0.00	0.00	0.00
73.85	2.00	0.42	5.00	0.00	0.00	0.00
73.90	2.00	0.42	5.00	0.00	0.00	0.00
73.95	2.00	0.42	5.00	0.00	0.00	0.00
74.00	2.00	0.42	5.00	0.00	0.00	0.00
74.05	2.00	0.42	5.00	0.00	0.00	0.00
74.10	2.00	0.42	5.00	0.00	0.00	0.00
74.15	2.00	0.42	5.00	0.00	0.00	0.00

74.20	2.00	0.42	5.00	0.00	0.00	0.00
74.25	2.00	0.42	5.00	0.00	0.00	0.00
74.30	2.00	0.42	5.00	0.00	0.00	0.00
74.35	2.00	0.42	5.00	0.00	0.00	0.00
74.40	2.00	0.42	5.00	0.00	0.00	0.00
74.45	2.00	0.42	5.00	0.00	0.00	0.00
74.50	2.00	0.41	5.00	0.00	0.00	0.00
74.55	2.00	0.41	5.00	0.00	0.00	0.00
74.60	2.00	0.41	5.00	0.00	0.00	0.00
74.65	2.00	0.41	5.00	0.00	0.00	0.00
74.70	2.00	0.41	5.00	0.00	0.00	0.00
74.75	2.00	0.41	5.00	0.00	0.00	0.00
74.80	2.00	0.41	5.00	0.00	0.00	0.00
74.85	2.00	0.41	5.00	0.00	0.00	0.00
74.90	2.00	0.41	5.00	0.00	0.00	0.00
74.95	2.00	0.41	5.00	0.00	0.00	0.00
75.00	2.00	0.41	5.00	0.00	0.00	0.00
75.05	2.00	0.41	5.00	0.00	0.00	0.00
75.10	2.00	0.41	5.00	0.00	0.00	0.00
75.15	2.00	0.41	5.00	0.00	0.00	0.00
75.20	2.00	0.41	5.00	0.00	0.00	0.00
75.25	2.00	0.41	5.00	0.00	0.00	0.00
75.30	2.00	0.41	5.00	0.00	0.00	0.00
75.35	2.00	0.41	5.00	0.00	0.00	0.00
75.40	2.00	0.41	5.00	0.00	0.00	0.00
75.45	2.00	0.41	5.00	0.00	0.00	0.00
75.50	2.00	0.41	5.00	0.00	0.00	0.00
75.55	2.00	0.41	5.00	0.00	0.00	0.00
75.60	2.00	0.41	5.00	0.00	0.00	0.00
75.65	2.00	0.41	5.00	0.00	0.00	0.00
75.70	2.00	0.41	5.00	0.00	0.00	0.00
75.75	2.00	0.41	5.00	0.00	0.00	0.00
75.80	2.00	0.41	5.00	0.00	0.00	0.00
75.85	2.00	0.41	5.00	0.00	0.00	0.00
75.90	2.00	0.41	5.00	0.00	0.00	0.00
75.95	2.00	0.41	5.00	0.00	0.00	0.00
76.00	2.00	0.41	5.00	0.00	0.00	0.00
76.05	2.00	0.41	5.00	0.00	0.00	0.00
76.10	2.00	0.41	5.00	0.00	0.00	0.00
76.15	2.00	0.41	5.00	0.00	0.00	0.00
76.20	2.00	0.41	5.00	0.00	0.00	0.00
76.25	2.00	0.41	5.00	0.00	0.00	0.00
76.30	2.00	0.41	5.00	0.00	0.00	0.00
76.35	2.00	0.41	5.00	0.00	0.00	0.00
76.40	2.00	0.41	5.00	0.00	0.00	0.00
76.45	2.00	0.41	5.00	0.00	0.00	0.00
76.50	2.00	0.41	5.00	0.00	0.00	0.00
76.55	2.00	0.41	5.00	0.00	0.00	0.00
76.60	2.00	0.41	5.00	0.00	0.00	0.00
76.65	2.00	0.41	5.00	0.00	0.00	0.00
76.70	2.00	0.41	5.00	0.00	0.00	0.00
76.75	2.00	0.41	5.00	0.00	0.00	0.00
76.80	2.00	0.41	5.00	0.00	0.00	0.00
76.85	2.00	0.41	5.00	0.00	0.00	0.00

76.90	2.00	0.41	5.00	0.00	0.00	0.00
76.95	2.00	0.41	5.00	0.00	0.00	0.00
77.00	2.00	0.41	5.00	0.00	0.00	0.00
77.05	2.00	0.41	5.00	0.00	0.00	0.00
77.10	2.00	0.41	5.00	0.00	0.00	0.00
77.15	2.00	0.41	5.00	0.00	0.00	0.00
77.20	2.00	0.41	5.00	0.00	0.00	0.00
77.25	2.00	0.41	5.00	0.00	0.00	0.00
77.30	2.00	0.41	5.00	0.00	0.00	0.00
77.35	2.00	0.41	5.00	0.00	0.00	0.00
77.40	2.00	0.41	5.00	0.00	0.00	0.00
77.45	2.00	0.41	5.00	0.00	0.00	0.00
77.50	2.00	0.41	5.00	0.00	0.00	0.00
77.55	2.00	0.41	5.00	0.00	0.00	0.00
77.60	2.00	0.41	5.00	0.00	0.00	0.00
77.65	2.00	0.41	5.00	0.00	0.00	0.00
77.70	2.00	0.41	5.00	0.00	0.00	0.00
77.75	2.00	0.41	5.00	0.00	0.00	0.00
77.80	2.00	0.41	5.00	0.00	0.00	0.00
77.85	2.00	0.41	5.00	0.00	0.00	0.00
77.90	2.00	0.41	5.00	0.00	0.00	0.00
77.95	2.00	0.41	5.00	0.00	0.00	0.00
78.00	2.00	0.41	5.00	0.00	0.00	0.00
78.05	2.00	0.41	5.00	0.00	0.00	0.00
78.10	2.00	0.41	5.00	0.00	0.00	0.00
78.15	2.00	0.41	5.00	0.00	0.00	0.00
78.20	2.00	0.41	5.00	0.00	0.00	0.00
78.25	2.00	0.41	5.00	0.00	0.00	0.00
78.30	2.00	0.41	5.00	0.00	0.00	0.00
78.35	2.00	0.41	5.00	0.00	0.00	0.00
78.40	2.00	0.41	5.00	0.00	0.00	0.00
78.45	2.00	0.41	5.00	0.00	0.00	0.00
78.50	2.00	0.41	5.00	0.00	0.00	0.00
78.55	2.00	0.41	5.00	0.00	0.00	0.00
78.60	2.00	0.41	5.00	0.00	0.00	0.00
78.65	2.00	0.41	5.00	0.00	0.00	0.00
78.70	2.00	0.41	5.00	0.00	0.00	0.00
78.75	2.00	0.41	5.00	0.00	0.00	0.00
78.80	2.00	0.41	5.00	0.00	0.00	0.00
78.85	2.00	0.41	5.00	0.00	0.00	0.00
78.90	2.00	0.41	5.00	0.00	0.00	0.00
78.95	2.00	0.41	5.00	0.00	0.00	0.00
79.00	2.00	0.41	5.00	0.00	0.00	0.00
79.05	2.00	0.41	5.00	0.00	0.00	0.00
79.10	2.00	0.41	5.00	0.00	0.00	0.00
79.15	2.00	0.41	5.00	0.00	0.00	0.00
79.20	2.00	0.41	5.00	0.00	0.00	0.00
79.25	2.00	0.41	5.00	0.00	0.00	0.00
79.30	2.00	0.41	5.00	0.00	0.00	0.00
79.35	2.00	0.41	5.00	0.00	0.00	0.00
79.40	2.00	0.41	5.00	0.00	0.00	0.00
79.45	2.00	0.41	5.00	0.00	0.00	0.00
79.50	2.00	0.41	5.00	0.00	0.00	0.00
79.55	2.00	0.41	5.00	0.00	0.00	0.00

79.60	2.00	0.41	5.00	0.00	0.00	0.00
79.65	2.00	0.41	5.00	0.00	0.00	0.00
79.70	2.00	0.41	5.00	0.00	0.00	0.00
79.75	2.00	0.41	5.00	0.00	0.00	0.00
79.80	2.00	0.41	5.00	0.00	0.00	0.00
79.85	2.00	0.40	5.00	0.00	0.00	0.00
79.90	2.00	0.40	5.00	0.00	0.00	0.00
79.95	2.00	0.40	5.00	0.00	0.00	0.00
80.00	2.00	0.40	5.00	0.00	0.00	0.00
80.05	2.00	0.40	5.00	0.00	0.00	0.00
80.10	2.00	0.40	5.00	0.00	0.00	0.00
80.15	2.00	0.40	5.00	0.00	0.00	0.00
80.20	2.00	0.40	5.00	0.00	0.00	0.00
80.25	2.00	0.40	5.00	0.00	0.00	0.00
80.30	2.00	0.40	5.00	0.00	0.00	0.00
80.35	2.00	0.40	5.00	0.00	0.00	0.00
80.40	2.00	0.40	5.00	0.00	0.00	0.00
80.45	2.00	0.40	5.00	0.00	0.00	0.00
80.50	2.00	0.40	5.00	0.00	0.00	0.00
80.55	2.00	0.40	5.00	0.00	0.00	0.00
80.60	2.00	0.40	5.00	0.00	0.00	0.00
80.65	2.00	0.40	5.00	0.00	0.00	0.00
80.70	2.00	0.40	5.00	0.00	0.00	0.00
80.75	2.00	0.40	5.00	0.00	0.00	0.00
80.80	2.00	0.40	5.00	0.00	0.00	0.00
80.85	2.00	0.40	5.00	0.00	0.00	0.00
80.90	2.00	0.40	5.00	0.00	0.00	0.00
80.95	2.00	0.40	5.00	0.00	0.00	0.00
81.00	2.00	0.40	5.00	0.00	0.00	0.00
81.05	2.00	0.40	5.00	0.00	0.00	0.00
81.10	2.00	0.40	5.00	0.00	0.00	0.00
81.15	2.00	0.40	5.00	0.00	0.00	0.00
81.20	2.00	0.40	5.00	0.00	0.00	0.00
81.25	2.00	0.40	5.00	0.00	0.00	0.00
81.30	2.00	0.40	5.00	0.00	0.00	0.00
81.35	2.00	0.40	5.00	0.00	0.00	0.00
81.40	2.00	0.40	5.00	0.00	0.00	0.00
81.45	2.00	0.40	5.00	0.00	0.00	0.00
81.50	2.00	0.40	5.00	0.00	0.00	0.00
81.55	2.00	0.40	5.00	0.00	0.00	0.00
81.60	2.00	0.40	5.00	0.00	0.00	0.00
81.65	2.00	0.40	5.00	0.00	0.00	0.00
81.70	2.00	0.40	5.00	0.00	0.00	0.00
81.75	2.00	0.40	5.00	0.00	0.00	0.00
81.80	2.00	0.40	5.00	0.00	0.00	0.00
81.85	2.00	0.40	5.00	0.00	0.00	0.00
81.90	2.00	0.40	5.00	0.00	0.00	0.00
81.95	2.00	0.40	5.00	0.00	0.00	0.00
82.00	2.00	0.40	5.00	0.00	0.00	0.00
82.05	2.00	0.40	5.00	0.00	0.00	0.00
82.10	2.00	0.40	5.00	0.00	0.00	0.00
82.15	2.00	0.40	5.00	0.00	0.00	0.00
82.20	2.00	0.40	5.00	0.00	0.00	0.00
82.25	2.00	0.40	5.00	0.00	0.00	0.00

82.30	2.00	0.40	5.00	0.00	0.00	0.00
82.35	2.00	0.40	5.00	0.00	0.00	0.00
82.40	2.00	0.40	5.00	0.00	0.00	0.00
82.45	2.00	0.40	5.00	0.00	0.00	0.00
82.50	2.00	0.40	5.00	0.00	0.00	0.00
82.55	2.00	0.40	5.00	0.00	0.00	0.00
82.60	2.00	0.40	5.00	0.00	0.00	0.00
82.65	2.00	0.40	5.00	0.00	0.00	0.00
82.70	2.00	0.40	5.00	0.00	0.00	0.00
82.75	2.00	0.40	5.00	0.00	0.00	0.00
82.80	2.00	0.40	5.00	0.00	0.00	0.00
82.85	2.00	0.40	5.00	0.00	0.00	0.00
82.90	2.00	0.40	5.00	0.00	0.00	0.00
82.95	2.00	0.40	5.00	0.00	0.00	0.00
83.00	2.00	0.40	5.00	0.00	0.00	0.00
83.05	2.00	0.40	5.00	0.00	0.00	0.00
83.10	2.00	0.40	5.00	0.00	0.00	0.00
83.15	2.00	0.40	5.00	0.00	0.00	0.00
83.20	2.00	0.40	5.00	0.00	0.00	0.00
83.25	2.00	0.40	5.00	0.00	0.00	0.00
83.30	2.00	0.40	5.00	0.00	0.00	0.00
83.35	2.00	0.40	5.00	0.00	0.00	0.00
83.40	2.00	0.40	5.00	0.00	0.00	0.00
83.45	2.00	0.40	5.00	0.00	0.00	0.00
83.50	2.00	0.40	5.00	0.00	0.00	0.00
83.55	2.00	0.40	5.00	0.00	0.00	0.00
83.60	2.00	0.40	5.00	0.00	0.00	0.00
83.65	2.00	0.40	5.00	0.00	0.00	0.00
83.70	2.00	0.40	5.00	0.00	0.00	0.00
83.75	2.00	0.40	5.00	0.00	0.00	0.00
83.80	2.00	0.40	5.00	0.00	0.00	0.00
83.85	2.00	0.40	5.00	0.00	0.00	0.00
83.90	2.00	0.40	5.00	0.00	0.00	0.00
83.95	2.00	0.40	5.00	0.00	0.00	0.00
84.00	2.00	0.40	5.00	0.00	0.00	0.00
84.05	2.00	0.40	5.00	0.00	0.00	0.00
84.10	2.00	0.40	5.00	0.00	0.00	0.00
84.15	2.00	0.40	5.00	0.00	0.00	0.00
84.20	2.00	0.40	5.00	0.00	0.00	0.00
84.25	2.00	0.40	5.00	0.00	0.00	0.00
84.30	2.00	0.40	5.00	0.00	0.00	0.00
84.35	2.00	0.40	5.00	0.00	0.00	0.00
84.40	2.00	0.40	5.00	0.00	0.00	0.00
84.45	2.00	0.40	5.00	0.00	0.00	0.00
84.50	2.00	0.40	5.00	0.00	0.00	0.00
84.55	2.00	0.40	5.00	0.00	0.00	0.00
84.60	2.00	0.40	5.00	0.00	0.00	0.00
84.65	2.00	0.40	5.00	0.00	0.00	0.00
84.70	2.00	0.40	5.00	0.00	0.00	0.00
84.75	2.00	0.40	5.00	0.00	0.00	0.00
84.80	2.00	0.40	5.00	0.00	0.00	0.00
84.85	2.00	0.40	5.00	0.00	0.00	0.00
84.90	2.00	0.40	5.00	0.00	0.00	0.00
84.95	2.00	0.40	5.00	0.00	0.00	0.00

85.00	2.00	0.40	5.00	0.00	0.00	0.00
85.05	2.00	0.40	5.00	0.00	0.00	0.00
85.10	2.00	0.40	5.00	0.00	0.00	0.00
85.15	2.00	0.40	5.00	0.00	0.00	0.00
85.20	2.00	0.40	5.00	0.00	0.00	0.00
85.25	2.00	0.40	5.00	0.00	0.00	0.00
85.30	2.00	0.40	5.00	0.00	0.00	0.00
85.35	2.00	0.40	5.00	0.00	0.00	0.00
85.40	2.00	0.40	5.00	0.00	0.00	0.00
85.45	2.00	0.40	5.00	0.00	0.00	0.00
85.50	2.00	0.40	5.00	0.00	0.00	0.00
85.55	2.00	0.40	5.00	0.00	0.00	0.00
85.60	2.00	0.40	5.00	0.00	0.00	0.00
85.65	2.00	0.40	5.00	0.00	0.00	0.00
85.70	2.00	0.40	5.00	0.00	0.00	0.00
85.75	2.00	0.40	5.00	0.00	0.00	0.00
85.80	2.00	0.40	5.00	0.00	0.00	0.00
85.85	2.00	0.40	5.00	0.00	0.00	0.00
85.90	2.00	0.40	5.00	0.00	0.00	0.00
85.95	2.00	0.40	5.00	0.00	0.00	0.00
86.00	2.00	0.40	5.00	0.00	0.00	0.00
86.05	2.00	0.40	5.00	0.00	0.00	0.00
86.10	2.00	0.40	5.00	0.00	0.00	0.00
86.15	2.00	0.40	5.00	0.00	0.00	0.00
86.20	2.00	0.40	5.00	0.00	0.00	0.00
86.25	2.00	0.40	5.00	0.00	0.00	0.00
86.30	2.00	0.40	5.00	0.00	0.00	0.00
86.35	2.00	0.40	5.00	0.00	0.00	0.00
86.40	2.00	0.40	5.00	0.00	0.00	0.00
86.45	2.00	0.40	5.00	0.00	0.00	0.00
86.50	2.00	0.40	5.00	0.00	0.00	0.00
86.55	2.00	0.40	5.00	0.00	0.00	0.00
86.60	2.00	0.40	5.00	0.00	0.00	0.00
86.65	2.00	0.40	5.00	0.00	0.00	0.00
86.70	2.00	0.40	5.00	0.00	0.00	0.00
86.75	2.00	0.40	5.00	0.00	0.00	0.00
86.80	2.00	0.40	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

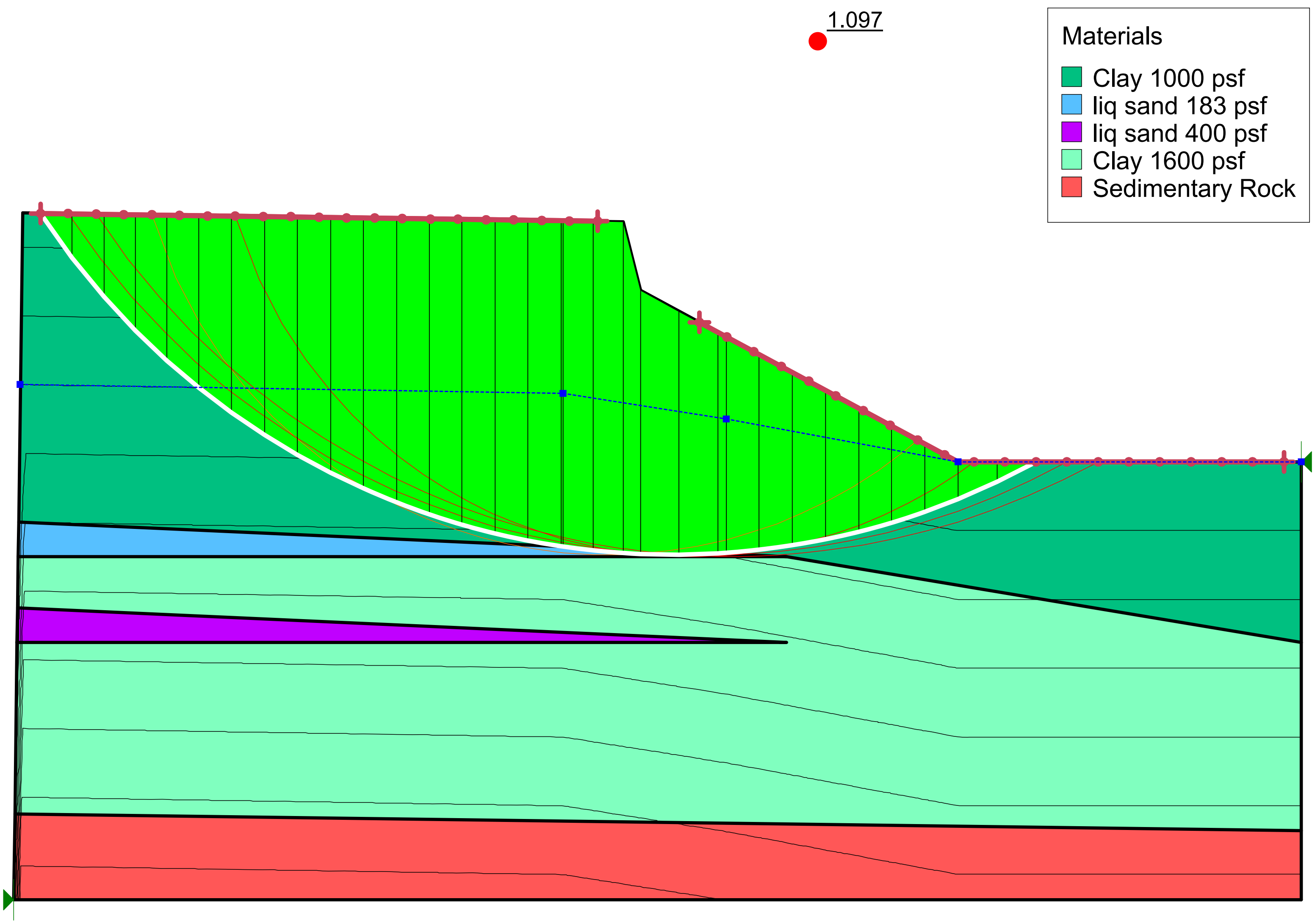
Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Appendix IV.3 Slope Stability Trials

Las Trampas Creek Bridge
P17043
Psuedostatic
Horizontal Seismic Coefficient 0.2g
Liquefiable Layers



Slope Stability

File Information

File Version: 8.15
Title: Las Trampas north
Created By: Frank Taber
Last Edited By: Frank Taber
Revision Number: 17
Date: 3/21/2019
Time: 3:28:57 PM
Tool Version: 8.15.6.13446
File Name: Las Trampas North March 2019.gsz
Directory: G:\Projects\Y2017\P17043 S Main St Br Las Trampas Cr\Calculations\GeoStudio\
Last Solved Date: 3/21/2019
Last Solved Time: 3:29:04 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Slope Stability

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 10
Resisting Side Maximum Convex Angle: 1 °

Driving Side Maximum Convex Angle: 5 °
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Clay 1000 psf

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

liq sand 183 psf

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 183 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

liq sand 400 psf

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay 1600 psf

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 1,600 psf
Phi': 0 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sedimentary Rock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (3.08324, 99.97024) ft
Left-Zone Right Coordinate: (68, 99.04286) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (79.91219, 87.26368) ft
Right-Zone Right Coordinate: (148, 71) ft
Right-Zone Increment: 20
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 20) ft
Right Coordinate: (150, 71) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	0.75	80
Coordinate 2	64	79
Coordinate 3	83	76
Coordinate 4	110	71
Coordinate 5	150	71

Seismic Coefficients

Horz Seismic Coef.: 0.2

Points

	X (ft)	Y (ft)

Point 1	1	100
Point 2	71	99
Point 3	73	91
Point 4	110	71
Point 5	150	71
Point 6	150	20
Point 7	0	20
Point 8	0.55	64
Point 9	90	60
Point 10	0.5	60
Point 11	0.425	54
Point 12	90	50
Point 13	0.375	50
Point 14	150	50
Point 15	0.125	30
Point 16	150	28

Regions

	Material	Points	Area (ft^2)
Region 1	Clay 1600 psf	10,11,12,13,15,16,14,9	4,161.3
Region 2	liq sand 183 psf	8,10,9	179
Region 3	liq sand 400 psf	11,13,12	179.25
Region 4	Clay 1000 psf	9,14,5,4,3,2,1,8	4,183
Region 5	Sedimentary Rock	15,7,6,16	1,349.5

Current Slip Surface

Slip Surface: 63
F of S: 1.097
Volume: 2,586.8169 ft^3

Weight: 284,549.86 lbs
Resisting Moment: 10,267,677 lbs-ft
Activating Moment: 9,361,690.6 lbs-ft
Resisting Force: 101,082.48 lbs
Activating Force: 92,199.817 lbs
F of S Rank (Analysis): 1 of 2,205 slip surfaces
F of S Rank (Query): 1 of 5 slip surfaces
Exit: (119.11916, 71) ft
Entry: (3.08324, 99.970239) ft
Radius: 88.240316 ft
Center: (76.819065, 148.44066) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	4.9276665	97.373681	-1,088.2392	-917.81948	-0	1,000
Slice 2	8.6165195	92.527309	-789.46488	-148.3292	-0	1,000
Slice 3	12.305372	88.298988	-529.25693	429.34165	0	1,000
Slice 4	15.994225	84.56417	-299.84354	885.17763	0	1,000
Slice 5	19.683078	81.23968	-96.034701	1,258.9982	0	1,000
Slice 6	23.446571	78.213025	89.115672	1,581.291	0	1,000
Slice 7	27.284704	75.452155	257.60741	1,867.3914	0	1,000
Slice 8	31.122838	72.987529	407.61352	2,122.9017	0	1,000
Slice 9	34.960971	70.7908	540.90285	2,357.0993	0	1,000
Slice 10	38.799104	68.839697	658.86516	2,576.7238	0	1,000
Slice 11	42.637237	67.116475	762.60761	2,786.6537	0	1,000
Slice 12	46.47537	65.606869	853.02052	2,990.2977	0	1,000
Slice 13	50.313503	64.299346	930.82339	3,189.8152	0	1,000
Slice 14	54.151636	63.184585	996.59793	3,386.2279	0	1,000
Slice 15	57.989769	62.255088	1,050.812	3,579.4653	0	1,000
Slice 16	61.827902	61.504899	1,093.8372	3,768.3719	0	1,000
	63.873484	61.155212	1,113.6396	3,700.3192	0	183

Slice 17						
Slice 18	65.75	60.915131	1,111.2537	3,773.2884	0	183
Slice 19	69.25	60.543118	1,099.9831	3,910.4875	0	183
Slice 20	72	60.337723	1,085.705	3,618.2598	0	183
Slice 21	75.262457	60.243094	1,059.4661	3,200.0311	0	183
Slice 22	79.787372	60.279339	1,012.6221	3,072.7715	0	183
Slice 23	82.524914	60.386299	978.97581	3,273.9211	0	1,000
Slice 24	84.928571	60.595121	938.97874	3,172.2707	0	1,000
Slice 25	88.785714	61.037204	866.82133	2,976.8789	0	1,000
Slice 26	92.642857	61.652882	783.83162	2,733.6717	0	1,000
Slice 27	96.5	62.44589	689.77648	2,441.7411	0	1,000
Slice 28	100.35714	63.421201	584.3456	2,102.4057	0	1,000
Slice 29	104.21429	64.585192	467.14113	1,719.358	0	1,000
Slice 30	108.07143	65.945869	337.66347	1,298.5758	0	1,000
Slice 31	112.27979	67.677479	207.32533	941.83898	0	1,000
Slice 32	116.83937	69.839234	72.431825	650.07614	0	1,000

Appendix IV.4 Preliminary Axial Pile Capacity Analysis

```
==========================================================================

                 SHAFT for Windows, Version 2017.8.2

                  Serial Number :  158117577

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                (c) Copyright ENSOFT, Inc., 1987-2017
                      All Rights Reserved

==========================================================================


Path to file locations      : G:\Projects\Y2017\P17043 S Main St Br Las Trampas
Cr\Calculations\SHAFT\
Name of input data file     : Abut 1.sf8d
Name of output file         : Abut 1.sf8o
Name of plot output file    : Abut 1.sf8p
Name of runtime file        : Abut 1.sf8r


--------------------------------------------------------------------------
                     Time and Date of Analysis
--------------------------------------------------------------------------

          Date:  July 08, 2019     Time:  14:20:29

Las Trampas Abut 1, elev. 132, 4 ft CIDH


PROPOSED DEPTH =      60.0 FT
----------------


NUMBER OF LAYERS =    4
------------------


WATER TABLE DEPTH =      15.0 FT.
-------------------




SOIL INFORMATION
---------------

LAYER NO 1----CLAY
```

```
  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                         = 0.600E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.100E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                         = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.100E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.200E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.700E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.100E-04


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                         = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.230E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.200E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                         = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.230E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
```

```
   DEPTH, FT                                             = 0.360E+02


   LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.100E-04


 LAYER NO 3----SAND

   AT THE TOP

   SIDE FRICTION PROCEDURE: Ko METHOD
   LATERAL EARTH-PRESSURE COEFFICIENT - Ko               = 0.250E+00
   INTERNAL FRICTION ANGLE, DEG.                         = 0.401E+02  (*)
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.340E+02
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.115E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.360E+02

   AT THE BOTTOM

   SIDE FRICTION PROCEDURE: Ko METHOD
   LATERAL EARTH-PRESSURE COEFFICIENT - Ko               = 0.250E+00
   INTERNAL FRICTION ANGLE, DEG.                         = 0.394E+02  (*)
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.340E+02
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.115E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.450E+02

   LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.100E-04


LAYER NO  4----DECOMPOSED ROCK

   AT THE TOP

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                   = 0.000E+00
   POISSION RATIO OF GRAVEL                              = 0.300E+00
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.100E+03
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.130E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.450E+02


   AT THE BOTTOM

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                   = 0.000E+00
```

```
  POISSION RATIO OF GRAVEL                                = 0.300E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST           = 0.100E+03
  SOIL UNIT WEIGHT, LB/CU FT                              = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT                = 0.100E+11
  DEPTH, FT                                               = 0.750E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                  = 0.700E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                 = 0.100E-04


(*) ESTIMATED BY THE PROGRAM BASED ON OTHER PARAMETERS


INPUT DRILLED SHAFT INFORMATION
------------------------------

 MINIMUM SHAFT DIAMETER    =    4.000  FT.
 MAXIMUM SHAFT DIAMETER    =    4.000  FT.
 RATIO BASE/SHAFT DIAMETER =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    5.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 ELASTIC MODULUS, Ec       = 0.320E+07 LB/SQ IN


COMPUTATION RESULTS
-------------------


- CASE ANALYZED      :     1
  VARIATION LENGTH   :     1
  VARIATION DIAMETER :     1


DRILLED SHAFT INFORMATION

-------------------------

 DIAMETER OF STEM          =    4.000  FT.
```

```
DIAMETER OF BASE          =    4.000  FT.
END OF STEM TO BASE       =    0.000  FT.
ANGLE OF BELL             =    0.000  DEG.
IGNORED TOP PORTION       =    5.000  FT.
IGNORED BOTTOM PORTION    =    0.000  FT.
AREA OF ONE PERCENT STEEL =   18.098  SQ.IN.
ELASTIC MODULUS, Ec       = 0.320E+07 LB/SQ IN
VOLUME OF UNDERREAM       =    0.000  CU.YDS.
SHAFT LENGTH              =   60.000  FT.
```

PREDICTED RESULTS

QS   = ULTIMATE SIDE RESISTANCE;
QB   = ULTIMATE BASE RESISTANCE;
WT   = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU   = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FT)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
6.0	2.79	3.46	48.51	51.97	2.42	0.00	2.42
7.0	3.26	6.91	49.46	56.37	4.84	0.00	4.84
8.0	3.72	10.37	50.40	60.77	7.26	0.00	7.26
9.0	4.19	13.82	51.34	65.17	9.68	0.00	9.68
10.0	4.65	17.28	52.28	69.56	12.10	0.00	12.10
11.0	5.12	20.74	53.23	73.96	14.52	0.00	14.52
12.0	5.59	24.19	54.17	78.36	16.94	0.00	16.94
13.0	6.05	27.65	66.00	93.65	19.35	0.00	19.36
14.0	6.52	31.11	78.90	110.00	21.77	0.00	21.77
15.0	6.98	34.56	92.85	127.41	24.19	0.00	24.19
16.0	7.45	38.02	107.83	145.85	26.61	0.00	26.61
17.0	7.91	41.47	119.00	160.48	29.03	0.00	29.03
18.0	8.38	44.93	126.40	171.33	31.45	0.00	31.45
19.0	8.84	48.39	130.08	178.47	33.87	0.00	33.87
20.0	9.31	51.84	130.08	181.92	36.29	0.00	36.29
21.0	9.78	59.79	130.08	189.87	41.85	0.00	41.86
22.0	10.24	67.74	130.08	197.82	47.42	0.00	47.42
23.0	10.71	75.69	130.08	205.77	52.98	0.00	52.98
24.0	11.17	83.64	130.08	213.72	58.55	0.00	58.55
25.0	11.64	91.59	130.08	221.67	64.11	0.00	64.11
26.0	12.10	99.54	130.08	229.62	69.68	0.00	69.68
27.0	12.57	107.49	130.08	237.57	75.24	0.00	75.24

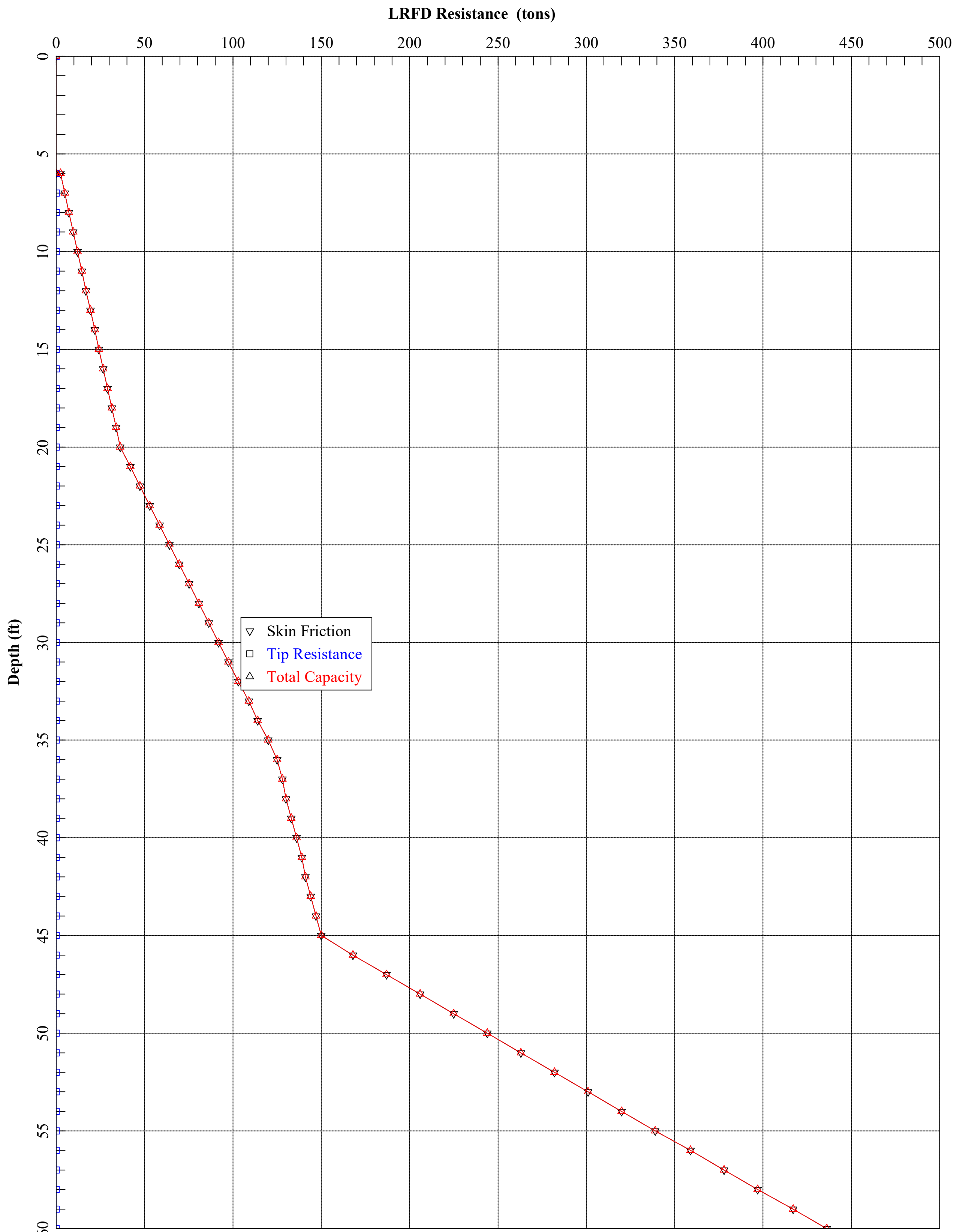
28.0	13.03	115.44	130.08	245.52	80.81	0.00	80.81
29.0	13.50	123.39	146.14	269.53	86.37	0.00	86.37
30.0	13.96	131.34	164.95	296.28	91.93	0.00	91.94
31.0	14.43	139.28	186.61	325.89	97.50	0.00	97.50
32.0	14.90	147.23	211.23	358.46	103.06	0.00	103.07
33.0	15.36	155.18	230.82	386.00	108.63	0.00	108.63
34.0	15.83	163.13	244.94	408.08	114.19	0.00	114.20
35.0	16.29	171.08	253.18	424.26	119.76	0.00	119.76
36.0	16.76	179.03	255.11	434.14	125.32	0.00	125.32
37.0	17.22	182.70	256.07	438.76	127.89	0.00	127.89
38.0	17.69	186.42	269.21	455.63	130.49	0.00	130.50
39.0	18.15	190.20	283.68	473.87	133.14	0.00	133.14
40.0	18.62	194.03	299.80	493.83	135.82	0.00	135.83
41.0	19.08	197.93	317.59	515.52	138.55	0.00	138.56
42.0	19.55	201.89	331.38	533.26	141.32	0.00	141.32
43.0	20.02	205.90	341.08	546.99	144.13	0.00	144.13
44.0	20.48	209.97	346.64	556.61	146.98	0.00	146.98
45.0	20.95	214.10	347.97	562.07	149.87	0.00	149.88
46.0	21.41	240.70	349.27	589.97	168.49	0.00	168.49
47.0	21.88	267.39	350.56	617.96	187.18	0.00	187.18
48.0	22.34	294.20	351.83	646.03	205.94	0.00	205.94
49.0	22.81	321.10	353.08	674.18	224.77	0.00	224.77
50.0	23.27	348.11	354.32	702.42	243.67	0.00	243.68
51.0	23.74	375.21	355.54	730.75	262.65	0.00	262.65
52.0	24.21	402.41	356.74	759.15	281.69	0.00	281.69
53.0	24.67	429.72	357.92	787.64	300.80	0.00	300.80
54.0	25.14	457.11	359.09	816.21	319.98	0.00	319.98
55.0	25.60	484.61	360.25	844.85	339.23	0.00	339.23
56.0	26.07	512.20	361.39	873.58	358.54	0.00	358.54
57.0	26.53	539.88	362.51	902.39	377.92	0.00	377.92
58.0	27.00	567.65	363.62	931.28	397.36	0.00	397.36
59.0	27.46	595.52	364.72	960.24	416.86	0.00	416.87
60.0	27.93	623.48	364.49	987.97	436.44	0.00	436.44

AXIAL LOAD VS SETTLEMENT CURVES

LOAD SETTLEMENT RELATIONSHIP

TOP LOAD TONS	TOP MOVEMENT IN.
0.6598E+02	0.2401E-01
0.1320E+03	0.4803E-01

0.1979E+03	0.7204E-01
0.2639E+03	0.9606E-01
0.3299E+03	0.1201E+00
0.3959E+03	0.1441E+00
0.4618E+03	0.1681E+00
0.5278E+03	0.1921E+00
0.5938E+03	0.2161E+00
0.6598E+03	0.2401E+00
0.7406E+03	0.7416E+00
0.8215E+03	0.1243E+01
0.9024E+03	0.1744E+01
0.9832E+03	0.2246E+01
0.9832E+03	0.2695E+01



Abutment 1 LRFD 48" CIDH Preliminary

==

SHAFT for Windows, Version 2017.8.2

Serial Number : 158117577

VERTICALLY LOADED DRILLED SHAFT ANALYSIS

==

Path to file locations : G:\Projects\Y2017\P17043 S Main St Br Las Trampas Cr\Calculations\SHAFT\
Name of input data file : Abut 3.sf8d
Name of output file : Abut 3.sf8o
Name of plot output file : Abut 3.sf8p
Name of runtime file : Abut 3.sf8r

Time and Date of Analysis

Date: July 05, 2019 Time: 15:46:33

Las Trampas Abut 3, elev. 138.5, 4 ft CIDH

PROPOSED DEPTH = 70.0 FT

NUMBER OF LAYERS = 4

WATER TABLE DEPTH = 20.0 FT.

SOIL INFORMATION

LAYER NO 1----CLAY

```
  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                          = 0.600E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.900E+03
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.110E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                          = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.900E+03
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.110E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.250E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.700E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.100E-04


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                          = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.160E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.250E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                          = 0.900E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.160E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
```

```
   DEPTH, FT                                             = 0.390E+02


   LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.100E-04


 LAYER NO 3----SAND

   AT THE TOP

   SIDE FRICTION PROCEDURE: Ko METHOD
   LATERAL EARTH-PRESSURE COEFFICIENT - Ko               = 0.250E+00
   INTERNAL FRICTION ANGLE, DEG.                         = 0.394E+02  (*)
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.340E+02
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.115E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.390E+02

   AT THE BOTTOM

   SIDE FRICTION PROCEDURE: Ko METHOD
   LATERAL EARTH-PRESSURE COEFFICIENT - Ko               = 0.250E+00
   INTERNAL FRICTION ANGLE, DEG.                         = 0.382E+02  (*)
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.340E+02
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.115E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.570E+02

   LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.100E-04


LAYER NO  4----DECOMPOSED ROCK

   AT THE TOP

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                   = 0.000E+00
   POISSION RATIO OF GRAVEL                              = 0.300E+00
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.100E+03
   SOIL UNIT WEIGHT, LB/CU FT                            = 0.130E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
   DEPTH, FT                                             = 0.570E+02


   AT THE BOTTOM

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                   = 0.000E+00
```

```
  POISSION RATIO OF GRAVEL                             = 0.300E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.100E+03
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.770E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.700E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.100E-04


(*) ESTIMATED BY THE PROGRAM BASED ON OTHER PARAMETERS


INPUT DRILLED SHAFT INFORMATION
------------------------------

 MINIMUM SHAFT DIAMETER    =    4.000  FT.
 MAXIMUM SHAFT DIAMETER    =    4.000  FT.
 RATIO BASE/SHAFT DIAMETER =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    5.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 ELASTIC MODULUS, Ec       = 0.320E+07 LB/SQ IN



COMPUTATION RESULTS
-------------------



- CASE ANALYZED      :     1
  VARIATION LENGTH   :     1
  VARIATION DIAMETER :     1


DRILLED SHAFT INFORMATION

-------------------------

 DIAMETER OF STEM          =    4.000  FT.
```

```
 DIAMETER OF BASE          =    4.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    5.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 AREA OF ONE PERCENT STEEL =   18.098  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.320E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.
 SHAFT LENGTH              =   70.000  FT.
```

PREDICTED RESULTS

```
QS      = ULTIMATE SIDE RESISTANCE;
QB      = ULTIMATE BASE RESISTANCE;
WT      = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU      = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.
```

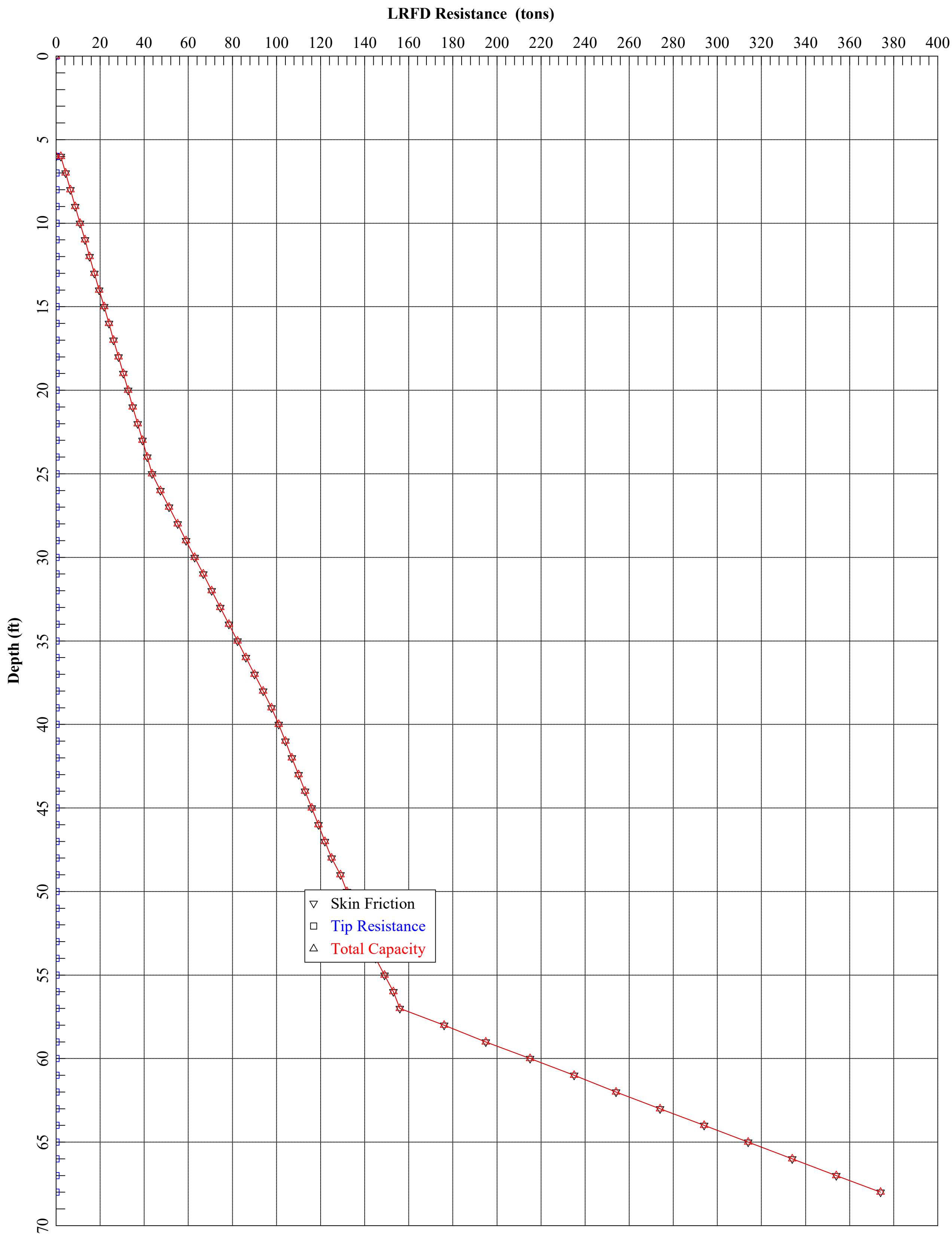
LENGTH (FT)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
6.0	2.79	3.11	41.72	44.83	2.18	0.00	2.18
7.0	3.26	6.22	42.39	48.62	4.35	0.00	4.36
8.0	3.72	9.33	43.07	52.40	6.53	0.00	6.53
9.0	4.19	12.44	43.75	56.19	8.71	0.00	8.71
10.0	4.65	15.55	44.43	59.98	10.89	0.00	10.89
11.0	5.12	18.66	45.11	63.77	13.06	0.00	13.06
12.0	5.59	21.77	45.79	67.56	15.24	0.00	15.24
13.0	6.05	24.88	46.47	71.35	17.42	0.00	17.42
14.0	6.52	28.00	47.15	75.14	19.60	0.00	19.60
15.0	6.98	31.11	47.82	78.93	21.77	0.00	21.77
16.0	7.45	34.22	48.50	82.72	23.95	0.00	23.95
17.0	7.91	37.33	49.18	86.51	26.13	0.00	26.13
18.0	8.38	40.44	55.70	96.13	28.31	0.00	28.31
19.0	8.84	43.55	62.76	106.31	30.48	0.00	30.48
20.0	9.31	46.66	70.36	117.01	32.66	0.00	32.66
21.0	9.78	49.77	78.48	128.25	34.84	0.00	34.84
22.0	10.24	52.88	84.52	137.40	37.02	0.00	37.02
23.0	10.71	55.99	88.51	144.50	39.19	0.00	39.19
24.0	11.17	59.10	90.49	149.59	41.37	0.00	41.37
25.0	11.64	62.21	90.49	152.70	43.55	0.00	43.55
26.0	12.10	67.74	90.49	158.23	47.42	0.00	47.42
27.0	12.57	73.27	90.49	163.76	51.29	0.00	51.29

28.0	13.03	78.80	90.49	169.29	55.16	0.00	55.16
29.0	13.50	84.33	90.49	174.82	59.03	0.00	59.03
30.0	13.96	89.86	90.49	180.35	62.90	0.00	62.90
31.0	14.43	95.39	90.49	185.88	66.77	0.00	66.77
32.0	14.90	100.92	115.37	216.30	70.64	0.00	70.65
33.0	15.36	106.45	143.02	249.47	74.52	0.00	74.52
34.0	15.83	111.98	173.44	285.42	78.39	0.00	78.39
35.0	16.29	117.51	206.62	324.13	82.26	0.00	82.26
36.0	16.76	123.04	231.50	354.54	86.13	0.00	86.13
37.0	17.22	128.57	248.09	376.66	90.00	0.00	90.00
38.0	17.69	134.10	256.39	390.49	93.87	0.00	93.87
39.0	18.15	139.63	256.39	396.02	97.74	0.00	97.74
40.0	18.62	143.79	256.39	400.17	100.65	0.00	100.65
41.0	19.08	148.00	256.39	404.39	103.60	0.00	103.60
42.0	19.55	152.27	256.39	408.66	106.59	0.00	106.59
43.0	20.02	156.60	256.39	412.99	109.62	0.00	109.62
44.0	20.48	160.98	256.39	417.37	112.69	0.00	112.69
45.0	20.95	165.42	256.39	421.81	115.80	0.00	115.80
46.0	21.41	169.92	256.39	426.30	118.94	0.00	118.94
47.0	21.88	174.47	256.39	430.86	122.13	0.00	122.13
48.0	22.34	179.07	256.39	435.46	125.35	0.00	125.35
49.0	22.81	183.74	256.39	440.12	128.61	0.00	128.62
50.0	23.27	188.45	271.82	460.27	131.92	0.00	131.92
51.0	23.74	193.22	289.13	482.35	135.25	0.00	135.26
52.0	24.21	198.04	308.35	506.40	138.63	0.00	138.63
53.0	24.67	202.92	329.50	532.42	142.04	0.00	142.05
54.0	25.14	207.85	345.72	553.57	145.50	0.00	145.50
55.0	25.60	212.84	356.96	569.79	148.98	0.00	148.99
56.0	26.07	217.87	363.16	581.03	152.51	0.00	152.51
57.0	26.53	222.96	364.27	587.23	156.07	0.00	156.08
58.0	27.00	250.88	365.36	616.24	175.62	0.00	175.62
59.0	27.46	278.89	366.43	645.32	195.22	0.00	195.23
60.0	27.93	306.99	367.50	674.49	214.89	0.00	214.90
61.0	28.39	335.18	368.55	703.73	234.63	0.00	234.63
62.0	28.86	363.46	369.59	733.05	254.42	0.00	254.42
63.0	29.33	391.82	370.62	762.44	274.27	0.00	274.28
64.0	29.79	420.27	371.64	791.91	294.19	0.00	294.19
65.0	30.26	448.81	372.65	821.46	314.17	0.00	314.17
66.0	30.72	477.43	373.64	851.08	334.20	0.00	334.20
67.0	31.19	506.14	374.63	880.77	354.30	0.00	354.30
68.0	31.65	534.93	375.61	910.53	374.45	0.00	374.45

AXIAL LOAD VS SETTLEMENT CURVES

LOAD SETTLEMENT RELATIONSHIP

TOP LOAD TONS	TOP MOVEMENT IN.
0.5628E+02	0.1911E-01
0.1126E+03	0.3823E-01
0.1688E+03	0.5734E-01
0.2251E+03	0.7645E-01
0.2814E+03	0.9556E-01
0.3377E+03	0.1147E+00
0.3940E+03	0.1338E+00
0.4503E+03	0.1529E+00
0.5065E+03	0.1720E+00
0.5628E+03	0.1911E+00
0.6506E+03	0.7354E+00
0.7384E+03	0.1280E+01
0.8261E+03	0.1824E+01
0.9139E+03	0.2368E+01
0.9139E+03	0.2842E+01



Abutment 3 LRFD 48" CIDH Preliminary

==

SHAFT for Windows, Version 2017.8.2

Serial Number : 158117577

VERTICALLY LOADED DRILLED SHAFT ANALYSIS

==

Path to file locations : G:\Projects\Y2017\P17043 S Main St Br Las Trampas Cr\Calculations\SHAFT\
Name of input data file : Bent 2.sf8d
Name of output file : Bent 2.sf8o
Name of plot output file : Bent 2.sf8p
Name of runtime file : Bent 2.sf8r

Time and Date of Analysis

Date: July 05, 2019 Time: 15:36:49

Las Trampas Pier 2, elev. 117.0, 6 ft CIDH

PROPOSED DEPTH = 58.0 FT

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 15.0 FT.

SOIL INFORMATION

LAYER NO 1----CLAY

```
  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                           = 0.600E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.900E+03
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00  (*)
  END BEARING COEFFICIENT-Nc                           = 0.880E+01  (*)
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.900E+03
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.140E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.700E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.100E-04


LAYER NO 2----SAND

  AT THE TOP

  SIDE FRICTION PROCEDURE: Ko METHOD
  LATERAL EARTH-PRESSURE COEFFICIENT - Ko              = 0.250E+00
  INTERNAL FRICTION ANGLE, DEG.                        = 0.421E+02  (*)
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.340E+02
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.140E+02

  AT THE BOTTOM

  SIDE FRICTION PROCEDURE: Ko METHOD
  LATERAL EARTH-PRESSURE COEFFICIENT - Ko              = 0.250E+00
  INTERNAL FRICTION ANGLE, DEG.                        = 0.395E+02  (*)
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.340E+02
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.410E+02
```

```
   LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.100E-04


LAYER NO  3----DECOMPOSED ROCK

   AT THE TOP

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                = 0.000E+00
   POISSION RATIO OF GRAVEL                           = 0.300E+00
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.100E+03
   SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
   DEPTH, FT                                          = 0.410E+02


   AT THE BOTTOM

   ELASTIC MODULUS OF GRAVEL, LB/SQ IN                = 0.000E+00
   POISSION RATIO OF GRAVEL                           = 0.300E+00
   BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.100E+03
   SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
   MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
   DEPTH, FT                                          = 0.700E+02


   LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.700E+00
   LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.100E-04



 (*) ESTIMATED BY THE PROGRAM BASED ON OTHER PARAMETERS



 INPUT DRILLED SHAFT INFORMATION
 ------------------------------

  MINIMUM SHAFT DIAMETER    =    6.000  FT.
  MAXIMUM SHAFT DIAMETER    =    6.000  FT.
  RATIO BASE/SHAFT DIAMETER =    0.000  FT.
  ANGLE OF BELL             =    0.000  DEG.
  IGNORED TOP PORTION       =    5.000  FT.
  IGNORED BOTTOM PORTION    =    0.000  FT.
  ELASTIC MODULUS, Ec       = 0.320E+07 LB/SQ IN
```

COMPUTATION RESULTS

- CASE ANALYZED : 1
  VARIATION LENGTH : 1
  VARIATION DIAMETER : 1

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	6.000	FT.
DIAMETER OF BASE	=	6.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	5.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	40.720	SQ.IN.
ELASTIC MODULUS, Ec	=	0.320E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.
SHAFT LENGTH	=	58.000	FT.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR
TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR
TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FT)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
6.0	6.28	4.67	107.88	112.54	3.27	0.00	3.27
7.0	7.33	9.33	110.39	119.72	6.53	0.00	6.53

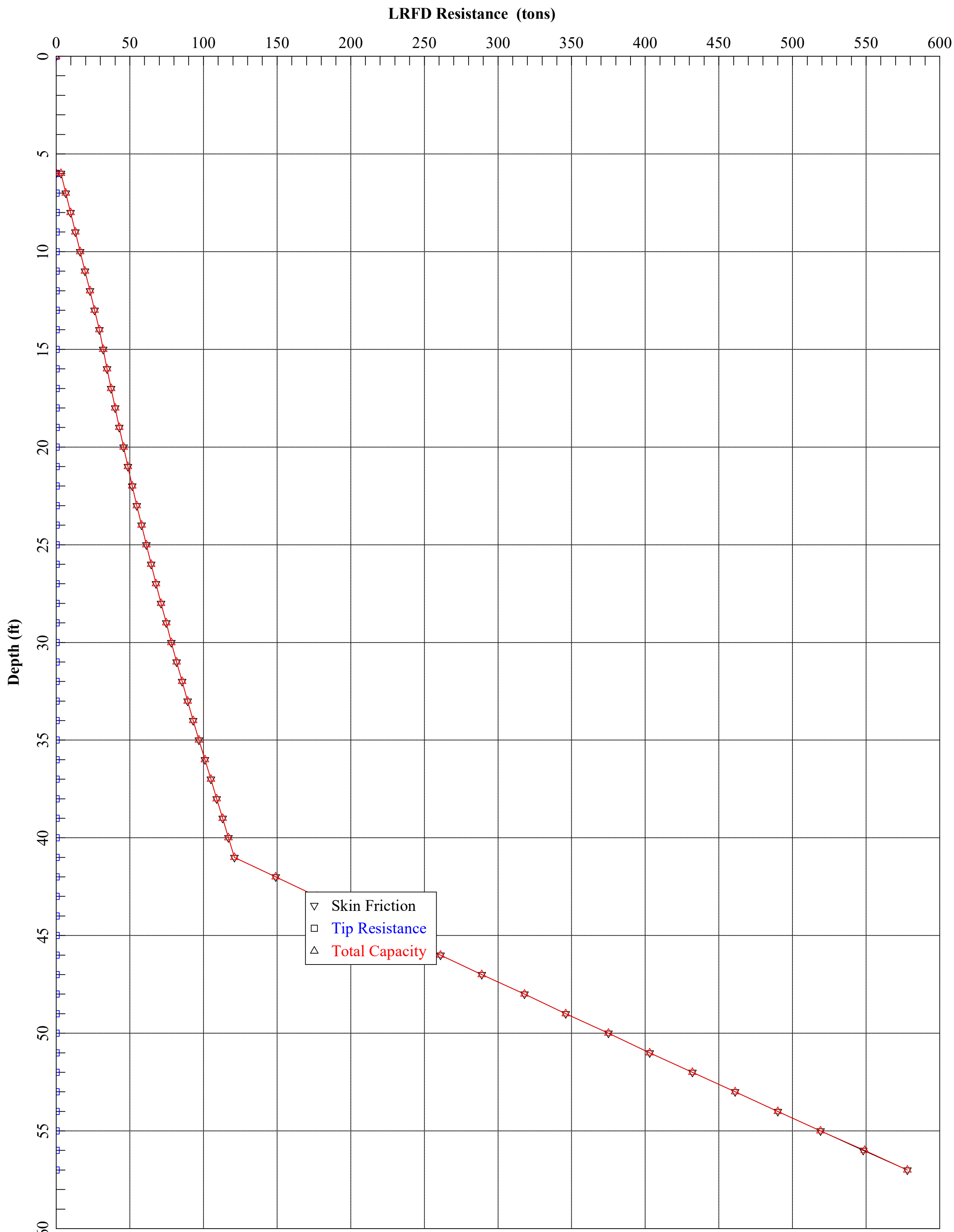
8.0	8.38	14.00	113.30	127.30	9.80	0.00	9.80
9.0	9.43	18.66	117.07	135.73	13.06	0.00	13.07
10.0	10.47	23.33	121.60	144.93	16.33	0.00	16.33
11.0	11.52	28.00	126.80	154.80	19.60	0.00	19.60
12.0	12.57	32.66	132.58	165.24	22.86	0.00	22.86
13.0	13.62	37.33	138.86	176.18	26.13	0.00	26.13
14.0	14.66	41.99	145.53	187.53	29.39	0.00	29.40
15.0	15.71	45.64	152.21	197.85	31.95	0.00	31.95
16.0	16.76	49.38	158.89	208.27	34.57	0.00	34.57
17.0	17.80	53.23	165.56	218.79	37.26	0.00	37.26
18.0	18.85	57.17	172.24	229.41	40.02	0.00	40.02
19.0	19.90	61.20	178.92	240.12	42.84	0.00	42.84
20.0	20.95	65.33	185.59	250.93	45.73	0.00	45.74
21.0	21.99	69.56	192.27	261.83	48.69	0.00	48.70
22.0	23.04	73.88	198.95	272.83	51.72	0.00	51.72
23.0	24.09	78.30	205.62	283.92	54.81	0.00	54.81
24.0	25.14	82.81	212.30	295.11	57.97	0.00	57.97
25.0	26.18	87.41	218.98	306.39	61.19	0.00	61.19
26.0	27.23	92.10	225.65	317.76	64.47	0.00	64.47
27.0	28.28	96.89	232.33	329.22	67.82	0.00	67.82
28.0	29.33	101.76	239.01	340.77	71.23	0.00	71.24
29.0	30.37	106.73	245.69	352.41	74.71	0.00	74.71
30.0	31.42	111.78	297.92	409.70	78.25	0.00	78.25
31.0	32.47	116.92	353.33	470.25	81.85	0.00	81.85
32.0	33.51	122.15	411.90	534.05	85.51	0.00	85.51
33.0	34.56	127.47	473.58	601.05	89.23	0.00	89.23
34.0	35.61	132.87	538.35	671.23	93.01	0.01	93.02
35.0	36.66	138.36	606.19	744.55	96.85	0.01	96.86
36.0	37.70	143.94	663.03	806.97	100.75	0.01	100.76
37.0	38.75	149.59	708.96	858.55	104.72	0.01	104.72
38.0	39.80	155.34	744.04	899.38	108.74	0.01	108.75
39.0	40.85	161.18	768.33	929.51	112.83	0.01	112.83
40.0	41.89	167.10	781.93	949.03	116.97	0.01	116.98
41.0	42.94	173.12	784.89	958.00	121.18	0.01	121.19
42.0	43.99	212.74	787.80	1000.55	148.92	0.01	148.93
43.0	45.04	252.53	790.67	1043.21	176.77	0.01	176.78
44.0	46.08	292.48	793.51	1085.99	204.74	0.01	204.74
45.0	47.13	332.58	796.30	1128.88	232.81	0.01	232.82
46.0	48.18	372.84	799.05	1171.90	260.99	0.01	261.00
47.0	49.22	413.26	801.77	1215.02	289.28	0.01	289.29
48.0	50.27	453.82	804.45	1258.27	317.67	0.01	317.68
49.0	51.32	494.53	807.09	1301.62	346.17	0.01	346.18
50.0	52.37	535.39	809.70	1345.09	374.77	0.01	374.78
51.0	53.41	576.40	812.28	1388.67	403.48	0.01	403.49
52.0	54.46	617.55	814.82	1432.37	432.28	0.01	432.29
53.0	55.51	658.84	817.33	1476.17	461.19	0.01	461.20
54.0	56.56	700.27	819.82	1520.09	490.19	0.01	490.20
55.0	57.60	741.85	822.27	1564.12	519.29	0.01	519.30

56.0	58.65	783.56	824.69	1608.26	548.49	0.01	548.50
57.0	59.70	825.41	827.09	1652.50	577.79	0.01	577.80

AXIAL LOAD VS SETTLEMENT CURVES

LOAD SETTLEMENT RELATIONSHIP

TOP LOAD TONS	TOP MOVEMENT IN.
0.8696E+02	0.1999E-01
0.1739E+03	0.3998E-01
0.2609E+03	0.5997E-01
0.3478E+03	0.7996E-01
0.4348E+03	0.9995E-01
0.5217E+03	0.1199E+00
0.6087E+03	0.1399E+00
0.6957E+03	0.1599E+00
0.7826E+03	0.1799E+00
0.8696E+03	0.1999E+00
0.1059E+04	0.9850E+00
0.1249E+04	0.1770E+01
0.1439E+04	0.2555E+01
0.1629E+04	0.3340E+01
0.1629E+04	0.4009E+01



Bent 2 LRFD 72" CIDH Preliminary

Appendix IV.5 Preliminary Lateral Analysis Parameters

Appendix IV.4 LPILE Input Parameters

Support Location	Boring	Top Elevation (ft)	Bottom Elevation (ft)	Layer Thickness (ft)	Soil Type	γ (pcf)*	φ (°)	c (psf)	k (pci)	ε_{50}
Abut 1	R-17-001 and CPT-18-001	cut off 132	111	21	Stiff Clay without Free Water (Reese)	55	xx	1000	500	0.007
		111	98	13	Stiff Clay without Free Water (Reese)	55	xx	2300	1000	0.005
		98	87	11	Sand (Reese)	60	34	xx	60	xx
							Uniaxial Compressive Strength qu (lbs/in*2	Initial Modulus of Rock Mass(lbs/in*2)	RQD (%)	Strain Factor, k rm1
		87	69	18	Weak Rock (Reese)	70	3000	300000	14	0.00005
Bent 2	CPT-18-001, R-18-003, CPT-18-002	cut off 117	103	14	Stiff Clay without Free Water (Reese)	55	xx	1000	500	0.007
		103	76	27	Sand (Reese)	60	34	xx	60	xx
							Uniaxial Compressive Strength qu (lbs/in*2	Initial Modulus of Rock Mass(lbs/in*2)	RQD (%)	Strain Factor, k rm1
		76	63	13	Weak Rock (Reese)	70	3000	300000	14	0.00005
Abut 3	R-17-003 and CPT-18-002	cut off 138.5	114		Stiff Clay without Free Water (Reese)	55	xx	900	500	0.007
		114	100		Stiff Clay without Free Water (Reese)	55	xx	1600	1000	0.005
		100	82		Sand (Reese)	60	34	xx	60	xx
							Uniaxial Compressive Strength qu (lbs/in*2	Initial Modulus of Rock Mass(lbs/in*2)	RQD (%)	Strain Factor, k rm1
		82	62		Weak Rock (Reese)	70	3000	300000	14	0.00005

Notes:

* indicates assumed buoyant unit weight value

APPENDIX F

INITIAL SITE ASSESSMENT/PRELIMINARY SITE INVESTIGATION

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HAZARDOUS WASTE
INITIAL SITE ASSESSMENT/PRELIMINARY SITE INVESTIGATION

FOR THE

LAS TRAMPAS CREEK BRIDGE AT SOUTH MAIN STREET REPLACEMENT PROJECT WALNUT CREEK, CALIFORNIA

Prepared for:

City of Walnut Creek
1666 North Main Street
Walnut Creek, CA, 94596
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CITY OF WALNUT CREEK

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WRECO

Las Trampas Creek Bridge at South Main Street Replacement Project
City of Walnut Creek, California
Federal-Aid Project No. BRLS-5225(026)

Initial Site Assessment and Preliminary Site Investigation

Submitted to:
City of Walnut Creek, Engineering Department

This report has been prepared by a qualified lead, asbestos, and hazardous materials technical specialist who attests to the technical information contained herein. I declare that to the best of my professional knowledge and belief, I meet the definition of an Environmental Professional as defined in 40 Code of Federal Regulations, Part 312.

Tony Jones
Senior Environmental Scientist
CDPH Lead Certified Sampling Technician (29245)
AHERA Building Inspector for Asbestos (CA-002-05)
AHERA Management Planning for Asbestos (CA-002-07)

10/18/18
Date

Las Trampas Creek Bridge at South Main Street Replacement Project
City of Walnut Creek, California
Federal-Aid Project No. BRLS-5225(026)

Initial Site Assessment and Preliminary Site Investigation

Submitted to:
City of Walnut Creek, Engineering Department

This report has been prepared by or under the supervision of the following Professional Geologist. The Registered Professional Geologist attests to the technical information contained herein and has judged the qualifications of any technical specialists providing environmental data upon which recommendations, conclusions, and decisions are based.

Melissa McAssey
Professional Geologist #8132

10/18/18
Date

Las Trampas Creek Bridge at South Main Street Replacement Project
City of Walnut Creek, California
Federal-Aid Project No. BRLS-5225(026)

Initial Site Assessment and Preliminary Site Investigation

Submitted to:
City of Walnut Creek, Engineering Department

This report has been prepared by or under the supervision of the following Certified Asbestos Consultant (CAC) and Certified Lead Inspector/Assessor (CLIA). The CAC and CLIA attests to the technical information contained herein and has judged the qualifications of any technical specialists providing asbestos and lead expertise upon which recommendations, conclusions, and decisions are based.

Jim Koniuto, CAC CLIA
CA State Certified Asbestos Consultant (CAC #05-3872)
CA State Certified Lead Inspector/Assessor (CDPH #20466)

10/18/2018

Date

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Figures

Tables

Appendices

Acronyms and Abbreviations

AAI	All Appropriate Inquiries
ACCM	Asbestos Containing Construction Material
ACM	Asbestos Containing Material
ADL	Aerially Deposited Lead
ADT	Average Daily Traffic
AHERA	Asbestos Hazard Emergency Response Act
ASTM	American Society for Testing and Materials
AUL	Activity and Use Limitation
bgs	below ground surface
Caltrans	California Department of Transportation
Cal/OSHA	California Department of Occupational Safety and Health
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIDH	cast-in-drill-hole
CIP	cast-in-place
CRS	California Road System
CSOs	Construction Safety Orders
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EDR	Environmental Data Resources
ESL	Environmental Screening Level
FEMA	Federal Emergency Management Agency
ft	feet
GISOs	General Industry Safety Orders
HBP	Highway Bridge Program
ID	inside diameter
ISA	Initial Site Assessment
LBP	Lead-based Paint
LUST	Leaking Underground Storage Tank
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	no further action
NOA	Naturally Occurring Asbestos
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
PCB	Polychlorinated biphenyl
PEA	Preliminary Endangerment Assessment
PG	Professional Geologist
PLM	Polarized Light Microscopy
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
RACM	Regulated Asbestos Containing Material
RCRA	Resource Conservation Recovery Act
REC	Recognized Environmental Condition

RGA	Recovered Government Archive
RWQCB	Regional Water Quality Control Board
ROW	Right-of-Way
SER	Standard Environmental Reference
STLC	Soluble Threshold Limit Concentration
SPT	Standard Penetration Test
SWRCB	State Water Resource Control Board
TTLC	Total Threshold Limit Concentration
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UST	Underground Storage Tank
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

The City of Walnut Creek, Public Works Engineering Department, is proposing to replace the Las Trampas Creek Bridge at South Main Street (Project) under the Federally Funded Highway Bridge Program (HBP), Project No. BRLS5225(026). The Las Trampas Creek Bridge is a five-span reinforced concrete “T”-beam/slab bridge structure (Bridge No. 28C0075) classified as structurally deficient, located in the City of Walnut Creek (City), Contra Costa County (County), California. The existing bridge was originally constructed in 1919, with widenings in both 1950 and 1956. The proposed project includes street improvements to construct the new bridge approaches and utility relocations of sewer, water, electric, and communications.

This report presents results of an Initial Site Assessment (ISA) and Preliminary Site Investigation (PSI) in a combined report. The combined study was conducted by WRECO for property associated with the Project, including California Department of Transportation (Caltrans) right-of-way (ROW), City ROW, County ROW, and private parcels located along South Main Street and Broadway Plaza.

The ISA component of this study included regulatory records searches, file reviews, and a visual site survey. WRECO found no evidence of Activity and Use Limitations (AUL) at the Project area or adjacent properties. However, several current and potential Recognized Environmental Conditions (RECs) were identified during the ISA, including:

- Former Texaco service station (~1980s-1991), 1275 Main St – petroleum hydrocarbons in soil and groundwater (case closed April 2001);
- The Virginia Cleaners Facility (Diablo Cleaners ~1957-1973; Virginia Cleaners ~1973-1998), 1305 and 1335 S. Main St - tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride in soil and groundwater;
- Former Unocal Station (~1950-1978), 1322 S. Main St – petroleum hydrocarbons in soil and groundwater (case closed May 1998); and
- Former ARCO service station (~1955-1978), 1345 South Main St – petroleum hydrocarbons, volatile organic compounds (VOCs), lead, and polyaromatic hydrocarbons (PAHs) in soil and groundwater.

The findings of the ISA triggered the recommendation for a PSI. The PSI included soil and groundwater sampling, as the depth to groundwater in the Project area was anticipated to be about 15 feet below ground surface (bgs). The PSI included:

- Limited subsurface soil investigation at two boring locations;
- Groundwater sample collection and analysis from two boring locations; and
- Sampling of suspect materials on the bridge for asbestos-containing material (ACM) and lead based paint.

The above-listed studies were performed to verify the presence/absence of RECs, to evaluate the available options for soil disposal or reuse during construction, and to provide specific guidance for waste management and worker safety during construction.

Seven soil samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, and metals. All soil samples had arsenic concentrations that exceeded the ESLs for residential, commercial and industrial, and construction worker, but were below the Total Threshold Limit Concentration (TTLC) limit. Laboratory results indicated low detectable concentrations of TPHg (3.4 mg/kg) in SB-02@15 feet, TPHd (10 mg/kg) and TPHmo (130 mg/kg) in S-01-A@5 feet, and TPHd (1.7 mg/kg) in SB-02@5 feet. Soil from 5-20 feet below ground surface may contain arsenic that exceeds ESLs (residential, commercial/industrial, and construction worker), and shallow soil contains low concentrations of petroleum hydrocarbons. Therefore, health and safety precautions should be taken to limit exposure and hazards.

Two groundwater samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, VOCs, and metals. Groundwater samples exceeded Regional Water Quality Control Board (RWQCB) Tier 1 ESLs for arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, silver, vanadium, zinc, TPHg, and TPHd. In addition, sample W-01 had Tier 1 ESL exceedances for mercury, TPHmo, ethylbenzene, and xylenes; sample W-02 had Tier 1 ESL exceedances for DCE, TCE, and vinyl chloride. Most of these constituents exceeded the RWQCB WQOs, CTR, and EPA NTR criteria for surface water. Groundwater encountered during demolition or construction on the Las Trampas Creek Bridge should be contained and treated prior to discharge or disposal.

Suspect lead-based paint (LBP) samples, collected from the Las Trampas Creek Bridge area, had lead concentrations that ranged from ND to 105 ppm, that are well below the regulatory threshold value of 5000 ppm, provided by the USEPA and CDPH (0.5% by weight or 5,000 parts per million (ppm) by paint chip analysis).

The lead concentrations from the paint chip samples analyzed were well below these regulatory levels for hazardous waste and can therefore be disposed of at a Class II or III landfill.

Three of the four suspected ACM samples, collected from the Las Trampas Creek Bridge roadway and concrete sidewalks, were below detection limits for asbestos content (less than 1%). One sample contained 10% chrysotile (ASB-04 - gray transite material) which exceeds the USEPA and CDPH regulatory threshold of 1%, and DTSC standard of friable (if pulverized) with concentration greater than 1% asbestos.

However, the transite-like pipe covering along the utility piping on the underside of the bridge (on both the eastern and western sides) did contain 10% chrysotile, that does exceed the USEPA and CDPH regulatory threshold of 1%. The bridge structure demolition is regulated by the EPA’s National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations as ACM or RACM and regulated by Cal-OSHA’s regulations as ACCM.

A summary of this study's recommendations is presented the table below:

Description	Evidence of REC Found	Recommended Actions
Excavated surface soil	Results were below RCRA and California Hazard Waste classification levels for metals, petroleum hydrocarbons, and volatile organic compounds. Informal consultations with the San Francisco Bay RWQCB in April and May of 2018 revealed that it is unknown whether PCE and its breakdown products exist in soils along sewer lines adjacent to the former Virginia Cleaners site (1305-1335 S Main St).	Dispose of excavated soils as Designated or Non-hazardous waste at Class II unit or Class III landfill depending on facility acceptance standard. Soil excavated along sewer lines adjacent to the former drycleaner site should be screened for PCE and its breakdown products to properly classify excavated soils for disposal.
Painted Surfaces – bridge railing, light post, white roadway striping, red painted curbs	Lead-based paint survey revealed lead-based paint concentrations were below regulatory thresholds for USEPA, CDPH; and no samples exceeded state or federal hazardous waste thresholds.	Manage waste per Cal OSHA T8 CCR Section 1532.1
Groundwater	Groundwater samples exceeded RWQCB Tier 1 ESLs for TPHg, TPHd, TPHmo, ethylbenzene, xylenes, DCE, TCE, and vinyl chloride. Most of these constituents exceeded the RWQCB WQOs, CTR, and EPA NTR criteria for surface water	Groundwater that is encountered during the demolition or construction of the Las Trampas Creek Bridge, must be contained and treated prior to discharge to surface waters under an appropriate RWQCB NPDES/WDR permit or disposed of off-site at a wastewater treatment facility.
Concrete and pipe jacket (utilities along the side of bridge), asphalt	No asbestos was found in concrete deck materials accessible from the surface of the bridge. Sample ASB-04 - gray transite material contained 10% chrysotile which exceeds the USEPA and CDPH regulatory threshold of 1%. Samples were not collected from abutments and concrete foundation for creek due to limited access.	Provide demolition notification prior to demolition to BAAQMD. Abate 10% potentially friable ACCM/RACM using state licensed asbestos abatement contractor prior to demolition. Manage waste per Cal OSHA T8 CCR Section 1529.
Concrete and Asphalt waste	Concrete and Asphalt should not be disposed of in Landfill; both can be reclaimed and recycled for use on the Project area and/or other facilities. Asphalt-concrete and Portland cement concrete grindings shall be reused in accordance with San Francisco Bay Regional Water Quality Control Board's guidelines for Caltrans' projects or transported offsite for recycling or disposal.	All asphalt grindings require disposal at a Class 1 disposal site or reuse in accordance with the Department of Fish and Game Agreement on AC Grindings, Chunks, and Pieces (1993) and California Department of Transportation Asphalt-Concrete and Portland Cement Concrete Grindings Reuse Guidance (2007).

1 INTRODUCTION

This report presents the results of an Initial Site Assessment (ISA) and Preliminary Site Investigation (PSI) conducted by WRECO, on behalf of the City of Walnut Creek (City), for the Las Trampas Creek Bridge at South Main Street Replacement Project (Project), in Contra Costa County (County), California (Figure 1). The primary access to the Project area is via Highway 680 from either exit at South Main Street or Olympic Boulevard (Blvd). The Project area is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue, and is ½-block north of the Kaiser Permanente Hospital (Figure 2). The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants, and the new Agora at South Main apartments and retail space. Driveway access to these features are located on all four corners of the bridge. Numerous utilities are mounted on both sides underneath the bridge, and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

1.1 Project Description

The City of Walnut Creek is proposing to replace the five-span reinforced concrete “T”-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek. The bridge is located on South Main Street approximately 0.1 miles south of Olympic Boulevard.

The project site is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is ½ block north of the Kaiser Permanente Hospital. The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants and the new Agora at South Main apartments and retail space. Driveway access to these features are located on all four corners of the bridge. Numerous utilities are mounted on both sides and underneath the bridge and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

The project will be 88.53 percent federally funded under the Highway Bridge Program (HBP) and 11.47 percent funded by local matching funds. Caltrans will provide project oversight as required through Caltrans Local Assistance. All aspects of the project will meet federal and state requirements.

1.1.1 Existing Bridge

Type & History

The existing bridge is a reinforced concrete “T”-beam bridge built in 1919. In 1950 the bridge was widened on the south side with a reinforced concrete “T”-beam superstructure and in 1956 the bridge was widened on the north side with a reinforced concrete slab superstructure. The existing structure is approximately 131’± long on bent style abutments.

Deficiencies

There are multiple cracks and spalls with exposed rebar in the soffit rendering the bridge Structurally Deficient and Functionally Obsolete. The reinforced concrete T-Girder/Slab structure has been classified Structurally Deficient and Functionally Obsolete with an overall sufficiency rating of 47.4. There are numerous cracks with efflorescence in the soffit and regions of severe spalling with exposed rusted rebar. The bridge is classified as Functionally Obsolete due to its inadequate clear width for the current and future Average Daily Traffic (ADT) volume.

Deck Geometry
The existing bridge section is approximately 74.5 feet to 81 feet wide (including sidewalks). The existing bridge does not provide shoulders on either side. Refer to the Existing Condition section for description of the bridge width.

Existing Condition
South Main Street provides a north-south connection through the City with a curved alignment and generally flat roadway profile grade. Adjacent intersections at Botelho Drive and Newell Avenue are signal controlled.

The existing bridge section is approximately 74.5 feet to 81 feet wide (including sidewalks). The existing north approach roadway clear width is approximately 62.7 feet wide, which includes five traffic lanes and a 4.2-ft raised median. The existing south approach roadway clear width is approximately 69.9 feet wide, which includes five traffic lanes, a parking lane and a 6-ft wide raised median. The difference between the two approaches is the parking lane on the south approach. The superelevation transitions from approximately 3 percent at the Botelho Drive intersection to 5 percent at the Broadway Plaza intersection.

Proposed Horizontal Alignment
The proposed roadway approaches are planned to be slightly realigned from their existing condition between the intersections at Botelho Drive and Broadway Plaza. Under the HBP guidelines, local agencies are reimbursed for up to 200 feet of approach roadway on each side of the bridge (for on system bridges) unless longer approaches can be justified to provide the minimum horizontal and vertical conforms. Roadway Approaches are anticipated to be less than 200 feet long on either side of the proposed bridge. Impacts to existing driveways and pedestrian paths will be minimized.

Cross Section
Based upon recommended AASHTO guidelines and Contra Costa County standards, 12’ lanes and 8’ shoulders would be provided. The Core Area Zone design guidelines call for 10-foot sidewalks at a minimum and will be proposed for the bridge.

The proposed clear roadway width at the proposed bridge will be approximately 100'. This will provide for two 12’ traffic lanes in each direction, two 8’ shoulders, a 4'-5' median and 10' wide sidewalks on each side of the bridge and accommodate the left turn pockets approaching the intersections of Botelho Drive and Broadway Plaza.

Right-of-Way

According to Caltrans right of way maps and other recorded maps within the project area, there is an existing right of way which encompasses the existing bridge as well as South Main Street to the North and South of the existing bridge.

It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements will be minimized by approximately maintaining the existing roadway alignment. Some right-of-way acquisition will be required to accommodate the bridge widening and associated impacts.

Bridge Construction and Existing Bridge Removal

Installation of water diversion measures. The project will control the flow of water through the APE by using sand bags to divert the water into a pipe that will convey it through the worksite.

Demolition of the existing bridge, piles, and abutments. The project will demolish the existing bridge in stages as described in the Stage Construction Section.

There is a total of two abutments and four bents to be removed. Bents 2 and 5 are found near the top of the channel slope and feature reinforced concrete columns with pier walls enclosing the abutments. Bents 3 and 4 are found near the bottom of the channel. Each bent has a total of seven footings. The bridge inspection report describes the original (northernmost) portion of the structure to be founded on timber piles at bents 2 through 5 and spread footings at the abutments.

As built plans show that the bent footings for the first widening were also founded on timber piles. However, as built plans show that for the second widening, footings for bents 2 through 5 were founded on precast concrete piles. Abutments are buried in the existing road embankment and are founded on spread footings throughout each portion of the original and widened structures.

Demolition of Bents 3 and 4 will include removal up to 32 timber piles and 20 precast concrete piles to a 3-ft feet depth below channel grade and demolition of the fourteen 6-foot-wide by 6-foot-long by 2-foot-thick footings.

Demolition of Bents 2 and 5 will include partial removal up to 48 timber piles and 20 precast concrete piles to a 3-ft feet depth below original grade and full removal of up to 16 timber piles if found in conflict with the new cast-in-drilled-hole concrete abutment piles and demolition of the fourteen 6-foot-wide by 8-foot-long by 2-foot-thick footings.

Demolition of abutments 1 and 6 will include removal of the fourteen 6-foot-wide by 6-foot-long by 2-foot-thick footings.

The 60.9-foot-wide by 200-foot-long northern approach will be excavated to 5 feet deep to expose existing utilities and allow for reconstruction of the road base; the 79.5-foot-wide by 200-foot-long southern approach will be excavated to 5 feet deep to expose existing utilities and allow for reconstruction of the road base.

Removal of existing erosion-control measures. The project will remove concrete-filled sand bags embedded in the banks, as well as removal of the concrete-lined streambed. Disturbance to soils behind and beneath these features will be to 1 feet deep.

Tree removal. 15 to 20 existing trees will be removed to 3-feet-deep.

Temporary Shoring. Temporary shoring will likely be required to construct the new abutments under stage construction and the pier within the channel. Temporary shoring would likely consist of sheet piles or cast in drilled hole (CIDH) soldier piles.

Constructing a new bridge and approaches. The project will construct a new bridge with two 110-foot-wide by 5-foot-thick by 6-foot-deep abutments with multiple 4 to 6 foot diameter CIDH concrete piles up to 120 feet deep; two new roadway approaches in largely the same alignment as the existing approaches; and a central bent with multiple 4 to 6 foot-in-diameter CIDH concrete piles up to 120 feet deep. The CIDH pile installation at the center pier would require a temporary work pad to be constructed in the channel to provide adequate width for the contractor's equipment (drill rig, pile oscillator, crane, excavator, etc.). An earthen ramp would be constructed (likely adjacent to the southwest corner of the bridge to provide access to equipment entering the channel for both the existing bridge removal and the center pier construction.

Reconstruction and improvement of streambanks. Erosion-control elements such as a new concrete streambed slope paving will be constructed.

Reconstruction of sidewalks, driveways, and roadway median. Roadway elements such as sidewalks, driveways, and a median will be reconstructed throughout the APE to 2 feet deep.

1.1.2 Contractor Staging Areas

Early in project development, a potential contractor staging area was identified in a vacant lot under Highway 680 along Rudgear Road about a mile south of the project site. The parcel is approximately 1-mile south of the project site and is owned by Contra Costa County (APN 183-093-031-7). However, this lot would not likely be pursued for use in this project due to the potential sensitivity of the site with regards to cultural significance.

Other potential staging areas are the parking lots directly adjacent to the project site. These lots include the Ross shopping center parking lot which has direct access onto main street and the Chase Bank parking lot and a few others. These lots may potentially provide a few parking spaces for equipment storage/ job trailers.

1.1.3 Proposed Structure

Preferred Alternative (Single Span)

The preferred alternative is a two-span bridge with a center pier aligned with the existing nose wall of the adjacent downstream culvert structure. This alternative would require a pier support within the channel. The abutments of the proposed bridge will be just behind pier 2 and 5 of the existing bridge, providing a total bridge length of approximately 104'. Viable superstructure types include:

Cast-in-place (CIP), post-tensioned Concrete Slab
Precast, prestressed Voided Concrete Slab

Substructure/Foundations

Large Diameter CIDH concrete piles will likely be used to minimize vibration impact to adjacent structures and utilities. Existing buildings will be prone to damage from vibration, and the public is sensitive to vibration. Minimization of vibration will reduce the chances of real or perceived damage and maintain a positive public opinion of the project.

Based on the high-seismic shaking potential and proximity of active faults, slope failure/lateral spreading, liquefaction, and settlement are considered high. Bridge foundations and retaining structures will be required to resist additional lateral loads due to potential lateral spreading.

1.1.4 Utilities

Utilities at the project site include underground electrical, telephone, cable and water. Several conduits including 15 four-inch AT&T ducts are mounted on the downstream side of the bridge. Additional conduits including a 4-inch PG&E ducts are mounted on the upstream side of the bridge. These side-mounted conduits will likely be relocated to the sidewalks of the proposed bridge. The as-built plans also show a 12-inch-diameter water line that runs roughly down the centerline of the bridge and is mounted on the columns below the bridge. Several utility manholes and vaults occupy the areas on both sides of the bridge. Adjacent fire sprinklers valves are located at the northwest corner of the bridge.

1.2 Purpose of the Initial Site Assessment and Preliminary Site Investigation

WRECO was contracted and tasked by Quincy Engineering, Inc. (Quincy) to perform an ISA and, if necessary, a PSI in agreement with the City of Walnut Creek for the furnishing of professional services for the Las Trampas Creek Bridge at South Main Street Replacement Project. The ISA/PSI was required as part of Caltrans' environmental review, consistent with Caltrans Local Assistance Procedures Manual and Caltrans Standard Environmental Reference (SER) Environmental Handbook (EH) Volume 1, Chapter 10 "Guidelines for Hazardous Materials, Hazardous Waste, and Contamination."

During performance of the ISA, WRECO determined that a PSI would be required to fully investigate the potential for hazardous material risks to the Project. The purpose of the combined ISA/PSI report is to assess the potential risks posed by hazardous materials at the Project area to environmental resources and human health, and to communicate the findings and recommendations of the investigation. The ISA investigation evaluated the Project area for the presence of recognized environmental conditions (RECs). The ISA was completed and summarized in a technical memorandum dated July 27, 2017 (Appendix A), which identified evidence of hazardous chemicals in soil and groundwater within the Project's limits.

The industry standard for preparing an ISA is found in the American Society of Testing and Materials (ASTM) Standard E 1527- [13] per Caltrans SER Chapter 10. The ASTM defines a REC as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws.

The term [REC] is not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

Two additional types of RECs are included in the revised ASTM publication, including Historical REC (HREC) and Controlled REC (CREC). A HREC is defined by ASTM as a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by the regulatory authority without subjecting the property to any required controls. A CREC is defined by ASTM as a REC resulting from a past release of any hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority (for example, as evidenced by a no further action (NFA) letter or equivalent or meeting risk-based criteria established by the regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls (for example, property use restrictions, AULs, institutional controls, or engineering controls).

As part of the Phase I ESA, an all appropriate inquiries (AAI) was conducted in accordance with the Environmental Protection Agency Standards and Practices for All Appropriate Inquiries (40 CFR Part 312). The AAI needs to be included as part of the process of evaluating a property's environmental conditions and assessing potential liability for any contamination. The intention of the ISA is to identify potential issues that may impact the Project with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601) and petroleum products.

No significant data gaps were identified during the completion of this ISA. Certain exceptions in this ISA/PSI, to the AAI standard, included: 1) no property appraisals performed for the Project area; and 2) no direct interviews with the owners of the subject parcels. This report is not intended to serve as a compliance assessment of the Project area.

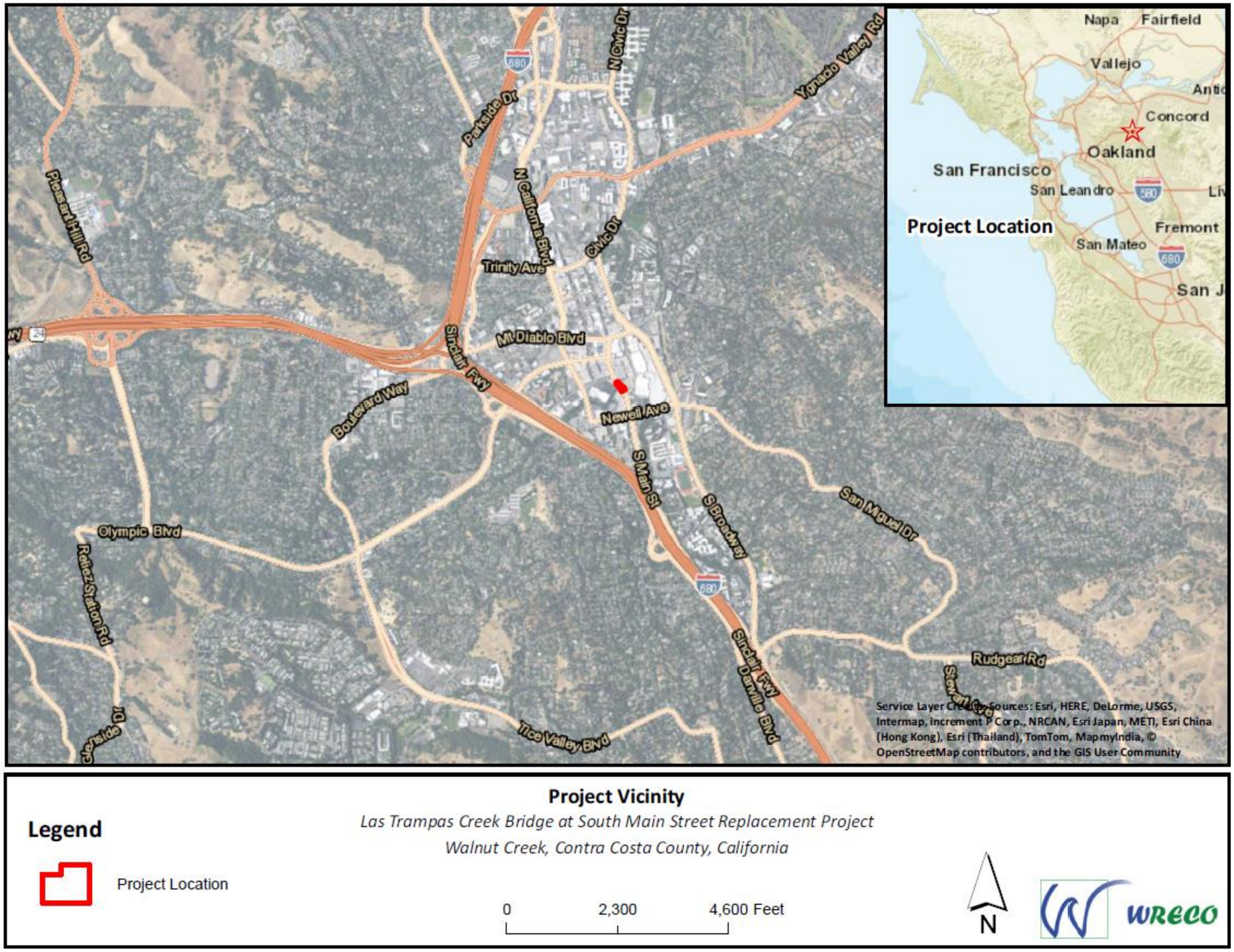

Figure 1. Project Vicinity Map

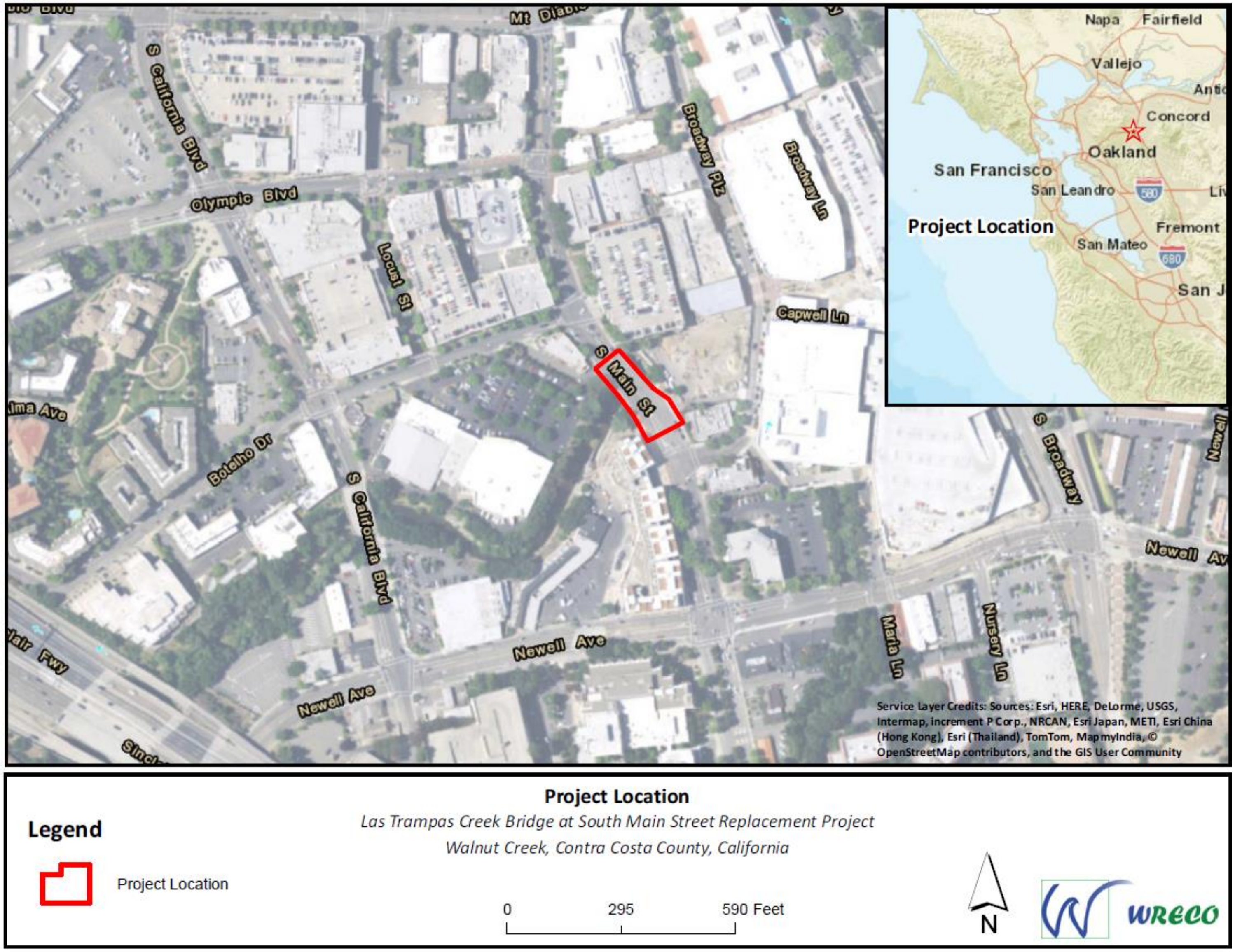

Figure 2. Project Location Map

2 PROJECT AREA SETTING

The Project site is located at the crossing of South Main Street and Las Trampas Creek in downtown Walnut Creek in Contra Costa County, approximately 16 miles east of the City of Oakland. The Project site is situated on the southern end of the Walnut Creek Valley, between the Briones Hills and Shell Ridge near the base of Mount Diablo. The natural slope of the valley is gradual to the north; however, the Project Site and vicinity are relatively level. The Project area is in downtown Walnut Creek, just southwest of the Broadway Plaza shopping area.

2.1 Physical Setting

2.1.1 Topography

The United States Geological Survey (USGS), [Walnut Creek, California] 7.5 Minute Topographic Quadrangle map was reviewed. The elevation of the Project site is approximately 137 feet above mean sea level (MSL). The regional drainage is sloped moderately to the north-northwest. A copy of the USGS 7.5 Minute Topographic Quadrangle 2012 Map of Walnut Creek, California, is included in Appendix B.

2.1.2 Regional Geology

The Project is located within the Coast Ranges Geomorphic Province of California. This province extends along most of the California coast and is bounded by the Great Valley and Klamath Mountains to the east, the Pacific Ocean to the west, the Transverse Range Mountains to the south and the California-Oregon border to the north. Much of the Coast Range province is composed of marine sedimentary deposits and volcanic rocks that form northwest trending mountain ridges and valleys, running subparallel to the San Andreas Fault Zone. The relatively thick marine sediments dip east beneath the alluvium of the Great Valley. The Coast Ranges can be further divided into the northern and southern ranges, which are separated by the San Francisco Bay. The San Francisco Bay lies within a broad depression created from an east-west expansion between the San Andreas and the Hayward fault systems. West of the San Andreas Fault lies the Salinian Block, a granitic core that extends from the southern end of the province to north of the Farallon Islands.

The Coast Ranges are composed chiefly of thick Mesozoic and Cenozoic sedimentary strata that has been uplifted, terraced, and wave-cut. The Northern Coast Ranges are comprised largely of the Franciscan Complex or Assemblage, which consists primarily of graywacke, shale, greenstone (altered volcanic rocks), basalt, chert (ancient silica-rich ocean deposits), and sandstone that originated as ancient sea floor sediments. Franciscan rocks are overlain by volcanic cones and flows of the Quien Sabe, Sonoma and Clear Lake volcanic fields (CGS, 2002). The regional geologic map is shown as Figure 3.

The EDR GeoCheck® Physical Setting Source Summary (Appendix C) provided geologic information in the general area of the Project area, which was identified as Stratified Sequence of the Cenozoic Era, Tertiary System, and Paleocene Series.

2.1.3 Local Geology and Soils

The Geologic Map of the Walnut Creek Quadrangle (Dibblee, 2005) depicts the Project area as underlain by Quaternary-aged alluvium (Qa) labeled as surficial sediments described as alluvial gravel, sand, and clay of valley areas. Near the Project area are surficial outcroppings of Miocene-aged Monterey Formation (Tms/Tmc). The Tms unit is described as sandstone, light gray to tan, medium grained, arkosic and the Tmc unit is described as clay shale/siltstone, gray, vaguely bedded, argillaceous to sandy, includes fine grained sandstone. A soils map is shown as Figure 4.

The subsurface soils in the Project area generally consists of sandy fine-grained sediment, silt and clay, to a depth of approximately 15 feet bgs. Below 15 feet, sediments are primarily sand, grading fine to coarse, and including less than five-foot intervals of clayey sand or silty sand.

The EDR GeoCheck® Physical Setting Source Addendum report (Appendix C) provided information on dominant soil composition in the general vicinity of the Project area. One of the soil types were identified as Clear Lake with soil texture clay, consisting of fine grained soils, silts and clays, poorly drained, with very slow infiltration rates, soils are clayey, have a high-water table, or are shallow to an impervious layer. The other soil type was identified as Conejo with soil texture clay loam, consisting of fine-grained soils, silts and clays, well drained, with slow infiltration rates, soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

2.1.4 Naturally Occurring Asbestos

Naturally Occurring Asbestos (NOA) can occur in serpentine. The most common forms of NOA minerals are chrysotile, actinolite, and tremolite. A review of the "General Location Guide for Ultramafic Rocks in California – Areas Likely to Contain Naturally Occurring Asbestos" (CGS Open-file Report 2000-19, 2000) indicated that NOA was not mapped on, or in the vicinity of the Project area.

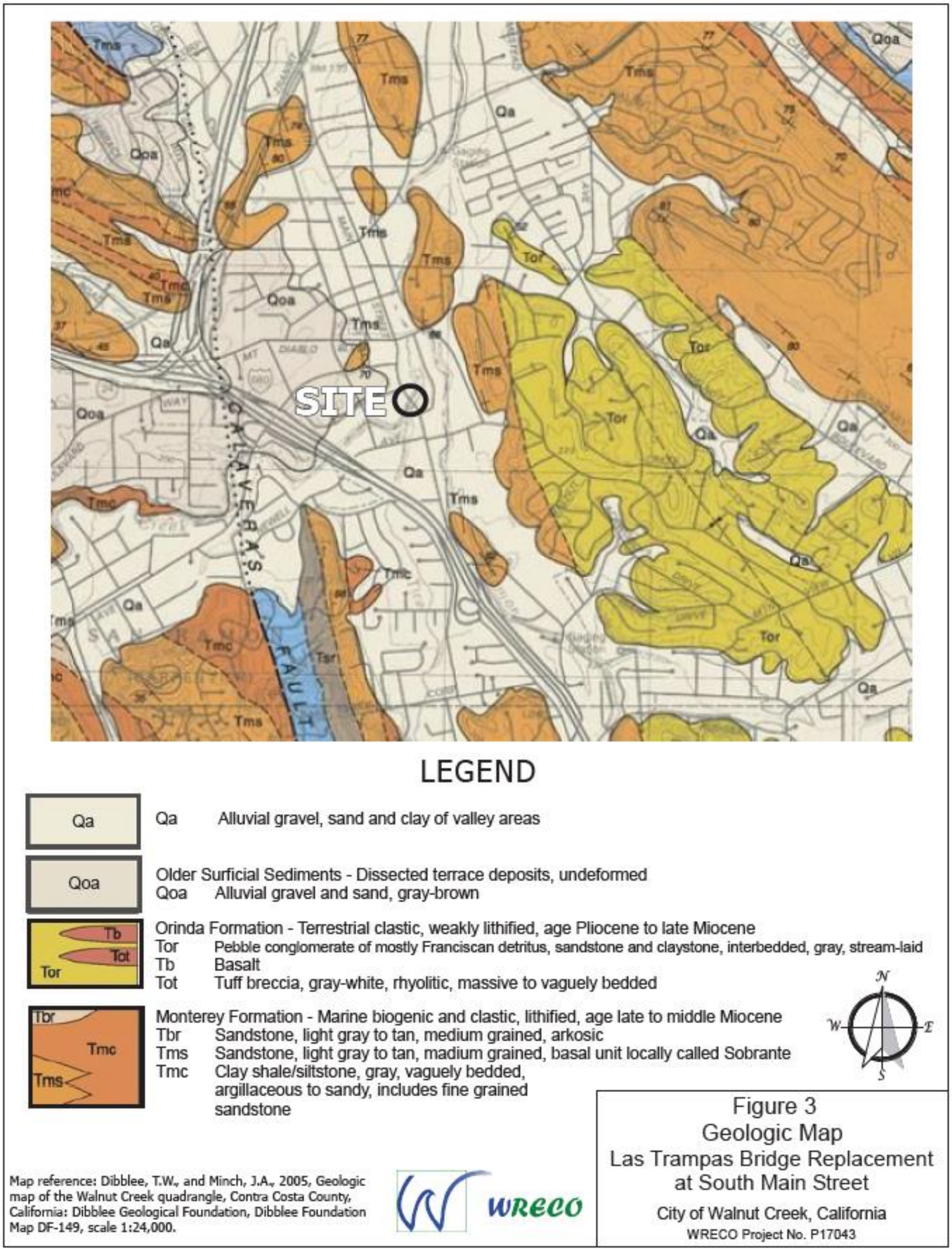

Figure 3. Regional Geologic Map

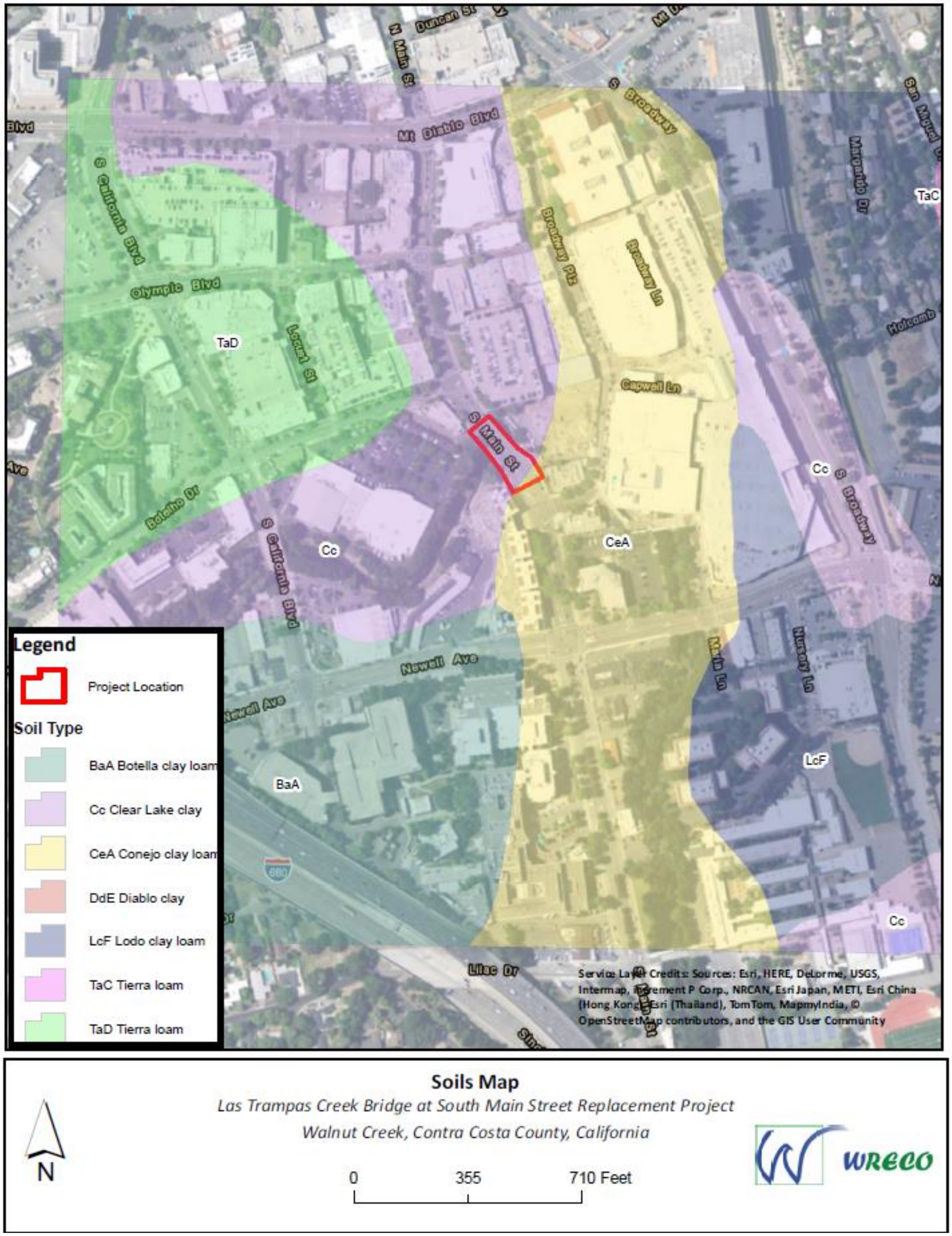

Figure 4. Soils Map

2.1.5 Groundwater Hydrology

The Project area is located within the northern portion of the Ygnacio Valley Groundwater Basin, as defined by the California Department of Water Resources (DWR). The Ygnacio Valley Groundwater Basin is in northern Contra Costa County along the south shore of Suisun Bay. The basin is about 30 miles northeast of San Francisco. It is bounded by Suisun Bay on the north, by Highway 680 and Taylor Road on the west, by the Concord Fault, which separates this basin from the Clayton Valley Groundwater Basin, on the east, and by the City of Walnut Creek on the south. The Contra Costa Canal, and the cities of Pleasant Hill and Walnut Creek overlie the basin. Walnut and Grayson Creeks flow through the basin before draining into Pacheco Creek and then into the Suisun Bay (DWR 2006).

Depth to groundwater near the Project area ranges from approximately 14 to 16 feet bgs, and groundwater flow direction is typically to the northwest (GeoTracker 2017). Regional groundwater flows are estimated to be west-northwest.

The EDR report with the GeoCheck® Physical Setting Source Summary identified ten groundwater wells in the EDR AQUIFLOW Information System within a mile of the Project area. The groundwater flow direction for the wells ranged from north-northeast to east-northeast.

Groundwater levels measured in the soil borings at the time of WRECO's geotechnical and environmental subsurface exploration for the Project are shown in Table 1 below.

Table 1. Groundwater Data Subsurface Exploration

Boring ID	Date Measured	Groundwater Depth (feet)	Groundwater Elevation (feet)	Notes
S-01/ R-17-001	08/2/2017	24.5	124.9	Measured during drilling
		21.5	127.9	Measured 25 minutes after first encounter
SB-02/ R-17-003	09/6/2017	18.0	131.6	Measured during drilling

2.1.6 Surface Water Hydrology

The Project area is in the Walnut Creek Watershed, which covers approximately 145 square miles in the central portion of Contra Costa County. Draining the west side of Mount Diablo, and the east side of the East Bay Hills, its major tributaries include San Ramon Creek, Bollinger Canyon Creek, Las Trampas Creek, Lafayette Creek, Grayson Creek, Murderer's Creek, Pine Creek, and Galindo Creek. The main stem of Walnut Creek has been significantly altered from its original morphology due to urbanization and construction of flood control features.

Las Trampas Creek is formed by several small intermittent tributaries near Las Trampas Peak and flows north and east to its confluence with San Ramon Creek. Las Trampas Creek receives water from Lafayette Creek, Grizzly Creek, Tice Creek, and an unnamed tributary. Las Trampas

Creek flows underground immediately downstream of the South Main Street bridge crossing and converges with San Ramon Creek at Liberty Bell Plaza, approximately 0.2 miles downstream of the Project area. Las Trampas Creek and San Ramon Creek converge forming Walnut Creek at a location approximately 0.25 miles northeast of the Project area.

Most of the impervious surfaces within and adjacent to the Project area, directs surface water to storm drain facilities that are directed to Las Trampas Creek outfalls.

2.2 Current Land Use

The current land use designations immediately adjacent to the Project location include "Retail sales," "Restaurant," "Residential," and "Shopping Center." For additional information on adjacent properties, refer to Section 3.1.5 of this report. The parcels immediately surrounding the Project were identified by the Contra Costa County "CCMAP," an interactive mapping database with Assessor property information. Parcels identified are as follows:

- West of the Project: Ross Dress for Less retail parking lot (1295 S Main St, APN 184-070-011)
- Northwest of the Project: Gott's Roadside restaurant (1275 S Main St, APN 184-070-013)
- North and east of the Project: parking lots and structures for the Broadway Plaza shopping center (APN 183-011-024)
- South of the Project: Agora at South Main residential apartments (1496 Newell Ave, 184-070-027)
- Southeast of the Project: Stanford's Restaurant and Bar (1322 S Main St, APN 183-011-019)

3 INITIAL SITE ASSESSMENT

3.1 Records Review

3.1.1 State Water Quality Control Board GeoTracker Database

GeoTracker is the State Water Resources Control Board's (SWRCB) (a division of the California Department of Water Resources) data management system for sites that impact groundwater or have the potential to impact groundwater. GeoTracker's online database contains sites that require groundwater cleanup as well as permitted facilities that could impact groundwater.

A review of the online GeoTracker database identified an open cleanup site immediately adjacent to the southwestern segment of the Project area, located at 1305 and 1335 South Main Street. According to sampling from previous investigations related to the cleanup site, PCE and its breakdown products were remediated in soil at the former Virginia Cleaners location (1305-1335 S Main St). Four closed leaking underground storage tank (LUST) cleanup sites were also identified near the Project area, as shown in the figure below. Three of these sites are former gasoline stations and the fourth site is a historic tire and rubber company. The listings include sites that are also identified in the EDR database (Appendix C, Table 2, and Table 3). The GeoTracker sites within 1/8-mile are delineated in Figure 5. Case documents for these cleanup sites are included in Appendix D.

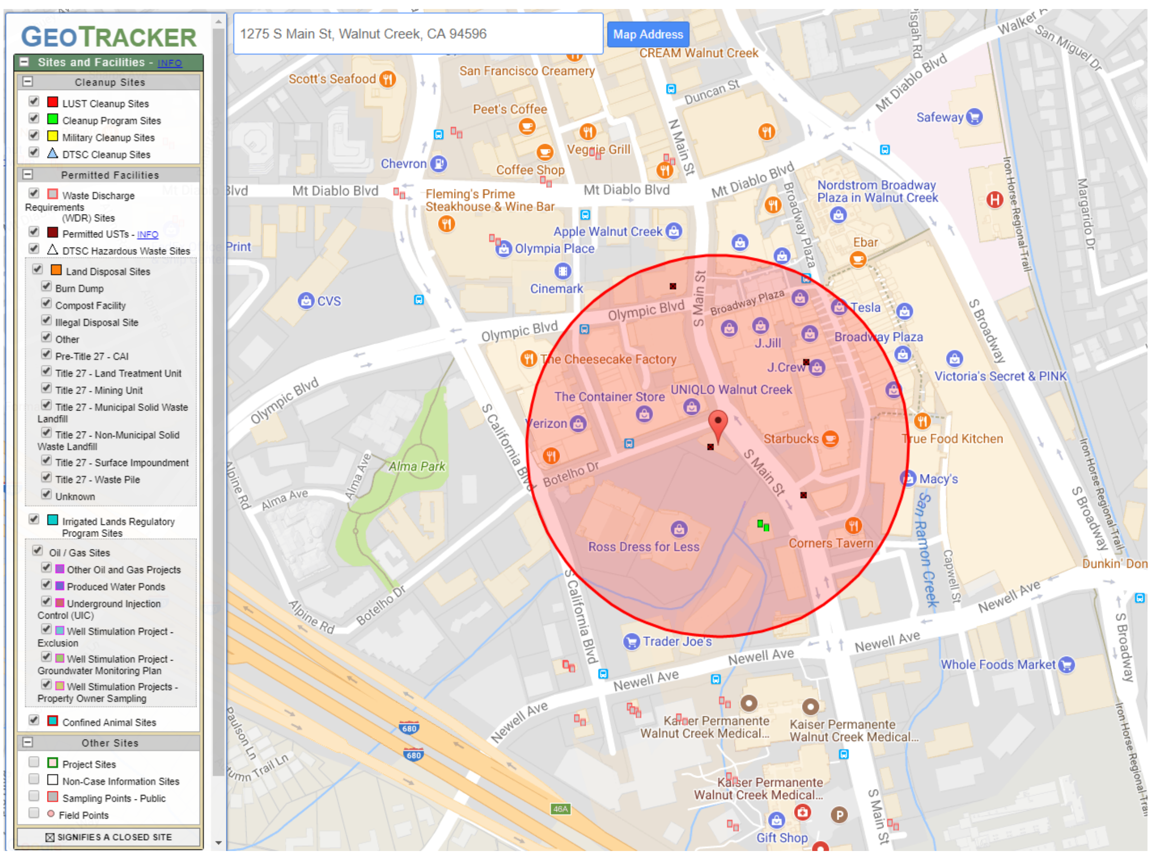

Figure 5. GeoTracker Sites Within 1/8-Mile of the Project Location

3.1.2 Department of Toxic Substances Control EnviroStor Database

The DTSC's EnviroStor database is an online search and Geographic Information System (GIS) tool for identifying sites that have known contamination or sites for which there may be reasons to investigate further. It also identifies facilities that are authorized to treat, store, dispose, or transfer (TSDF) hazardous waste.

The EnviroStor database did not list any sites within the Project area. Only one waste oil cleanup site and one historical hazardous waste facility (0.4 miles and 0.7 miles from the Project location, respectively) were identified in the database (Figure 6).

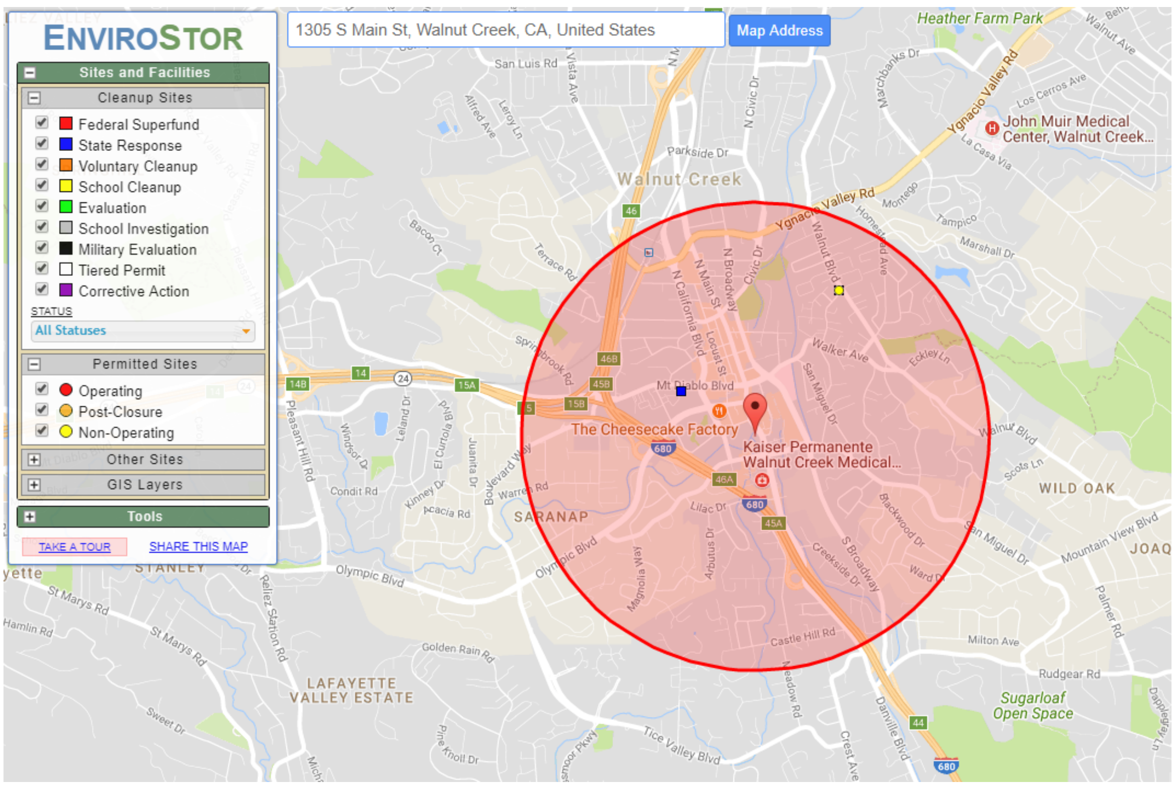

Figure 6. EnviroStor Sites Within 1-Mile of the Project Location

3.2 RWQCB Informal Consultation

Informal consultations with the San Francisco Bay RWQCB (SFB-RWQCB) in April and May of 2018 revealed that PCE and its breakdown products may persist in groundwater in the vicinity of the former Virginia Cleaners (1305-1335 S Main St) and in soils along sanitary sewer lines adjacent to the former drycleaner site.

Because the proposed Project includes excavation within shallow groundwater aquifers and may require dewatering, the SFB-RWQCB cautioned that care should be taken to avoid exacerbating the extent of soil and groundwater pollution during construction activities and that technologies should be utilized as necessary to minimize or eliminate potential downward vertical migration of pollutants during and after completion of the construction project.

The proposed Project also includes the relocation of existing buried sanitary sewer siphon pipes running adjacent to the western edge of the existing bridge, beneath Las Trampas Creek. The SFB-RWQCB suggested that the area along the sanitary sewer lines has the potential to be impacted by PCE and its breakdown products. This area of potential concern is shown in Figure 7. Correspondences pertaining to the informal consultations are included in Appendix E.

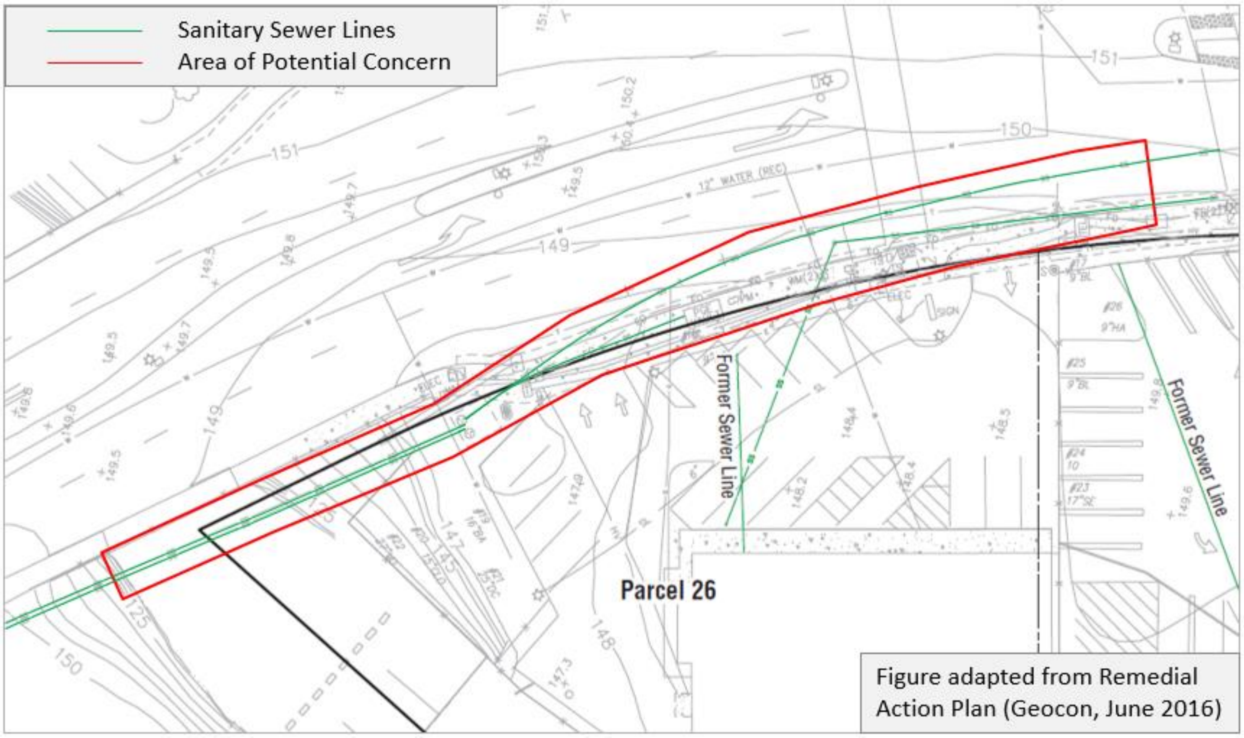

Figure 7. Areas of Potential Concern

3.3 EDR Regulatory Records Search

In accordance with ASTM Standard E1527-13 and part of the ISA, a computerized radius search of pertinent federal, state, and tribal environmental record databases was performed by EDR of Shelton, Connecticut. The database search was conducted to identify environmental regulatory records associated with the Project area and nearby properties that would indicate environmental conditions (i.e., reported releases of hazardous substances and/or petroleum products), which may have the potential to adversely impact the Project area and surrounding vicinity.

Database listings were reviewed for properties located within a 1-mile radius of the Project area. Database search results produced by EDR were reviewed in conjunction with governmental records reviewed during this ISA. The Project area (target property) was not listed in any of the federal, state, and local databases searched by EDR. Properties located near the Project area that were identified in one or more of the databases searched are discussed below.

Table 2. Database Findings Summary - Sites Identified

Regulatory Database	Search Distance	Target Property	<1/8	1/8 – 1/4	1/4 – 1/2	1/2- 1	>1	Total Plotted
RCRA- LQG	0.25 mile		1	1	NR	NR	NR	2
RCRA- SQG	0.25 mile		5	3	NR	NR	NR	8
RESPONSE	1 mile		0	0	1	0	NR	1
ENVIROSTOR	1 mile		0	0	1	0	NR	1
LUST	0.5 mile		5	12	3	NR	NR	20
SLIC	0.5 mile		1	0	2	NR	NR	3
UST	0.25 mile		1	4	NR	NR	NR	5
HIST Cal-Sites	1 mile		0	0	1	0	NR	1
SWEEPS UST	0.25 mile		3	7	NR	NR	NR	10
HIST UST	0.25 mile		5	11	NR	NR	NR	16
CA FID UST	0.25 mile		3	5	NR	NR	NR	8
RCRA NonGen/NLR	0.25 mile		0	1	NR	NR	NR	1
DRYCLEANERS	0.25 mile		3	2	NR	NR	NR	5
HAZNET	0.001 mile		1	NR	NR	NR	NR	1
HIST CORTESE	0.5 mile		4	7	3	NR	NR	14
Notify 65	1 mile		0	0	0	2	NR	2
CONTRA COSTA CO. SITE LIST	0.25 mile		19	29	NR	NR	NR	48
EDR Historical Auto Stations	0.125 mile		7	NR	NR	NR	NR	7
EDR Historical Cleaners	0.125 mile		7	NR	NR	NR	NR	7
NOTE: TP = Target Property; NR = Not Requested at this Search Distance								

Multiple federal and state agency database listings were identified within the ASTM-specified search distances from the Project area. A total of 160 sites were plotted in the EDR Database, with 65 sites located within 1/8-mile from the Project area. A release resulting from activities at nearby properties can sometimes impact surrounding properties. Regulatory records concerning nearby properties are reviewed in order to identify a release of hazardous materials which would be expected to impact conditions at the Project area.

To evaluate whether a database address listing represents a REC with respect to the Project area, the following criteria was applied for this ISA:

- The listing must indicate that a hazardous substance release (or spill or discharge) has occurred or is likely to have occurred. In the absence of a release to the environment, it is unlikely that an address listing represents a REC with respect to the Project area.
- The Project area must be located downgradient to the listed address. Local groundwater flow direction is likely to the northwest based on local topography and nearby groundwater information. An address with a known or suspected release must be upgradient and therefore generally to the east-southeast of the Project area in order to represent a REC with respect to the Project area. A listed address that is cross- or downgradient with respect to the Project area is unlikely to represent a REC for the Project area.

- A known or suspected release at an off-site location must have affected or must have the potential to affect groundwater flowing toward the Project area.

3.3.1 Project Area

Some properties that are directly adjoining the Project area were listed in some of the federal and state agency databases, including **RCRA-SQG** (EPA's comprehensive information system for sites that generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act [RCRA]), **LUST** (leaking underground storage tank sites included in GeoTracker), **ENF** (enforcement action listing by Water Board), **HIST CORTESE** (sites designated by the State Water Resources Control Board [SWRCB], Integrated Waste Board, and DTSC [that is no longer updated]), **CONTRA COSTA CO. SITE LIST** (Contra Costa County Master List of facilities including underground tank program, hazardous waste generator program & business plan program), **HAZNET** (data extracted from the copies of hazardous waste manifests received each year by the DTSC), **SLIC** (cleanup program sites, formerly known as spills, leaks, investigations, and cleanups), NPDES (national pollutant discharge and elimination service), **Historical Cleaner** (listings of potential dry cleaners that were identified in business directories), **Historical Auto** (listings of potential gas station/filling station/service station sites that were identified in business directories), **FINDS** (facility index system that contains both facility information and pointers to other sources of information that contain more detail), **ECHO** (EPA's enforcement and compliance history database), **DRYCLEANERS** (list of drycleaner related facilities that have EPA ID numbers).

The adjoining properties to the Las Trampas Creek Bridge, were identified in the EDR database and include the properties to the south-southeast (1305, 1335, and 1345 S Main St), to the east-northeast (1322 S Main St), and to the north-northwest (1275 S Main St), in addition to other sites located upgradient and cross-gradient to the Las Trampas Creek, that are discussed below in Table 3.

Table 3. Discussion of Sites Identified in EDR Database within 500 feet of Project Area

Property Address (Location to Project Area)	Previous Business Name	EDR Database	Current Use	Summary/Pollutants of Concern	Case Status	Potential Pollution Risk (low, moderate, high)
1149 S Main St (0.089- mile NNW of Project area)	**Chevron** SS #95275 gas station, Robinson Norman Chevron	SWEEPS UST, CA FID UST, CONTRA CONSTA CO. SITE LIST, EDR Hist Auto, HIST UST, LUST, HIST CORTESE	Retail store – Anthropologie & Co.	Former gas station (1969-1987)	NFA letter -**Case Closed** as of 6/4/1998	Low (downgradient)
1231 S Main St (0.036-mile NNW of Project area)	**Goodyear Tire & Rubber Co., RY-NCK Tire & Brake Inc**	SWEEPS UST, HIST UST, CA FID UST, CONTRA CONSTA CO. SITE LIST, EDR Hist Auto, LUST, HIST CORTESE	Retail store – Giants' Dugout Store	RY-NCK Tire & Brake Inc (1987-2000); Petroleum hydrocarbons	NFA letter -**Case Closed** as of 3/3/1997	Low (downgradient)
1232 S Main St (0.034-mile NNW of Project area)	**RY-NCK Tire & Brake Inc**	EDR Hist Auto	N/A	Auto and home supply (1985-1986)	N/A	Low (downgradient)
1275 S Main St (0.009-mile WNW of Project Area)	**Texaco** gas station, All Foreign Auto Service	LUST, ENF, HIST CORTESE, CONTRA COSTA CO. SITE LIST, EDR Hist Auto	Gott's Roadside Restaurant	Former gas station (1973-1991)	NFA letter -**Case Closed** as of 4/18/2001	Low (downgradient)
1301 Broadway Plaza (0.034-mile NE of Project area)	**Macy's**	EMI, CONTRA COSTA CO. SITE LIST	Macy's	Emissions (2010-2014) - CO (0.001 tons/year) and NOX (0.003 tons/year); HMBP and HWG under CUPA	N/A	Low (downgradient)
1322 S Main St (adjoining property; ENE of Project area)	**Unocal** gas station	LUST	Stanford's Restaurant	Potential residual petroleum hydrocarbons in soil	NFA letter -**Case Closed** as of 5/1/1998	Low (cross-gradient)

Table 3. Discussion of Sites Identified in EDR Database within 500 feet of Project Area

Property Address (Location to Project Area)	Previous Business Name	EDR Database	Current Use	Summary/Pollutants of Concern	Case Status	Potential Pollution Risk (low, moderate, high)
1305-1335 S Main St (adjoining property; 0.019-mile S of Project area)	**7-Eleven Store, Diablo Cleaners**, **Virginia Cleaners, Motopsycho**	HAZNET, EDR Hist Cleaner, RCRA-SQG, FINDS, ECHO, DRYCLEANERS, CONTRA COSTA CO. SITE LIST, SLIC	*1305, 1335, and 1345 S. Main St were consolidated into one parcel and redeveloped as **1500 Newell Ave - Agora at South Main/Essex Apt Homes** ~ **Pacific Catch Seafood Restaurant** ~ **California Pizza Kitchen**	Diablo Cleaners (1969-1996) and Virginia Cleaners (1997-1999); Environmental investigations performed from 1989 to 2013 and identified PCE in soil and gw. From October 2013 - March 2014, remedial action was performed at the site and included the removal of approximately 7,775 cubic yards of soil impacted by VOCs, petroleum hydrocarbons, lead, and PAHs. During remedial action activities, a groundwater dewatering and treatment system was operated (November 2013- April 2015) and approximately 6.5 million gallons of groundwater was treated, removing approximately 1 pound of VOCs. Prior to excavation, dry-cleaning solvents – PCE, TCE, DCE, and VC were detected in soil, gw, and soil vapor beneath the former drycleaners location in the southern portion of the site. The dissolved plume extended north (downgradient) toward the Las Trampas Creek, adjacent to the northwest. Solvents have not been detected in creek water. The plume has not been fully delineated.	**Open Case**	**High** (Adjoining Property)
1345 S Main St (adjoining property; SE of Project area)	**ARCO** gas station, Russ Richfield Service	EDR Hist Auto	**1500 Newell Ave - Agora at South Main/Essex Apt Homes ~ T-Mobile Cell Phone Store**	Former gas station from approximately 1956 to 1975 - Petroleum hydrocarbons in soil and USTs with associated piping removed during excavation activities; Potential residual petroleum hydrocarbons in soil	N/A	Low (Adjoining Property)
1387 S California Blvd (0.161-mile SW of Project area)	Walnut Creek **Beacon** gas station, Exxon #74061, Pauls Auto Center	UST, CA FID UST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Beacon Gas station - FasTest Smog Centers	In 1991, hydrocarbon pollution associated with former Exxon station found in soil/gw; remedial action plan and air/sparge treatment system in 1995-1998; Potential residual petroleum hydrocarbons in soil/gw	NFA letter -**Case Closed** as of 8/30/2001	Low (upgradient)

Table 3. Discussion of Sites Identified in EDR Database within 500 feet of Project Area

Property Address (Location to Project Area)	Previous Business Name	EDR Database	Current Use	Summary/Pollutants of Concern	Case Status	Potential Pollution Risk (low, moderate, high)
1400 Newell Ave (0.017-mile S of Project area)	**Certified Tire & Service Centers WC**	CONTRA COSTA CO. SITE LIST	Parking structure	HMBP and HWG in CUPA program for Contra Costa County	N/A	Low (cross-gradient)
1425 S Main St (0.056-mile SSE - 0.111-mile S of Project area)	**Kaiser Permanente Medical Center, Kaiser Medical Center, Kaiser WC**	LUST, UST, SWEEPS UST, HIST UST, CA FID UST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Kaiser Permanente Medical Center	Leaking underground storage tank; Potential residual petroleum hydrocarbons (diesel) in soil/gw	NFA letter -**Case Closed** as of 4/14/1995	Low (cross-gradient)
1491 Newell Ave (0.013-mile SSE of Project area)	East Bay **Union 76** Inc	EDR Hist Auto	Georges Giant Hamburger	Former gas station; Current commercial strip mall; potential residual petroleum hydrocarbons in soil/gw	N/A	Low (cross-gradient)
1500 Newell Ave (0.021-mile S of Project area) *1305, 1335, and 1345 S. Main St were consolidated into this parcel	**Newell Village**, Essex Walnut Owner LP, **Valet America Inc** (1983)	NPDES, CONTRA COSTA CO. SITE LIST, DRYCLEANERS, HAZNET, EDR Hist Cleaner	Agora at South Main/Essex Apt Homes	NPDES for dewatering during construction; Soil excavation for new building (2009-2013) removed impacted soil and groundwater; COCs include those for properties at 1305, 1335, and 1345 S. Main St (see above)	N/A	Low (South of Project area)
1552-1554 Newell Ave (0.072-mile SSW of Project area)	**Dry Cleaning Systems Inc.**	EDR Hist Cleaner	Vogue Cleaners (Sanitone Certified Master Drycleaner)- Cartridge World	Dry-cleaning Plant: [Voguish Inc] 1991-1996; [Dry Cleaning Systems Inc.] 1997 – 2014	N/A	Low (upgradient)
1599 Newell Ave (0.133-mile SW of Project area)	Kaiser **Shell** gas station, **Exxon** service station, **Texxoil**	LUST, UST, SWEEPS UST, HIST UST, CA FID UST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Flyers/Kaiser Auto Care gas station	Current Flyers/Kaiser Auto Care gas station; Potential residual petroleum hydrocarbons in soil/gw	NFA letter -**Case Closed** as of 3/11/2014	Low (upgradient)
1611 Newell Ave (0.166-mile SW of Project area)	**BP Oil** Company facility, Walnut Creek **Beacon** gas station, **Mobil** service station	UST, SWEEPS UST, CA FID UST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Walnut Creek Gasoline/Mobil	Current Mobil gas station; constructed in 1959; Potential residual petroleum hydrocarbons in soil/gw	NFA letter -**Case Closed** as of 7/13/2012	Low (cross-gradient)

3.4 Historical Use Information

Information regarding prior uses of the Project area was collected using available historical reference sources. Information related to the historical use of this property and surrounding area was obtained from a review of aerial photographs, historical topographic maps, fire insurance maps, and city directory information provided as part of the EDR report.

3.4.1 Historical Aerial Photography

Historical site uses can frequently be ascertained from a review of aerial photographs. Aerial photographs of the Project area and surrounding area were provided by EDR for the following years: 1939, 1946, 1949, 1950, 1958, 1968, 1974, 1979, 1982, 1993, 1998, 2005, 2006, 2009, 2010, and 2012. The EDR Aerial Photo Decade Package is included in Appendix F. Below is a summary of the Project area use description and significant changes observed in the photographs.

Year	Source	Project area Use Description/Significant Changes
1939	USDA 1" =500'	There is an existing road and bridge. Areas to the north and west of the Las Trampas Creek are highly developed. Orchards are visible west and south of the Project area. Areas to the east are undeveloped grasslands.
1946, 1949	USGS 1" =500'	Same as above; 1946: slight increases in building developments north and south of the bridge. Buildings developed within orchards. 1949: slight increase in building developments north of the bridge.
1950	USDA 1" =500'	More housing developments in orchard area west and south of the Project area. Two additional dirt roads connected to South Main Street south of the bridge.
1958	USGS 1" =500'	Project vicinity significantly developed, minimal orchards visible. Several major paved roadways visible including Botelho Dr, Olympic Blvd, Newell Ave, and Broadway Plaza. Las Trampas Creek and Walnut Creek no longer visible to the north. Beginnings of highway 680 visible.
1968, 1974	USGS 1" =500'	Project vicinity completely developed. Orchards removed. Project area surrounded parking lots and small buildings to the south. Las Trampas Creek lined with concrete and cleared of trees between S Main St. and S California Blvd.
1979, 1982	USDA 1" =500'	Same as above; 1979: some tree growth along Las Trampas Creek (poor photo quality); 1982: small buildings to the south of the Project area removed.
1993, 1998	USGS/DOQQ 1" =500'	New small buildings developed south of the Project area, south of the S Main St and Botelho Dr. intersection, and north of S Main St and Broadway Plaza intersection. Large building developed at the location of the existing parking structure.
2005, 2006 2009, 2010, 2012	USDA/NAIP 1" =500'	Same as above; large building developed northwest of the S Main St and Botelho Dr. intersection. Project area appears as current configuration except for residential apartments south of the bridge built in 2015.

3.4.2 Historical Topographic Maps

A historical map report was prepared by EDR and included a search of a collection of public and private topographic maps. Maps dated 1897 (Concord), 1915 (Concord), 1947 (Las Trampas Ridge, Walnut Creek), 1948 (Concord), 1949 (Las Trampas Ridge, Walnut Creek), 1959 (Las Trampas Ridge, Walnut Creek), 1968 (Las Trampas Ridge, Walnut Creek), 1973 (Las Trampas Ridge, Walnut Creek), 1980 (Las Trampas Ridge, Walnut Creek), 1995 (Walnut Creek), 1996 (Las Trampas Ridge, Walnut Creek), and 2012 (Las Trampas Ridge, Walnut Creek) were provided for review by EDR. The EDR Historical Topographic Map Report is included as Appendix B.

Year	Project area Use Description/Significant Changes
1897	There is a small developed area north of the Project area with streets and buildings. The Southern Pacific Railroad is visible. The City of Walnut Creek name is shown. Sugarloaf Hill is named to the south.
1915	The Sacramento Northern Railroad is built. Other smaller towns are labeled (Saranap, Napland, Krelling, Locust).
1947	The Project area and vicinity have developed significantly. Roads and buildings are identified. Las Trampas Creek Bridge is located on Route 21. Las Trampas, Tice, and San Ramon creeks are labeled. Limited building development to the south and significant development to the north of the Project area. Newell Ave and Botelho Dr (existing) are shown extending from Route 21 to the west.
1948	More streets are visible north and west of the Project area. Route 24 extends from 21 to the west. Lafayette Creek and towns (Walden, Oxley, Saranap) are labeled.
1949	Project area appears similar to the previous map. Boundary monuments or benchmarks are visible throughout.
1959	Walnut Creek and San Ramon city boundaries are distinguished. More development visible throughout. Building developments are no labeled in this map. Map shows the Las Trampas Creek Bridge to be part of a 4-lane roadway. Existing roads have been fully developed surrounding the Project area. Walnut Creek channelized underground. Sacramento Northern Railroad track labels are changed to "Old RR Grade"
1968, 1973, 1980	The Project area and vicinity appear similar to the previous map.
1995	Highway 680 is labeled.
1996, 2012	The Project area and vicinity appear similar to the previous map.

3.4.3 Sanborn Fire Insurance Maps

Fire insurance maps (Sanborn Maps) are used to determine fire hazards and were produced for most urban areas beginning in the late 1800's. Maps were provided by EDR for the following years: 1915, 1926, 1943, 1953, and 1956. The Certified Sanborn® Map Report is included as Appendix G.

Year	Project area Use Description/Significant Changes
1915	Only the northern section of the Project area is shown. Northwest of the bridge, there is a barn, buggy shed, and granary; Locust Ave is shown, and Walnut Creek Grammar School is NW of the Project area; So Main St (not labeled) has several commercial buildings with a Church, IDES Hall, and residential structures.
1926	Only the northern section of the Project area is shown. S Main St is labeled County Road, and Las Trampas Creek Bridge is shown as a reinforced concrete bridge; Buggy shed and granary replaced with a storage building; Barn removed.
1943	Only the northern section of the Project area is shown. Storage building removed; Walnut Creek Grammar School has expanded its buildings.
1953	Only the northern section of the Project area is shown. Stores have been built to the north of the Project area, including a nursery; Botelho is shown where Locust Ave was identified; Broadway (Plaza) is shown to the east of the Project area; no buildings or structures are shown near the creek or bridge.
1956	The entire area around Las Trampas Creek and bridge are shown; County Road changed to S Main St; South of the bridge/Project area is a gas station shown as Gas & Oil (likely the former Arco station at 1345 S Main St); East of the bridge/Project area is a gas station shown as Gas & Oil (the former Unocal station at 1322 S Main St); several stores and office buildings are shown to the south-southeast of the Project area; Newell Ave is shown crossing S Main St; San Ramon Creek is shown to the east of S Main St; Broadway (Plaza) is shown connecting to S Main St, and several stores, banks and service shops are located along the road (former area where Macy's will occupy).

3.4.4 City Directory Review

Historical use of the property can be inferred from previous companies that may have operated at the facility and in nearby facilities. The Project area had listings in the research source (Haines Criss-Cross Directory and Cole Information Services) for the following years: 1975, 1980, 1985, 1992, 1995, 1999, 2003, 2008, and 2013. A summary of the historical city directory records researched is listed below. The EDR City Directory Abstract is provided in Appendix H.

Northwest of Project Site (1275 S Main St)

Date Range	Description
Present	Gott's Roadside Restaurant
2013, 2008, 2003, 1999,	Fresh Choice Restaurant
1995	Not listed
1992, 1985, 1980	All Foreign Auto SV
1975	Bob Turners Texaco

West of Project Site (1295 S Main St)

Date Range	Description
Present, 2013, 2008	Ross Dress for Less
2003, 1999	Ross Stores Inc.
1995	Not listed
1992	Ross Stores Inc.
1985	Pickle Deli
1980, 1975	Not Listed

Southeast of Project Site (1300 S Main St)

Date Range	Description
Present, 2013, 2008, 2003, 1999	Stanford's Restaurant & Bar

South of Project Site (1305 S Main St)

Date Range	Description
Present	Pacific Catch Seafood Restaurant
2013	Not Listed
2008	7-Eleven
2003, 1999	7-Eleven Food Store
1995	Not Listed
1992	7-Eleven Food Store
1985, 1980, 1975	Parker House Liquor

South of Project Site (1335 S Main St)

Date Range	Description
Present	California Pizza Kitchen
2013, 2008, 2003	Not Listed
1999	Virginia Cleaners
1995, 1992, 1985, 1980, 1975	Diablo Cleaners

3.5 Reconnaissance of the Property Area and Vicinity

WRECO staff conducted the Project area reconnaissance visit on July 14, 2017. The proposed Project footprint and adjacent properties that may be impacted were reviewed. The Project area generally appeared consistent with the documented historic use of the area, but with more development in recent years. This area is characterized with predominantly commercial businesses, parking areas, and few residential buildings.

Multiple utility conduits are mounted on both sides of the bridge and existing railings appeared to be of different ages. Roadway surface water flow appears to head toward two curb-side storm drains located at the southwestern corner of the bridge. Immediately northwest of this location, storm drain culvert outfalls into Las Trampas Creek over aged concrete.

The properties adjoining the Project area were observed and identified:

- A parking structure and parking lot for the Broadway Plaza shopping center (APN 183-011-024) are northeast and east of the Project area;
- A restaurant (Stanford’s, 1322 S Main St – APN 183-011-019) is located to the east-southeast of the Project area;
- Directly adjoining the northwestern side of the creek is Ross Dress for Less retail store and parking lot (1295 S Main St, APN 184-070-011);
- The previous stores (7-Eleven and Motopsycho) are removed and several parcels were consolidated into one large parcel that is now occupied by Agora at South Main residential apartments (1496-1500 Newell Ave, APN 184-070-027) to the south of the Project area; and
- Across Las Trampas Creek to the north, along the western side of the bridge, is a new restaurant (Gott’s Roadside – 1275 S Main St, APN 184-070-013).

The bridge and roadway were inspected as part of the site reconnaissance, and several environmental and structural concerns were identified:

- The existing pavement section contains asphalt concrete that contained *de minimis* surface staining and pavement striping (striping may contain LBP).
- The concrete sidewalk on either side of the bridge has red paint on the curb which may contain lead.
- The sidewalk contains buried utilities and vaults that are likely connected to the utility conduits that are attached to the underside of the pedestrian walkway on both sides of the bridge. All utilities will require re-routing and removal for the bridge demolition.
- The concrete abutments may have asbestos containing material (ACM) as a strengthening agent for the pre-cast structures.
- Some of the underside-mounted utilities might contain pipe wrapping material that has ACM.
- Existing railings are different on each side of the bridge and are painted with potentially lead-based paint (LBP).
- Storm drain culverts outfall to Las Trampas Creek over aged sacked concrete, that are used to stabilize the banks of the creek.
- The center median has concrete curbs with decorative pavers.
- Access to the creek is difficult and may require a rope or ladder system to gain entry.

3.6 ISA Findings and Recommendation

According to historical records, the Project area was utilized as a main roadway in the early 1900s and continued to experience continued development throughout the 20th century. In 1956 two gas stations were present to the south (former ARCO service station - 1345 S Main St) and the east (former Unocal service station – 1322 S Main St). By 1969, Diablo Cleaners was located at 1335 S Main St (until 1996) and then became Virginia Cleaners in 1997 (until 1999). A liquor store (Parker House Liquor) was located at 1305 S Main St from approximately 1975 to 1985, and then became 7-Eleven until about 2010. Throughout the latter half of the 20th century, additional construction in this area of Broadway Plaza continued, creating an outside mall for pedestrian access adjacent to the Project area.

Las Trampas Creek, flowing east from the hills of Moraga and Lafayette, and San Ramon Creek, flowing north from the hills above San Ramon, merge in the heart of downtown and continue to flow north as Walnut Creek to the San Francisco Bay. Both Creeks have been significantly altered from its natural condition to fit the expanding urban form. They are mostly inaccessible to the public and have lost much of their environmental value. Significantly, at the confluence of the two branches, the City has overwhelmed the creeks by covering them entirely with streets and a shopping center. The Las Trampas Creek segments are in open trapezoidal channels, open rectangular concrete channels and entirely covered. Two drop structures occur upstream of the Project area, and others occur downstream of the study area. The result of the extensive flood control work is that the entire channel system requires high levels of management and maintenance, and the habitat has been significantly compromised.

The Las Trampas Creek Bridge was originally constructed in 1919 and widened in 1950 and 1956. Given typical construction materials and methods of those times, ACM and lead-based paint (LBP) may exist at the Project location and become disturbed during demolition activities. The preliminary ISA identified several potential RECs at the Project area, and WRECO presented the following recommendations to the City of Walnut Creek (via Quincy Engineering) in the ISA Memo dated July 27, 2017 (Appendix A):

- The GeoTracker database identified an open clean-up site immediately adjacent to the Project at 1335 South Main Street. The site was a former dry-cleaning business (Virginia Cleaners, 1305-1335 S Main St) and has listed constituents of concern of chlorinated hydrocarbons, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride. Based on informal consultations with the San Francisco Bay RWQCB, these constituents were remediated in soil at the former drycleaner location but may persist in soils adjacent to sewer lines outside of the cleanup site. Soils excavated along sanitary sewer lines outside the drycleaner site remediation boundary should be screened for PCE and its breakdown products to verify that there were no historic releases along the City's sanitary sewer adjacent to the drycleaner. Additionally, there are various closed LUST sites located both adjacent to and within 1/8-mile of the Project.
- WRECO recommended conducting a Preliminary Site Investigation (PSI) based the findings mentioned above. Sampling below the existing City's sanitary sewer adjacent to the former drycleaner site was not recommended during the PSI due to access limitations.
- Structural sampling on the bridge for LBP and ACM; and
- Asphalt and concrete grindings waste.

WRECO was provided authorization from the City of Walnut Creek (and Quincy Engineering) to proceed with the PSI, and to combine the ISA with the additional investigation. A copy of the Caltrans ISA Checklist is presented in Appendix I and photographs documenting the reconnaissance and other site visits are included in Appendix J.

Figure 8. Las Trampas Creek Bridge – Soil/Groundwater Boring Locations

4 PRELIMINARY SITE INVESTIGATION

4.1 Soil and Groundwater Investigation

On August 2-3, and September 6, 2017, WRECO conducted a Preliminary Site Investigation along the Las Trampas Creek Bridge, as part of the Replacement Project. Three soil borings were drilled and sampled for both geotechnical and environmental sampling, to better characterize the subsurface soil and groundwater conditions. The environmental sampling was conducted to screen shallow soils for hazardous materials that may be encountered by workers, and to assess available options for excavated soil reuse and/or waste management for the upcoming Bridge Replacement Project.

Prior to field work being performed, the sample locations were marked in white paint and USA North 811 was contacted to mark utilities near the boring locations. A drilling/soil boring permit was procured from the Contra Costa Environmental Health division. The work was completed in conjunction with the geotechnical borings for the structural design specifications. The borings were completed by Geo-Ex Subsurface Exploration under the supervision of a WRECO geologist. On August 2, 2017, boring R-17-001 was drilled using a CME-75 truck mounted drill rig with 4-inch diameter continuous flight augers until groundwater was encountered, then mud rotary drilling was used to advance the boring to the total depth of 80.1 feet bgs (elevation 69.3 feet). Groundwater was encountered at approximately 21 feet bgs in boring R-17-001. Soil samples for environmental analysis were collected from R-17-001 (S-01) at depth intervals of 5 feet bgs, 20 feet bgs, and 25 feet bgs. A groundwater sample was collected from the boring and labeled W-01.

On August 3, 2017, boring A-17-001 was attempted three times (A, B, and C) using a 6-inch diameter hand auger, but terminated at 3-feet deep due to an unknown buried obstruction.

On September 6, 2017, boring R-17-003 was drilled using a CME-75 truck mounted drill rig using continuous flight augers until groundwater was encountered, then mud rotary drilling was used to advance the boring to the rock surface (elev. 81.6 ft). Rock core was then recovered using 2.5-inch inside diameter (ID) HQ-wireline diamond coring equipment to a total depth of 86.8 feet bgs (elevation 62.8 feet). Groundwater was encountered at approximately 16.5 ft bgs in boring R-17-003. Soil samples for environmental analysis were collected from R-17-003 (labeled as SB-02) at depth intervals of (0-1) feet bgs, (1-2) feet bgs, (2-3) feet bgs, 5 feet bgs, 10 feet bgs, 15 feet bgs, and 20 feet bgs. A groundwater sample was collected from the boring and labeled W-02 (18 feet).

Shallow soil samples from (0-5) feet bgs were collected using a hand auger that was cleaned and decontaminated between soil sample locations. Soil samples taken deeper than 5 feet bgs were obtained using both a California Modified Sampler (Cal-Mod) fitted with three 6-inch stainless steel sleeve liners and a Standard Penetration Test (SPT) Sampler without liners. The soil sampler was advanced/driven using a 140-pound auto-trip hammer, free falling 30-inches, in general conformance with conducting the Cal-Mod Sampler (ASTM D3550) and the SPT (ASTM D1586). The borings were logged, and the sediments were classified by an on-site WRECO geologist as drilling progressed using the procedures in the *2010 Caltrans Soil and*

Rock Logging, Classification, and Presentation Manual. The boring field logs are provided in Appendix K, and the boring locations are shown on Figure 8.

All soil samples were either placed in laboratory-approved containers or the sample tubes were capped at each end with a Teflon sheet and plastic lid. All samples were labeled, logged onto the Chain of Custody form, placed into an ice chest with ice, trip blanks, and transported to the laboratory for analytical testing. The soil samples were submitted under Chain of Custody to McCampbell Analytical, Inc., Pittsburg, California. Samples were analyzed for benzene, toluene, ethylbenzene, xylenes (BTEX), methyl tertiary butyl ether (MTBE), and total petroleum hydrocarbons (TPH) as gasoline (TPHg), using EPA Method 8021/8015; TPH as diesel (TPHd) and motor oil (TPHmo) without Silica Gel, using EPA Method 8015; and CAM-17 Metals using EPA Method 6020. Soil samples taken at R-17-003 (SB-02) at depths between (0-3) feet bgs were put on hold.

Groundwater samples were collected with a high-density polyethylene (DHPE) bailer attached to a rope. Water samples were placed in laboratory-provided ampules with specific preservatives, sealed, labeled, and placed in an ice chest with ice, trip blanks, and transported to the laboratory for analytical testing. The groundwater samples were submitted under Chain of Custody for analysis by McCampbell Analytical, Inc. in Pittsburg, California. Water samples were analyzed for BTEX, MTBE, and TPHg, using EPA Method 8021/8015; TPHd and TPHmo (without Silica Gel), using EPA Method 8015; volatile organic compounds (VOCs) using EPA Method 8260; and CAM-17 Metals using EPA Method 6020. Clear groundwater samples for W-01 and W-02 could not be obtained in the time allotted for drilling, therefore the CAM 17 results from murky samples preserved on site are not representative of dissolved metals in groundwater. Groundwater sample W-02 (SB-02) was analyzed for VOCs due to its proximity to the open case dry-cleaning site.

The borings were backfilled with neat cement grout to near existing ground surface (±6 inches) and backfilled with quickset concrete dyed black. The geotechnical boring locations are shown on the Log of Test Borings (LOTB) figure provided in Appendix K.

4.1.1 Soil and Groundwater Analyses

The soil and groundwater samples collected, constituents of concern, and analyses performed are summarized below. Detailed sampling methods, procedures, and results are provided in subsequent sections.

Table 4. Analysis of Collected Samples

Sample ID	Sample Description	Constituents of Concern	Analyses Requested	EPA Methods
S-01-A	Soil bore @ 5 ft bgs	lead, gasoline, diesel, waste oil	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals	8021/8015; 8015; 6020
S-01-C	Soil bore @ 20 ft bgs	lead, gasoline, diesel, waste oil	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals	8021/8015; 8015; 6020
S-01-E	Soil bore @ 25 ft bgs	lead, gasoline, diesel, waste oil	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals	8021/8015; 8015; 6020
SB-02 0-1	Soil bore @ 0-1 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	*Put on hold until requested otherwise*	--
SB-02 1-2	Soil bore @ 1-2 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	*Put on hold until requested otherwise*	--
SB-02 2-3	Soil bore @ 2-3 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	*Put on hold until requested otherwise*	--
SB-02 5’	Soil bore @ 5 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260
SB-02 10’	Soil bore @ 10 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260
SB-02 15’	Soil bore @ 15 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260
SB-02 20’	Soil bore @ 20 ft bgs	lead, TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260
W-01	Groundwater @ 25 ft bgs	Gasoline, diesel, waste oil	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260
W-02 18’	Groundwater @ 18 ft bgs	TCE, PCE, vinyl chloride, gasoline, diesel, waste oil, chlorinated hydrocarbons	BTEX, MTBE, TPH as Gas; TPH as Diesel + Motor Oil without Silica Gel; CAM 17 Metals; VOCs	8021/8015; 8015; 6020; 8260

4.1.2 Soil and Groundwater Results

The results of the limited subsurface investigation are summarized in Tables 4, 5 and 6, and are compared to Environmental Screening Levels (ESLs) provided by the RWQCB. Concentrations of metals in soil were below the RWQCB ESLs, TTLC and STLC limits, except for arsenic. Arsenic concentrations in soil ranged from 3.8 to 9.2 mg/kg, which exceeds the ESLs for residential, commercial-industrial, and construction worker.

Of the seven soil samples analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, and VOCs, only four soil samples had detectable concentrations, all below the Tier 1 RWQCB ESLs. Soil sample S-01-A (5’) contained detectable TPHd (10 mg/kg) and TPHmo (130 mg/kg) concentrations. Soil sample SB-02 (5’) contained detectable TPHd (1.7 mg/kg) and TCE (0.0073 mg/kg) concentrations. Soil sample SB-02 (15’) contained a detectable TPHg (3.4 mg/kg) concentration. Soil sample SB-02 (20’) contained detectable TCE (0.0075 mg/kg) and DCE (0.011 mg/kg) concentrations.

Groundwater sample concentrations exceeded RWQCB Tier 1 ESLs for TPHg, TPHd, ethylbenzene and xylenes (W-01), DCE, PCE, and vinyl chloride (W-02), and most Water Quality Objectives (WQO), CA Toxics Rule (CTR), and EPA National Toxics Rule (NTR) criteria for surface water for these constituents. Laboratory reports are provided in Appendix L.

Table 5. Analytical Results for Soil Samples - Metals

Boring/ Sample ID	*Constituent*	*CAM 17 Metals (mg/Kg)*	*ESL (Table S-1)*			*Hazardous Waste Criteria*		*Waste Reuse and Disposal Screening*				*CA Hazardous Waste Classification*
			Residential Use (mg/Kg)	*Com/Ind Use (mg/Kg)*	*Construction Worker (mg/Kg)*	*STLC (mg/L)*	*TTLC Limit (mg/Kg)*	*Total ≥ TTLC?*	*Total ≥ Res ESL?*	*Total ≥ Com ESL?*	*[1]Total ≥10 x STLC?*	
S-01-A 5’	Arsenic	**3.8**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	120	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	29	--	--	--	5	2,500	no	no	no	no	
	Cobalt	7	23	350	28	80	8,000	no	no	no	no	
	Copper	16	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	17	80	320	160	5	1,000	no	no	no	no	
	Mercury	ND	13	190	44	0.2	20	no	no	no	no	
	Nickel	30	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	39	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	44	23,000	350,000	110,000	250	5,000	no	no	no	no	
S-01-C 20’	Arsenic	**5.0**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	110	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	35	--	--	--	5	2,500	no	no	no	no	
	Cobalt	7.3	23	350	28	80	8,000	no	no	no	no	
	Copper	14	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	5.2	80	320	160	5	1,000	no	no	no	no	
	Mercury	ND	13	190	44	0.2	20	no	no	no	no	
	Nickel	38	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	36	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	45	23,000	350,000	110,000	250	5,000	no	no	no	no	
S-01-E 25’	Arsenic	**9.2**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	260	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	37	--	--	--	5	2,500	no	no	no	no	
	Cobalt	12	23	350	28	80	8,000	no	no	no	no	
	Copper	14	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	6.2	80	320	160	5	1,000	no	no	no	no	
	Mercury	ND	13	190	44	0.2	20	no	no	no	no	
	Nickel	40	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	34	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	43	23,000	350,000	110,000	250	5,000	no	no	no	no	

[1]If a substance is ten times (by rule of thumb) the STLC value found on the TTLC, the Waste Extraction test (WET) should be performed. If any substance in the waste so analyze equals or exceeds the STLC value, it is considered a non-RCRA hazardous waste.

Table 5. Analytical Results for Soil Samples - Metals

Boring/ Sample ID	*Constituent*	*CAM 17 Metals (mg/Kg)*	*ESL (Table S-1)*			*Hazardous Waste Criteria*		*Waste Reuse and Disposal Screening*				*CA Hazardous Waste Classification*
			Residential Use (mg/Kg)	*Com/Ind Use (mg/Kg)*	*Construction Worker (mg/Kg)*	*STLC (mg/L)*	*TTLC Limit (mg/Kg)*	*Total ≥ TTLC?*	*Total ≥ Res ESL?*	*Total ≥ Com ESL?*	*[1]Total ≥10 x STLC?*	
SB-02 5'	Arsenic	**5.3**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	120	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	30	--	--	--	5	2,500	no	no	no	no	
	Cobalt	6.9	23	350	28	80	8,000	no	no	no	no	
	Copper	12	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	6.1	80	320	160	5	1,000	no	no	no	no	
	Mercury	0.054	13	190	44	0.2	20	no	no	no	no	
	Nickel	30	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	39	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	41	23,000	350,000	110,000	250	5,000	no	no	no	no	
SB-02 10'	Arsenic	**5.2**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	120	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	28	--	--	--	5	2,500	no	no	no	no	
	Cobalt	6.1	23	350	28	80	8,000	no	no	no	no	
	Copper	11	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	5.1	80	320	160	5	1,000	no	no	no	no	
	Mercury	ND	13	190	44	0.2	20	no	no	no	no	
	Nickel	27	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	35	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	39	23,000	350,000	110,000	250	5,000	no	no	no	no	
SB-02 15'	Arsenic	**6.7**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	110	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	34	--	--	--	5	2,500	no	no	no	no	
	Cobalt	6.6	23	350	28	80	8,000	no	no	no	no	
	Copper	16	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	6.2	80	320	160	5	1,000	no	no	no	no	
	Mercury	0.057	13	190	44	0.2	20	no	no	no	no	
	Nickel	38	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	33	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	40	23,000	350,000	110,000	250	5,000	no	no	no	no	

Table 5. Analytical Results for Soil Samples - Metals

Boring/ Sample ID	Constituent	CAM 17 Metals (mg/Kg)	ESL (Table S-1)			Hazardous Waste Criteria		Waste Reuse and Disposal Screening				CA Hazardous Waste Classification
			Residential Use (mg/Kg)	Com/Ind Use (mg/Kg)	Construction Worker (mg/Kg)	STLC (mg/L)	TTLC Limit (mg/Kg)	Total ≥ TTLC?	Total ≥ Res ESL?	Total ≥ Com ESL?	[1]Total ≥10 x STLC?	
SB-02 20'	Arsenic	**4.6**	0.067	0.31	0.98	5.0	500	no	**yes**	**yes**	no	Non-hazardous
	Barium	120	15,000	220,000	3,000	100	10,000	no	no	no	no	
	Chromium	35	--	--	--	5	2,500	no	no	no	no	
	Cobalt	6	23	350	28	80	8,000	no	no	no	no	
	Copper	14	3,100	47,000	14,000	25	2,500	no	no	no	no	
	Lead	4.8	80	320	160	5	1,000	no	no	no	no	
	Mercury	0.069	13	190	44	0.2	20	no	no	no	no	
	Nickel	37	820	11,000	86	20	2,000	no	no	no	no	
	Vanadium	28	390	5,800	470	24	2,400	no	no	no	no	
	Zinc	41	23,000	350,000	110,000	250	5,000	no	no	no	no	

STLC = Soluble Threshold Limit Concentration; TTLC = Total Threshold Limit Concentration; ESL = Environmental Screening Level; mg/Kg = milligram per kilogram; mg/L = milligram per liter; ND = non-detectable

Table 6. Analytical Results for Soil Samples – Petroleum Hydrocarbons and VOCs

Analyte	Tier 1 ESL [1] (mg/kg)	Results (mg/kg)						
		S-01-A 5'	S-01-C 20'	S-01-E 25'	SB-02 5'	SB-02 10'	SB-02 15'	SB-02 20'
TPH(g) (C6-C12)	100	ND	ND	ND	ND	ND	**3.4**	ND
TPH-Diesel (C10-C23)	230	**10**	ND	ND	**1.7**	ND	ND	ND
TPH-Motor Oil (C18-C36)	5100	**130**	ND	ND	ND	ND	ND	ND
MTBE	0.023	ND	ND	ND	-	-	-	-
Benzene	0.044	ND	ND	ND	-	-	-	-
Toluene	2.9	ND	ND	ND	-	-	-	-
Ethylbenzene	1.4	ND	ND	ND	-	-	-	-
Xylenes	2.3	ND	ND	ND	-	-	-	-
Trichloroethene (TCE)	0.46	-	-	-	**0.0073**	ND	ND	**0.0075**
cis-1,2-Dichloroethene (DCE)	0.19	-	-	-	ND	ND	ND	**0.011**
All other VOCs	-	-	-	-	ND	ND	ND	ND

ESL = Environmental Screening Level; mg/Kg = milligram per kilogram; ND = not detected

Table 7. Analytical Results for Groundwater Samples

Analyte	RWQCB Tier 1 ESLs (µg/L)	RWQCB Region 2 Receiving WQO[2], EPA CTR, NTR (Freshwater Wetland-Estuarine) (enforceable)[3] (µg/L)	Results (µg/L)	
			W-01	W-02
TPH gas (C6-C12)	100	--	**700**	**130**
TPH diesel (C10-C23)	100	--	**19,000**	**200**
TPH motor oil (C18-C36)	--	--	**16,000**	ND
MTBE	5	--	ND	ND
Benzene	1	1	ND	ND
Toluene	40	150	ND	ND
Ethylbenzene	13	700	**33**	ND
Xylenes	20	--	**160**	ND
cis-1,2-Dichloroethene (DCE)	6.0	--	--	**11**
Tetrachloroethene (PCE)	3.0	0.80	--	**6.8**
Trichloroethene (TCE)	5.0	2.70	--	**4.1**
Vinyl Chloride (VC)	0.061	0.50	--	**1.1**
All other VOCs	--	--	--	ND

ESL = Environmental Screening Level; µg/L = micrograms per liter; ND = not detected; -- = no data; RWQCB Region 2 Receiving Water Quality Objectives (WQO) and CA Toxics Rule (CTR), EPA National Toxics Rule (NTR) (Freshwater Wetland-Estuarine) (enforceable); WQO[2]= SAN FRANCISCO BAY BASIN (REGION 2) WATER QUALITY CONTROL PLAN (BASIN PLAN) (December 31, 2010); (enforceable)[3]= Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California (40 CFR Part 131); most stringent criteria between WQO, NTR, CTR used for value in µg/L.

4.2 Structural Elements (LBP and ACM) Investigation

On August 3, 2017, as part of the ISA/PSI, the Las Trampas Creek Bridge was evaluated for the presence, extent, and condition of any above-ground, regulated LBP and ACM in order to assess safe work practices and waste disposal.

The structural element samples collected, constituents of concern, and analyses performed for LBP, and ACM samples are summarized below. Detailed sampling methods, procedures, and results are provided in subsequent sections.

Table 8. Analytical Results for Structural Element Samples

Sample ID	Sample Description	Constituents of Concern	Analyses Requested	EPA Methods
LBP-01	Paint solid	Lead	Flame Atomic Absorption Spectrophotometry	7000B
LBP-02	Bulk solid	Lead	Flame Atomic Absorption Spectrophotometry	7000B
LBP-03	Paint solid	Lead	Flame Atomic Absorption Spectrophotometry	7000B
LBP-04	Bulk solid	Lead	Flame Atomic Absorption Spectrophotometry	7000B
LBP-05	Bulk solid	Lead	Flame Atomic Absorption Spectrophotometry	7000B
ASB-01	Gray concrete	Asbestos	Asbestos Polarized Light Microscopy (PLM)	600/M4-82-020
ASB-02	Gray concrete	Asbestos	Asbestos Polarized Light Microscopy (PLM)	600/M4-82-020
ASB-03	Black non-fibrous material	Asbestos	Asbestos Polarized Light Microscopy (PLM)	600/M4-82-020
ASB-04	Gray transite	Asbestos	Asbestos Polarized Light Microscopy (PLM)	600/M4-82-020

4.2.1 Lead-Based Paint (LBP)

LBP is defined in Title 17, California Code of Regulations (CCR), Division 1, Chapter 8, as paint or other surface coatings that contain an amount of lead equal to, or more than one milligram per square centimeter (1.0 mg/cm^2); or half of one percent (0.5%) by weight.

In 1972, the Consumer Products Safety Commission limited lead content in new paint to 0.5% (5,000 ppm) and, in 1978, to 0.06% (600 ppm). Title 17 of the CCR presumes that paint on structures built before January 1, 1978, is LBP and disturbance of that structure requires use of lead-safe work practices including containment and cleaning the work area after the Project is completed. California regulates lead containing construction wastes through its hazardous waste regulation in Title 22 CCR Chapter 8. Total lead levels above 1,000 ppm (0.1% by mass) is considered California Hazardous waste. Lead levels above 350 ppm (0.035% by mass), while not hazardous, must be disposed of in a Class I landfill per AB 2784.

USEPA and CDPH define lead-based paint as paint having a lead content equal to or greater than 0.5% by weight or 5,000 parts per million (ppm) by paint chip analysis. Cal/OSHA considers any level of lead in paint to be a potential exposure hazard for the worker. The LBP investigation was conducted under the direction and quality control of a California Certified Lead Inspector/Assessor (CLIA) #20466.

4.2.1.1 LBP Sampling Methods and Results

On August 3, 2017, five LBP samples were collected from the Las Trampas Creek Bridge to evaluate the presence, extent, and condition of any above-ground, regulated LBP that may be present on the bridge to assess safe work practices and waste disposal options. The bridge has hand rails, curbs, and striping that are painted with suspect LBP. A visual inspection of the painted surfaces was completed prior to collecting paint chip samples from suspected LBP surfaces.

Suspect LBP samples were obtained by scraping or chipping off small pieces of the paint. Each LBP sample was bagged in a sealable plastic bag (i.e., Ziploc), labeled with the sample ID number, time, date, location, and photographed. Paint sample LBP-01 was taken from the brown metal railing paint (east side of bridge); LBP-02 was taken from the tan sidewalk coating; LBP-03 was taken from the green light post (in median) paint; LBP-04 was taken from the red curb paint (west side of bridge); and LBP-05 was taken from the white roadway striping. The LBP samples were transported with a Chain of Custody form, to TestAmerica Laboratory in Pleasanton, California, an approved and certified laboratory by the Department of Toxic Substances Control (DTSC). On August 7, 2017, the ACM samples were transported from TestAmerica Laboratory to QuanTEM Laboratories in Oklahoma City, Oklahoma, and analyzed for lead paint using EPA Method 7000/7420 Atomic Absorption Spectroscopy.

Laboratory results indicated that three LBP samples had no detectable lead paint, and two LBP samples contained lead results of 61.78 mg/kg (LBP-02; 0.0061% by wt) and 104 ppm (LBP-03; 0.0104% by wt). Laboratory results indicated that detectable lead results were identified in paint chip bulk samples from the tan sidewalk coating on the eastern side of the bridge, and in paint chip samples from the green painted metal light post in the center median. Both concentrations are below the California hazardous waste threshold and below the lead-based paint threshold provided by USEPA and CDPH of 5000 ppm (0.5% by wt), and the California hazardous waste threshold of 0.1%. LBP-01, -02, and -03 exceed the zero threshold for Cal/OSHA Lead in Construction Standard. The results of the lead-based paint sampling are summarized in Table 7, photographs taken during LBP sampling is provided in Appendix J, and laboratory reports are provided in Appendix L.

Table 9. Analytical Results for Lead Samples

Analyte	USEPA/CDPH threshold	Results				
		LBP-01 paint (mg/kg)	LBP-02 bulk (mg/kg)	LBP-03 paint (mg/kg)	LBP-04 bulk (mg/kg)	LBP-05 bulk (mg/kg)
Lead	0.5% by weight or 5000 ppm	DL 48.9	DL 49.4	DL 49.6	DL 49.9	DL 49.9
		<48.9	61.7 (0.00617% by weight)	104 (0.0104% by weight)	<49.9	<49.9

Note: EPA Method 7000B (1) = EPA 600/R-93/200 Preparation Modified. EPA 7000B Analysis Modified; Lead in paint hazard levels are determined by: lab test results of 5,000 ppm (parts per million) or more, or 0.5% or more (by weight); XRF test results of 1.0 milligrams of lead per square centimeter (1.0 mg/cm^2) or more per the CDPH; bulk sample means concrete with paint on it, and paint sample means paint chips were provided; LBP-01 taken from the brown metal rail paint; LBP-02 taken from the tan sidewalk coating; LBP-03 taken from green light post paint; LBP-04 taken from red curb paint; and LBP-05 taken from the white roadway striping.

Figure 9. Lead Sampling Locations

4.2.2 Asbestos-Containing Materials (ACMs)

ACM is defined in Title 8, CCR Section 1529, as any material that has more than one percent (1%) asbestos. Title 8 of the California Code of Regulations Section 1735 requires a pre-demolition survey for asbestos-containing construction materials (ACCM). Cal/OSHA classifies any material as having greater than one-tenth of 1% asbestos as ACCM. This study satisfies the requirements of the pre-demolition survey for ACCM.

For assessing waste handling procedures associated with a demolition or renovation, the federal NESHAP Subpart M Section 61.145 requires the identification and removal of all regulated asbestos containing material (RACM) prior to demolition or renovation. RACM is defined by NESHAP as asbestos which is friable and contains greater than 1% asbestos. Friable asbestos is asbestos which can be crushed, crumbled, or pulverized using simple hand pressure when dry. Non-friable ACMs containing greater than 1% asbestos are also considered to be RACM if they are subjected to sanding, drilling, grinding, cutting, and abrading, or may be crumbled, pulverized, or reduced to powder during demolition or renovation.

DTSC classifies asbestos-containing material as hazardous waste if it is “friable” and contains one percent (1.0%) or more asbestos as hazardous waste. DTSC considers non-friable bulk asbestos-containing waste to be non-hazardous regardless of its asbestos content, so it is not subject to regulation under Title 22, Division 4.5, of the California Code of Regulations. Because the United States Environmental Protection Agency (U.S. EPA) does not regulate asbestos as hazardous waste under the Resource Conservation and Recovery Act (RCRA), it is considered to be a "non-RCRA," or "California-only" hazardous waste.

In combination, the EPA and OSHA requirements govern the testing, handling, and disposal of materials containing asbestos.

The ACM survey was conducted under the direction and quality control of a California Certified Asbestos Consultant (CAC #05-3872). The survey was performed as part of an ISA or Phase I Environmental Site Assessment as defined by Title 22 California Code of Regulations §69200 (d) and (j) and as part of a greater environmental review pursuant to California Health and Safety Code §25570.2 (f).

4.2.2.1 ACM Sampling Methods and Results

On August 3, 2017, four ACM samples were collected to evaluate the presence, extent, and condition of any above-ground, ACCM and RACM that may be present on or in the composition of the bridge, to assess safe work practices and waste disposal options. ACM is suspected for the bridge concrete abutments and deck. A visual inspection of the concrete deck and abutments was completed prior to collecting concrete chip samples from suspected ACM locations. Concrete chip samples of a size representative of the surface of interest were collected in plastic bags, labeled, and the sampling location was photographed.

Suspect ACM samples were obtained by scraping or chipping off small pieces of the deck and abutment of the bridge. Each ACM sample was bagged in a sealable plastic bag (i.e., Ziploc), labeled with the sample ID number, time, date, approximate location, and logged with photographs. The four ACM samples were transported with a Chain of Custody form, to TestAmerica Laboratory in Pleasanton, California, an approved and certified laboratory by the DTSC. On August 7, 2017, the ACM samples were transported from TestAmerica Laboratory to EMLab P&K (a TestAmerica Company) in San Francisco, California and analyzed for asbestos content using polarized light microscopy (PLM) EPA Method 600/M4-82-020 and EPA Method 600/R-93-116.

WRECO staff performed a visual inspection and destructive sampling for asbestos following criteria outlined in the Asbestos Hazard Emergency Response Act (AHERA) sampling protocol (40 CFR 763.86), Cal/OSHA requirements, to identify sources of friable and non-friable ACMs. Materials suspected of containing asbestos were collected using wet methods, and dust producing methods such as cutting, drilling or sawing were avoided. A total of four bulk asbestos samples were collected within the Project area using appropriate sampling tools. A map of asbestos sample locations is provided in Figure 10 below.

Laboratory results indicated that sample ASB-04 contained 10% chrysotile asbestos. The results of the bulk asbestos sampling are summarized in Table 8. Photographs taken during the sampling of ACM is provided in Appendix J, and analytical reports are provided in Appendix L. Samples were not collected from the abutments or piers beneath the bridge due to limited entry access to the creek and will be tested at a later time, prior to demolition when access is provided.

The pipe casing represented by ASB-04 was determined to be non-friable but having the potential to become friable upon demolition and therefore is RACM under NESHAPs. DTSC would potentially classify the pipe casing waste as hazardous if pulverized (friable) during demolition. The pipe casing is also ACM and ACCM under Cal/OSHA Title 8 of the California Code of Regulation Standard 1529.

Table 10. Analytical Results for Asbestos Samples

Analyte	USEPA/CDPH threshold	Results			
		ASB-01 gray concrete	ASB-02 gray concrete	ASB-03 black non-fibrous material	ASB-04 gray transite
Asbestos	less than 1%	ND	ND	ND	**10% Chrysotile**

Note: Asbestos PLM (EPA Methods 600/R-93/116 & 600/M4-82-020, SOP EM-AS-S-1267); * = sample composite homogeneity was poor; Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually; ND means no fibers were detected; When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed

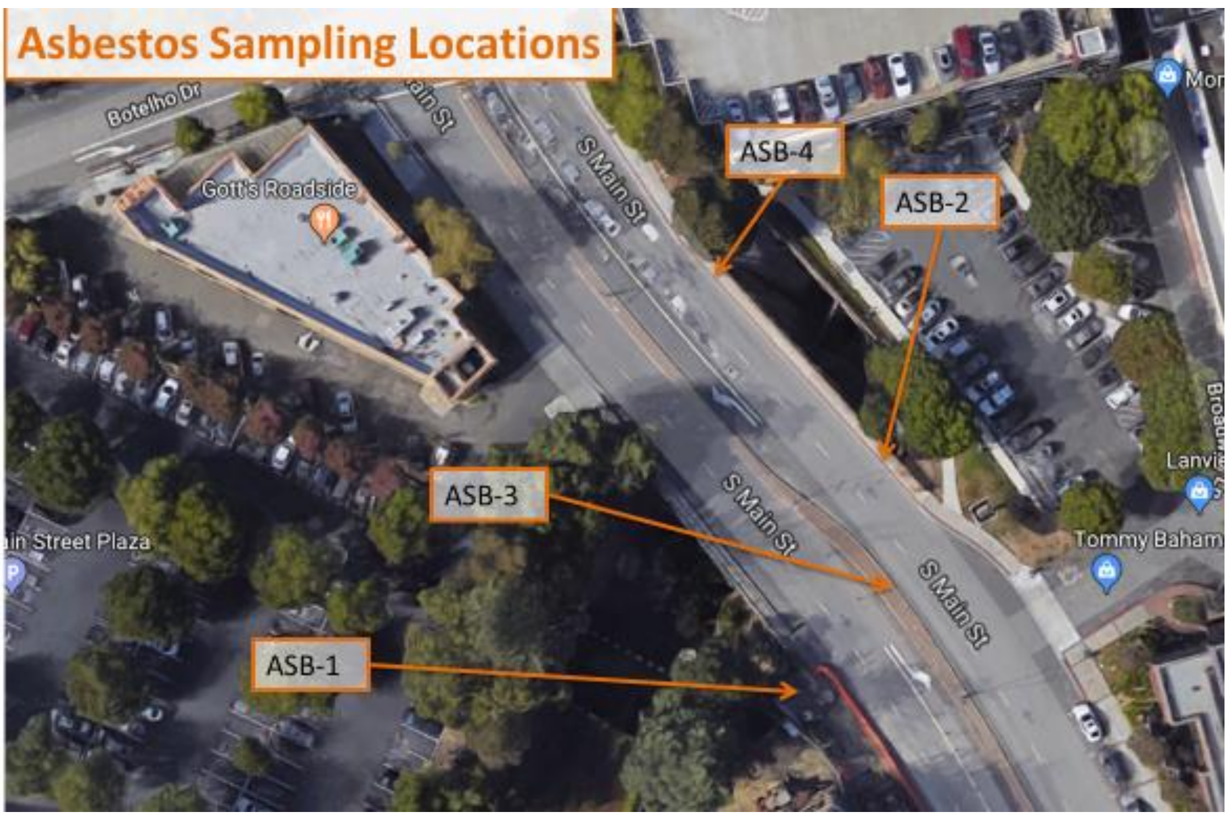

Figure 10. Bulk Asbestos Sampling Locations

4.3 PSI Results and Findings

The results of the limited subsurface investigation are summarized in Tables 4 through 8. Seven soil samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, and metals. All soil samples had arsenic concentrations that exceeded the ESLs for residential, commercial and industrial, and construction worker. All other detectable metal results were below ESLs and TTLC concentrations. Concentrations of BTEX and MTBE were below detection limits for all soil samples. Concentrations of TPHg, TPHd, and TPHmo were below ESLs for all samples analyzed. Laboratory results indicated low detectable concentrations of TPHg (3.4 mg/kg) in SB-

02@15’, TPHd (10 mg/kg) and TPHmo (130 mg/kg) in S-01-A@5’, and TPHd (1.7 mg/kg) in SB-02@5’.

Two groundwater samples were analyzed for BTEX, MTBE, TPHg, TPHd, TPHmo, VOCs, and metals. Groundwater samples exceeded RWQCB Tier 1 ESLs for arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, silver, vanadium, zinc, TPHg, and TPHd. In addition, sample W-01 had Tier 1 ESL exceedances for mercury, TPHmo, ethylbenzene, and xylenes; sample W-02 had Tier 1 ESL exceedances for DCE, TCE, and vinyl chloride. No other VOCs were detected in the sample W-02. Most of these constituents exceeded the RWQCB WQOs, CTR, and EPA NTR criteria for surface water. Groundwater, encountered during demolition and/or construction of the current and/or future bridge, will need to be contained and treated prior to discharge or disposal due to the high levels of metals and VOCs.

Suspect LBP samples, collected from the Las Trampas Creek Bridge area, had lead concentrations that ranged from ND to 105 ppm, that are well below the regulatory threshold value of 5000 ppm, provided by the USEPA and CDPH (0.5% by weight or 5,000 parts per million (ppm) by paint chip analysis).

Suspect ACM samples, collected from the Las Trampas Creek Bridge roadway and concrete sidewalks, were below detection limits for asbestos content (less than 1%), except for one sample that contained 10% chrysotile (ASB-04 - gray transite material) which exceeds the USEPA and CDPH regulatory threshold of 1%.

The Las Trampas Creek Bridge is a large structure and based on preliminary sample analysis of the roadway and curbs, three out of four samples had no asbestos content. However, caution should be used during demolition of the bridge piers and abutments, since these structures were not sampled due to limited entry access to the creek. Additional testing of materials in the field for waste management may indicate asbestos content in different sections of the bridge.

4.4 Conclusions and Recommendations

4.4.1 Waste Management

Shallow soil may contain arsenic that exceeds ESLs (residential, commercial/industrial, and construction worker), and health and safety precautions should be taken to limit exposure and hazards. The soil excavated near the boring locations should be segregated in separate stockpiles from other areas being excavated for pier footings, in order to properly screen for waste disposal classification during demolition/construction.

Cal/OSHA considers any level of lead in paint to be a potential exposure hazard for construction workers. Total lead levels above 1,000 ppm (0.1% by mass) are considered as California Hazardous waste. Lead levels above 350 ppm (0.035% by mass), while not hazardous, must be transported under Uniform Hazardous Waste Manifest (22 CCR, Section 66262.23) and disposed of in a Class I landfill or at other landfills that have specific permits to accept these wastes (Health and Safety Code, Section 25157.8).

No bridge materials sampled for this investigation contained asbestos fibers in concentrations greater than the laboratory reporting limit for Polarized Light Microscopy analysis. However, the transite-like pipe covering along the utility piping on the underside of the bridge (on both the eastern and western sides) did contain 10% chrysotile, that does exceed the USEPA and CDPH regulatory threshold of 1%. The bridge structure demolition is regulated by the EPA’s NESHAP regulations as ACM or RACM, and it is regulated by Cal-OSHA as ACCM, and DTSC for waste disposal.

While this investigation determined that three out of four of the ACM samples did not contain asbestos above the laboratory detection limit, the NESHAP regulations still require notification of the demolition be submitted to the Bay Area Air Quality Management District (BAAQMD) and the EPA (NESHAP Section 61.145(b)). Notifications must contain certain specified information, including but not limited to, the scheduled starting and completion date of the work, the location of the site, the names of operators or asbestos removal contractors, methods of removal and the amount of asbestos, and whether the operation is a demolition or renovation.

For waste disposal consideration, generally, DTSC classifies ACM as hazardous waste if it is “friable” and contains one percent (1.0%) or more asbestos as hazardous waste. Because the USEPA does not regulate asbestos as hazardous waste under the Resource Conservation Fact Sheet, December 2006, Managing Asbestos Waste and Recovery Act, it is a "non-RCRA," or "California-only" hazardous waste. DTSC considers non-friable bulk asbestos-containing waste to be non-hazardous regardless of its asbestos content, so it is not subject to regulation under Title 22, Division 4.5, of the California Code of Regulations.

Consistent with CCR Title 22 disposal unit classification system (Figure 11), WRECO recommends that excavated soil at locations and depth ranges sampled in this PSI be disposed and contained at a Class II unit, or as non-hazardous waste at a Class III landfill depending on specific facility acceptance standards. WRECO recommends segregated stockpiling excavated soils for waste screening and disposal unit classification during construction.

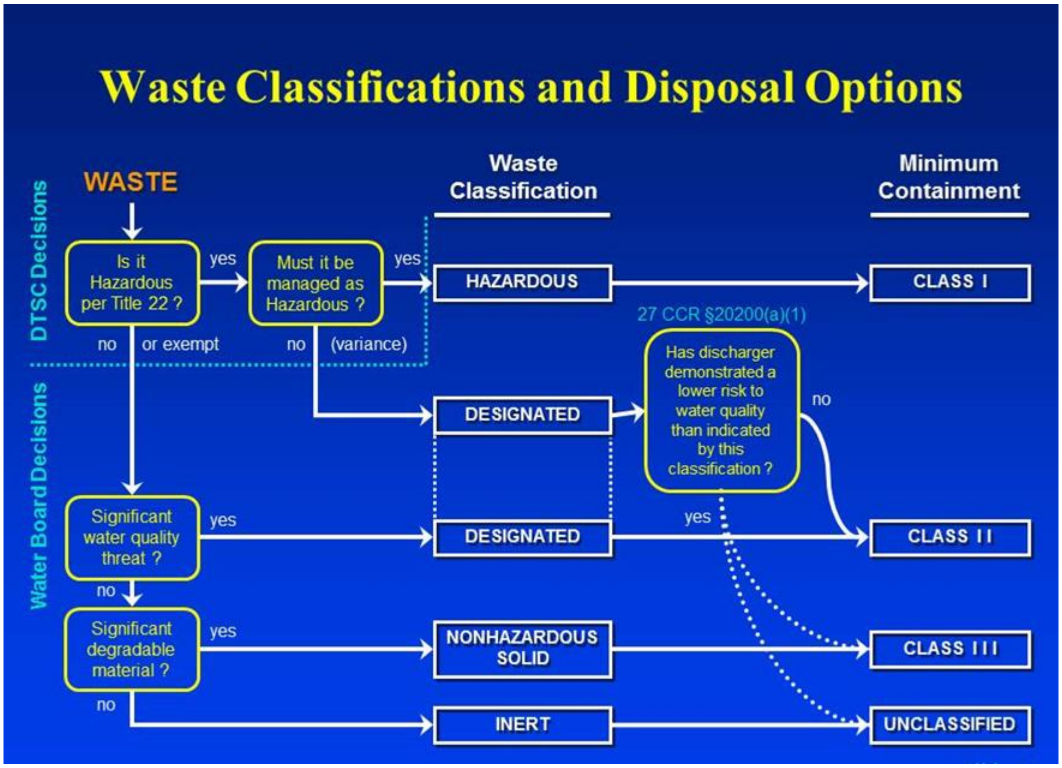

Figure 11. California Waste Classifications and Disposal Options

4.4.2 Worker Safety

The following state and federal regulations govern the protection of worker safety at potential hazardous material sites:

- Worker education and training (Hazard Communication Standard) 29 CFR 1910.1200, 1915.1200, 1917.28, 1918.90, and 1926.59, 1910.1018 (inorganic arsenic)
- Construction Safety Orders 8 CCR Division 1, Chapter 4; 1529
- Lead in Construction 8 CCR 1532.1
- General Industry Safety Orders 8 CCR 5214. Inorganic Arsenic.
- Environmental Health Standards for Management of Hazardous Waste 22 CCR Division 4.5

All on-site personnel shall comply with standards found in the Construction Safety Orders (CSOs) and General Industry Safety Orders (GISOs) as defined by the California Occupational Safety and Health Administration (Cal/OSHA).

5 ISA/PSI RECOMMENDATIONS SUMMARY

Description	Evidence of REC Found	Recommended Actions
Excavated surface soil	Results were below RCRA and California Hazard Waste classification levels for metals, petroleum hydrocarbons, and volatile organic compounds. Informal consultations with the San Francisco Bay RWQCB in April and May of 2018 revealed that it is unknown whether PCE and its breakdown products exist in soils along sewer lines adjacent to the former Virginia Cleaners site (1305-1335 S Main St).	Dispose of excavated soils as Designated or Non-hazardous waste at Class II unit or Class III landfill depending on facility acceptance standard. Soil excavated along sewer lines adjacent to the former drycleaner site should be screened for PCE and its breakdown products to properly classify excavated soils for disposal.
Painted Surfaces – bridge railing, light post, white roadway striping, red painted curbs	Lead-based paint survey revealed lead-based paint concentrations were below regulatory thresholds for USEPA, CDPH; and no samples exceeded state or federal hazardous waste thresholds.	Manage waste per Cal OSHA T8 CCR Section 1532.1
Groundwater	Groundwater samples exceeded RWQCB Tier 1 ESLs for TPHg, TPHd, TPHmo, ethylbenzene, xylenes, DCE, TCE, and vinyl chloride. Most of these constituents exceeded the RWQCB WQOs, CTR, and EPA NTR criteria for surface water	Groundwater that is encountered during the demolition or construction of the Las Trampas Creek Bridge, must be contained and treated prior to discharge to surface waters under an appropriate RWQCB NPDES/WDR permit or disposed of off-site at a wastewater treatment facility.
Concrete and pipe jacket (utilities along the side of bridge), asphalt	No asbestos was found in concrete deck materials accessible from the surface of the bridge. Sample ASB-04 - gray transite material contained 10% chrysotile which exceeds the USEPA and CDPH regulatory threshold of 1%. Samples were not collected from abutments and concrete foundation for creek due to limited access.	Provide demolition notification prior to demolition to BAAQMD. Abate 10% potentially friable ACCM/RACM using state licensed asbestos abatement contractor prior to demolition. Manage waste per Cal OSHA T8 CCR Section 1529.
Concrete and Asphalt waste	Concrete and Asphalt should not be disposed of in Landfill; both can be reclaimed and recycled for use on the Project area and/or other facilities. Asphalt-concrete and Portland cement concrete grindings shall be reused in accordance with San Francisco Bay Regional Water Quality Control Board's guidelines for Caltrans' projects or transported offsite for recycling or disposal.	All asphalt grindings require disposal at a Class 1 disposal site or reuse in accordance with the Department of Fish and Game Agreement on AC Grindings, Chunks, and Pieces (1993) and California Department of Transportation Asphalt-Concrete and Portland Cement Concrete Grindings Reuse Guidance (2007).

6 LIMITATIONS

The scope of an ISA is limited to anecdotal and visual evidence of potential RECs and does not include verification of RECs based upon environmental testing. As is the case for any project that proposes excavation, the potential exists for unknown hazardous contamination to be revealed during Project construction (such as previously undetected petroleum hydrocarbon contamination from nearby gas stations or potential explosive threat if a natural gas or petroleum transmission pipeline is ruptured during construction).

The ISA/PSI for the Las Trampas Creek Bridge at South Main Street Replacement Project located in Walnut Creek, Contra Costa County, California, was performed in general accordance with the Caltrans procedures and guidelines for performing and preparing ISAs and PSIs. During the performance of the assessment, all readily available materials pertaining to the Project site were collected and reviewed to prepare this document. This assessment is not a full-scale environmental site investigation to prove that the Project site is environmentally devoid of hazardous or toxic materials. Information and data were provided by presumably competent third parties with knowledge about the site and surrounding areas.

This ISA/PSI consists of professional opinions and recommendations made in accordance with generally accepted environmental principles and practices. The conclusions are based upon an evaluation of the information gathered and general observations of conditions prevalent at the Project site during the site visit. This ISA does not otherwise provide any implied or expressed guarantees regarding the characteristics or conditions of environmental media at the Project site.

Opinions given in this ISA report, relative to the potential for hazardous materials to exist within the study area, are based upon the information derived from the site reconnaissance conducted on July 14, 2017, and from other information sources described herein. Certain indicators of the presence of hazardous materials or petroleum hydrocarbons not readily observable during the reconnaissance may become observable later. Readily available public information sources were reviewed as providing complete and accurate information, without independent verification. The findings and conclusions in this report are based solely on the limited scope of an ISA, including information from a variety of sources. Because the scope of an ISA is necessarily limited and based in part on third party sources and significant assumptions, it is not warranted that the Subject Properties do not include hazardous material or petroleum hydrocarbon releases in areas not identified in this report.

This ISA/PSI is not intended to identify all hazards or unsafe conditions, or to imply that others do not exist. This survey was planned and implemented based on a mutually agreed scope of work and WRECO’s experience in performing this type of assessment.

WRECO has performed this survey in a professional manner using the degree of skill and care exercised for similar projects under similar conditions, by reputable and competent environmental consultants. WRECO shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time that this survey was conducted.

WRECO further states that no warranties, expressed or implied are made regarding the quality, fitness, or results to be achieved as a consequence of this report or impacted by information not properly disclosed to WRECO at the time of this report. It further states that no responsibility is assumed for the control or correction of conditions or practices existing at the premises of the client.

Verification of material quantities is the responsibility of the contractor that will be performing future abatement activities at this Site.

Hazardous materials must be handled in strict accordance with the various federal, state, and local regulations. Failure to abide by these regulations can result in penalties to both the contractor as well as the owner.

It is the responsibility of the construction contractor to determine the appropriate RCRA waste and California waste present at the Project site.

7 REFERENCES

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Appendix A ISA Memo dated June 27, 2017

1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
Phone: 925.941.0017
Fax: 925.941.0018
www.wreco.com

Memorandum

Date: **July 27, 2017**

To: **Patrick Flynn, P.E.**
Quincy Engineering

From: **Tony Jones, WRECO**

Subject: **Initial Site Assessment Memo – Las Trampas Creek Bridge Over South Main Street Bridge Replacement Project**
City of Walnut Creek, California

The purpose of this memorandum is to outline WRECO's preliminary findings from the Initial Site Assessment and provide the evidentiary basis for recommending further investigation and combining the Initial Site Assessment (ISA) and recommended Preliminary Site Investigation (PSI) into one study and report.

Initial Site Assessment Work Performed

WRECO reviewed the Department of Toxic Substances Control's EnviroStor database record, the California State Water Resources Control Board's GeoTracker record, and the Environmental Data Resources (EDR) database (including the radius report, historic aerial photographs, fire insurance maps, and topo maps) for information relevant to the potential presence of pollution at the Project site.

Preliminary Findings

The EDR database and Geotracker research revealed several hazardous material risk sites within several hundred feet of the project site. The constituents of concern include: chlorinated hydrocarbons, tetrachloroethylene (PCE), trichloroethylene (TCE), vinyl chloride, and gasoline.

Per the *Fact Sheet – Invitation to Comment on Proposed Cleanup Plan Former Virginia Cleaners Facility, 1305 & 1335 S. Main St., Walnut Creek, Contra Costa County* (Fact Sheet) by the Regional Water Quality Control Board – San Francisco Bay Region dated August 2013, there is a currently open cleanup site immediately adjacent to the southwestern segment of the Project located at 1305 and 1335 South Main Street, Walnut Creek, California. The site was historically as a dry cleaning facility approximately from 1973 to 2000. In 2000, site investigations discovered PCE present in both the soil and groundwater. Groundwater monitoring wells for monitoring PCE and vinyl chloride were installed and monitored since 2006. PCE had been detected and identified as migrating, via the groundwater, to the northwest toward South Main Street. PCE concentrations greater than concentrations that are protective of indoor air quality were collected both in 2007 and 2013. Per the Fact Sheet, a cleanup plan including excavation greater than 20 feet below ground surface, which is five to seven feet below the top of the groundwater surface, was being proposed. Based on information currently publicly available and a cost recovery annual estimate letter for the fiscal year 2017/2018 reporting period, there are ongoing monitoring and reporting activities being conducted with oversite from the San Francisco Bay Regional Water Quality Control Board.

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There are also various closed leaking underground storage tank (LUST) cleanup sites within 0.5 miles of the Project location.

Recommendations

The items noted above are evidence of potential environmental and/or health hazards, regarded as potential Recognized Environmental Conditions, and are located within or immediately adjoining the Project's footprint.

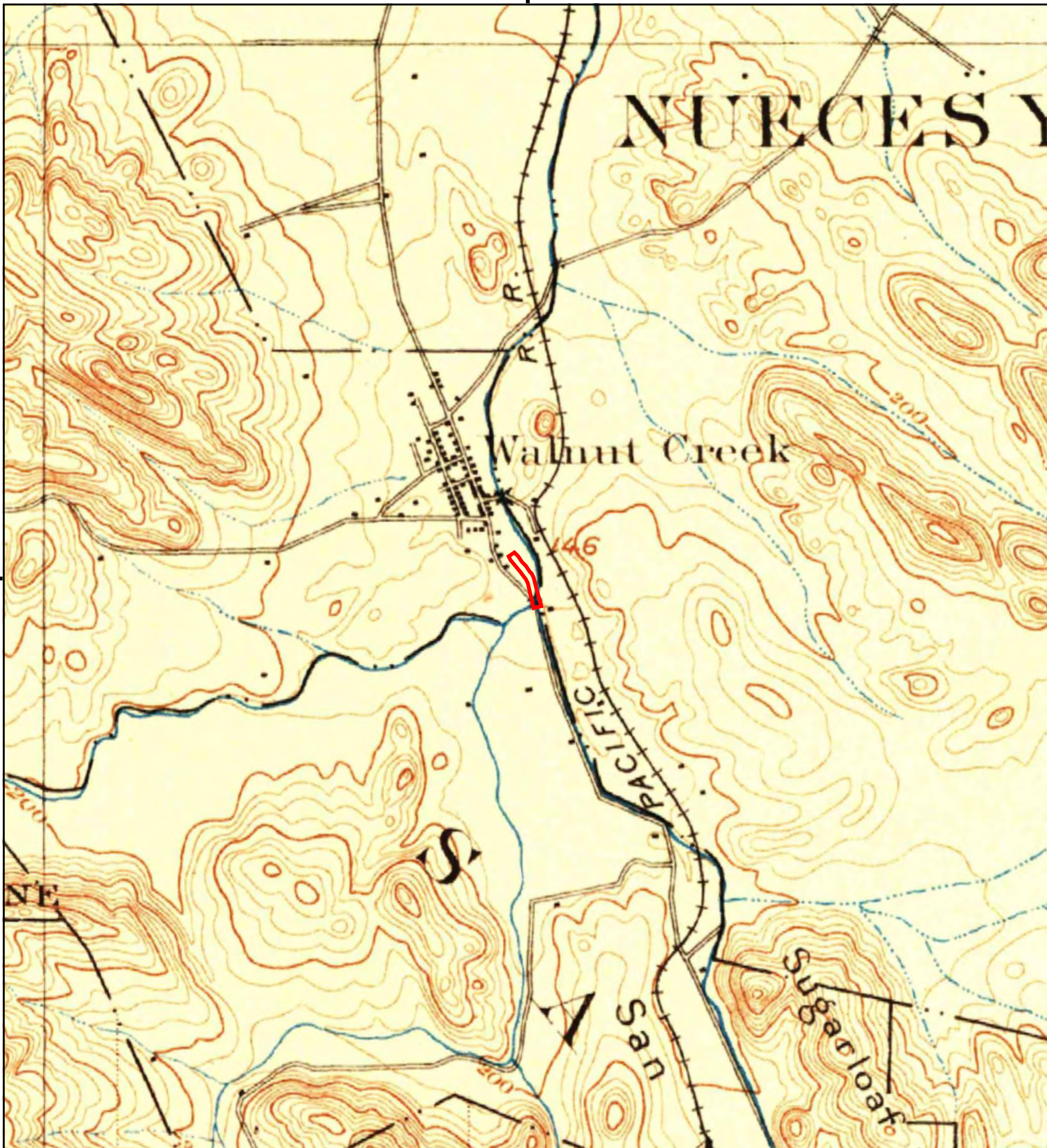
WRECO recommends conducting a PSI including sampling per task 5.1.2 of WRECO's scope of work. The EDR report, GeoTracker, and EnviroStor records reviews have revealed the potential for project site soil to contain hazardous materials at levels which would limit soil disposal options and potentially require special soil waste management.

WRECO hereby requests authorization from the City to proceed with the PSI including soil and groundwater investigation and to consolidate the investigation into one ISA/PSI study and report to conserve resources.

Appendix B Historic Topographic Maps

Historical Topo Map

1897



0 Miles 0.25 0.5 1 1.5

This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

TP, Concord, 1897, 15-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

N

Las Trampas Creek Bridge Replacement
1301 South Main Street
Walnut Creek, CA 94596

Inquiry Number: 5001058.4
July 21, 2017

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

07/21/17

Site Name:	**Client Name:**
Las Trampas Creek Bridge Re|	WRECO
1301 South Main Street	1243 Alpine Rd Ste 108
Walnut Creek, CA 94596	Walnut Creek, CA 94596
EDR Inquiry # 5001058.4	Contact: Flannery Banks

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by WRECO were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:		***Coordinates:***	
P.O.#	P17043	**Latitude:**	37.894512 37° 53' 40" North
Project:	Las Trampas Creek Bridge	**Longitude:**	-122.058986 -122° 3' 32" West
		UTM Zone:	Zone 10 North
		UTM X Meters:	582737.64
		UTM Y Meters:	4194528.35
		Elevation:	132.62' above sea level

Maps Provided:

2012	1948
1996	1947
1995	1915
1980	1897
1973	
1968	
1959	
1949	

Topo Sheet Key

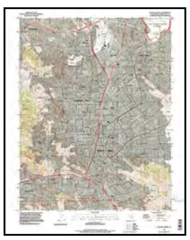
This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2012 Source Sheets

Las Trampas Ridge
2012
7.5-minute, 24000

Walnut Creek
2012
7.5-minute, 24000

1996 Source Sheets



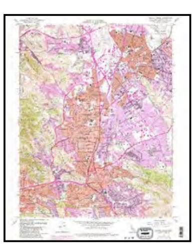
Walnut Creek
1996
7.5-minute, 24000
Aerial Photo Revised 1993

Las Trampas Ridge
1996
7.5-minute, 24000
Aerial Photo Revised 1993

1995 Source Sheets

Walnut Creek
1995
7.5-minute, 24000
Aerial Photo Revised 1995

1980 Source Sheets



Walnut Creek
1980
7.5-minute, 24000
Aerial Photo Revised 1978

Las Trampas Ridge
1980
7.5-minute, 24000
Aerial Photo Revised 1978

Topo Sheet Key

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1973 Source Sheets

Las Trampas Ridge
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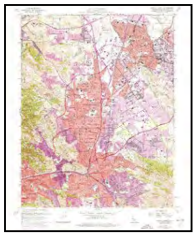
7.5-minute, 24000
Aerial Photo Revised 1973



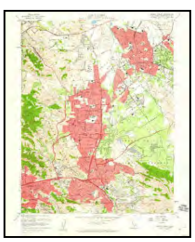
Walnut Creek
1973
7.5-minute, 24000
Aerial Photo Revised 1973

1968 Source Sheets

Las Trampas Ridge
1968
7.5-minute, 24000
Aerial Photo Revised 1968

Walnut Creek
1968
7.5-minute, 24000
Aerial Photo Revised 1968

1959 Source Sheets



Walnut Creek
1959
7.5-minute, 24000
Aerial Photo Revised 1958

Las Trampas Ridge
1959
7.5-minute, 24000
Aerial Photo Revised 1958

1949 Source Sheets

Walnut Creek
1949
7.5-minute, 24000
Aerial Photo Revised 1946

Las Trampas Ridge
1949
7.5-minute, 24000
Aerial Photo Revised 1946

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1948 Source Sheets

CONCORD
1948
15-minute, 50000

1947 Source Sheets

Las Trampas Ridge
1947
7.5-minute, 24000
Aerial Photo Revised 1946

Walnut Creek
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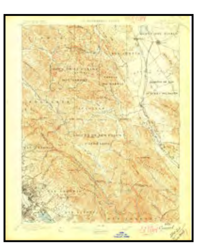
7.5-minute, 24000
Aerial Photo Revised 1946

1915 Source Sheets

Concord
1915
15-minute, 62500

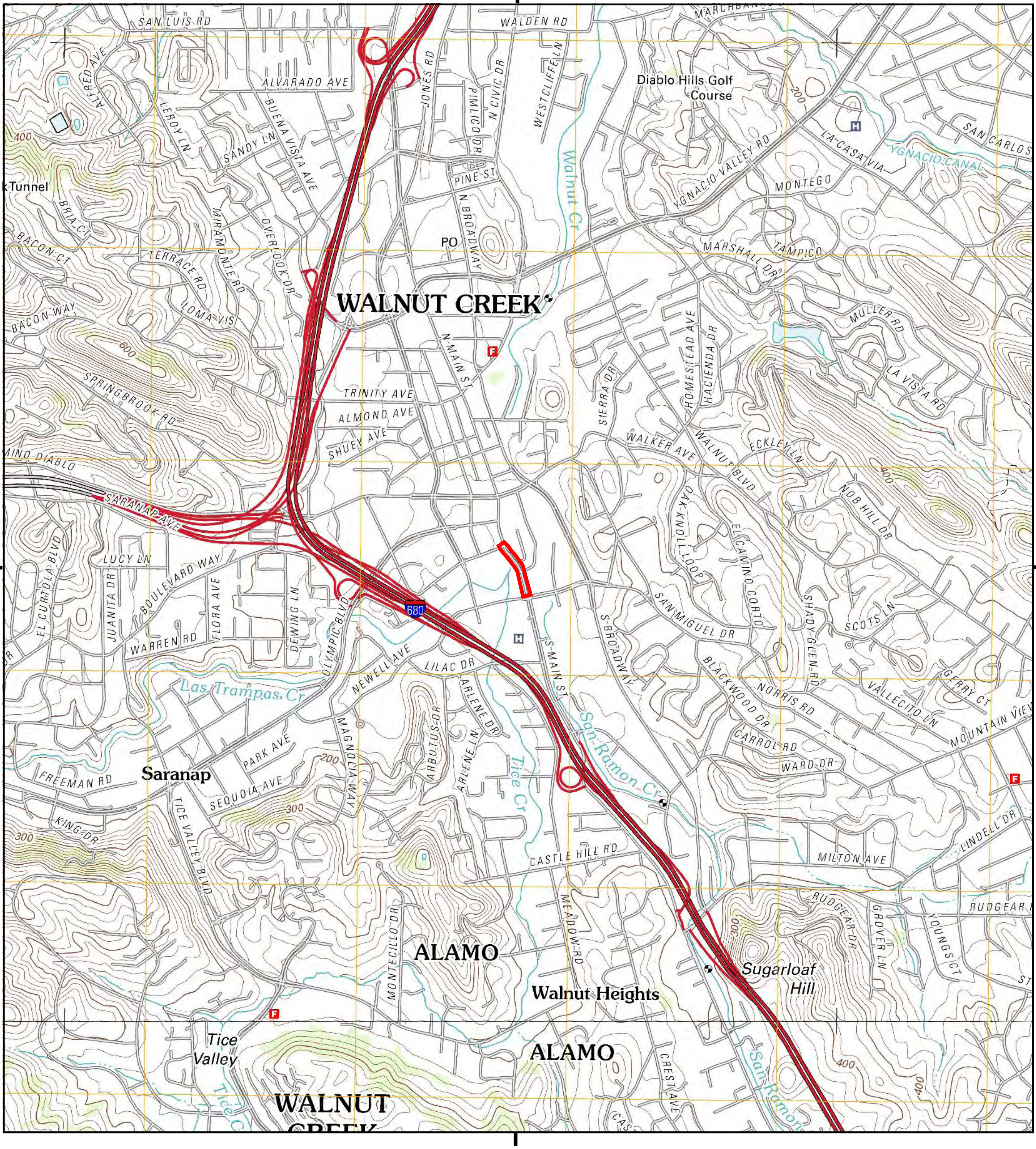
1897 Source Sheets



Concord
1897
15-minute, 62500

Historical Topo Map

2012



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W E
SW S SE

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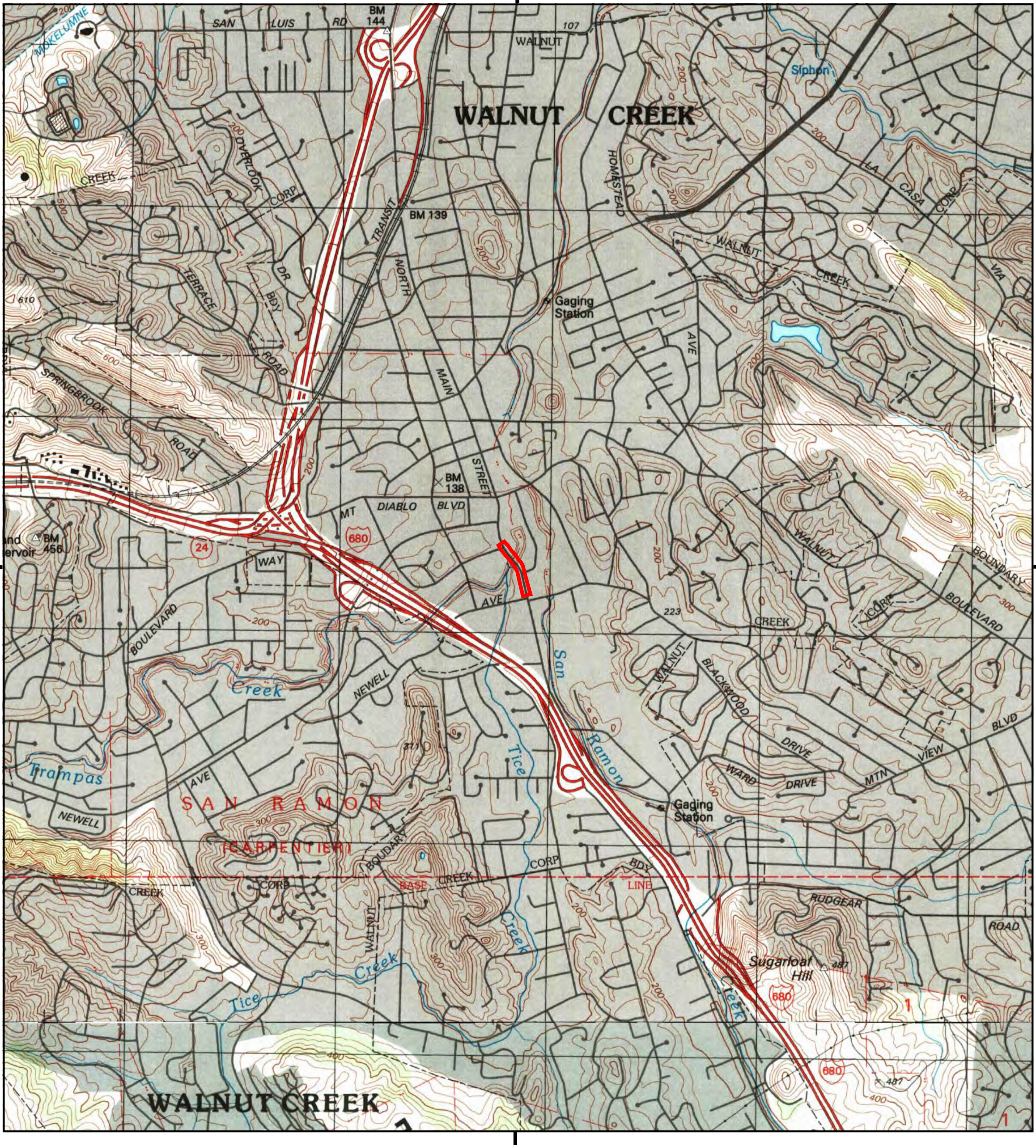
S, Las Trampas Ridge, 2012, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Historical Topo Map

1996



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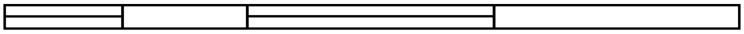


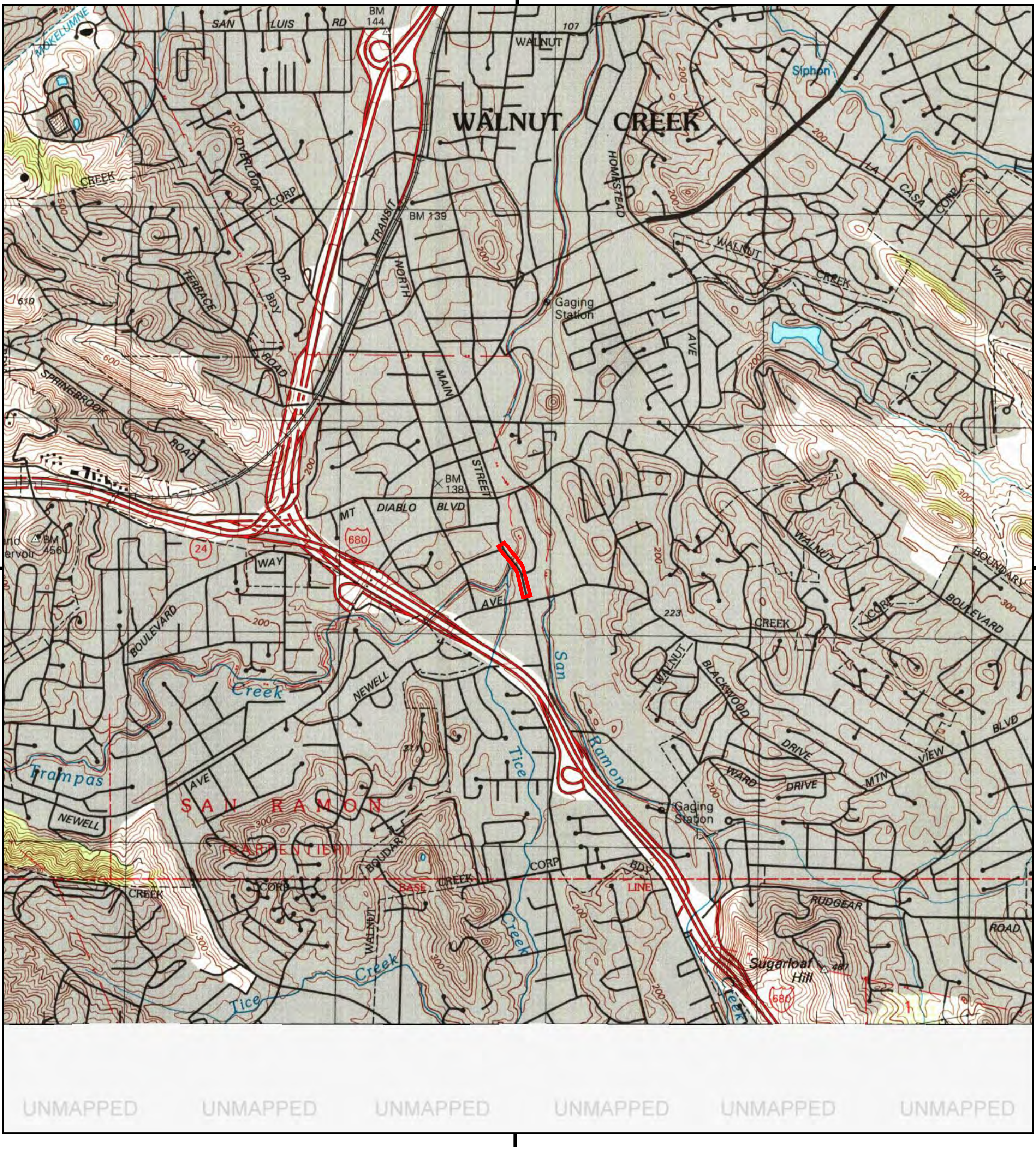
NW N NE
W E
SW S SE

TP, Walnut Creek, 1996, 7.5-minute
S, Las Trampas Ridge, 1996, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Historical Topo Map

1995



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NW N NE

W E

SW S SE

TP, Walnut Creek, 1995, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
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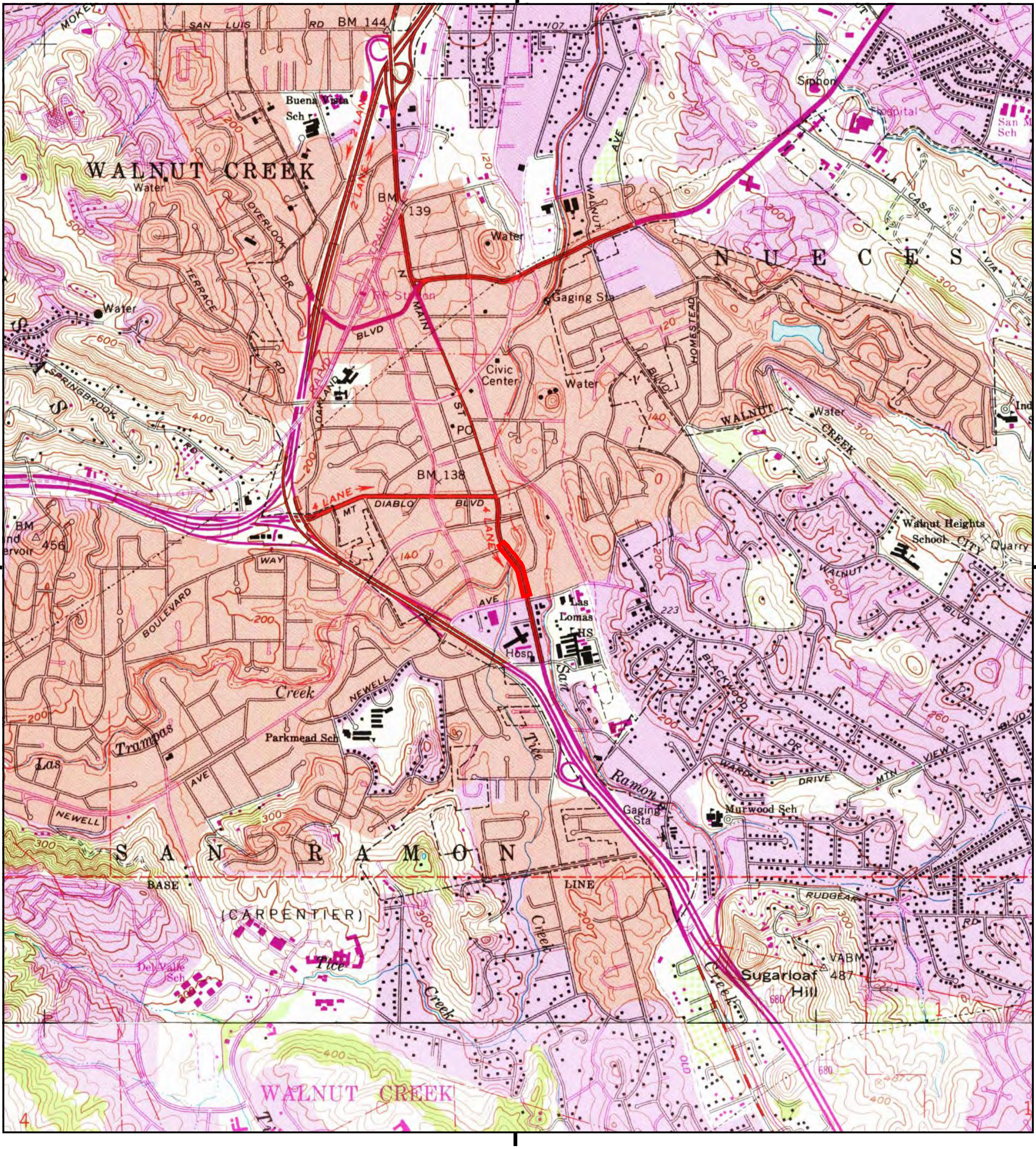
CLIENT: WRECO

N

Historical Topo Map

1980



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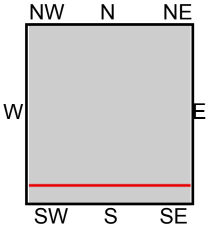


TP, Walnut Creek, 1980, 7.5-minute
S, Las Trampas Ridge, 1980, 7.5-minute

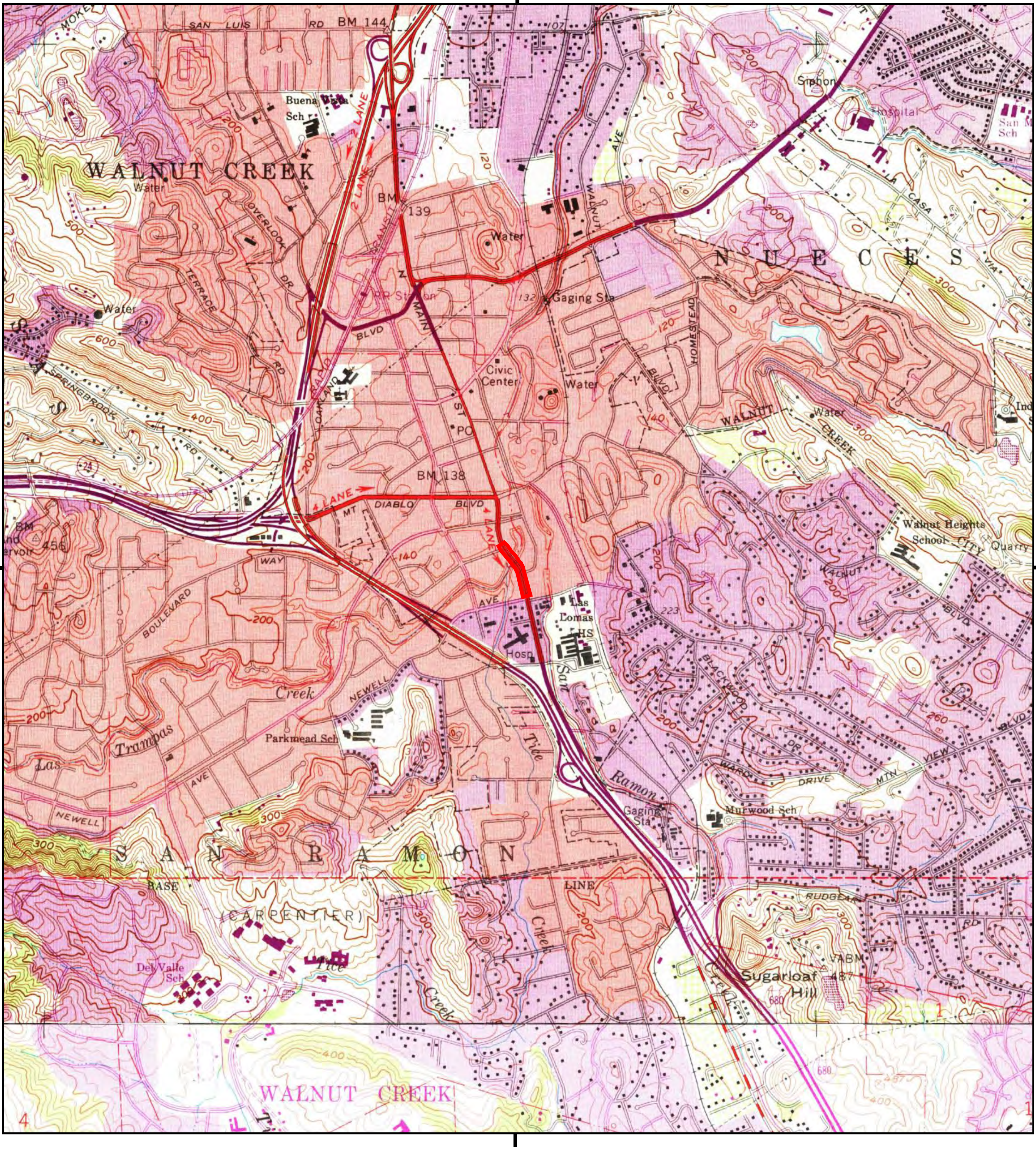
0 Miles 0.25 0.5 1 1.5

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

N

Historical Topo Map

1973



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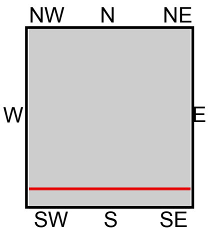

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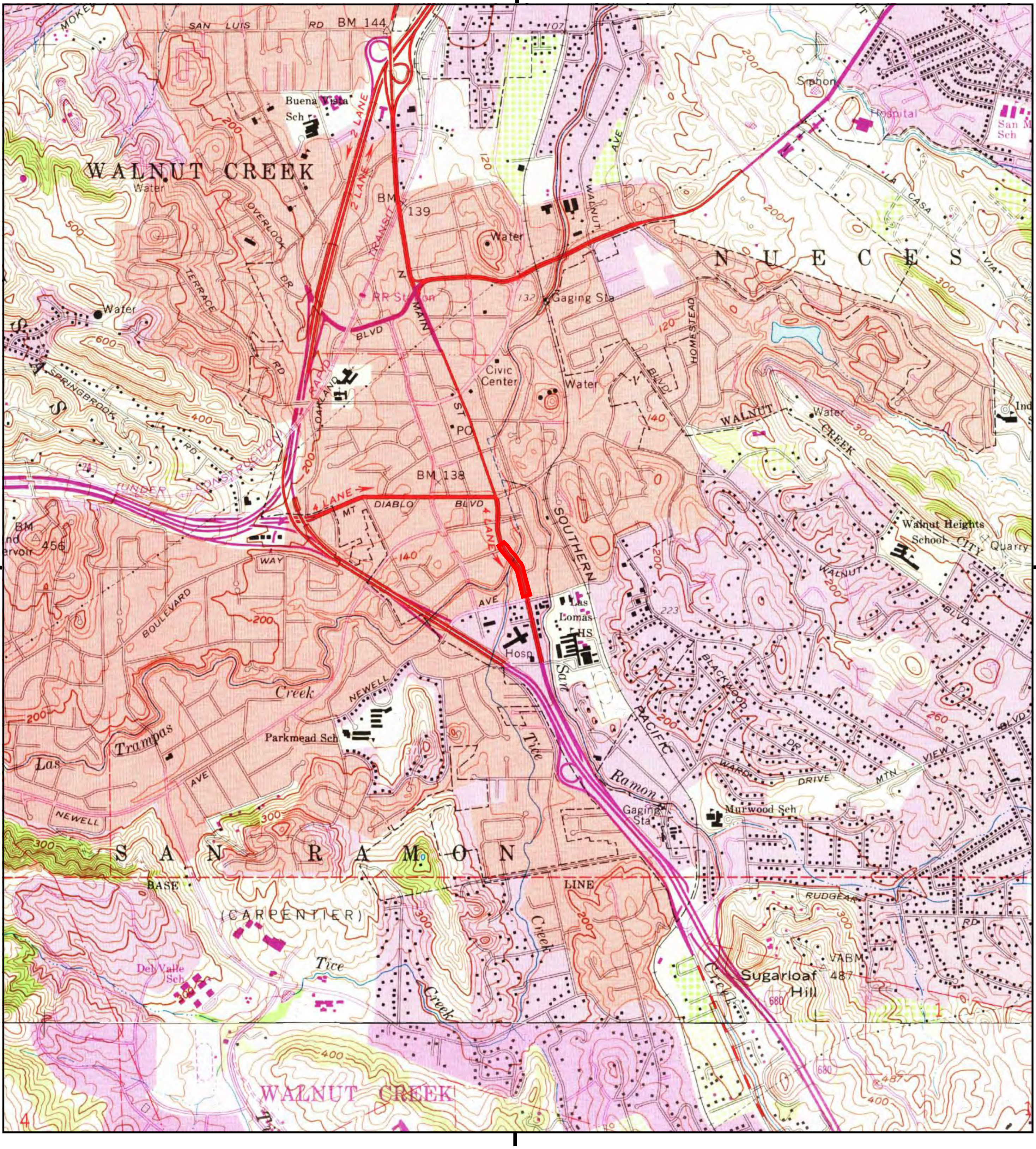
S, Las Trampas Ridge, 1973, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Historical Topo Map

1968



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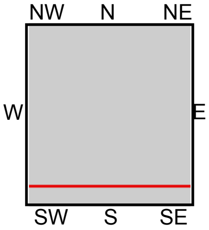

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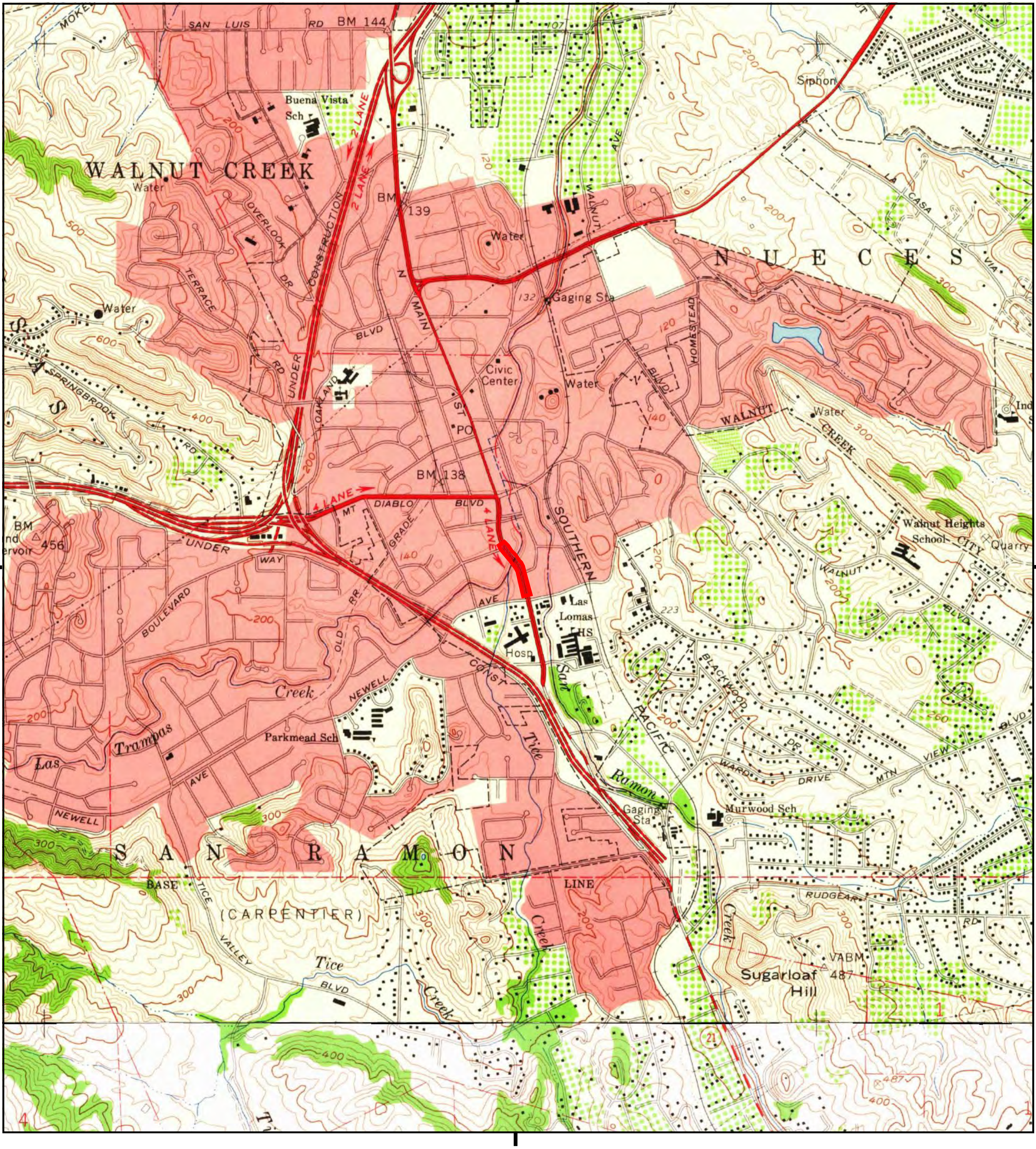
SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Historical Topo Map

1959



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

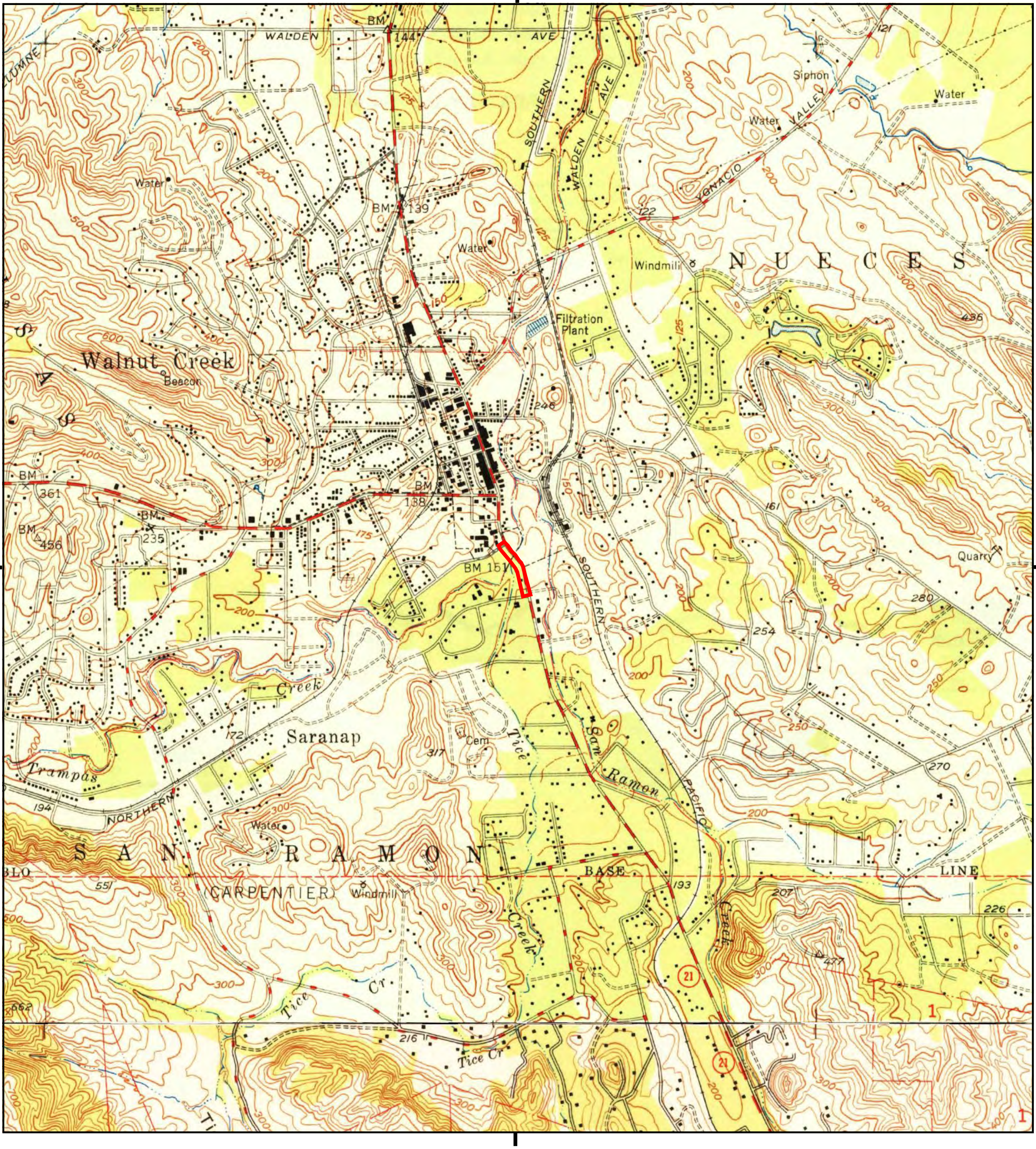
TP, Walnut Creek, 1959, 7.5-minute
S, Las Trampas Ridge, 1959, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

N

Historical Topo Map

1949



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

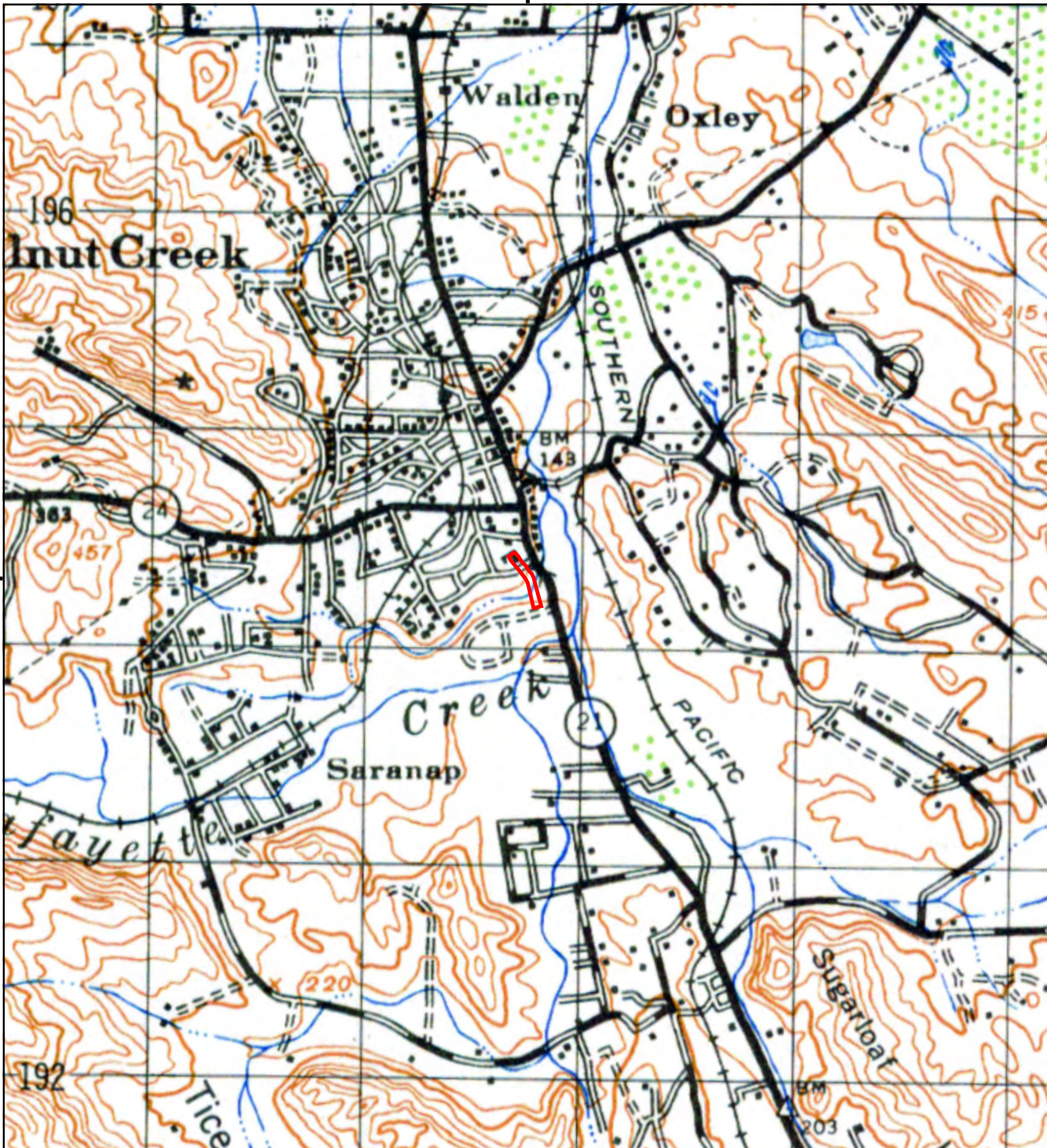
NW N NE
W E
SW S SE

TP, Walnut Creek, 1949, 7.5-minute
S, Las Trampas Ridge, 1949, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Historical Topo Map

1948



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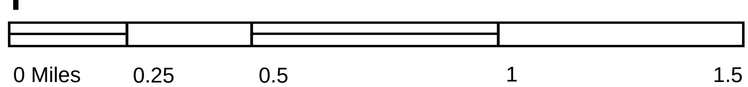


NW N NE

W E

SW S SE

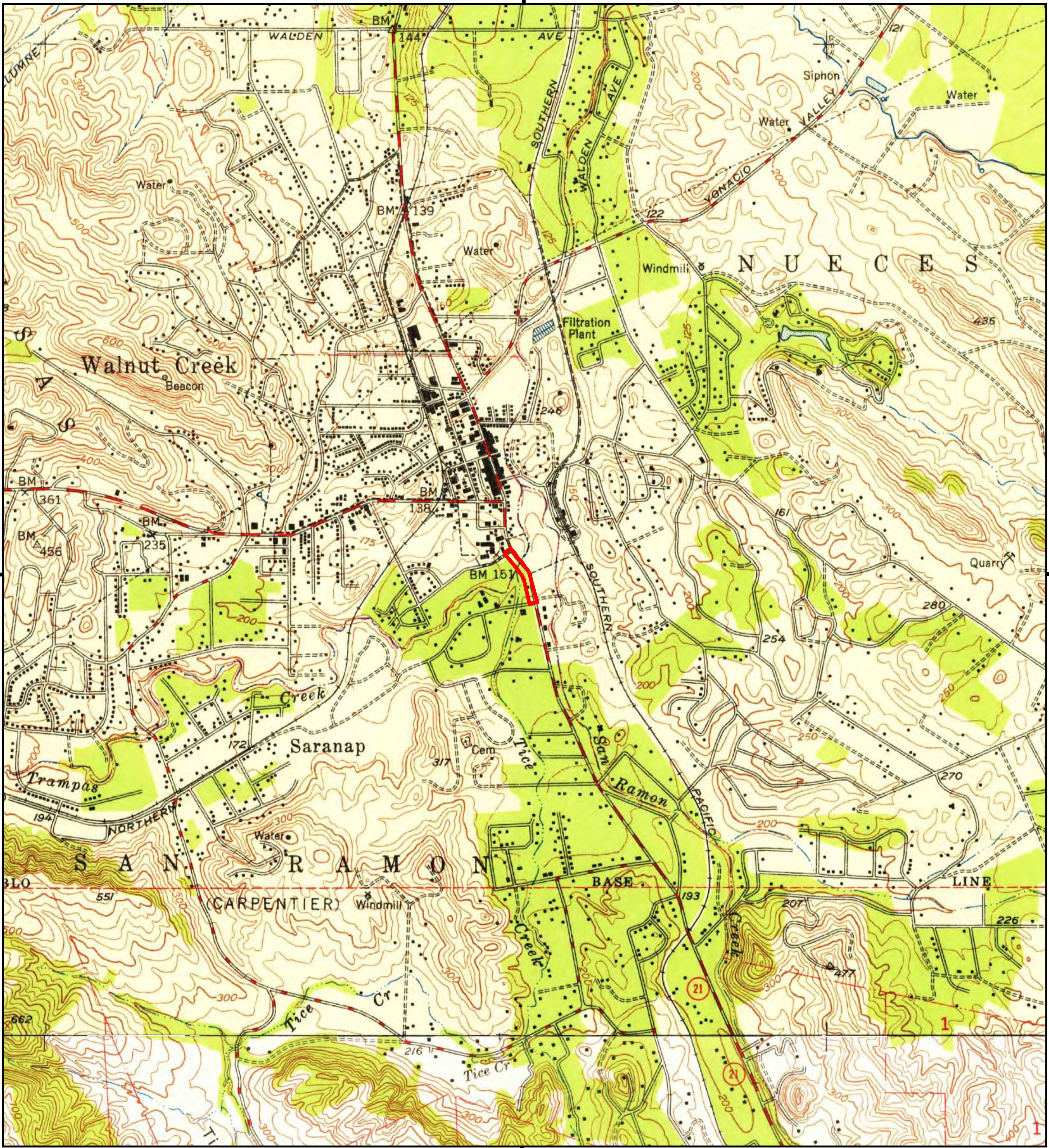
TP, CONCORD, 1948, 15-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

N

Historical Topo Map

1947



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

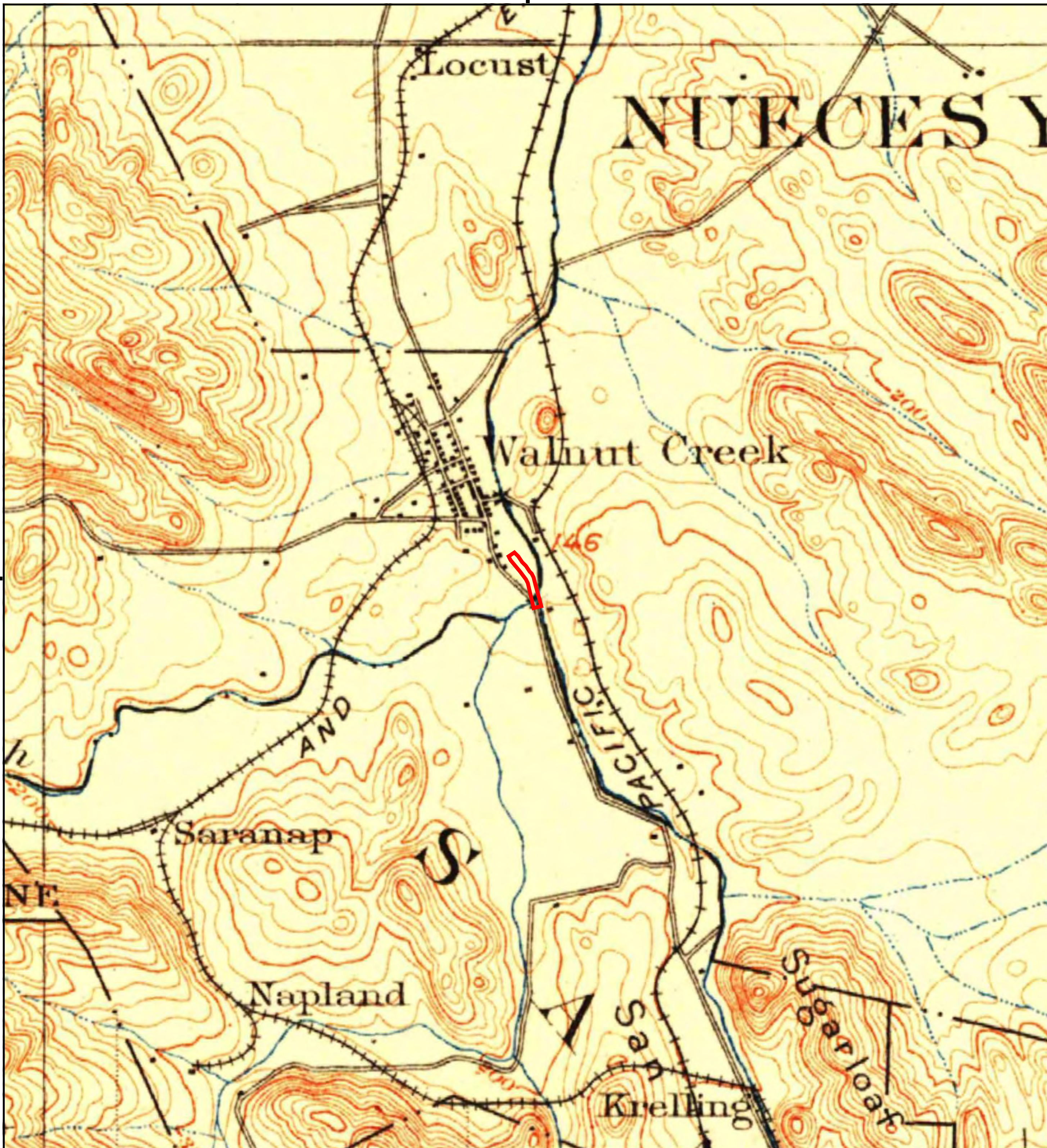
NW N NE
W E
SW S SE

TP, Walnut Creek, 1947, 7.5-minute
S, Las Trampas Ridge, 1947, 7.5-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

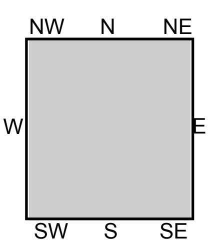
Historical Topo Map

1915



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



TP, Concord, 1915, 15-minute

SITE NAME: Las Trampas Creek Bridge Replacement
ADDRESS: 1301 South Main Street
Walnut Creek, CA 94596
CLIENT: WRECO

Appendix C EDR Radius Report

Las Trampas Creek Bridge Replacement
1301 South Main Street
Walnut Creek, CA 94596

Inquiry Number: 5001058.2s
July 26, 2017

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

FORM-LBC-LMI

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GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

1301 SOUTH MAIN STREET
WALNUT CREEK, CA 94596

COORDINATES

Latitude (North):	37.8945120 - 37˚ 53' 40.24''
Longitude (West):	122.0589860 - 122˚ 3' 32.34''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	582739.7
UTM Y (Meters):	4194323.0
Elevation:	137 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5641124 WALNUT CREEK, CA
Version Date:	2012

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140606, 20140608
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
1301 SOUTH MAIN STREET
WALNUT CREEK, CA 94596

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	DIABLO CLEANERS	1335 S MAIN	HAZNET	Higher	1 ft.
A2	DIABLO CLEANERS INC	1335 SO MAIN ST	EDR Hist Cleaner	Higher	1 ft.
A3	UNOCAL	1322 MAIN ST S	LUST	Higher	1 ft.
A4	RUSSS RICHFIELD SERV	1345 S MAIN ST	EDR Hist Auto	Higher	1 ft.
B5	TEXACO	1275 MAIN	LUST, ENF, HIST CORTESE, CONTRA COSTA CO. SITE...	Higher	50, 0.009, WNW
B6	ALL FOREIGN AUTO SER	1275 S MAIN ST	EDR Hist Auto	Higher	50, 0.009, WNW
C7	EAST BAY UNION 76 IN	1491 NEWELL AVE	EDR Hist Auto	Higher	70, 0.013, SSE
C8	CERTIFIED TIRE & SER	1400 NEWELL AVE	CONTRA COSTA CO. SITE LIST	Higher	89, 0.017, South
A9	FORMER VIRGINIA CLEA	1335 S MAIN ST	RCRA-SQG, FINDS, ECHO, DRYCLEANERS, CONTRA COSTA...	Lower	91, 0.017, SSW
A10	VIRGINIA CLEANERS	1305-1335 MAIN ST S	SLIC	Higher	98, 0.019, South
C11	NEWELL VILLAGE	1500 NEWELL AVENUE	NPDES, CONTRA COSTA CO. SITE LIST	Higher	112, 0.021, South
C12	ESSEX WALNUT OWNER L	1500 NEWELL AVE	DRYCLEANERS, HAZNET	Higher	112, 0.021, South
C13	VALET AMERICA INC	1500 NEWELL AVE #409	EDR Hist Cleaner	Higher	112, 0.021, South
D14	RY-NCK TIRE & BRAKE	1232 S MAIN	EDR Hist Auto	Higher	181, 0.034, NNW
E15	MACY'S (WALNUT CREEK	1301 BROADWAY PLAZA	EMI, CONTRA COSTA CO. SITE LIST	Higher	181, 0.034, NE
D16	GOODYEAR TIRE & RUBB	1231 MAIN	LUST, HIST CORTESE	Higher	189, 0.036, NNW
D17	RY-NCK TIRE & BRAKE	1231 S MAIN ST	SWEEPS UST, HIST UST, CA FID UST, CONTRA COSTA CO...	Higher	189, 0.036, NNW
D18	GOODYEAR AUTO SERVIC	1231 S MAIN ST	HIST UST	Higher	189, 0.036, NNW
D19	RY-NCK TIRE & BRAKE	1231 S MAIN	EDR Hist Auto	Higher	189, 0.036, NNW
F20	STONE ENTERPRISES IN	1540 NEWELL CENTER	EDR Hist Auto	Lower	268, 0.051, SSW
D21	THE TALBOTS INC. #91	1201 S MAIN ST	HAZNET, CONTRA COSTA CO. SITE LIST	Higher	269, 0.051, NW
E22	MACYS EXPANSION PROJ	1320 BROADWAY PLAZA	CHMIRS, NPDES, CONTRA COSTA CO. SITE LIST	Higher	274, 0.052, ENE
23	ROSS DRESS FOR LESS	1295 S MAIN ST	HAZNET, CONTRA COSTA CO. SITE LIST	Higher	289, 0.055, WSW
C24	KAISER MEDICAL CENTE	1425 MAIN ST S	LUST, HIST CORTESE	Higher	295, 0.056, SSE
F25	PRODUCTION COLOR LAB	1548 NEWELL AVE	CONTRA COSTA CO. SITE LIST	Higher	298, 0.056, SSW
E26	NYX PROFESSIONAL MAK	1306 BROADWAY PLZ	CONTRA COSTA CO. SITE LIST	Higher	319, 0.060, NE
G27	PANERA BREAD	1140 LOCUST ST	CONTRA COSTA CO. SITE LIST	Higher	327, 0.062, WNW
G28	CHIPOTLE MEXICAN GRI	1158 LOCUST ST D-2A	CONTRA COSTA CO. SITE LIST	Higher	327, 0.062, WNW
F29	DRY CLEANING SYSTEMS	1552 NEWELL AVE	EDR Hist Cleaner	Higher	381, 0.072, SSW
30	TOMS BROADWAY CAMERA	8 BROADWAY LN	RCRA-SQG, FINDS, ECHO, HAZNET	Higher	384, 0.073, ESE
F31	VOGUISH INC	1554 NEWELL AVE	EDR Hist Cleaner	Higher	397, 0.075, SSW
H32	P.F. CHANGS CHINA BI	1205 BROADWAY PLZ	CONTRA COSTA CO. SITE LIST	Higher	412, 0.078, North
I33	ROBINSON NORMAN	1149 S MAIN AT BDWY	EDR Hist Auto	Higher	471, 0.089, NNW
I34	CHEVRON SS# 95275	1149 S MAIN ST	SWEEPS UST, CA FID UST, CONTRA COSTA CO. SITE LIST	Higher	471, 0.089, NNW
I35	95275	1149 S MAIN ST	HIST UST	Higher	471, 0.089, NNW
I36	CHEVRON	1149 MAIN ST S	LUST, HIST CORTESE	Higher	471, 0.089, NNW
J37	ST. PAUL CLEANERS	1381 E NEWELL AVENUE	RCRA-SQG, FINDS, ECHO, DRYCLEANERS, HAZNET	Higher	498, 0.094, ESE
J38	ST PAUL CLEANERS	1381 E NEWELL AVENUE	EMI, CONTRA COSTA CO. SITE LIST	Higher	498, 0.094, ESE
J39	ST PAULS CLEANERS	1381 E NEWELL AVE	EDR Hist Cleaner	Higher	498, 0.094, ESE

MAPPED SITES SUMMARY

Target Property Address:
1301 SOUTH MAIN STREET
WALNUT CREEK, CA 94596

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
40	AVEDA #744	146 BROADWAY LN SPC.	RCRA-SQG, FINDS, ECHO	Higher	530, 0.100, ENE
H41	AVEDA #744	1163 BROADWAY PLAZA	RCRA-SQG	Higher	584, 0.111, North
K42	KAISER PERMANENTE WA	1425 S MAIN ST	UST	Higher	588, 0.111, South
K43	KAISER PERMANENTE -	1425 S MAIN ST	RCRA-LQG	Higher	588, 0.111, South
K44	KAISER FOUNDATION HO	1425 SO MAIN STREET	HIST UST, EMI, CONTRA COSTA CO. SITE LIST	Higher	588, 0.111, South
K45	KAISER WALNUT CREEK	1425 S MAIN ST	SWEEPS UST, HIST UST, CA FID UST, CONTRA COSTA CO...	Higher	588, 0.111, South
J46	NEWELL SQUARE ONE HO	1345 NEWELL AVE STE	EDR Hist Cleaner	Higher	598, 0.113, ESE
L47	SEPHORA STORE #202	1149 BROADWAY PLAZA	HAZNET, CONTRA COSTA CO. SITE LIST	Higher	630, 0.119, North
J48	NEWELL SQUARE ONE HO	1401 NURSERY LN C	EDR Hist Cleaner	Higher	630, 0.119, ESE
M49	MEHRZAU HAMZEH	1599 NEWELL AVE	HIST UST	Higher	690, 0.131, SW
M50	MEHRZAD HAMZEH	1599 NEWELL AVE	HIST UST	Higher	690, 0.131, SW
M51	KAISER SHELL	1599 NEWELL AVE	LUST, SWEEPS UST, HIST UST, CA FID UST, HIST...	Higher	701, 0.133, SW
M52	TEXXOIL	1599 NEWELL AVE	UST	Higher	701, 0.133, SW
N53	GERARD TIRE #215	1281 S CALIFORNIA BL	CONTRA COSTA CO. SITE LIST	Higher	733, 0.139, West
L54	NORDSTROM, INC	1200 BROADWAY PLAZA	EMI, CONTRA COSTA CO. SITE LIST	Higher	752, 0.142, NNE
O55	BANK OF AMERICA	1500 MT DIABLO BLVD	LUST, CONTRA COSTA CO. SITE LIST	Higher	794, 0.150, NNW
P56	WHOLE FOODS MARKET -	1333 NEWELL AVE	CONTRA COSTA CO. SITE LIST	Higher	801, 0.152, ESE
N57	PETCO #1301	1301 S CALIFORNIA BL	CONTRA COSTA CO. SITE LIST	Higher	803, 0.152, WSW
58	NORGE CLEANERS	1375 S CALIFORNIA BL	CONTRA COSTA CO. SITE LIST	Higher	851, 0.161, SW
M59	PAULS AUTO CENTER	1387 S CALIFORNIA BL	SWEEPS UST, CA FID UST, CONTRA COSTA CO. SITE LIST	Higher	851, 0.161, SW
M60	EXXON SERVICE STATIO	1387 S CALIFORNIA	LUST, HIST UST, HIST CORTESE	Higher	851, 0.161, SW
M61	WALNUT CREEK BEACON	1387 S CALIFORNIA BL	UST	Higher	851, 0.161, SW
M62	BP	1611 NEWELL AVE	LUST	Higher	877, 0.166, SW
M63	WALNUT CREEK BEACON	1611 NEWELL AVE	UST	Higher	877, 0.166, SW
M64	MOBIL SERVICE STATIO	1611 NEWELL AVE	HIST UST	Higher	877, 0.166, SW
M65	BP OIL COMPANY FACIL	1611 NEWELL AVE	LUST, SWEEPS UST, CA FID UST, HAZNET, HIST...	Higher	877, 0.166, SW
M66	WALNUT CREEK GASOLIN	1611 NEWELL AVE	RCRA-SQG, FINDS, ECHO	Higher	877, 0.166, SW
O67	WALNUT CREEK AUTOMOT	1532 MT DIABLO BLVD	CONTRA COSTA CO. SITE LIST	Higher	877, 0.166, NNW
68	CLASSIC CLEANING	1350 MT DIABLO BOULE	RCRA-SQG, FINDS, ECHO, DRYCLEANERS, EMI, CONTRA...	Higher	918, 0.174, North
Q69	FIRESTONE #3664	1556 MOUNT DIABLO BL	LUST, SWEEPS UST, HIST UST, CA FID UST, HIST...	Higher	955, 0.181, NNW
Q70	FIRESTONE 3666	1556 MT DEABLO BLVD	HIST UST	Higher	955, 0.181, NNW
R71	FORMER AUTO REPAIR C	1675 MT DIABLO BLVD	LUST, ENF	Higher	964, 0.183, NW
R72	N SERVICE LLC	1675 MOUNT DIABLO BL	RCRA NonGen / NLR, FINDS, ECHO, HAZNET	Higher	964, 0.183, NW
R73	SAN FRANCISCO FEDERA	1601 MT DIABLO BLVD	LUST, SWEEPS UST, CA FID UST, ENF, HIST CORTESE,...	Higher	964, 0.183, NW
R74	FORMER AUTO REPAIR C	1675 MT DIABLO BLVD	LUST, CONTRA COSTA CO. SITE LIST	Higher	964, 0.183, NW
R75	COST PLUS INC. #6204	1697 MT DIABLO BLVD	CONTRA COSTA CO. SITE LIST	Higher	964, 0.183, NW
S76	HOSANNA CLEANERS	1280 NEWELL AVE C	CONTRA COSTA CO. SITE LIST	Higher	977, 0.185, ESE
P77	HOSANNA 1HR CLEANERS	1280 C NEWELL AVE	DRYCLEANERS	Higher	1010, 0.191, ESE
78	KAISER PERMANENTE LI	1500 LILAC DR	HAZNET, CONTRA COSTA CO. SITE LIST	Higher	1028, 0.195, SSE

MAPPED SITES SUMMARY

Target Property Address:
1301 SOUTH MAIN STREET
WALNUT CREEK, CA 94596

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
Q79	STUDIO BLUE REPROGRA	1323 LOCUST ST	CONTRA COSTA CO. SITE LIST	Higher	1078, 0.204, NW
T80	BRUBAKER, FRANCES	1628 MT DIABLO BLVD	CONTRA COSTA CO. SITE LIST	Higher	1087, 0.206, NW
R81	CVS PHARMACY #9545	1123 S CALIFORNIA BL	CONTRA COSTA CO. SITE LIST	Higher	1131, 0.214, WNW
R82	CVS PHARMACY #9545	1123 S CALIFORNIA BL	RCRA-LQG, FINDS, ECHO	Higher	1131, 0.214, WNW
S83	ADVANCED IMAGE	1250 NEWELL AVE B	CONTRA COSTA CO. SITE LIST	Higher	1157, 0.219, East
T84	BIG 5 SPORTING GOODS	1630 MT DIABLO BLVD	CONTRA COSTA CO. SITE LIST	Higher	1160, 0.220, NW
Q85	MT DIABLO COUNCIL BO	1343 LOCUST STREET	HIST UST	Higher	1174, 0.222, NNW
Q86	MT DIABLO COUNCIL, B	1343 LOCUST ST	CONTRA COSTA CO. SITE LIST	Higher	1174, 0.222, NNW
87	SAFEWAY 0917	600 S BROADWAY AVE	HAZNET, CONTRA COSTA CO. SITE LIST	Higher	1217, 0.230, NNE
T88	CHEVRON STATION NO 9	1700 MT DIABLO BLVD	RCRA-SQG	Higher	1232, 0.233, NW
T89	CHEVRON #5595	1700 MOUNT DIABLO BL	SWEEPS UST	Higher	1232, 0.233, NW
T90	CHEVRON USA #95595	1700 MT DIABLO BLVD	UST	Higher	1232, 0.233, NW
T91	CHEVRON	1700 MT DIABLO BLVD	LUST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Higher	1232, 0.233, NW
T92	CHEVRON	1700 MT DIABLO BLVD	LUST	Higher	1232, 0.233, NW
T93	95595	1700 MT DIABLO BLVD	HIST UST	Higher	1232, 0.233, NW
U94	UNION OIL SS 3323	1715 MT DIABLO BOULE	HIST UST	Higher	1291, 0.245, NW
U95	UNION OIL SS# 3323	1715 MT DIABLO BLVD	LUST, HIST UST, HIST CORTESE, CONTRA COSTA CO....	Higher	1291, 0.245, NW
U96	UNOCAL SS# 3323	1715 MOUNT DIABLO BL	SWEEPS UST	Higher	1291, 0.245, NW
97	T-MOBILE WEST CORP/B	1299 NEWELL HILL PL	CONTRA COSTA CO. SITE LIST	Higher	1311, 0.248, East
V98	CENTER FOR SPORTS ME	1777 BOTELHO DR 110	CONTRA COSTA CO. SITE LIST	Higher	1319, 0.250, WSW
V99	AT&T MOBILITY - SOUT	1777 BOTELHO DR	CONTRA COSTA CO. SITE LIST	Higher	1319, 0.250, WSW
U100	KAISER SAND & GRAVEL	1333 NORTH CALIFORNI	SLIC	Higher	1392, 0.264, NW
U101	WAYNE STEAD CADILLAC	1800 MT DIABLO BLVD	RESPONSE, ENVIROSTOR, HIST Cal-Sites	Higher	1461, 0.277, NW
102	MANITSAS PROPERTIES	1902 MT DIABLO BLVD	LUST, ENF, HIST CORTESE, CONTRA COSTA CO. SITE...	Higher	1630, 0.309, WNW
103	MCCORDACK PROPERTY	1909 MT DIABLO BLVD	LUST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Higher	1982, 0.375, WNW
W104	FORMER DUTCH GIRL CL	1950 MOUNT DIABLO BL	SLIC	Higher	2393, 0.453, WNW
W105	M SERVICE INC	2008 MT DIABLO BLVD	LUST, HIST CORTESE, CONTRA COSTA CO. SITE LIST	Higher	2479, 0.470, WNW
X106	XTRA OIL CO.	1980 MAIN, N.	Notify 65	Higher	4053, 0.768, NNW
X107	XTRA OIL CO.	1980 MAIN, N.	Notify 65	Higher	4127, 0.782, NNW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - National Priority List
Proposed NPL - Proposed National Priority List Sites
NPL LIENS - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY - Federal Facility Site Information listing
SEMS - Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE - Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-CESQG - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS - Land Use Control Information System
US ENG CONTROLS - Engineering Controls Sites List
US INST CONTROL - Sites with Institutional Controls

Federal ERNS list

ERNS - Emergency Response Notification System

EXECUTIVE SUMMARY

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - Solid Waste Information System

State and tribal leaking storage tank lists

INDIAN LUST - - - - - - - - - - - - - - - Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST - - - - - - - - - - - - - - - - - - Underground Storage Tank Listing
AST - Aboveground Petroleum Storage Tank Facilities
INDIAN UST - - - - - - - - - - - - - - - - - Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

VCP - Voluntary Cleanup Program Properties
INDIAN VCP - - - - - - - - - - - - - - - - - Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS - - - - - - - - - - - - - Considered Brownfieds Sites Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - - - - - - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

WMUDS/SWAT - - - - - - - - - - - - - - Waste Management Unit Database
SWRCY - Recycler Database
HAULERS - - - - - - - - - - - - - - - - - - - Registered Waste Tire Haulers Listing
INDIAN ODI - - - - - - - - - - - - - - - - - Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9 - - - - - - - - - - Torres Martinez Reservation Illegal Dump Site Locations
ODI - Open Dump Inventory
IHS OPEN DUMPS - - - - - - - - - - Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL - - - - - - - - - - - - - - - Delisted National Clandestine Laboratory Register
SCH - School Property Evaluation Program
CDL - Clandestine Drug Labs
Toxic Pits - Toxic Pits Cleanup Act Sites
US CDL - National Clandestine Laboratory Register

Local Land Records

LIENS - Environmental Liens Listing
LIENS 2 - CERCLA Lien Information
DEED - Deed Restriction Listing

Records of Emergency Release Reports

HMIRS - Hazardous Materials Information Reporting System

CHMIRS	California Hazardous Material Incident Report System
LDS	Land Disposal Sites Listing
MCS	Military Cleanup Sites Listing
SPILLS 90	SPILLS 90 data from FirstSearch

Other Ascertainable Records

FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
UXO	Unexploded Ordnance Sites
DOCKET HWC	Hazardous Waste Compliance Docket Listing
ECHO	Enforcement & Compliance History Information
FUELS PROGRAM	EPA Fuels Program Registered Listing
CA BOND EXP. PLAN	Bond Expenditure Plan
Cortese	"Cortese" Hazardous Waste & Substances Sites List
CUPA Listings	CUPA Resources List
EMI	Emissions Inventory Data
ENF	Enforcement Action Listing
Financial Assurance	Financial Assurance Information Listing
ICE	ICE
HWP	EnviroStor Permitted Facilities Listing
HWT	Registered Hazardous Waste Transporter Database
MINES	Mines Site Location Listing
MWMP	Medical Waste Management Program Listing

NPDES	NPDES Permits Listing
PEST LIC	Pesticide Regulation Licenses Listing
PROC	Certified Processors Database
UIC	UIC Listing
WASTEWATER PITS	Oil Wastewater Pits Listing
WDS	Waste Discharge System
WIP	Well Investigation Program Case List

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal RCRA generators list

RCRA-LQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

A review of the RCRA-LQG list, as provided by EDR, and dated 12/12/2016 has revealed that there are 2 RCRA-LQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
KAISER PERMANENTE -	1425 S MAIN ST	S 0 - 1/8 (0.111 mi.)	K43	68
CVS PHARMACY #9545	***1123 S CALIFORNIA BL***	***WNW 1/8 - 1/4 (0.214 mi.)***	***R82***	***158***

EXECUTIVE SUMMARY

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 12/12/2016 has revealed that there are 8 RCRA-SQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TOMS BROADWAY CAMERA	***8 BROADWAY LN***	***ESE 0 - 1/8 (0.073 mi.)***	***30***	***43***
ST. PAUL CLEANERS	***1381 E NEWELL AVENUE***	***ESE 0 - 1/8 (0.094 mi.)***	***J37***	***52***
AVEDA #744	***146 BROADWAY LN SPC.***	***ENE 0 - 1/8 (0.100 mi.)***	***40***	***64***
AVEDA #744	1163 BROADWAY PLAZA	N 0 - 1/8 (0.111 mi.)	H41	66
WALNUT CREEK GASOLIN	***1611 NEWELL AVE***	***SW 1/8 - 1/4 (0.166 mi.)***	***M66***	***122***
CLASSIC CLEANING	***1350 MT DIABLO BOULE***	***N 1/8 - 1/4 (0.174 mi.)***	***68***	***124***
CHEVRON STATION NO 9	1700 MT DIABLO BLVD	NW 1/8 - 1/4 (0.233 mi.)	T88	168

Lower Elevation	Address	Direction / Distance	Map ID	Page
FORMER VIRGINIA CLEA	***1335 S MAIN ST***	***SSW 0 - 1/8 (0.017 mi.)***	***A9***	***17***

State- and tribal - equivalent NPL

RESPONSE: Identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk.

A review of the RESPONSE list, as provided by EDR, has revealed that there is 1 RESPONSE site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WAYNE STEAD CADILLAC	***1800 MT DIABLO BLVD***	***NW 1/4 - 1/2 (0.277 mi.)***	***U101***	***184***

Database: RESPONSE, Date of Government Version: 01/30/2017
Status: Certified
Facility Id: 7550005

State- and tribal - equivalent CERCLIS

ENVIROSTOR: The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

A review of the ENVIROSTOR list, as provided by EDR, and dated 01/30/2017 has revealed that there is

EXECUTIVE SUMMARY

1 ENVIROSTOR site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WAYNE STEAD CADILLAC Facility Id: 7550005 Status: Certified	***1800 MT DIABLO BLVD***	***NW 1/4 - 1/2 (0.277 mi.)***	***U101***	***184***

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank (LUST) Sites included in GeoTracker. GeoTracker is the Water Boards data management system for sites that impact, or have the potential to impact, water quality in California, with emphasis on groundwater.

A review of the LUST list, as provided by EDR, has revealed that there are 20 LUST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
UNOCAL Database: LUST REG 2, Date of Government Version: 09/30/2004 Database: LUST, Date of Government Version: 03/13/2017 Status: Completed - Case Closed Facility Id: 07-0708 Facility Status: Case Closed Global Id: T0601300655 date9: 5/1/1998	1322 MAIN ST S	0 - 1/8 (0.000 mi.)	A3	10
TEXACO Database: LUST REG 2, Date of Government Version: 09/30/2004 Database: LUST, Date of Government Version: 03/13/2017 Status: Completed - Case Closed Facility Id: 07-0421 Facility Status: Case Closed Global Id: T0601300390 date9: 4/18/2001	***1275 MAIN***	***WNW 0 - 1/8 (0.009 mi.)***	***B5***	***12***
GOODYEAR TIRE & RUBB Database: LUST REG 2, Date of Government Version: 09/30/2004 Database: LUST, Date of Government Version: 03/13/2017 Status: Completed - Case Closed Facility Id: 07-0567 Facility Status: Case Closed Global Id: T0601300523 date9: 3/3/1997	***1231 MAIN***	***NNW 0 - 1/8 (0.036 mi.)***	***D16***	***29***
KAISER MEDICAL CENTE Database: LUST REG 2, Date of Government Version: 09/30/2004 Database: LUST, Date of Government Version: 03/13/2017 Status: Completed - Case Closed Facility Id: 07-0412 Facility Status: Case Closed Global Id: T0601300382 date9: 4/14/1995	***1425 MAIN ST S***	***SSE 0 - 1/8 (0.056 mi.)***	***C24***	***40***
CHEVRON Database: LUST REG 2, Date of Government Version: 09/30/2004 Database: LUST, Date of Government Version: 03/13/2017	***1149 MAIN ST S***	***NNW 0 - 1/8 (0.089 mi.)***	***I36***	***50***

Status: Completed - Case Closed
Facility Id: 07-0086
Facility Status: Case Closed
Global Id: T0601300082
date9: 6/4/1998

KAISER SHELL	***1599 NEWELL AVE***	***SW 1/8 - 1/4 (0.133 mi.)***	***M51***	***88***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0297
Facility Status: Case Closed
Global Id: T0601399969
Global Id: T0601300277
date9: 10/1/1997

BANK OF AMERICA	***1500 MT DIABLO BLVD***	***NNW 1/8 - 1/4 (0.150 mi.)***	***O55***	***97***

Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Global Id: T10000003345

EXXON SERVICE STATIO	***1387 S CALIFORNIA***	***SW 1/8 - 1/4 (0.161 mi.)***	***M60***	***104***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0132
Facility Status: Case Closed
Global Id: T0601300123
date9: 8/30/2001

BP	1611 NEWELL AVE	SW 1/8 - 1/4 (0.166 mi.)	M62	110

Database: LUST REG 2, Date of Government Version: 09/30/2004
Facility Id: 07-0198
Facility Status: Post remedial action monitoring

BP OIL COMPANY FACIL	***1611 NEWELL AVE***	***SW 1/8 - 1/4 (0.166 mi.)***	***M65***	***112***

Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Global Id: T0601300185

FIRESTONE #3664	***1556 MOUNT DIABLO BL***	***NNW 1/8 - 1/4 (0.181 mi.)***	***Q69***	***132***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0674
Facility Status: Case Closed
Global Id: T0601300623
date9: 3/24/1997

FORMER AUTO REPAIR C	***1675 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R71***	***136***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Facility Id: 07-0809
Facility Status: Case Closed
date9: 9/16/2002

SAN FRANCISCO FEDERA	***1601 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R73***	***139***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0272

Facility Status: Post remedial action monitoring
Global Id: T0601300253

FORMER AUTO REPAIR C	***1675 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R74***	***152***

Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Global Id: T0601392676

CHEVRON	***1700 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.233 mi.)***	***T91***	***173***

Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Global Id: T0601300068

CHEVRON	1700 MT DIABLO BLVD	NW 1/8 - 1/4 (0.233 mi.)	T92	177

Database: LUST REG 2, Date of Government Version: 09/30/2004
Facility Id: 07-0072
Facility Status: Post remedial action monitoring

UNION OIL SS# 3323	***1715 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.245 mi.)***	***U95***	***179***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0357
Facility Status: Case Closed
Global Id: T0601300333
date9: 4/3/1997

MANITSAS PROPERTIES	***1902 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.309 mi.)***	***102***	***187***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0163
Facility Status: Preliminary site assessment underway
Global Id: T0601300153

MCCORDACK PROPERTY	***1909 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.375 mi.)***	***103***	***191***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0190
Facility Status: Case Closed
Global Id: T0601300177
date9: 6/11/1997

M SERVICE INC	***2008 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.470 mi.)***	***W105***	***194***

Database: LUST REG 2, Date of Government Version: 09/30/2004
Database: LUST, Date of Government Version: 03/13/2017
Status: Completed - Case Closed
Facility Id: 07-0395
Facility Status: Preliminary site assessment underway
Global Id: T0601300367

SLIC: Cleanup Program Sites (CPS; also known as Site Cleanups [SC] and formerly known as Spills, Leaks, Investigations, and Cleanups [SLIC] sites) included in GeoTracker. GeoTracker is the Water Boards data management system for sites that impact, or have the potential to impact, water quality in California, with emphasis on groundwater.

A review of the SLIC list, as provided by EDR, has revealed that there are 3 SLIC sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
VIRGINIA CLEANERS Database: SLIC REG 2, Date of Government Version: 09/30/2004 Database: SLIC, Date of Government Version: 03/13/2017 Facility Status: Open - Verification Monitoring Facility Id: 07S0130 Global Id: SL1824A1145	1305-1335 MAIN ST S	S 0 - 1/8 (0.019 mi.)	A10	20
KAISER SAND & GRAVEL Database: SLIC REG 2, Date of Government Version: 09/30/2004 Facility Id: SL20278896	1333 NORTH CALIFORNI	NW 1/4 - 1/2 (0.264 mi.)	U100	184
FORMER DUTCH GIRL CL Database: SLIC, Date of Government Version: 03/13/2017 Facility Status: Open - Inactive Global Id: T10000005790	1950 MOUNT DIABLO BL	WNW 1/4 - 1/2 (0.453 mi.)	W104	193

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the State Water Resources Control Board's Hazardous Substance Storage Container Database.

A review of the UST list, as provided by EDR, has revealed that there are 5 UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
KAISER PERMANENTE WA Database: UST, Date of Government Version: 03/12/2017 Facility Id: 07-000-708986 Facility Id: 708986	1425 S MAIN ST	S 0 - 1/8 (0.111 mi.)	K42	67
TEXXOIL Database: UST, Date of Government Version: 03/12/2017 Facility Id: 07-000-763381 Facility Id: 763381	1599 NEWELL AVE	SW 1/8 - 1/4 (0.133 mi.)	M52	95
WALNUT CREEK BEACON Database: UST, Date of Government Version: 03/12/2017 Facility Id: 07-000-723895 Facility Id: 723895	1387 S CALIFORNIA BL	SW 1/8 - 1/4 (0.161 mi.)	M61	110
WALNUT CREEK BEACON Database: UST, Date of Government Version: 03/12/2017 Facility Id: 739564 Facility Id: 07-000-739564	1611 NEWELL AVE	SW 1/8 - 1/4 (0.166 mi.)	M63	111
CHEVRON USA #95595 Database: UST, Date of Government Version: 03/12/2017 Facility Id: 07-000-762781 Facility Id: 762781	1700 MT DIABLO BLVD	NW 1/8 - 1/4 (0.233 mi.)	T90	172

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Local Lists of Hazardous waste / Contaminated Sites

HIST Cal-Sites: Formerly known as ASPIS, this database contains both known and potential hazardous substance sites. The source is the California Department of Toxic Substance Control. No longer updated by the state agency. It has been replaced by ENVIROSTOR.

A review of the HIST Cal-Sites list, as provided by EDR, and dated 08/08/2005 has revealed that there is 1 HIST Cal-Sites site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WAYNE STEAD CADILLAC	*1800 MT DIABLO BLVD*	*NW 1/4 - 1/2 (0.277 mi.)*	*U101*	*184*

Local Lists of Registered Storage Tanks

SWEEPS UST: Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

A review of the SWEEPS UST list, as provided by EDR, and dated 06/01/1994 has revealed that there are 10 SWEEPS UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RY-NCK TIRE & BRAKE Comp Number: 8253	*1231 S MAIN ST*	*NNW 0 - 1/8 (0.036 mi.)*	*D17*	*31*
CHEVRON SS# 95275 Comp Number: 62732	*1149 S MAIN ST*	*NNW 0 - 1/8 (0.089 mi.)*	*I34*	*47*
KAISER WALNUT CREEK Status: A Tank Status: A Comp Number: 8986	*1425 S MAIN ST*	*S 0 - 1/8 (0.111 mi.)*	*K45*	*82*
KAISER SHELL Status: A Tank Status: A Comp Number: 63381	*1599 NEWELL AVE*	*SW 1/8 - 1/4 (0.133 mi.)*	*M51*	*88*
PAULS AUTO CENTER Status: A Tank Status: A Comp Number: 23895	*1387 S CALIFORNIA BL*	*SW 1/8 - 1/4 (0.161 mi.)*	*M59*	*101*
BP OIL COMPANY FACIL Status: A Tank Status: A Comp Number: 39564	*1611 NEWELL AVE*	*SW 1/8 - 1/4 (0.166 mi.)*	*M65*	*112*
FIRESTONE #3664 Comp Number: 60568	*1556 MOUNT DIABLO BL*	*NNW 1/8 - 1/4 (0.181 mi.)*	*Q69*	*132*
SAN FRANCISCO FEDERA	*1601 MT DIABLO BLVD*	*NW 1/8 - 1/4 (0.183 mi.)*	*R73*	*139*

Comp Number: 70655				
CHEVRON #5595 Comp Number: 62781	1700 MOUNT DIABLO BL	NW 1/8 - 1/4 (0.233 mi.)	T89	169
UNOCAL SS# 3323 Status: A Tank Status: A Comp Number: 31724	1715 MOUNT DIABLO BL	NW 1/8 - 1/4 (0.245 mi.)	U96	182

HIST UST: Historical UST Registered Database.

A review of the HIST UST list, as provided by EDR, and dated 10/15/1990 has revealed that there are 16 HIST UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RY-NCK TIRE & BRAKE	***1231 S MAIN ST***	***NNW 0 - 1/8 (0.036 mi.)***	***D17***	***31***
GOODYEAR AUTO SERVIC Facility Id: 00000008253	1231 S MAIN ST	NNW 0 - 1/8 (0.036 mi.)	D18	33
95275 Facility Id: 00000062732	1149 S MAIN ST	NNW 0 - 1/8 (0.089 mi.)	I35	49
KAISER FOUNDATION HO Facility Id: 00000008986	***1425 SO MAIN STREET***	***S 0 - 1/8 (0.111 mi.)***	***K44***	***74***
KAISER WALNUT CREEK	***1425 S MAIN ST***	***S 0 - 1/8 (0.111 mi.)***	***K45***	***82***
MEHRZAU HAMZEH Facility Id: 00000063381	1599 NEWELL AVE	SW 1/8 - 1/4 (0.131 mi.)	M49	86
MEHRZAD HAMZEH Facility Id: 00000057154	1599 NEWELL AVE	SW 1/8 - 1/4 (0.131 mi.)	M50	87
KAISER SHELL	***1599 NEWELL AVE***	***SW 1/8 - 1/4 (0.133 mi.)***	***M51***	***88***
EXXON SERVICE STATIO Facility Id: 00000023895	***1387 S CALIFORNIA***	***SW 1/8 - 1/4 (0.161 mi.)***	***M60***	***104***
MOBIL SERVICE STATIO Facility Id: 00000039564	1611 NEWELL AVE	SW 1/8 - 1/4 (0.166 mi.)	M64	111
FIRESTONE #3664 Facility Id: 00000060568	***1556 MOUNT DIABLO BL***	***NNW 1/8 - 1/4 (0.181 mi.)***	***Q69***	***132***
FIRESTONE 3666	1556 MT DEABLO BLVD	NNW 1/8 - 1/4 (0.181 mi.)	Q70	135
MT DIABLO COUNCIL BO Facility Id: 00000040478	1343 LOCUST STREET	NNW 1/8 - 1/4 (0.222 mi.)	Q85	165
95595 Facility Id: 00000062781	1700 MT DIABLO BLVD	NW 1/8 - 1/4 (0.233 mi.)	T93	178
UNION OIL SS 3323 Facility Id: 00000031724	1715 MT DIABLO BOULE	NW 1/8 - 1/4 (0.245 mi.)	U94	179
UNION OIL SS# 3323 Facility Id: 00000060901	***1715 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.245 mi.)***	***U95***	***179***

EXECUTIVE SUMMARY

CA FID UST: The Facility Inventory Database contains active and inactive underground storage tank locations. The source is the State Water Resource Control Board.

A review of the CA FID UST list, as provided by EDR, and dated 10/31/1994 has revealed that there are 8 CA FID UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RY-NCK TIRE & BRAKE Facility Id: 07001223 Status: A	***1231 S MAIN ST***	***NNW 0 - 1/8 (0.036 mi.)***	***D17***	***31***
CHEVRON SS# 95275 Facility Id: 07000386 Status: I	***1149 S MAIN ST***	***NNW 0 - 1/8 (0.089 mi.)***	***I34***	***47***
KAISER WALNUT CREEK Facility Id: 07000483 Status: A	***1425 S MAIN ST***	***S 0 - 1/8 (0.111 mi.)***	***K45***	***82***
KAISER SHELL Facility Id: 07000370 Status: A	***1599 NEWELL AVE***	***SW 1/8 - 1/4 (0.133 mi.)***	***M51***	***88***
PAULS AUTO CENTER Facility Id: 07000208 Status: A	***1387 S CALIFORNIA BL***	***SW 1/8 - 1/4 (0.161 mi.)***	***M59***	***101***
BP OIL COMPANY FACIL Facility Id: 07000283 Status: A	***1611 NEWELL AVE***	***SW 1/8 - 1/4 (0.166 mi.)***	***M65***	***112***
FIRESTONE #3664 Facility Id: 07000974 Status: I	***1556 MOUNT DIABLO BL***	***NNW 1/8 - 1/4 (0.181 mi.)***	***Q69***	***132***
SAN FRANCISCO FEDERA Facility Id: 07000352 Status: I	***1601 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R73***	***139***

Other Ascertainable Records

RCRA NonGen / NLR: RCRAInfo is EPA’s comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA NonGen / NLR list, as provided by EDR, and dated 12/12/2016 has revealed that there is 1 RCRA NonGen / NLR site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
N SERVICE LLC	***1675 MOUNT DIABLO BL***	***NW 1/8 - 1/4 (0.183 mi.)***	***R72***	***138***

EXECUTIVE SUMMARY

DRYCLEANERS: A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaners' agents; linen supply; coin-operated laundries and cleaning; drycleaning plants except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

A review of the DRYCLEANERS list, as provided by EDR, and dated 03/09/2017 has revealed that there are 5 DRYCLEANERS sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ESSEX WALNUT OWNER L EPA Id: CAL000387238	***1500 NEWELL AVE***	***S 0 - 1/8 (0.021 mi.)***	***C12***	***25***
ST. PAUL CLEANERS EPA Id: CAL000288122 EPA Id: CAL000330986 EPA Id: CAL000415744 EPA Id: CAD981171549	***1381 E NEWELL AVENUE***	***ESE 0 - 1/8 (0.094 mi.)***	***J37***	***52***
CLASSIC CLEANING EPA Id: CAL000190459 EPA Id: CAD982465569	***1350 MT DIABLO BOULE***	***N 1/8 - 1/4 (0.174 mi.)***	***68***	***124***
HOSANNA 1HR CLEANERS EPA Id: CAL000129033	1280 C NEWELL AVE	ESE 1/8 - 1/4 (0.191 mi.)	P77	155

Lower Elevation	Address	Direction / Distance	Map ID	Page
FORMER VIRGINIA CLEA EPA Id: CAD981976749	***1335 S MAIN ST***	***SSW 0 - 1/8 (0.017 mi.)***	***A9***	***17***

HAZNET: The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000-1,000,000 annually, representing approximately 350,000-500,000 shipments. Data from non-California manifests & continuation sheets are not included at the present time. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, & disposal method. The source is the Department of Toxic Substance Control is the agency. This database begins with calendar year 1993.

A review of the HAZNET list, as provided by EDR, and dated 12/31/2015 has revealed that there is 1 HAZNET site within approximately 0.001 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DIABLO CLEANERS GEPAID: CAD981976749	1335 S MAIN	0 - 1/8 (0.000 mi.)	A1	8

HIST CORTESE: The sites for the list are designated by the State Water Resource Control Board [LUST], the Integrated Waste Board [SWF/LS], and the Department of Toxic Substances Control [CALSITES]. This listing is no longer updated by the state agency.

A review of the HIST CORTESE list, as provided by EDR, and dated 04/01/2001 has revealed that there are 14 HIST CORTESE sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TEXACO	***1275 MAIN***	***WNW 0 - 1/8 (0.009 mi.)***	***B5***	***12***

Reg Id: 07-0421				
GOODYEAR TIRE & RUBB Reg Id: 07-0567	***1231 MAIN***	***NNW 0 - 1/8 (0.036 mi.)***	***D16***	***29***
KAISER MEDICAL CENTE Reg Id: 07-0412	***1425 MAIN ST S***	***SSE 0 - 1/8 (0.056 mi.)***	***C24***	***40***
CHEVRON Reg Id: 07-0086	***1149 MAIN ST S***	***NNW 0 - 1/8 (0.089 mi.)***	***I36***	***50***
KAISER SHELL Reg Id: 07-0297	***1599 NEWELL AVE***	***SW 1/8 - 1/4 (0.133 mi.)***	***M51***	***88***
EXXON SERVICE STATIO Reg Id: 07-0132	***1387 S CALIFORNIA***	***SW 1/8 - 1/4 (0.161 mi.)***	***M60***	***104***
BP OIL COMPANY FACIL Reg Id: 07-0198	***1611 NEWELL AVE***	***SW 1/8 - 1/4 (0.166 mi.)***	***M65***	***112***
FIRESTONE #3664 Reg Id: 07-0674	***1556 MOUNT DIABLO BL***	***NNW 1/8 - 1/4 (0.181 mi.)***	***Q69***	***132***
SAN FRANCISCO FEDERA Reg Id: 07-0272	***1601 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R73***	***139***
CHEVRON Reg Id: 07-0072	***1700 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.233 mi.)***	***T91***	***173***
UNION OIL SS# 3323 Reg Id: 07-0357	***1715 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.245 mi.)***	***U95***	***179***
MANITSAS PROPERTIES Reg Id: 07-0163	***1902 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.309 mi.)***	***102***	***187***
MCCORDACK PROPERTY Reg Id: 07-0190	***1909 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.375 mi.)***	***103***	***191***
M SERVICE INC Reg Id: 07-0395	***2008 MT DIABLO BLVD***	***WNW 1/4 - 1/2 (0.470 mi.)***	***W105***	***194***

Notify 65: Listings of all Proposition 65 incidents reported to counties by the State Water Resources Control Board and the Regional Water Quality Control Board. This database is no longer updated by the reporting agency.

A review of the Notify 65 list, as provided by EDR, and dated 12/16/2016 has revealed that there are 2 Notify 65 sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
XTRA OIL CO.	1980 MAIN, N.	NNW 1/2 - 1 (0.768 mi.)	X106	196
XTRA OIL CO.	1980 MAIN, N.	NNW 1/2 - 1 (0.782 mi.)	X107	197

CONTRA COSTA CO. SITE LIST: Lists includes sites from the Underground Tank Program, Hazardous Waste Generator Program & Business Plan 12185 Program

A review of the CONTRA COSTA CO. SITE LIST list, as provided by EDR, and dated 11/17/2016 has revealed that there are 48 CONTRA COSTA CO. SITE LIST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TEXACO	***1275 MAIN***	***WNW 0 - 1/8 (0.009 mi.)***	***B5***	***12***

EXECUTIVE SUMMARY

Facility Id: 771382				
CERTIFIED TIRE & SER Facility Id: 770883	1400 NEWELL AVE	S 0 - 1/8 (0.017 mi.)	C8	17
NEWELL VILLAGE Facility Id: 773615	***1500 NEWELL AVENUE***	***S 0 - 1/8 (0.021 mi.)***	***C11***	***21***
MACY'S (WALNUT CREEK Facility Id: 774379	***1301 BROADWAY PLAZA***	***NE 0 - 1/8 (0.034 mi.)***	***E15***	***28***
RY-NCK TIRE & BRAKE Facility Id: 708253	***1231 S MAIN ST***	***NNW 0 - 1/8 (0.036 mi.)***	***D17***	***31***
THE TALBOTS INC. #91 Facility Id: 775026	***1201 S MAIN ST***	***NW 0 - 1/8 (0.051 mi.)***	***D21***	***34***
MACYS EXPANSION PROJ Facility Id: 774380	***1320 BROADWAY PLAZA***	***ENE 0 - 1/8 (0.052 mi.)***	***E22***	***35***
ROSS DRESS FOR LESS Facility Id: 774905	***1295 S MAIN ST***	***WSW 0 - 1/8 (0.055 mi.)***	***23***	***39***
PRODUCTION COLOR LAB Facility Id: 707705	1548 NEWELL AVE	SSW 0 - 1/8 (0.056 mi.)	F25	41
NYX PROFESSIONAL MAK Facility Id: 775282	1306 BROADWAY PLZ	NE 0 - 1/8 (0.060 mi.)	E26	42
PANERA BREAD Facility Id: 774863	1140 LOCUST ST	WNW 0 - 1/8 (0.062 mi.)	G27	42
CHIPOTLE MEXICAN GRI Facility Id: 774894	1158 LOCUST ST D-2A	WNW 0 - 1/8 (0.062 mi.)	G28	42
P.F. CHANGS CHINA BI Facility Id: 775313	1205 BROADWAY PLZ	N 0 - 1/8 (0.078 mi.)	H32	46
CHEVRON SS# 95275 Facility Id: 762732	***1149 S MAIN ST***	***NNW 0 - 1/8 (0.089 mi.)***	***I34***	***47***
ST PAUL CLEANERS Facility Id: 770420	***1381 E NEWELL AVENUE***	***ESE 0 - 1/8 (0.094 mi.)***	***J38***	***57***
KAISER FOUNDATION HO Facility Id: 774029	***1425 SO MAIN STREET***	***S 0 - 1/8 (0.111 mi.)***	***K44***	***74***
KAISER WALNUT CREEK Facility Id: 773802 Facility Id: 708986	***1425 S MAIN ST***	***S 0 - 1/8 (0.111 mi.)***	***K45***	***82***
SEPHORA STORE #202 Facility Id: 775285	***1149 BROADWAY PLAZA***	***N 0 - 1/8 (0.119 mi.)***	***L47***	***85***
KAISER SHELL Facility Id: 774329 Facility Id: 763381	***1599 NEWELL AVE***	***SW 1/8 - 1/4 (0.133 mi.)***	***M51***	***88***
GERARD TIRE #215 Facility Id: 770466	1281 S CALIFORNIA BL	W 1/8 - 1/4 (0.139 mi.)	N53	95
NORDSTROM, INC Facility Id: 774441	***1200 BROADWAY PLAZA***	***NNE 1/8 - 1/4 (0.142 mi.)***	***L54***	***96***
BANK OF AMERICA Facility Id: 772467	***1500 MT DIABLO BLVD***	***NNW 1/8 - 1/4 (0.150 mi.)***	***O55***	***97***
WHOLE FOODS MARKET - Facility Id: 774861	1333 NEWELL AVE	ESE 1/8 - 1/4 (0.152 mi.)	P56	100
PETCO #1301	1301 S CALIFORNIA BL	WSW 1/8 - 1/4 (0.152 mi.)	N57	100

EXECUTIVE SUMMARY

Facility Id: 774794				
NORGE CLEANERS Facility Id: 770701	1375 S CALIFORNIA BL	SW 1/8 - 1/4 (0.161 mi.)	58	101
PAULS AUTO CENTER Facility Id: 723895	***1387 S CALIFORNIA BL***	***SW 1/8 - 1/4 (0.161 mi.)***	***M59***	***101***
BP OIL COMPANY FACIL Facility Id: 773123 Facility Id: 739564	***1611 NEWELL AVE***	***SW 1/8 - 1/4 (0.166 mi.)***	***M65***	***112***
WALNUT CREEK AUTOMOT Facility Id: 770826	1532 MT DIABLO BLVD	NNW 1/8 - 1/4 (0.166 mi.)	O67	124
CLASSIC CLEANING Facility Id: 771009	***1350 MT DIABLO BOULE***	***N 1/8 - 1/4 (0.174 mi.)***	***68***	***124***
FIRESTONE #3664 Facility Id: 760568	***1556 MOUNT DIABLO BL***	***NNW 1/8 - 1/4 (0.181 mi.)***	***Q69***	***132***
SAN FRANCISCO FEDERA Facility Id: 770655	***1601 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R73***	***139***
FORMER AUTO REPAIR C Facility Id: 771899	***1675 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.183 mi.)***	***R74***	***152***
COST PLUS INC. #6204 Facility Id: 774778	1697 MT DIABLO BLVD	NW 1/8 - 1/4 (0.183 mi.)	R75	154
HOSANNA CLEANERS Facility Id: 772204	1280 NEWELL AVE C	ESE 1/8 - 1/4 (0.185 mi.)	S76	155
KAISER PERMANENTE LI Facility Id: 774308	***1500 LILAC DR***	***SSE 1/8 - 1/4 (0.195 mi.)***	***78***	***156***
STUDIO BLUE REPROGRA Facility Id: 707651	1323 LOCUST ST	NW 1/8 - 1/4 (0.204 mi.)	Q79	157
BRUBAKER, FRANCES Facility Id: 770602	1628 MT DIABLO BLVD	NW 1/8 - 1/4 (0.206 mi.)	T80	157
CVS PHARMACY #9545 Facility Id: 772913	1123 S CALIFORNIA BL	WNW 1/8 - 1/4 (0.214 mi.)	R81	157
ADVANCED IMAGE Facility Id: 773712	1250 NEWELL AVE B	E 1/8 - 1/4 (0.219 mi.)	S83	165
BIG 5 SPORTING GOODS Facility Id: 775137	1630 MT DIABLO BLVD	NW 1/8 - 1/4 (0.220 mi.)	T84	165
MT DIABLO COUNCIL, B Facility Id: 771882	1343 LOCUST ST	NNW 1/8 - 1/4 (0.222 mi.)	Q86	166
SAFEWAY 0917 Facility Id: 774491	***600 S BROADWAY AVE***	***NNE 1/8 - 1/4 (0.230 mi.)***	***87***	***166***
CHEVRON Facility Id: 772357 Facility Id: 762781	***1700 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.233 mi.)***	***T91***	***173***
UNION OIL SS# 3323 Facility Id: 731724	***1715 MT DIABLO BLVD***	***NW 1/8 - 1/4 (0.245 mi.)***	***U95***	***179***
T-MOBILE WEST CORP/B Facility Id: 774030	1299 NEWELL HILL PL	E 1/8 - 1/4 (0.248 mi.)	97	183
CENTER FOR SPORTS ME Facility Id: 773711	1777 BOTELHO DR 110	WSW 1/8 - 1/4 (0.250 mi.)	V98	183
AT&T MOBILITY - SOUT	1777 BOTELHO DR	WSW 1/8 - 1/4 (0.250 mi.)	V99	183

EXECUTIVE SUMMARY

Facility Id: 773372

Lower Elevation	Address	Direction / Distance	Map ID	Page
FORMER VIRGINIA CLEA Facility Id: 770698	***1335 S MAIN ST***	***SSW 0 - 1/8 (0.017 mi.)***	***A9***	***17***

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR Hist Auto: EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR Hist Auto list, as provided by EDR, has revealed that there are 7 EDR Hist Auto sites within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RUSSS RICHFIELD SERV	1345 S MAIN ST	0 - 1/8 (0.000 mi.)	A4	12
ALL FOREIGN AUTO SER	1275 S MAIN ST	WNW 0 - 1/8 (0.009 mi.)	B6	16
EAST BAY UNION 76 IN	1491 NEWELL AVE	SSE 0 - 1/8 (0.013 mi.)	C7	16
RY-NCK TIRE & BRAKE	1232 S MAIN	NNW 0 - 1/8 (0.034 mi.)	D14	27
RY-NCK TIRE & BRAKE	1231 S MAIN	NNW 0 - 1/8 (0.036 mi.)	D19	33
ROBINSON NORMAN	1149 S MAIN AT BDWY	NNW 0 - 1/8 (0.089 mi.)	I33	47

Lower Elevation	Address	Direction / Distance	Map ID	Page
STONE ENTERPRISES IN	1540 NEWELL CENTER	SSW 0 - 1/8 (0.051 mi.)	F20	34

EDR Hist Cleaner: EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR Hist Cleaner list, as provided by EDR, has revealed that there are 7 EDR Hist Cleaner sites within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DIABLO CLEANERS INC	1335 SO MAIN ST	0 - 1/8 (0.000 mi.)	A2	9
VALET AMERICA INC	1500 NEWELL AVE #409	S 0 - 1/8 (0.021 mi.)	C13	27

EXECUTIVE SUMMARY

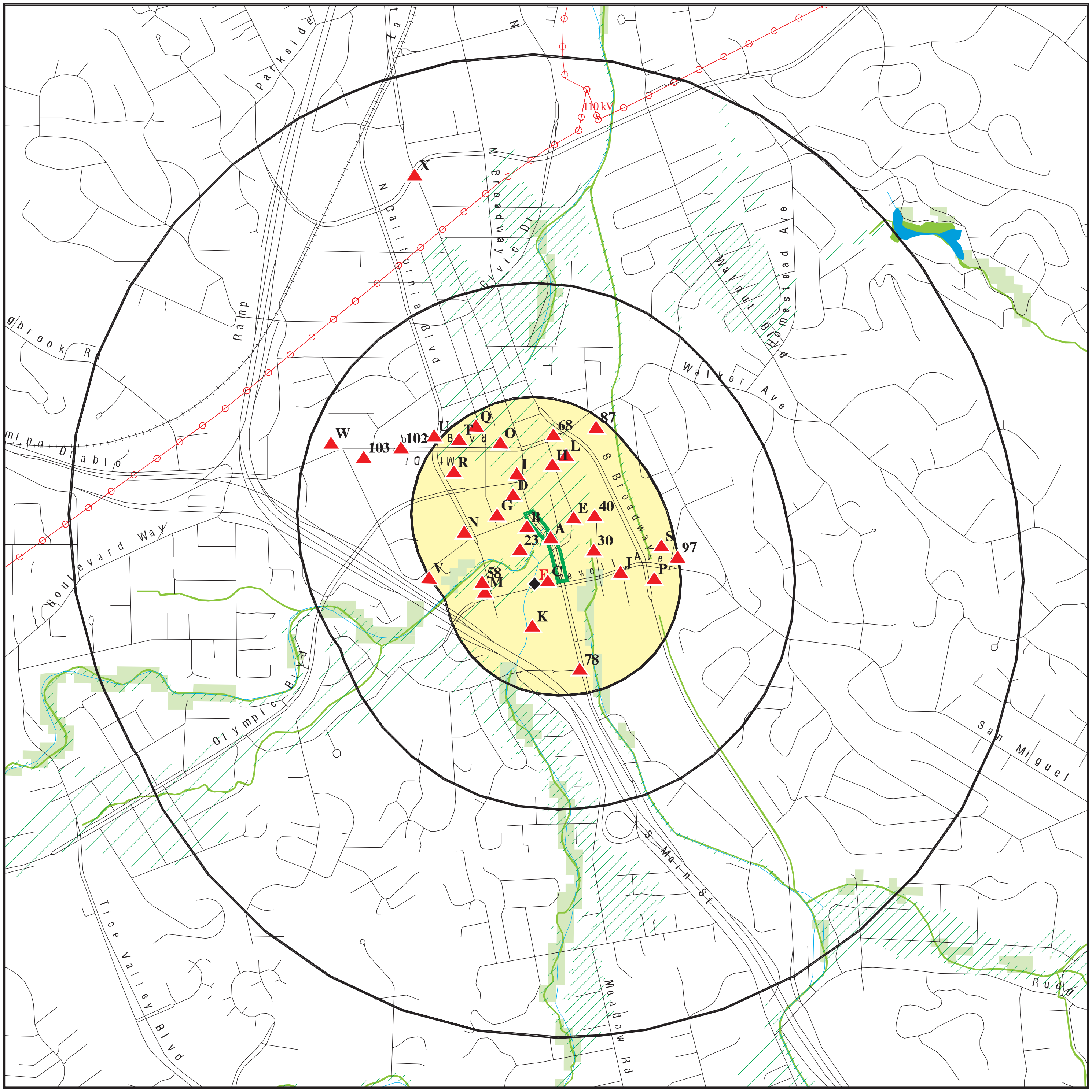
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DRY CLEANING SYSTEMS	1552 NEWELL AVE	SSW 0 - 1/8 (0.072 mi.)	F29	42
VOGUISH INC	1554 NEWELL AVE	SSW 0 - 1/8 (0.075 mi.)	F31	46
ST PAULS CLEANERS	1381 E NEWELL AVE	ESE 0 - 1/8 (0.094 mi.)	J39	64
NEWELL SQUARE ONE HO	1345 NEWELL AVE STE	ESE 0 - 1/8 (0.113 mi.)	J46	84
NEWELL SQUARE ONE HO	1401 NURSERY LN C	ESE 0 - 1/8 (0.119 mi.)	J48	85

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 3 records.

Site Name	Database(s)
	CDL
	CDL
YOON & YOUNG INC DBA ALAMO CLEANER	DRYCLEANERS

OVERVIEW MAP - 5001058.2S

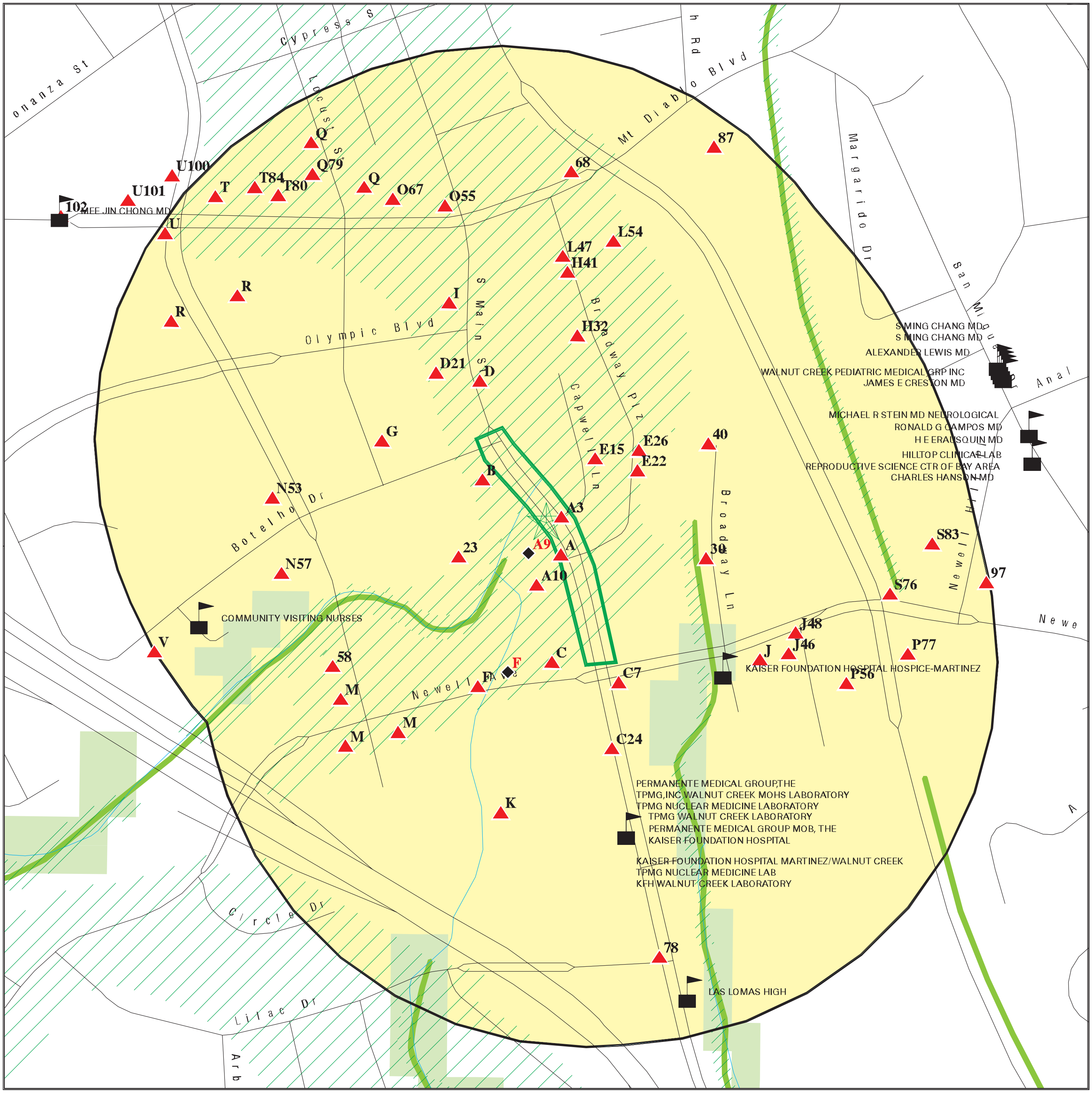


- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Upgradient Area
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Las Trampas Creek Bridge Replacement ADDRESS: 1301 South Main Street Walnut Creek CA 94596 LAT/LONG: 37.894512 / 122.058986	CLIENT: WRECO CONTACT: Flannery Banks INQUIRY #: 5001058.2s DATE: July 26, 2017 8:10 pm

DETAIL MAP - 5001058.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Las Trampas Creek Bridge Replacement	CLIENT: WRECO
ADDRESS: 1301 South Main Street, Walnut Creek CA 94596	CONTACT: Flannery Banks
	INQUIRY #: 5001058.2s
LAT/LONG: 37.894512 / 122.058986	DATE: July 26, 2017 8:12 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	0.001		0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		1	1	NR	NR	NR	2
RCRA-SQG	0.250		5	3	NR	NR	NR	8
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	0.001		0	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
RESPONSE	1.000		0	0	1	0	NR	1
State- and tribal - equivalent CERCLIS								
ENVIROSTOR	1.000		0	0	1	0	NR	1
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		5	12	3	NR	NR	20

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST	0.500		0	0	0	NR	NR	0
SLIC	0.500		1	0	2	NR	NR	3
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		1	4	NR	NR	NR	5
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
WMUDS/SWAT	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
HAULERS	0.001		0	NR	NR	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	0.001		0	NR	NR	NR	NR	0
HIST Cal-Sites	1.000		0	0	1	0	NR	1
SCH	0.250		0	0	NR	NR	NR	0
CDL	0.001		0	NR	NR	NR	NR	0
Toxic Pits	1.000		0	0	0	0	NR	0
US CDL	0.001		0	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
SWEEPS UST	0.250		3	7	NR	NR	NR	10
HIST UST	0.250		5	11	NR	NR	NR	16
CA FID UST	0.250		3	5	NR	NR	NR	8
Local Land Records								
LIENS	0.001		0	NR	NR	NR	NR	0
LIENS 2	0.001		0	NR	NR	NR	NR	0
DEED	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.001		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
CHMIRS	0.001		0	NR	NR	NR	NR	0
LDS	0.001		0	NR	NR	NR	NR	0
MCS	0.001		0	NR	NR	NR	NR	0
SPILLS 90	0.001		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	1	NR	NR	NR	1
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	0.001		0	NR	NR	NR	NR	0
EPA WATCH LIST	0.001		0	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	0.001		0	NR	NR	NR	NR	0
TRIS	0.001		0	NR	NR	NR	NR	0
SSTS	0.001		0	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	0.001		0	NR	NR	NR	NR	0
RAATS	0.001		0	NR	NR	NR	NR	0
PRP	0.001		0	NR	NR	NR	NR	0
PADS	0.001		0	NR	NR	NR	NR	0
ICIS	0.001		0	NR	NR	NR	NR	0
FTTS	0.001		0	NR	NR	NR	NR	0
MLTS	0.001		0	NR	NR	NR	NR	0
COAL ASH DOE	0.001		0	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	0.001		0	NR	NR	NR	NR	0
RADINFO	0.001		0	NR	NR	NR	NR	0
HIST FTTS	0.001		0	NR	NR	NR	NR	0
DOT OPS	0.001		0	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	0.001		0	NR	NR	NR	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	0.001		0	NR	NR	NR	NR	0
US AIRS	0.001		0	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.001		0	NR	NR	NR	NR	0
FINDS	0.001		0	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	0.001		0	NR	NR	NR	NR	0
ECHO	0.001		0	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
CA BOND EXP. PLAN	1.000		0	0	0	0	NR	0
Cortese	0.500		0	0	0	NR	NR	0
CUPA Listings	0.250		0	0	NR	NR	NR	0
DRYCLEANERS	0.250		3	2	NR	NR	NR	5
EMI	0.001		0	NR	NR	NR	NR	0
ENF	0.001		0	NR	NR	NR	NR	0
Financial Assurance	0.001		0	NR	NR	NR	NR	0
HAZNET	0.001		1	NR	NR	NR	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
ICE	0.001		0	NR	NR	NR	NR	0
HIST CORTESE	0.500		4	7	3	NR	NR	14
HWP	1.000		0	0	0	0	NR	0
HWT	0.250		0	0	NR	NR	NR	0
MINES	0.001		0	NR	NR	NR	NR	0
MWMP	0.250		0	0	NR	NR	NR	0
NPDES	0.001		0	NR	NR	NR	NR	0
PEST LIC	0.001		0	NR	NR	NR	NR	0
PROC	0.500		0	0	0	NR	NR	0
Notify 65	1.000		0	0	0	2	NR	2
CONTRA COSTA CO. SITE LIST	0.250		19	29	NR	NR	NR	48
UIC	0.001		0	NR	NR	NR	NR	0
WASTEWATER PITS	0.500		0	0	0	NR	NR	0
WDS	0.001		0	NR	NR	NR	NR	0
WIP	0.250		0	0	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		7	NR	NR	NR	NR	7
EDR Hist Cleaner	0.125		7	NR	NR	NR	NR	7
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LF	0.001		0	NR	NR	NR	NR	0
RGA LUST	0.001		0	NR	NR	NR	NR	0
- Totals --		0	65	82	11	2	0	160

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

GEOCHECK ® - PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

LAS TRAMPAS CREEK BRIDGE REPLACEMENT
1301 SOUTH MAIN STREET
WALNUT CREEK, CA 94596

TARGET PROPERTY COORDINATES

Latitude (North):	37.894512 - 37˚ 53’ 40.24’’
Longitude (West):	122.058986 - 122˚ 3’ 32.35’’
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	582739.7
UTM Y (Meters):	4194323.0
Elevation:	137 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5641124 WALNUT CREEK, CA
Version Date:	2012

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

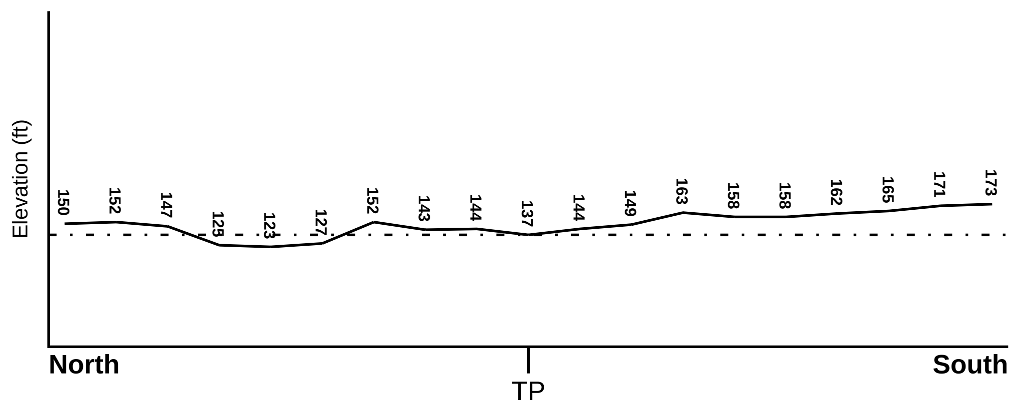
TOPOGRAPHIC INFORMATION

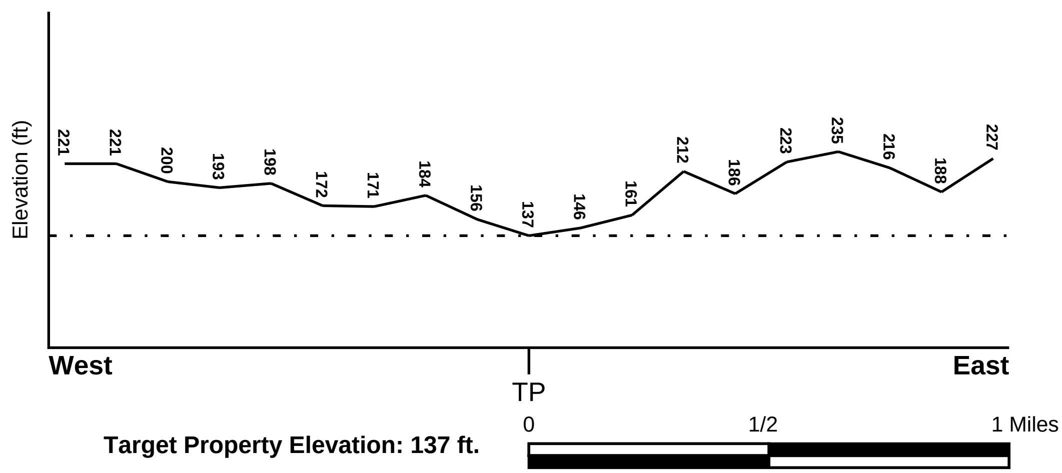
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General North

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 137 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
06013C0293F	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
06013C0287F	FEMA FIRM Flood data
06013C0291F	FEMA FIRM Flood data
06013C0289F	FEMA FIRM Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
WALNUT CREEK	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
1	1/8 - 1/4 Mile South	Not Reported
2	1/8 - 1/4 Mile NNW	NNE
3	1/2 - 1 Mile WNW	Not Reported
4	1/2 - 1 Mile NNW	NE
5	1/2 - 1 Mile North	ENE
1G	1/2 - 1 Mile North	ENE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
2G	1/2 - 1 Mile NNW	NE
3G	1/8 - 1/4 Mile NNW	NNE
4G	1/2 - 1 Mile WNW	Not Reported
5G	1/8 - 1/4 Mile South	Not Reported

For additional site information, refer to Physical Setting Source Map Findings.

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

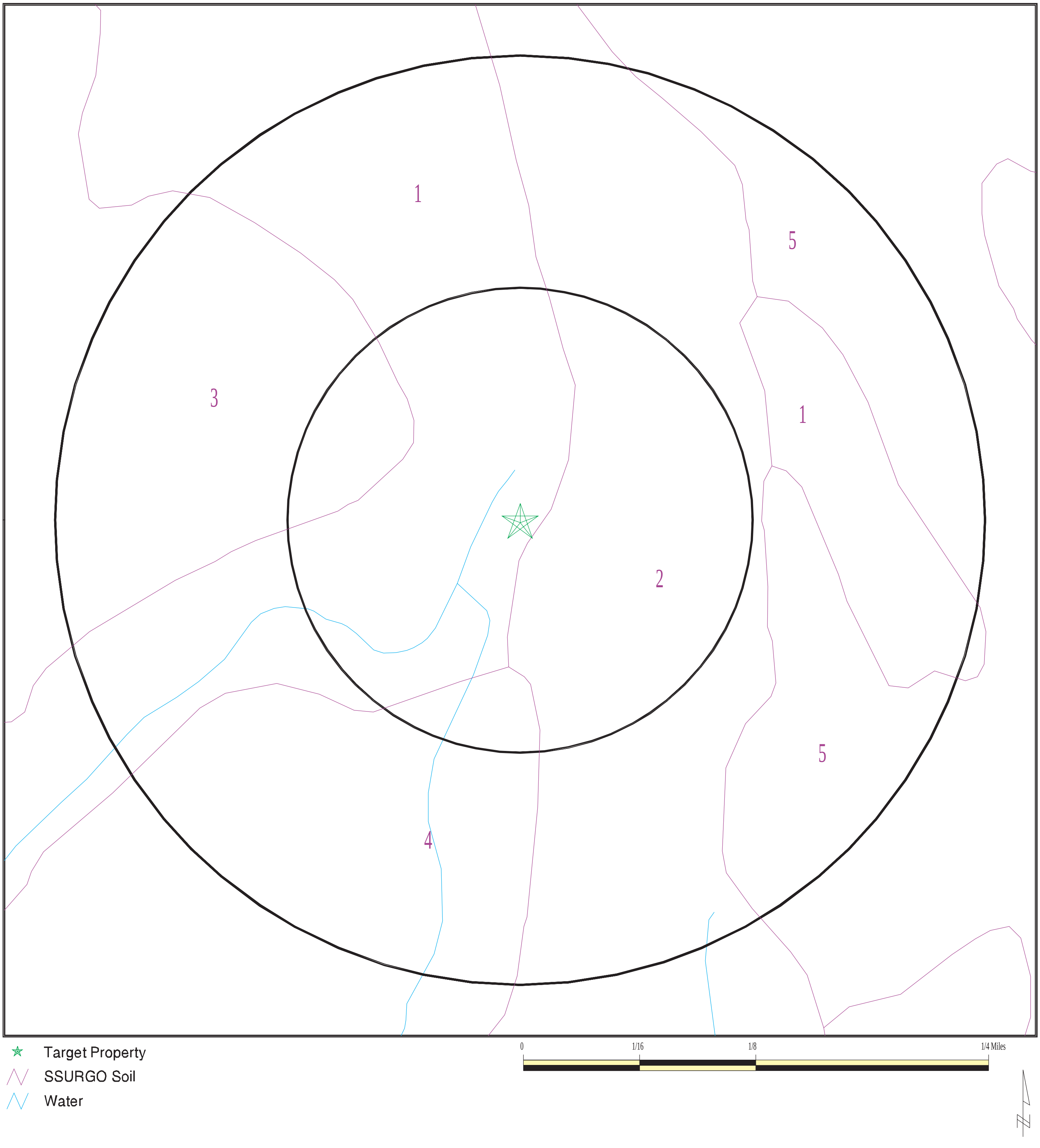
Era: Cenozoic
System: Tertiary
Series: Paleocene
Code: Tx *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5001058.2s



SITE NAME: Las Trampas Creek Bridge Replacement	CLIENT: WRECO
ADDRESS: 1301 South Main Street	CONTACT: Flannery Banks
Walnut Creek CA 94596	INQUIRY #: 5001058.2s
LAT/LONG: 37.894512 / 122.058986	DATE: July 26, 2017 8:13 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: CLEAR LAKE

Soil Surface Texture: clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	29 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 6.1
2	29 inches	59 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name: CONEJO

Soil Surface Texture: clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	27 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.3 Min: 6.1
2	27 inches	59 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.3 Min: 6.1

Soil Map ID: 3

Soil Component Name: TIERRA

Soil Surface Texture: loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	25 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 6 Min: 5.1
2	25 inches	59 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 0.42 Min: 0.01	Max: 7.3 Min: 5.6
3	59 inches	70 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 8.4 Min: 7.9

Soil Map ID: 4

Soil Component Name: BOTELLA

Soil Surface Texture: clay loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	3 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 6.5 Min: 5.6
2	3 inches	68 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.3 Min: 6.1

Soil Map ID: 5

Soil Component Name: LODO

Soil Surface Texture: clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 46 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	18 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.3 Min: 5.6

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	18 inches	22 inches	unweathered bedrock	Not reported	Not reported	Max: 1.4 Min: 0	Max: Min:

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 0.001 miles
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

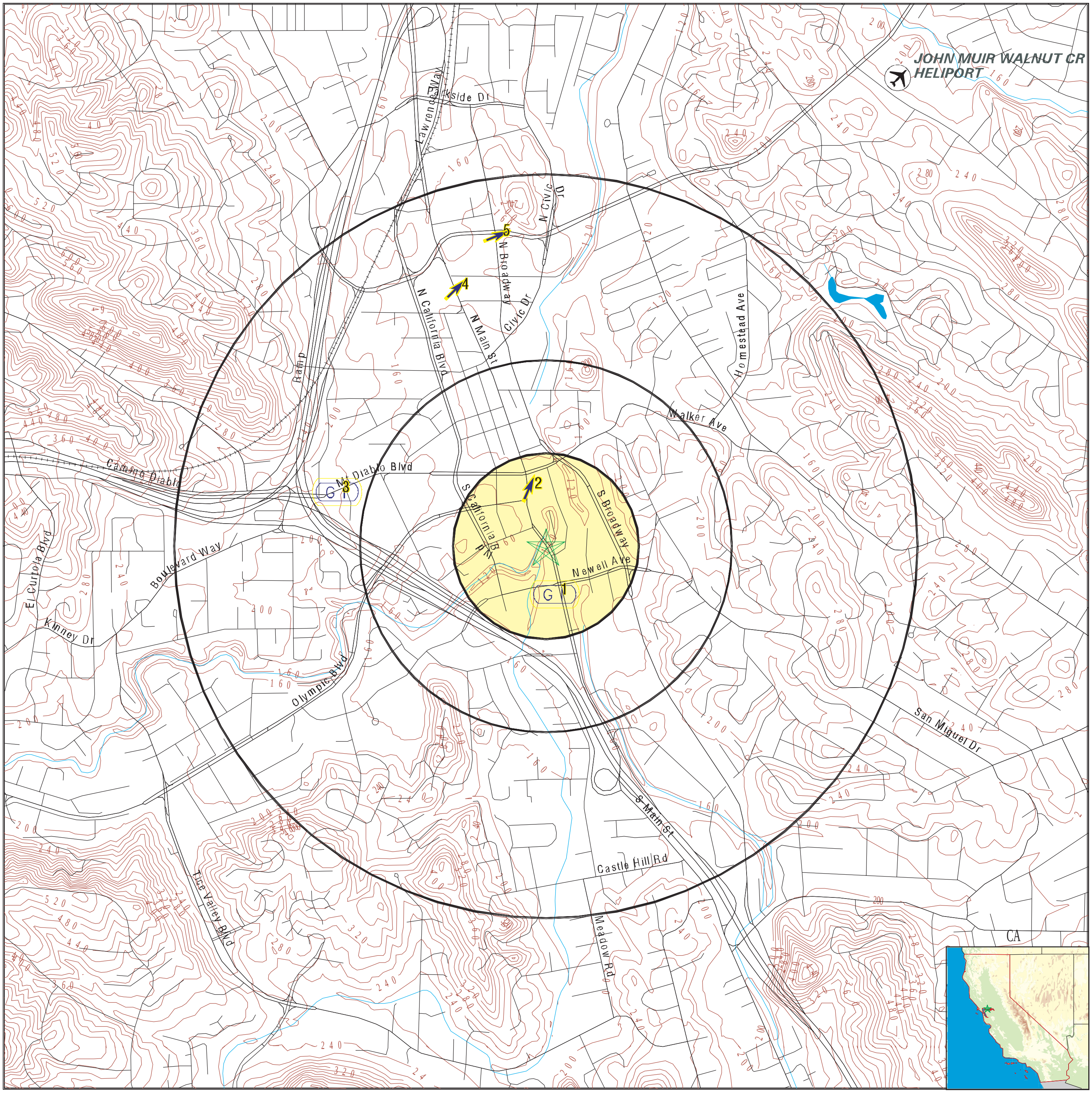
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 5001058.2s



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- Earthquake Fault Lines
- Airports
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- HD Closest Hydrogeological Data
- Oil, gas or related wells

SITE NAME: Las Trampas Creek Bridge Replacement	CLIENT: WRECO
ADDRESS: 1301 South Main Street	CONTACT: Flannery Banks
Walnut Creek CA 94596	INQUIRY #: 5001058.2s
LAT/LONG: 37.894512 / 122.058986	DATE: July 26, 2017 8:12 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID / Direction / Distance / Elevation			Database	EDR ID Number
1 **South** **1/8 - 1/4 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	08986 Not Reported Not Reported Not Reported 15 08/1996	**AQUIFLOW**	**66227**
2 **NNW** **1/8 - 1/4 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	07-0086 NNE Not Reported Not Reported 20 09/1988	**AQUIFLOW**	**38516**
3 **WNW** **1/2 - 1 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	71279 Not Reported Not Reported Not Reported 14 02/28/1991	**AQUIFLOW**	**64603**
4 **NNW** **1/2 - 1 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	19559 NE 10.90 16.19 Not Reported 04/13/1994	**AQUIFLOW**	**66243**
5 **North** **1/2 - 1 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	07-0130 ENE 20 16 Not Reported 05/07/1993	**AQUIFLOW**	**38522**
1G **North** **1/2 - 1 Mile** **Lower**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	07-0130 ENE 20 16 Not Reported 05/07/1993	**AQUIFLOW**	**38522**
2G **NNW** **1/2 - 1 Mile** **Lower**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	19559 NE 10.90 16.19 Not Reported 04/13/1994	**AQUIFLOW**	**66243**

Map ID / Direction / Distance / Elevation			Database	EDR ID Number
3G **NNW** **1/8 - 1/4 Mile** **Lower**	Site ID:	07-0086	**AQUIFLOW**	**38516**
	Groundwater Flow:	NNE		
	Shallow Water Depth:	Not Reported		
	Deep Water Depth:	Not Reported		
	Average Water Depth:	20		
	Date:	09/1988		
4G **WNW** **1/2 - 1 Mile** **Lower**	Site ID:	71279	**AQUIFLOW**	**64603**
	Groundwater Flow:	Not Reported		
	Shallow Water Depth:	Not Reported		
	Deep Water Depth:	Not Reported		
	Average Water Depth:	14		
	Date:	02/28/1991		
5G **South** **1/8 - 1/4 Mile** **Lower**	Site ID:	08986	**AQUIFLOW**	**66227**
	Groundwater Flow:	Not Reported		
	Shallow Water Depth:	Not Reported		
	Deep Water Depth:	Not Reported		
	Average Water Depth:	15		
	Date:	08/1996		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: CA Radon

Radon Test Results

Zipcode	Num Tests	> 4 pCi/L
94596	36	1

Federal EPA Radon Zone for CONTRA COSTA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 94596

Number of sites tested: 4

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.800 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: Department of Fish & Game
Telephone: 916-445-0411

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Database
Source: Department of Water Resources
Telephone: 916-651-9648

California Drinking Water Quality Database
Source: Department of Public Health
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

OTHER STATE DATABASE INFORMATION

California Oil and Gas Well Locations
Source: Department of Conservation
Telephone: 916-323-1779
Oil and Gas well locations in the state.

RADON

State Database: CA Radon
Source: Department of Health Services
Telephone: 916-324-2208
Radon Database for California

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

STREET AND ADDRESS INFORMATION

Appendix D File Review Data

FACT SHEET- Invitation to Comment on Proposed Cleanup Plan Former Virginia Cleaners Facility 1305 & 1335 S. Main St., Walnut Creek Contra Costa County

August 2013

Summary

This notification is being provided to nearby landowners and residents/occupants as well as other interested persons. It describes site background, past work to investigate and clean up site contamination, next steps, the Regional Water Quality Control Board's oversight process for the site, and how you can obtain more information. The Regional Water Board is the lead agency overseeing investigation and cleanup of the site.

Site Description

The Former Virginia Cleaners is located at 1305 & 1335 South Main Street, Walnut Creek, California (Figure 1). The Site is bounded to the east by South Main Street, the north by the Las Trampas Creek channel, the west by a commercial strip mall, and to the south by the remainder of the development property and Newell Avenue. The Site is approximately 0.65 acres and currently contains no structures. The property has been owned by Essex Walnut Owner, L.P., and is being redeveloped for residential condominiums with commercial space on the ground floor and underground parking.. Shallow groundwater at the Site is not used for drinking water; drinking water is supplied by the East Bay Municipal Utility District. Versar, Inc. (Versar) is the environmental consultant working on behalf of the responsible party.

Site History

Dry cleaning was performed at the Site from approximately 1973 to 2000. Initially, "Diablo Cleaners" performed dry cleaning from 1973 to approximately 1995, then "Virginia Cleaners" operated from 1998 until some time in 2000. Several small retail tenants occupied the former dry cleaning space until 2013, when the building was removed in preparation for redevelopment.

Site Investigations

Beginning in 2000, investigations of the property identified the dry cleaning chemical perchloroethene (PCE; also known as "perc" and "tetrachloroethene") in soil below the southwestern corner of the building, in vapors within the soil, and in groundwater. Organic compounds related to the natural breakdown of PCE, including vinyl chloride, were also detected. These chemicals have not been detected in the adjacent Las Trampas Creek. Groundwater monitoring wells were installed and these chemicals have been monitored since 2006. PCE was detected at concentrations greater than drinking water standards, and has been shown to be migrating in groundwater to the northwest, towards South Main Street. Soil vapor samples collected within the Site boundaries in 2007 and 2013 contained concentrations of PCE greater than concentrations that are protective of indoor air quality.

Proposed Cleanup Plan

The Regional Water Board will consider approving the amended Remedial Action Plan, dated August 13, 2013. As part of construction, a major portion of the Site will be excavated to greater than 20 feet below the ground surface, which is five to seven feet below the top of the groundwater surface ("water table"). To allow construction below the water table, the excavation will be dewatered continuously for four to six months. The extracted water will be treated and discharged to an onsite storm drain under a Regional Water Board permit. Removal of impacted soil and groundwater by excavation and dewatering is expected to result in cleanup of the dry cleaner chemicals. Soil vapor and groundwater will be monitored during and after Site redevelopment to ensure Site occupants and neighbors are protected and cleanup meets applicable regulatory goals.

You are invited to review the amended Remedial Action Plan and all relevant site documents on line at http://geotracker.waterboards.ca.gov/ (case number 07S0130). All written and verbal comments received by the Regional Water Board by September 6, 2013 will be considered prior to approving the cleanup plan. All comments should be directed to:

Regional Water Quality Control Board - San Francisco Bay Region
Attn: Cleet Carlton
1515 Clay Street, Suite 1400
Oakland, California 94612

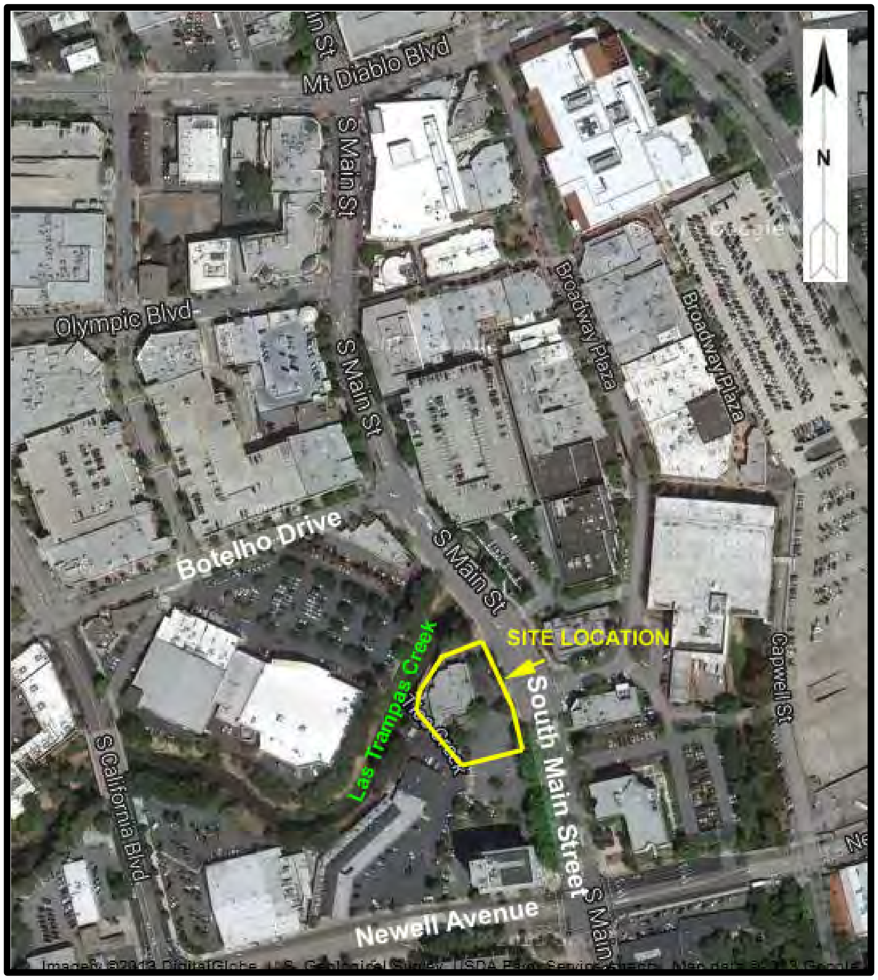
Regional Water Board Oversight Process

The Regional Water Board oversees more than 3,000 site cleanup cases in the Bay Area, including more than 2,000 leaking fuel tank cases. Regional Water Board staff direct investigation or cleanup work and set cleanup standards under Water Code authority. Responsible parties (e.g., past owners/operators) propose specific measures, perform the actual work, and submit technical reports documenting task completion. As part of this process, we circulate key documents, such as draft cleanup plans, to interested persons and provide an opportunity for comment on these documents. Interested persons include other agencies, local officials, non-profit organizations, and interested landowners and residents/occupants in the site vicinity.

For Further Information: If you have questions or comments about this case, you may contact Regional Water Board project manager Cleet Carlton at (510) 622-2374 (E-mail ccarlton@waterboards.ca.gov), or environmental consultant Tim Berger at (916) 863-9323 (E-mail tberger@versar.com).

You may also access site information online at http://geotracker.waterboards.ca.gov/. Click on "Advanced Search" and enter the Case ID 07S0130.

Site Location Map
Former Virginia Cleaners Facility
1305-1335 South Main Street, Walnut Creek



Geocon Project No. S9989-02-01
June 30, 2016

Essex Property Trust, Inc.
c/o Mr. Bill Bain
925 East Meadow Drive
Palo Alto, California 94303

Subject: REMEDIAL ACTION REPORT
NEWELL VILLAGE
1500 NEWELL AVENUE AND 1305-1345 SOUTH MAIN STREET
WALNUT CREEK, CALIFORNIA

Dear Mr. Bain:

In accordance with your request, we are pleased to submit this draft Remedial Action Report for the 1500 Newell Avenue and 1305 – 1345 South Main Street properties (the Site) in Walnut Creek, California.

The Remedial Action Report describes activities performed to remediate the site contaminant condition, documents the results of those activities, and recommends actions to be taken where cleanup goals were not achieved. This technical report is required to be submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) as a requirement of their *Approval of Amended Remedial Action Plan for Property at 1305-1345 South Main Street, Walnut Creek, Contra Costa County*, dated September 16, 2013, Case No. 07S0130. The final Remedial Action Report must be uploaded to the State Water Resources Control Board's GeoTracker website.

We appreciate the opportunity to assist you and Essex Property Trust on this project. Please let us know if you have questions regarding the Remedial Action Report, or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

PROFESSIONAL GEOLOGIST TIM BERGER No. 5225 STATE OF CALIFORNIA

Tim Berger, PG
Senior Geologist

REGISTERED GEOLOGIST JAMES F. BRAKE NO. 5753 STATE OF CALIFORNIA

Jim Brake, PG
Senior Geologist, Vice President

GEOCON CONSULTANTS, INC.

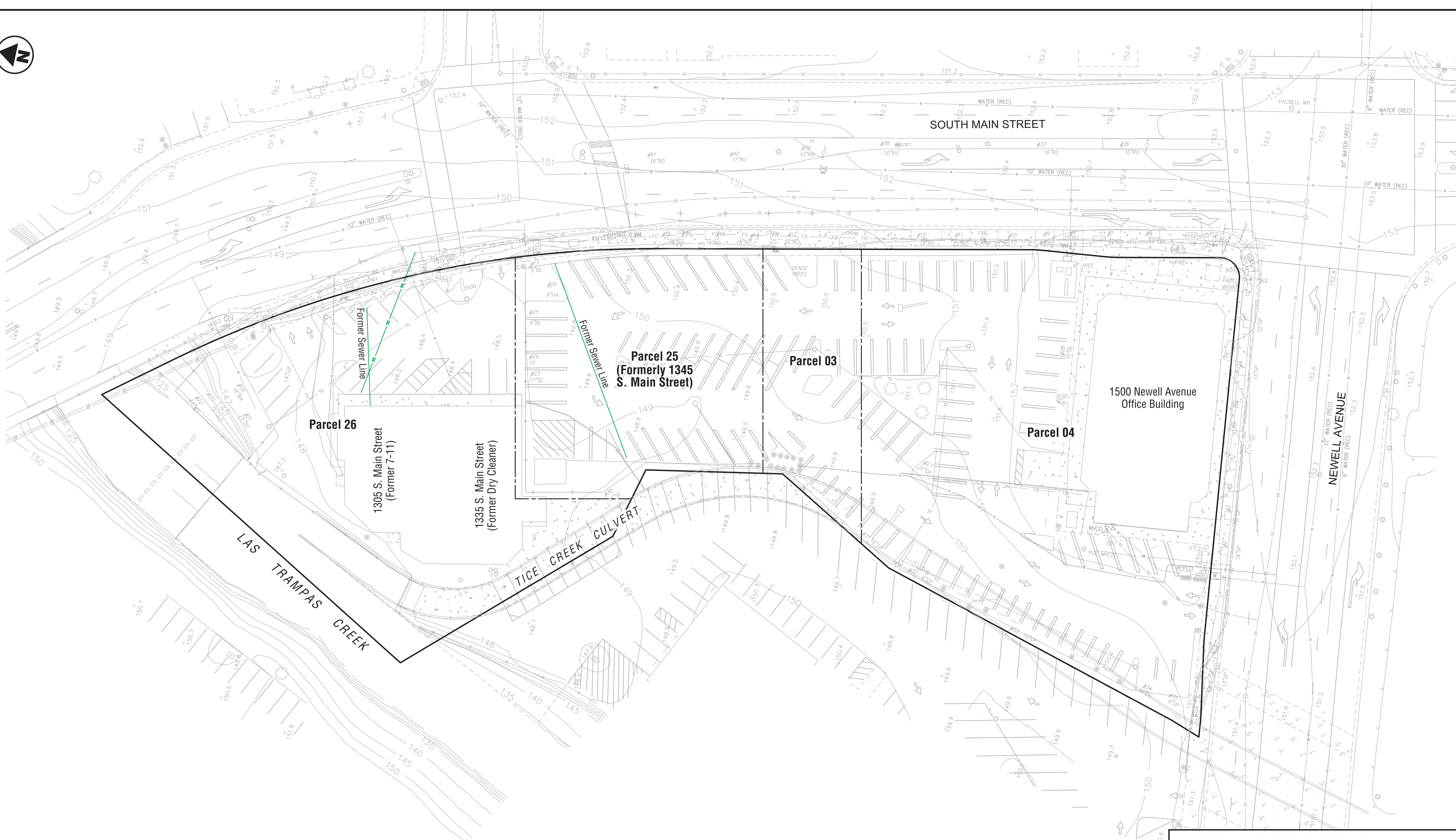
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Essex Newell Dewatering Wells

1305-1345 South Main Street
Walnut Creek, California

VICINITY MAP

S9989-02-01	June 2016	Figure 1



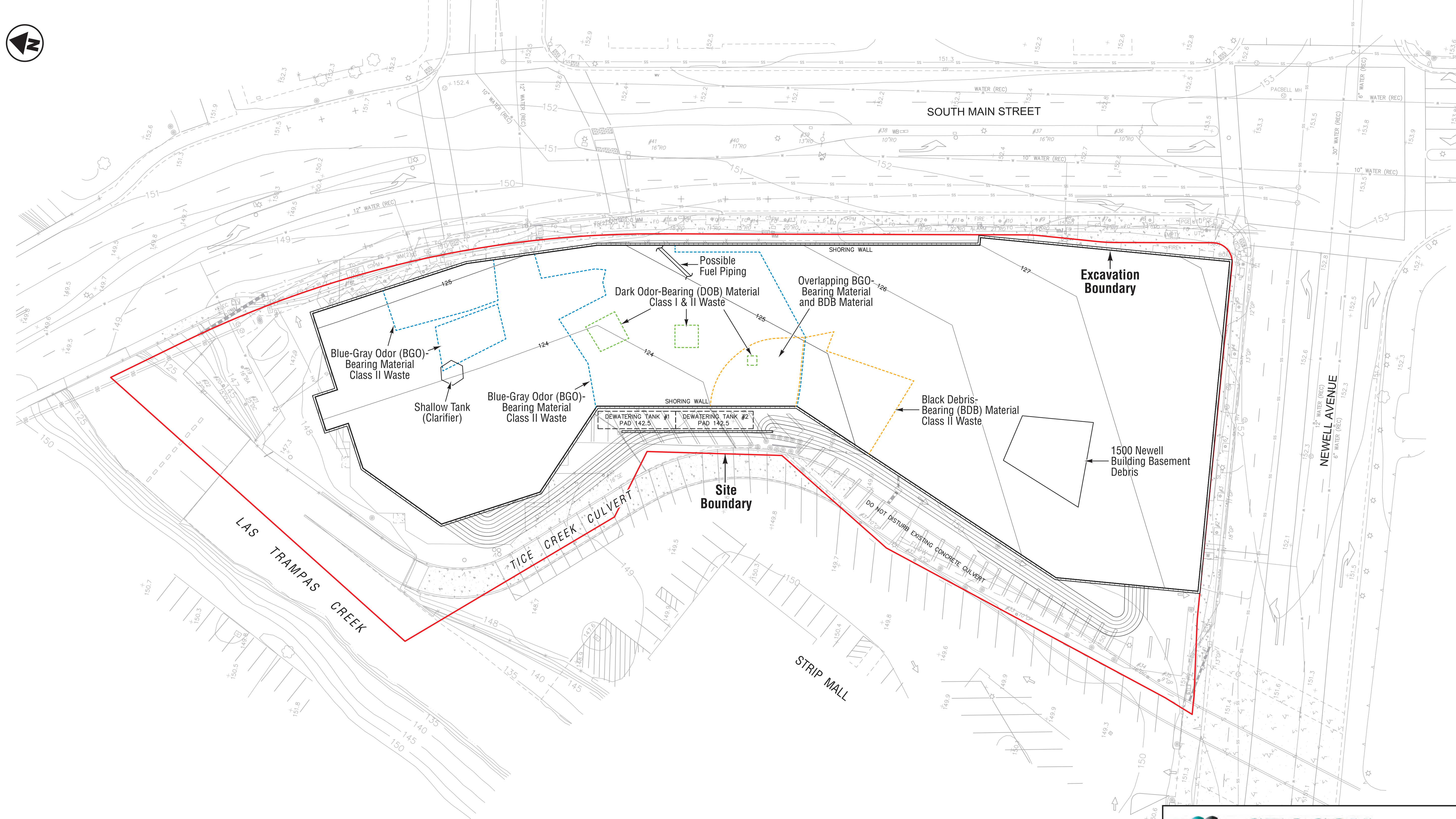
GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Essex Newell Dewatering Wells

1305-1345 South Main Street
Walnut Creek, California

Former Site Layout

S9989-02-01	June 2016	Figure 2



GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Essex Newell Dewatering Wells

1305-1345 South Main Street, Walnut Creek, California

Location and Extents of Characterized Material & Debris

S9989-02-01	June 2016	Figure 3

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CASE SUMMARY

REPORT DATE
7/26/1994

HAZARDOUS MATERIAL INCIDENT REPORT FILED WITH OES?

I. REPORTED BY -
UNKNOWN

CREATED BY
UNKNOWN

III. SITE LOCATION

FACILITY NAME
UNOCAL

FACILITY ADDRESS
1322 MAIN ST S
WALNUT CREEK, CA 94596
CONTRA COSTA COUNTY

FACILITY ID

ORIENTATION OF SITE TO STREET

CROSS STREET
BROADWAY PLAZA

V. SUBSTANCES RELEASED / CONTAMINANT(S) OF CONCERN
GASOLINE

VI. DISCOVERY/ABATEMENT

DATE DISCHARGE BEGAN

DATE DISCOVERED	HOW DISCOVERED	DESCRIPTION
7/15/1993	Tank Closure	

DATE STOPPED	STOP METHOD	DESCRIPTION
7/15/1993		

VII. SOURCE/CAUSE

SOURCE OF DISCHARGE
Other

CAUSE OF DISCHARGE
Unknown

DISCHARGE DESCRIPTION

VIII. CASE TYPE

CASE TYPE
Other Groundwater (uses other than drinking water)

IX. REMEDIAL ACTION
NO REMEDIAL ACTIONS ENTERED

X. GENERAL COMMENTS

XI. CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

XII. REGULATORY USE ONLY

LOCAL AGENCY CASE NUMBER
07-0708

REGIONAL BOARD CASE NUMBER
07-0708

LOCAL AGENCY

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
SUE LOYD	SL	CONTRA COSTA COUNTY	sloyd@hsd.co.contra-costa.ca.us

ADDRESS
4333 PACHECO BLVD.
MARTINEZ, CA 94553

CONTACT DESCRIPTION

REGIONAL BOARD

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
KEVIN BROWN	KEB	SAN FRANCISCO BAY RWQCB (REGION 2)	kebrown@waterboards.ca.gov

ADDRESS
1515 CLAY STREET, SUITE 1400
OAKLAND, CA 94612

CONTACT DESCRIPTION

PHONE TYPE	PHONE NUMBER	EXTENSION
office	(510)-622-2358	

Cal/EPA

San Francisco
Bay Regional
Water Quality
Control Board

2101 Webster St. #500
Oakland, CA
94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

May 1, 1998
File No.07-0708 (JGU)
2118.11

Mr. Robert Boust
Unocal Corporation
2121 N. California Blvd, Suite 250
Walnut Creek, CA 44596

Subject: Transmittal of the Closure Letter and Site Closure Summary
1322 South Main Street, Walnut Creek, Contra Costa County

Dear Mr. Boust:

Attached please find the uniform underground storage tank closure letter and the site closure summary form for the subject site.

The existing monitoring wells that no longer be used should be properly destroyed pursuant to the Contra Costa County monitoring well abandonment guidelines. For more information regarding these guidelines, please contact the General Environmental Division staff at (925) 646-2286 within 30 days of the date of this letter.

Please contact Jolanta Uchman of my staff at (510) 286-1332 if you have any questions regarding this matter.

Sincerely

Loretta K. Barsamian
Executive Officer

Stephen I. Morse
Chief, Toxics Division

Enclosure: Closure Letter
Site Closure Summary, Site Plan

cc with enclosure:

Ms. Dena Hutchin
CCCHSD
Pacheco Blvd.
Martinez, CA 94533

Mr. Stephen J. Carter
Gettler-Ryan Inc.
6747 Sierra Court, Suite J
Dublin, CA 94568

Mr. Steve Mizera SWRCB

Cal/EPA

San Francisco
Bay Regional
Water Quality
Control Board

2101 Webster St. #500
Oakland, CA
94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

May 1, 1998
File No.07-0708 (JGU)
2118.11

Mr. Robert Boust
Unocal Corporation
2121 N. California Blvd, Suite 250
Walnut Creek, CA 44596

Subject: **Case Closure, Underground Storage Tank (UST)**
1322 South Main Street, Walnut Creek, Contra Costa County, CA

Dear Mr. Boust:

This letter confirms the completion of a site investigation and remedial action for the underground storage tanks formerly located at the above described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquiries concerning the former underground storage tanks are greatly appreciated.

Based upon the information in the above referenced file and with the provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground storage tanks release is required.

This notice is issued pursuant to a regulation contained in Section 2721(e) of Title 23 of the California Code of Regulations.

Please contact our office, if you have any questions regarding this matter.

Sincerely,

Loretta K. Barsamian
Executive Officer

Site Summary Form

01-May-98

Site: UNOCAL **RB File No.:** 07-0708 JGU Yes **County:** 07

1322 MAIN ST S, WALNUT CREEK, CA

Nearest Surface Water:	Walnut Creek 0' NNW	**Pit Samples Submitted?:**	Yes	**Highest GW Depth:**	14.3'
Potential Ecological Risk:	unlikely	**No. Borings:**	8	**Lowest GW Depth:**	18.72'
Distance to Wells:	unknown **Affected?:** No	**No. Wells:**	3	**Direction of GW Flow:**	NW
Human Health Risk:	unlikely	**Ground Elev:**	136'		

Staff Notes: 13267 letter 1/9/97. Closure requested 4/98. RB closure letter 5/1/98.

Geology: Fill material to a depth of about 4.5' bgs underlain by silt, clayey silt, sandy silt to 20'bgs;GW @ 18-21' bgs.

Comments: Formerly a UNOCAL service station operating from 1950 to 1978. No information about USTs removed from the site. A bank structure built by 1980 and demolished in 1995. Site investigation conducted at the site in 1995 revealed pollution in soil and GW; TPH-g in GW samples up to14,000 ppb, no benzene. Impacted soil was excavated to 20-22'bgs in the area of former pump and product piping, in the SE corner. After excavation approx. 2,200 gal of water pumped from the pit 1/97. 3 MWs installed downgradient from the USTs in 2/97. Max concentration in GW samples: 110 ppb of TPH-g and 7.7ppb of MtBE.

Management Rqmts: The site is currently operated as Stanford's restaurant.

Reports: Soil Sampling/Subsurface Investigation Report and Work Plan/Proposal by Kaprealian Engineering, Inc. (KEI) 2/22/96; RB letter Request for Add Information 1/9/97; Status of Environmental Investigation by KEI 1/20/97; Delineation Assessment Report by KEI 4/14/97; Fourth Quarter Monitoring Report by KEI 2/20/98; Site Closure Request/Report by Gettler -Ryan, Inc. 3/30/98.

Remedial Activity

	Action Taken	Amount
Free Product:		
Soil:	over-excavation + offsite disposal	808 t
Ground Water:	pumped + offsite disposal	2,400 gal
Vapor:		0

Groundwater Results, ppb

DATE	LOCATION	TPH-G	TPH-D	BENZENE	TOLUENE	XYLENE	ETHYLBENZE	MTBE	HVOC	OTHERS
12/12/97	MW-1	<50		<0.5	<0.5	<0.5	<0.5	<5.0		
3/13/97	MW-1	110		<0.5	<0.5	<0.5	<0.5	7.7		
1/29/96	tank pit 1EB	2,200		ND	ND	24	27			*the pit was ove
1/30/96	tank pit 2EB	840		ND	ND	83	85			
12/18/95	tank pit EB1	14,000		ND	39	320	1,300			
11/20/95	tank pit WS-P1	160		ND	ND	45	0.75			

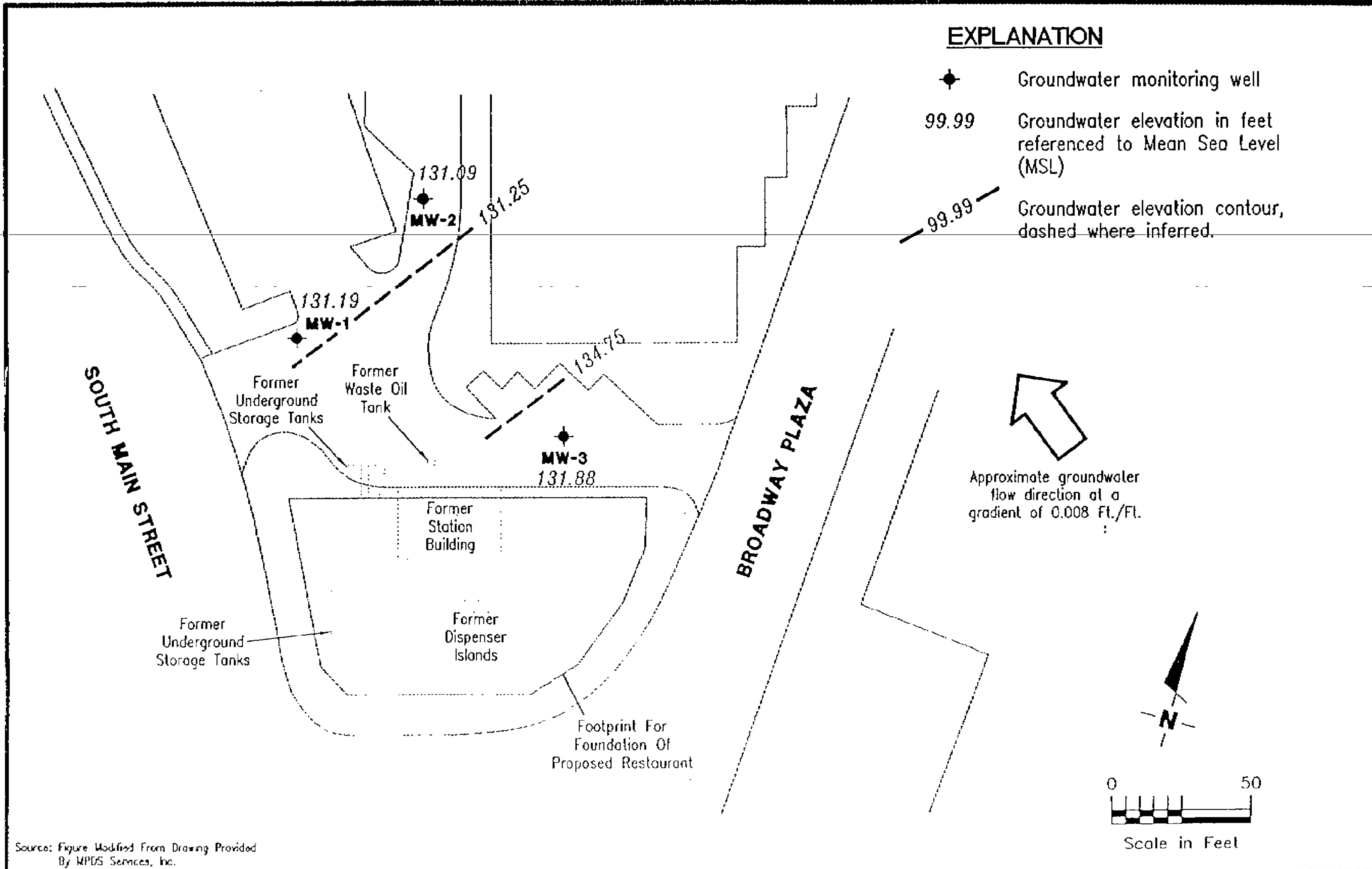
Soil Results, ppm

LOCATION	TPH-gas Initial	TPH-gas Final	TPH-diesel Initial	TPH-diesel Final	Benzene Initial	Benzene Final	Toluene Initial	Toluene Final	Xylene Initial	Xylene Final	Ethyl-benzene Initial	Ethyl-benzene Final
EB-1 12/18/95	940				2.7		5		4.4		13	
EB-11 9.5' 7/93 TRPH 5600ppm												
tank pit PT1 12'	1,400	3.9			ND	ND	5.8	0.013	100	0.013	15	0.32

Tank Information

TANKNO	SIZE	CONTENTS	REMOVED	ACTION	DATE

RB File # 07-0708



Gettler - Ryan Inc.

6747 Sierra Ct., Suite J (510) 551-7555
Dublin, CA 94568

POTENTIOMETRIC MAP
Former Unocal Service Station No. 3407
1322 South Main Street
Walnut Creek, California

FIGURE 1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
280050		December 12, 1997	

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CASE SUMMARY

REPORT DATE
11/8/1991

HAZARDOUS MATERIAL INCIDENT REPORT FILED WITH OES?

I. REPORTED BY -
UNKNOWN

CREATED BY
UNKNOWN

III. SITE LOCATION

FACILITY NAME
TEXACO

FACILITY ID

FACILITY ADDRESS
1275 MAIN ST S
WALNUT CREEK, CA 94598
CONTRA COSTA COUNTY

ORIENTATION OF SITE TO STREET

CROSS STREET

V. SUBSTANCES RELEASED / CONTAMINANT(S) OF CONCERN
GASOLINE

VI. DISCOVERY/ABATEMENT

DATE DISCHARGE BEGAN

DATE DISCOVERED	HOW DISCOVERED	DESCRIPTION
10/14/1991	Other Means	

DATE STOPPED	STOP METHOD	DESCRIPTION
10/14/1991		

VII. SOURCE/CAUSE

SOURCE OF DISCHARGE
Other

CAUSE OF DISCHARGE
Unknown

DISCHARGE DESCRIPTION

VIII. CASE TYPE

CASE TYPE
Other Groundwater (uses other than drinking water)

IX. REMEDIAL ACTION
NO REMEDIAL ACTIONS ENTERED

X. GENERAL COMMENTS

XI. CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

XII. REGULATORY USE ONLY

LOCAL AGENCY CASE NUMBER
71382

REGIONAL BOARD CASE NUMBER
07-0421

LOCAL AGENCY

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
SUE LOYD	SL	CONTRA COSTA COUNTY	sloyd@hsd.co.contra-costa.ca.us

ADDRESS
4333 PACHECO BLVD.
MARTINEZ, CA 94553

CONTACT DESCRIPTION

REGIONAL BOARD

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
KEVIN BROWN	KEB	SAN FRANCISCO BAY RWQCB (REGION 2)	kebrown@waterboards.ca.gov

ADDRESS
1515 CLAY STREET, SUITE 1400
OAKLAND, CA 94612

CONTACT DESCRIPTION

PHONE TYPE	PHONE NUMBER	EXTENSION
office	(510)-622-2358	

California Regional Water Quality Control Board

San Francisco Bay Region

Winston H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 FAX (510) 622-2460

Gray Davis
Governor

April 18, 2001
File No. 07-0421 (JGU)
2118.11

Karen Petryna
Equiva Services LLC
P.O. BOX 7869
Burbank, CA 91501

Subject: Transmittal of the Closure Letter and Site Closure Summary
1275 South Main Street, Walnut Creek, Contra Costa County

Dear Ms. Petryna:

Attached please find the uniform underground storage tank closure letter and the site closure summary form for the subject site.

The existing monitoring wells that will no longer be used should be properly destroyed pursuant to the Contra Costa County monitoring well abandonment guidelines. For more information regarding these guidelines, please contact the General Environmental Division staff at (925) 646-5225 within 30 days of the date of this letter.

Please contact Jolanta Uchman of my staff at (510) 622-2432 or e-mail jgu@rb2.swrb.ca.gov if you have any questions regarding this matter.

Sincerely,

Loretta K. Barsamian
Executive Officer

Stephen A. Hill
Chief, Toxics Cleanup Division

Enclosure: Closure Letter
Site Closure Summary
Site Plan

cc w/ enc:

Ms. Paul Andrews
CCCHSD
4333 Pacheco Blvd.
Martinez, CA 94553

Mr. Steve Mizera, SWRCB

Ms. Ana Friel
Cambria Environmental Technology, Inc.
270 Perkins Street
P.O. Box 259
Sonoma, CA 95476

Mr. Paul Cortese
Cortese Investment Co.
21 Lafayette Circle, #200
Lafayette, CA 94549

California Regional Water Quality Control Board
Whiston H. Hickox
Secretatyfor
Enviroinnental
Protection
San Francisco Bay Region
InternetAddress: http-//www.swrcb.ca.gov
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 ~g,- FAX (5 10) 622-2460
Karen Petryna
Equiva Services LLC
P.O. BOX 7869
Burbank, CA 91501
April 18, 2001
File No. 07-0421 (JGU)
2118.11
Subject: Transmittal of the Closure Letter and Site Closure Summary
1275 South Main Street, Walnut Creek, Contra Costa County
Dear Ms. Petryna:
Gray Davis
Governor
Attached please find the uniform underground storage tank closure letter and
the site closure
summary form for the subject site.
The existing monitoring wells that will no longer be used should be properly
destroyed pursuant
to the Contra Costa County monitoring well abandonment guidelines. For more
infom-iation
regarding these guidelines, please contact the General Environmental Division
staff at (925) 646-
5225 within 30 days of the date of this letter.
Please contact Jolanta Uchman of my staff at (510) 622-2432 or e-mail
J'gu@rb2.swrb.ca.gov if
you have any questions regarding this matter.
Sincerely,
Loretta K. Barsamian
Execu ive- 0
(j~7en ill
Chief, Toxics Cleanup Division
Enclosure: Closure Letter
Site Closure Summary
Site Plan
cc W/ enc:
Ms. Paul Andrews Mr. Steve Mizera, SWRCB
CCCHSD
4333 Pacheco Blvd.
Martinez, CA 94553
Ms. Ana Friel
Mr. Paul Cortese
Cambria Environmental Technology, Inc.
Cortese
Investment Co.
270 Perkins Street
21 Lafayette Circle, #200
P.O. Box 259
Lafayette, CA 94549
Sonoma, CA 95476

California Regional Water Quality Control Board
San Francisco Bay Region

Winston H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 • FAX (510) 622-2460

Gray Davis
Governor

April 18, 2001
File No. 07-0421 (JGU)
2118.11

Karen Petryna
Equiva Services LLC
P.O. BOX 7869
Burbank, CA 91501

Subject: **Case Closure - Underground Storage Tank – 1275 South Main Street, Walnut Creek, Contra Costa County**

Dear Ms. Petryna:

This letter confirms the completion of a site investigation and remedial action for the underground storage tank formerly located at the above described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquiries concerning the former underground storage tanks are greatly appreciated.

Based upon the available information, including the land use, and with the provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground storage tank release is required.

This notice is issued pursuant to a regulation contained in Titles 23, California Water Code of Regulations, Division 3, Chapter 16, Section 2721(e).

Please contact our office, if you have any questions regarding this matter.

Sincerely,

Stephen Hill for

Loretta K. Barsamian
Executive Officer

California Regional Water Quality Control Board
San Francisco Bay Region
Winston H. Hickox
Secretaiyfor
Environinental
Protection
Karen Petryna
Equiva Services LLC
P.O. BOX 7869
Burbank, CA 91501
Internet Address: http://www.swreb.ca.gov
1515 Clay Street, Suite 1400, Oakland, Califomia 94612
Phone (510) 622-2300 - FAX (510) 622-2460
April 18, 2001
File No. 07-0421 (JGU)
2118.11
Gray Davis
Governor
Subject: Case Closure - Underground Storage Tank - 1275 South Main Street, Walnut Creek, Contra Costa County

Dear Ms. Petryna:

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This notice is issued pursuant to a regulation contained in Titles 23, California Water Code of Regulations, Division 3, Chapter 16, Section 2721(e).

Please contact our office, if you have any questions regarding this matter.

Sincerely,

Lof~tta K. Barsamiatf-
Executive Officer

California Environmental Protection Agency

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and Cut Your energy costs, see our Web-site at http://www.swrcb.ca.gov.

cli Recycled Paper

Site Summary Form

18-Apr-01

Site: TEXACO | **RB File No.:** 07-0421 | JGU | Yes | **County:** 07

1275 MAIN ST S, WALNUT CREEK, CA

Nearest Surface Water:	Flood Control Channel of Wa S Prop. li	**Pit Samples Submitted?:**	Yes	**Highest GW Depth:**	4' bgs
Potential Ecological Risk:		**No. Borings:**	23	**Lowest GW Depth:**	21'
Distance to Wells:	0.3 mi SS **Affected?:** No	**No. Wells:**	7	**Direction of GW Flow:**	SSE
Human Health Risk:		**Ground Elev:**	~147 MSL		

Staff Notes: sent request for additional information 3/22/00, response due 4/15/00; No further action letter 4/18/01.

Geology: clayey to sandy silt from 0' to 10' bgs; fine coarse sand with some silty clay & gravel 10' - 37' bgs;

Comments: Site is a former Texaco service station. Currently, the site is operated as a Fresh Choice restaurant. Surrounding land use is commercial property. Five USTs have been removed from the site. The only documented tank removal is of a waste oil tank removed in September 1991. A preliminary site characterization was performed in October 1991 and consisted of the drilling of eleven soil borings. Soil samples contained up to 770 ppm TPHg and 4.1 ppm benzene. Grab groundwater samples contained up to 61,000 ppb TPHg and 5,600 ppb benzene. In September 1992, four temporary groundwater monitoring wells were installed. Groundwater was encountered at ~20' bgs. Soil samples contained up to 1,600 ppm TPHg (18' bgs) and 5.9 ppm benzene (18' bgs). Groundwater samples contained up to 3,400 ppb TPHg and 110 ppb benzene. The temporary wells were subsequently abandoned. In January and February 1994, seven soil vapor extraction/monitoring wells and five air sparging wells were installed. The SVE system was shut down June 29, 1999. Sensitive receptor survey found a water well 0.3 miles SSE from the site. Groundwater samples collected during the most recent sampling event in November 1999 contained up to 15,000 ppb TPHg and 7 ppb benzene. MtBE was non-detect. Low risk groundwater case

Management Rqmts:

Reports: Preliminary Site Characterization Report (Seacor) 11/91; Aquifer and Vapor Extraction Testing Report (Seacor) 12/92; Remedial Action Workplan (Seacor) 6/93; Response to RWQCB letter (Fluor Daniel GTI) 4/97; Remediation System Shut Down/Site Information Summary Form (Cambria) 6/99; Quarterly Monitoring Reports (Cambria).

Remedial Activity

	Action Taken	Amount
Free Product:		
Soil:		
Ground Water:		0
Vapor:	extracted	298 lbs.

Groundwater Results, ppb

DATE	LOCATION	TPH-G	TPH-D	BENZENE	TOLUENE	XYLENE	ETHYLBENZE	MTBE	HVOC	OTHERS	GW DEPTH
9/21/99	MW-2	3400		110	8.8	31	65				
10/15/91	SB-5	61000		81	5500	20000	4200				22.00'
10/15/91	SB-7	29000		5600	2700	7600	2200				22.00'
11/24/99	VP-2	74		7	5.6	1.1	2.6	6.9			19.82'
5/24/95	VP-4	11000		1100	11	33	<10				21.85'
4/24/96	VP-4	7600		4100	27	23	<10	<30			20.89'
9/13/96	VP-4	3500		1300	14	36	17	<300			21.29'
12/6/96	VP-4	2900		1100	12	20	16	<200			21.20'
3/17/97	VP-4	420		130	1.2	2.5	1.1	<30			20.37'
6/18/97	VP-4	3200		640	12	24	16	<200			22.85'
8/19/97	VP-4	1900		370	11	17	18	<200			23.19'
11/24/97	VP-4	2100		270	6.8	19	8.5	<30			20.00'
3/30/98	VP-4	4800		1480	17.2	26.5	43	<100			18.26'
5/29/98	VP-4	7600		1400	<50	<50	<50	<250			20.50'
2/11/99	VP-4	83		21	<0.5	1.6	0.52	<2.5			11.45'
5/24/99	VP-4	1530		38.9	13.6	110	80	28.7			19.11'
11/24/99	VP-4	15000		700	<100	2000	<100	<500			22.42'
5/5/00	VP-4	2420		271	12.3	46.1	10.8	238			19.99'
11/16/00	VP-4	3680		797	33.3	11.4	11.7	152			21.38'
5/24/99	VP-5	<50		1.18	1.27	2.95	0.724	47.2			17.55'

Soil Results, ppm

LOCATION	TPH-gas Initial	TPH-gas Final	TPH-diesel Initial	TPH-diesel Final	Benzene Initial	Benzene Final	Toluene Initial	Toluene Final	Xylene Initial	Xylene Final	Ethyl-benzene Initial	Ethyl-benzene Final	MtBE Initial	MtBE Final	Other Initial	Other Final
MW-1 9/21/92 18'	1600		<5		5.9		11		63		190					
S-B1-3 10/91 19.5'	770				4.1		2.7		71		12					

Tank Information

TANKNO	SIZE	CONTENTS	REMOVED	ACTION	DATE
1	750	waste oil	Yes	removed and disposed	9/17/91

23-Jan-01

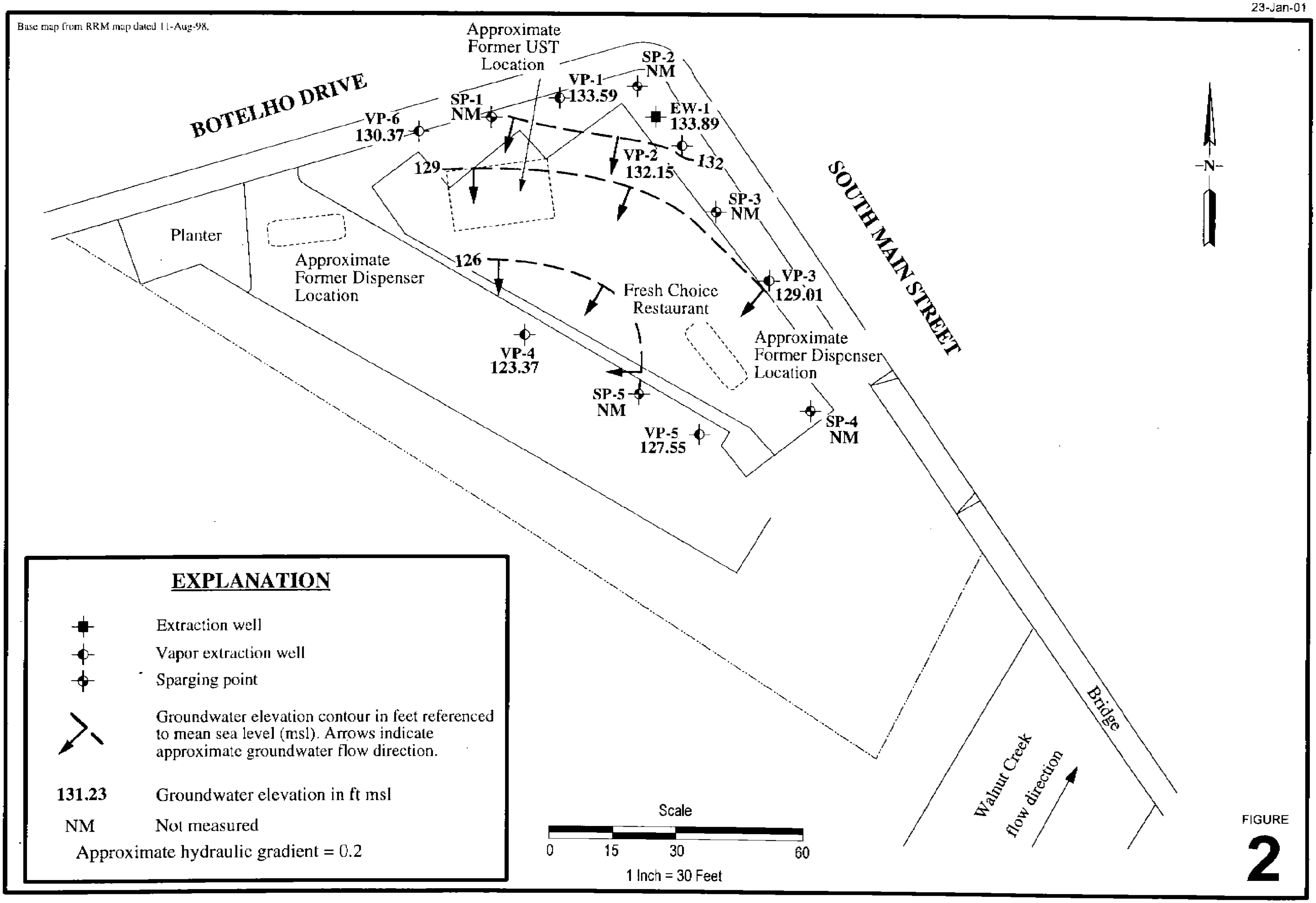


FIGURE
2

1350

Former Texaco Service Station
1275 South Main Street
Walnut Creek, California

CAMBRIA

Groundwater Contour Map

November 16, 2001

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CASE SUMMARY

REPORT DATE
8/27/1993

HAZARDOUS MATERIAL INCIDENT REPORT FILED WITH OES?

I. REPORTED BY -
UNKNOWN

CREATED BY
UNKNOWN

III. SITE LOCATION

FACILITY NAME
GOODYEAR TIRE & RUBBER COMPANY

FACILITY ADDRESS
1231 MAIN ST S
WALNUT CREEK, CA 94596
CONTRA COSTA COUNTY

FACILITY ID

ORIENTATION OF SITE TO STREET

CROSS STREET

V. SUBSTANCES RELEASED / CONTAMINANT(S) OF CONCERN

WASTE OIL / MOTOR / HYDRAULIC / LUBRICATING

VI. DISCOVERY/ABATEMENT

DATE DISCHARGE BEGAN

DATE DISCOVERED	HOW DISCOVERED	DESCRIPTION
8/27/1993	Tank Closure	

DATE STOPPED	STOP METHOD	DESCRIPTION
8/27/1993		

VII. SOURCE/CAUSE

SOURCE OF DISCHARGE
Other

CAUSE OF DISCHARGE
Unknown

DISCHARGE DESCRIPTION

VIII. CASE TYPE

CASE TYPE
Soil

IX. REMEDIAL ACTION

NO REMEDIAL ACTIONS ENTERED

X. GENERAL COMMENTS

XI. CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

XII. REGULATORY USE ONLY

LOCAL AGENCY CASE NUMBER
08253

REGIONAL BOARD CASE NUMBER
07-0567

LOCAL AGENCY

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
SUE LOYD	SL	CONTRA COSTA COUNTY	sloyd@hsd.co.contra-costa.ca.us

ADDRESS
4333 PACHECO BLVD.
MARTINEZ, CA 94553

CONTACT DESCRIPTION

REGIONAL BOARD

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
KEVIN BROWN	KEB	SAN FRANCISCO BAY RWQCB (REGION 2)	kebrown@waterboards.ca.gov

ADDRESS
1515 CLAY STREET, SUITE 1400
OAKLAND, CA 94612

CONTACT DESCRIPTION

PHONE TYPE	PHONE NUMBER	EXTENSION
office	(510)-622-2358	

Cal/EPA

San Francisco Bay Regional Water Quality Control Board

2101 Webster Street Suite 500
Oakland, CA 94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

April 3, 1997
File Nos. 07-0567 (ES)
2118.11

Mr. Brad Ioerger
Goodyear Tire and Rubber Company
Chemical Environmental Protection
1144 East Market Street
Akron, OH 44316-0001

Re: Case Closure for Underground Storage Tank Site at Former Goodyear Tire & Rubber Facility 5742, 1231 South Main Street, Walnut Creek, California

Dear Mr. Ioerger:

This letter confirms the completion of a site investigation and remedial action for the underground storage tank formerly located at the above described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquires concerning the former underground storage tank are greatly appreciated.

Based on the information in the above-referenced file and with the provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground tank release is required.

This notice is issued pursuant to a regulation contained in Section 2721(e) of Title 23 of the California Code of Regulations.

Please contact our office if you have any questions regarding this matter.

Sincerely,

Dennis A Mishek
for Loretta K. Barsamian
Executive Officer

07-0567

Cal/EPA

San Francisco Bay Regional Water Quality Control Board

2101 Webster Street Suite 500
Oakland, CA 94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

April 3, 1997
File Nos. 07-0567 (ES)
2118.11

Mr. Brad Ioerger
Goodyear Tire and Rubber Company
Chemical Environmental Protection
1144 East Market Street
Akron, OH 44316-0001

Re: **Transmittal of Case Closure Letter and Site Summary Form Former Goodyear Tire & Rubber Facility 5742, 1231 South Main Street, Walnut Creek, California**

Dear Mr. Ioerger:

Enclosed please find a copy of case closure letter and site information summary form for the above-referenced site.

Please contact Eddy So at (510) 286-4366 if you have further questions.

Sincerely,

Loretta K. Barsamian
Executive Officer

Stephen I. Morse

Steve I. Morse, Chief by DAM
Toxics Cleanup Division

Encl.: Case Closure Letter
Site Information Summary

cc: Bruce Benike, CCCHSD
Dave Deaner, SWRCB
Allan Patton, SWRCB

Site Summary Form

21-Mar-97

Site: GOODYEAR TIRE & RUBBE **RB File No.:** 07-0567 ES Yes **County:** 07

1231 MAIN ST S, WALNUT CREEK, CA

Surface Water:

Pit Samples Submitted?: No

Highest GW Depth:

Ecological Risk:

No Borings:

Lowest GW Depth:

Distance to Wells: **Affected?:** No

No Wells:

Direction of GW Flow:

Human Health Risk:

Ground Elev:

Staff Notes:

Geology:

Comments: We have no information at all about this site. Discharger is to submit information to us within 45 days from 2/18/97.

Management Rqmts:

Reports:

Remedial Activity

	Action Taken	Amount
Free Product:		
Soil:		0
Ground Water:		0
Vapor:		0

Groundwater Results

DATE	LOCATION	TPH-G	TPH-D	BENZENE	TOLUENE	XYLENE	ETHYLBENZE	MTBE	HVOC	OTHERS

Soil Results

	TPH-gas		TPH-diesel		Benzene		Toluene		Xylene		Ethyl-benzene	
LOCATION	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final

Tank Information

TANKNO	SIZE	CONTENTS	REMOVED	ACTION	DATE

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CASE SUMMARY

REPORT DATE
7/7/1988

HAZARDOUS MATERIAL INCIDENT REPORT FILED WITH OES?

I. REPORTED BY -
UNKNOWN

CREATED BY
UNKNOWN

III. SITE LOCATION

FACILITY NAME
CHEVRON

FACILITY ADDRESS
1149 MAIN ST S
WALNUT CREEK, CA 94598
CONTRA COSTA COUNTY

FACILITY ID

ORIENTATION OF SITE TO STREET

CROSS STREET
OLYMPIC BLVD

V. SUBSTANCES RELEASED / CONTAMINANT(S) OF CONCERN
GASOLINE

VI. DISCOVERY/ABATEMENT

DATE DISCHARGE BEGAN

DATE DISCOVERED	HOW DISCOVERED	DESCRIPTION
7/7/1988	Tank Closure	

DATE STOPPED	STOP METHOD	DESCRIPTION
7/7/1988		

VII. SOURCE/CAUSE

SOURCE OF DISCHARGE
Other

CAUSE OF DISCHARGE
Unknown

DISCHARGE DESCRIPTION

VIII. CASE TYPE

CASE TYPE
Aquifer used for drinking water supply

IX. REMEDIAL ACTION
NO REMEDIAL ACTIONS ENTERED

X. GENERAL COMMENTS

XI. CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

XII. REGULATORY USE ONLY

LOCAL AGENCY CASE NUMBER
62732

REGIONAL BOARD CASE NUMBER
07-0086

LOCAL AGENCY

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
SUE LOYD	SL	CONTRA COSTA COUNTY	sloyd@hsd.co.contra-costa.ca.us

ADDRESS
4333 PACHECO BLVD.
MARTINEZ, CA 94553

CONTACT DESCRIPTION

REGIONAL BOARD

CONTACT NAME	INITIALS	ORGANIZATION_NAME	EMAIL ADDRESS
KEVIN BROWN	KEB	SAN FRANCISCO BAY RWQCB (REGION 2)	kebrown@waterboards.ca.gov

ADDRESS
1515 CLAY STREET, SUITE 1400
OAKLAND, CA 94612

CONTACT DESCRIPTION

PHONE TYPE	PHONE NUMBER	EXTENSION
office	(510)-622-2358	

Cal/EPA

San Francisco
Bay Regional
Water Quality
Control Board

2101 Webster St. #500
Oakland, CA
94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

June 4, 1998
File No. 07-0086 (JGU)
2118.11

Mr. Rod Simmons
Chevron Products Company
P.O. Box 6004
San Ramon, CA 94583

Subject: Transmittal of the Closure Letter and Site Closure Summary
1149 S Main Street, Walnut Creek, Contra Costa County

Dear Mr. Simmons:

Attached please find the uniform underground storage tank closure letter and the site closure summary form for the subject site.

The existing monitoring wells that no longer be used should be properly destroyed pursuant to the Contra Costa County monitoring well abandonment guidelines. For more information regarding these guidelines, please contact the General Environmental Division staff at (925) 646-2286 within 30 days of the date of this letter.

If you have any questions regarding this matter, please contact Jolanta Uchman of my staff at (510) 286-1332

Sincerely

Loretta K. Barsamian
Executive Officer

Stephen I. Morse
Chief, Toxics Division

Enclosure: Closure Letter
Site Closure Summary, Site Plan

cc with enclosure:

Ms. Dena Hutchin
CCCHSD
4333 Pacheco Blvd.
Martinez, CA 94533

Mr. Steve Mizera SWRCB

Cal/EPA

San Francisco
Bay Regional
Water Quality
Control Board

2101 Webster St. #500
Oakland, CA
94612
(510) 286-1255
FAX (510) 286-1380

Pete Wilson
Governor

June 4, 1998
File No. 07-0086 (JGU)
2118.11

Mr. Rod Simmons
Chevron Products Company
P.O.Box 6004
San Ramon, CA 94583

Subject: **Case Closure, Underground Storage Tank (UST)**
1149 S Main Street, Walnut Creek, Contra Costa County, CA

Dear Mr. Simmons:

This letter confirms the completion of a site investigation and remedial action for the underground storage tanks formerly located at the above described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquiries concerning the former underground storage tanks are greatly appreciated.

Based upon the information in the above referenced file and with the provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground storage tanks release is required.

This notice is issued pursuant to a regulation contained in Section 2721(e) of Title 23 of the California Code of Regulations.

Please contact our office, if you have any questions regarding this matter.

Sincerely,

for Stephen Morse

Loretta K. Barsamian
Executive Officer

Site Summary Form

04-Jun-98

Site: CHEVRON **RB File No.:** 07-0086 JGU Yes **County:** 07

1149 MAIN ST S, WALNUT CREEK, CA

Nearest Surface Water: Las Trampas Creek 400' E

Potential Ecological Risk: unknown

Distance to Wells: 1200' N **Affected?:** No

Human Health Risk: unlikely

Pit Samples Submitted?: Yes

No. Borings: 26

No. Wells: 8

Ground Elev: 142'

Highest GW Depth: 14.8'

Lowest GW Depth: 22.17'

Direction of GW Flow: NNE

Staff Notes: The submittal of add info due 45 days from 2/24/97. RB no further action letter 6/4/98.

Geology: Fine grained, silty clay with lenses of sand & gravel to 30' bgs; below 30' bgs, a very firm silty clay; GW@ ~21'bgs.

Comments: 4 USTs removed 7/88. Pollution found in soil and ground water. 8 MWs installed at the site between 1988-91. ~750 cyds removed in 1991 to the depth of 21' bgs (water table) backfilled with clean native and imported materials. Confirmatory samples with residual concentrations of TPH-g above 100 ppm. CCCHSD issued a letter 2/1992 requesting no additional activities for the soil but continue groundwater monitoring. Add excavation to approx. 20 ft bgs over most of site, except the former pump islands, for shopping center construction in 1994; dewatering of the excavation; discharged GW sampled - ND for TPH. GW sampling results from 12/97 showed residual concentrations of hydrocarbons. GW collected from MW-4,7& 8 and tested for nitrate , concentrations below 1ppm. No sensitive receptor found. A low-risk GW case. No further action.

Management Rqmts: Currently the site is a garage with underground levels.

Reports: Full Service Station Demolition 7/88 Blaine Tech Services; Site Assessment Rpt. Groundwater Technology, Inc. (GTI) 9/88; Phase II Invest. GTI, 11/88; Preliminary Remedial Assessment Dames & Moore 4/5/90; On and Off Site Soil Assessment 12/90 GTI; Add'l Assessment Rpt. GTI 8/29/91; Soil Excavation/Remediation Rpt GTI 10/15/91; Stockpiled soil sampling results, Touchstone Development 7/27/94; Monitoring Well Destruction Proposal GTI 10/5/94; Quarterly GW Sampling Reports (QR) by GTI 4/92-4/94; QRs by Blaine Tech. 12/94-1/98; Site Closure Summary Report by Cambria 6/5/97.

Remedial Activity

	Action Taken	Amount
Free Product:		
Soil:	over-excavation + offsite disposal	750 cy
Ground Water:	dewatering of excavation 3-4/94	unkn.
Vapor:		0

Groundwater Results, ppb

DATE	LOCATION	TPH-G	TPH-D	BENZENE	TOLUENE	XYLENE	ETHYLBENZE	MTBE	HVOC	OTHERS
11/9/88	MW-4	2300		350	270	300	64			
12/18/97	MW-4	2300		1.1	< 0.5	14	43	< 2.5		
6/27/96	MW-4	9200		22	<20	160	650	<100		
6/13/94	MW-6	< 0.50		0.7	< 0.5	1.3	< 0.5	NA		
12/13/91	MW-6	14000		1200	15	1700	780	NA		
12/18/97	MW-8	170		< 0.5	< 0.5	< 0.5	< 0.5	< 2.5		
11/22/95	MW-8	190		<0.5	<0.5	<0.5	<0.5	NA		
7/3/97	MWs4,7,8									Nitrate <1000

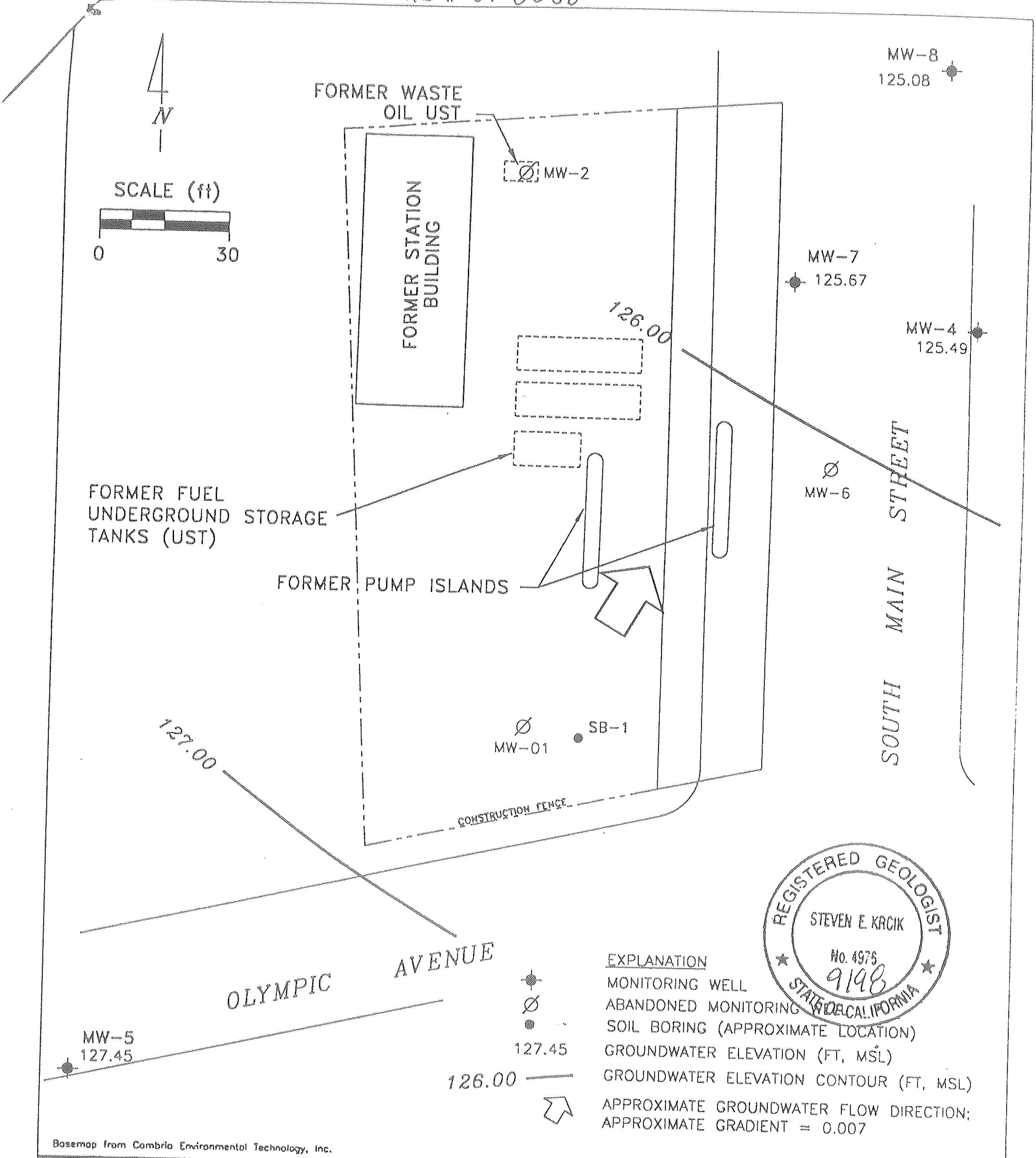
Soil Results, ppm

	TPH-gas		TPH-diesel		Benzene		Toluene		Xylene		Ethyl-benzene	
LOCATION	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
gas tank pit	290	16			6	1.7	20		42		8.8	
PC-7 8'	2000				1.8		0.14		97		11	
WO tank pit 7/88 10'			17,000									

Tank Information

TANKNO	SIZE	CONTENTS	REMOVED	ACTION	DATE
1	10,000	gasoline	Yes	removed and disposed	7/7/88
2	10,000	gasoline	Yes	removed and disposed	7/7/88
3	5,000	gasoline	Yes	removed and disposed	7/7/88
4	550	waste oil	Yes	removed and disposed	7/7/88

RO# 01-0086



PREPARED BY RRM engineering contracting firm	Former Chevron Station 9-5275 1149 South Main Street Walnut Creek, California GROUNDWATER ELEVATION CONTOUR MAP, DECEMBER 18, 1997	FIGURE: 1 PROJECT: DAC04

Appendix E RWQCB Informal Consultation Documents

From: Felix, Cecil@Waterboards [mailto:Cecil.Felix@waterboards.ca.gov]
Sent: Wednesday, May 30, 2018 11:37 AM
To: Tony Jones
Subject: RE: Las Trampas Creek Bridge Draft Foundation Type and BMP memo

Hi Tony, I've looked the pdf attachments. My concerns with the project:

1. Care should be taken to avoid exacerbating the extent of soil and groundwater pollution during construction activities. Technologies should be utilized as necessary to minimize or eliminate potential downward vertical migration of pollutants during and after completion of the construction project.

2. Be aware that if the total acreage of soil cover is great than one acre the site is subject to the NPDES General Permit for Construction Activities. The Permit requires that you identify and implement stormwater BMPs for all potential pollutants that may be discharged in stormwater, such as the pollutants associated with the Virginia Cleaner sites.

3. I encourage you to provide any soil and groundwater pollution screening data generated during the project so that our agency can utilize the data to determine the degree and extent of VOC impacts associated with the Virginian Cleaners site and potentially other sites in the area.

Please let me know if you have any concerns regarding this email.

Cecilio Felix
SFBRWQCB
(510) 622-2343
cecil.felix@waterboards.ca.gov

From: Tony Jones [mailto:tony_jones@wreco.com]
Sent: Thursday, May 17, 2018 3:43 PM
To: Felix, Cecil@Waterboards <Cecil.Felix@waterboards.ca.gov>
Subject: FW: Las Trampas Creek Bridge Draft Foundation Type and BMP memo

Cecil, this may have gone out to the wrong email so I am sending it again to you.

Sorry for the misdirect.

Tony Jones | Senior Environmental Scientist/Project Manager
WRECO 1243 Alpine Road, Suite 108, Walnut Creek, CA 94596
O: 925.941.0017 x224 | C: 209.404.2433 | E: tony_jones@wreco.com | W: www.wreco.com

From: Tony Jones
Sent: Monday, May 14, 2018 5:14 PM
To: 'csf@rb2.swrcb.ca.gov'
Cc: P. E. Alex Wong (wong@walnut-creek.org); 'Robert Ferguson'; David Kitzmann; HanBin Liang
Subject: FW: Las Trampas Creek Bridge Draft Foundation Type and BMP memo

Cecil, per our discussion last month regarding the Las Trampas Creek Bridge at South Main Street project in Walnut Creek, I have attached a memo from the City's project designer summarizing proposed construction methods and groundwater protection BMPs. Also attached are the latest proposed design plans. Lastly, I linked below the draft ISA/PSI (Phase I/II).

Draft ISA/PSI

I appreciate you taking the time to look at the project and provide comment on our proposed approach.

Thank you.

Tony Jones | Senior Environmental Scientist/Project Manager
WRECO 1243 Alpine Road, Suite 108, Walnut Creek, CA 94596
O: 925.941.0017 x224 | C: 209.404.2433 | E: tony_jones@wreco.com | W: www.wreco.com

Email Attachments

1. Memo summarizing proposed construction methods and groundwater protection BMPs

2. Proposed design plans

Las Trampas Creek Bridge at South Main Street (Bridge No. 28C0075)
Bridge Replacement Project
Federal Project # BRLS5225(026)

FOUNDATION TYPE SELECTION AND CONSTRUCTION BEST MANAGEMENT PRACTICES MEMO

This Foundation Type Selection and Best Practices Memo presents the most appropriate foundation type for this bridge replacement project given the site and environmental constraints. The selected foundation type needs to meet the project design requirements and provide the lowest risk of groundwater contamination. This memo is needed to initiate coordination with San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) to present planned construction operations, which may pose a risk to groundwater contamination, and to discuss how to best address these issues and minimize risks. The purpose of this memo is to present the various best management practices that can be used to minimize potential groundwater contamination during project construction.

BRIEF PROJECT DESCRIPTION

The City of Walnut Creek proposes to replace the existing bridge over Las Trampas Creek with a new two-span concrete bridge. The project is in flat, urban terrain in a highly developed commercial area of Downtown Walnut Creek. Las Trampas Creek is a concrete lined channel at the project site and feeds into a double-barrel concrete box culvert located approximately 30 feet downstream of the bridge. Just upstream of the site, there is a concrete drop structure and energy dissipaters. The creek drains a watershed of approximately 27.2 square miles at the South Main Street bridge crossing.

HAZARDOUS MATERIAL CONSIDERATION

The Initial Site Assessment (ISA) and Preliminary Site Investigation (PSI) report describes a potential subsurface contaminant in aquifers from a pre-existing dry-cleaning facility that was located on or near the Essex Property (now the Agora Building). This information was listed on the SFBRWQCB's GeoTracker. It is likely that the dry-cleaning facility used a strong stripping agent (such as perchloroethylene) and discharged it into the sanitary sewer and storm drain system. Remediation of the potentially contaminated aquifer was initiated during development of the Agora Apartments and Retail building. In 2013-2014, remedial action was taken consisting of approximately 7,775 cubic yards of impacted soil around the project site and groundwater treatment.

Informal discussions with the SFBRWQCB indicated that additional remediation efforts for this bridge replacement project may be needed.

APPROACH ROAD WORK AND UTILITY RELOCATION

The southernmost 200-feet of the northern approach (between Botelho Drive and the bridge) and 200-foot-long southern approach (between the bridge and Broadway Plaza) would be excavated to approximately 5 feet deep in specified locations to expose and relocate existing utilities and allow for reconstruction of the road base. Between the intersections at Olympic Boulevard and Botelho Drive (approximately 400 feet along South Main Street), the northern approach would consist of temporary pavement striping with no ground disturbance.

Between the intersections of Broadway Plaza and Newell Avenue (approximately 350 feet along South Main Street), the southern approach would consist of temporary pavement striping and median removal and replacement.

Numerous utilities are mounted on both sides and underneath the bridge. Temporary relocation of these utilities would be required at each end of the bridge during construction. An existing pair of buried sanitary sewer siphon pipes run adjacent to western edge of the existing bridge, beneath Las Trampas Creek, and would require relocation during bridge construction.

FOUNDATION TYPE (PREFERRED)

The preferred foundation type is **Cast-in-Drilled-Hole (CIDH) Concrete Piles**. Large Diameter CIDH concrete piles are preferred to minimize vibration impact to adjacent structures and utilities. Potential geologic and potential seismic hazards for the site include seismic shaking (ground motion), subsidence, liquefaction, lateral spread, and seismically induced settlement. Foundations would need to be designed to resist the forces produced by these phenomena. CIDH concrete piles are effective at resisting these forces.

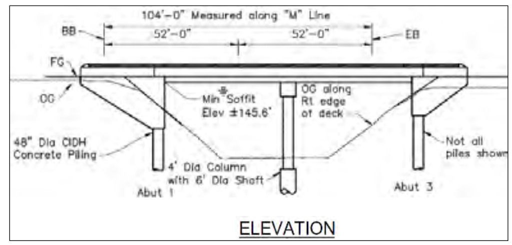


Figure 1

Concrete abutments would be founded on a single row of CIDH concrete piles and the center pier would consist of a concrete pier cap and a multiple column pier on CIDH concrete piles. Due to the extensive soft clay, potential liquefiable sand layers and the necessary pile lengths, larger-diameter piles are likely to be required to ensure an adequate pile diameter-to-length ratio and to resist anticipated lateral loads. CIDH piles at least 4-feet in diameter are anticipated at the abutments. Piles at the center pier are expected to be 6 feet in diameter.

OTHER FOUNDATION TYPES CONSIDERED

Driven Piles: Driven piles present vibration and noise impacts and are not desirable in a congested urban area. Driven (displacement type) piles are considered feasible to achieve foundation support through significant end bearing within the very dense sand/weathered rock. From a geotechnical standpoint, displacement type driven pipe piles are the most feasible driven pile foundation type, considering the site conditions. Driven precast concrete piles may not achieve sufficient penetration below potential liquefiable layers to provide sufficient lateral resistance without battering piles. However, battering piles would create potential subsurface conflicts with existing piles which are planned to remain in place. Also, battered piles should generally not be used where downdrag may occur (likely in the northern abutment).

Driven steel H-section (non-displacement) piles are not recommended due to limited lateral capacities in the upper layers of soil at the site. Non-displacement piles will require battering but are not recommended for the similar reasons as displacement type driven piles listed above.

Shallow Foundations: Shallow foundations, such as spread footings, are not feasible due to the depth required to achieve suitably firm and secure bearing materials.

EXISTING BRIDGE REMOVAL

The proposed bridge would be constructed in two stages, one per season with a winter shutdown. During the first season of construction, the west portion of the bridge would be removed, and traffic would be directed to the east portion of the existing bridge. During the second season of construction, pedestrian and vehicular traffic would be redirected to the new half of the bridge constructed in season 1.

The existing bridge was widened twice over its lifespan. There is a total of two abutments and four bents to be removed. Bents 2 and 5 are found near the top of the channel slope and feature reinforced concrete columns with pier walls enclosing the abutments. Bents 3 and 4 are found near the bottom of the channel. Each bent has a total of seven footings. The original (north-easternmost) portion of the structure is founded on timber piles at bents 2 through 5. The bent footings for the first widening were also founded on timber piles. However, for the second widening, footings for bents 2 through 5 were founded on precast concrete piles. Abutments are buried in the existing road embankment and are founded on spread footings throughout each portion of the original and widened structures.

Demolition of Bents 3 and 4 would include removal up to 32 timber piles and 20 precast concrete piles to a depth 3-ft below channel grade and demolition of the fourteen 6-ft wide by 6-ft long by 2-ft thick footings. Demolition of Bents 2 and 5 would include partial removal up to 64 timber piles and 20 precast concrete piles to a 3-ft feet depth below original grade and demolition of the fourteen 6-foot-wide by 8-foot-long by 2-foot-thick footings. Demolition of abutments 1 and 6 would include removal of the fourteen 6-foot-wide by 6-foot-long by 2-foot-thick footings.

INSTALLATION OF STREAM DIVERSION MEASURES

The project would control the flow of water through the APE by diverting water from Las Trampas Creek into a pipe that would convey it through the worksite.

The Las Trampas Creek is expected to be flowing within the project area year-round. A water diversion system would be required to divert the flow through the area for the duration of the in-channel construction and provide contractor access.

Temporary cofferdams would be constructed both upstream and downstream of the bridge. The cofferdams would be constructed with a combination of clean crushed rock and sandbags. The cofferdam would have an impervious membrane made up of plastic sheeting to keep the water from seeping into the work area.

Figure 2: Example of Stream diversion and Earthen Work Pad for Bridge Removal

Temporary culverts consisting of pipes would be used to divert the flows away from the work area and downstream. The pipes would be installed through the upstream and downstream cofferdams running parallel to the direction of flow. The cofferdams and culverts would be installed at the bottom of the channel. Clean crushed rock and sandbags would be used to divert the flow into the pipes. The cofferdams would completely block the normal flow of the creek, keeping water out of the work area, and allowing only the flow that enters the diversion pipes to pass under the bridge. All diversion activities will adhere to Caltrans standard specifications.

FOUNDATION INSTALLATION

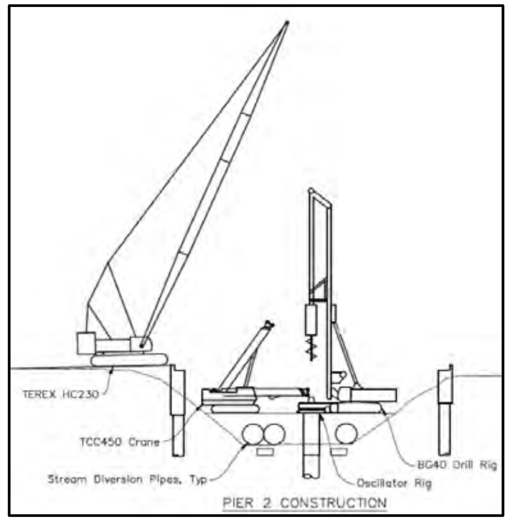


Figure 3

The center pier would be constructed with a cast-in-place concrete pier cap founded on multiple 3-ft to 4-ft diameter concrete columns with multiple 4 to 6-ft diameter CIDH concrete piles up to 120 feet deep. The CIDH pile installation at the center pier would require a temporary work pad to be constructed in the channel to provide adequate width for the contractor's equipment (drill rig, pile oscillator, crane, excavator, etc.). The temporary work pad would be placed above the stream diversion pipes. It is not anticipated that cranes will be able to maneuver onto the channel bottom. So, an earthen ramp would be constructed (likely adjacent to the northwest corner of the bridge) to provide access for equipment entering the channel for both the existing bridge removal and the center pier construction.

REPLACEMENT OF EXISTING SLOPE PROTECTION MEASURES


Figure 4

The project would remove concrete-filled sand bags embedded in the banks upstream of the bridge (shown in Figure 4). The embankment on the northwest corner in this area would be used to provide contractor access. All concrete-filled sand bags at the northwest bank would be removed and replaced with a concrete lined embankment.

Much of the existing concrete-lined streambed would also be removed to allow for removal of the existing bridge and the construction of the proposed piles.

Disturbance of the soils behind and beneath the concrete-filled sandbags and concrete-lined channel would be approximately 1-ft deep in most areas outside the existing bridge limits.

TEMPORARY SHORING

Figure 5

Due to the proximity of the adjacent properties and the planned stage construction, temporary shoring will likely be required to construct the new abutments and pier. Temporary shoring systems would likely consist of CIDH soldier pile or sheet pile retaining walls. CIDH soldier piles avoid the need to drive/vibrate steel piles into the ground.

Temporary shoring would be required to control temporary cut slopes at 6 locations during construction as shown in Figure 5.

Best Management Practices

Measure #1: Minimize Existing Bridge Foundation Removal

The existing bridge is founded on a combination of driven timber and precast concrete piles. Placing the proposed bridge abutment at the same location of the existing bridge would require removal of many existing piles, which would increase ground disturbance. The abutments of the proposed bridge are planned to be just behind piers 2 and 5 of the existing bridge to minimize ground disturbance. Removal of existing concrete footings is unavoidable. Partial removal of the uppermost portions of existing piles would be required to allow for final grading.

Measure #2: Provide Casing for CIDH Piling

To minimize the potential for increased groundwater contamination, temporary or permanent steel casings may be required for permanent CIDH concrete piles and/or temporary CIDH soldier piles. Casing would be installed into undisturbed native soils prior to excavation for the CIDH pile. These casings would create barriers across the subsurface soil strata to minimize potential for vertical cross contamination of multiple aquifers. Based on a review of environmental and geotechnical studies conducted in project area, at least two impacted water bearing zones (WBZ) exist beneath the project site within the first 45 feet below ground surface (bgs). The steel casings would likely need to be advanced to at least 45 feet bgs for installation of permanent CIDH concrete piles and/or temporary CIDH soldier piles.

Measure #3: Additional Geotechnical Testing

To narrow the range for the required casing depth, the project would have to advance two Cone Penetrometer Test (CPT) borings, one on each side of the creek, using membrane interface probe (MIP) to verify the depths to the WBZs and clay zones. The first WBZ is approximately at 18-20 ft bgs and changes to clay at approximately 25 ft bgs. This confined WBZ is contaminated from various gasoline and dry-cleaning chemicals. The second WBZ is approximately at 31-34 ft bgs and changes to clay at approximately 38 ft bgs. The second confined WBZ is also impacted by VOCs, however, it is less impacted than the first WBZ. A CPT using MIP can produce a log with resistivity and conductivity, which can help to evaluate the WBZs and clay above/below the WBZs, to extrapolate the depth that solid casings would be necessary to prevent cross-contamination of aquifers/WBZs and to the extent, contaminating additional WBZs that are deeper than previously explored

Measure #4: Minimize proposed Abutment excavation

The size of the concrete abutments will be minimized to reduce the amount of ground disturbance during construction. The project specifications will also address the need to limit the amount of time that excavations can remain open.

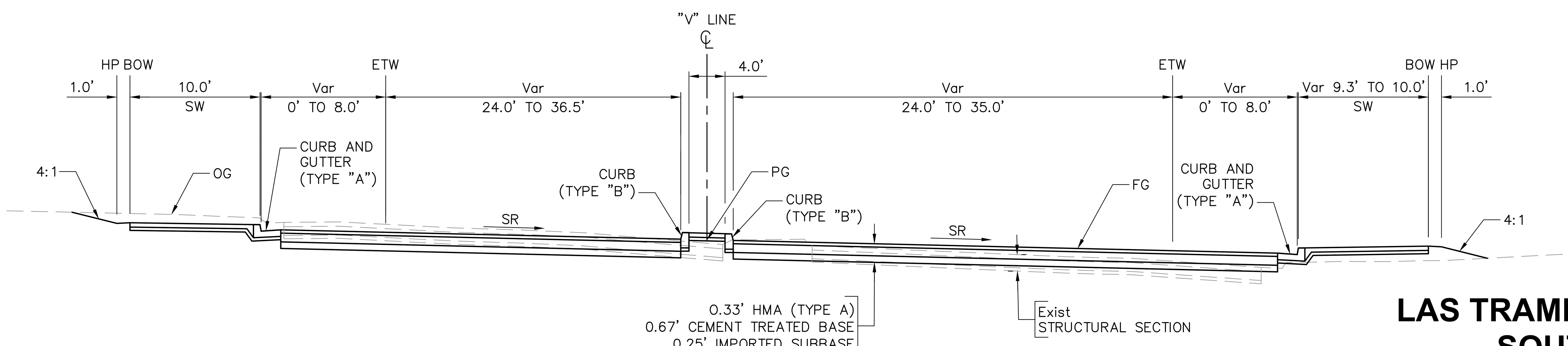
Measure #5: Minimize Utility Relocations

Every effort will be made to minimize or avoid underground utility relocations. This would be especially important for the buried sanitary sewer system running along South Main Street in front of the Agora site. The sanitary sewer siphon beneath Las Trampas Creek would likely require relocation.

Measure #6: Minimize Open Excavation Timing
Open excavations that encounter groundwater will be managed on-site to minimize the duration and rate of groundwater extraction. Creek diversion, shoring, and CIDH excavations will be timed and sequenced to avoid extended exposure to groundwater. Groundwater dewatering volumes will be monitored to the extent feasible.

Measure #7: Dewatering BMP
The project anticipates encountering groundwater at the project site, both in shallow excavations near the creek bottom, and during deeper foundation excavations. To the extent feasible, the project will seek to reuse excess groundwater collected at the project site. Any excess groundwater collected through impoundment or dewatering would be discharged to the Contra Costa Sanitary District under permit. If the District is unable to receive dewatered groundwater from the project at any point, the project will secure an SFBRWQCB's VOC and Fuel NPDES General Permit (ORDER NO. R2-2012-0012), for onsite groundwater treatment and discharge to Las Trampas Creek.

Measure #8: Minimize Slope Protection Replacement
The existing slope paving and concrete bag slope protection provides a barrier between surface and ground water. Although most of the slope protection would need to be removed and replaced beneath the existing bridge and above the sanitary sewer siphon, portions of the existing slope protection could be left in place during foundation construction to minimize cross contamination of the surface and groundwater.



TYPICAL SECTION

QUINCY ENGINEERING

DRAFT

LAS TRAMPAS CREEK BRIDGE AT SOUTH MAIN STREET

BRIDGE REPLACEMENT PROJECT

SCALE 1" = 20'

5 11 201

TIME PLOTTED 2:12:28 PM

DATE PLOTTED 5/11/2018 2:12:28 PM

USERNAME Andrewm

FILE S:\Client\Walnut Creek\W03-600 Las Trampas Creek Bridge at S. Main St. Replacement\CAD\Exhibits\W06300_Lane Algs Layout.dwg

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT
04	CC	CR	N/A N/A

QUINCY ENGINEERING

SLO County Public Works Department
1050 Monterey Street,
San Luis Obispo, CA 93408

TO BE DETERMINED

PROFILE GRADE
NO SCALE

Notes:
1. Paint "Las Trampas Bridge"
2. Paint "No. XXX-XXXX"
3. Structure Approach (Type EQ)

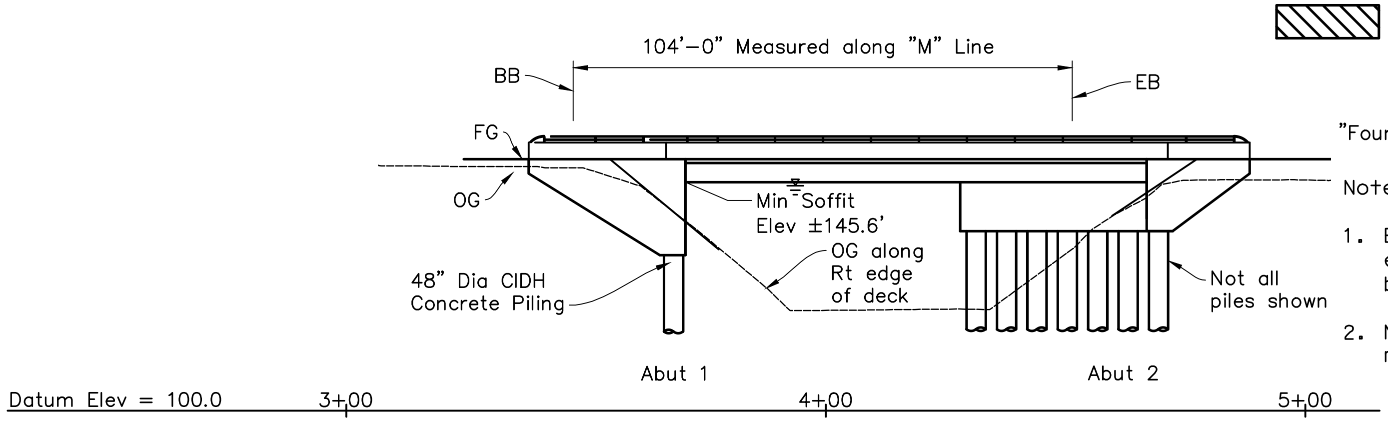
Highwater elevation = 145.22' (100 year)
143.37' +2' Freeboard (50 year)

Existing structure
Temporary Shoring
Bridge to be Removed
Closure Pour

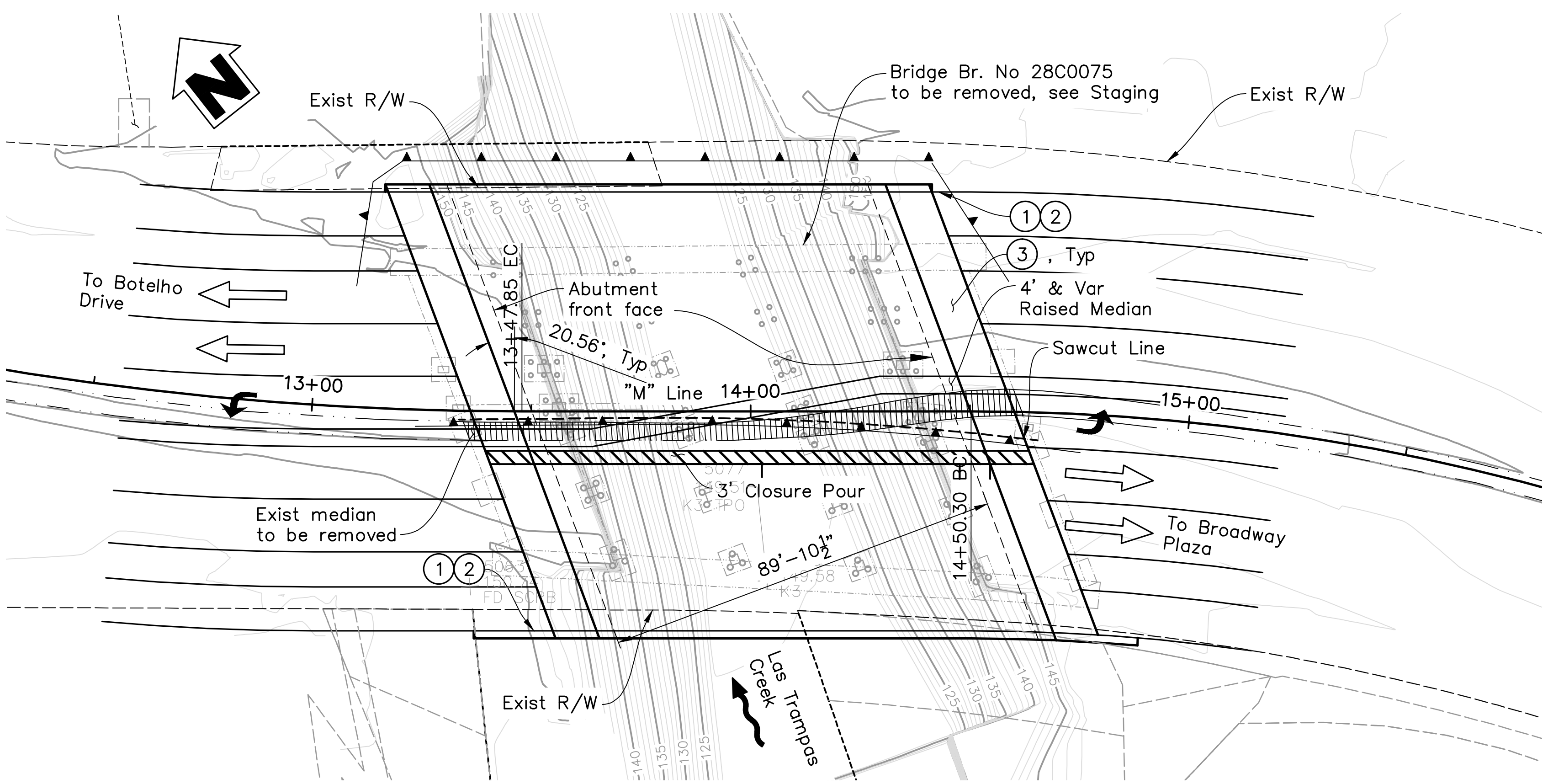
For General Notes, see "Deck Contours" sheet.
For Hydrologic Summary and Scour Data Table, see "Foundation Plan" sheet.
For Utilities, see "Typical Section" sheet.

Notes:

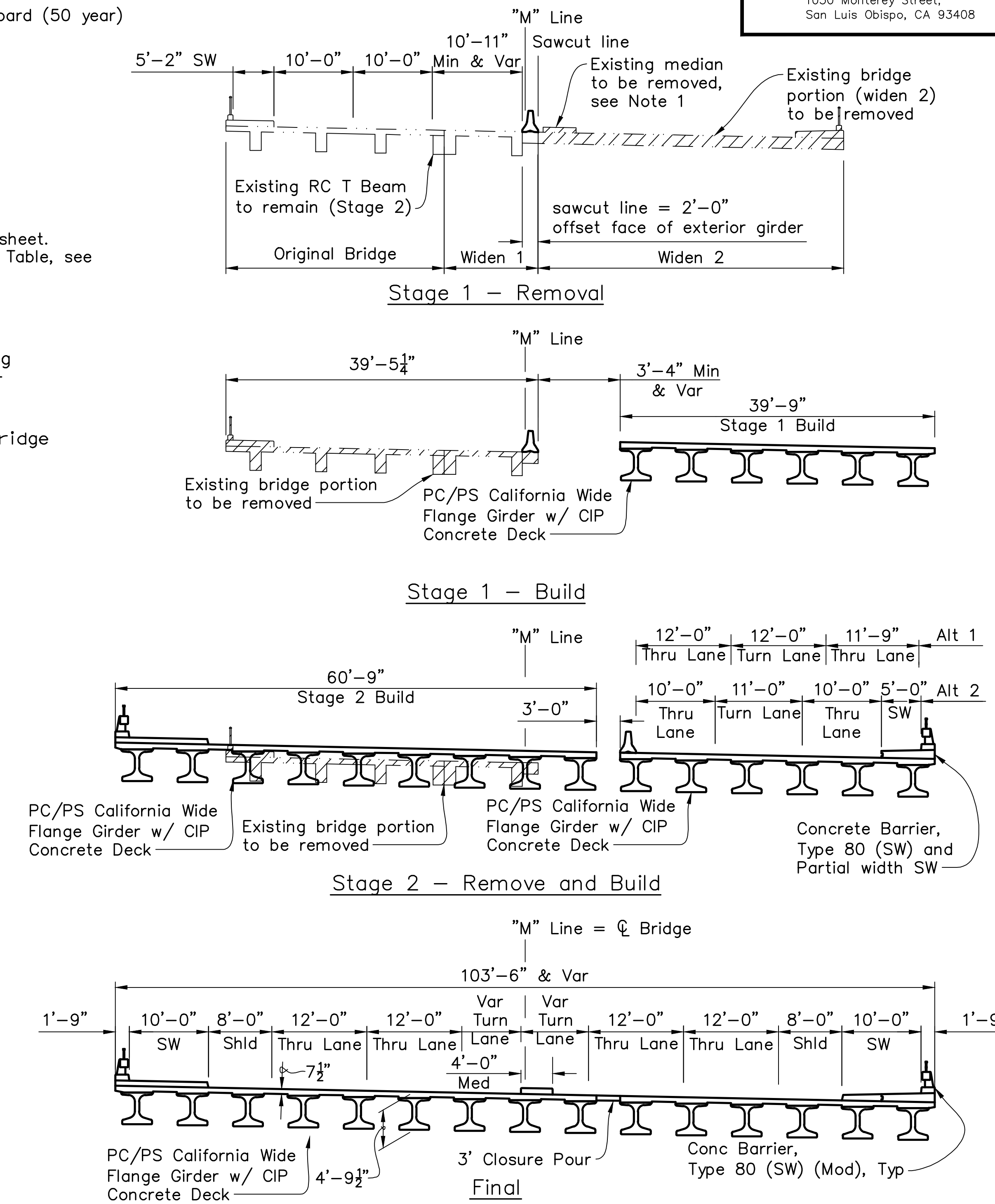
1. Existing median to be removed along entire length of existing bridge at beginning of Stage 1.
2. Northern foundations of existing bridge not shown.



ELEVATION
1"=20'



PLAN
1"=20'



TYPICAL SECTION
1"=10'

BRIDGE ALTERNATIVE 1 – LONG SINGLE SPAN

DESIGNED BY	H. Chou	DATE	11/6/2017
DRAWN BY	H. Chou	DATE	11/6/2017
CHECKED BY	R. Ferguson	DATE	11/28/2017
APPROVED		DATE	

Robert Ferguson, PE
PROJECT ENGINEER

ADVANCED PLANNING STUDY

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET

BRIDGE NO. XXXXXXX | UNIT:
SCALE: As Shown | PROJECT NUMBER & PHASE: W06300

PREPARED FOR THE CITY OF WALNUT CREEK– ENGINEERING DEPARTMENT

DESIGN OVERSIGHT
SIGN OFF DATE

Notes:

1. Paint "Las Trampas Bridge"
2. Paint "No. XXX-XXXX"
3. Structure Approach (Type EQ)

Highwater elevation = 145.30' (100 year)
143.47' + 2' Freeboard (50 year)

Existing structure
Temporary Shoring
Bridge to be Removed
Closure Pour

For General Notes, see "Deck Contours" sheet.
For Hydrologic Summary and Scour Data Table, see "Foundation Plan" sheet.
For Utilities, see "Typical Section" sheet.

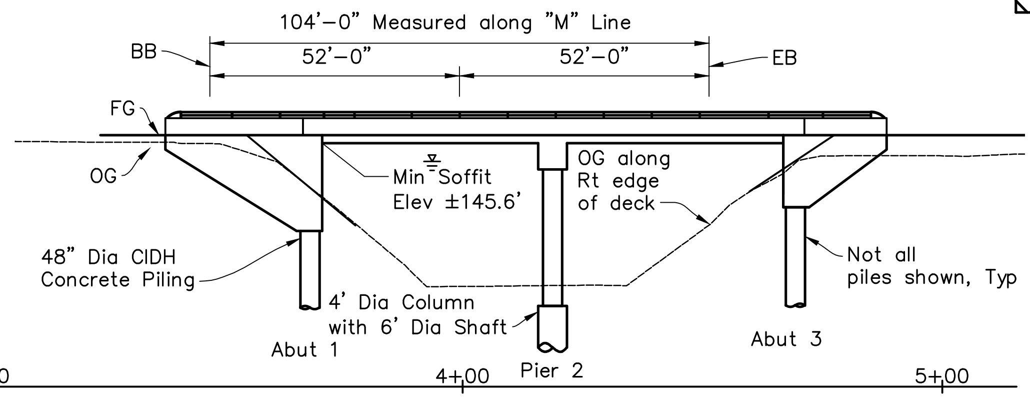
Notes:

1. Existing median to be removed along entire length of existing bridge at beginning of Stage 1.
2. Northern foundations of existing bridge not shown.

TO BE DETERMINED

PROFILE GRADE

NO SCALE



ELEVATION

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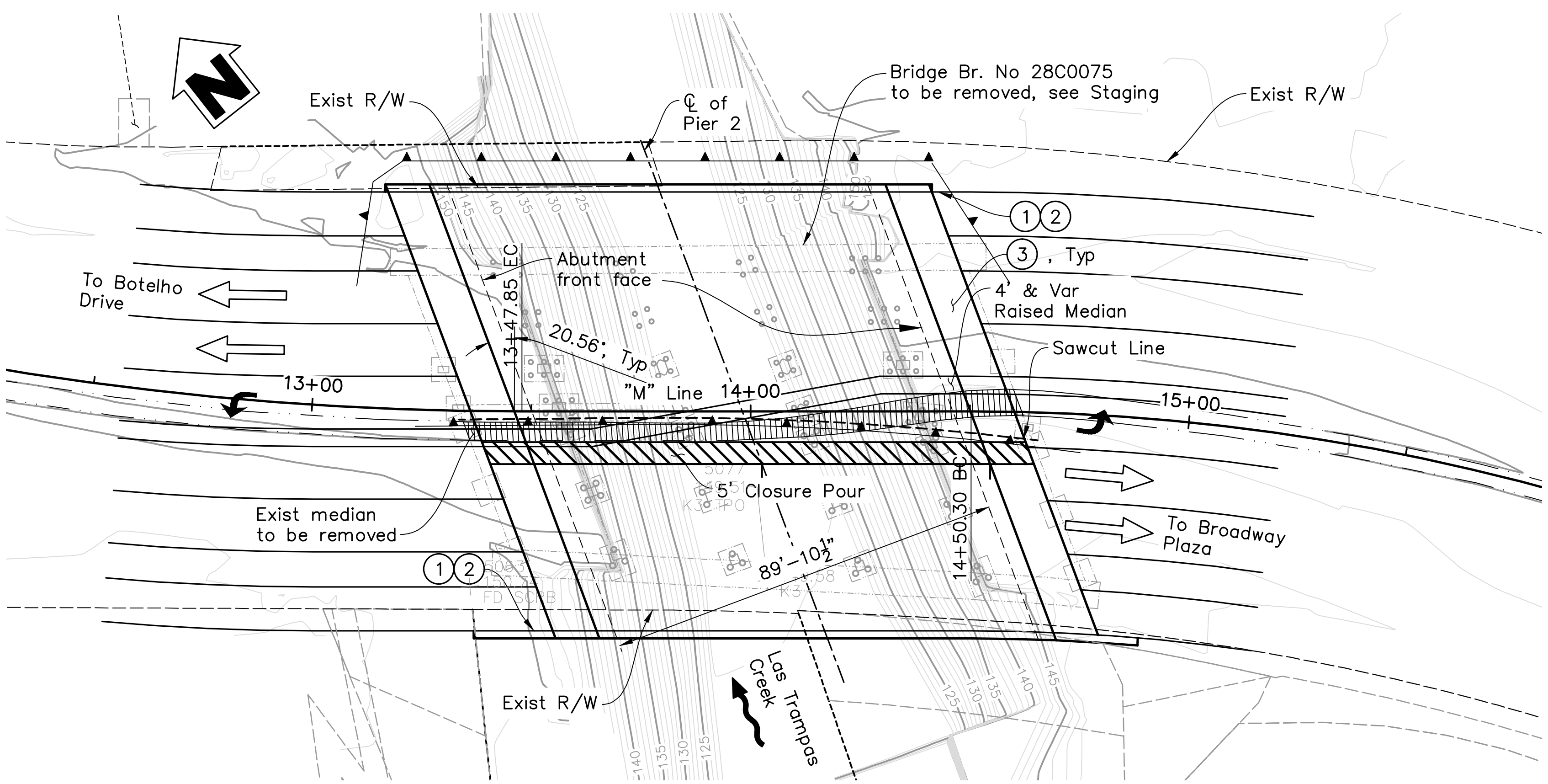

PLAN

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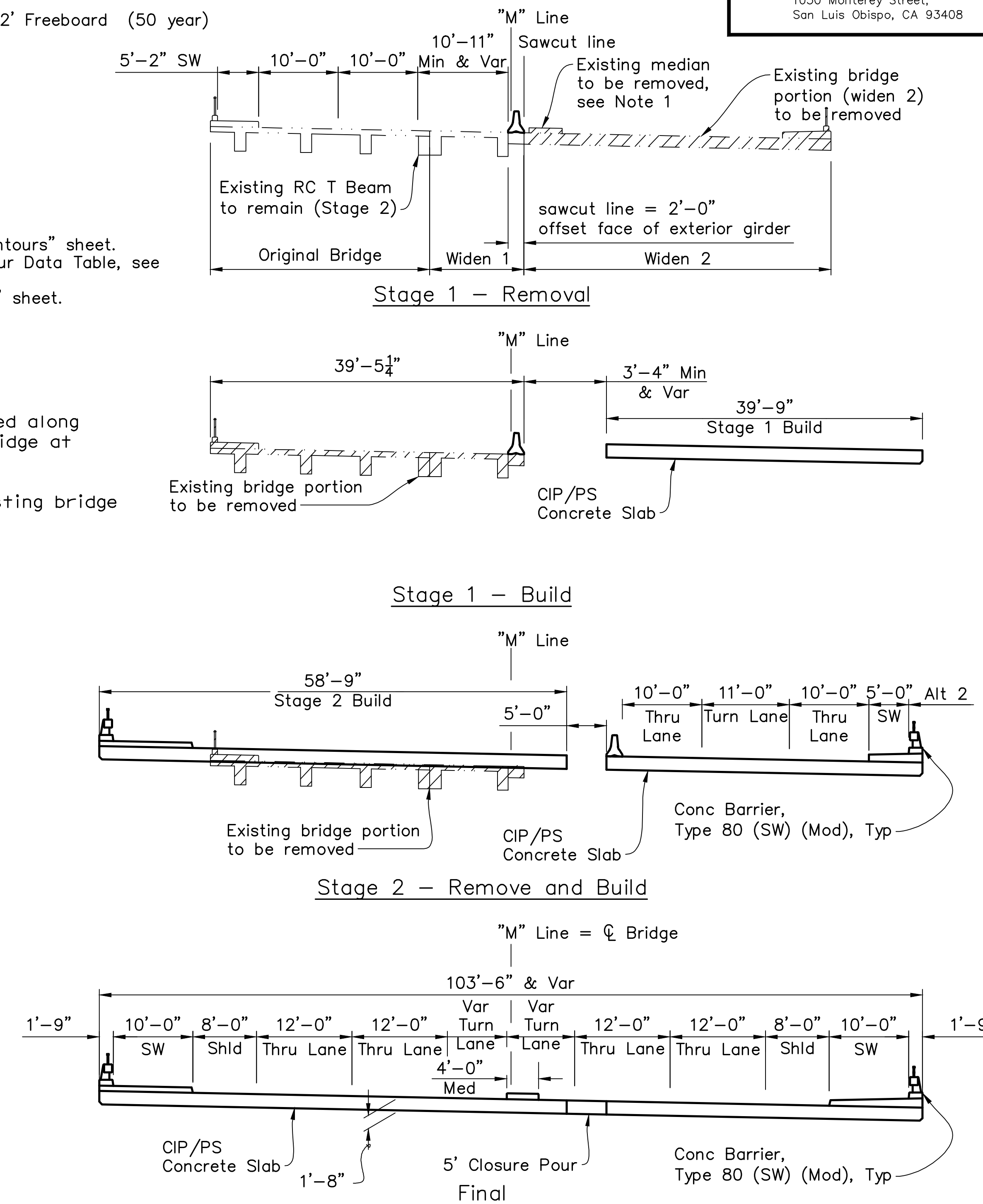


TYPICAL SECTION

1"=10'

BRIDGE ALTERNATIVE 2A – LONG TWO SPAN

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT
04	CC	CR	N/A N/A

QUINCY ENGINEERING

SLO County Public Works Department
1050 Monterey Street,
San Luis Obispo, CA 93408

DESIGNED BY	H. Chou	DATE	11/6/2017
DRAWN BY	H. Chou	DATE	11/6/2017
CHECKED BY	R. Ferguson	DATE	11/7/2017
APPROVED		DATE	

Robert Ferguson, PE
PROJECT ENGINEER

ADVANCED PLANNING STUDY

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET

BRIDGE NO. XXXXXXX
UNIT:
SCALE: As Shown
PROJECT NUMBER & PHASE: W06300

DESIGN OVERSIGHT

SIGN OFF DATE

PREPARED FOR THE CITY OF WALNUT CREEK– ENGINEERING DEPARTMENT

DESIGN DETAIL SHEET (ENGLISH) (REV.7/16/10)

FILE S:\Client\Walnut Creek\W03-600 Las Trampas Creek Bridge at S. Main St. Replacement\CAD\W06300a-a-aps02A.dwg

DATE PLOTTED 2/15/2018 2:36:33 PM
TIME PLOTTED 2:36:33 PM
USERNAME Andyc

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT
04	CC	CR	N/A N/A

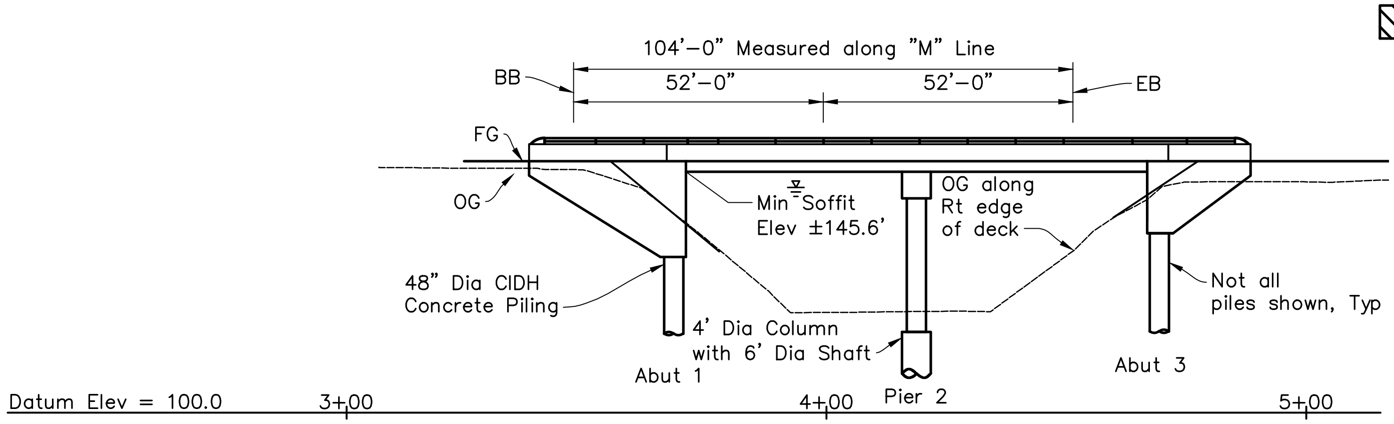
QUINCY ENGINEERING

SLO County Public Works Department
1050 Monterey Street,
San Luis Obispo, CA 93408

TO BE DETERMINED

PROFILE GRADE

NO SCALE



ELEVATION

1"=20'

Notes:

(1) Paint "Las Trampas Bridge"

(2) Paint "No. XXX–XXXX"

(3) Structure Approach (Type EQ)

Highwater elevation = 145.30' (100 year)
143.47' + 2' Freeboard (50 year)

Existing structure

Temporary Shoring

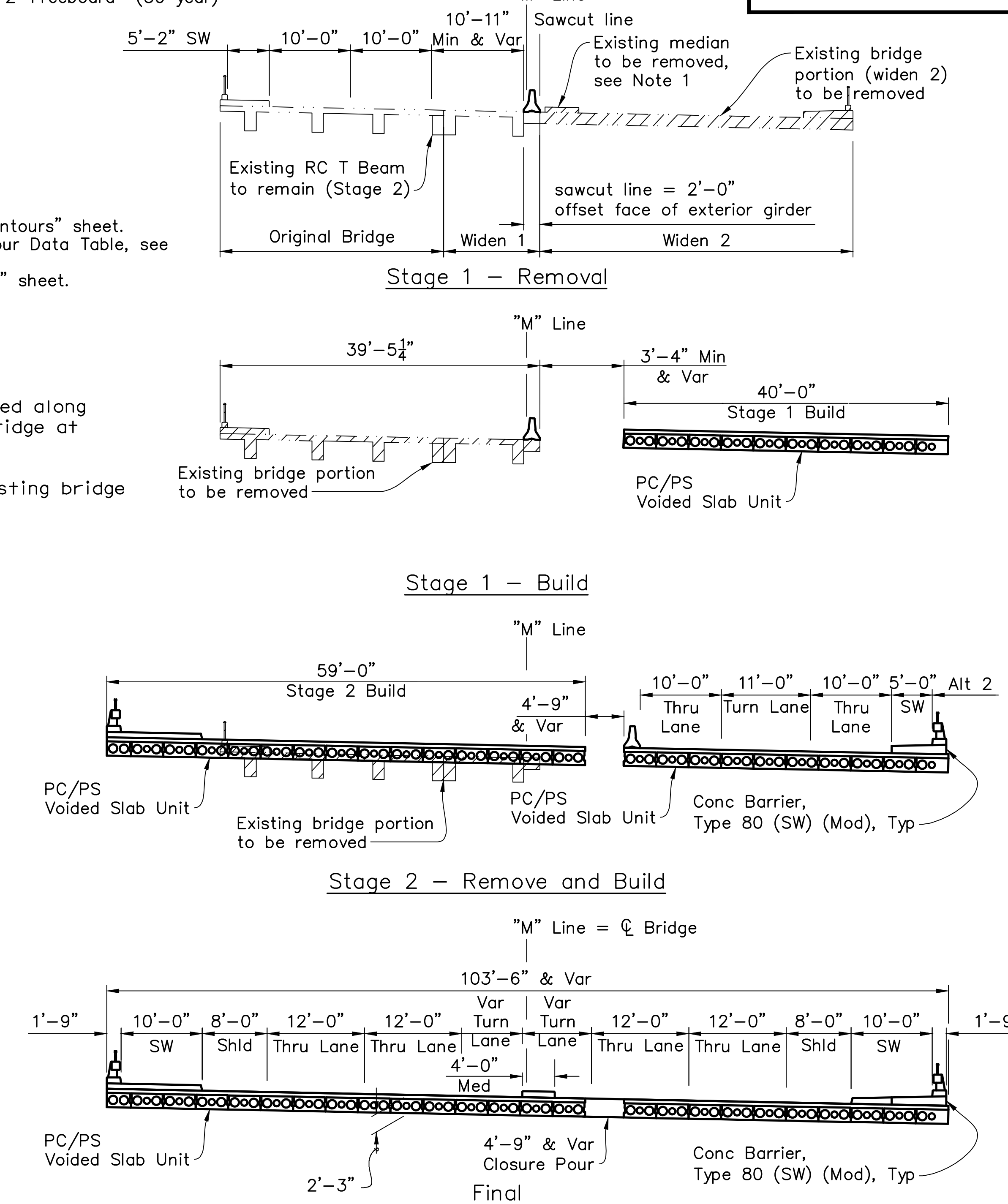
Bridge to be Removed

Closure Pour

For General Notes, see "Deck Contours" sheet.
For Hydrologic Summary and Scour Data Table, see "Foundation Plan" sheet.
For Utilities, see "Typical Section" sheet.

Notes:

1. Existing median to be removed along entire length of existing bridge at beginning of Stage 1.
2. Northern foundations of existing bridge not shown.



TYPICAL SECTION

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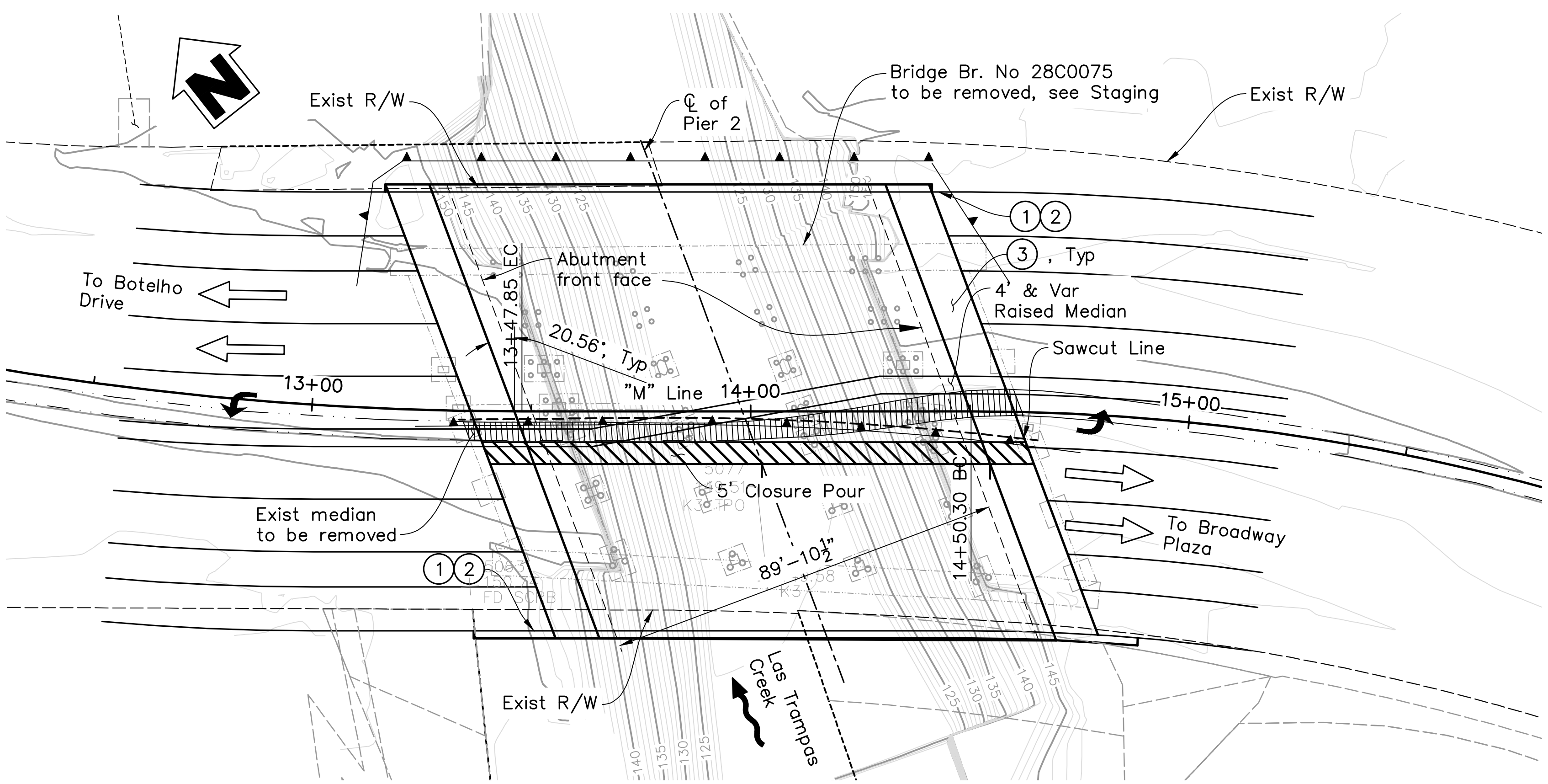


PLAN

1"=20'

BRIDGE ALTERNATIVE 2B – LONG TWO SPAN

DESIGNED BY	H. Chou	DATE	11/6/2017
DRAWN BY	H. Chou	DATE	11/6/2017
CHECKED BY	R. Ferguson	DATE	11/7/2017
APPROVED		DATE	

Robert Ferguson, PE
PROJECT ENGINEER

ADVANCED PLANNING STUDY

LAS TRAMPAS CREEK BRIDGE ON SOUTH MAIN STREET

BRIDGE NO. XXXXXXX | UNIT:

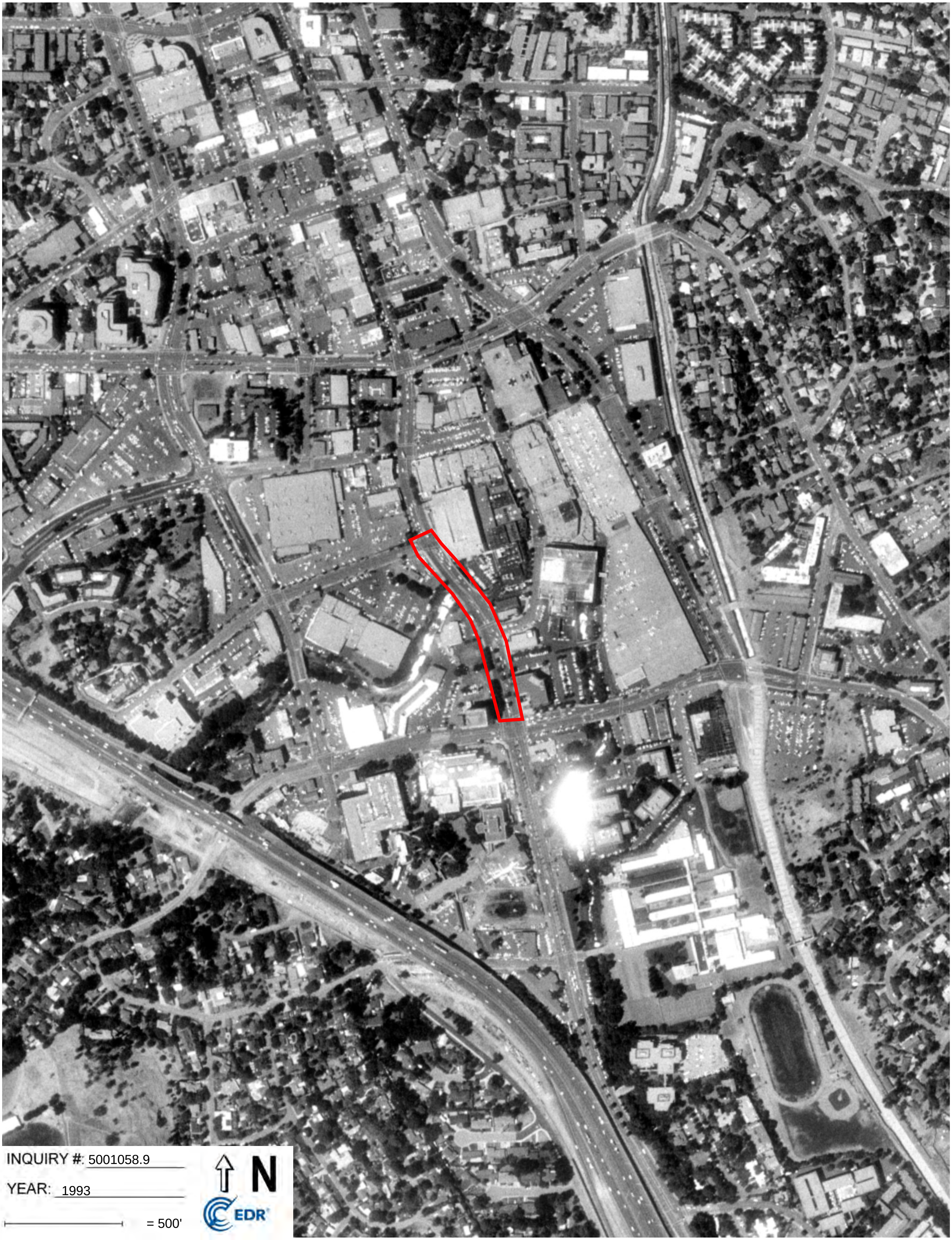
SCALE: As Shown | PROJECT NUMBER & PHASE: W06300

DESIGN OVERSIGHT

SIGN OFF DATE

PREPARED FOR THE CITY OF WALNUT CREEK– ENGINEERING DEPARTMENT

Appendix F Historic Aerial Photographs



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EDR


INQUIRY #: 5001058.9
YEAR: 1982
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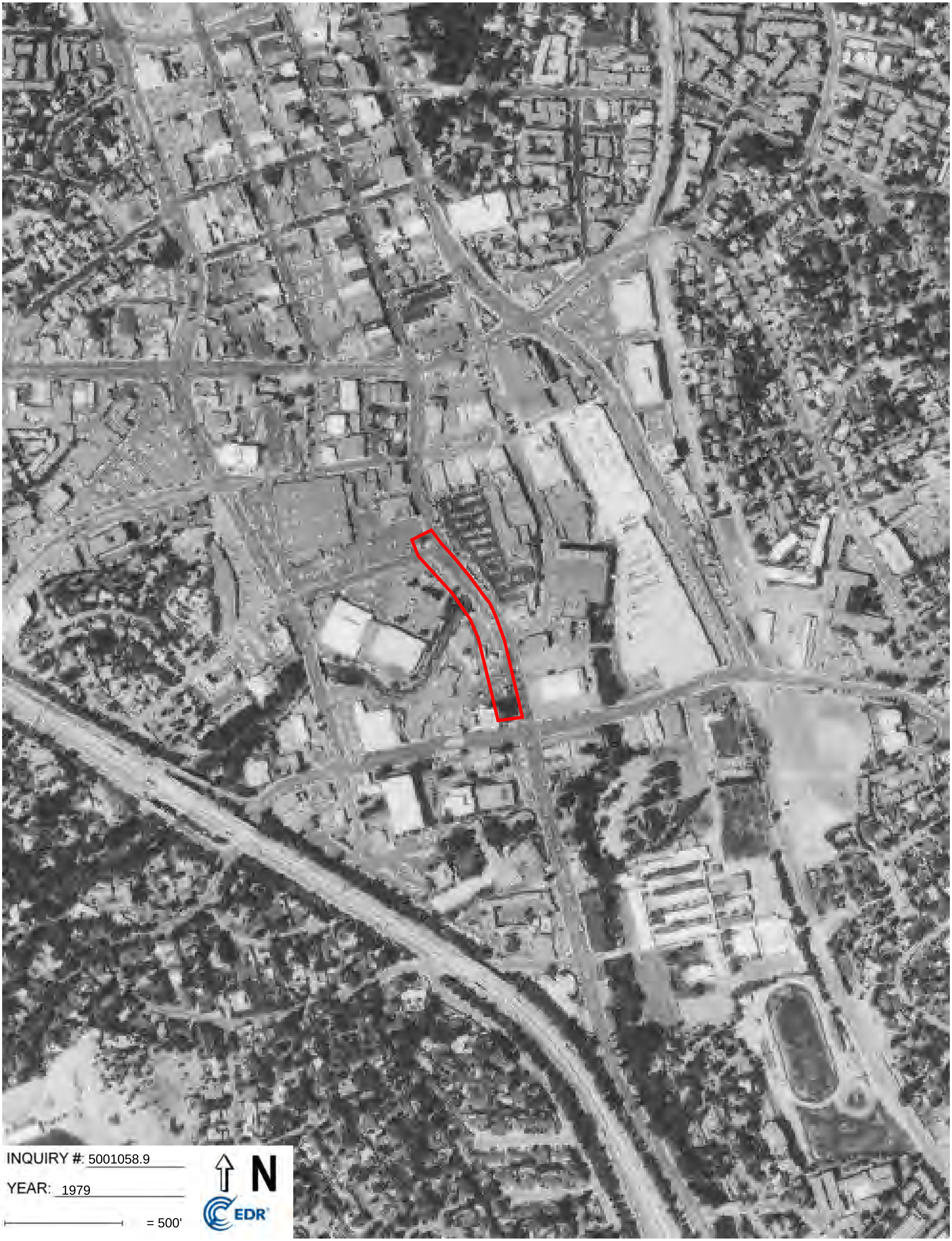
N
EDR



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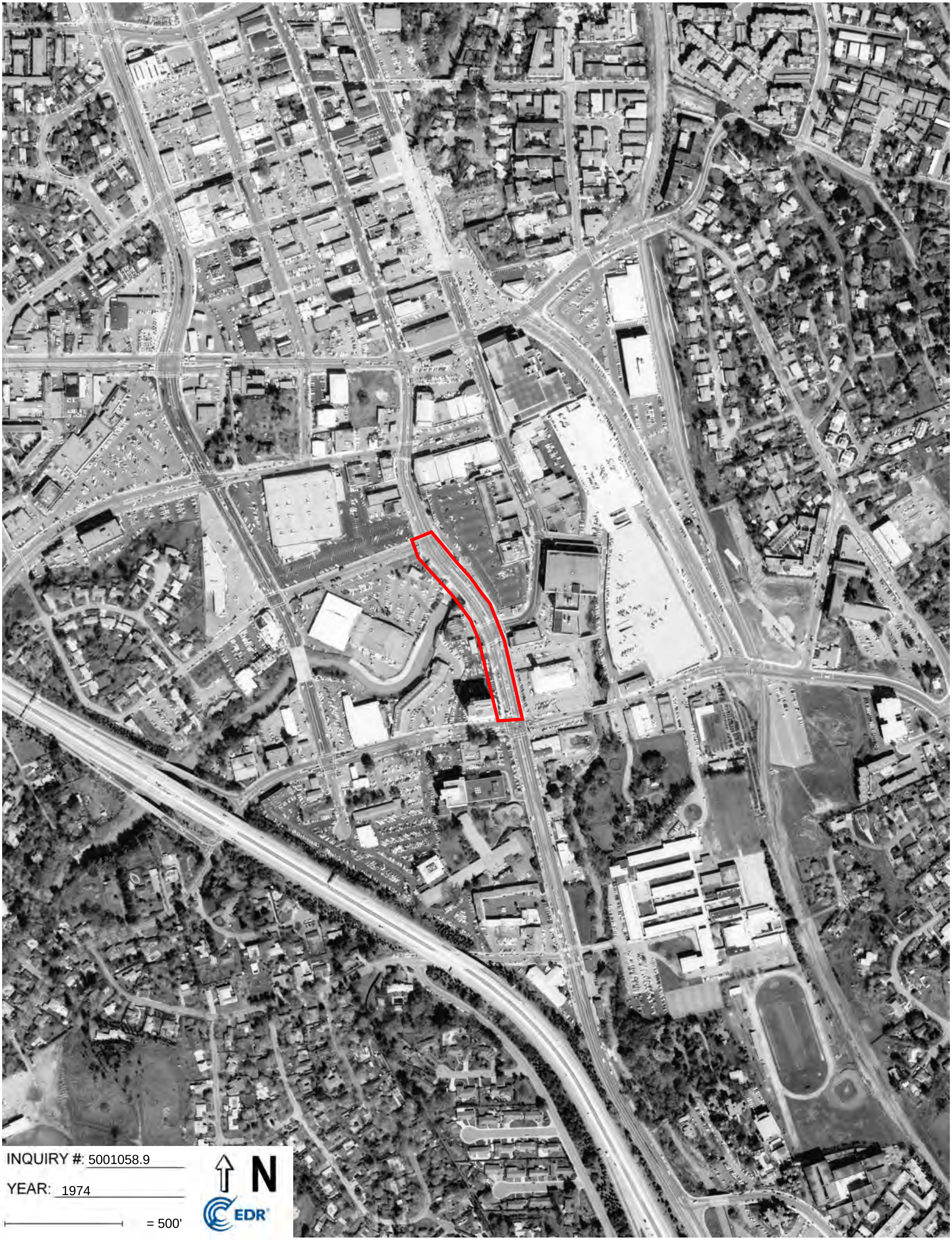

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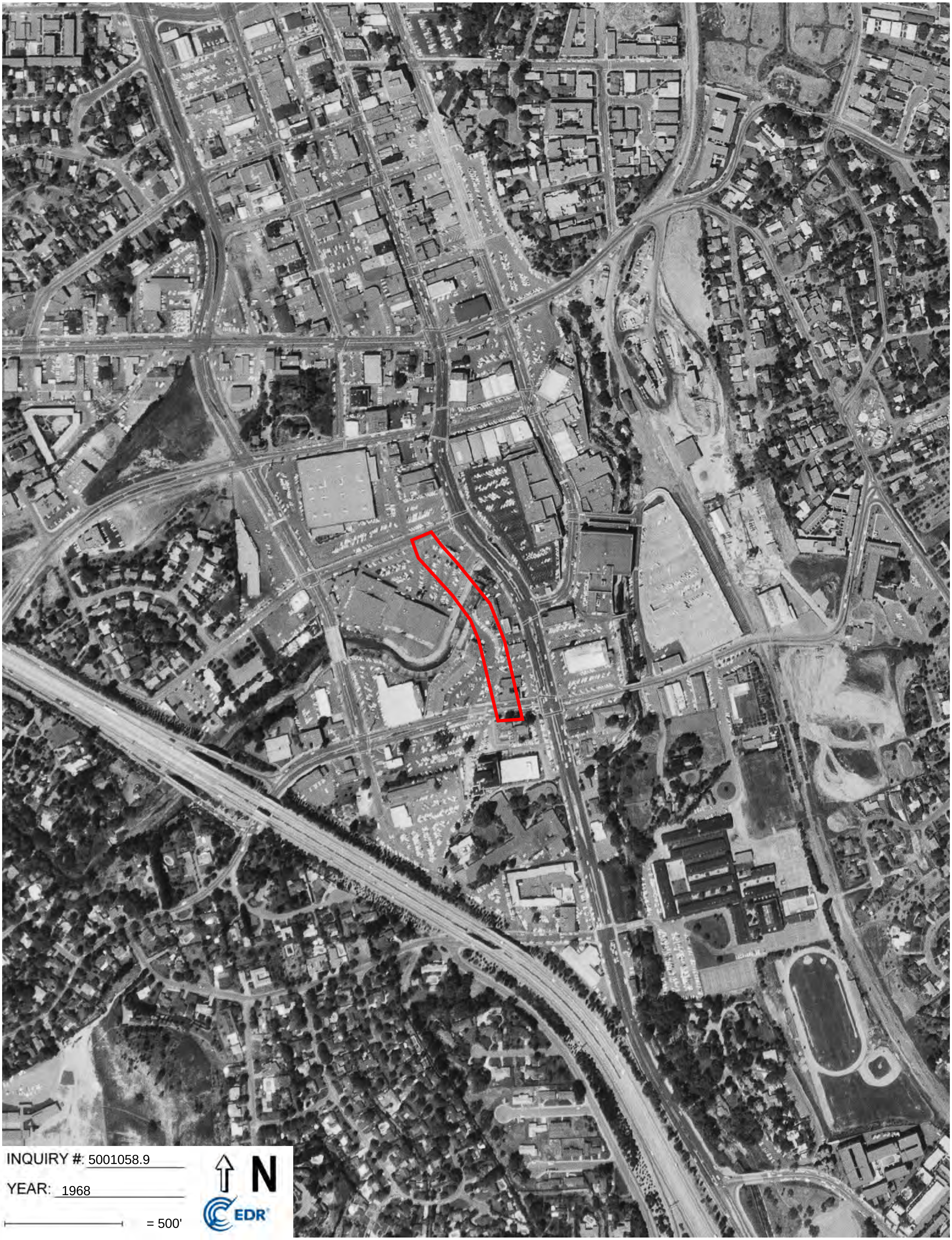
EDR



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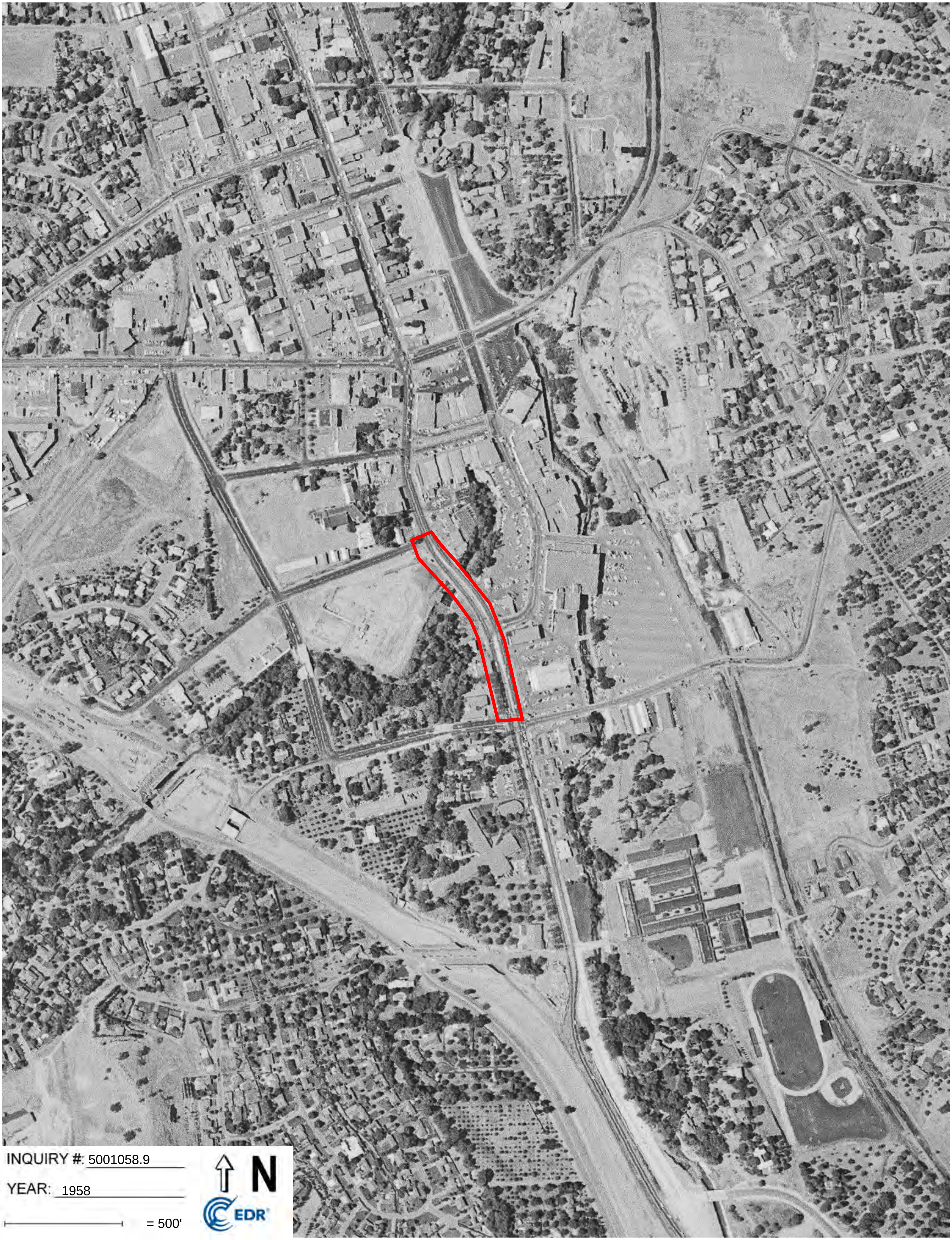

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YEAR: 1950

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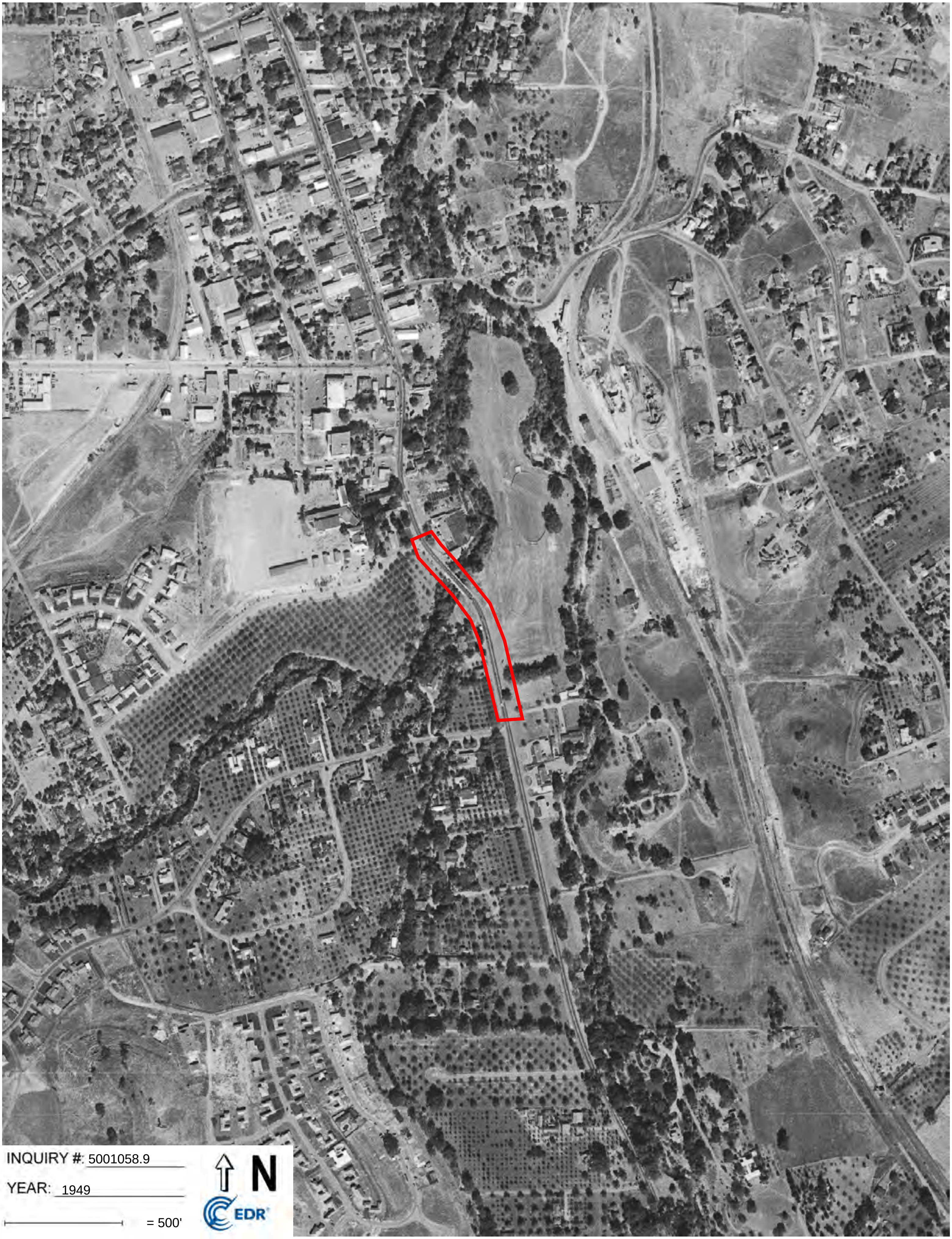
EDR



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EDR

INQUIRY #: 5001058.9

YEAR: 1946

= 500'

N

EDR

INQUIRY #: 5001058.9

YEAR: 1939

= 500'

N

EDR

Las Trampas Creek Bridge Replacement

1301 South Main Street

Walnut Creek, CA 94596

Inquiry Number: 5001058.9

July 24, 2017

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

07/24/17

Site Name:	Client Name:
Las Trampas Creek Bridge Re|	WRECO
1301 South Main Street	1243 Alpine Rd Ste 108
Walnut Creek, CA 94596	Walnut Creek, CA 94596
EDR Inquiry # 5001058.9	Contact: Flannery Banks

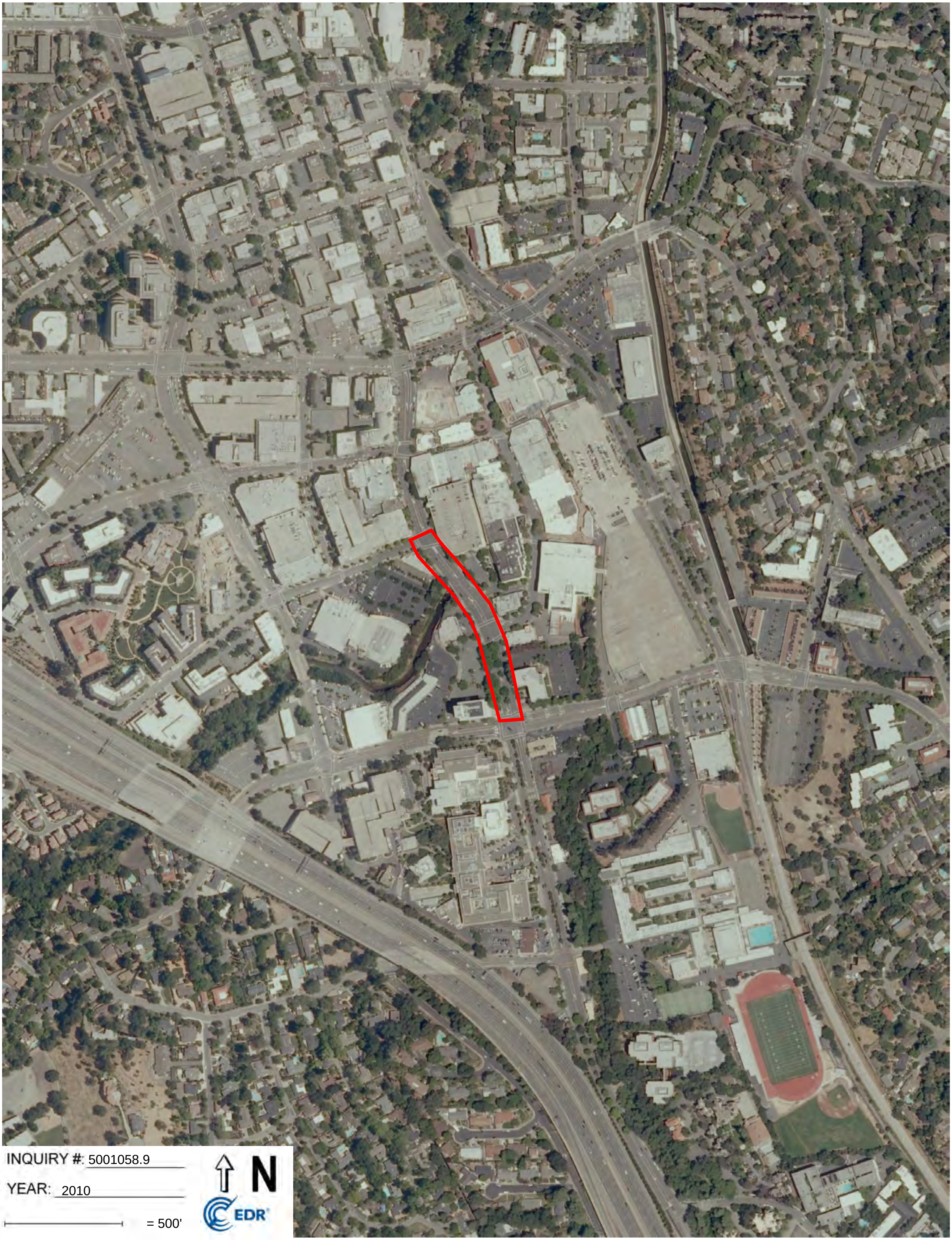
Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
2005	1"=500'	Flight Year: 2005	USDA/NAIP
1998	1"=500'	Flight Date: August 27, 1998	USDA
1993	1"=500'	Acquisition Date: July 10, 1993	USGS/DOQQ
1982	1"=500'	Flight Date: July 05, 1982	USDA
1979	1"=500'	Flight Date: August 16, 1979	USDA
1974	1"=500'	Flight Date: April 30, 1974	USGS
1968	1"=500'	Flight Date: April 22, 1968	USGS
1958	1"=500'	Flight Date: July 21, 1958	USGS
1950	1"=500'	Flight Date: March 13, 1950	USDA
1949	1"=500'	Flight Date: October 13, 1949	USGS
1946	1"=500'	Flight Date: July 22, 1946	USGS
1939	1"=500'	Flight Date: July 25, 1939	USDA

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

INQUIRY #: 5001058.9
YEAR: 2012
= 500'
N
EDR



INQUIRY #: 5001058.9

YEAR: 2010

= 500'

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EDR

INQUIRY #: 5001058.9

YEAR: 2009

= 500'

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INQUIRY #: 5001058.9
YEAR: 2006
= 500'
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EDR


INQUIRY #: 5001058.9
YEAR: 2005
= 500'
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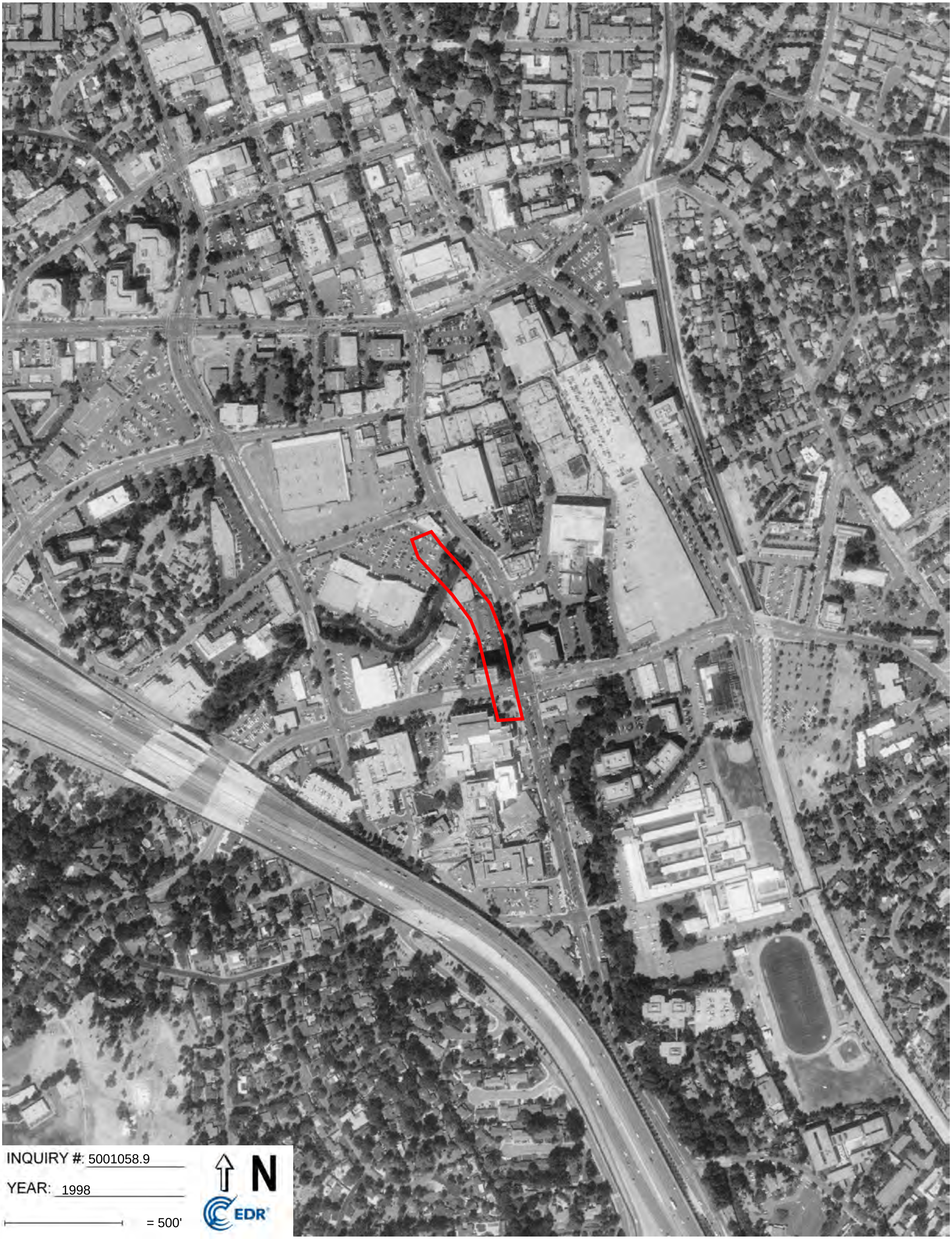

INQUIRY #: 5001058.9

YEAR: 1998

= 500'

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EDR

Appendix G Sanborn Fire Insurance Maps

Las Trampas Creek Bridge Replacement

1301 South Main Street

Walnut Creek, CA 94596

Inquiry Number: 5001058.3

July 25, 2017

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

07/25/17

Site Name:

Las Trampas Creek Bridge Rep
1301 South Main Street
Walnut Creek, CA 94596
EDR Inquiry # 5001058.3

Client Name:

WRECO
1243 Alpine Rd Ste 108
Walnut Creek, CA 94596
Contact: Flannery Banks

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by WRECO were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # D483-4A3E-A2C8

PO # P17043

Project Las Trampas Creek Bridge

Maps Provided:

1956
1953
1943
1926
1915

Sanborn® Library search results

Certification #: D483-4A3E-A2C8

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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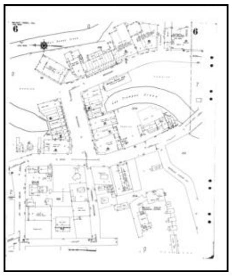
Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

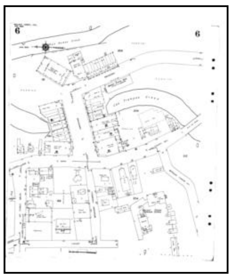
1956 Source Sheets



Volume 1, Sheet 6
1956

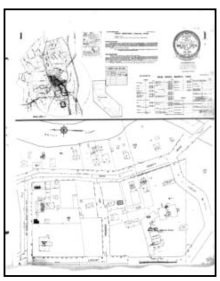
Volume 1, Sheet 7
1956

1953 Source Sheets



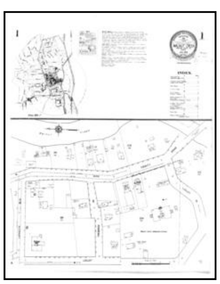
Volume 1, Sheet 6
1953

1943 Source Sheets



Volume 1, Sheet Keymap/Sheet1
1943

1926 Source Sheets



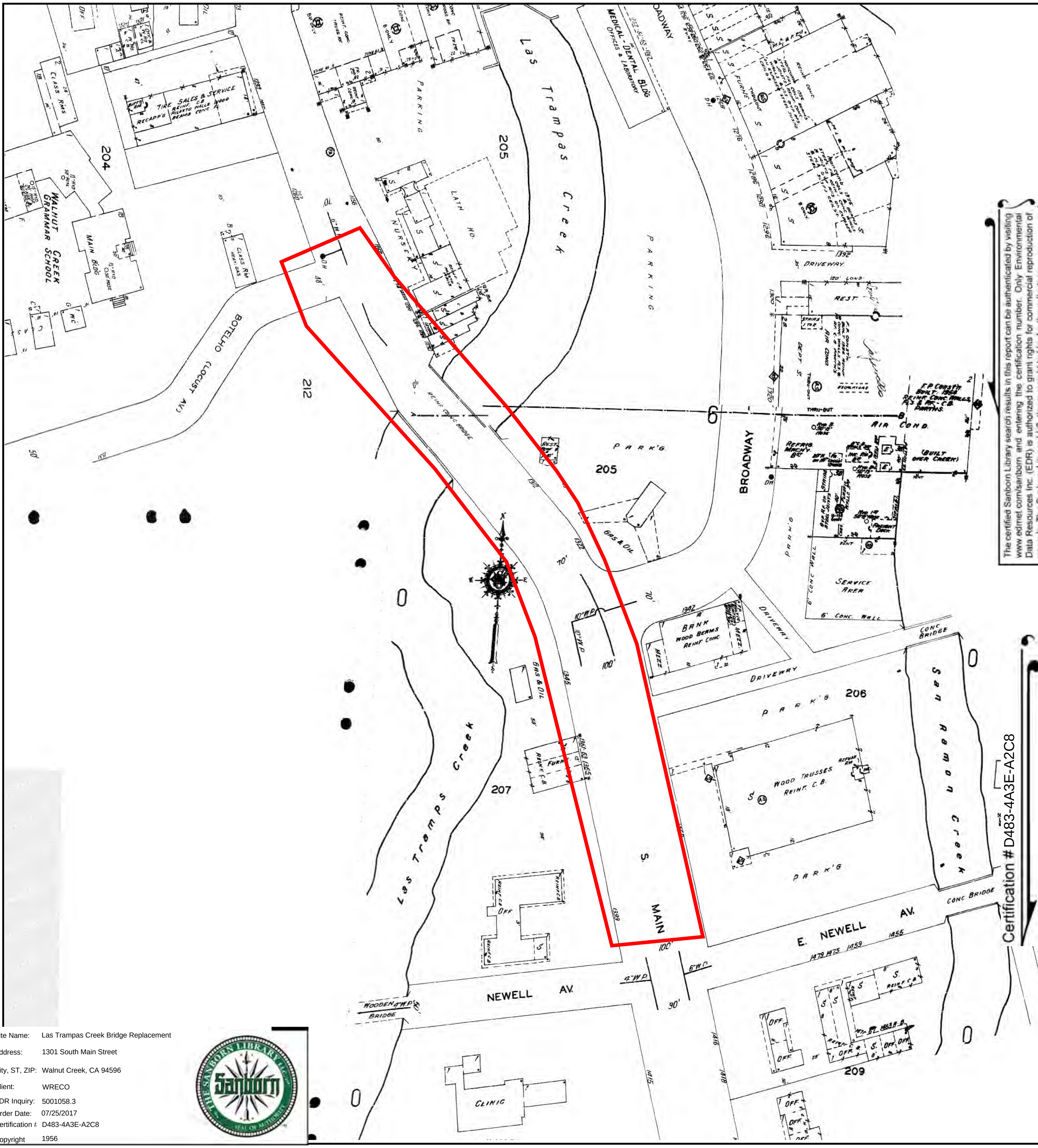
Volume 1, Sheet Keymap/Sheet1
1926

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1915 Source Sheets

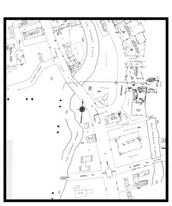
Volume 1, Sheet 1
1915

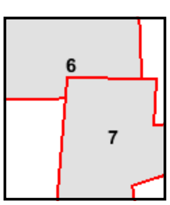


Site Name: Las Trampas Creek Bridge Replacement
Address: 1301 South Main Street
City, ST, ZIP: Walnut Creek, CA 94596
Client: WRECO
EDR Inquiry: 5001058.3
Order Date: 07/25/2017
Certification #: D483-4A3E-A2C8
Copyright: 1956

This Certified Sanborn Map combines the following sheets.
Outlined areas indicate map sheets within the collection.

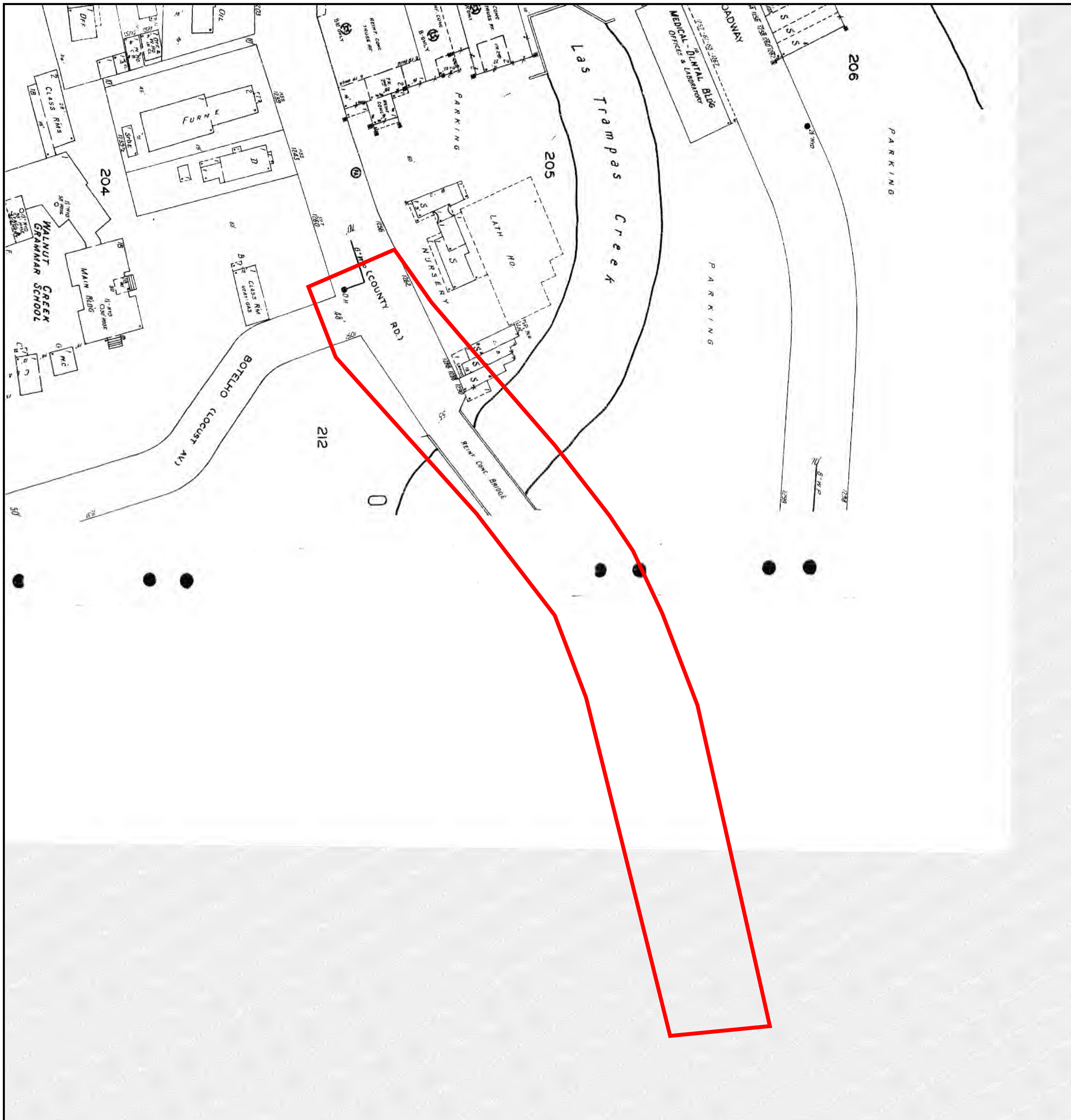
0 Feet 150 300 600





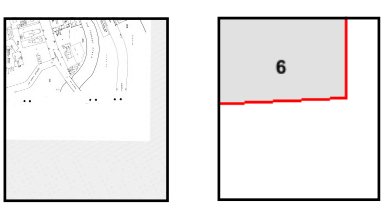
Volume 1, Sheet 7
Volume 1, Sheet 6

N



Site Name: Las Trampas Creek Bridge Replacement
Address: 1301 South Main Street
City, ST, ZIP: Walnut Creek, CA 94596
Client: WRECO
EDR Inquiry: 5001058.3
Order Date: 07/25/2017
Certification #: D483-4A3E-A2C8
Copyright 1953

This Certified Sanborn Map combines the following sheets.
Outlined areas indicate map sheets within the collection.



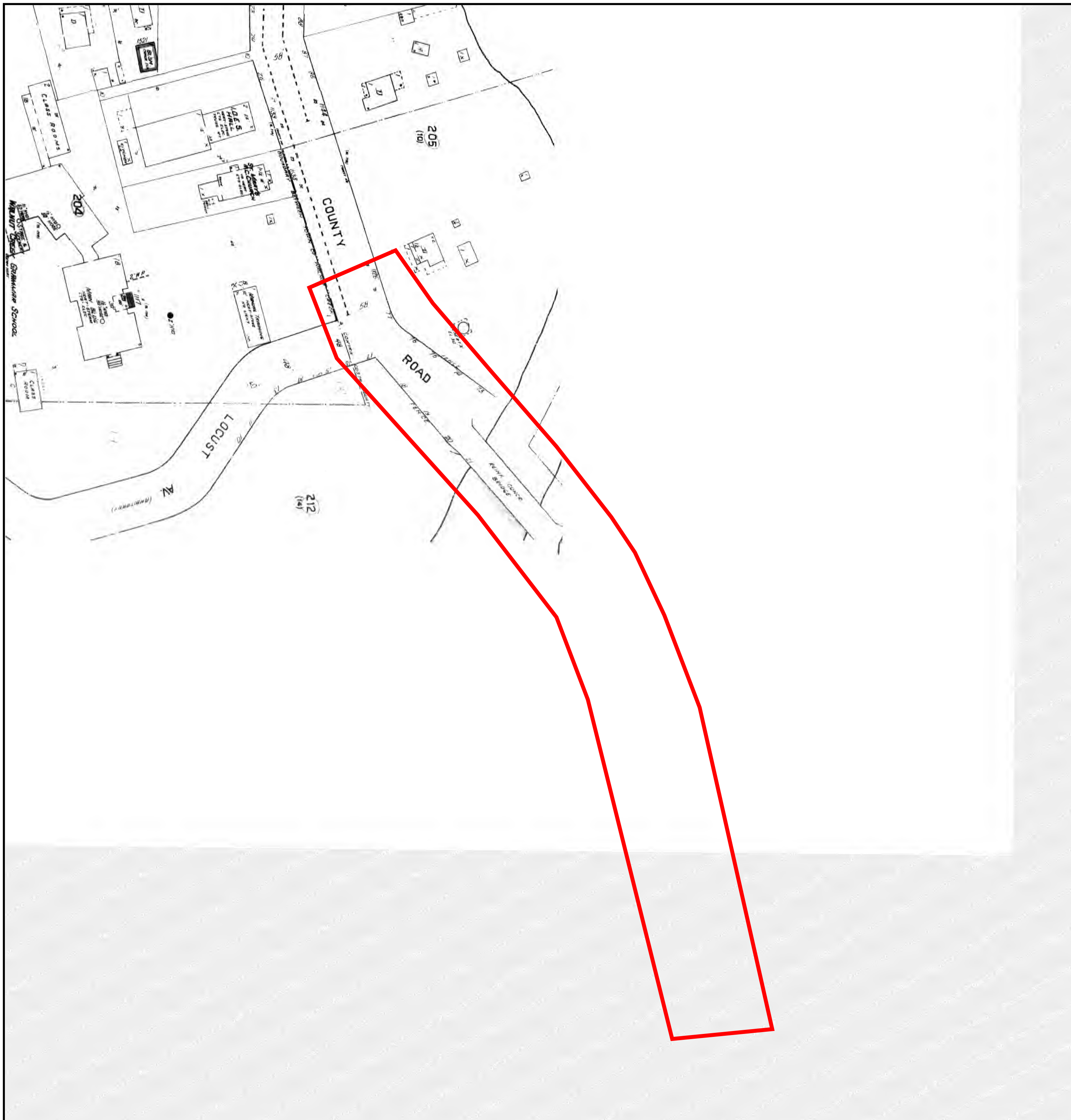
Volume 1, Sheet 6

0 Feet 150 300 600

N

Certified Sanborn® Map

1943



Certification # D483-4A3E-A2C8

Site Name: Las Trampas Creek Bridge Replacement
Address: 1301 South Main Street
City, ST, ZIP: Walnut Creek, CA 94596
Client: WRECO
EDR Inquiry: 5001058.3
Order Date: 07/25/2017
Certification # D483-4A3E-A2C8
Copyright 1943

This Certified Sanborn Map combines the following sheets.
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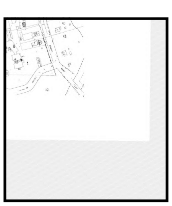

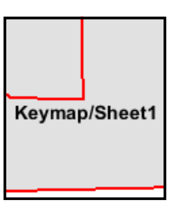

Volume 1, Sheet Keymap/Sheet1

0 Feet 150 300 600

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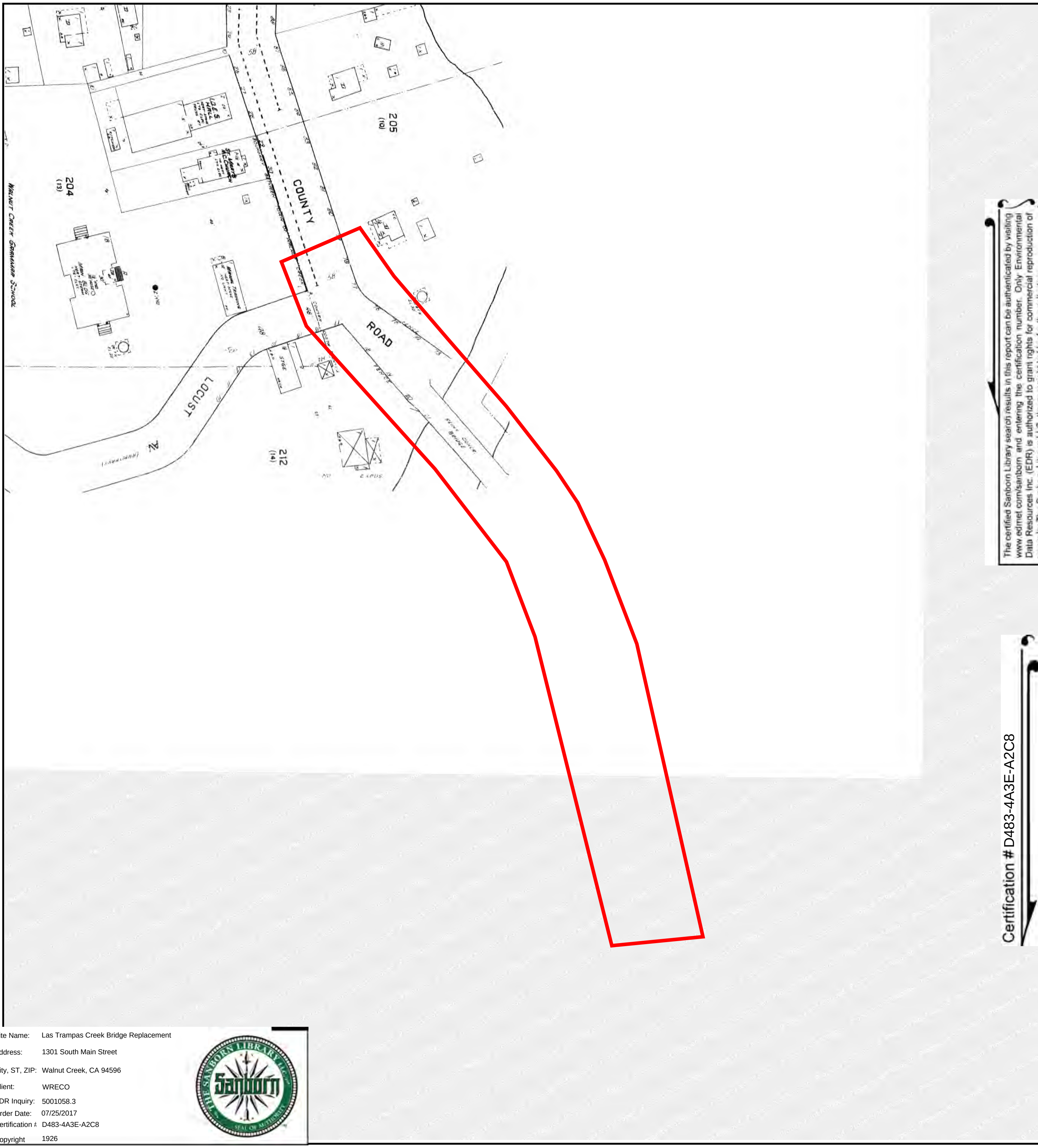
EDR®

Certified Sanborn® Map

1926



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Site Name: Las Trampas Creek Bridge Replacement
Address: 1301 South Main Street
City, ST, ZIP: Walnut Creek, CA 94596
Client: WRECO
EDR Inquiry: 5001058.3
Order Date: 07/25/2017
Certification #: D483-4A3E-A2C8
Copyright: 1926

This Certified Sanborn Map combines the following sheets.
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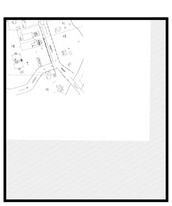

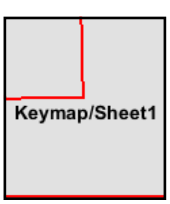

Volume 1, Sheet Keymap/Sheet1

0 Feet 150 300 600

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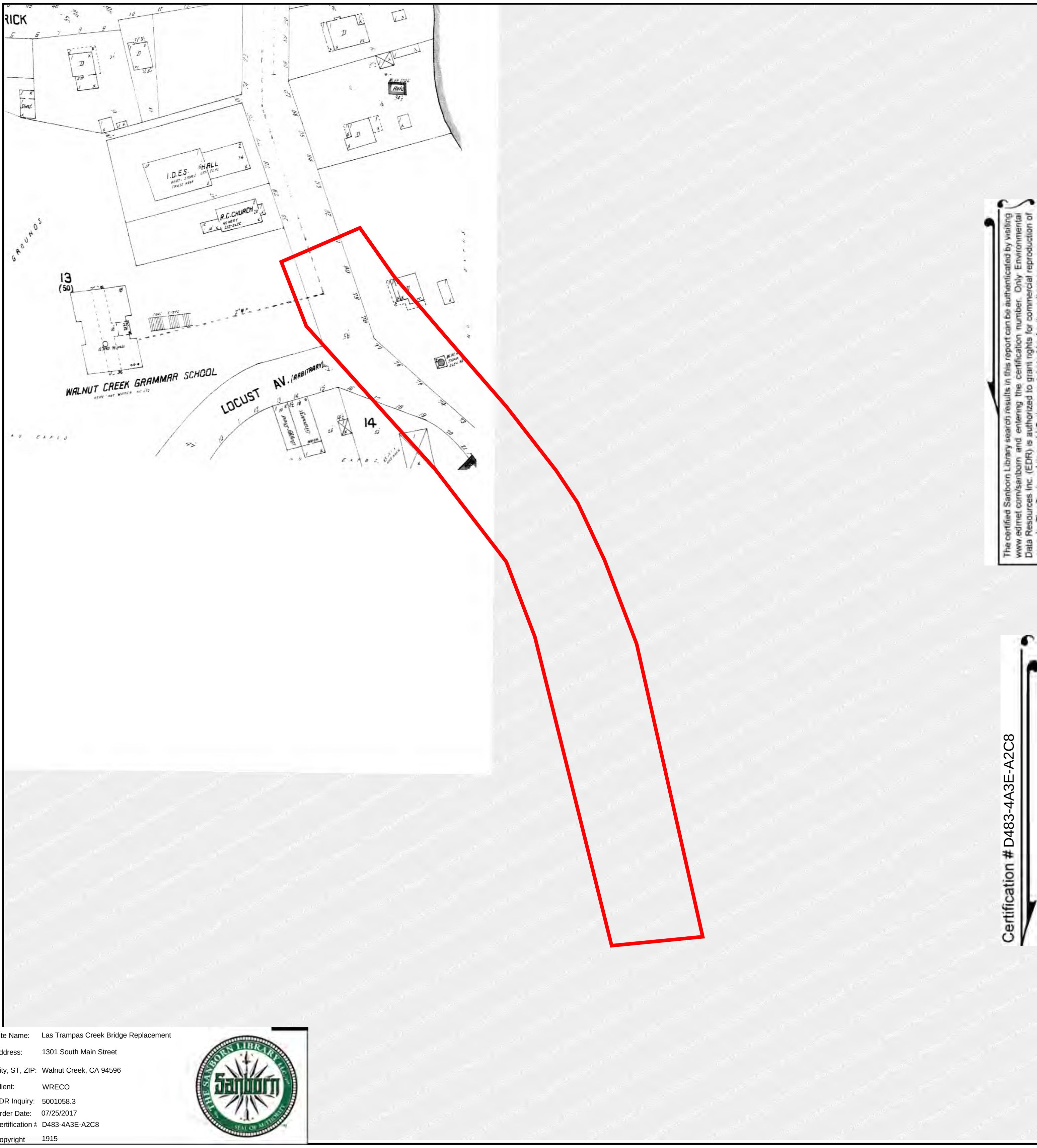
Certified Sanborn® Map



Certification # D483-4A3E-A2C8

Site Name: Las Trampas Creek Bridge Replacement
Address: 1301 South Main Street
City, ST, ZIP: Walnut Creek, CA 94596
Client: WRECO
EDR Inquiry: 5001058.3
Order Date: 07/25/2017
Certification #: D483-4A3E-A2C8
Copyright: 1915

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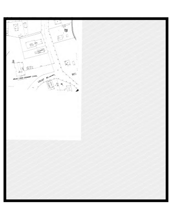

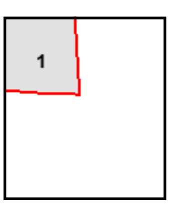

Volume 1, Sheet 1

0 Feet 150 300 600

N

Appendix H City Directories

Las Trampas Creek Bridge Replacement
1301 South Main Street
Walnut Creek, CA 94596

Inquiry Number: 5001058.5
July 25, 2017

The EDR-City Directory Image Report

EDR® Environmental Data Resources Inc

6 Armstrong Road
Shelton, CT 06484
800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Report is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Report includes a search of available city directory data at 5 year intervals.

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. A check mark indicates where information was identified in the source and provided in this report.

Year	***Target Street***	***Cross Street***	***Source***
2013	☑	☐	Cole Information Services
2008	☑	☐	Cole Information Services
2003	☑	☐	Cole Information Services
1999	☑	☐	Cole Information Services
1995	☑	☐	Cole Information Services
1992	☑	☐	Cole Information Services
1985	☑	☐	Haines Criss-Cross Directory
1980	☑	☐	Haines Criss-Cross Directory
1975	☑	☐	Haines Criss-Cross Directory

RECORD SOURCES

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FINDINGS

TARGET PROPERTY STREET

1301 South Main Street
Walnut Creek, CA 94596

Year	*CD Image*	*Source*
S MAIN ST		
2013	pg A2	Cole Information Services
2008	pg A4	Cole Information Services
2003	pg A7	Cole Information Services
1999	pg A9	Cole Information Services
1995	pg A11	Cole Information Services
1992	pg A13	Cole Information Services
1985	pg A15	Haines Criss-Cross Directory
1980	pg A16	Haines Criss-Cross Directory
1975	pg A17	Haines Criss-Cross Directory

FINDINGS

CROSS STREETS

No Cross Streets Identified

City Directory Images

Target Street	Cross Street	Source
✓	-	Cole Information Services

S MAIN ST 2013

1000	NEIMAN MARCUS
1119	TIFFANY & CO
1129	APPLE STORE
1139	GAP
1149	BARNES & NOBLE
1201	LULULEMON ATHLETICA
	TALBOTS
1231	GIANTS DUGOUT STORES
1245	SLEEP TRAIN
1251	LOFT
1255	CAMERA WEST
	GINA KHAN SALON INC
	SEDUSA STUDIO
1259	THE CHILDRENS PLACE
1275	FRESH CHOICE
1295	ROSS DRESS FOR LESS
1300	STANFORDS RESTAURANT & BAR
1390	CHASE
	CHASE BANK
1420	LAWRENCE BEAMEN
1425	KAISER PERMANENTE
	KAISER PERMANENTE MARTINEZ MEDICAL C
	KAISER PERMANENTE MEDICAL CENTERVAL
	KAISER PERMANENTE MEDICAL OFFICESPL
	KAISER PERMANENTE MEDICAL OFFICESVA
	KAISER PERMANENTE WALNUT CREEK MEDIC
1426	CLARISSA BRIDAL SALON
1432	INDULGE SALON
	SCHLOEGEL MARSHA
	SHIVA
1444	BLOOM RETREAT
1448	THE DOOR
1460	ACALANES UNION HIGH SCHOOL DISTRICT
	LAS LOMAS HIGH SCHOOL
1495	MICHAEL KS THE ORIGINAL HICKRY PIT
1500	SCRUBS ETC
1508	LA SEINE ALTERATIONS
1516	DELUXE CUTS & NAILS
	PANCOAST PIZZA
1520	THE MASSAGE PLACE
1530	YOGA WORKS
1600	ANDERSSON PATRICIA K ATTORNEY
	ANDERSSON PATRICIA K ATTY
	BARRON & ASSOCIATES
	BERNARD PARTNERSHIP
	BRAIN SCIENCE INTERNATIONAL
	BRANDT ANDERSON
	CAROLYN HOKANSON PHD
	CELLA LANGE & CELLA ATTORNEYS AT LAW
	CHADDHA KOMAL

S MAIN ST 2013 (Cont'd)

1600	CHILDRENS SKIN DISEASE FOUNDATION
	CREEKSIDE THERAPY CENTER
	CYGNA ENERGY SERVICES
	DAVIDON HOMES
	FADEL INSURANCE AGENCY
	FINANCIAL NETWORK CORP MICHAEL RICIN
	FINISH LINE CAFE
	GILL JOHN P ATTY AT LAW
	HAWLEY DANIEL V CFP
	HUGHES GILL COCHRANE LAW OFFICES
	HUGHES MICHAEL J ATTY AT LAW
	INNOCENCE LEGAL TEAM
	JORDAN DAVID L LIVINGSTON LAW FIRM
	JP KING & ASSOCIATES INC
	KAIPERM DIABLO FEDERAL CREDIT UNION
	KATHRYN MEHLERCLARK MARRIAGE FAMILY
	KAUFFMAN JULIANN EDD
	KOLIIN RANDY PSYD
	KRASNA SUZANNE CFP
	LAW OFFICES OF DOYLE & ASSOCIATES
	LAW OFFICES OF RICHARD S MILLER
	LINDAMOODBELL LEARNING PROCESSES
	LIVINGSTON RENEE WELZE
	LPL FINANCIAL
	MARK BLOCH MD
	MARLEY MIDDLEBROOK PSYD
	NORMAN SHARON MFT
	OGRADY PHD DAVID
	OGRADY SUSAN PHD
	PACIFIC INTERWEST BUILDING CONSULTAN
	PANTER DEBORAH L ATTORNEY AT LAW
	PETER M FUKUMAE CPA
	PILLAR FINANCIAL SERVICES
	PREMIER BENEFIT RESOURCES
	PRING TURNER CAPITAL GROUP INC
	PROFESSIONAL REPORTING SERVICE
	RHONDA BAROVSKY LCSW MEDIATION SERVI
	SEITZ CHERYL
	SHARON NORMAN
	SUZANNE KRASNA
	SYMMETRICS MARKETING
	TENCONI DONALD LAW OFFICE OF
	THAYER MEG PHD
	THOMAS NANCY E
	TRUE WEALTH ADVISORY GROUP
	WINSLOW BEV PHD MFT

S MAIN ST 2008

1119	TIFFANY CO
1129	APPLE STORE
1139	POTTERY BARN KIDS
1149	BARNES & NOBLE
1201	TALBOTS KIDS
1231	GOODYEAR TIRE CENTERS
1245	CYNTHIA AZEVEDO
	JUDITH ORON
	SLEEP TRAIN MATTRESS CENTER
1251	ANN TAYLOR LOFT
1255	BODYPLAN INSTITUTE
	GINA KHAN SALON INC
1259	THE CHILDRENS PLACE
1275	FRESH CHOICE
1295	ROSS DRESS FOR LESS
1300	STANFORDS RESTAURANT & BAR
1305	7 ELEVEN FOOD STORES
1335	TRUE
1390	ALIQUOT ASSOCIATES INC
	DENNIS HIGHTOW
	PIETER K WILLIAMS
	RICHARD GUADAGNI
	WASHINGTON MUTUAL BANK
1420	GBP MUSIC RECORDING STUDIO
1424	CLARISSA
	CLARISSA BRIDAL
1425	KAIPERM DIABLO FEDERAL CR UN
	KAISER CLINIC
	KAISER HOSPITAL
	KAISER HOSPITAL ENGINEERING
	KAISER MEDICAL GENERAL INFORMATION
	KAISER PEDIATRIC PHARMACY
	KAISER WALNUT CREEK MAIN PHARMACY
	KAISER WALNUT CREEK MEDICAL GROUP
	MOCHA MANAGEMENT INC
	NUCLEAR MEDICINE
	PERMANENTE MEDICAL GROUP
	TPMG
	TPMG DEPT PLS SURG
	TPMG OCCUPL MEDICAL
1432	INDULGE SALON
	KARIM RAMIN
	POSH BY AMBER NICOLE
	TRACIE BARNES COSMETOLOGY
1444	CORNUCOPIA
1448	ZHENG LONG RESTAURANT
1460	ACALANES UNION HIGH SCHOOL DISTRICT
	LAS LOMAS HIGH SCHOOL ATNDNC OFFICE
	LAS LOMAS MUSIC FOUNDATION
1475	PERMANENTE MEDICAL GROUP

S MAIN ST 2008 (Cont'd)

1495	THE ORIGINAL HICK RY PIT
1500	TALL ETC
1508	LA SEINE
1516	DELUXE CUTS & NAILS
	NAILS BY ANGELA
1520	THE MASSAGE PLACE
1530	BODYWORKS PLUS
	PEACEFUL JOURNEY HEALING ARTS
1600	A BETTER LETTER
	ALL WALL & CEILING INC
	AMERICAN COLLEGE CLNCAL HYPNSIS
	ARCHITECTURAL DIMENSIONS
	BAY AREA MORTGAGE CO
	BEAVER DANIEL P LAW OFFICES OF
	BENEFITS RESOURCE GROUP INC
	BERNARD MARKETING ASSOCIATES INC
	BLOCH M RANDALL MD
	BORSUK & ASSOCIATES
	CAHOLO INC
	CELLA LANGE & CELLA LLP
	CORNERSTONE
	CORNERSTONE PERIPHERAL TECH
	CREEKSIDE THERAPY CENTER
	DANIEL HAWLEY CFP
	DAVIDON CORP
	DOCUMENT SYSTEMS INC
	DON TENCONI LAW OFFICES
	DONEY SAVINGS
	DOYLE SUSAN M ATTORNEY
	EQUITY ONE INC
	GUILD MORTGAGE CO
	HOMEOWNERS EDUCATION ASSOCIATION
	HUGHES & GILL LAW OFFICES
	J & S PARTNERS INC
	JOHN BARNARD
	KING J P & ASSOCIATES INC
	KRASNA FINANCIAL PLANNING ASSOCIATES
	LAW OF OFFICES ANDERSSON & ANDERSSON
	LAW OFFICES DOYLE & ASSOCS PC
	LEPPER & HARRINGTON LAW OFFICES
	LEVY VANDEPOEL
	LIGHTHOUSE VENTURES LLC
	LIVINGSTON LAW FIRM
	LOST CAMPERS INC
	M BLOCH
	MEG THAYER PHD
	MERRITT L WEISINGER
	MMS DESIGN ASSOCIATES
	PILLAR FINANCIAL SERVICES INC
	PRING TURNER CAPITAL GROUP INC

S MAIN ST 2008 (Cont'd)

1600	PROFESSIONAL REPORTING SERVICES
	RAINTREE FAIRFIELD LP
	ROBERT FIELD
	SALLY LOGRASSO
	SIX SPIRITS LLC
	SPIGHT PROPERTIES I LLC
	STEWART PAIGE CHAMBERS PC
	SUSTAINABLE BUSINESS SOLUTIONS LLC
	SUZANNE KRASNA
	SYMMETRICS MARKETING
	TAHALAMO DESIGN & BUILD INC GENERAL
	VAN DE POEL & LEVY LLP
	WALNUT CREEK FAMILY LAW CENTER
	WASHINGTON MUTUAL BANK
1620	OCCUPANT UNKNOWN

S MAIN ST 2003

1149	BARNES & NOBLE BOOKSELLERS
1201	OCCUPANT UNKNOWN
	SHOE PAVILLION
1231	GOODYEAR TIRE CENTERS
	MARGARET BOYDEN
1234	PAT BATES
1245	LEEZA DFK AVEDA LFSTYL SALON S
	M MASSON
1251	ANN TAYLOR LOFT
	ANNTAYLOR RETAIL INC
1275	FRESH CHOICE RESTAURANT
	OCCUPANT UNKNOWN
1295	ROSS STORES INC
1300	B ROBINSON
1305	SEVEN ELEVEN FOOD STORES
1390	ADDUS HEALTH CARE
	ALIQUOT ASSOCS INC
	META WECHSLER
	RICHARD GUADAGNI
	WASHINGTON MTL HOME LOAN CTR
	WASHINGTON MUTUAL BANK
1420	A CTR FOR WELL BEING
	NETWORK CHRPRCTC OF CNTR COSTA
	STEIGERWALD TIFFANEE DC
1424	CLARISSA BRIDAL SALON INC
	CLARISSA II
	OCCUPANT UNKNOWN
1425	KAIPERM DIABLO FCU
	KAISER PRMNNT WLNT CRK MDCL
1432	OCCUPANT UNKNOWN
	PREMIERE KITCHENS
1444	CORNUCOPIA
	OCCUPANT UNKNOWN
	THE WELLNESS COMMUNITY
1448	LIN YE
	ZHENG LONG RESTAURANT
1460	LAS LOMAS HIGH SCHL ATNDNC OFC
	LAS LOMAS HIGH SCHOOL
	OCCUPANT UNKNOWN
1495	MICHAEL KS THE ORGNL HCKRY PIT
	OCCUPANT UNKNOWN
	THE ORIGINAL HICKRY PIT
1500	OCCUPANT UNKNOWN
	TALL ETC
1508	ACCESSIBLE ALTERATION
	LA SEINE
	SELINA CHOW
1516	NAILS BY ANGELA
1520	ANNA NAILS
	ANOTHER BAD CREATION BY ANS

S MAIN ST 2003 (Cont'd)

1520	BEAVERS FELICIA
1530	OCCUPANT UNKNOWN
1600	A & M LINEN
	A1 DATA & TELECOM SERVICE
	ANDERSON & WATT
	ANDRSN & WATT ATTYS AT LAW
	ARMSTRONG GILMOUR ACCOUNTANCY CORP
	BAY LANDING APARTMENTS
	BENEFITS RESOURCE GROUP
	BERNARD MARKETING ASSOCS
	BORSUK & ASSOCS
	BOYD E BURNISON A PROF LAW
	CELLA LANGE & CELLA ATTYS AT L
	CLANCY WEISINGER & ASC ATTYS
	CLANCY WEISINGER & ASSOCS
	CONNECTEC SITE SERVICES
	DAVIDON HOMES
	DAVIDON HOMES A CAL LTD
	DEPOEL VAN
	DOCUMENT SYSTEMS INC
	EVAULT INC
	FOUR SEASONS APARTMENTS
	GARY M LEPPER
	HANNA INSURANCE AGENCY
	HOMES DAVIDON
	IKON OFFICE SLTN CPYNG & DUPNG
	LAW OFFICES OF JOHN BARNARD
	LEPPER & HARRINGTON
	MARK ANIELLO
	MERRITT L WEISINGER
	PATRICK CLANCY
	PATRICK E CLANCY
	QUANTUM LEAP
	RENEE LIVINGSTON
	RETIREMENT ASSET MANAGEMENT
	SHANNON ARMSTRONG
	SOMERSET PARK APT
	SYMMETRICS MARKETING
	TATE LIVINGSTON
	THOMAS BANTZ
	WCSI PROPERTIES L LC
	WEISINGER MRT L A PRFSNL LAW

S MAIN ST 1999

1149	BARNES & NOBLE BOOKSELLERS
1201	AMERICAN SAVINGS BANK BANK LOCATIONS
	AMERICAN SAVINGS BANK LOAN CENTER
1231	GOODYEAR TIRE CENTERS RY NCK TIRE & ATUOMTN CENTE
1245	LEEZA DFK
	MASSON MARNI HAIRSTYLIST
	ORON JUDITH HAIRSTYLIST
	WALKER ELLE
1275	FRESH CHOICE RESTAURANT
1295	ROSS STORES INCORPORATED
1300	STANFORDS RESTAURANT & BAR
1305	SEVEN-ELEVEN FOOD STORES STORES
1335	VIRGINIA CLEANERS
1390	ADDUS HEALTHCARE INCORPORATED
	HOME SAVINGS OF AMERICA
	HOME SAVINGS OF AMERICA WALNUT CREEK
1420	DIVORCE CENTER
	LAWRENCE BEAMEN
1424	HARL J E FINE FASHION & FUR
	J E HARL FINE FASHION & FUR
1425	CONTRA COSTA ELECTRIC KAISER
	KAISER PERMANENTE
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK ADMIN
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK ALCOH
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK CARDI
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK DERM
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK ECHOC
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK EKG E
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK EMER
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK HEAR
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK HOSP
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK INJCT
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK LABORATORY
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK NUC M
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK ONCOL
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK PHARM
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK SURGE
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK TRAUM
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK URGEN
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK URO
	KAISER PERMANENTE MEDICAL CENTER WALNUT CREEK WOMEN
	KAISER PERMANENTE MEDICAL CENTER WALNUT CRK ADMNSTRV O
	KASIER PERMANENTE MEDICAL CENTER
1426	BENNYS MENSWEAR
	CHARLES ENEA LIMITED BENNYS MENSWEAR
1432	PREMIER KITCHENS INCORPORATED
	PRUDENTIAL JON DOUGLAS COMPANY
1444	CORNUCOPIA
1460	LAS LOMAS HIGH SCHOOL
	LAS LOMAS HIGH SCHOOL ATTENDANCE OFFICE

S MAIN ST 1999 (Cont'd)

1495	EMIL VILLAS ORIGINAL HICKRY PIT
	HICK RY PIT ORIGINAL THE
	MICHAEL KS THE ORIGINAL HICKRY PIT
	ORIGINAL HICKRY PIT THE
1500	TALL ETC
1508	LASEINE
1520	BYE-BYE RAZOR BUMPS
	COLOR TIME BY DIANNA
	COMPUTER SYSTEMS UNLIMITED
	TOTAL BEAUTY
1600	ARCHITECTURAL DIMENSIONS
	BERNARD MARKETING
	BLACK THREADS ENTERPRISES
	C T FINANCIAL
	CALIFORNIA CAPITAL
	CLANCY WEISINGER & ASSOCIATES
	CLANCY WEISINGER & ASSOCIATES ATTORNEYS AT LAW
	COMMUNITY INTEGRATED WORK PROGRAM
	DAVIDON HOMES
	EQUITY ONE
	G M A RESEARCH CORPORATION
	HARRINGTON MATTHEW P LEPPER SCHAEFER & HARRINGTON
	HECKENLIVELY JOHN W ATTORNEY AT LAW
	HEILBRONNER JAMES M
	IKON DOCUMENT SERVICES BUSINESS IMAGING
	INSEON
	JOHN BARNARD
	LAW OFFICES OF JOHN BARNARD
	LEPPER SCHAEFER & HARRINGTON
	MARITZ MARKETING RESEARCH INCORPORATED
	MARLBOROUGH MANAGEMENT
	MELLON MORTGAGE COMPANY
	PEGASUS DISK TECHNOLOGIES
	SCHAEFER EDWARD N LEPPER SCHAEFER & HARRINGTON
	SUZANNE KRASNA
	THOMAS NANCY E
	VALLEY HOME BROKERS
	VALLEY HOME LOANS
	VALLEY PROPERTY MANAGEMENT
	WEISINGER MERRITT L
	WEISINGER MERRITT L CLANCY WEISINGER ASSOCIATION ATTORNE
	WEST COAST INFORMATION SYSTEMS WESCO
	WORLD OF BUSINESS

Target Street	Cross Street	Source
✓	-	Cole Information Services

S MAIN ST 1995

1201	AMERICAN SAVINGS BANK
1231	GOODYEAR TIRE CTR
1300	FIRST NATIONWIDE BANK
1335	DIABLO CLEANERS
1390	KEY HOLIDAYS
	KEY TOURS INTL
	PREMIER HEALTH SVC
1420	DIABLO FINANCIAL CTR
	DIVORCE CENTER
1424	J E HARL FINE FASHION & FUR
1425	KAIPERM WALNUT CREEK FCU
	KAISER PERMANENTE
1426	BOB WILCOX REAL ESTATE
	PICTURE FRAME CO
1440	BROADWAY EAST
1444	WELLS & BENNETT REALTORS
1448	BROADWAY EAST RESTAURANT
1460	LAS LOMAS HIGH SCHOOL
1495	EMIL VILLAS ORIGINAL HICKRY
1500	BARRY WEINBERGS FITNESS
1516	SWAN POOLS
1520	CELLULAR WORLD
	MARCIS SKIN CARE CTR
1530	DARLENE OLENJACK
	STATE FARM INSURANCE
1600	AIR CONDITIONING & REFRIG
	APOLLO COMMUNICATIONS
	ARCHITECTURAL DIMENSIONS
	BELL GROUP INC
	BIO MED THERAPY
	CAJUN JOES DEVELOPMENT
	CALIFORNIA CAPITAL
	CHASE MANHATTAN FINANCIAL SVC
	DARLEY INTERNATIONAL
	DAVIDON HOMES
	DWULET & DWULET
	EXECUTIVE AIR TRAVEL
	FAIRBANKS MORSE PUMP CORP
	FIRST EQUITY GROUP
	GMA RESEARCH CORP
	JOHN W HECKENLIVELY
	LAFAYETTE MORTGAGE
	LAND MASTERS REAL ESTATE SVC
	LANDCRAFT CORP
	MARLBOROUGH MANAGEMENT
	PEROXIDATION SYSTEMS INC
	PREFERRED MORTGAGE
	PUERTO RICO MARINE MANAGEMENT
	QUANTUM LEAP
	RETAIL PROPERTY DEVELOPMENT CO

S MAIN ST 1995 (Cont'd)

1600	SMITH BARNEY HARRIS UPHAM & CO
	SNAPP, PASTY
	SOS SECRETARIAL OFFICE SVC
	SUBWAY DEVELOPMENT CORP
	SYSNET
	TERRAZZO MOSAIC ASSN
	VALLEY HOME BROKERS
	VALLEY HOME LOANS
	VEXICON
	W W WARD & ASSOC
	WORLD OF BUSINESS

S MAIN ST 1992

1201	AMER SAVINGS&LN ASN
	BERKELEY SVNGS&LOAN
1231	GOODYEAR TIRE CNTR
1245	MEDALLION RUG GLRY
1275	ALL FOREIGN AUTO SV
1295	ROSS STORES INC
1300	FIRST NATIONWD SVGS
1305	SEVEN 11 FOOD 26083
1335	DIABLO CLEANERS
1390	ADVISORY SERV GROUP
	KEY HOLIDAYS
	MEDICAL PRSNNL POOL
	PERSONNEL POOL
	TAX DEFERRED SAVING
	TAYLOR ASSOCIATES
1420	DIABLO FINANCIAL CT
	HUFF, AUDREY K
1424	JOANNS
1426	PICTURE FRAME THE
1444	WELLS&BENNETT RLTRS
1448	BROADWAY EAST REST
1460	LAS LOMAS HI
1475	WALNT CRK INN
1495	HICKRY PIT
1500	CORSI J FITNESS EQP
1520	MARCIS SKIN CARE CT
1530	OLEJNICZAK, DARLENE A
	STATE FARM INS AGNT
1600	AETNA INSURANCE
	ALEXANDER LAND
	ANTARES RESOURCES
	APOLLO COMMNCTN
	ARCHITECTURAL DMNSN
	BELL GROUP INC
	BLACKBURN DEVLP CO
	CARLSON ASSOCIATES
	CENTRON DPL CO 1
	CHASE MANHATN FNCL
	CUNNINGHAM FOODS
	DAVIDON HOMES
	DRIGGARS REAL EST
	DWULET&DWULET
	E D I ARCH PLANNING
	EDLER&ASSOCIATES
	EXECUTIVE AIR TRVL
	FAIRBANKS MORSE PMP
	G M A RESEARCH CORP
	HEALTH RESRCH INST
	HECKENLIVELY J ATTY
	HEMINGWAY ASSOCIATE

S MAIN ST 1992 (Cont'd)

1600	IMAGE GROUP
	INTL PAPER COMPANY
	JONES STEPHEN
	KEELEY COMMNCTNS
	KOPPELMAN JAY L
	LAFAYT MORTGAGE
	MAKE BELIEVE FARM
	MARLBOROUGH MANGMNT
	MINE SAFETY APPLNCS
	NAVIERAS DE PUERTO
	NOR CA MORTGAGE
	PEOPLESOFT
	PEROXIDATION SYSTMS
	PLATT DONALD R ATTY
	RETAIL PROP DVLPMNT
	S O S SECRETARIAL 1
	SEARS MORTGAGE CORP
	SOS SCRTRL SERV 1
	SUBWAY DEVELOPMENT
	SUDER, LOIS M
	SYSNET
	WARD W W&ASSOCIATES
	WORLD OF BUSINESS

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

S MAIN ST 1985

1275	ALL FOREIGN AUTO SV	932-6888	0
1286	XXXX	00	
1288	BROADWAY SHOE RPR	934-0254	4
1290	WALNT CRK TOBACCNST	939-2242	4
1295	PICKLE DELI	933-9210	0
1300	FIRST NATIONWD SVGS	938-5720	3
1305	PARKER HOUSE LIQUOR	935-4100	
1322	XXXX	00	
1327	XXXX	00	
1329	XXXX	00	
1335	DIABLO CLEANERS	935-6670	
1390	GENERAL ELECTRIC CO	947-0550	4
	HOME SAVINGS OF AM	935-7015	

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

S MAIN ST 1980

1245	BRODERICK WM G	934-8625	6
*	HENDRICK PIANO CO	934-9304	
	NOECKER CARL B	935-5669	
*	RIVE GAUCHE SLN	938-8323	+0
*	SAFEWAY DRIVING SCH	933-3181	7
*	SKIN CARE CHRISTINE	938-5990	+0
	WORRALL PHYLLIS	938-7248	7
1275*	ALL FOREIGN AUTO SV	932-6888	+0
1286*	DEANS SHOES&REPAIRS	934-0254	
1290*	THE TINDER BOX	939-2242	
*	TINDER BOX PIPE SH	939-2242	
1295*	COOPERATIVE SHPG CT	935-6150	3
*	PICKLE DELI	933-9210	+0
1300*	DICKMAN BUILDERS	932-3074	+0
1305*	PARKER HOUSE LIQUOR	935-4100	
1322	XXXX	00	
1327	XXXX	00	
1335*	DIABLO CLEANERS	935-6670	
1345	XXXX	00	
1420*	AARON STETSON INS	935-0680	+0
*	DIVORCE CENTER	937-6320	
*	DIVORCE CTR DO OWN	937-6320	8
A	BODDUM CHRISTIAN P	937-8062	7
A*	CARLSON DOUGLAS ENG	938-4939	9

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

S MAIN ST 1975

```
1231*GOODYR TIRE&RBBR SV935-4820
1245 CHRISTIANSEN LLOYD 934-8625 3
    *HENDRICK PIANO CO  934-9304
    *K D F M MLTPLX STR0934-5300+5
    *KDFM MULTIPLEX STER934-5300
     NOECKER CARL B     935-5669
    *ROGER WILLIAMS MUSC937-8880 4
1275*BOB TURNERS TEXACO 937-0696 4
    *TURNERS TEXACO SERV937-0696 4
1286*DEANS SHOES&REPAIRS934-0254
1290*TINDER BOX PIPE SH 939-2242
1295*COOPERATIVE SHPG CT935-1522 4
    *COOPRTV SHPPNG CTRS935-6150 3
1305*PARKER HOUSE LIQUOR935-4100
1322*MIILU&MACPHERSON   934-9898
1327*KENS GUITAR STUDIO 939-0660+5
1335*DIABLO CLEANERS    935-6670
1345*GAGE RUSS          933-5300
    *RUSS ARCO SERVICE  933-5300 2
1420 OFLYNG RAY         937-3221 3
    *OPEN SPACE COMTE   933-3880+5
    *WAVE PROJECT THE   937-6339 4
```

Appendix I Caltrans ISA Checklist

APPENDIX DD - Hazardous Waste

Table of Contents

Preparation Guidelines for Initial Site Assessment (ISA) Checklist for Hazardous Waste

The ISA Checklist is a guide for district screening and assessment of projects for potential hazardous waste involvement. It is not intended to take a lot of time and effort to complete; however, some assessments may take longer to complete just because of the magnitude and/or location of a proposed project.

Project Information Section

Be sure that the Project Manager and Project Engineer have been identified. Do not begin the ISA until the written project description and location maps have been provided (Since hazardous waste could effect project development, it is important to know what type of work is proposed and where it will be located).

Location Map

It is suggested that the location map provided by Design be attached to the ISA Checklist to provide a record of the area that has been assessed, as well as the findings. All future project limit changes should cause Design to request further assessment for hazardous waste.

Project Screening Section

Items 1 and 2 are risk indicators that could be used to determine the level of effort required to complete the ISA. Generally, a project that requires new right of way, excavation, structure modification or demolition, or utility relocation will have a greater potential for hazardous waste involvement than a project that does not include these features. An urban location would generally present more of a risk than a rural location; industrial land uses would generally be more risky than commercial uses; and so on.

Items 3 through 6 deal with the actual assessment:

- First, check available records to see if a known site is present. This item should not take a lot of effort, but it will require contacting the Regional Water Quality Control Board, the Department of Health Services, and the city/county agencies that deal with leaking underground tanks.

- Next, conduct a field inspection to look for indicators of potential hazardous waste or contamination. Identify businesses that store or use potentially hazardous materials (service stations, auto wrecking yards, paint companies, machine shops, metal platers, electronic manufacturers, dry cleaners, agricultural chemical suppliers, etc.). Other things to look for include landfills and dumps, surface storage of potentially hazardous materials (sumps, pits, steel drums, etc.), illegal dumping sites (especially on rural projects), and serpentine.

- Based on the field inspection, if there may have been a previous land use that could still present a hazardous waste or contamination risk, it may be necessary to verify the previous land use (e.g., abandoned service stations can usually be identified by the type of structure and location: the underground tank may still be there).

ISA Determination

The ISA determination is simply "Yes" or "No."

NO: No findings have been made that would indicate a known or potential hazardous waste problem within or near the proposed project.

YES: A known or potential site has been identified that could affect the proposed project and will take more time and effort to define and coordinate cleanup options.

Caltrans Metric

Initial Site Assessment (ISA) Checklist

Project Information

District _4_ County _CC_ Route _N/A_ Post Mile _N/A______ EA _N/A________

Description The City of Walnut Creek is proposing to replace the South Main Street five-span reinforced concrete "T"-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek.

Is the project on the HW Study Minimal-Risk Projects List (HW1)? No

Project Manager Tony Jones phone # 925.941.0017 x223

Project Engineer ______________________ phone # ______________________

Project Screening

Attach the project location map to this checklist to show location of all known and/or potential HW sites identified.

1. Project Features: New R/W? No Excavation? Yes Railroad Involvement? No

   Structure demolition/modification? Yes Subsurface utility relocation? Yes

2. Project Setting Located on South Main Street over Las Trampas Creek.

   Rural or Urban Urban

   Current land uses Roadway

   Adjacent land uses Mixed Use Commercial Residential
   (industrial, light industry, commercial, agricultural, residential, etc.)

3. Check federal, State, and local environmental and health regulatory agency records as necessary, to see if any known hazardous waste site is in or near the project area. If a known site is identified, show its location on the attached map and attach additional sheets, as needed, to provide pertinent information for the proposed project.

4. Conduct Field Inspection. Date July 2017 Use the attached map to locate potential or known HW sites.

   STORAGE STRUCTURES / PIPELINES:

   Underground tanks None Observed Surface tanks None Observed

   Sumps None Observed Ponds None Observed

   Drums None Observed Basins None Observed

   Transformers None Observed Landfill None

   Other Underground transformers are likely present, but weren't observed.

Initial Site Assessment (ISA) Checklist

(continued)

CONTAMINATION: (spills, leaks, illegal dumping, etc.)

Surface staining Yes on roadway Oil sheen None Observed

Odors None Observed Vegetation damage None Observed

Other ______

HAZARDOUS MATERIALS: (asbestos, lead, etc.)

Buildings Potential asbestos and LBP on bridge Spray-on fireproofing None Observed

Pipe wrap Some side-mounted utilities might be pipe wrapped Friable tile None Observed

Acoustical plaster None Observed Serpentine None Observed

Paint LBP potentially on bridge rails Other Striping potentially LBP

5. Additional record search, as necessary, of subsequent land uses that could have resulted in a hazardous waste site. Use the attached map to show the location of potential hazardous waste sites.

6. Other comments and/or observations: Main potential sources for HW within the Project area are contaminants including oil/petroleum products ending up on the site via roadway traffic, asbestos around old utility lines, and lead-based paint in the railings and/or pavement striping.

ISA Determination

Does the project have potential hazardous waste involvement? Yes If there is known or potential hazardous waste involvement, is additional ISA work needed before task orders can be prepared for the Investigation? Yes If "YES," explain; then give an estimate of additional time required: A Phase II Environmental Site Assessment is recommended.

A brief memo should be prepared to transmit the ISA conclusions to the Project Manager and Project Engineer.

ISA Conducted by Flannery Banks **Date** 7/14/17

Appendix J Site Photos

Las Trampas Creek Bridge at South Main Street Replacement Project
LBP/ACM Sampling – August 3, 2017

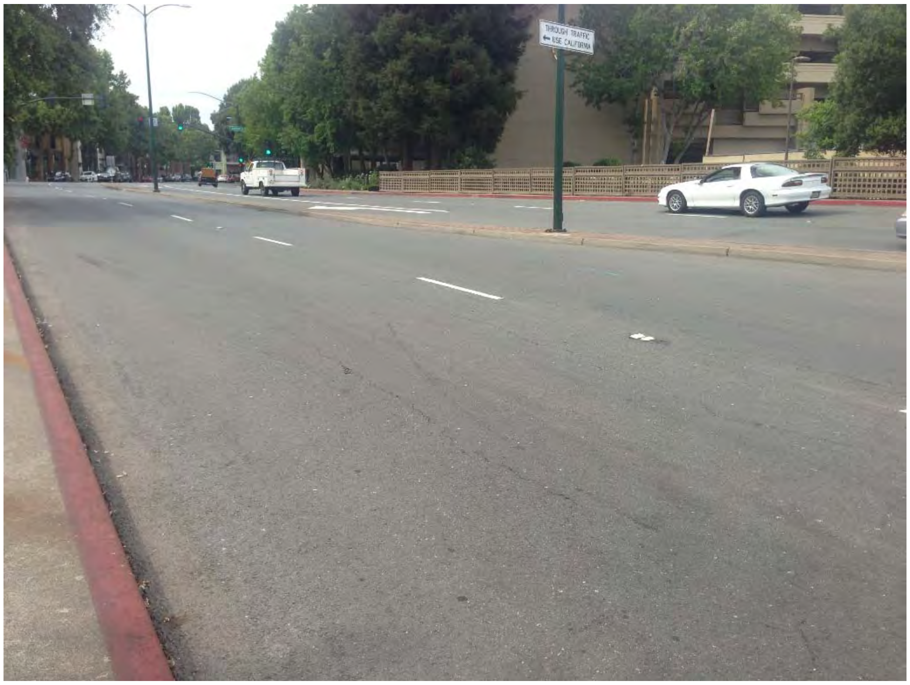


Photo 1. Looking NE towards parking structure on South Main St, Las Trampas Creek Bridge, overview of potential LBP and ACM sampling points

Photo 2. Sample ASB-01 taken from the concrete sidewalk along the western side of the bridge

Photo 3. Sample LBP-01 taken from the brown metal railing paint along the western side of the bridge

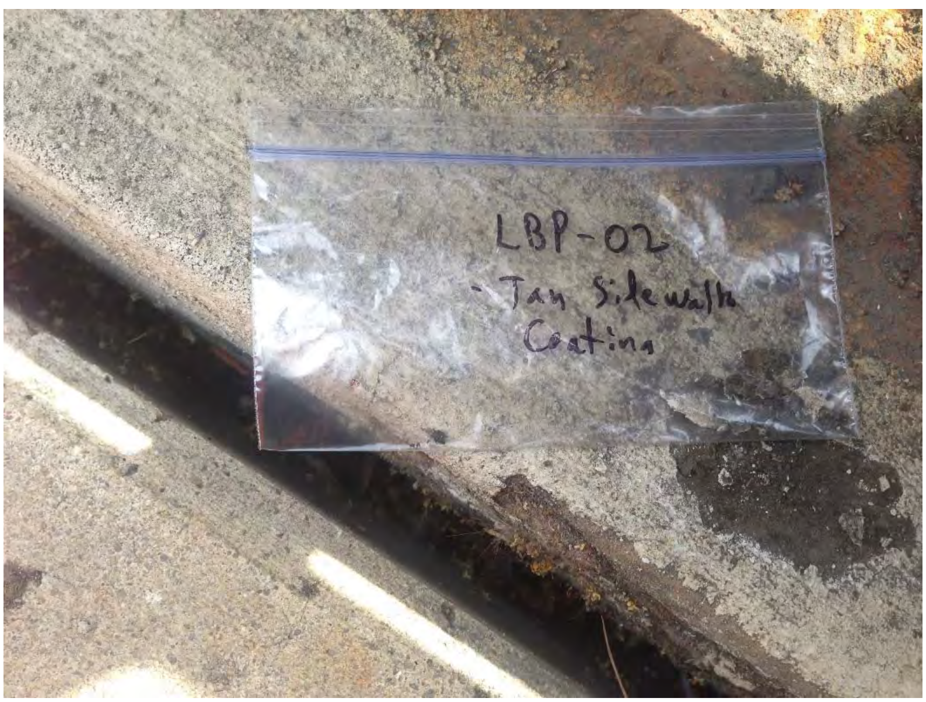


Photo 4. Sample LBP-02 taken from the tan sidewalk coating along the western side of the bridge

Photo 5. (left) Sample LBP-03 taken from the green paint on the light post in the center median; (right) photo showing light post in the center median

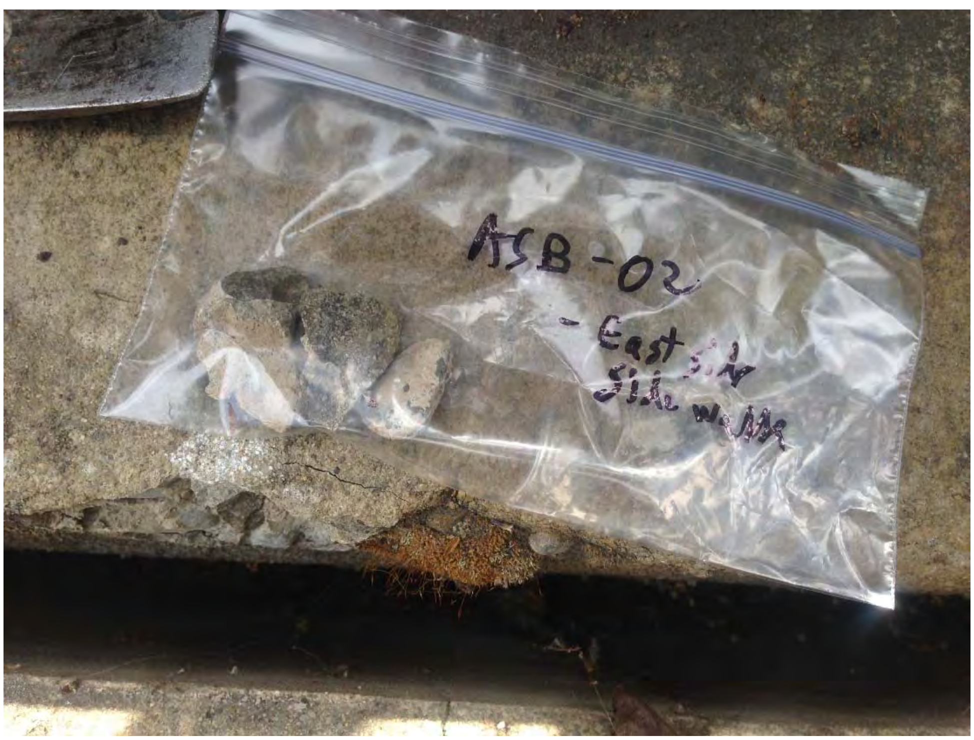


Photo 6. Sample ASB-02 taken from concrete above the stormwater drain on the east side of the bridge

Photo 7. Sample ASB-03 taken from asphalt roadway along the east side of the center median


Photo 8. Sample LBP-04 taken from red painted concrete curb along sidewalk on west side of the bridge

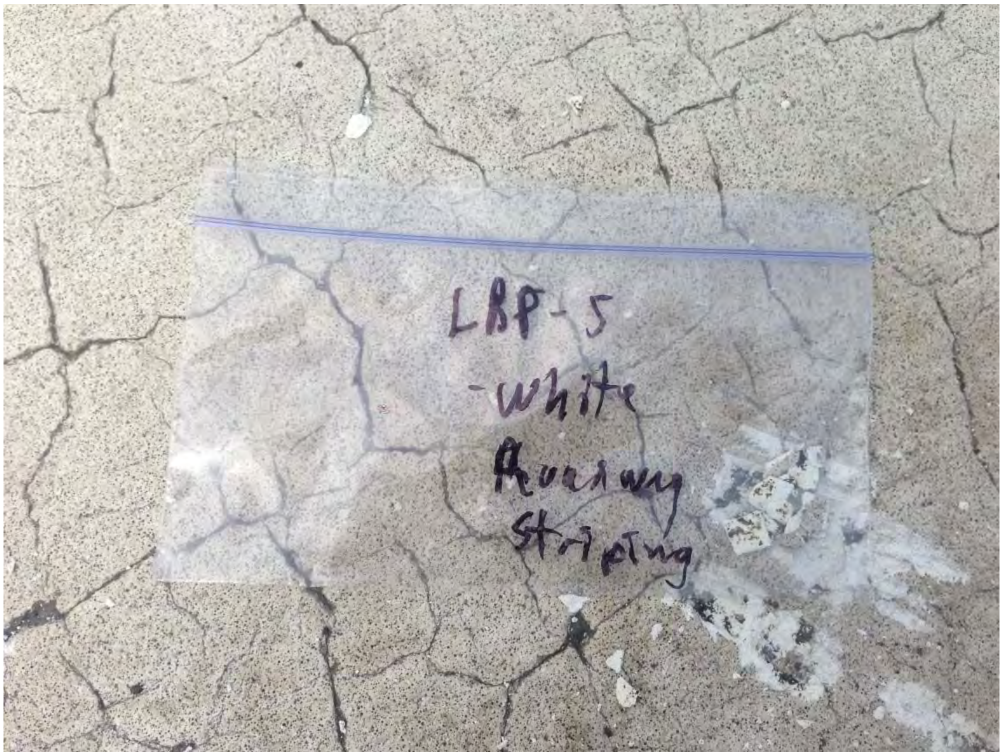


Photo 9. Sample LBP-05 taken from white roadway striping along the northbound side of the bridge

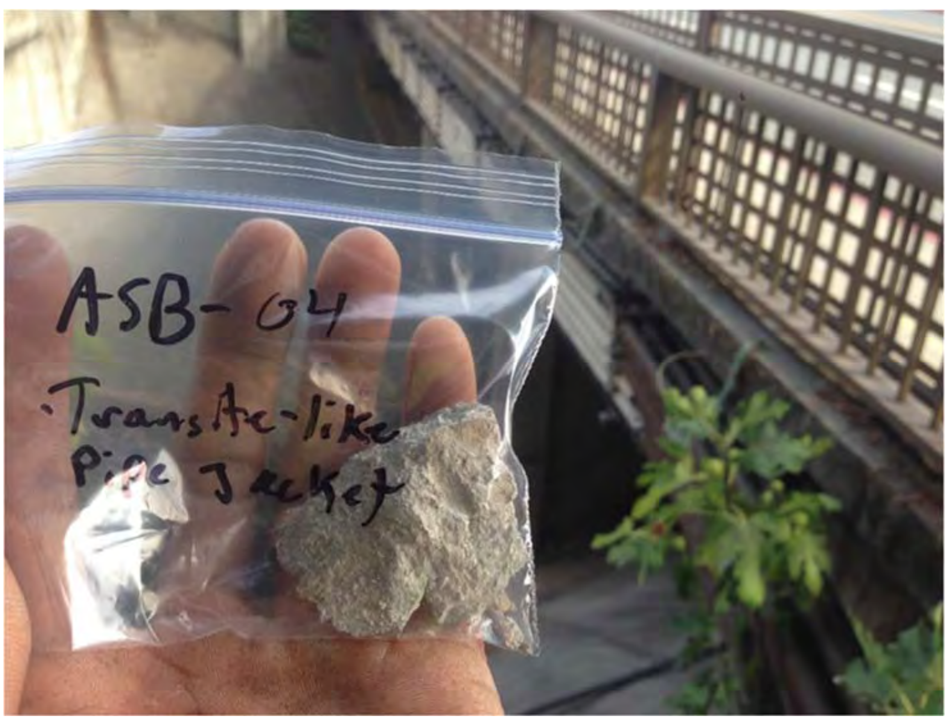
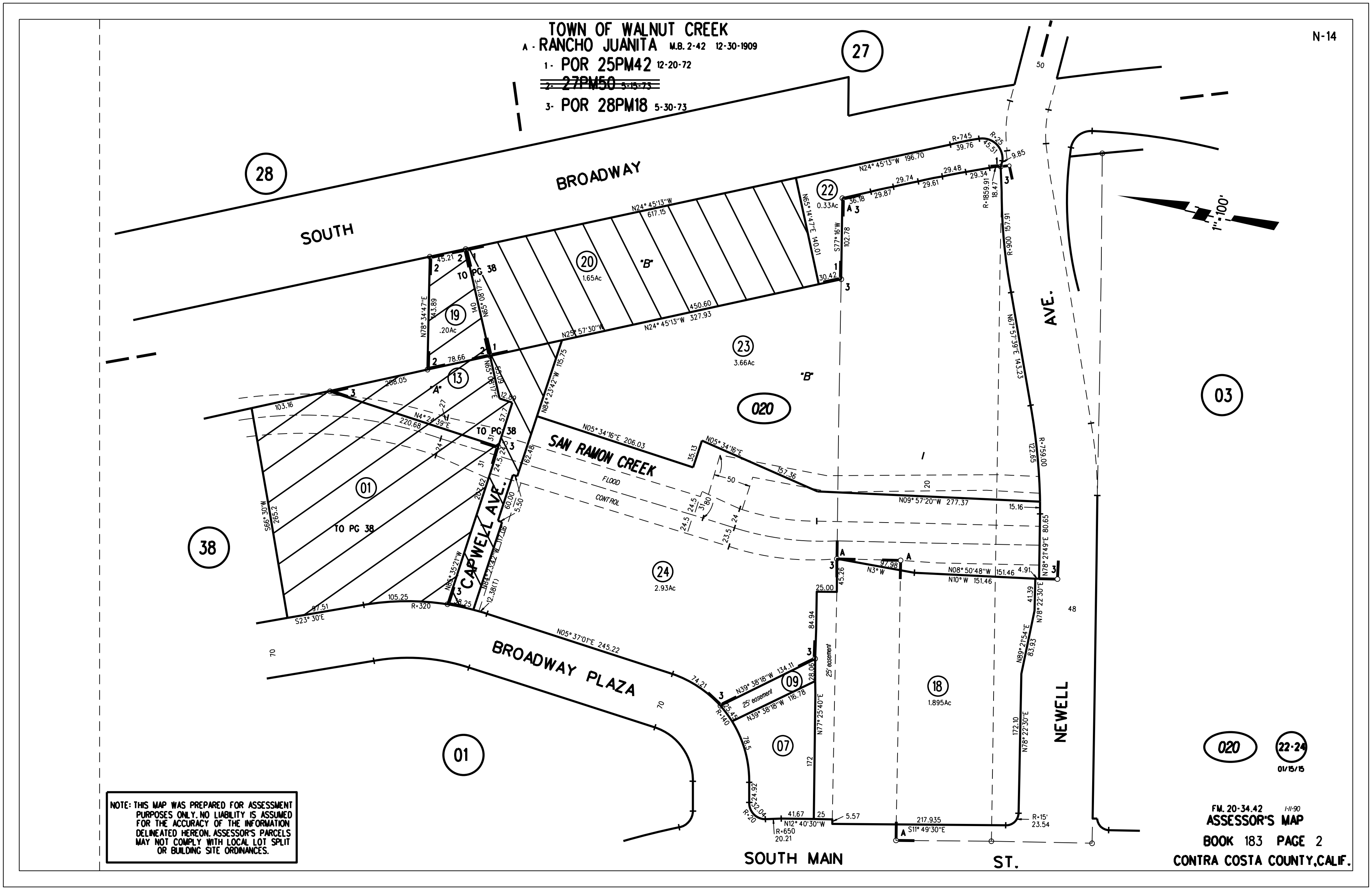


Photo 10. Sample ASB-04 taken from transite-like pipe cover (jacket) on east side of the bridge


Photo 11. Closeup of utilities and transite-like pipe cover along east side of the bridge

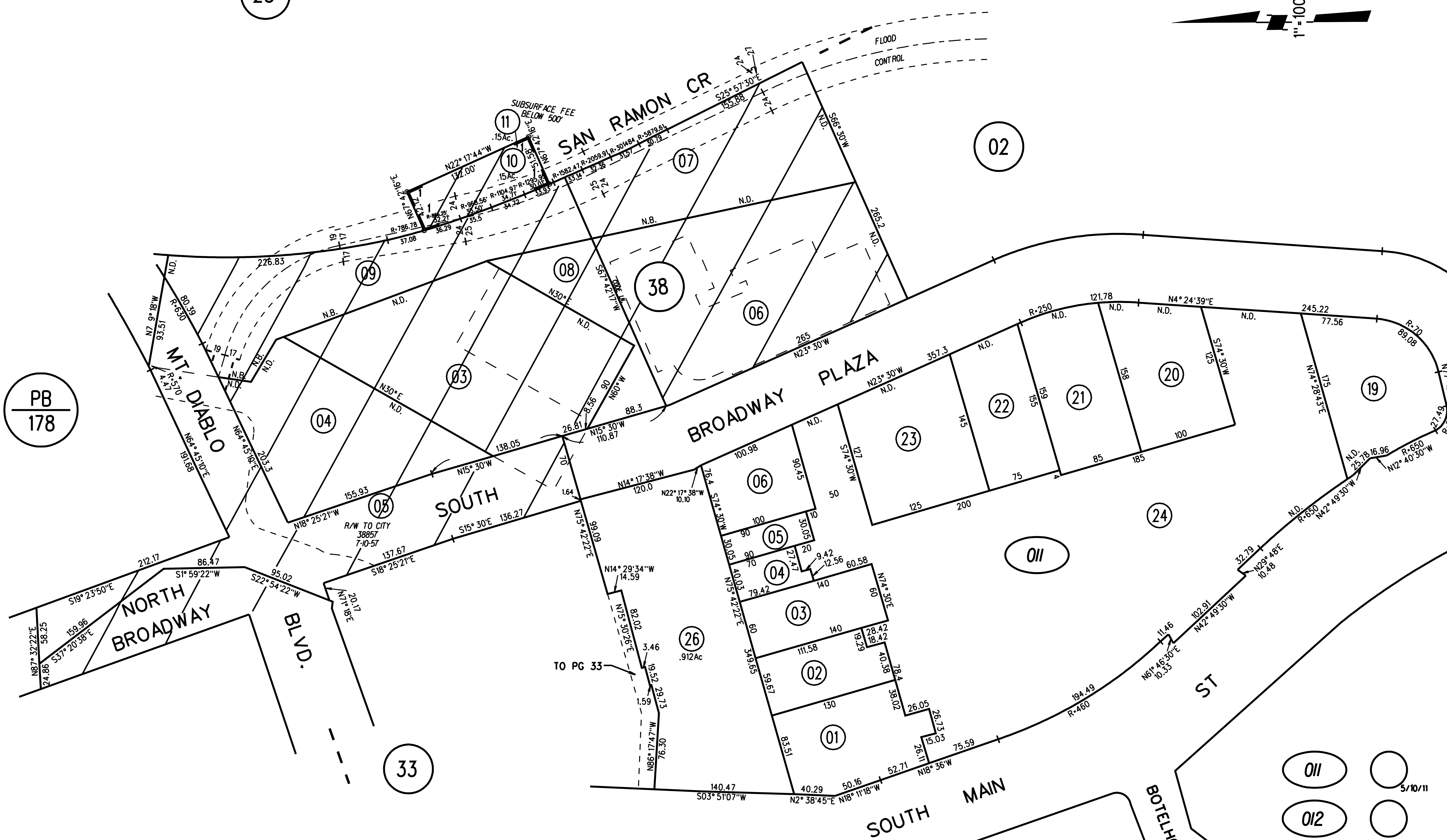

Photo 12. Overview of LBP samples (LBP-01 – LBP-05) and ACM samples (ACM-01 – ACM-04) prior to submitting to TestAmerica Laboratories.

Appendix K Field Data Sheets and Boring Logs



TOWN OF WALNUT CREEK
A - RANCHO JUANITA M.B. 2-42 12-30-1909
1- POR 25PM42 12-20-72
2- ~~27PM50 5-15-73~~
3- POR 28PM18 5-30-73
N-14
SOUTH BROADWAY
SAN RAMON CREEK
FLOOD CONTROL
CAPWELL AVE.
BROADWAY PLAZA
NEWELL AVE.
SOUTH MAIN ST.
TO PG 38
1" = 100'
020
22-24
01/15/15
NOTE: THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE INFORMATION DELINEATED HEREON. ASSESSOR'S PARCELS MAY NOT COMPLY WITH LOCAL LOT SPLIT OR BUILDING SITE ORDINANCES.
FM. 20-34.42 1-11-90
ASSESSOR'S MAP
BOOK 183 PAGE 2
CONTRA COSTA COUNTY, CALIF.

TOWN OF WALNUT CREEK
1- 24PM28 9/27/1972



NOTE: THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE INFORMATION DELINEATED HEREON. ASSESSOR'S PARCELS MAY NOT COMPLY WITH LOCAL LOT SPLIT OR BUILDING SITE ORDINANCES.

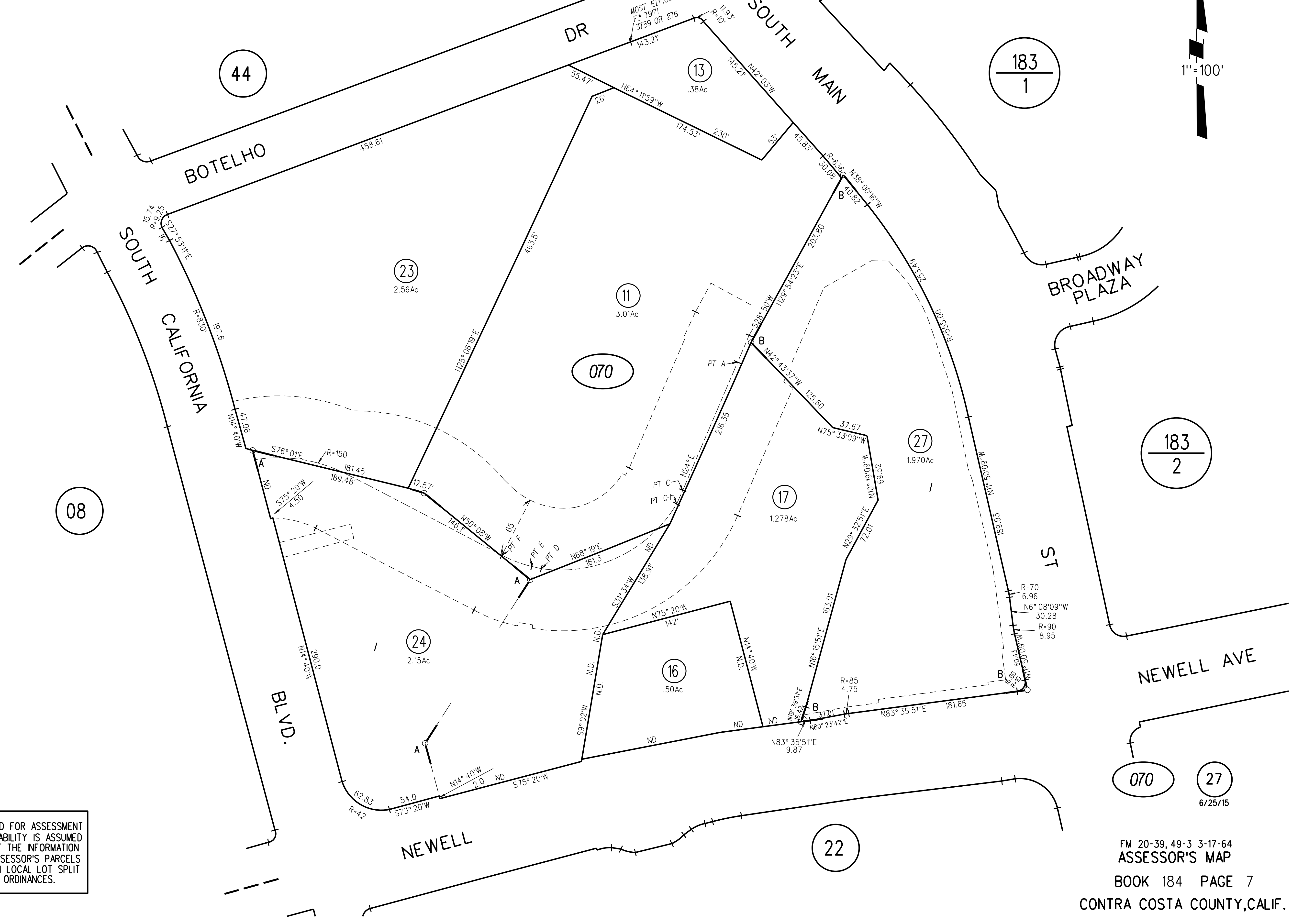
FM. 20-34
ASSESSOR'S MAP
BOOK 183 PAGE 1
CONTRA COSTA COUNTY, CALIF.

N-14

RANCHO SAN RAMON

A- NEWELL TRACT MB 24-746 2/24/1940

B- 2016 ROLL- TRACT 9273 MB 523-9 (NEWELL VILLAGE) 3/31/15



NOTE: THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE INFORMATION DELINEATED HEREON. ASSESSOR'S PARCELS MAY NOT COMPLY WITH LOCAL LOT SPLIT OR BUILDING SITE ORDINANCES.

070 27
6/25/15

FM 20-39, 49-3 3-17-64

ASSESSOR'S MAP

BOOK 184 PAGE 7

CONTRA COSTA COUNTY, CALIF.

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
D. Lukashov	**8-3-17**	**8-3-17**		**A-17-001A**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration		**149.1 ft**
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hand Auger	**CME-75 Truck Mounted**	**6"**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk	**N/A**	
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING: **Not encountered.** — AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Native soil; top 4" quickset concrete dyed black.		**3.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (14").		S-1									
	1													
			Poorly-graded GRAVEL (GP); brown; dry; mostly fine to coarse GRAVEL ; little fine to coarse SAND ; trace fines ; (FILL).											
147.09	2													
			Poorly-graded SAND (SP); brown; dry; mostly fine to coarse SAND ; trace fines ; (FILL).											
	3		Bottom of borehole at 3.0 ft bgs Terminated on buried obstruction. This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.											
145.09	4													
	5													
143.09	6													
	7													
141.09	8													
	9													
	10													

WRECO
8331 Sierra College Blvd., Suite 208
Granite Bay, CA 95661
(916) 757-6150

REPORT TITLE				HOLE ID
BORING RECORD				**A-17-001A**
DIST. **04**	COUNTY **Contra Costa**	ROUTE	POSTMILE	PROJECT NO. **P17043**
PROJECT OR BRIDGE NAME **Las Trampas Creek Bridge Replacement Project**				
BRIDGE NUMBER	PREPARED BY **A. Kahn**		DATE **8-4-17**	SHEET **1 of 1**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
D. Lukashov	**8-3-17**	**8-3-17**		**A-17-001B**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration		**149.0 ft**
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hand Auger	**CME-75 Truck Mounted**	**6"**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
	N/A	
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Native soil; top 4" quickset concrete dyed black.	DURING DRILLING: **Not encountered.**	**3.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (14").											
	1													
147.04	2		Poorly-graded GRAVEL (GP); brown; dry; mostly fine to coarse GRAVEL ; little fine to coarse SAND ; trace fines ; (FILL).											
			Poorly-graded SAND (SP); brown; dry; mostly fine to coarse SAND ; trace fines ; (FILL).											
	3		Bottom of borehole at 3.0 ft bgs Terminated on buried obstruction. This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.											
145.04	4													
	5													
143.04	6													
	7													
141.04	8													
	9													
	10													

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Granite Bay, CA 95661
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REPORT TITLE				HOLE ID
BORING RECORD				**A-17-001B**
DIST. **04**	COUNTY **Contra Costa**	ROUTE	POSTMILE	PROJECT NO. **P17043**
PROJECT OR BRIDGE NAME **Las Trampas Creek Bridge Replacement Project**				
BRIDGE NUMBER	PREPARED BY **A. Kahn**		DATE **8-4-17**	SHEET **1 of 1**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
D. Lukashov	8-3-17	8-3-17		A-17-001C

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration		149.2 ft
DRILLING METHOD	**DRILL RIG**	**BOREHOLE DIAMETER**
Hand Auger	CME-75 Truck Mounted	6"
SAMPLER TYPE(S) AND SIZE(S) (ID)	**SPT HAMMER TYPE**	**HAMMER EFFICIENCY, ERi**
	N/A	
BOREHOLE BACKFILL AND COMPLETION	**GROUNDWATER READINGS — DURING DRILLING / AFTER DRILLING (DATE)**	**TOTAL DEPTH OF BORING**
Native soil; top 4" quickset concrete dyed black.	Not encountered.	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (14").											
	1													
			Poorly-graded GRAVEL (GP); brown; dry; mostly fine to coarse GRAVEL ; little fine to coarse SAND ; trace fines ; (FILL).											
147.22	2													
			Poorly-graded SAND (SP); brown; dry; mostly fine to coarse SAND ; trace fines ; (FILL).											
	3		Bottom of borehole at 3.0 ft bgs Terminated on buried obstruction. This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.											
145.22	4													
	5													
143.22	6													
	7													
141.22	8													
	9													
	10													

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REPORT TITLE				HOLE ID
BORING RECORD				A-17-001C
DIST.	**COUNTY**	**ROUTE**	**POSTMILE**	**PROJECT NO.**
04	Contra Costa			P17043
PROJECT OR BRIDGE NAME				
Las Trampas Creek Bridge Replacement Project				
BRIDGE NUMBER	**PREPARED BY**	**DATE**	**SHEET**	
	A. Kahn	8-4-17	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
D. Lukashov	**8-2-17**	**8-2-17**	**0.0 ft / 1.0 ft**	**R-17-001**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration		**149.4 ft**

DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Rotary Wash	**CME-75 Truck Mounted**	**4.5"**

SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4"), Cal (2.5")	**Automatic/140lbs/30" drop**	**72%**

BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS	DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat cement grout; top 4" quickset concrete dyed black.		**24.5 ft**	**21.5 ft on 8-2-17 8:56AM**	**30.1 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Remarks
	0	ASPHALT CONCRETE (12").	S-1			100				
		Lean CLAY with SAND (CL); medium stiff; reddish brown; slightly moist; little fine SAND ; mostly fines ; PP=0.75 -1.0 tsf.								
144.42	5		S-2	3 3 5	8	72		83	24	PA, PI
139.42	10		S-3	3 3 4	7	50				
		SANDY lean CLAY (CL); medium stiff; brown; moist; some fine SAND ; mostly fines ; PP=0.5 tsf.								
134.42	15		S-4	3 4 4	8	100				
129.42	20		S-5	3 3 4	7	100			22	CR, PI
124.42	25		S-6	5 7 8	15	83		61	18	PA, PI
119.42	30	Gray; low plasticity fines ; PP=0.75 tsf.	S-7	3 4 5	9	100				
114.42	35		S-8	3 3 5	8	100				
		2" lens of poorly-graded SAND (SP), fine to coarse.								
		SILTY SAND (SM); medium dense; gray; wet; mostly fine to medium SAND ; few fines.								
	40									

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-17-001**
DIST. **04**	COUNTY **Contra Costa**	ROUTE	POSTMILE	PROJECT NO. **P17043**
PROJECT OR BRIDGE NAME **Las Trampas Creek Bridge Replacement Project**				
BRIDGE NUMBER	PREPARED BY **A. Kahn**	DATE **8-3-17**	SHEET **1 of 2**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Remarks
	40	SILTY SAND (SM) *(continued)*.	S-9	4 5 7	12	94				
		Poorly-graded SAND with SILT (SP-SM); medium dense; gray; wet; mostly fine to coarse SAND ; little low plasticity fines.								
104.42	45		S-10	7 11 14	25	89		20		PA
99.42	50		S-11	4 5 7	12	78				
94.42	55	Approximately 6" thick gravelley layer.								
89.42	60	Dense; some fine GRAVEL.	S-12	11 15 25	40	89				
		Poorly-graded SAND with SILT (SP-SM); very dense; grayish brown; wet; mostly fine to medium SAND ; little nonplastic fines ; (SEDIMENTARY ROCK, decomposed).								
84.42	65		S-13	50/4"		100				
79.42	70									
74.42	75		S-14	50/3"		100				
69.42	80	Bottom of borehole at 80.1 ft bgs Terminated at planned depth This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.	S-15	50/1"		0				
64.42	85									

WRECO
8331 Sierra College Blvd., Suite 208
Granite Bay, CA 95661
(916) 757-6150

REPORT TITLE				HOLE ID
BORING RECORD				**R-17-001**
DIST. **04**	COUNTY **Contra Costa**	ROUTE	POSTMILE	PROJECT NO. **P17043**
PROJECT OR BRIDGE NAME **Las Trampas Creek Bridge Replacement Project**				
BRIDGE NUMBER	PREPARED BY **A. Kahn**	DATE **8-3-17**		SHEET **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
D. Lukashov	**9-6-17**	**9-6-17**	**5.0 ft / 1.0 ft**	**R-17-003**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration		**149.6 ft**

DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Rotary Wash	**CME-75 Truck Mounted**	**4"**

SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
86.8	**Automatic/140lbs/30" drop**	**72%**

BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS	DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat cement grout; top 4" quickset concrete dyed black.		**18.0 ft**		**86.8 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Remarks
	0	ASPHALT CONCRETE (3").	S-1			100				
		AGGREGATE BASE (8").								
		CLAYEY GRAVEL (GC); light brown; dry; mostly fine to coarse GRAVEL ; little fine to coarse SAND ; some low plasticity fines.								
		SANDY lean CLAY (CL); stiff; light brown; dry; some fine to coarse SAND ; mostly medium plasticity fines ; PP=1.5 tsf.								
144.60	5		S-2	4 7 8	15					
			S-3	3 4 5	9	100				
139.60	10		S-4	2 3 6	9					
			S-5	4 4 5	9	100		54	12	PA, PI
134.60	15									
		Lean CLAY with SAND (CL); stiff; dark gray; moist; few fine SAND ; mostly low plasticity fines ; PP=1.5 tsf.								
129.60	20		S-6	3 5 6	11	100				
			S-7	4 6 8	14	0				
124.60	25									
		SANDY lean CLAY (CL); stiff; dark gray; moist; some fine to coarse SAND ; mostly low plasticity fines ; PP=1.5 tsf.								
119.60	30		S-8	2 2 2	4	100		66	11	PA, PI
114.60	35									
	40									

(continued)

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(916) 757-6150

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	RQD (%)	Fines (%)	Plasticity Index	Drilling Method	Casing Depth	Remarks
	40		SANDY lean CLAY (CL) *(continued)*.		S-9	4 5 6	11	94						
104.60	45		PP=1.0 tsf.											
99.60	50				S-10	3 4 8	12	83						
94.60	55		Poorly-graded SAND with CLAY (SP-SC); medium dense; dark gray; wet; mostly fine to coarse SAND ; little low plasticity fines.											
89.60	60				S-11	10 12 11	23	78		19				PA
84.60	65		SEDIMENTARY ROCK; dark gray; intensely weathered; (Poorly-graded GRAVEL with SILT; very dense; mostly fine to coarse SAND; few low plasticity fines).											
79.60	70				S-12	25 50/3"		100						
			SEDIMENTARY ROCK (SANDSTONE); fine grained; grayish black; intensely weathered; moderately soft.		C-01			0	0					
					C-02			97	10					
74.60	75		Moderately weathered; moderately hard; moderately fractured.		C-03			98	36					
69.60	80		Extensive fracturing due to mechanical breaks.		C-04			100	0					
64.60	85													

Bottom of borehole at 86.8 ft bgs
Terminated at planned depth

This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock legend or below.

WRECO
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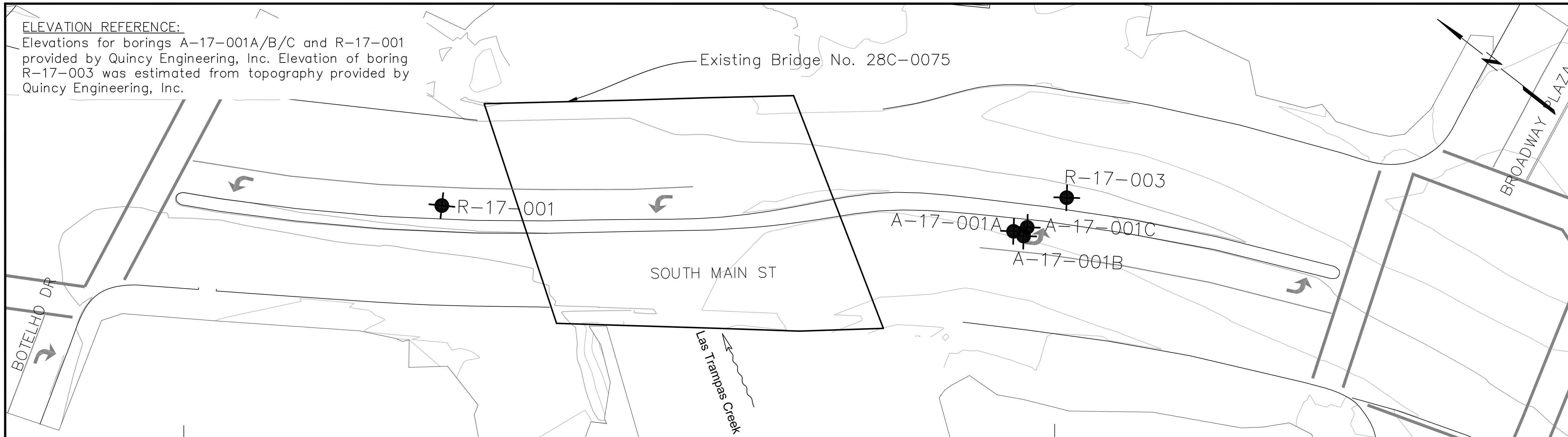
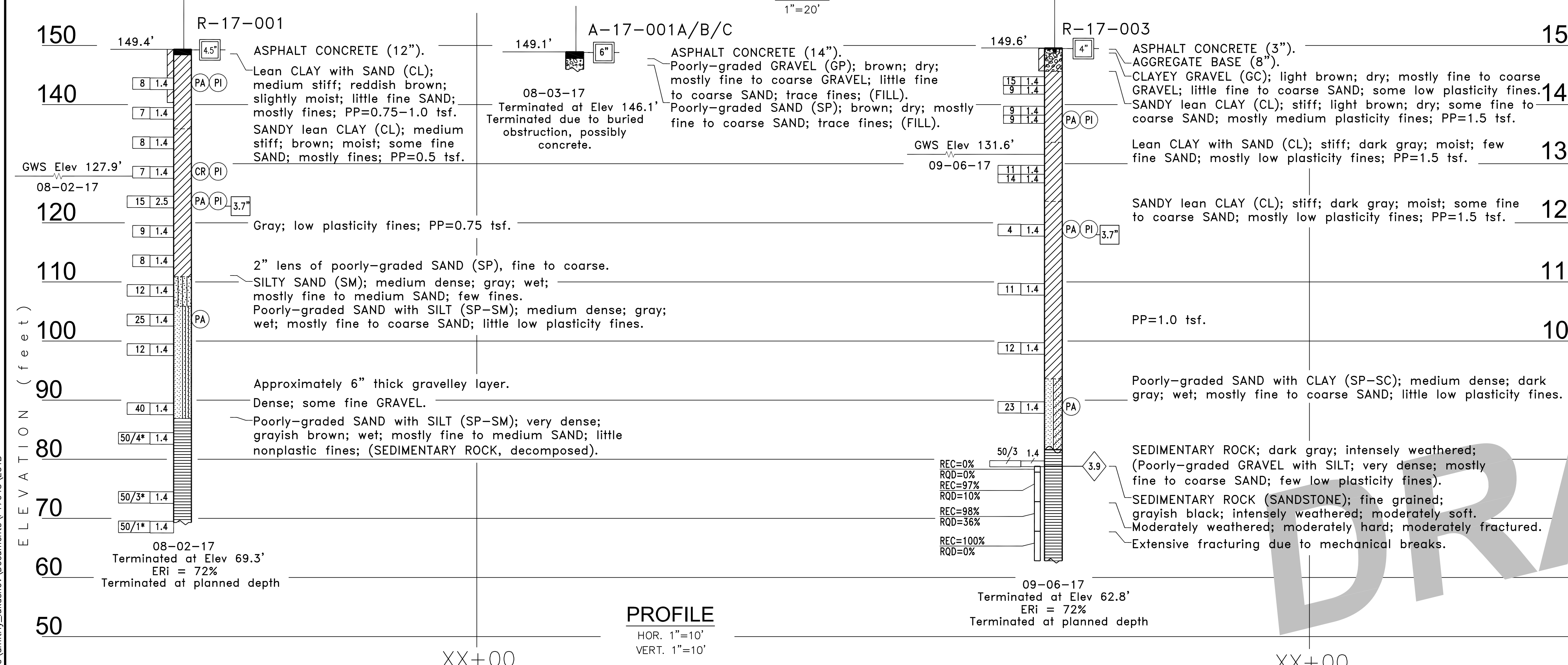
Granite Bay, CA 95661
(916) 757-6150

REPORT TITLE					HOLE ID
BORING RECORD					R-17-003
DIST. 04	COUNTY Contra Costa	ROUTE	POSTMILE		PROJECT NO. P17043
PROJECT OR BRIDGE NAME Las Trampas Creek Bridge Replacement Project					
BRIDGE NUMBER	PREPARED BY A. Kahn			DATE 9-7-17	SHEET 2 of 2



PLAN
1"=20'



PROFILE
HOR. 1"=10'
VERT. 1"=10'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	XX			

CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

REGISTERED GEOLOGIST DAVID A. KITZMANN No. 2412 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

WRECO
8331 SIERRA COLLEGE BLVD.
ROSEVILLE, CALIFORNIA 95661 WRECO JOB NO: P17043

QUINCY ENGINEERING, INC.
11017 COBBLEROCK DRIVE, SUITE 100
RANCHO CORDOVA, CALIFORNIA 95670

Notes:

1. Field classification of soils was in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010 Edition).

2. 1.4" samples were taken using a 1.375" split barrel sampler per Standard Penetration Test (SPT) performed in accordance with ASTM D1586-11.

3. 1.4" and 2.5" samples were taken with an automated hammer system consisting of a hammer weight of 140 lbs. free falling a distance of 30". Autohammer energy ratio (ETR) measurements indicate an ETR=72%. The last 12" of an 18" drive were recovered as the blow count number required to drive the sampler.

4. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-11. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 6" "seating drive" interval penetration. Material characteristics shown in ( ) where estimated.

5. The blow counts shown on the logs are the raw blow counts which have not been corrected for hammer energy, sample size, overburden, or any other correction factor.

6. The apparent density of granular soil is based on a corrected Standard Penetration Test N60 value.

7. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheet reflects the fluid level in the borings on the specified date.

8. Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.

9. Boring locations were measuring in the field based on existing site features and correlated project data provided by Quincy Engineering, Inc.

10. Electronic media for plan view provided by Quincy Engineering, Inc.

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR X	DRAWN BY: D. Lukashov	FIELD INVESTIGATION BY: D. Lukashov	DATE: 08/02/17 & 09/06/17
	CHECKED BY: A. Kahn		

PREPARED FOR THE
CITY OF WALNUT CREEK
ENGINEERING DEPARTMENT

XX
PROJECT ENGINEER

BRIDGE NO. XXX-XXXX
POST MILE XX.XX

LAS TRAMPAS CREEK BRIDGE AT SOUTH MAIN STREET REPLACEMENT PROJECT
LOG OF TEST BORINGS

CU XXXXXX
EA XXXXXX

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET XX OF XX

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

Appendix L Laboratory Analytical Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-81061-1
Client Project/Site: Las Trampas Creek Bridge

For:
WRECO
1243 Alpine Road
Suite 108
Walnut Creek, California 94596

Attn: Tony Jones

Authorized for release by:
8/10/2017 9:10:14 AM

Cherie Cuellar, Project Management Assistant I
(925)484-1919
cherie.cuellar@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

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Job ID: 720-81061-1

Laboratory: TestAmerica Pleasanton

Narrative

Job Narrative
720-81061-1

Comments
No additional comments.

Receipt
The samples were received on 8/3/2017 4:00 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 26.8º C.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Subcontract Work
Method General Sub Contract Method: This method was subcontracted to EMLab P&K - Denver. The subcontract laboratory certification is different from that of the facility issuing the final report.

Method General Sub Contract Method: This method was subcontracted to Quantem Laboratories. The subcontract laboratory certification is different from that of the facility issuing the final report.

2033 Heritage Park Dr, Oklahoma City, OK 73120 | 1.800.822.1650

Environmental Chemistry Analysis Report

QuanTEM Set ID: 283552
Date Received: 08/08/17
Received By: Sherrie Leftwich
Date Sampled:
Time Sampled:
Analyst: CR
Date of Report: 08/09/17

AIHA ID: 101352

Client: Test America Laboratories - Sacramento
Karen Dahl
880 Riverside Pkwy
West Sacramento, CA 95605

Acct. No.: C021

Project: Las Trampas Creek Bridge
Location: N/A
Project No.: 72011466

QuanTEM ID	Client ID	Matrix	Parameter	Results	Reporting Limits	Units	Date/Time Analyzed	Method
001	LBP-01 (720-81061-	Paint	Lead	<48.9	48.9	ppm	08/08/17 15:13	P EPA 7000B (1)
002	LBP-02 (720-81061-	Bulk	Lead	61.7	49.4	mg/kg	08/09/17 10:43	B EPA 7000B (1)
003	LBP-03 (720-81061-	Paint	Lead	104	49.6	ppm	08/08/17 15:13	P EPA 7000B (1)
004	LBP-04 (720-81061-	Bulk	Lead	<49.9	49.9	mg/kg	08/09/17 10:43	B EPA 7000B (1)
005	LBP-05 (720-81061-5	Bulk	Lead	<49.9	49.9	mg/kg	08/09/17 10:43	B EPA 7000B (1)

Authorized Signature: Cherry Rossen
Cherry Rossen, Technical Manager

Note: Sample results have not been corrected for blank values.

This report applies only to the standards or procedures indicated and to the specific samples tested. It is not indicative of the qualities of apparently identical or similar products or procedures, nor does it represent an ongoing assurance program unless so noted. These reports are for the exclusive use of the client and are not to be reproduced without specific written permission. QuanTEM is not responsible for user-supplied data used in calculations.

Unless otherwise noted, upon receipt the condition of the sample was acceptable for analysis.

Wipe materials must meet ASTM E1792 criteria. Method detection limits and resultant reporting limits may not be valid for non-ASTM E1792 wipe material.

EPA Method 7000B (1) = EPA 600/R-93/200 Preparation Modified. EPA 7000B Analysis Modified

EPA Method 7082 (2) = EPA 600/R-93/200 Preparation Modified. EPA 7082 Analysis Modified

Supplemental Report
QAQC Results

QA ID: **15528** | **Date:** 8/8/2017 | **Lab Number:** 283552
Test: Lead | **Matrix:** Paint | **Approved By:** Cherry Rossen
Date Approved: 8/8/2017

Notes:

Blank Data:

Type of Blank	Blank Value
FCB	0
ICB	0
Matrix Blank	0
Matrix Blank	0

Standards Data:

Standard	Low Limit	Obtained	High Limit
CCV	4.5	4.8	5.5
FCV	4.5	4.9	5.5
ICV	0.9	1.1	1.1

Duplicate Data:

Sample Number	Result	Duplicate	% RPD
283439-017	17.425	14.661	17.2

Recovery Data:

Sample Number	Result	Spike Level	Result + Spike	% Recovery	Dup. Result + Spike	% Dup. Recovery	% Spike RPD
LCS-P1	0.000	2.228	2.085	93.6	2.561	114.9	20.5
LCS-P2	0.000	2.226	2.423	108.9	2.304	103.5	5.1

Authorized Signature: Cherry Rossen

Cherry Rossen, Technical Manager

Supplemental Report
QAQC Results

QA ID: **15529** | **Date:** 8/9/2017 | **Lab Number:** 283552
Test: Lead | **Matrix:** Bulk | **Approved By:** Cherry Rossen
Date Approved: 8/9/2017

Notes:

Blank Data:

Type of Blank	Blank Value
FCB	0
ICB	0
Matrix Blank	0

Standards Data:

Standard	Low Limit	Obtained	High Limit
CCV	4.5	4.8	5.5
FCV	4.5	4.8	5.5
ICV	0.9	1.1	1.1
RLVS	0.08	0.22	0.24

Duplicate Data:

Sample Number	Result	Duplicate	% RPD
283552-004	0.061	0.068	11.1

Recovery Data:

Sample Number	Result	Spike Level	Result + Spike	% Recovery	Dup. Result + Spike	% Dup. Recovery	% Spike RPD
LCS-B1	0.000	2.450	2.599	106.1	2.554	104.3	1.7
283552-004	0.061	2.000	2.120	102.9			

Authorized Signature: Cherry Rossen

Cherry Rossen, Technical Manager

TestAmerica Pleasanton

1220 Quarry Lane
Pleasanton, CA 94566
Phone (925) 484-1919 Fax (925) 600-3002

Chain of Custody Record

283552

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Cuellar, Cherie	Carrier Tracking No(s):
Client Contact: Shipping/Receiving	Phone:	E-Mail: cherie.cuellar@testamericainc.com	State of Origin: California
Company: Quantem Laboratories		Accreditations Required (See note): State Program - California	
Address: 2033 Heritage Park Drive,	Due Date Requested: 8/9/2017		
City: Oklahoma City	TAT Requested (days):		
State, Zip: OK, 73120			
Phone:	PO #:		
Email:	WO #:		
Project Name: Las Trampas Creek Bridge	Project #: 72011466		
Site:	SSOW#:		

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUB (General Sub Contract Method)/ Lead by 7420
			Preservation Code:				
LBP-01 (720-81061-1)	8/2/17	16:00 Pacific		Solid			X
LBP-02 (720-81061-2)	8/2/17	16:00 Pacific		Solid			X
LBP-03 (720-81061-3)	8/2/17	16:00 Pacific		Solid			X
LBP-04 (720-81061-4)	8/2/17	16:00 Pacific		Solid			X
LBP-05 (720-81061-5)	8/2/17	16:00 Pacific		Solid			X

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accr Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification

Unconfirmed

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2

Sample Disposal (A fee may be assessed if samples are re

Return To Client *Disposal By Lab*

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method ment:

Relinquished by: 8/... 1530 Date/Time: Company Received by: e/Time:

EMLab P&K
A TestAmerica Company

Report for:

Cherie Cuellar
TestAmerica-Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566

Regarding: Project: 720-81061-1; Las Trampas Creek Bridge
EML ID: 1771854

Approved by:

Approved Signatory
Amin Suliman

Dates of Analysis:
Asbestos PLM: 08-09-2017

Service SOPs: Asbestos PLM (EPA Methods 600/R-93/116 & 600/M4-82-020, SOP EM-AS-S-1267)

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. The results relate only to the items tested. The results include an inherent uncertainty of measurement associated with estimating percentages by polarized light microscopy. Measurement uncertainty data for sample results with >1% asbestos concentration can be provided when requested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K
6000 Shoreline Ct, Ste 205, So. San Francisco, CA 94080
(866) 888-6653 Fax (623) 780-7695 www.emlab.com

Client: TestAmerica-Pleasanton
C/O: Cherie Cuellar
Re: 720-81061-1; Las Trampas Creek Bridge

Date of Sampling: 08-02-2017
Date of Receipt: 08-07-2017
Date of Report: 08-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Total Samples Submitted:	4
Total Samples Analyzed:	4
Total Samples with Layer Asbestos Content > 1%:	1

Location: 720-81061-6, ASB-01 Lab ID-Version‡: 8281041-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Poor

Location: 720-81061-7, ASB-02 Lab ID-Version‡: 8281042-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Poor

Location: 720-81061-8, ASB-03 Lab ID-Version‡: 8281043-1

Sample Layers	Asbestos Content
Black Non-Fibrous Material	ND
Sample Composite Homogeneity:	Poor

Location: 720-81061-9, ASB-04 Lab ID-Version‡: 8281044-1

Sample Layers	Asbestos Content
Gray Transite	10% Chrysotile
Sample Composite Homogeneity:	Poor

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

720-81061

TESTAMERICA Pleasanton Chain of Custody
1220 Quarry Lane • Pleasanton CA 94566-4756
Phone: (925) 484-1919 • Fax: (925) 600-3002

Reference #: 177464

Date 8/3/17 Page 1 of 1

Report To

Attn: Tony Jones
Company: WRECO
Address: 1243 Alpine Rd.
Email: tony-jones@wreco.com
Bill To: Tony Jones — Sampled By: T. Jones
Attn: Tony Jones — Phone: 209-404-2433

Analysis Request

Volatile Organics GC/MS (VOCs) ☐ EPA 8260B | HVOCs by ☐ EPA 8260B | EPA 8260B: ☐ Gas ☐ BTEX ☐ 5 Oxygenates ☐ DCA, EDB ☐ Ethanol | TEPH EPA 8015B ☐ Silica Gel ☐ Diesel ☐ Motor Oil ☐ Other | SemiVolatile Organics GC/MS ☐ EPA 8270C | PNA/PAH's by ☐ 8270C ☐ 8270C SIM | Oil and Grease (EPA 1664/9071) ☐ Petroleum ☐ Total | Pesticides ☐ EPA 8081 PCBs ☐ EPA 8082 | CAM17 Metals (EPA 6010/7470/7471) | Metals: ☐ 6010B ☐ 200.7 ☐ Lead ☐ LUFT ☐ RCRA ☐ Other: | Metals: ☐ 6020 ☐ 200.8 (ICP-MS): | ☐ W.E.T (STLC) ☐ W.E.T (DI) ☐ TCLP | Hex. Chrom by ☐ EPA 7196 ☐ or EPA 7199 | pH ☐ 9040 ☐ SM4500 | ☐ Spec. Cond. ☐ Alkalinity ☐ TSS ☐ SS ☐ TDS | Anions: ☐ Cl ☐ SO_4 ☐ NO_3 ☐ F ☐ Br ☐ NO_2 ☐ PO_4 | ☐ Perchlorate by EPA 314.0 | COD ☐ EPA 410.4 ☐ SM5220D ☐ Turbidity | ~~EPA 7000~~ Asbestos EPA 600R-93/116/NIOSH LM | EPA ...

Sample ID	Date	Time	Matrix	Preserv	Asbestos EPA 600R-93/116/NIOSH LM	EPA ...
LBP-01	8/3/17	4pm	S			✓
LBP-02	↓	↓	↓			✓
LBP-03	↓	↓	↓			✓
LBP-04	↓	↓	↓			✓
LBP-05	↓	↓	↓			✓
ASB-01	↓	↓	↓		✓	
ASB-02	↓	↓	↓		✓	
ASB-03	↓	↓	↓		✓	
ASB-04	↓	↓	↓		✓	

720-81061 Chain of Custody

Project Info.

Project Name/ #: Las Trampas Creek Bridge
PO#:
Credit Card Y/N: If yes, please call with payment information ASAP

TAT: 10 Day | **5 Day** | 4 Day | 3 Day | 2 Day | 1 Day | Other:

Report: ☐ Routine ☐ Level 3 ☐ Level 4 ☐ EDD ☐ EDF
Special Instructions / Comments: ☐ Global ID ______

Sample Receipt

\# of Containers: 9
Head Space:
Temp: 26.8°C

1) Relinquished by:	2) Relinquished by:	3) Relinquished by:
Signature: [signature] Time: 4pm	Signature: Time:	Signature: Time:
Printed Name: Tony Jones Date: 8/3/17	Printed Name: Date:	Printed Name: Date:
Company: WRECO	Company:	Company:

1) Received by:	2) Received by:	3) Received by:
Signature: [signature] Time: 1600	Signature: Time:	Signature: Time:
Printed Name: Summer Thipdee Date: 8/3/17	Printed Name: Date:	Printed Name: Date:
Company: TA P	Company:	Company:

See Terms and Conditions on reverse

Rev.10

Login Sample Receipt Checklist

Client: WRECO

Job Number: 720-81061-1

Login Number: 81061
List Number: 1
Creator: Thibodeaux, Summer J

List Source: TestAmerica Pleasanton

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Thermal preservation not required.
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

McCampbell Analytical, Inc.

"When Quality Counts"

Analytical Report

WorkOrder:	1709120
Report Created for:	WRECO
	1243 Alpine Road, Suite 108 Walnut Creek, CA 94596
Project Contact:	Flannery Banks
Project P.O.:	
Project Name:	P17043; Las Trampas 2
Project Received:	09/06/2017

Analytical Report reviewed & approved for release on 09/12/2017 by:

Angela Rydelius,
Laboratory Manager

The report shall not be reproduced except in full, without the written approval of the laboratory. The analytical results relate only to the items tested. Results reported conform to the most current NELAP standards, where applicable, unless otherwise stated in the case narrative.

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http://www.mccampbell.com / E-mail: main@mccampbell.com

Glossary of Terms & Qualifier Definitions

Client: WRECO
Project: P17043; Las Trampas 2
WorkOrder: 1709120

Glossary Abbreviation

%D	Serial Dilution Percent Difference
95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test (Serial Dilution)
DUP	Duplicate
EDL	Estimated Detection Limit
ERS	External reference sample. Second source calibration verification.
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
ST	Sorbent Tube
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

Glossary of Terms & Qualifier Definitions

Client: WRECO
Project: P17043; Las Trampas 2
WorkOrder: 1709120

Analytical Qualifiers

S	Surrogate spike recovery outside accepted recovery limits
a4	Reporting limits raised due to the sample's matrix prohibiting a full volume extraction.
b1	Aqueous sample that contains greater than ~1 vol. % sediment
c2	Surrogate recovery outside of the control limits due to matrix interference.
e2	Diesel range compounds are significant; no recognizable pattern
e4	Gasoline range compounds are significant.
e7	Oil range compounds are significant
e8	Pattern resembles kerosene/kerosene range/jet fuel range

Quality Control Qualifiers

F1	MS/MSD recovery and/or RPD is out of acceptance criteria; LCS validates the prep batch.
F2	LCS/LCSD recovery and/or RPD is out of acceptance criteria.
F10	MS/MSD outside control limits. Physical or chemical interferences exist due to sample matrix.
F13	Indigenous sample results too high for a representative matrix spike analysis.

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	1709120-004A	Soil	09/06/2017 07:59	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/08/2017 22:30
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/08/2017 22:30
Benzene	ND	0.0050	1	09/08/2017 22:30
Bromobenzene	ND	0.0050	1	09/08/2017 22:30
Bromochloromethane	ND	0.0050	1	09/08/2017 22:30
Bromodichloromethane	ND	0.0050	1	09/08/2017 22:30
Bromoform	ND	0.0050	1	09/08/2017 22:30
Bromomethane	ND	0.0050	1	09/08/2017 22:30
2-Butanone (MEK)	ND	0.020	1	09/08/2017 22:30
t-Butyl alcohol (TBA)	ND	0.050	1	09/08/2017 22:30
n-Butyl benzene	ND	0.0050	1	09/08/2017 22:30
sec-Butyl benzene	ND	0.0050	1	09/08/2017 22:30
tert-Butyl benzene	ND	0.0050	1	09/08/2017 22:30
Carbon Disulfide	ND	0.0050	1	09/08/2017 22:30
Carbon Tetrachloride	ND	0.0050	1	09/08/2017 22:30
Chlorobenzene	ND	0.0050	1	09/08/2017 22:30
Chloroethane	ND	0.0050	1	09/08/2017 22:30
Chloroform	ND	0.0050	1	09/08/2017 22:30
Chloromethane	ND	0.0050	1	09/08/2017 22:30
2-Chlorotoluene	ND	0.0050	1	09/08/2017 22:30
4-Chlorotoluene	ND	0.0050	1	09/08/2017 22:30
Dibromochloromethane	ND	0.0050	1	09/08/2017 22:30
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/08/2017 22:30
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/08/2017 22:30
Dibromomethane	ND	0.0050	1	09/08/2017 22:30
1,2-Dichlorobenzene	ND	0.0050	1	09/08/2017 22:30
1,3-Dichlorobenzene	ND	0.0050	1	09/08/2017 22:30
1,4-Dichlorobenzene	ND	0.0050	1	09/08/2017 22:30
Dichlorodifluoromethane	ND	0.0050	1	09/08/2017 22:30
1,1-Dichloroethane	ND	0.0050	1	09/08/2017 22:30
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/08/2017 22:30
1,1-Dichloroethene	ND	0.0050	1	09/08/2017 22:30
cis-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 22:30
trans-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 22:30
1,2-Dichloropropane	ND	0.0050	1	09/08/2017 22:30
1,3-Dichloropropane	ND	0.0050	1	09/08/2017 22:30
2,2-Dichloropropane	ND	0.0050	1	09/08/2017 22:30

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	**1709120-004A**	**Soil**	**09/06/2017 07:59**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/08/2017 22:30
cis-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 22:30
trans-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 22:30
Diisopropyl ether (DIPE)	ND	0.0050	1	09/08/2017 22:30
Ethylbenzene	ND	0.0050	1	09/08/2017 22:30
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/08/2017 22:30
Freon 113	ND	0.0050	1	09/08/2017 22:30
Hexachlorobutadiene	ND	0.0050	1	09/08/2017 22:30
Hexachloroethane	ND	0.0050	1	09/08/2017 22:30
2-Hexanone	ND	0.0050	1	09/08/2017 22:30
Isopropylbenzene	ND	0.0050	1	09/08/2017 22:30
4-Isopropyl toluene	ND	0.0050	1	09/08/2017 22:30
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/08/2017 22:30
Methylene chloride	ND	0.0050	1	09/08/2017 22:30
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/08/2017 22:30
Naphthalene	ND	0.0050	1	09/08/2017 22:30
n-Propyl benzene	ND	0.0050	1	09/08/2017 22:30
Styrene	ND	0.0050	1	09/08/2017 22:30
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 22:30
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 22:30
Tetrachloroethene	**0.0073**	0.0050	1	09/08/2017 22:30
Toluene	ND	0.0050	1	09/08/2017 22:30
1,2,3-Trichlorobenzene	ND	0.0050	1	09/08/2017 22:30
1,2,4-Trichlorobenzene	ND	0.0050	1	09/08/2017 22:30
1,1,1-Trichloroethane	ND	0.0050	1	09/08/2017 22:30
1,1,2-Trichloroethane	ND	0.0050	1	09/08/2017 22:30
Trichloroethene	ND	0.0050	1	09/08/2017 22:30
Trichlorofluoromethane	ND	0.0050	1	09/08/2017 22:30
1,2,3-Trichloropropane	ND	0.0050	1	09/08/2017 22:30
1,2,4-Trimethylbenzene	ND	0.0050	1	09/08/2017 22:30
1,3,5-Trimethylbenzene	ND	0.0050	1	09/08/2017 22:30
Vinyl Chloride	ND	0.0050	1	09/08/2017 22:30
Xylenes, Total	ND	0.0050	1	09/08/2017 22:30

(Cont.)

Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	**1709120-004A**	**Soil**	**09/06/2017 07:59**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	108	82-136		09/08/2017 22:30
Toluene-d8	121	92-139		09/08/2017 22:30
4-BFB	98	82-135		09/08/2017 22:30
Benzene-d6	95	55-122		09/08/2017 22:30
Ethylbenzene-d10	106	58-141		09/08/2017 22:30
1,2-DCB-d4	78	51-107		09/08/2017 22:30

Analyst(s): KF

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	1709120-005A	Soil	09/06/2017 08:12	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/08/2017 23:10
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/08/2017 23:10
Benzene	ND	0.0050	1	09/08/2017 23:10
Bromobenzene	ND	0.0050	1	09/08/2017 23:10
Bromochloromethane	ND	0.0050	1	09/08/2017 23:10
Bromodichloromethane	ND	0.0050	1	09/08/2017 23:10
Bromoform	ND	0.0050	1	09/08/2017 23:10
Bromomethane	ND	0.0050	1	09/08/2017 23:10
2-Butanone (MEK)	ND	0.020	1	09/08/2017 23:10
t-Butyl alcohol (TBA)	ND	0.050	1	09/08/2017 23:10
n-Butyl benzene	ND	0.0050	1	09/08/2017 23:10
sec-Butyl benzene	ND	0.0050	1	09/08/2017 23:10
tert-Butyl benzene	ND	0.0050	1	09/08/2017 23:10
Carbon Disulfide	ND	0.0050	1	09/08/2017 23:10
Carbon Tetrachloride	ND	0.0050	1	09/08/2017 23:10
Chlorobenzene	ND	0.0050	1	09/08/2017 23:10
Chloroethane	ND	0.0050	1	09/08/2017 23:10
Chloroform	ND	0.0050	1	09/08/2017 23:10
Chloromethane	ND	0.0050	1	09/08/2017 23:10
2-Chlorotoluene	ND	0.0050	1	09/08/2017 23:10
4-Chlorotoluene	ND	0.0050	1	09/08/2017 23:10
Dibromochloromethane	ND	0.0050	1	09/08/2017 23:10
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/08/2017 23:10
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/08/2017 23:10
Dibromomethane	ND	0.0050	1	09/08/2017 23:10
1,2-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:10
1,3-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:10
1,4-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:10
Dichlorodifluoromethane	ND	0.0050	1	09/08/2017 23:10
1,1-Dichloroethane	ND	0.0050	1	09/08/2017 23:10
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/08/2017 23:10
1,1-Dichloroethene	ND	0.0050	1	09/08/2017 23:10
cis-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 23:10
trans-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 23:10
1,2-Dichloropropane	ND	0.0050	1	09/08/2017 23:10
1,3-Dichloropropane	ND	0.0050	1	09/08/2017 23:10
2,2-Dichloropropane	ND	0.0050	1	09/08/2017 23:10

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	1709120-005A	Soil	09/06/2017 08:12	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/08/2017 23:10
cis-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 23:10
trans-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 23:10
Diisopropyl ether (DIPE)	ND	0.0050	1	09/08/2017 23:10
Ethylbenzene	ND	0.0050	1	09/08/2017 23:10
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/08/2017 23:10
Freon 113	ND	0.0050	1	09/08/2017 23:10
Hexachlorobutadiene	ND	0.0050	1	09/08/2017 23:10
Hexachloroethane	ND	0.0050	1	09/08/2017 23:10
2-Hexanone	ND	0.0050	1	09/08/2017 23:10
Isopropylbenzene	ND	0.0050	1	09/08/2017 23:10
4-Isopropyl toluene	ND	0.0050	1	09/08/2017 23:10
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/08/2017 23:10
Methylene chloride	ND	0.0050	1	09/08/2017 23:10
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/08/2017 23:10
Naphthalene	ND	0.0050	1	09/08/2017 23:10
n-Propyl benzene	ND	0.0050	1	09/08/2017 23:10
Styrene	ND	0.0050	1	09/08/2017 23:10
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 23:10
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 23:10
Tetrachloroethene	ND	0.0050	1	09/08/2017 23:10
Toluene	ND	0.0050	1	09/08/2017 23:10
1,2,3-Trichlorobenzene	ND	0.0050	1	09/08/2017 23:10
1,2,4-Trichlorobenzene	ND	0.0050	1	09/08/2017 23:10
1,1,1-Trichloroethane	ND	0.0050	1	09/08/2017 23:10
1,1,2-Trichloroethane	ND	0.0050	1	09/08/2017 23:10
Trichloroethene	ND	0.0050	1	09/08/2017 23:10
Trichlorofluoromethane	ND	0.0050	1	09/08/2017 23:10
1,2,3-Trichloropropane	ND	0.0050	1	09/08/2017 23:10
1,2,4-Trimethylbenzene	ND	0.0050	1	09/08/2017 23:10
1,3,5-Trimethylbenzene	ND	0.0050	1	09/08/2017 23:10
Vinyl Chloride	ND	0.0050	1	09/08/2017 23:10
Xylenes, Total	ND	0.0050	1	09/08/2017 23:10

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	**1709120-005A**	**Soil**	**09/06/2017 08:12**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	108	82-136		09/08/2017 23:10
Toluene-d8	122	92-139		09/08/2017 23:10
4-BFB	95	82-135		09/08/2017 23:10
Benzene-d6	90	55-122		09/08/2017 23:10
Ethylbenzene-d10	100	58-141		09/08/2017 23:10
1,2-DCB-d4	75	51-107		09/08/2017 23:10

Analyst(s): KF

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	1709120-006A	Soil	09/06/2017 08:26	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/08/2017 23:50
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/08/2017 23:50
Benzene	ND	0.0050	1	09/08/2017 23:50
Bromobenzene	ND	0.0050	1	09/08/2017 23:50
Bromochloromethane	ND	0.0050	1	09/08/2017 23:50
Bromodichloromethane	ND	0.0050	1	09/08/2017 23:50
Bromoform	ND	0.0050	1	09/08/2017 23:50
Bromomethane	ND	0.0050	1	09/08/2017 23:50
2-Butanone (MEK)	ND	0.020	1	09/08/2017 23:50
t-Butyl alcohol (TBA)	ND	0.050	1	09/08/2017 23:50
n-Butyl benzene	ND	0.0050	1	09/08/2017 23:50
sec-Butyl benzene	ND	0.0050	1	09/08/2017 23:50
tert-Butyl benzene	ND	0.0050	1	09/08/2017 23:50
Carbon Disulfide	ND	0.0050	1	09/08/2017 23:50
Carbon Tetrachloride	ND	0.0050	1	09/08/2017 23:50
Chlorobenzene	ND	0.0050	1	09/08/2017 23:50
Chloroethane	ND	0.0050	1	09/08/2017 23:50
Chloroform	ND	0.0050	1	09/08/2017 23:50
Chloromethane	ND	0.0050	1	09/08/2017 23:50
2-Chlorotoluene	ND	0.0050	1	09/08/2017 23:50
4-Chlorotoluene	ND	0.0050	1	09/08/2017 23:50
Dibromochloromethane	ND	0.0050	1	09/08/2017 23:50
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/08/2017 23:50
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/08/2017 23:50
Dibromomethane	ND	0.0050	1	09/08/2017 23:50
1,2-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:50
1,3-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:50
1,4-Dichlorobenzene	ND	0.0050	1	09/08/2017 23:50
Dichlorodifluoromethane	ND	0.0050	1	09/08/2017 23:50
1,1-Dichloroethane	ND	0.0050	1	09/08/2017 23:50
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/08/2017 23:50
1,1-Dichloroethene	ND	0.0050	1	09/08/2017 23:50
cis-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 23:50
trans-1,2-Dichloroethene	ND	0.0050	1	09/08/2017 23:50
1,2-Dichloropropane	ND	0.0050	1	09/08/2017 23:50
1,3-Dichloropropane	ND	0.0050	1	09/08/2017 23:50
2,2-Dichloropropane	ND	0.0050	1	09/08/2017 23:50

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	1709120-006A	Soil	09/06/2017 08:26	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/08/2017 23:50
cis-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 23:50
trans-1,3-Dichloropropene	ND	0.0050	1	09/08/2017 23:50
Diisopropyl ether (DIPE)	ND	0.0050	1	09/08/2017 23:50
Ethylbenzene	ND	0.0050	1	09/08/2017 23:50
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/08/2017 23:50
Freon 113	ND	0.0050	1	09/08/2017 23:50
Hexachlorobutadiene	ND	0.0050	1	09/08/2017 23:50
Hexachloroethane	ND	0.0050	1	09/08/2017 23:50
2-Hexanone	ND	0.0050	1	09/08/2017 23:50
Isopropylbenzene	ND	0.0050	1	09/08/2017 23:50
4-Isopropyl toluene	ND	0.0050	1	09/08/2017 23:50
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/08/2017 23:50
Methylene chloride	ND	0.0050	1	09/08/2017 23:50
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/08/2017 23:50
Naphthalene	ND	0.0050	1	09/08/2017 23:50
n-Propyl benzene	ND	0.0050	1	09/08/2017 23:50
Styrene	ND	0.0050	1	09/08/2017 23:50
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 23:50
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/08/2017 23:50
Tetrachloroethene	ND	0.0050	1	09/08/2017 23:50
Toluene	ND	0.0050	1	09/08/2017 23:50
1,2,3-Trichlorobenzene	ND	0.0050	1	09/08/2017 23:50
1,2,4-Trichlorobenzene	ND	0.0050	1	09/08/2017 23:50
1,1,1-Trichloroethane	ND	0.0050	1	09/08/2017 23:50
1,1,2-Trichloroethane	ND	0.0050	1	09/08/2017 23:50
Trichloroethene	ND	0.0050	1	09/08/2017 23:50
Trichlorofluoromethane	ND	0.0050	1	09/08/2017 23:50
1,2,3-Trichloropropane	ND	0.0050	1	09/08/2017 23:50
1,2,4-Trimethylbenzene	ND	0.0050	1	09/08/2017 23:50
1,3,5-Trimethylbenzene	ND	0.0050	1	09/08/2017 23:50
Vinyl Chloride	ND	0.0050	1	09/08/2017 23:50
Xylenes, Total	ND	0.0050	1	09/08/2017 23:50

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	**1709120-006A**	**Soil**	**09/06/2017 08:26**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	108	82-136		09/08/2017 23:50
Toluene-d8	119	92-139		09/08/2017 23:50
4-BFB	128	82-135		09/08/2017 23:50
Benzene-d6	93	55-122		09/08/2017 23:50
Ethylbenzene-d10	102	58-141		09/08/2017 23:50
1,2-DCB-d4	82	51-107		09/08/2017 23:50

Analyst(s): KF

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	1709120-007A	Soil	09/06/2017 08:45	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/09/2017 00:30
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/09/2017 00:30
Benzene	ND	0.0050	1	09/09/2017 00:30
Bromobenzene	ND	0.0050	1	09/09/2017 00:30
Bromochloromethane	ND	0.0050	1	09/09/2017 00:30
Bromodichloromethane	ND	0.0050	1	09/09/2017 00:30
Bromoform	ND	0.0050	1	09/09/2017 00:30
Bromomethane	ND	0.0050	1	09/09/2017 00:30
2-Butanone (MEK)	ND	0.020	1	09/09/2017 00:30
t-Butyl alcohol (TBA)	ND	0.050	1	09/09/2017 00:30
n-Butyl benzene	ND	0.0050	1	09/09/2017 00:30
sec-Butyl benzene	ND	0.0050	1	09/09/2017 00:30
tert-Butyl benzene	ND	0.0050	1	09/09/2017 00:30
Carbon Disulfide	ND	0.0050	1	09/09/2017 00:30
Carbon Tetrachloride	ND	0.0050	1	09/09/2017 00:30
Chlorobenzene	ND	0.0050	1	09/09/2017 00:30
Chloroethane	ND	0.0050	1	09/09/2017 00:30
Chloroform	ND	0.0050	1	09/09/2017 00:30
Chloromethane	ND	0.0050	1	09/09/2017 00:30
2-Chlorotoluene	ND	0.0050	1	09/09/2017 00:30
4-Chlorotoluene	ND	0.0050	1	09/09/2017 00:30
Dibromochloromethane	ND	0.0050	1	09/09/2017 00:30
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/09/2017 00:30
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/09/2017 00:30
Dibromomethane	ND	0.0050	1	09/09/2017 00:30
1,2-Dichlorobenzene	ND	0.0050	1	09/09/2017 00:30
1,3-Dichlorobenzene	ND	0.0050	1	09/09/2017 00:30
1,4-Dichlorobenzene	ND	0.0050	1	09/09/2017 00:30
Dichlorodifluoromethane	ND	0.0050	1	09/09/2017 00:30
1,1-Dichloroethane	ND	0.0050	1	09/09/2017 00:30
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/09/2017 00:30
1,1-Dichloroethene	ND	0.0050	1	09/09/2017 00:30
cis-1,2-Dichloroethene	**0.011**	0.0050	1	09/09/2017 00:30
trans-1,2-Dichloroethene	ND	0.0050	1	09/09/2017 00:30
1,2-Dichloropropane	ND	0.0050	1	09/09/2017 00:30
1,3-Dichloropropane	ND	0.0050	1	09/09/2017 00:30
2,2-Dichloropropane	ND	0.0050	1	09/09/2017 00:30

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	1709120-007A	Soil	09/06/2017 08:45	GC10	144897

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/09/2017 00:30
cis-1,3-Dichloropropene	ND	0.0050	1	09/09/2017 00:30
trans-1,3-Dichloropropene	ND	0.0050	1	09/09/2017 00:30
Diisopropyl ether (DIPE)	ND	0.0050	1	09/09/2017 00:30
Ethylbenzene	ND	0.0050	1	09/09/2017 00:30
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/09/2017 00:30
Freon 113	ND	0.0050	1	09/09/2017 00:30
Hexachlorobutadiene	ND	0.0050	1	09/09/2017 00:30
Hexachloroethane	ND	0.0050	1	09/09/2017 00:30
2-Hexanone	ND	0.0050	1	09/09/2017 00:30
Isopropylbenzene	ND	0.0050	1	09/09/2017 00:30
4-Isopropyl toluene	ND	0.0050	1	09/09/2017 00:30
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/09/2017 00:30
Methylene chloride	ND	0.0050	1	09/09/2017 00:30
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/09/2017 00:30
Naphthalene	ND	0.0050	1	09/09/2017 00:30
n-Propyl benzene	ND	0.0050	1	09/09/2017 00:30
Styrene	ND	0.0050	1	09/09/2017 00:30
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/09/2017 00:30
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/09/2017 00:30
Tetrachloroethene	ND	0.0050	1	09/09/2017 00:30
Toluene	ND	0.0050	1	09/09/2017 00:30
1,2,3-Trichlorobenzene	ND	0.0050	1	09/09/2017 00:30
1,2,4-Trichlorobenzene	ND	0.0050	1	09/09/2017 00:30
1,1,1-Trichloroethane	ND	0.0050	1	09/09/2017 00:30
1,1,2-Trichloroethane	ND	0.0050	1	09/09/2017 00:30
Trichloroethene	**0.0075**	0.0050	1	09/09/2017 00:30
Trichlorofluoromethane	ND	0.0050	1	09/09/2017 00:30
1,2,3-Trichloropropane	ND	0.0050	1	09/09/2017 00:30
1,2,4-Trimethylbenzene	ND	0.0050	1	09/09/2017 00:30
1,3,5-Trimethylbenzene	ND	0.0050	1	09/09/2017 00:30
Vinyl Chloride	ND	0.0050	1	09/09/2017 00:30
Xylenes, Total	ND	0.0050	1	09/09/2017 00:30

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Angela Rydelius, Lab Manager

Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	**1709120-007A**	**Soil**	**09/06/2017 08:45**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	108	82-136		09/09/2017 00:30
Toluene-d8	121	92-139		09/09/2017 00:30
4-BFB	99	82-135		09/09/2017 00:30
Benzene-d6	85	55-122		09/09/2017 00:30
Ethylbenzene-d10	94	58-141		09/09/2017 00:30
1,2-DCB-d4	73	51-107		09/09/2017 00:30

Analyst(s): KF

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/8/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	1709120-008A	Water	09/06/2017 08:55	GC10	145115

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	10	1	09/08/2017 21:49
tert-Amyl methyl ether (TAME)	ND	0.50	1	09/08/2017 21:49
Benzene	ND	0.50	1	09/08/2017 21:49
Bromobenzene	ND	0.50	1	09/08/2017 21:49
Bromochloromethane	ND	0.50	1	09/08/2017 21:49
Bromodichloromethane	ND	0.50	1	09/08/2017 21:49
Bromoform	ND	0.50	1	09/08/2017 21:49
Bromomethane	ND	0.50	1	09/08/2017 21:49
2-Butanone (MEK)	ND	2.0	1	09/08/2017 21:49
t-Butyl alcohol (TBA)	ND	2.0	1	09/08/2017 21:49
n-Butyl benzene	ND	0.50	1	09/08/2017 21:49
sec-Butyl benzene	ND	0.50	1	09/08/2017 21:49
tert-Butyl benzene	ND	0.50	1	09/08/2017 21:49
Carbon Disulfide	ND	0.50	1	09/08/2017 21:49
Carbon Tetrachloride	ND	0.50	1	09/08/2017 21:49
Chlorobenzene	ND	0.50	1	09/08/2017 21:49
Chloroethane	ND	0.50	1	09/08/2017 21:49
Chloroform	ND	0.50	1	09/08/2017 21:49
Chloromethane	ND	0.50	1	09/08/2017 21:49
2-Chlorotoluene	ND	0.50	1	09/08/2017 21:49
4-Chlorotoluene	ND	0.50	1	09/08/2017 21:49
Dibromochloromethane	ND	0.50	1	09/08/2017 21:49
1,2-Dibromo-3-chloropropane	ND	0.20	1	09/08/2017 21:49
1,2-Dibromoethane (EDB)	ND	0.50	1	09/08/2017 21:49
Dibromomethane	ND	0.50	1	09/08/2017 21:49
1,2-Dichlorobenzene	ND	0.50	1	09/08/2017 21:49
1,3-Dichlorobenzene	ND	0.50	1	09/08/2017 21:49
1,4-Dichlorobenzene	ND	0.50	1	09/08/2017 21:49
Dichlorodifluoromethane	ND	0.50	1	09/08/2017 21:49
1,1-Dichloroethane	ND	0.50	1	09/08/2017 21:49
1,2-Dichloroethane (1,2-DCA)	ND	0.50	1	09/08/2017 21:49
1,1-Dichloroethene	ND	0.50	1	09/08/2017 21:49
cis-1,2-Dichloroethene	**11**	0.50	1	09/08/2017 21:49
trans-1,2-Dichloroethene	ND	0.50	1	09/08/2017 21:49
1,2-Dichloropropane	ND	0.50	1	09/08/2017 21:49
1,3-Dichloropropane	ND	0.50	1	09/08/2017 21:49
2,2-Dichloropropane	ND	0.50	1	09/08/2017 21:49

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/8/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	1709120-008A	Water	09/06/2017 08:55	GC10	145115

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.50	1	09/08/2017 21:49
cis-1,3-Dichloropropene	ND	0.50	1	09/08/2017 21:49
trans-1,3-Dichloropropene	ND	0.50	1	09/08/2017 21:49
Diisopropyl ether (DIPE)	ND	0.50	1	09/08/2017 21:49
Ethylbenzene	ND	0.50	1	09/08/2017 21:49
Ethyl tert-butyl ether (ETBE)	ND	0.50	1	09/08/2017 21:49
Freon 113	ND	0.50	1	09/08/2017 21:49
Hexachlorobutadiene	ND	0.50	1	09/08/2017 21:49
Hexachloroethane	ND	0.50	1	09/08/2017 21:49
2-Hexanone	ND	0.50	1	09/08/2017 21:49
Isopropylbenzene	ND	0.50	1	09/08/2017 21:49
4-Isopropyl toluene	ND	0.50	1	09/08/2017 21:49
Methyl-t-butyl ether (MTBE)	ND	0.50	1	09/08/2017 21:49
Methylene chloride	ND	0.50	1	09/08/2017 21:49
4-Methyl-2-pentanone (MIBK)	ND	0.50	1	09/08/2017 21:49
Naphthalene	ND	0.50	1	09/08/2017 21:49
n-Propyl benzene	ND	0.50	1	09/08/2017 21:49
Styrene	ND	0.50	1	09/08/2017 21:49
1,1,1,2-Tetrachloroethane	ND	0.50	1	09/08/2017 21:49
1,1,2,2-Tetrachloroethane	ND	0.50	1	09/08/2017 21:49
Tetrachloroethene	**6.8**	0.50	1	09/08/2017 21:49
Toluene	ND	0.50	1	09/08/2017 21:49
1,2,3-Trichlorobenzene	ND	0.50	1	09/08/2017 21:49
1,2,4-Trichlorobenzene	ND	0.50	1	09/08/2017 21:49
1,1,1-Trichloroethane	ND	0.50	1	09/08/2017 21:49
1,1,2-Trichloroethane	ND	0.50	1	09/08/2017 21:49
Trichloroethene	**4.1**	0.50	1	09/08/2017 21:49
Trichlorofluoromethane	ND	0.50	1	09/08/2017 21:49
1,2,3-Trichloropropane	ND	0.50	1	09/08/2017 21:49
1,2,4-Trimethylbenzene	ND	0.50	1	09/08/2017 21:49
1,3,5-Trimethylbenzene	ND	0.50	1	09/08/2017 21:49
Vinyl Chloride	**1.1**	0.50	1	09/08/2017 21:49
Xylenes, Total	ND	0.50	1	09/08/2017 21:49

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/8/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	**1709120-008A**	**Water**	**09/06/2017 08:55**	**GC10**	**145115**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	112	78-134		09/08/2017 21:49
Toluene-d8	108	82-120		09/08/2017 21:49
4-BFB	105	69-131		09/08/2017 21:49

Analyst(s): KF

Analytical Comments: b1

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

TPH(g)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	**1709120-004A**	**Soil**	**09/06/2017 07:59**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.25	1	09/08/2017 22:30

Surrogates	REC (%)	Limits	Date Analyzed
Dibromofluoromethane	111	70-130	09/08/2017 22:30
Benzene-D6	87	60-140	09/08/2017 22:30

Analyst(s): KF

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	**1709120-005A**	**Soil**	**09/06/2017 08:12**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.25	1	09/08/2017 23:10

Surrogates	REC (%)	Limits	Date Analyzed
Dibromofluoromethane	110	70-130	09/08/2017 23:10
Benzene-D6	82	60-140	09/08/2017 23:10

Analyst(s): KF

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	**1709120-006A**	**Soil**	**09/06/2017 08:26**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	**3.4**	0.25	1	09/08/2017 23:50

Surrogates	REC (%)	Limits	Date Analyzed
Dibromofluoromethane	111	70-130	09/08/2017 23:50
Benzene-D6	82	60-140	09/08/2017 23:50

Analyst(s): KF

(Cont.)

Angela Rydelius, Lab Manager

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/6/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	mg/kg

TPH(g)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	**1709120-007A**	**Soil**	**09/06/2017 08:45**	**GC10**	**144897**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.25	1	09/09/2017 00:30

Surrogates	REC (%)	Limits	Date Analyzed
Dibromofluoromethane	111	70-130	09/09/2017 00:30
Benzene-D6	80	60-140	09/09/2017 00:30

Analyst(s): KF

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW5030B
Date Prepared:	9/8/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

TPH(g)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	**1709120-008A**	**Water**	**09/06/2017 08:55**	**GC10**	**145115**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	**130**	50	1	09/08/2017 21:49

Surrogates	REC (%)	Limits	Date Analyzed
Dibromofluoromethane	115	70-130	09/08/2017 21:49

Analyst(s): KF

Analytical Comments: b1

Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3050B
Date Prepared:	9/6/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	**1709120-004A**	**Soil**	**09/06/2017 07:59**	**ICP-MS2**	**144921**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	09/07/2017 01:50
Arsenic	**5.3**	0.50	1	09/07/2017 01:50
Barium	**120**	5.0	1	09/07/2017 01:50
Beryllium	**0.52**	0.50	1	09/07/2017 01:50
Cadmium	**0.32**	0.25	1	09/07/2017 01:50
Chromium	**30**	0.50	1	09/07/2017 01:50
Cobalt	**6.9**	0.50	1	09/07/2017 01:50
Copper	**12**	0.50	1	09/07/2017 01:50
Lead	**6.1**	0.50	1	09/07/2017 01:50
Mercury	**0.054**	0.050	1	09/07/2017 01:50
Molybdenum	**0.61**	0.50	1	09/07/2017 01:50
Nickel	**30**	0.50	1	09/07/2017 01:50
Selenium	ND	0.50	1	09/07/2017 01:50
Silver	ND	0.50	1	09/07/2017 01:50
Thallium	ND	0.50	1	09/07/2017 01:50
Vanadium	**39**	0.50	1	09/07/2017 01:50
Zinc	**41**	5.0	1	09/07/2017 01:50

Surrogates	REC (%)	Limits	
Terbium	105	70-130	09/07/2017 01:50

Analyst(s): ND

(Cont.)

Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3050B
Date Prepared:	9/6/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	**1709120-005A**	**Soil**	**09/06/2017 08:12**	**ICP-MS2**	**144921**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	09/07/2017 01:56
Arsenic	**5.2**	0.50	1	09/07/2017 01:56
Barium	**120**	5.0	1	09/07/2017 01:56
Beryllium	ND	0.50	1	09/07/2017 01:56
Cadmium	**0.45**	0.25	1	09/07/2017 01:56
Chromium	**28**	0.50	1	09/07/2017 01:56
Cobalt	**6.1**	0.50	1	09/07/2017 01:56
Copper	**11**	0.50	1	09/07/2017 01:56
Lead	**5.1**	0.50	1	09/07/2017 01:56
Mercury	ND	0.050	1	09/07/2017 01:56
Molybdenum	**0.57**	0.50	1	09/07/2017 01:56
Nickel	**27**	0.50	1	09/07/2017 01:56
Selenium	ND	0.50	1	09/07/2017 01:56
Silver	ND	0.50	1	09/07/2017 01:56
Thallium	ND	0.50	1	09/07/2017 01:56
Vanadium	**35**	0.50	1	09/07/2017 01:56
Zinc	**39**	5.0	1	09/07/2017 01:56

Surrogates	REC (%)	Limits	Date Analyzed
Terbium	100	70-130	09/07/2017 01:56

Analyst(s): ND

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3050B
Date Prepared:	9/6/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	**1709120-006A**	**Soil**	**09/06/2017 08:26**	**ICP-MS2**	**144921**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	09/07/2017 02:02
Arsenic	**6.7**	0.50	1	09/07/2017 02:02
Barium	**110**	5.0	1	09/07/2017 02:02
Beryllium	ND	0.50	1	09/07/2017 02:02
Cadmium	ND	0.25	1	09/07/2017 02:02
Chromium	**34**	0.50	1	09/07/2017 02:02
Cobalt	**6.6**	0.50	1	09/07/2017 02:02
Copper	**16**	0.50	1	09/07/2017 02:02
Lead	**6.2**	0.50	1	09/07/2017 02:02
Mercury	**0.057**	0.050	1	09/07/2017 02:02
Molybdenum	**1.4**	0.50	1	09/07/2017 02:02
Nickel	**38**	0.50	1	09/07/2017 02:02
Selenium	ND	0.50	1	09/07/2017 02:02
Silver	ND	0.50	1	09/07/2017 02:02
Thallium	ND	0.50	1	09/07/2017 02:02
Vanadium	**33**	0.50	1	09/07/2017 02:02
Zinc	**40**	5.0	1	09/07/2017 02:02

Surrogates	REC (%)	Limits	
Terbium	104	70-130	09/07/2017 02:02

Analyst(s): ND

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3050B
Date Prepared:	9/6/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	**1709120-007A**	**Soil**	**09/06/2017 08:45**	**ICP-MS2**	**144921**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	09/07/2017 02:08
Arsenic	**4.6**	0.50	1	09/07/2017 02:08
Barium	**120**	5.0	1	09/07/2017 02:08
Beryllium	ND	0.50	1	09/07/2017 02:08
Cadmium	**0.29**	0.25	1	09/07/2017 02:08
Chromium	**35**	0.50	1	09/07/2017 02:08
Cobalt	**6.0**	0.50	1	09/07/2017 02:08
Copper	**14**	0.50	1	09/07/2017 02:08
Lead	**4.8**	0.50	1	09/07/2017 02:08
Mercury	**0.069**	0.050	1	09/07/2017 02:08
Molybdenum	ND	0.50	1	09/07/2017 02:08
Nickel	**37**	0.50	1	09/07/2017 02:08
Selenium	ND	0.50	1	09/07/2017 02:08
Silver	ND	0.50	1	09/07/2017 02:08
Thallium	ND	0.50	1	09/07/2017 02:08
Vanadium	**28**	0.50	1	09/07/2017 02:08
Zinc	**41**	5.0	1	09/07/2017 02:08

Surrogates	REC (%)	Limits	Date Analyzed
Terbium	100	70-130	09/07/2017 02:08

Analyst(s): ND

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	E200.8
Date Prepared:	9/11/17	**Analytical Method:**	E200.8
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	**1709120-008C**	**Water**	**09/06/2017 08:55**	**ICP-MS2**	**145181**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	10	20	09/12/2017 04:47
Arsenic	**140**	10	20	09/12/2017 04:47
Barium	**14,000**	100	20	09/12/2017 04:47
Beryllium	**40**	10	20	09/12/2017 04:47
Cadmium	**110**	5.0	20	09/12/2017 04:47
Chromium	**630**	10	20	09/12/2017 04:47
Cobalt	**520**	10	20	09/12/2017 04:47
Copper	**980**	40	20	09/12/2017 04:47
Lead	**620**	10	20	09/12/2017 04:47
Mercury	**5.0**	1.0	20	09/12/2017 04:47
Molybdenum	ND	10	20	09/12/2017 04:47
Nickel	**2100**	10	20	09/12/2017 04:47
Selenium	ND	10	20	09/12/2017 04:47
Silver	**6.8**	3.8	20	09/12/2017 04:47
Thallium	ND	10	20	09/12/2017 04:47
Vanadium	**690**	10	20	09/12/2017 04:47
Zinc	**2000**	300	20	09/12/2017 04:47

Surrogates	REC (%)	Qualifiers	Limits	
Terbium	65	S	70-130	09/12/2017 04:47

Analyst(s): ND

Analytical Comments: c2,b1

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3550B
Date Prepared:	9/6/17	**Analytical Method:**	SW8015B
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-5	**1709120-004A**	**Soil**	**09/06/2017 07:59**	**GC9b**	**144909**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**1.7**	1.0	1	09/08/2017 14:44
TPH-Motor Oil (C18-C36)	ND	5.0	1	09/08/2017 14:44

Surrogates	REC (%)	Limits	Date Analyzed
C9	101	78-126	09/08/2017 14:44

Analyst(s): TK Analytical Comments: e2,e8,e7

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-10	**1709120-005A**	**Soil**	**09/06/2017 08:12**	**GC11A**	**144909**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	09/08/2017 09:05
TPH-Motor Oil (C18-C36)	ND	5.0	1	09/08/2017 09:05

Surrogates	REC (%)	Limits	Date Analyzed
C9	86	78-126	09/08/2017 09:05

Analyst(s): TK

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-15	**1709120-006A**	**Soil**	**09/06/2017 08:26**	**GC9b**	**144909**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	09/08/2017 13:23
TPH-Motor Oil (C18-C36)	ND	5.0	1	09/08/2017 13:23

Surrogates	REC (%)	Limits	Date Analyzed
C9	99	78-126	09/08/2017 13:23

Analyst(s): TK

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Angela Rydelius, Lab Manager

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3550B
Date Prepared:	9/6/17	**Analytical Method:**	SW8015B
Project:	P17043; Las Trampas 2	**Unit:**	mg/Kg

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
SB-02-20	**1709120-007A**	**Soil**	**09/06/2017 08:45**	**GC9b**	**144909**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	09/08/2017 14:02
TPH-Motor Oil (C18-C36)	ND	5.0	1	09/08/2017 14:02

Surrogates	REC (%)	Limits	Date Analyzed
C9	99	78-126	09/08/2017 14:02

Analyst(s): TK

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Angela Rydelius, Lab Manager

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Analytical Report

Client:	WRECO	**WorkOrder:**	1709120
Date Received:	9/6/17 13:54	**Extraction Method**	SW3510C
Date Prepared:	9/6/17	**Analytical Method:**	SW8015B
Project:	P17043; Las Trampas 2	**Unit:**	µg/L

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CU-02-18	**1709120-008B**	**Water**	**09/06/2017 08:55**	**GC11B**	**144905**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**200**	100	1	09/08/2017 14:03
TPH-Motor Oil (C18-C36)	ND	500	1	09/08/2017 14:03

Surrogates	REC (%)	Limits	Date Analyzed
C9	110	61-139	09/08/2017 14:03

Analyst(s): TK

Analytical Comments: e2,e8,e4,a4,b1

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acetone	ND	0.809	0.10	1	-	81	48-156
tert-Amyl methyl ether (TAME)	ND	0.0369	0.0050	0.050	-	74	56-115
Benzene	ND	0.0425	0.0050	0.050	-	85	63-131
Bromobenzene	ND	0.0438	0.0050	0.050	-	88	66-127
Bromochloromethane	ND	0.0416	0.0050	0.050	-	83	64-124
Bromodichloromethane	ND	0.0437	0.0050	0.050	-	87	64-120
Bromoform	ND	0.0327	0.0050	0.050	-	65	48-92
Bromomethane	ND	0.0440	0.0050	0.050	-	88	25-163
2-Butanone (MEK)	ND	0.145	0.020	0.20	-	72	51-133
t-Butyl alcohol (TBA)	ND	0.136	0.050	0.20	-	68	52-129
n-Butyl benzene	ND	0.0599	0.0050	0.050	-	120	83-200
sec-Butyl benzene	ND	0.0584	0.0050	0.050	-	117	81-199
tert-Butyl benzene	ND	0.0565	0.0050	0.050	-	113	79-178
Carbon Disulfide	ND	0.0446	0.0050	0.050	-	89	64-136
Carbon Tetrachloride	ND	0.0498	0.0050	0.050	-	100	66-140
Chlorobenzene	ND	0.0441	0.0050	0.050	-	88	73-116
Chloroethane	ND	0.0386	0.0050	0.050	-	77	35-147
Chloroform	ND	0.0442	0.0050	0.050	-	88	65-130
Chloromethane	ND	0.0364	0.0050	0.050	-	73	30-137
2-Chlorotoluene	ND	0.0510	0.0050	0.050	-	102	75-152
4-Chlorotoluene	ND	0.0500	0.0050	0.050	-	100	71-148
Dibromochloromethane	ND	0.0380	0.0050	0.050	-	76	61-106
1,2-Dibromo-3-chloropropane	ND	0.0116	0.0040	0.020	-	58	36-120
1,2-Dibromoethane (EDB)	ND	0.0404	0.0040	0.050	-	81	67-118
Dibromomethane	ND	0.0387	0.0050	0.050	-	77	61-116
1,2-Dichlorobenzene	ND	0.0368	0.0050	0.050	-	74	59-106
1,3-Dichlorobenzene	ND	0.0480	0.0050	0.050	-	96	75-129
1,4-Dichlorobenzene	ND	0.0436	0.0050	0.050	-	87	66-127
Dichlorodifluoromethane	ND	0.0208	0.0050	0.050	-	42	13-74
1,1-Dichloroethane	ND	0.0440	0.0050	0.050	-	88	65-134
1,2-Dichloroethane (1,2-DCA)	ND	0.0411	0.0040	0.050	-	82	57-131
1,1-Dichloroethene	ND	0.0425	0.0050	0.050	-	85	62-127
cis-1,2-Dichloroethene	ND	0.0423	0.0050	0.050	-	85	66-130
trans-1,2-Dichloroethene	ND	0.0433	0.0050	0.050	-	87	60-131
1,2-Dichloropropane	ND	0.0412	0.0050	0.050	-	82	63-127
1,3-Dichloropropane	ND	0.0415	0.0050	0.050	-	83	68-124
2,2-Dichloropropane	ND	0.0531	0.0050	0.050	-	106	63-150

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
1,1-Dichloropropene	ND	0.0453	0.0050	0.050	-	91	67-134
cis-1,3-Dichloropropene	ND	0.0450	0.0050	0.050	-	90	65-138
trans-1,3-Dichloropropene	ND	0.0432	0.0050	0.050	-	86	66-124
Diisopropyl ether (DIPE)	ND	0.0405	0.0050	0.050	-	81	58-129
Ethylbenzene	ND	0.0504	0.0050	0.050	-	101	73-145
Ethyl tert-butyl ether (ETBE)	ND	0.0401	0.0050	0.050	-	80	62-125
Freon 113	ND	0.0388	0.0050	0.050	-	78	55-116
Hexachlorobutadiene	ND	0.0620	0.0050	0.050	-	124	75-178
Hexachloroethane	ND	0.0512	0.0050	0.050	-	102	75-152
2-Hexanone	ND	0.0282	0.0050	0.050	-	56	41-113
Isopropylbenzene	ND	0.0586	0.0050	0.050	-	117	67-172
4-Isopropyl toluene	ND	0.0585	0.0050	0.050	-	117	88-171
Methyl-t-butyl ether (MTBE)	ND	0.0387	0.0050	0.050	-	77	58-122
Methylene chloride	ND	0.0452	0.0050	0.050	-	90	57-140
4-Methyl-2-pentanone (MIBK)	ND	0.0328	0.0050	0.050	-	66	42-117
Naphthalene	ND	0.0181	0.0050	0.050	-	36	29-65
n-Propyl benzene	ND	0.0583	0.0050	0.050	-	117	85-174
Styrene	ND	0.0454	0.0050	0.050	-	91	63-126
1,1,1,2-Tetrachloroethane	ND	0.0482	0.0050	0.050	-	96	68-131
1,1,2,2-Tetrachloroethane	ND	0.0327	0.0050	0.050	-	65	45-121
Tetrachloroethene	ND	0.0528	0.0050	0.050	-	106	65-150
Toluene	ND	0.0484	0.0050	0.050	-	97	72-135
1,2,3-Trichlorobenzene	ND	0.0259	0.0050	0.050	-	52	35-80
1,2,4-Trichlorobenzene	ND	0.0350	0.0050	0.050	-	70	45-103
1,1,1-Trichloroethane	ND	0.0474	0.0050	0.050	-	95	67-137
1,1,2-Trichloroethane	ND	0.0395	0.0050	0.050	-	79	67-117
Trichloroethene	ND	0.0447	0.0050	0.050	-	89	62-135
Trichlorofluoromethane	ND	0.0408	0.0050	0.050	-	82	56-124
1,2,3-Trichloropropane	ND	0.0380	0.0050	0.050	-	76	58-133
1,2,4-Trimethylbenzene	ND	0.0543	0.0050	0.050	-	109	78-161
1,3,5-Trimethylbenzene	ND	0.0565	0.0050	0.050	-	113	85-170
Vinyl Chloride	ND	0.0357	0.0050	0.050	-	71	32-142
Xylenes, Total	ND	0.147	0.0050	0.15	-	98	70-137

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery							
Dibromofluoromethane	0.1312	0.129		0.12	105	103	87-127
Toluene-d8	0.1593	0.144		0.12	127	116	93-141
4-BFB	0.01312	0.0124		0.012	105	99	84-137
Benzene-d6	0.09233	0.0897		0.10	92	90	67-131
Ethylbenzene-d10	0.1023	0.107		0.10	102	107	78-153
1,2-DCB-d4	0.07745	0.0827		0.10	77	83	63-109

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Acetone	0.782	0.822	1	ND	78	82	36-141	5.05	20
tert-Amyl methyl ether (TAME)	0.0309	0.0318	0.050	ND	57	59	46-105	2.83	20
Benzene	0.0334	0.0331	0.050	ND	67	66	46-124	0.686	20
Bromobenzene	0.0331	0.0318	0.050	ND	66	64	50-119	4.06	20
Bromochloromethane	0.0348	0.0355	0.050	ND	70	71	42-122	1.91	20
Bromodichloromethane	0.0328	0.0335	0.050	ND	66	67	48-112	1.90	20
Bromoform	0.0260	0.0269	0.050	ND	52	54	36-90	3.14	20
Bromomethane	0.0344	0.0316	0.050	ND	69	63	10-149	8.66	20
2-Butanone (MEK)	0.139	0.118	0.20	ND	66	55	43-114	16.4	20
t-Butyl alcohol (TBA)	0.136	0.147	0.20	ND	68	73	33-123	7.40	20
n-Butyl benzene	0.0207	0.0180	0.050	ND	41	36,F1	40-185	13.9	20
sec-Butyl benzene	0.0192	0.0168	0.050	ND	39,F1	34,F1	40-183	13.8	20
tert-Butyl benzene	0.0193	0.0170	0.050	ND	39,F1	34,F1	44-168	12.7	20
Carbon Disulfide	0.0316	0.0308	0.050	ND	63	62	23-139	2.61	20
Carbon Tetrachloride	0.0298	0.0290	0.050	ND	60	58	43-133	2.63	20
Chlorobenzene	0.0312	0.0308	0.050	ND	62	62	51-115	0	20
Chloroethane	0.0334	0.0322	0.050	ND	67	64	16-138	3.56	20
Chloroform	0.0356	0.0359	0.050	ND	71	72	54-117	0.821	20
Chloromethane	0.0281	0.0263	0.050	ND	56	53	14-128	6.68	20
2-Chlorotoluene	0.0305	0.0288	0.050	ND	61	58	54-141	5.96	20
4-Chlorotoluene	0.0287	0.0270	0.050	ND	57	54	52-134	6.16	20
Dibromochloromethane	0.0313	0.0320	0.050	ND	63	64	46-102	2.09	20
1,2-Dibromo-3-chloropropane	0.0134	0.0125	0.020	ND	67	63	16-120	6.56	20
1,2-Dibromoethane (EDB)	0.0336	0.0344	0.050	ND	67	69	48-113	2.32	20
Dibromomethane	0.0327	0.0338	0.050	ND	65	68	44-110	3.34	20
1,2-Dichlorobenzene	0.0263	0.0259	0.050	ND	48	48	43-106	0	20
1,3-Dichlorobenzene	0.0268	0.0252	0.050	ND	54	50	49-128	6.29	20
1,4-Dichlorobenzene	0.0279	0.0268	0.050	ND	56	54	48-120	3.84	20
Dichlorodifluoromethane	0.0160	0.0150	0.050	ND	32	30	8-63	6.70	20
1,1-Dichloroethane	0.0350	0.0353	0.050	ND	70	71	50-122	1.05	20
1,2-Dichloroethane (1,2-DCA)	0.0344	0.0354	0.050	ND	69	71	46-116	2.99	20
1,1-Dichloroethene	0.0324	0.0324	0.050	ND	65	65	37-124	0	20
cis-1,2-Dichloroethene	0.0354	0.0356	0.050	ND	71	71	47-123	0	20
trans-1,2-Dichloroethene	0.0341	0.0339	0.050	ND	68	68	31-131	0	20
1,2-Dichloropropane	0.0316	0.0313	0.050	ND	63	63	50-116	0	20
1,3-Dichloropropane	0.0334	0.0339	0.050	ND	67	68	52-115	1.53	20
2,2-Dichloropropane	0.0341	0.0342	0.050	ND	68	68	43-137	0	20

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
1,1-Dichloropropene	0.0309	0.0300	0.050	ND	62	60	43-126	2.91	20
cis-1,3-Dichloropropene	0.0340	0.0345	0.050	ND	68	69	35-134	1.36	20
trans-1,3-Dichloropropene	0.0322	0.0324	0.050	ND	64	65	35-124	0.774	20
Diisopropyl ether (DIPE)	0.0317	0.0318	0.050	ND	63	64	49-116	0.134	20
Ethylbenzene	0.0297	0.0280	0.050	ND	59	56	49-137	5.73	20
Ethyl tert-butyl ether (ETBE)	0.0328	0.0335	0.050	ND	66	67	50-113	2.20	20
Freon 113	0.0220	0.0209	0.050	ND	44	42	28-114	5.33	20
Hexachlorobutadiene	0.0102	0.0105	0.050	ND	20,F1	21,F1	22-180	2.74	20
Hexachloroethane	0.0207	0.0190	0.050	ND	35	31	28-158	8.44	20
2-Hexanone	0.0286	0.0301	0.050	ND	57	60	31-102	4.97	20
Isopropylbenzene	0.0308	0.0276	0.050	ND	62	55	50-153	11.1	20
4-Isopropyl toluene	0.0218	0.0191	0.050	ND	44	38,F1	41-171	13.3	20
Methyl-t-butyl ether (MTBE)	0.0342	0.0355	0.050	ND	68	71	48-110	3.92	20
Methylene chloride	0.0339	0.0344	0.050	ND	68	69	42-127	1.50	20
4-Methyl-2-pentanone (MIBK)	0.0299	0.0312	0.050	ND	60	63	24-114	4.39	20
Naphthalene	0.0214	0.0218	0.050	ND	43	44	19-69	2.01	20
n-Propyl benzene	0.0260	0.0234	0.050	ND	52	47	46-168	10.2	20
Styrene	0.0246	0.0238	0.050	ND	49	48	42-122	3.31	20
1,1,1,2-Tetrachloroethane	0.0320	0.0316	0.050	ND	64	63	52-121	1.29	20
1,1,2,2-Tetrachloroethane	0.0350	0.0352	0.050	ND	70	70	27-116	0	20
Tetrachloroethene	0.0258	0.0240	0.050	ND	52	48	37-149	7.11	20
Toluene	0.0307	0.0299	0.050	ND	61	60	52-124	2.59	20
1,2,3-Trichlorobenzene	0.0165	0.0178	0.050	ND	33	36	20-86	7.85	20
1,2,4-Trichlorobenzene	0.0167	0.0171	0.050	ND	33	34	24-107	2.18	20
1,1,1-Trichloroethane	0.0321	0.0321	0.050	ND	64	64	48-128	0	20
1,1,2-Trichloroethane	0.0339	0.0351	0.050	ND	68	70	51-110	3.31	20
Trichloroethene	0.0312	0.0307	0.050	ND	62	61	42-128	1.53	20
Trichlorofluoromethane	0.0278	0.0276	0.050	ND	56	55	31-121	0.930	20
1,2,3-Trichloropropane	0.0376	0.0378	0.050	ND	75	76	50-115	0.415	20
1,2,4-Trimethylbenzene	0.0319	0.0299	0.050	ND	55	51	48-151	6.71	20
1,3,5-Trimethylbenzene	0.0290	0.0265	0.050	ND	58	53	51-159	9.04	20
Vinyl Chloride	0.0326	0.0308	0.050	ND	65	62	11-136	5.63	20
Xylenes, Total	0.0756	0.0716	0.15	ND	50	48	38-141	5.43	20

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Surrogate Recovery									
Dibromofluoromethane	0.138	0.139	0.12		110	111	82-136	1.13	20
Toluene-d8	0.156	0.156	0.12		125	125	92-139	0	20
4-BFB	0.0137	0.0137	0.012		110	109	82-135	0.392	20
Benzene-d6	0.0779	0.0769	0.10		78	77	55-122	1.32	20
Ethylbenzene-d10	0.0665	0.0623	0.10		67	62	58-141	6.53	20
1,2-DCB-d4	0.0601	0.0581	0.10		60	58	51-107	3.47	20

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/8/17	**BatchID:**	145115
Date Analyzed:	9/8/17	**Extraction Method**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-145115

QC Summary Report for SW8260B

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
Acetone	ND	10	-	-	-
tert-Amyl methyl ether (TAME)	ND	0.50	-	-	-
Benzene	ND	0.50	-	-	-
Bromobenzene	ND	0.50	-	-	-
Bromochloromethane	ND	0.50	-	-	-
Bromodichloromethane	ND	0.50	-	-	-
Bromoform	ND	0.50	-	-	-
Bromomethane	ND	0.50	-	-	-
2-Butanone (MEK)	ND	2.0	-	-	-
t-Butyl alcohol (TBA)	ND	2.0	-	-	-
n-Butyl benzene	ND	0.50	-	-	-
sec-Butyl benzene	ND	0.50	-	-	-
tert-Butyl benzene	ND	0.50	-	-	-
Carbon Disulfide	ND	0.50	-	-	-
Carbon Tetrachloride	ND	0.50	-	-	-
Chlorobenzene	ND	0.50	-	-	-
Chloroethane	ND	0.50	-	-	-
Chloroform	ND	0.50	-	-	-
Chloromethane	ND	0.50	-	-	-
2-Chlorotoluene	ND	0.50	-	-	-
4-Chlorotoluene	ND	0.50	-	-	-
Dibromochloromethane	ND	0.50	-	-	-
1,2-Dibromo-3-chloropropane	ND	0.20	-	-	-
1,2-Dibromoethane (EDB)	ND	0.50	-	-	-
Dibromomethane	ND	0.50	-	-	-
1,2-Dichlorobenzene	ND	0.50	-	-	-
1,3-Dichlorobenzene	ND	0.50	-	-	-
1,4-Dichlorobenzene	ND	0.50	-	-	-
Dichlorodifluoromethane	ND	0.50	-	-	-
1,1-Dichloroethane	ND	0.50	-	-	-
1,2-Dichloroethane (1,2-DCA)	ND	0.50	-	-	-
1,1-Dichloroethene	ND	0.50	-	-	-
cis-1,2-Dichloroethene	ND	0.50	-	-	-
trans-1,2-Dichloroethene	ND	0.50	-	-	-
1,2-Dichloropropane	ND	0.50	-	-	-
1,3-Dichloropropane	ND	0.50	-	-	-
2,2-Dichloropropane	ND	0.50	-	-	-
1,1-Dichloropropene	ND	0.50	-	-	-
cis-1,3-Dichloropropene	ND	0.50	-	-	-

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/8/17	**BatchID:**	145115
Date Analyzed:	9/8/17	**Extraction Method**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-145115

QC Summary Report for SW8260B

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
trans-1,3-Dichloropropene	ND	0.50	-	-	-
Diisopropyl ether (DIPE)	ND	0.50	-	-	-
Ethylbenzene	ND	0.50	-	-	-
Ethyl tert-butyl ether (ETBE)	ND	0.50	-	-	-
Freon 113	ND	0.50	-	-	-
Hexachlorobutadiene	ND	0.50	-	-	-
Hexachloroethane	ND	0.50	-	-	-
2-Hexanone	ND	0.50	-	-	-
Isopropylbenzene	ND	0.50	-	-	-
4-Isopropyl toluene	ND	0.50	-	-	-
Methyl-t-butyl ether (MTBE)	ND	0.50	-	-	-
Methylene chloride	ND	0.50	-	-	-
4-Methyl-2-pentanone (MIBK)	ND	0.50	-	-	-
Naphthalene	ND	0.50	-	-	-
n-Propyl benzene	ND	0.50	-	-	-
Styrene	ND	0.50	-	-	-
1,1,1,2-Tetrachloroethane	ND	0.50	-	-	-
1,1,2,2-Tetrachloroethane	ND	0.50	-	-	-
Tetrachloroethene	ND	0.50	-	-	-
Toluene	ND	0.50	-	-	-
1,2,3-Trichlorobenzene	ND	0.50	-	-	-
1,2,4-Trichlorobenzene	ND	0.50	-	-	-
1,1,1-Trichloroethane	ND	0.50	-	-	-
1,1,2-Trichloroethane	ND	0.50	-	-	-
Trichloroethene	ND	0.50	-	-	-
Trichlorofluoromethane	ND	0.50	-	-	-
1,2,3-Trichloropropane	ND	0.50	-	-	-
1,2,4-Trimethylbenzene	ND	0.50	-	-	-
1,3,5-Trimethylbenzene	ND	0.50	-	-	-
Vinyl Chloride	ND	0.50	-	-	-
Xylenes, Total	ND	0.50	-	-	-
Surrogate Recovery					
Dibromofluoromethane	27.17		25	109	91-133
Toluene-d8	27.76		25	111	87-127
4-BFB	2.352		2.5	94	66-140

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/8/17	**BatchID:**	145115
Date Analyzed:	9/8/17	**Extraction Method**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-145115

QC Summary Report for SW8260B

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
Acetone	142	138	200	71	69	47-122	2.76	20
tert-Amyl methyl ether (TAME)	7.97	7.94	10	80	79	62-121	0.338	20
Benzene	9.29	9.03	10	93	90	74-121	2.86	20
Bromobenzene	9.20	8.94	10	92	89	63-127	2.80	20
Bromochloromethane	8.87	8.70	10	89	87	70-126	1.90	20
Bromodichloromethane	9.28	9.20	10	93	92	66-127	0.822	20
Bromoform	7.69	7.42	10	77	74	60-119	3.63	20
Bromomethane	10.9	10.0	10	109	100	32-155	8.20	20
2-Butanone (MEK)	28.0	27.1	40	70	68	51-117	3.50	20
t-Butyl alcohol (TBA)	23.9	22.6	40	60	56	41-122	5.72	20
n-Butyl benzene	9.84	9.47	10	98	95	73-137	3.84	20
sec-Butyl benzene	9.66	9.56	10	97	96	71-137	0.982	20
tert-Butyl benzene	10.3	10.1	10	103	101	61-136	1.74	20
Carbon Disulfide	9.98	9.70	10	100	97	61-139	2.83	20
Carbon Tetrachloride	10.0	9.70	10	101	97	69-137	3.62	20
Chlorobenzene	9.34	9.15	10	93	92	71-122	2.03	20
Chloroethane	10.8	10.2	10	108	102	54-132	6.05	20
Chloroform	9.25	9.04	10	93	90	73-122	2.34	20
Chloromethane	11.4	10.9	10	114	109	48-136	4.14	20
2-Chlorotoluene	10.1	10.1	10	101	101	65-134	0	20
4-Chlorotoluene	9.84	9.88	10	98	99	65-130	0.468	20
Dibromochloromethane	7.93	7.85	10	79	79	65-121	0	20
1,2-Dibromo-3-chloropropane	2.75	2.63	4	69	66	41-132	4.65	20
1,2-Dibromoethane (EDB)	8.44	8.24	10	84	82	67-125	2.51	20
Dibromomethane	8.42	8.28	10	84	83	68-121	1.62	20
1,2-Dichlorobenzene	9.17	9.03	10	92	90	69-128	1.52	20
1,3-Dichlorobenzene	9.52	9.45	10	95	95	71-131	0	20
1,4-Dichlorobenzene	9.19	9.18	10	92	92	70-128	0	20
Dichlorodifluoromethane	8.77	8.41	10	88	84	21-158	4.22	20
1,1-Dichloroethane	9.38	9.23	10	94	92	73-123	1.65	20
1,2-Dichloroethane (1,2-DCA)	8.65	8.38	10	86	84	61-127	3.11	20
1,1-Dichloroethene	9.17	8.90	10	92	89	68-130	2.98	20
cis-1,2-Dichloroethene	9.28	8.99	10	93	90	72-123	3.17	20
trans-1,2-Dichloroethene	9.53	9.33	10	95	93	64-138	2.10	20
1,2-Dichloropropane	9.21	8.91	10	92	89	71-121	3.29	20
1,3-Dichloropropane	8.43	8.29	10	84	83	69-120	1.67	20
2,2-Dichloropropane	11.5	11.2	10	115	112	64-142	2.51	20
1,1-Dichloropropene	9.60	9.31	10	96	93	70-130	3.14	20
cis-1,3-Dichloropropene	9.66	9.49	10	97	95	58-136	1.81	20

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/8/17	**BatchID:**	145115
Date Analyzed:	9/8/17	**Extraction Method**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-145115

QC Summary Report for SW8260B

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
trans-1,3-Dichloropropene	9.70	9.28	10	97	93	66-119	4.32	20
Diisopropyl ether (DIPE)	9.01	8.84	10	90	88	66-123	1.87	20
Ethylbenzene	9.46	9.37	10	95	94	71-125	0.995	20
Ethyl tert-butyl ether (ETBE)	8.57	8.42	10	86	84	67-122	1.81	20
Freon 113	9.12	8.84	10	91	88	68-132	3.08	20
Hexachlorobutadiene	9.66	9.41	10	97	94	56-155	2.57	20
Hexachloroethane	9.14	8.63	10	91	86	61-129	5.80	20
2-Hexanone	6.66	6.28	10	67	63	51-115	5.78	20
Isopropylbenzene	9.86	10.1	10	99	101	66-134	2.53	20
4-Isopropyl toluene	10.4	10.0	10	104	100	70-136	3.85	20
Methyl-t-butyl ether (MTBE)	7.67	7.72	10	77	77	64-118	0	20
Methylene chloride	8.15	7.92	10	81	79	62-121	2.84	20
4-Methyl-2-pentanone (MIBK)	7.48	7.24	10	75	72	51-115	3.27	20
Naphthalene	7.63	7.27	10	76	73	55-137	4.76	20
n-Propyl benzene	10.2	10.2	10	102	102	63-140	0	20
Styrene	8.98	9.42	10	90	94	62-133	4.81	20
1,1,1,2-Tetrachloroethane	9.68	9.52	10	97	95	69-128	1.65	20
1,1,2,2-Tetrachloroethane	8.21	7.71	10	82	77	60-118	6.32	20
Tetrachloroethene	9.67	9.27	10	97	93	63-136	4.19	20
Toluene	9.55	9.19	10	95	92	67-124	3.82	20
1,2,3-Trichlorobenzene	8.37	7.88	10	84	79	57-145	6.01	20
1,2,4-Trichlorobenzene	8.94	8.53	10	89	85	60-144	4.67	20
1,1,1-Trichloroethane	9.89	9.57	10	99	96	70-133	3.30	20
1,1,2-Trichloroethane	8.51	8.30	10	85	83	65-125	2.42	20
Trichloroethene	9.34	9.08	10	93	91	67-133	2.73	20
Trichlorofluoromethane	8.96	8.72	10	90	87	59-145	2.82	20
1,2,3-Trichloropropane	8.27	7.88	10	83	79	65-115	4.76	20
1,2,4-Trimethylbenzene	10.4	9.96	10	104	100	67-136	4.55	20
1,3,5-Trimethylbenzene	10.6	10.2	10	106	101	68-135	3.93	20
Vinyl Chloride	11.0	10.4	10	110	104	53-146	5.66	20
Xylenes, Total	28.3	29.5	30	94	98	68-128	4.09	20
Surrogate Recovery								
Dibromofluoromethane	27.5	27.5	25	110	110	91-133	0	20
Toluene-d8	27.8	27.4	25	111	110	87-127	1.29	20
4-BFB	2.58	2.63	2.5	103	105	66-140	1.67	20

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144897
Date Analyzed:	9/6/17	**Extraction Method**	SW5030B
Instrument:	GC10, GC18, GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-144897 1709079-023AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	0.25	-	-	-
Surrogate Recovery					
Dibromofluoromethane	0.1425		0.12	114	70-130
Benzene-D6	0.09169		0.10	92	70-130

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(g) (C6-C12)	1.19	0.990	1	119, F2	99	67-117	18.6	20
Surrogate Recovery								
Dibromofluoromethane	0.142	0.141	0.12	113	113	70-130	0	20
Benzene-D6	0.131	0.113	0.10	131	113	60-140	14.3	20

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH(g) (C6-C12)	N/A	N/A		N/A	N/A	N/A	-	N/A	-
Surrogate Recovery									
Dibromofluoromethane	N/A	N/A			N/A	N/A	-	N/A	-
Benzene-D6	N/A	N/A			N/A	N/A	-	N/A	-

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/8/17	**BatchID:**	145115
Date Analyzed:	9/8/17	**Extraction Method**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-145115

QC Summary Report for SW8260B

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	50	-	-	-
Surrogate Recovery					
Dibromofluoromethane	27.87		25	111	70-130

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(g) (C6-C12)	179	178	200	89	89	70-130	0	20
Surrogate Recovery								
Dibromofluoromethane	29.4	29.1	25	117	117	70-130	0	20

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144921
Date Analyzed:	9/6/17	**Extraction Method**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144921 1709108-001GMS/MSD 1709108-001GPDS

QC Summary Report for Metals

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Antimony	ND	51.9	0.50	50	-	104	75-125
Arsenic	ND	52.9	0.50	50	-	106	75-125
Barium	ND	540	5.0	500	-	108	75-125
Beryllium	ND	53.7	0.50	50	-	107	75-125
Cadmium	ND	50.1	0.25	50	-	100	75-125
Chromium	ND	50.6	0.50	50	-	101	75-125
Cobalt	ND	51.9	0.50	50	-	104	75-125
Copper	ND	50.2	0.50	50	-	100	75-125
Lead	ND	52.3	0.50	50	-	105	75-125
Mercury	ND	1.29	0.050	1.25	-	103	75-125
Molybdenum	ND	50.6	0.50	50	-	101	75-125
Nickel	ND	50.5	0.50	50	-	101	75-125
Selenium	ND	51.9	0.50	50	-	104	75-125
Silver	ND	51.9	0.50	50	-	104	75-125
Thallium	ND	51.2	0.50	50	-	102	75-125
Vanadium	ND	51.1	0.50	50	-	102	75-125
Zinc	ND	506	5.0	500	-	101	75-125
Surrogate Recovery							
Terbium	537.3	544		500	107	109	70-130

(Cont.)

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144921
Date Analyzed:	9/6/17	**Extraction Method**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144921 1709108-001GMS/MSD 1709108-001GPDS

QC Summary Report for Metals

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Antimony	52.0	52.5	50	ND	103	104	75-125	0.996	20
Arsenic	54.9	55.4	50	1.920	106	107	75-125	0.906	20
Barium	588	574	500	27.87	112	109	75-125	2.46	20
Beryllium	53.6	53.1	50	ND	107	106	75-125	0.881	20
Cadmium	52.0	50.0	50	ND	104	100	75-125	3.92	20
Chromium	119	130	50	282.7	0,F13	0,F13	75-125	NA	20
Cobalt	55.5	55.1	50	5.762	99	99	75-125	0	20
Copper	93.0	84.0	50	34.22	117	100	75-125	10.1	20
Lead	89.9	76.4	50	30.74	118	91	75-125	16.2	20
Mercury	1.32	3.02	1.25	0.06990	100	236,F10	75-125	78.5,F10	20
Molybdenum	55.6	66.8	50	5.946	99	122	75-125	18.4	20
Nickel	83.6	108	50	43.14	81	130,F10	75-125	25.6,F10	20
Selenium	53.1	51.6	50	ND	106	103	75-125	2.88	20
Silver	51.6	50.5	50	ND	103	101	75-125	2.19	20
Thallium	51.7	50.7	50	ND	103	101	75-125	1.97	20
Vanadium	74.5	69.7	50	19.74	110	100	75-125	6.73	20
Zinc	553	538	500	34.31	104	101	75-125	2.80	20
Surrogate Recovery									
Terbium	547	549	500		109	110	70-130	0.474	20

Analyte	PDS Result	SPK Val	SPKRef Val	PDS %REC	PDS Limits
Mercury	1.37	1.25	0.06990	104	75-125
Nickel	92.1	50	43.14	98	75-125

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Antimony	ND<2.5	ND	-	-
Arsenic	ND<2.5	1.920	-	-
Barium	27.6	27.87	0.969	-
Beryllium	ND<2.5	ND	-	-
Cadmium	ND<1.2	ND	-	-
Chromium	282	282.7	0.248	20
Cobalt	6.09	5.762	5.69	-

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144921
Date Analyzed:	9/6/17	**Extraction Method**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144921 1709108-001GMS/MSD 1709108-001GPDS

QC Summary Report for Metals

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Copper	34.8	34.22	1.69	20
Lead	31.2	30.74	1.50	20
Mercury	ND<0.25	0.06990	-	-
Molybdenum	5.94	5.946	0.101	-
Nickel	43.8	43.14	1.53	20
Selenium	ND<2.5	ND	-	-
Silver	ND<2.5	ND	-	-
Thallium	ND<2.5	ND	-	-
Vanadium	20.0	19.74	1.32	20
Zinc	36.6	34.31	6.67	-

%D Control Limit applied to analytes with concentrations greater than 25 times the reporting limits.

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/11/17	**BatchID:**	145181
Date Analyzed:	9/12/17	**Extraction Method**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-145181 1709305-001DMS/MSD

QC Summary Report for Metals

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Antimony	ND	52.4	0.50	50	-	105	85-115
Arsenic	ND	50.4	0.50	50	-	101	85-115
Barium	ND	525	5.0	500	-	105	85-115
Beryllium	ND	54.6	0.50	50	-	109	85-115
Cadmium	ND	51.0	0.25	50	-	102	85-115
Chromium	ND	49.4	0.50	50	-	99	85-115
Cobalt	ND	48.0	0.50	50	-	96	85-115
Copper	ND	50.5	2.0	50	-	101	85-115
Lead	ND	51.9	0.50	50	-	104	85-115
Mercury	ND	1.28	0.050	1.25	-	103	85-115
Molybdenum	ND	51.2	0.50	50	-	102	85-115
Nickel	ND	50.2	0.50	50	-	100	85-115
Selenium	ND	52.1	0.50	50	-	104	85-115
Silver	ND	52.3	0.19	50	-	105	85-115
Thallium	ND	49.3	0.50	50	-	99	85-115
Vanadium	ND	49.5	0.50	50	-	99	85-115
Zinc	ND	499	15	500	-	100	85-115
Surrogate Recovery							
Terbium	782.6	800		750	104	107	70-130

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/11/17	**BatchID:**	145181
Date Analyzed:	9/12/17	**Extraction Method**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-145181 1709305-001DMS/MSD

QC Summary Report for Metals

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Antimony	53.7	53.7	50	ND	107	107	75-125	0	20
Arsenic	52.8	53.7	50	ND	106	107	75-125	1.63	20
Barium	597	595	500	57	108	108	75-125	0	20
Beryllium	53.2	53.6	50	ND	106	107	75-125	0.824	20
Cadmium	53.1	52.5	50	ND	106	105	75-125	1.27	20
Chromium	190	190	50	130	112	111	75-125	0.263	20
Cobalt	47.6	47.7	50	0.57	94	94	75-125	0	20
Copper	54.1	54.6	50	3.3	102	103	75-125	0.920	20
Lead	52.2	52.5	50	ND	104	105	75-125	0.611	20
Mercury	1.35	1.38	1.25	ND	107	109	75-125	2.42	20
Molybdenum	104	104	50	50	108	107	75-125	0.193	20
Nickel	51.5	52.2	50	1.3	101	102	75-125	1.29	20
Selenium	69.1	67.6	50	13	113	109	75-125	2.22	20
Silver	50.1	50.2	50	ND	100	100	75-125	0	20
Thallium	48.8	49.0	50	ND	97	98	75-125	0.573	20
Vanadium	60.4	60.2	50	7.8	105	105	75-125	0	20
Zinc	516	526	500	ND	103	105	75-125	1.80	20
Surrogate Recovery									
Terbium	815	805	750		109	107	70-130	1.22	20

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Antimony	ND<2.5	ND	-	-
Arsenic	ND<2.5	ND	-	-
Barium	56.0	57	1.75	-
Beryllium	ND<2.5	ND	-	-
Cadmium	ND<1.2	ND	-	-
Chromium	136	130	4.62	20
Cobalt	ND<2.5	0.57	-	-
Copper	ND<10	3.3	-	-
Lead	ND<2.5	ND	-	-
Mercury	ND<0.25	ND	-	-
Molybdenum	48.9	50	2.20	20
Nickel	ND<2.5	1.3	-	-
Selenium	12.7	13	2.31	20

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/11/17	**BatchID:**	145181
Date Analyzed:	9/12/17	**Extraction Method**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-145181 1709305-001DMS/MSD

QC Summary Report for Metals

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Silver	ND<0.95	ND	-	-
Thallium	ND<2.5	ND	-	-
Vanadium	7.78	7.8	0.256	-
Zinc	ND<75	ND	-	-

%D Control Limit applied to analytes with concentrations greater than 25 times the reporting limits.

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144909
Date Analyzed:	9/6/17	**Extraction Method**	SW3550B
Instrument:	GC39A	**Analytical Method:**	SW8015B
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS-144909 1709097-002AMS/MSD

QC Report for SW8015B w/out SG Clean-Up

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
TPH-Diesel (C10-C23)	ND	45.1	1.0	40	-	113	75-128
TPH-Motor Oil (C18-C36)	ND	-	5.0	-	-	-	-
Surrogate Recovery							
C26	23.55	23.4		25	94	93	81-112

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH-Diesel (C10-C23)	NR	NR		23	NR	NR	-	NR	-
Surrogate Recovery									
C26	NR	NR			NR	NR	-	NR	-

QA/QC Officer

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1709120
Date Prepared:	9/5/17	**BatchID:**	144905
Date Analyzed:	9/5/17 - 9/6/17	**Extraction Method**	SW3510C
Instrument:	GC39A, GC9b	**Analytical Method:**	SW8015B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas 2	**Sample ID:**	MB/LCS/LCSD-144905

QC Report for SW8015B w/out SG Clean-Up

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH-Diesel (C10-C23)	ND	50	-	-	-
TPH-Motor Oil (C18-C36)	ND	250	-	-	-
Surrogate Recovery					
C9	673.2		625	108	68-127

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH-Diesel (C10-C23)	1300	1230	1000	130	123	86-142	5.61	30
Surrogate Recovery								
C9	582	589	625	93	94	68-127	1.12	30

McCampbell Analytical, Inc.

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CHAIN-OF-CUSTODY RECORD

WorkOrder: 1709120 **ClientCode: WREC**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag
☐ Detection Summary ☐ Dry-Weight

Report to:
Flannery Banks
WRECO
1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
(925) 941-0017 FAX: (916) 412-3589

Email: flannery_banks@wreco.com
cc/3rd Party: tony_jones@wreco.com;
PO:
ProjectNo: P17043; Las Trampas 2

Bill to:
Accounts Payable
WRECO
1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
Sue_Wang@wreco.com

Requested TAT: **5 days;**

Date Received: **09/06/2017**
Date Logged: **09/06/2017**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12
1709120-004	SB-02-5	Soil	9/6/2017 07:59	☐	A		A		A		A					
1709120-005	SB-02-10	Soil	9/6/2017 08:12	☐	A		A		A		A					
1709120-006	SB-02-15	Soil	9/6/2017 08:26	☐	A		A		A		A					
1709120-007	SB-02-20	Soil	9/6/2017 08:45	☐	A		A		A		A					
1709120-008	CU-02-18	Water	9/6/2017 08:55	☐		A		A		C		B				

Test Legend:

1	8260B_S	2	8260B_W	3	8260GAS_S	4	8260GAS_W
5	CAM17MS_TTLC_S	6	CAM17MS_TTLC_W	7	TPH(DMO)_S	8	TPH(DMO)_W
9		10		11		12	

Prepared by: Kena Ponce

The following SampIDs: 004A, 005A, 006A, 007A contain testgroup Gas8260_S.; The following SampID: 008A contains testgroup Gas8260_W.

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

WORK ORDER SUMMARY

Client Name: WRECO **Project:** P17043; Las Trampas 2 **Work Order:** 1709120
Client Contact: Flannery Banks **QC Level:** LEVEL 2
Contact's Email: flannery_banks@wreco.com **Comments:** **Date Logged:** 9/6/2017

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1709120-001A	SB-02-0-1	Soil		1	8OZ GJ	☐	9/6/2017 7:34			☑	
1709120-002A	SB-02-1-2	Soil		1	8OZ GJ	☐	9/6/2017 7:38			☑	
1709120-003A	SB-02-2-3	Soil		1	8OZ GJ	☐	9/6/2017 7:41			☑	
1709120-004A	SB-02-5	Soil	SW8015B (Diesel & Motor Oil)	1	8OZ GJ	☐	9/6/2017 7:59	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			TPH(g) & 8260 by P&T GCMS			☐		5 days		☐	
1709120-005A	SB-02-10	Soil	SW8015B (Diesel & Motor Oil)	1	8OZ GJ	☐	9/6/2017 8:12	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			TPH(g) & 8260 by P&T GCMS			☐		5 days		☐	
1709120-006A	SB-02-15	Soil	SW8015B (Diesel & Motor Oil)	1	8OZ GJ	☐	9/6/2017 8:26	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			TPH(g) & 8260 by P&T GCMS			☐		5 days		☐	
1709120-007A	SB-02-20	Soil	SW8015B (Diesel & Motor Oil)	1	8OZ GJ	☐	9/6/2017 8:45	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			TPH(g) & 8260 by P&T GCMS			☐		5 days		☐	
1709120-008A	CU-02-18	Water	TPH(g) & 8260 by P&T GCMS	2	2 VOAs w/HCL	☐	9/6/2017 8:55	5 days	5%+	☐	

NOTES:
- **STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).**
- **MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.**

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WORK ORDER SUMMARY

Client Name: WRECO **Project:** P17043; Las Trampas 2 **Work Order:** 1709120

Client Contact: Flannery Banks **QC Level:** LEVEL 2

Contact's Email: flannery_banks@wreco.com **Comments:** **Date Logged:** 9/6/2017

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1709120-008B	CU-02-18	Water	SW8015B (Diesel & Motor Oil)	2	aVOA	☐	9/6/2017 8:55	5 days	5%+	☐	
1709120-008C	CU-02-18	Water	E200.8 (CAM 17)	1	250mL HDPE w/ HNO3	☐	9/6/2017 8:55	5 days	5%+	☐	

NOTES: **- STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).**

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

General COC

MAI Work Order # 1709120

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CHAIN OF CUSTODY RECORD

Turn Around Time: 1 Day Rush		2 Day Rush		3 Day Rush		STD	●
Quote #							
J-Flag / MDL		ESL		Cleanup Approved		Bottle Order #	
Delivery Format: PDF	●	GeoTracker EDF		EDD		Write On (DW)	
EQuIS							

Report To: Flannery Banks   Bill To: WRECO
Company: WRECO 1243 Alpine Rd, Ste 108, Walnut Creek, CA 94596
Email: flannery_banks@wreco.com
Alt Email: tony_jones@wreco.com   Tele: 925-941-0017
Project Name: Las Trampas 2   Project #: P17043
Project Location: Walnut Creek   PO #
Sampler Signature: [signature]

Analysis Requested

SAMPLE ID Location / Field Point	Sampling Date	Sampling Time	#Containers	Matrix	Preservative	BTEX & TPH as Gas ~~(8021/8015)~~ 8260 MTBE	TPH as Diesel (8015) + Motor Oil Without Silica Gel	TPH as Diesel (8015) + Motor Oil With Silica Gel	Total Oil & Grease (1664 / 9071) Without Silica Gel	Total Petroleum Hydrocarbons - Oil & Grease (1664 / 9071) With Silica Gel	Total Petroleum Hydrocarbons (418.1) With Silica Gel	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ; Aroclors only	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.8 / 6020)*	Metals (200.8 / 6020)	Baylands Requirements	Lab to filter sample for dissolved metals analysis
SB-02-0-1	9/6/17	734	1	S	N/A															
SB-02-1-2		738	1	S	N/A															
SB-02-2-3		741	1	S	N/A															
SB-02-5		759	1	S	N/A	X	X							X			X			
SB-02-10		812	1	S	N/A	X	X							X			X			
SB-02-15		826	1	S	N/A	X	X							X			X			
SB-02-20		845	1	S	N/A	X	X							X			X			
GW-02-18	↓	855	5	GW	2,4	X	X							X			X			

MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

* If metals are requested for water samples and the water type (Matrix) is not specified on the chain of custody, MAI will default to metals by E200.8.

Please provide an adequate volume of sample. If the volume is not sufficient for a MS/MSD a LCS/LCSD will be prepared in its place and noted in the report.

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
Flannery Banks [signature] WRECO	9/6/17	1354	[signature]	9/6/17	1354

Comments / Instructions

Matrix Code: DW=Drinking Water, GW=Ground Water, WW=Waste Water, SW=Seawater, S=Soil, SL=Sludge, A=Air, WP=Wipe, O=Other

Preservative Code: 1=4°C 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=ZnOAc/NaOH 7=None

Temp 3.4 °C Initials ____

Page ___ of ___

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Sample Receipt Checklist

Client Name:	**WRECO**	Date and Time Received	**9/6/2017 13:54**
Project Name:	**P17043; Las Trampas 2**	Date Logged:	**9/6/2017**
		Received by:	Jena Alfaro
WorkOrder №:	**1709120** Matrix: Soil/Water	Logged by:	Kena Ponce
Carrier:	Client Drop-In		

Chain of Custody (COC) Information

	Yes	No	NA
Chain of custody present?	☑	☐	
Chain of custody signed when relinquished and received?	☑	☐	
Chain of custody agrees with sample labels?	☑	☐	
Sample IDs noted by Client on COC?	☑	☐	
Date and Time of collection noted by Client on COC?	☑	☐	
Sampler's name noted on COC?	☑	☐	
COC agrees with Quote?	☐	☐	☑

Sample Receipt Information

	Yes	No	NA
Custody seals intact on shipping container/cooler?	☐	☐	☑
Shipping container/cooler in good condition?	☑	☐	
Samples in proper containers/bottles?	☑	☐	
Sample containers intact?	☑	☐	
Sufficient sample volume for indicated test?	☑	☐	

Sample Preservation and Hold Time (HT) Information

	Yes	No	NA
All samples received within holding time?	☑	☐	☐
Sample/Temp Blank temperature	Temp: 3.4°C		☐
Water - VOA vials have zero headspace / no bubbles?	☑	☐	☐
Sample labels checked for correct preservation?	☑	☐	
pH acceptable upon receipt (Metal: <2; 522: <4; 218.7: >8)?	☐	☑	☐
Samples Received on Ice?	☑	☐	

(Ice Type: WET ICE)

UCMR Samples:

	Yes	No	NA
Total Chlorine tested and acceptable upon receipt for EPA 522?	☐	☐	☑
Free Chlorine tested and acceptable upon receipt for EPA 218.7, 300.1, 537, 539?	☐	☐	☑

Comments: pH adjusted in Lab.

McCampbell Analytical, Inc.

"When Quality Counts"

Analytical Report

WorkOrder: 1708114

Report Created for: WRECO

1243 Alpine Road, Suite 108
Walnut Creek, CA 94596

Project Contact: Flannery Banks
Project P.O.:
Project Name: P17043; Las Trampas Creek Bridge

Project Received: 08/02/2017

Analytical Report reviewed & approved for release on 08/10/2017 by:

Angela Rydelius,
Laboratory Manager

The report shall not be reproduced except in full, without the written approval of the laboratory. The analytical results relate only to the items tested. Results reported conform to the most current NELAP standards, where applicable, unless otherwise stated in the case narrative.

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Glossary of Terms & Qualifier Definitions

Client: WRECO
Project: P17043; Las Trampas Creek Bridge
WorkOrder: 1708114

Glossary Abbreviation

%D	Serial Dilution Percent Difference
95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test (Serial Dilution)
DUP	Duplicate
EDL	Estimated Detection Limit
ERS	External reference sample. Second source calibration verification.
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
ST	Sorbent Tube
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

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Glossary of Terms & Qualifier Definitions

Client: WRECO
Project: P17043; Las Trampas Creek Bridge
WorkOrder: 1708114

Analytical Qualifiers

a1	Sample diluted due to matrix interference
a9	Reporting limit near, but not identical to, our standard reporting limit due to variable Encore/Solid sample weight
b1	Aqueous sample that contains greater than ~1 vol. % sediment
d7	Strongly aged gasoline or diesel range compounds are significant in the TPH(g) chromatogram
e2	Diesel range compounds are significant; no recognizable pattern
e7	Oil range compounds are significant
e8	Pattern resembles kerosene/kerosene range/jet fuel range

Quality Control Qualifiers

F1	MS/MSD recovery and/or RPD is out of acceptance criteria; LCS validates the prep batch.
F10	MS/MSD outside control limits. Physical or chemical interferences exist due to sample matrix.
F11	DLT outside control limits. Physical or chemical interferences exist due to sample matrix. Sample results may be estimates.
F13	Indigenous sample results too high for a representative matrix spike analysis.

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5030B
Date Prepared:	8/9/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Trip Blank	**1708114-005A**	**Water**	**08/01/2017 08:47**	**GC10**	**143274**

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	10	1	08/09/2017 18:21
tert-Amyl methyl ether (TAME)	ND	0.50	1	08/09/2017 18:21
Benzene	ND	0.50	1	08/09/2017 18:21
Bromobenzene	ND	0.50	1	08/09/2017 18:21
Bromochloromethane	ND	0.50	1	08/09/2017 18:21
Bromodichloromethane	ND	0.50	1	08/09/2017 18:21
Bromoform	ND	0.50	1	08/09/2017 18:21
Bromomethane	ND	0.50	1	08/09/2017 18:21
2-Butanone (MEK)	ND	2.0	1	08/09/2017 18:21
t-Butyl alcohol (TBA)	ND	2.0	1	08/09/2017 18:21
n-Butyl benzene	ND	0.50	1	08/09/2017 18:21
sec-Butyl benzene	ND	0.50	1	08/09/2017 18:21
tert-Butyl benzene	ND	0.50	1	08/09/2017 18:21
Carbon Disulfide	ND	0.50	1	08/09/2017 18:21
Carbon Tetrachloride	ND	0.50	1	08/09/2017 18:21
Chlorobenzene	ND	0.50	1	08/09/2017 18:21
Chloroethane	ND	0.50	1	08/09/2017 18:21
Chloroform	ND	0.50	1	08/09/2017 18:21
Chloromethane	ND	0.50	1	08/09/2017 18:21
2-Chlorotoluene	ND	0.50	1	08/09/2017 18:21
4-Chlorotoluene	ND	0.50	1	08/09/2017 18:21
Dibromochloromethane	ND	0.50	1	08/09/2017 18:21
1,2-Dibromo-3-chloropropane	ND	0.20	1	08/09/2017 18:21
1,2-Dibromoethane (EDB)	ND	0.50	1	08/09/2017 18:21
Dibromomethane	ND	0.50	1	08/09/2017 18:21
1,2-Dichlorobenzene	ND	0.50	1	08/09/2017 18:21
1,3-Dichlorobenzene	ND	0.50	1	08/09/2017 18:21
1,4-Dichlorobenzene	ND	0.50	1	08/09/2017 18:21
Dichlorodifluoromethane	ND	0.50	1	08/09/2017 18:21
1,1-Dichloroethane	ND	0.50	1	08/09/2017 18:21
1,2-Dichloroethane (1,2-DCA)	ND	0.50	1	08/09/2017 18:21
1,1-Dichloroethene	ND	0.50	1	08/09/2017 18:21
cis-1,2-Dichloroethene	ND	0.50	1	08/09/2017 18:21
trans-1,2-Dichloroethene	ND	0.50	1	08/09/2017 18:21
1,2-Dichloropropane	ND	0.50	1	08/09/2017 18:21
1,3-Dichloropropane	ND	0.50	1	08/09/2017 18:21
2,2-Dichloropropane	ND	0.50	1	08/09/2017 18:21

(Cont.)

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Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5030B
Date Prepared:	8/9/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Trip Blank	**1708114-005A**	**Water**	**08/01/2017 08:47**	**GC10**	**143274**

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.50	1	08/09/2017 18:21
cis-1,3-Dichloropropene	ND	0.50	1	08/09/2017 18:21
trans-1,3-Dichloropropene	ND	0.50	1	08/09/2017 18:21
Diisopropyl ether (DIPE)	ND	0.50	1	08/09/2017 18:21
Ethylbenzene	ND	0.50	1	08/09/2017 18:21
Ethyl tert-butyl ether (ETBE)	ND	0.50	1	08/09/2017 18:21
Freon 113	ND	0.50	1	08/09/2017 18:21
Hexachlorobutadiene	ND	0.50	1	08/09/2017 18:21
Hexachloroethane	ND	0.50	1	08/09/2017 18:21
2-Hexanone	ND	0.50	1	08/09/2017 18:21
Isopropylbenzene	ND	0.50	1	08/09/2017 18:21
4-Isopropyl toluene	ND	0.50	1	08/09/2017 18:21
Methyl-t-butyl ether (MTBE)	ND	0.50	1	08/09/2017 18:21
Methylene chloride	ND	0.50	1	08/09/2017 18:21
4-Methyl-2-pentanone (MIBK)	ND	0.50	1	08/09/2017 18:21
Naphthalene	ND	0.50	1	08/09/2017 18:21
n-Propyl benzene	ND	0.50	1	08/09/2017 18:21
Styrene	ND	0.50	1	08/09/2017 18:21
1,1,1,2-Tetrachloroethane	ND	0.50	1	08/09/2017 18:21
1,1,2,2-Tetrachloroethane	ND	0.50	1	08/09/2017 18:21
Tetrachloroethene	ND	0.50	1	08/09/2017 18:21
Toluene	ND	0.50	1	08/09/2017 18:21
1,2,3-Trichlorobenzene	ND	0.50	1	08/09/2017 18:21
1,2,4-Trichlorobenzene	ND	0.50	1	08/09/2017 18:21
1,1,1-Trichloroethane	ND	0.50	1	08/09/2017 18:21
1,1,2-Trichloroethane	ND	0.50	1	08/09/2017 18:21
Trichloroethene	ND	0.50	1	08/09/2017 18:21
Trichlorofluoromethane	ND	0.50	1	08/09/2017 18:21
1,2,3-Trichloropropane	ND	0.50	1	08/09/2017 18:21
1,2,4-Trimethylbenzene	ND	0.50	1	08/09/2017 18:21
1,3,5-Trimethylbenzene	ND	0.50	1	08/09/2017 18:21
Vinyl Chloride	ND	0.50	1	08/09/2017 18:21
Xylenes, Total	ND	0.50	1	08/09/2017 18:21

(Cont.)

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5030B
Date Prepared:	8/9/17	**Analytical Method:**	SW8260B
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Trip Blank	**1708114-005A**	**Water**	**08/01/2017 08:47**	**GC10**	**143274**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	104	70-130		08/09/2017 18:21
Toluene-d8	100	70-130		08/09/2017 18:21
4-BFB	92	70-130		08/09/2017 18:21

Analyst(s): JEM

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW3050B
Date Prepared:	8/2/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-A	**1708114-001A**	**Soil**	**08/01/2017 07:31**	**ICP-MS3**	**143071**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	08/03/2017 21:01
Arsenic	**3.8**	0.50	1	08/03/2017 21:01
Barium	**120**	5.0	1	08/03/2017 21:01
Beryllium	ND	0.50	1	08/03/2017 21:01
Cadmium	ND	0.25	1	08/03/2017 21:01
Chromium	**29**	0.50	1	08/03/2017 21:01
Cobalt	**7.0**	0.50	1	08/03/2017 21:01
Copper	**16**	0.50	1	08/03/2017 21:01
Lead	**17**	0.50	1	08/03/2017 21:01
Mercury	ND	0.050	1	08/03/2017 21:01
Molybdenum	**0.56**	0.50	1	08/03/2017 21:01
Nickel	**30**	0.50	1	08/03/2017 21:01
Selenium	ND	0.50	1	08/03/2017 21:01
Silver	ND	0.50	1	08/03/2017 21:01
Thallium	ND	0.50	1	08/03/2017 21:01
Vanadium	**39**	0.50	1	08/03/2017 21:01
Zinc	**44**	5.0	1	08/03/2017 21:01

Surrogates	REC (%)	Limits		
Terbium	104	70-130		08/03/2017 21:01

Analyst(s): DB

(Cont.)

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW3050B
Date Prepared:	8/2/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-C	**1708114-002A**	**Soil**	**08/01/2017 07:43**	**ICP-MS3**	**143071**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	08/03/2017 21:07
Arsenic	**5.0**	0.50	1	08/03/2017 21:07
Barium	**110**	5.0	1	08/03/2017 21:07
Beryllium	ND	0.50	1	08/03/2017 21:07
Cadmium	**0.34**	0.25	1	08/03/2017 21:07
Chromium	**35**	0.50	1	08/03/2017 21:07
Cobalt	**7.3**	0.50	1	08/03/2017 21:07
Copper	**14**	0.50	1	08/03/2017 21:07
Lead	**5.2**	0.50	1	08/03/2017 21:07
Mercury	ND	0.050	1	08/03/2017 21:07
Molybdenum	**0.58**	0.50	1	08/03/2017 21:07
Nickel	**38**	0.50	1	08/03/2017 21:07
Selenium	ND	0.50	1	08/03/2017 21:07
Silver	ND	0.50	1	08/03/2017 21:07
Thallium	ND	0.50	1	08/03/2017 21:07
Vanadium	**36**	0.50	1	08/03/2017 21:07
Zinc	**45**	5.0	1	08/03/2017 21:07

Surrogates	REC (%)	Limits		
Terbium	103	70-130		08/03/2017 21:07

Analyst(s): DB

(Cont.)

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW3050B
Date Prepared:	8/2/17	**Analytical Method:**	SW6020
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-E	**1708114-003A**	**Soil**	**08/01/2017 08:22**	**ICP-MS3**	**143071**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	0.50	1	08/03/2017 21:32
Arsenic	**9.2**	0.50	1	08/03/2017 21:32
Barium	**260**	5.0	1	08/03/2017 21:32
Beryllium	ND	0.50	1	08/03/2017 21:32
Cadmium	**0.49**	0.25	1	08/03/2017 21:32
Chromium	**37**	0.50	1	08/03/2017 21:32
Cobalt	**12**	0.50	1	08/03/2017 21:32
Copper	**14**	0.50	1	08/03/2017 21:32
Lead	**6.2**	0.50	1	08/03/2017 21:32
Mercury	ND	0.050	1	08/03/2017 21:32
Molybdenum	**0.64**	0.50	1	08/03/2017 21:32
Nickel	**40**	0.50	1	08/03/2017 21:32
Selenium	ND	0.50	1	08/03/2017 21:32
Silver	ND	0.50	1	08/03/2017 21:32
Thallium	ND	0.50	1	08/03/2017 21:32
Vanadium	**34**	0.50	1	08/03/2017 21:32
Zinc	**43**	5.0	1	08/03/2017 21:32

Surrogates	REC (%)	Limits	
Terbium	106	70-130	08/03/2017 21:32

Analyst(s): DB

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	E200.8
Date Prepared:	8/3/17	**Analytical Method:**	E200.8
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
W-01	**1708114-004C**	**Water**	**08/01/2017 08:47**	**ICP-MS2**	**143120**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	10	20	08/04/2017 14:28
Arsenic	**160**	10	20	08/04/2017 14:28
Barium	**21,000**	100	20	08/04/2017 14:28
Beryllium	**28**	10	20	08/04/2017 14:28
Cadmium	**33**	5.0	20	08/04/2017 14:28
Chromium	**1200**	10	20	08/04/2017 14:28
Cobalt	**710**	10	20	08/04/2017 14:28
Copper	**1600**	40	20	08/04/2017 14:28
Lead	**600**	10	20	08/04/2017 14:28
Mercury	**4.4**	1.0	20	08/04/2017 14:28
Molybdenum	ND	10	20	08/04/2017 14:28
Nickel	**3000**	10	20	08/04/2017 14:28
Selenium	ND	10	20	08/04/2017 14:28
Silver	**6.3**	3.8	20	08/04/2017 14:28
Thallium	ND	10	20	08/04/2017 14:28
Vanadium	**620**	10	20	08/04/2017 14:28
Zinc	**3400**	300	20	08/04/2017 14:28

Surrogates	REC (%)	Limits	Date Analyzed
Terbium	101	70-130	08/04/2017 14:28

Analyst(s): MIG   Analytical Comments: a1,b1

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Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5035
Date Prepared:	8/2/17	**Analytical Method:**	SW8021B/8015Bm
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE [Encore Sampling]

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-A	**1708114-001B**	**Soil**	**08/01/2017 07:31**	**GC19**	**143078**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.98	1	08/04/2017 21:07
MTBE	ND	0.049	1	08/04/2017 21:07
Benzene	ND	0.0049	1	08/04/2017 21:07
Toluene	ND	0.0049	1	08/04/2017 21:07
Ethylbenzene	ND	0.0049	1	08/04/2017 21:07
Xylenes	ND	0.015	1	08/04/2017 21:07

Surrogates	REC (%)	Limits	Date Analyzed
2-Fluorotoluene	79	62-126	08/04/2017 21:07

Analyst(s): IA   Analytical Comments: a9

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-C	**1708114-002B**	**Soil**	**08/01/2017 07:43**	**GC19**	**143078**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	08/04/2017 21:38
MTBE	ND	0.052	1	08/04/2017 21:38
Benzene	ND	0.0052	1	08/04/2017 21:38
Toluene	ND	0.0052	1	08/04/2017 21:38
Ethylbenzene	ND	0.0052	1	08/04/2017 21:38
Xylenes	ND	0.016	1	08/04/2017 21:38

Surrogates	REC (%)	Limits	Date Analyzed
2-Fluorotoluene	78	62-126	08/04/2017 21:38

Analyst(s): IA   Analytical Comments: a9

(Cont.)

NELAP 4033ORELAP

Angela Rydelius, Lab Manager

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5035
Date Prepared:	8/2/17	**Analytical Method:**	SW8021B/8015Bm
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE [Encore Sampling]

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-E	**1708114-003B**	**Soil**	**08/01/2017 08:22**	**GC19**	**143078**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.89	1	08/04/2017 22:10
MTBE	ND	0.044	1	08/04/2017 22:10
Benzene	ND	0.0044	1	08/04/2017 22:10
Toluene	ND	0.0044	1	08/04/2017 22:10
Ethylbenzene	ND	0.0044	1	08/04/2017 22:10
Xylenes	ND	0.013	1	08/04/2017 22:10

Surrogates	REC (%)	Limits	Date Analyzed
2-Fluorotoluene	75	62-126	08/04/2017 22:10

Analyst(s): IA   Analytical Comments: a9

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW5030B
Date Prepared:	8/7/17	**Analytical Method:**	SW8021B/8015Bm
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
W-01	**1708114-004A**	**Water**	**08/01/2017 08:47**	**GC3**	**143287**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	**700**	50	1	08/07/2017 16:27
MTBE	ND	5.0	1	08/07/2017 16:27
Benzene	ND	0.50	1	08/07/2017 16:27
Toluene	ND	0.50	1	08/07/2017 16:27
Ethylbenzene	**33**	0.50	1	08/07/2017 16:27
Xylenes	**160**	1.5	1	08/07/2017 16:27

Surrogates	REC (%)	Limits	Date Analyzed
aaa-TFT	107	89-115	08/07/2017 16:27

Analyst(s): IA   Analytical Comments: d7,b1

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Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW3550B
Date Prepared:	8/2/17	**Analytical Method:**	SW8015B
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	mg/Kg

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-A	**1708114-001A**	**Soil**	**08/01/2017 07:31**	**GC11A**	**143069**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**10**	5.0	5	08/05/2017 17:15
TPH-Motor Oil (C18-C36)	**130**	25	5	08/05/2017 17:15

Surrogates	REC (%)	Limits	Date Analyzed
C26	94	70-130	08/05/2017 17:15

Analyst(s): TK   Analytical Comments: e7,e2

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-C	**1708114-002A**	**Soil**	**08/01/2017 07:43**	**GC6B**	**143069**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	08/05/2017 07:28
TPH-Motor Oil (C18-C36)	ND	5.0	1	08/05/2017 07:28

Surrogates	REC (%)	Limits	Date Analyzed
C9	98	78-109	08/05/2017 07:28

Analyst(s): TK

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
S-01-E	**1708114-003A**	**Soil**	**08/01/2017 08:22**	**GC9b**	**143069**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	08/04/2017 11:28
TPH-Motor Oil (C18-C36)	ND	5.0	1	08/04/2017 11:28

Surrogates	REC (%)	Limits	Date Analyzed
C9	97	78-109	08/04/2017 11:28

Analyst(s): TK

NELAP 4033ORELAP   Angela Rydelius, Lab Manager

Analytical Report

Client:	WRECO	**WorkOrder:**	1708114
Date Received:	8/2/17 15:38	**Extraction Method:**	SW3510C
Date Prepared:	8/2/17	**Analytical Method:**	SW8015B
Project:	P17043; Las Trampas Creek Bridge	**Unit:**	µg/L

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
W-01	**1708114-004B**	**Water**	**08/01/2017 08:47**	**GC9b**	**143051**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**19,000**	150	1	08/04/2017 14:20
TPH-Motor Oil (C18-C36)	**16,000**	750	1	08/04/2017 14:20

Surrogates	REC (%)	Limits	Date Analyzed
C9	102	66-138	08/04/2017 14:20

Analyst(s): TK Analytical Comments: e7,e2,e8,b1

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143274
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143274 1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acetone	ND	164	10	200	-	82	46-155
tert-Amyl methyl ether (TAME)	ND	10.2	0.50	10	-	102	54-140
Benzene	ND	10.9	0.50	10	-	109	47-158
Bromobenzene	ND	10.4	0.50	10	-	104	50-155
Bromochloromethane	ND	9.89	0.50	10	-	99	48-160
Bromodichloromethane	ND	11.4	0.50	10	-	114	60-156
Bromoform	ND	9.19	0.50	10	-	92	43-149
Bromomethane	ND	11.2	0.50	10	-	112	61-159
2-Butanone (MEK)	ND	33.4	2.0	40	-	83	61-124
t-Butyl alcohol (TBA)	ND	32.9	2.0	40	-	82	42-140
n-Butyl benzene	ND	12.2	0.50	10	-	122	74-138
sec-Butyl benzene	ND	11.9	0.50	10	-	119	72-142
tert-Butyl benzene	ND	11.8	0.50	10	-	118	74-140
Carbon Disulfide	ND	12.1	0.50	10	-	121	64-127
Carbon Tetrachloride	ND	12.0	0.50	10	-	120	61-158
Chlorobenzene	ND	10.8	0.50	10	-	108	43-157
Chloroethane	ND	11.2	0.50	10	-	112	50-127
Chloroform	ND	11.0	0.50	10	-	110	56-154
Chloromethane	ND	10.6	0.50	10	-	106	41-132
2-Chlorotoluene	ND	11.6	0.50	10	-	116	50-155
4-Chlorotoluene	ND	11.0	0.50	10	-	110	53-153
Dibromochloromethane	ND	9.81	0.50	10	-	98	49-156
1,2-Dibromo-3-chloropropane	ND	4.17	0.20	4	-	104	46-149
1,2-Dibromoethane (EDB)	ND	10.0	0.50	10	-	100	44-155
Dibromomethane	ND	9.75	0.50	10	-	97	50-157
1,2-Dichlorobenzene	ND	10.4	0.50	10	-	104	48-156
1,3-Dichlorobenzene	ND	11.2	0.50	10	-	112	49-159
1,4-Dichlorobenzene	ND	10.5	0.50	10	-	105	51-151
Dichlorodifluoromethane	ND	9.41	0.50	10	-	94	61-117
1,1-Dichloroethane	ND	11.0	0.50	10	-	110	53-153
1,2-Dichloroethane (1,2-DCA)	ND	10.1	0.50	10	-	101	66-125
1,1-Dichloroethene	ND	10.7	0.50	10	-	107	47-149
cis-1,2-Dichloroethene	ND	10.8	0.50	10	-	108	54-155
trans-1,2-Dichloroethene	ND	10.7	0.50	10	-	107	46-151
1,2-Dichloropropane	ND	10.7	0.50	10	-	107	54-153
1,3-Dichloropropane	ND	9.96	0.50	10	-	100	49-150
2,2-Dichloropropane	ND	12.5	0.50	10	-	125	74-147

(Cont.)

QA/QC Officer

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143274
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143274 1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
1,1-Dichloropropene	ND	11.3	0.50	10	-	113	54-150
cis-1,3-Dichloropropene	ND	11.7	0.50	10	-	117	55-159
trans-1,3-Dichloropropene	ND	10.3	0.50	10	-	103	74-131
Diisopropyl ether (DIPE)	ND	10.5	0.50	10	-	105	57-136
Ethylbenzene	ND	11.6	0.50	10	-	116	60-152
Ethyl tert-butyl ether (ETBE)	ND	10.2	0.50	10	-	102	55-137
Freon 113	ND	10.6	0.50	10	-	106	47-138
Hexachlorobutadiene	ND	12.5	0.50	10	-	125	66-160
Hexachloroethane	ND	10.5	0.50	10	-	105	75-130
2-Hexanone	ND	8.85	0.50	10	-	89	70-115
Isopropylbenzene	ND	12.1	0.50	10	-	121	59-156
4-Isopropyl toluene	ND	11.6	0.50	10	-	116	75-138
Methyl-t-butyl ether (MTBE)	ND	9.26	0.50	10	-	93	53-139
Methylene chloride	ND	10.4	0.50	10	-	104	66-127
4-Methyl-2-pentanone (MIBK)	ND	8.93	0.50	10	-	89	42-153
Naphthalene	ND	8.90	0.50	10	-	89	66-127
n-Propyl benzene	ND	11.7	0.50	10	-	117	54-155
Styrene	ND	12.2	0.50	10	-	122	51-152
1,1,1,2-Tetrachloroethane	ND	11.6	0.50	10	-	116	58-159
1,1,2,2-Tetrachloroethane	ND	9.23	0.50	10	-	92	51-150
Tetrachloroethene	ND	11.0	0.50	10	-	110	55-145
Toluene	ND	11.2	0.50	10	-	112	52-137
1,2,3-Trichlorobenzene	ND	9.82	0.50	10	-	98	70-136
1,2,4-Trichlorobenzene	ND	10.8	0.50	10	-	108	74-137
1,1,1-Trichloroethane	ND	11.8	0.50	10	-	118	57-156
1,1,2-Trichloroethane	ND	10.0	0.50	10	-	100	51-150
Trichloroethene	ND	10.6	0.50	10	-	106	43-157
Trichlorofluoromethane	ND	11.0	0.50	10	-	110	50-147
1,2,3-Trichloropropane	ND	8.75	0.50	10	-	88	41-152
1,2,4-Trimethylbenzene	ND	11.6	0.50	10	-	116	57-157
1,3,5-Trimethylbenzene	ND	11.8	0.50	10	-	118	56-159
Vinyl Chloride	ND	11.9	0.50	10	-	119	42-137
Xylenes, Total	ND	35.7	0.50	30	-	119	70-130

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143274
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143274 1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery							
Dibromofluoromethane	24.86	24.8		25	99	99	70-130
Toluene-d8	25.92	26.0		25	104	104	70-130
4-BFB	2.307	2.51		2.5	92	100	70-130

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143274
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143274 1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Acetone	182	188	200	ND	89	92	66-158	3.19	20
tert-Amyl methyl ether (TAME)	10.0	10.5	10	ND	100	105	69-139	4.57	20
Benzene	10.1	10.0	10	ND	100	100	69-141	0	20
Bromobenzene	9.87	9.92	10	ND	99	99	70-127	0	20
Bromochloromethane	9.52	9.65	10	ND	95	96	72-142	1.35	20
Bromodichloromethane	11.1	11.3	10	ND	111	113	75-141	2.47	20
Bromoform	9.69	10.1	10	ND	97	101	72-126	4.32	20
Bromomethane	5.38	6.91	10	ND	54	69	50-160	24.8,F1	20
2-Butanone (MEK)	37.9	39.7	40	ND	95	99	69-154	4.59	20
t-Butyl alcohol (TBA)	36.8	40.8	40	ND	92	102	41-152	10.3	20
n-Butyl benzene	10.5	10.4	10	ND	105	104	70-134	1.14	20
sec-Butyl benzene	10.2	10.1	10	ND	102	101	73-131	1.16	20
tert-Butyl benzene	9.61	10.4	10	ND	96	104	71-125	7.54	20
Carbon Disulfide	10.8	10.8	10	ND	107	108	63-158	0.552	20
Carbon Tetrachloride	10.9	10.8	10	ND	109	108	72-143	0.873	20
Chlorobenzene	9.99	10.0	10	ND	100	100	77-120	0	20
Chloroethane	9.43	8.97	10	ND	94	90	54-131	4.97	20
Chloroform	10.3	10.4	10	ND	103	104	75-139	0.818	20
Chloromethane	7.65	7.99	10	ND	77	80	40-130	4.36	20
2-Chlorotoluene	10.4	10.3	10	ND	104	103	70-122	1.08	20
4-Chlorotoluene	9.94	9.74	10	ND	99	97	71-123	1.99	20
Dibromochloromethane	9.87	10.3	10	ND	99	103	78-132	4.05	20
1,2-Dibromo-3-chloropropane	4.54	5.05	4	ND	114	126	59-143	10.5	20
1,2-Dibromoethane (EDB)	10.1	10.4	10	ND	101	104	76-135	3.06	20
Dibromomethane	9.93	10.2	10	ND	99	102	78-135	2.99	20
1,2-Dichlorobenzene	9.74	9.60	10	ND	97	96	68-133	1.49	20
1,3-Dichlorobenzene	10.3	10.3	10	ND	103	103	78-122	0	20
1,4-Dichlorobenzene	9.82	9.82	10	ND	98	98	80-117	0	20
Dichlorodifluoromethane	8.19	7.87	10	ND	82	79	38-125	4.00	20
1,1-Dichloroethane	10.2	10.2	10	ND	101	102	65-152	0.472	20
1,2-Dichloroethane (1,2-DCA)	9.90	10.0	10	ND	99	100	73-139	1.23	20
1,1-Dichloroethene	9.46	9.59	10	ND	95	96	59-140	1.35	20
cis-1,2-Dichloroethene	9.97	10.0	10	ND	100	100	50-154	0	20
trans-1,2-Dichloroethene	9.66	9.76	10	ND	97	98	69-136	1.04	20
1,2-Dichloropropane	10.2	10.4	10	ND	102	104	78-132	1.69	20
1,3-Dichloropropane	9.93	10.2	10	ND	99	102	77-131	2.41	20
2,2-Dichloropropane	11.2	11.1	10	ND	112	111	61-160	0.716	20

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143274
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC10	**Analytical Method:**	SW8260B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143274 1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
1,1-Dichloropropene	10.1	10.0	10	ND	101	100	70-137	1.02	20
cis-1,3-Dichloropropene	11.0	11.4	10	ND	110	114	78-135	4.25	20
trans-1,3-Dichloropropene	9.98	10.4	10	ND	100	104	78-131	4.56	20
Diisopropyl ether (DIPE)	10.3	10.6	10	ND	103	106	72-140	2.22	20
Ethylbenzene	10.5	10.4	10	ND	105	104	73-128	0.808	20
Ethyl tert-butyl ether (ETBE)	10.4	10.8	10	ND	104	108	71-140	3.45	20
Freon 113	9.28	9.37	10	ND	93	94	60-136	0.938	20
Hexachlorobutadiene	11.2	11.2	10	ND	112	112	56-132	0	20
Hexachloroethane	9.77	9.86	10	ND	98	99	61-129	0.904	20
2-Hexanone	10.1	10.9	10	ND	101	109	57-149	7.67	20
Isopropylbenzene	10.8	10.8	10	ND	108	108	69-130	0	20
4-Isopropyl toluene	10.3	10.1	10	ND	103	101	75-124	1.23	20
Methyl-t-butyl ether (MTBE)	17.7	18.2	10	7.209	105	110	73-139	2.91	20
Methylene chloride	9.52	9.57	10	ND	95	96	74-128	0.536	20
4-Methyl-2-pentanone (MIBK)	10.1	10.8	10	ND	101	108	61-145	6.37	20
Naphthalene	9.77	9.87	10	ND	98	99	54-148	1.06	20
n-Propyl benzene	10.4	10.1	10	ND	104	101	71-121	2.46	20
Styrene	11.2	11.1	10	ND	112	111	56-140	0.534	20
1,1,1,2-Tetrachloroethane	11.2	11.2	10	ND	112	113	74-127	0.746	20
1,1,2,2-Tetrachloroethane	10.1	10.4	10	ND	101	104	63-142	2.55	20
Tetrachloroethene	9.92	9.81	10	ND	99	98	71-125	1.09	20
Toluene	10.1	10.2	10	ND	101	102	71-128	1.07	20
1,2,3-Trichlorobenzene	10.2	10.4	10	ND	102	104	59-135	2.08	20
1,2,4-Trichlorobenzene	10.7	10.8	10	ND	107	108	60-132	0.402	20
1,1,1-Trichloroethane	10.6	10.6	10	ND	106	106	75-138	0	20
1,1,2-Trichloroethane	9.88	10.1	10	ND	99	101	78-129	2.40	20
Trichloroethene	9.52	9.49	10	ND	95	95	64-132	0	20
Trichlorofluoromethane	9.79	9.76	10	ND	98	98	53-159	0	20
1,2,3-Trichloropropane	9.66	10.1	10	ND	97	101	68-130	4.26	20
1,2,4-Trimethylbenzene	10.5	10.6	10	ND	105	106	76-124	0.314	20
1,3,5-Trimethylbenzene	10.6	10.6	10	ND	106	106	77-124	0	20
Vinyl Chloride	8.66	8.38	10	ND	87	84	43-142	3.33	20
Xylenes, Total	32.1	31.6	30	ND	107	105	70-130	1.64	20

(Cont.)

QA/QC Officer

Quality Control Report

Client: WRECO
Date Prepared: 8/7/17
Date Analyzed: 8/7/17
Instrument: GC10
Matrix: Water
Project: P17043; Las Trampas Creek Bridge

WorkOrder: 1708114
BatchID: 143274
Extraction Method: SW5030B
Analytical Method: SW8260B
Unit: µg/L
Sample ID: MB/LCS-143274
1708194-002CMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Surrogate Recovery									
Dibromofluoromethane	25.6	25.7	25		102	103	73-131	0.454	20
Toluene-d8	25.4	25.7	25		102	103	72-117	0.952	20
4-BFB	2.61	2.62	2.5		104	105	74-116	0.394	20

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143071
Date Analyzed:	8/3/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143071 1708105-001AMS/MSD

QC Summary Report for Metals

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Antimony	ND	52.0	0.50	50	-	104	75-125
Arsenic	ND	51.3	0.50	50	-	103	75-125
Barium	ND	515	5.0	500	-	103	75-125
Beryllium	ND	50.5	0.50	50	-	101	75-125
Cadmium	ND	50.5	0.25	50	-	101	75-125
Chromium	ND	50.5	0.50	50	-	101	75-125
Cobalt	ND	50.4	0.50	50	-	101	75-125
Copper	ND	50.4	0.50	50	-	101	75-125
Lead	ND	50.8	0.50	50	-	102	75-125
Mercury	ND	1.29	0.050	1.25	-	103	75-125
Molybdenum	ND	50.7	0.50	50	-	101	75-125
Nickel	ND	50.1	0.50	50	-	100	75-125
Selenium	ND	47.2	0.50	50	-	94	75-125
Silver	ND	49.2	0.50	50	-	98	75-125
Thallium	ND	49.4	0.50	50	-	99	75-125
Vanadium	ND	50.2	0.50	50	-	100	75-125
Zinc	ND	502	5.0	500	-	100	75-125
Surrogate Recovery							
Terbium	534.6	550		500	107	110	70-130

(Cont.)

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143071
Date Analyzed:	8/3/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143071 1708105-001AMS/MSD

QC Summary Report for Metals

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Antimony	51.8	51.1	50	ND	103	102	75-125	1.40	20
Arsenic	53.3	52.6	50	1.242	104	103	75-125	1.44	20
Barium	604	588	500	63.61	108	105	75-125	2.58	20
Beryllium	46.8	47.7	50	ND	93	95	75-125	2.01	20
Cadmium	50.4	49.5	50	ND	101	99	75-125	1.72	20
Chromium	138	139	50	115.3	46,F10	48,F10	75-125	0.648	20
Cobalt	71.0	72.9	50	28.65	85	88	75-125	2.58	20
Copper	140	138	50	125.4	29,F10	25,F10	75-125	1.44	20
Lead	54.8	53.7	50	3.754	102	100	75-125	2.03	20
Mercury	1.35	1.31	1.25	ND	105	102	75-125	3.31	20
Molybdenum	51.4	50.6	50	ND	102	100	75-125	1.45	20
Nickel	127	121	50	89.93	74,F10	62,F10	75-125	5.08	20
Selenium	48.3	48.1	50	0.5159	96	95	75-125	0.290	20
Silver	48.4	48.1	50	ND	97	96	75-125	0.808	20
Thallium	48.9	48.6	50	ND	98	97	75-125	0.718	20
Vanadium	184	181	50	158.1	52,F10	45,F10	75-125	1.81	20
Zinc	582	573	500	88.23	99	97	75-125	1.49	20
Surrogate Recovery									
Terbium	563	558	500		113	112	70-130	1.03	20

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Antimony	ND<2.5	ND	-	-
Arsenic	ND<2.5	1.242	-	-
Barium	68.3	63.61	7.37	-
Beryllium	ND<2.5	ND	-	-
Cadmium	ND<1.2	ND	-	-
Chromium	135	115.3	17.1	20
Cobalt	33.8	28.65	18.0	20
Copper	138	125.4	10.0	20
Lead	4.05	3.754	7.88	-
Mercury	ND<0.25	ND	-	-
Molybdenum	ND<2.5	ND	-	-
Nickel	97.8	89.93	8.75	20
Selenium	ND<2.5	0.5159	-	-

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143071
Date Analyzed:	8/3/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143071 1708105-001AMS/MSD

QC Summary Report for Metals

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Silver	ND<2.5	ND	-	-
Thallium	ND<2.5	ND	-	-
Vanadium	184	158.1	16.4	20
Zinc	97.1	88.23	10.1	-

%D Control Limit applied to analytes with concentrations greater than 25 times the reporting limits.

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/3/17	**BatchID:**	143120
Date Analyzed:	8/4/17	**Extraction Method:**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143120 1708114-004CMS/MSD

QC Summary Report for Metals

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Antimony	ND	54.0	0.50	50	-	108	85-115
Arsenic	ND	51.2	0.50	50	-	102	85-115
Barium	ND	524	5.0	500	-	105	85-115
Beryllium	ND	50.0	0.50	50	-	100	85-115
Cadmium	ND	52.4	0.25	50	-	105	85-115
Chromium	ND	53.3	0.50	50	-	107	85-115
Cobalt	ND	48.6	0.50	50	-	97	85-115
Copper	ND	51.8	2.0	50	-	104	85-115
Lead	ND	51.3	0.50	50	-	103	85-115
Mercury	ND	1.29	0.050	1.25	-	103	85-115
Molybdenum	ND	53.1	0.50	50	-	106	85-115
Nickel	ND	51.4	0.50	50	-	103	85-115
Selenium	ND	51.3	0.50	50	-	103	85-115
Silver	ND	51.3	0.19	50	-	103	85-115
Thallium	ND	48.4	0.50	50	-	97	85-115
Vanadium	ND	53.9	0.50	50	-	108	85-115
Zinc	ND	508	15	500	-	101	85-115
Surrogate Recovery							
Terbium	789.4	817		750	105	109	70-130

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/3/17	**BatchID:**	143120
Date Analyzed:	8/4/17	**Extraction Method:**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143120 1708114-004CMS/MSD

QC Summary Report for Metals

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Antimony	ND<10	ND<10	50	ND<10	NR,F10	NR,F10	75-125	NR	20
Arsenic	252	258	50	156.0	193,F10	204,F10	75-125	2.19	20
Barium	22,000	21,900	500	21,320	128,F13	120	75-125	0.182	20
Beryllium	71.2	70.1	50	27.88	87	85	75-125	1.44	20
Cadmium	86.6	87.3	50	32.54	108	110	75-125	0.828	20
Chromium	1510	1520	50	1211	603,F13	609,F13	75-125	0.185	20
Cobalt	777	766	50	712.2	130,F13	107	75-125	1.53	20
Copper	1720	1710	50	1567	300,F13	284,F13	75-125	0.455	20
Lead	677	664	50	601.4	150,F13	124	75-125	1.94	20
Mercury	6.02	5.98	1.25	4.386	131,F10	128,F10	75-125	0.666	20
Molybdenum	12.7	15.6	50	ND<10	15,F10	20,F10	75-125	19.9	20
Nickel	3370	3320	50	3034	668,F13	580,F13	75-125	1.32	20
Selenium	19.8	20.0	50	ND<10	25,F10	26,F10	75-125	0.914	20
Silver	59.2	59.5	50	6.332	106	106	75-125	0	20
Thallium	43.2	42.6	50	ND<10	78	77	75-125	1.40	20
Vanadium	825	855	50	624.6	401,F13	460,F13	75-125	3.55	20
Zinc	4070	4100	500	3436	126,F13	133,F13	75-125	0.881	20
Surrogate Recovery									
Terbium	776	774	750		103	103	70-130	0	20

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Antimony	ND<50	ND<10	-	-
Arsenic	167	156.0	7.05	20
Barium	20,400	21,320	4.32	20
Beryllium	ND<50	27.88	-	-
Cadmium	33.1	32.54	1.72	20
Chromium	1270	1211	4.87	20
Cobalt	808	712.2	13.5	20
Copper	1650	1567	5.30	20
Lead	606	601.4	0.765	20
Mercury	5.68	4.386	29.5,F11	20
Molybdenum	ND<50	ND<10	-	-
Nickel	3180	3034	4.81	20
Selenium	ND<50	ND<10	-	-

(Cont.)

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/3/17	**BatchID:**	143120
Date Analyzed:	8/4/17	**Extraction Method:**	E200.8
Instrument:	ICP-MS2	**Analytical Method:**	E200.8
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143120 1708114-004CMS/MSD

QC Summary Report for Metals

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Silver	ND<19	6.332	-	-
Thallium	ND<50	ND<10	-	-
Vanadium	653	624.6	4.55	20
Zinc	3520	3436	2.44	20

%D Control Limit applied to analytes with concentrations greater than 25 times the reporting limits.

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143078
Date Analyzed:	8/3/17	**Extraction Method:**	SW5035
Instrument:	GC7	**Analytical Method:**	SW8021B/8015Bm
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS/LCSD-143078

QC Summary Report for SW8021B/8015Bm (Encore)

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	1.0	-	-	-
MTBE	ND	0.050	-	-	-
Benzene	ND	0.0050	-	-	-
Toluene	ND	0.0050	-	-	-
Ethylbenzene	ND	0.0050	-	-	-
Xylenes	ND	0.015	-	-	-
Surrogate Recovery					
2-Fluorotoluene	0.08164		0.10	82	75-134

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(btex)	0.541	0.554	0.60	90	92	82-118	2.38	30
MTBE	0.0910	0.0895	0.10	91	90	61-119	1.67	30
Benzene	0.0947	0.0886	0.10	95	89	77-128	6.73	30
Toluene	0.0983	0.0976	0.10	98	98	74-132	0	30
Ethylbenzene	0.104	0.102	0.10	104	102	84-127	2.17	30
Xylenes	0.317	0.323	0.30	106	108	86-129	1.86	30
Surrogate Recovery								
2-Fluorotoluene	0.0838	0.0842	0.10	84	84	75-134	0	30

NELAP 4033ORELAP

_______ QA/QC Officer

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/7/17	**BatchID:**	143287
Date Analyzed:	8/7/17	**Extraction Method:**	SW5030B
Instrument:	GC3	**Analytical Method:**	SW8021B/8015Bm
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143287 1708330-001AMS/MSD

QC Summary Report for SW8021B/8015Bm

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	50	-	-	-
MTBE	ND	5.0	-	-	-
Benzene	ND	0.50	-	-	-
Toluene	ND	0.50	-	-	-
Ethylbenzene	ND	0.50	-	-	-
Xylenes	ND	1.5	-	-	-
Surrogate Recovery					
aaa-TFT	9.969		10	100	89-116

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(btex)	60.2		60	100		78-116		-
MTBE	8.83		10	88		72-122		-
Benzene	9.18		10	92		81-123		-
Toluene	9.69		10	97		83-129		-
Ethylbenzene	10.2		10	102		88-126		-
Xylenes	31.8		30	106		87-131		-
Surrogate Recovery								
aaa-TFT	9.78		10	98		89-116		-

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH(btex)	61.5	58.9	60	ND	102	98	63-133	4.33	20
MTBE	8.70	9.23	10	ND	87	92	69-122	5.95	20
Benzene	8.87	9.20	10	ND	89	92	84-125	3.60	20
Toluene	9.53	9.69	10	ND	95	97	87-131	1.68	20
Ethylbenzene	9.91	10.2	10	ND	98	101	92-126	2.58	20
Xylenes	30.9	31.6	30	ND	102	105	88-132	2.36	20
Surrogate Recovery									
aaa-TFT	10.1	9.74	10		101	97	90-117	3.48	20

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QA/QC Officer

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Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143069
Date Analyzed:	8/3/17	**Extraction Method:**	SW3550B
Instrument:	GC9a	**Analytical Method:**	SW8015B
Matrix:	Soil	**Unit:**	mg/Kg
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS-143069 1708101-001AMS/MSD

QC Report for SW8015B w/out SG Clean-Up

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
TPH-Diesel (C10-C23)	ND	43.0	1.0	40	-	107	79-133
TPH-Motor Oil (C18-C36)	ND	-	5.0	-	-	-	-
Surrogate Recovery							
C26	25.55	25.6		25	102	103	81-103

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH-Diesel (C10-C23)	41.0	42.1	40	ND	102	105	59-150	2.63	30
Surrogate Recovery									
C26	25.3	25.3	25		101	101	70-130	0	30

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QA/QC Officer

Quality Control Report

Client:	WRECO	**WorkOrder:**	1708114
Date Prepared:	8/2/17	**BatchID:**	143051
Date Analyzed:	8/2/17 - 8/4/17	**Extraction Method:**	SW3510C
Instrument:	GC11A	**Analytical Method:**	SW8015B
Matrix:	Water	**Unit:**	µg/L
Project:	P17043; Las Trampas Creek Bridge	**Sample ID:**	MB/LCS/LCSD-143051

QC Report for SW8015B w/out SG Clean-Up

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH-Diesel (C10-C23)	ND	50	-	-	-
TPH-Motor Oil (C18-C36)	ND	250	-	-	-
Surrogate Recovery					
C9	567		625	91	79-111

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH-Diesel (C10-C23)	1110	1060	1000	111	106	88-134	5.14	30
Surrogate Recovery								
C9	625	559	625	100	89	79-111	11.2	30

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QA/QC Officer

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CHAIN-OF-CUSTODY RECORD

WorkOrder: 1708114 **ClientCode: WREC**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag
☐ Detection Summary ☐ Dry-Weight

Report to:
Flannery Banks
WRECO
1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
(925) 941-0017 FAX: (916) 412-3589

Email: flannery_banks@wreco.com
cc/3rd Party:
PO:
ProjectNo: P17043; Las Trampas Creek Bridge

Bill to:
Accounts Payable
WRECO
1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
Sue_Wang@wreco.com

Requested TAT: 5 days;

Date Received: 08/02/2017
Date Logged: 08/02/2017

Lab ID	Client ID	Matrix	Collection Date	Hold	1	2	3	4	5	6	7	8	9	10	11	12
1708114-001	S-01-A	Soil	8/1/2017 07:31	☐		A		B		A						
1708114-002	S-01-C	Soil	8/1/2017 07:43	☐		A		B		A						
1708114-003	S-01-E	Soil	8/1/2017 08:22	☐		A		B		A						
1708114-004	W-01	Water	8/1/2017 08:47	☐			C		A		B					
1708114-005	Trip Blank	Water	8/1/2017 08:47	☐	A											

Test Legend:

1	8260B_W	2	CAM17MS_TTLC_S	3	CAM17MS_TTLC_W	4	G-MBTEX_E
5	G-MBTEX_W	6	TPH(DMO)_S	7	TPH(DMO)_W	8	
9		10		11		12	

Prepared by: Kena Ponce

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

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WORK ORDER SUMMARY

Client Name: WRECO
Client Contact: Flannery Banks
Contact's Email: flannery_banks@wreco.com

Project: P17043; Las Trampas Creek Bridge
Comments:

Work Order: 1708114
QC Level: LEVEL 2
Date Logged: 8/2/2017

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1708114-001A	S-01-A	Soil	SW8015B (Diesel & Motor Oil)	1	16OZ GJ	☐	8/1/2017 7:31	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
1708114-001B	S-01-A	Soil	SW8021B/8015Bm (GMBTEX) (Encore)	1	Encore Sampler	☐	8/1/2017 7:31	5 days		☐	
1708114-002A	S-01-C	Soil	SW8015B (Diesel & Motor Oil)	1	16OZ GJ	☐	8/1/2017 7:43	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
1708114-002B	S-01-C	Soil	SW8021B/8015Bm (GMBTEX) (Encore)	1	Encore Sampler	☐	8/1/2017 7:43	5 days		☐	
1708114-003A	S-01-E	Soil	SW8015B (Diesel & Motor Oil)	1	16OZ GJ	☐	8/1/2017 8:22	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
1708114-003B	S-01-E	Soil	SW8021B/8015Bm (GMBTEX) (Encore)	1	Encore Sampler	☐	8/1/2017 8:22	5 days		☐	
1708114-004A	W-01	Water	SW8021B/8015Bm (G/MBTEX)	1	VOA w/ HCl	☐	8/1/2017 8:47	5 days	5%+	☐	
1708114-004B	W-01	Water	SW8015B (Diesel & Motor Oil)	1	VOA w/ HCl	☐	8/1/2017 8:47	5 days	5%+	☐	
1708114-004C	W-01	Water	E200.8 (CAM 17)	1	250mL HDPE w/ NaOH	☐	8/1/2017 8:47	5 days	5%+	☐	
1708114-005A	Trip Blank	Water	SW8260B (VOCs)	2	VOA w/ HCl	☐	8/1/2017 8:47	5 days	None	☐	

NOTES: - STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

General COC

MAI Work Order # 1708114

McCAMPBELL ANALYTICAL, INC.

1534 Willow Pass Rd. Pittsburg, Ca. 94565-1701
Telephone: (877) 252-9262 / Fax: (925) 252-9269
www.mccampbell.com main@mccampbell.com

CHAIN OF CUSTODY RECORD

Turn Around Time: 1 Day Rush		2 Day Rush		3 Day Rush		STD	●	Quote #	
J-Flag / MDL		ESL		Cleanup Approved				Bottle Order #	
Delivery Format:	PDF ●	GeoTracker EDF		EDD		Write On (DW)		EQuIS	

Report To: Flannery Banks Bill To: WRECO
Company: WRECO, 1243 Alpine Rd., Walnut Creek, CA 94596
Email: flannery_banks@wreco.com
Alt Email: Tele: 925.941.0017
Project Name: Las Trampas Creek Bridge Project # P17043
Project Location: Walnut Creek, CA PO #
Sampler Signature: [signature]

Analysis Requested

SAMPLE ID Location / Field Point	Sampling Date	Sampling Time	#Containers	Matrix	Preservative	BTEX & TPH as Gas (8021/ 8015) MTBE	TPH as Diesel (8015) + Motor Oil Without Silica Gel	TPH as Diesel (8015) + Motor Oil With Silca Gel	Total Oil & Grease (1664 / 9071) Without Silica Gel	Total Petroleum Hydrocarbons - Oil & Grease (1664 / 9071) With Silica Gel	Total Petroleum Hydrocarbons (418.1) With Silica Gel	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ; Aroclors only	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	* CAM 17 Metals (200.8 / 6020)*	Metals (200.8 / 6020)	Baylands Requirements	Lab to filter sample for dissolved metals analysis				
S-01-A	8/1/17	0731	2	SOIL	N/A	X	X										X							
~~S-01-B~~	8/1/17	0732	2	SOIL	N/A	X	X										X							
S-01-C	8/1/17	0743	2	SOIL	N/A	X	X										X							
~~S-01-D~~	8/1/17	0758	2	SOIL	N/A	X	X										X							
S-01-E	8/1/17	0822	2	SOIL	N/A	X	X										X							
W-01	8/1/17	0847	3	GW	4?, 2	X	X										X							
TRIP BLANK	8/1/17	0847	2		2									X										

MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

* If metals are requested for water samples and the water type (Matrix) is not specified on the chain of custody, MAI will default to metals by E200.8.

Please provide an adequate volume of sample. If the volume is not sufficient for a MS/MSD a LCS/LCSD will be prepared in its place and noted in the report.

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
[signature] / WRECO	8/1/17	1538	[signature]	8/1/17	1538
	8/2/17 2W			8/2/17 2W	

Comments / Instructions
* pH adjusted in Lab. 8/2/17

Matrix Code: DW=Drinking Water, GW=Ground Water, WW=Waste Water, SW=Seawater, S=Soil, SL=Sludge, A=Air, WP=Wipe, O=Other

Preservative Code: 1=4°C 2=HCl 3=H_2SO_4 4=HNO_3 5=NaOH 6=ZnOAc/NaOH 7=None

Temp 4.6 °C Initials ____

Page ___ of ___

McCampbell Analytical, Inc.
"When Quality Counts"

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Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Sample Receipt Checklist

Client Name:	**WRECO**	Date and Time Received	**8/2/2017 15:38**
Project Name:	**P17043; Las Trampas Creek Bridge**	Date Logged:	**8/2/2017**
		Received by:	Jena Alfaro
WorkOrder №:	**1708114** Matrix: Soil/Water	Logged by:	Kena Ponce
Carrier:	Client Drop-In		

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Sample IDs noted by Client on COC?	Yes ☑	No ☐	
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐	
Sampler's name noted on COC?	Yes ☑	No ☐	

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	NA ☐
Sample/Temp Blank temperature	Temp: 4°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☑	No ☐	NA ☐
Sample labels checked for correct preservation?	Yes ☑	No ☐	
pH acceptable upon receipt (Metal: <2; 522: <4; 218.7: >8)?	Yes ☐	No ☑	NA ☐
Samples Received on Ice?	Yes ☑	No ☐	
	(Ice Type: WET ICE)		

UCMR Samples:

Total Chlorine tested and acceptable upon receipt for EPA 522?	Yes ☐	No ☐	NA ☑
Free Chlorine tested and acceptable upon receipt for EPA 218.7, 300.1, 537, 539?	Yes ☐	No ☐	NA ☑

Comments: pH adjusted in Lab.

APPENDIX G

NOISE TECHNICAL MEMORANDUM

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Las Trampas Creek Bridge at South Main Street Replacement Project

Technical Noise Memorandum

City of Walnut Creek, California

Bridge No. 28C0075

Federal Project Number BRLS-5225 (026)

September 2018

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Las Trampas Creek Bridge at South Main Street Replacement Project

Technical Noise Memorandum

City of Walnut Creek, California

Bridge No. 28C0075

Federal Project Number – BRLS-5225 (026)

September 2018

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Table of Contents

Tables

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Introduction

This Technical Noise Memorandum (Memo) has been prepared to evaluate the potential construction noise impacts and mitigation measures associated with implementation of the South Main Street over Las Trampas Creek Bridge Project (Project) located in the City of Walnut Creek in Contra Costa County. The City of Walnut Creek (Lead Agency) is proposing to remove a structurally deficient bridge that will be replaced by a new bridge on a realigned and widened roadway along South Main Street. The City acquired funding through the Highway Bridge Program (HBP); therefore, the California Department of Transportation (Caltrans), on behalf of the Federal Highway Administration (FHWA), is acting as the NEPA lead agency as federal funds are involved. The following information provides an introduction to noise that will be used throughout this Memo to determine if construction activities would generate noise levels at nearby sensitive receptors (denoted as “R-1” or “R-2” throughout this document) that would exceed Caltrans and City threshold limits.

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. A specific pitch can be an annoyance, while loudness can affect our ability to hear. Pitch is the number of complete vibrations or cycles per second of a wave, that results in the range of tone from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment, and it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound’s effect. This characteristic of sound can be precisely measured with instruments.

Several noise measurement scales are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3.0 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3.0 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense. Each 10 dB increase in sound level is perceived as approximately a doubling of loudness. Sound intensity is normally measured through the A-weighted sound level (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Noise impacts can be described in three categories. The first is audible impacts, which refers to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3.0 dB or greater, since this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1.0 and 3.0 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise level of less than 1.0 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

As noise spreads from a source, it loses energy so that the further away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise sensitive receptor of concern. There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and community noise equivalent level (CNEL) or the day-night average level (L_{dn}) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours. Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by L_{max} for short-term noise impacts. L_{max} reflects peak operating conditions and addresses the annoying aspects of intermittent noise.

Another noise scale often used together with the L_{max} in noise ordinances for enforcement purposes is noise standards in terms of percentile noise levels. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tension, and thereby affecting blood pressure, functions of the heart, and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. Table A lists a Summary of Human Effects in Areas Exposed to 55 dBA L_{dn}. Table B lists common sound levels and their noise sources. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas. It is not only exposure to extremely high noise levels that can lead to hearing loss. Irreversible hearing damage can occur with long-term cumulative exposure to levels as low as 70 dBA. This 70 dBA threshold is not for singular or peak events; rather it is the average environmental sound level a person is exposed to over weeks and years that is critical in preventing hearing loss. So, if enough “quiet times” are also experienced, this threshold can be surpassed without significant damage occurring.

Table A: Summary of Human Effects in Areas Exposed to 55 dBA L_{dn}

Type of Effects	Magnitude of Effect
Speech - Indoors	100 percent sentence intelligibility (average) with a 5 dB margin of safety.
Speech – Outdoors	100 percent intelligibility (average) at 0.35 meters. 99 percent sentence intelligibility (average) at 1.0 meters. 95 percent sentence intelligibility (average) at 3.5 meters.
Average Community Reaction	None evident; 7 dB below level of significant complaints and threats of legal action and at least 16 dB below "vigorous action".
Complaints	1 percent dependent on attitude and other non-level related factors.
Annoyance	17 percent dependent on attitude and other non-level related factors
Attitude Towards Area	Noise essentially the least important of various factors.

Source: United States Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety" (March 1974)
dB = decibel/decibels
dBA = A-weighted decibels
L_{dn} = day-night average noise level

Table B: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments
Near Jet Engine	140	Deafening
Civil Defense Siren	130	Threshold of Pain
Hard Rock Band	120	Threshold of Feeling
Accelerating Motorcycle a Few Feet Away	110	Very Loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud
Ambulance Siren; Food Blender	95	Very Loud
Garbage Disposal	90	Very Loud
Freight Cars; Living Room Music	85	Loud
Pneumatic Drill; Vacuum Cleaner	80	Loud
Busy Restaurant	75	Moderately Loud
Near Freeway Auto Traffic	70	Moderately Loud
Average Office	60	Moderate
Suburban Street	55	Moderate
Light Traffic; Soft Radio Music in Apartment	50	Quiet
Large Transformer	45	Quiet
Average Residence Without Stereo Playing	40	Faint
Soft Whisper	30	Faint
Rustling Leaves	20	Very Faint
Human Breathing	10	Very Faint

Source: LSA Associates, Inc. (December 2017)

Project Alternatives

The environmental documentation for the proposed Project evaluates one Build Alternative. A No Project/No Build Alternative is also evaluated as required by the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

No Build Alternative

In the No Build Alternative, the existing Las Trampas Creek Bridge on South Main Street in the City of Walnut Creek would remain as is and would not be replaced with a new bridge. Additionally, approach work on each side of the bridge would not occur with implementation of the No Build Alternative. The Las Trampas Creek Bridge would remain functionally obsolete in that neither the bridge nor the roadway approaches would meet American Association of State Highway and Transportation Officials (AASHTO) land width and/or shoulder width standards, the bridge would continue to be structurally deficient, and would remain in non-compliance with code mandated flood flows.

Build Alternative (Proposed Project)

The proposed Project is located in downtown Walnut Creek on South Main Street between Botelho Drive to the north and Broadway Plaza to the south and Newell Avenue approximately 400-feet further south, at Latitude 37.894754 degrees and Longitude -122.059153 degrees. **Figure 1: Regional Location** and **Figure 2: Project Vicinity**, as attached, show the location of the Project site on a regional and local basis, respectively.

South Main Street is a five-lane arterial road that runs from Mt. Diablo Boulevard (where it turns into N. Main Street) to I-680 in the City of Walnut Creek in Contra Costa County. There is currently a five-lane bridge being used to cross over Las Trampas Creek. The bridge has been determined to be structurally deficient due to multiple cracks and spalls with exposed rebar in the soffit and functionally obsolete due to inadequate clear width for current and future Average Daily Traffic (ADT). The purpose of this project is to replace the structurally deficient bridge and realign and widen the existing roadway to allow for proper roadway operations per the City's standards.

The City of Walnut Creek is proposing to replace the five-span reinforced concrete "T"-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek. The bridge is located on South Main Street between Botelho Drive and Broadway Plaza.

The Project site is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Broadway Plaza and is ½ block north of the Kaiser Permanente Hospital. The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants and the new Agora at South Main apartments and retail space. Access driveways to these features are located on all four corners of the bridge. Numerous utilities are mounted on both sides, underneath the bridge, and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

South Main Street provides a north-south connection through the City with a curved alignment and generally flat roadway profile grade. Adjacent intersections at Botelho Drive and Broadway Plaza are signal controlled.

The existing bridge is a reinforced concrete “T”-beam bridge built in 1919. In 1950, the bridge was widened on the south side with a reinforced concrete “T”-beam superstructure and in 1956; the bridge was widened on the south side again with a reinforced concrete slab superstructure. The existing structure is approximately 131’± long on bent style abutments.

The existing bridge section is approximately 73 feet wide with a clear width of approximately 60.9 feet (which includes a raised median approximately 3.5 feet wide). The existing north approach roadway clear width is approximately 60.9 feet wide, which includes five traffic lanes. The south approach roadway is approximately 79.5 feet wide, which includes five 12-foot traffic lanes, and two 8-foot shoulders. The difference between the two approaches is the additional shoulders on the south approach. The cross-slope varies from approximately 2 percent at the bridge to 5 percent at the Broadway Plaza intersection.

Project Design

The proposed roadway approaches are planned to be slightly realigned (the lanes will be shifted approximately 9 feet toward the centerline of South Main Street) from their existing condition between the intersections of Botelho Drive and Broadway Plaza. Under the HBP guidelines, local agencies are reimbursed for up to 200 feet of approach roadway on each side of the bridge (for on system bridges) unless longer approaches can be justified to provide the minimum horizontal and vertical conforms. Roadway approaches are anticipated to be less than 200 feet long on either side of the proposed bridge. The roadway edges would conform to the existing sidewalks and driveways with as minimal an impact as possible.

Based upon recommended American Association of State Highway and Transportation Officials guidelines and Contra Costa County standards, 12 foot lanes and 8-foot shoulders would be provided. The Walnut Creek Pedestrian Master Plan design guidelines call for 10-foot sidewalks at a minimum in the Core Area Zone and will be proposed for the bridge.

The proposed clear roadway width at the proposed bridge will be approximately 100 feet. This will provide for two 12 foot wide traffic lanes in each direction, two 8 foot wide shoulders, a 4 foot wide raised median and 10 foot wide sidewalks on each side of the bridge and accommodate the left turn pockets approaching the intersections of Botelho Drive and Broadway Plaza. In summary, the proposed Project will replace the existing five-lane bridge with a new five lane bridge that will be widened to accommodate two 8-foot wide shoulders and 10-foot wide sidewalks. The proposed Project would not include a change in the horizontal or vertical alignment or increase the number of through-traffic lanes on the Las Trampas Creek Bridge or South Main Street.

Traffic Management, Right-of-Way and Construction Staging Areas
Detours are available around the bridge site. However, due to the large ADT on this facility, the construction will be staged to prevent high impact on nearby roads. The new bridge will be constructed utilizing staged construction. It is anticipated that a portion of existing bridge will be removed leaving multiple lanes of traffic on the remaining portion of the existing bridge. After a portion of the new bridge is constructed, traffic will be shifted to this new structure and the remaining portion of the existing bridge can be removed. The final portion of the new bridge will then be constructed.

County assessor maps do not show any in-fee right-of-way for the road. It is assumed the road is on a prescriptive easement which would include the maintained width of the road. It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements will be minimized by maintaining the existing roadway alignment. However, some right-of-way acquisition may be required to accommodate the realignment approaches to the Las Trampas Creek Bridge along South Main Street.

Other potential staging areas are the parking lots directly adjacent to the project site. These lots include the Ross shopping center parking lot which has direct access onto Main Street and the Chase Bank parking lot as well as other nearby lots in the vicinity of the Project. These lots may potentially provide a few parking spaces for equipment storage/ job trailers.

Construction Equipment

Typical excavators and earthmoving equipment would be used on this Project and near and within the Las Trampas Creek channel. In addition, it is likely that a supporting crane would be required. Heavy cranes, concrete pump trucks, and other heavy construction equipment would travel along local roads near the Project from the construction staging areas during the construction process.

Project engineers in collaboration with the City have identified some construction activities that may be completed during nighttime hours (between 9:00 PM and 6:00 AM). Activities such as installation of precast concrete girders, falsework girders, and rebar cages for concrete piles may be performed at night with permission from the City based on the “public good” (“public good” since such activities during the daytime may disrupt the flow of traffic along South Main Street requiring detours onto other nearby City streets). These operations would involve lifting long beams and rebar cages which would best be performed when little to no vehicular traffic is traveling along South Main Street.

Regulatory Requirements

California Department of Transportation Protocol Requirements

The Caltrans *Traffic Noise Analysis Protocol*, which supports 23 Code of Federal Regulations (CFR) 772.5, identifies a project as Type I when it involves one or more of the following:

1. The construction of a highway on a new location; or

2. The physical alteration of an existing highway where there is either:

    a. Substantial horizontal alteration: A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition, or

    b. Substantial vertical alteration: A project that removes shielding thereby exposing the line-of-sight between the receptor and the traffic noise source. This is done by altering either the vertical alignment of the highway or the topography between the highway traffic noise source and the receptor; or

3. The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a high-occupancy vehicle (HOV) lane, high-occupancy toll (HOT) lane, bus lane, or truck climbing lane; or

4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or

5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or

6. Restriping existing pavement for the purpose of adding a through traffic lane or an auxiliary lane; or

7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza.

A project that does not meet one or more of the requirements mentioned above is considered a Type III project. Though a Type III project does not require an operation-related noise analysis, a memorandum presenting the noise impacts associated with construction activities is typically completed.

CONSTRUCTION STANDARDS

Caltrans Standard Specifications in Section 14-8.02 would be required to minimize construction noise impacts on sensitive land uses near the project site. Caltrans Standard Specifications require noise levels from the construction contractor's operations between the hours of 9:00 p.m. and 6:00 a.m. to be at or below 86 A-weighted decibels (dBA) maximum instantaneous noise level (L_{max}) at a distance of 50 feet from the job site. It should be noted that this standard would be applicable to the proposed Project as construction activities may occur during nighttime hours (between 9:00 p.m. and 6:00 a.m.) with the City's permission.

LOCAL REGULATIONS

The City of Walnut Creek Municipal Code (Chapter 6 Nuisances, Article 2 Noise, Section 4-6.203 Prohibited Noises Enumerated) provides guidance on construction noise for various situations within the City. The City prohibits construction, except by permit, during any time other than between the hours of 7:00 A.M. and 6:00 P.M. on weekdays which are not holidays. If the Chief of Code Enforcement determines that the public health, safety, and welfare will not be impaired by construction activities outside the hours of 7:00 a.m. and 6:00 p.m. on weekdays which are not holidays, he or she may grant permission for such work to be done, the specific hours and days of operation to be enumerated in the permit.

The City of Walnut Creek does not provide construction noise threshold limits for sensitive receptors.

Existing Noise Sensitive Receptors

The proposed Project is located in an urbanized portion of the City of Walnut Creek. The closest sensitive receptor is a mixed-use building located at 1305 South Main Street. The mixed-use building is four stories in height with the first floor occupied by retail/restaurant uses and floors two through four occupied by multi-family residential units. The sensitive receptor is approximately 60 feet from the nearest point of the proposed Project construction footprint. This sensitive receptor is located approximately 31.9 feet from the nearest edge of the closest traffic lane on South Main Street.

It should also be noted that two restaurants (Stanford’s Restaurant and Bar located at 1300 South Main Street and Gott’s Restaurant located at 1275 South Main Street) both with an outside seating area are also considered sensitive receptors. The outside seating area at Stanford’s is located approximately 124 feet from the nearest point of the proposed Project construction footprint and approximately 22 feet from the nearest edge of the closest traffic lane on South Main Street. The outside seating area at Gott’s Restaurant is located approximately 72 feet from the nearest point of the proposed Project construction footprint and approximately 16.7 feet from the nearest edge of the closest traffic lane on South Main Street. Per the Caltrans Protocol, as these restaurants have an outside seating area, these are considered a second and third sensitive receptor in the Project area.

Figure 3: Location of Sensitive Receptors shows the location of the sensitive receptors (R-1 Mixed-Use Building, R-2 Stanford’s Restaurant and R-3 Gott’s Restaurant) compared to the location of the Project footprint where construction activities would occur.

Long-Term Operational Noise Impacts

No Build Alternative

No improvements to the Las Trampas Creek Bridge on South Main Street would be made other than routine roadway maintenance. Noise-sensitive receptors located within the Project area would not be exposed to a new traffic noise impact.

Build Alternative

The proposed Project will replace the existing five-lane bridge with a new five lane bridge that will be widened to accommodate two 8-foot wide shoulders and 10-foot wide sidewalks. The proposed Project would not include a change in the horizontal or vertical alignment or increase the number of through-traffic lanes on the Las Trampas Creek Bridge or South Main Street. As discussed above, R-1 (Mixed-Use Building) is currently located approximately 31.9 feet from the closest lane of traffic along South Main Street and R-2 (Stanford's Restaurant) is located approximately 21.6 feet from the closest lane of traffic along South Main Street. R-3 Gott's Restaurant) is located approximately 16.7 feet from the closest lane of traffic along South Main Street. Once the Project is built-out, the traffic lanes will be shifted further away from these sensitive receptors due to the lane realignment along South Main Street. Sensitive Receptor 1 would therefore be located approximately 39 feet from the closest lane of traffic along South Main Street and R-2 would be located approximately 29.6 feet from the closest lane of traffic along South Main Street, once Project build-out occurs. The nearest traffic lane on South Main Street, once the Project is operational, will not shift closer or further from R-3 (Gott's Restaurant) and would therefore not halve the distance from this sensitive receptor to the nearest South Main Street travel lane (the design of the Project will conform to the back of the sidewalk along Gott's recently constructed outdoor patio. The nearest travel lane of South Main Street will not get closer to Gott's Restaurant. South of the Gott's, the design begins development of an 8-foot wide shoulder, but the travel lanes would not shift closer or further away from SR-3). Implementation of the Project would therefore not result in the distance between the sensitive receptors and the realigned lanes of the proposed Project being halved.

As such, implementation of the proposed Project does not meet any of the Type I requirements described in the Traffic Noise Analysis Protocol and a detailed Type I long-term operational noise analysis is not required for the proposed Project. The proposed Project is classified as a Type III project, which only requires an analysis of noise associated with project construction.

This Memo is provided to identify project-related construction noise impacts and prescribe appropriate avoidance, minimization, and/or mitigation measures in order to comply with the Caltrans Standard Specifications in Section 14-8.02 and City standards as described in the Municipal Code.

Construction Noise Impacts

No Build Alternative

No construction activities would occur under the No Build Alternative and no short-term noise impacts would result.

Build Alternative

Two types of short-term noise impacts would occur during Project construction, including (1) equipment delivery and construction worker commutes and (2) Project construction operations.

The first type of short-term construction noise would result from the transport of construction equipment and materials to the Project site and from construction worker commutes. These transportation activities would incrementally raise noise levels on roads leading to the Project site. Larger trucks used in equipment delivery are expected to generate higher noise impacts than trucks associated with worker commutes. The single-event noise from equipment trucks passing at a distance of 50 feet from a sensitive noise receptor would reach a maximum level of 84 dBA L_{max}. However, the pieces of heavy equipment for grading and construction activities would be moved on site just one time, and would remain for the duration of construction. This one-time trip, when heavy construction equipment is moved on- and off-site, would not add to the daily traffic noise in the Project vicinity. Furthermore, the projected traffic from the construction worker commutes would be minimal when compared to existing traffic volumes on roadways near the Project and other affected streets, and its associated long-term noise level change would not be perceptible. Therefore, equipment transport noise and construction-related worker commute impacts would be short-term and would not be substantial.

The second type of short-term noise impact is related to noise generated during Project construction. Construction is performed in discrete steps, each having its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases will change the character of the noise generated, as well as the noise levels in the study area as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. **Table C: Typical Construction Equipment Noise Levels** lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments based on a distance of 50 feet between the equipment and a noise receptor.

Table C: Typical Construction Equipment Noise Levels

Equipment Description	Maximum Noise Level (L_{max}) at 50 Feet [1]
Backhoes	80
Compactor (ground)	80
Cranes	85
Dozers	85
Dump Trucks	84
Excavators	85
Flat Bed Trucks	84
Front-end Loaders	80
Graders	85
Jackhammers	85
Pick-up Truck	55
Pneumatic Tools	85
Pumps	77
Rock Drills	85
Rollers	85
Scrapers	85
Tractors	84

Source: *Federal Highway Administration Roadway Construction Noise Model* (January 2006).

1 Maximum noise levels were developed based on Spec 721.560 from the Central Artery/Tunnel (CA/T) program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.

Note: Noise levels reported in this table are rounded to the nearest whole number.

L_{max} = maximum instantaneous sound level

It should be noted that construction of the proposed Project is not anticipated to include pile driving activities; as such, noise and vibrations generated by the use of pile driving equipment is not analyzed as part of this Project.

Normal construction operations, specifically during the site preparation phase which includes excavation and grading, may generate high noise levels from an active construction area. Earthmoving equipment and compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings.

Noise associated with the use of earthmoving equipment is estimated between 55 and 85 dBA L_{max} at a distance of 50 feet from each piece of equipment. As seen in Table C, the maximum noise level generated by each excavator, bulldozer and pick-up truck is assumed to be approximately 85 dBA L_{max}, 85 dBA L_{max}, and 55 dBA L_{max} at 50 feet, respectively. Each piece of construction equipment operates as an individual point source. Utilizing the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Lmax\ (composite) = 10 * \log_{10}\left(\sum_{1}^{n} 10^{\frac{Ln}{10}}\right)$$

The conservative composite noise level during this phase of construction would be 88 dBA L_{max} at a distance of 50 feet from an active construction area. Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Lmax\ (at\ distance\ X) = Lmax\ (at\ 50\ feet) - 20 * \log_{10}\left(\frac{X}{50}\right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

The closest sensitive receptor, the mixed-use building occupied by multi-family residential units, is approximately 60 feet from the edge of the proposed construction footprint. The results of the equations above show that this sensitive receptor may be subject to short-term noise reaching 86 dBA L_{max} during general construction activities. This sensitive receptor would be exposed to short-term construction-related noise levels above existing ambient noise levels.

Construction Avoidance and Minimization Measures

The proposed Project shall comply with the City of Walnut Creek Municipal Code Section 4-6.203(f) by ensuring that construction activities only occur between the hours of 7:00 a.m. and 6:00 p.m. on weekdays which are not holidays except those activities which would best be performed at night (i.e. girder placement and Cast-in-drilled-hole pile rebar cage placement). For activities that would be performed during the evening outside of the hours of 7:00 AM and 6:00 PM, the construction contractor would be required to obtain permission from the City Engineer or the City Chief of Code Enforcement prior to the commencement of overnight construction activities. Furthermore, the construction activities occurring between the hours of 9:00 PM to 6:00 AM would need to conform to Caltrans Standard Specifications in Section 14-8.02 ensuring that construction noise levels are below 86 dBA L_{max} as measured at 50 feet from the job site. Neither the Municipal Code nor the General Plan provides construction noise limits for sensitive receptors.

Additionally, to reduce construction-related noise levels, the following minimization measures shall be implemented, to the extent feasible, during construction activities:

- The construction contractor and the City shall ensure that construction equipment will be equipped with intake and exhaust mufflers which are in good condition and appropriate for the equipment.

- The construction contractor shall locate stationary noise generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near the construction area.

- The construction contractor shall utilize “quiet” air compressors and other stationary noise sources where technology exists.

- The City shall designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., starting too early, bad muffler) and will require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

The City of Walnut Creek will continue public relations with residents near the proposed Project by providing construction information pamphlets which describe the type of construction activities that would occur, the duration of Project construction, indication that a temporary increase in ambient noise levels could occur during Project construction, and a phone number where concerned residents can call City Staff if noise levels from construction activities are exceeded during hours as specified by the City’s Municipal Code.

References

State of California, California State Transportation Agency, Department of Transportation. 2015. Standard Specifications.

———. 2011. Traffic Noise Analysis Protocol. May.

City of Walnut Creek, General Plan 2025, Chapter 6 Safety and Nosie, April 4, 2004.

City of Walnut Creek, Design, Community & Environment, General Plan 2025 Environmental Impact Report, Chapter 4.13 Noise, August 5, 2005.

ATTACHMENT A: FIGURES 1-3

LEGEND

☆ Project Location

N

0 2.5 5
Miles

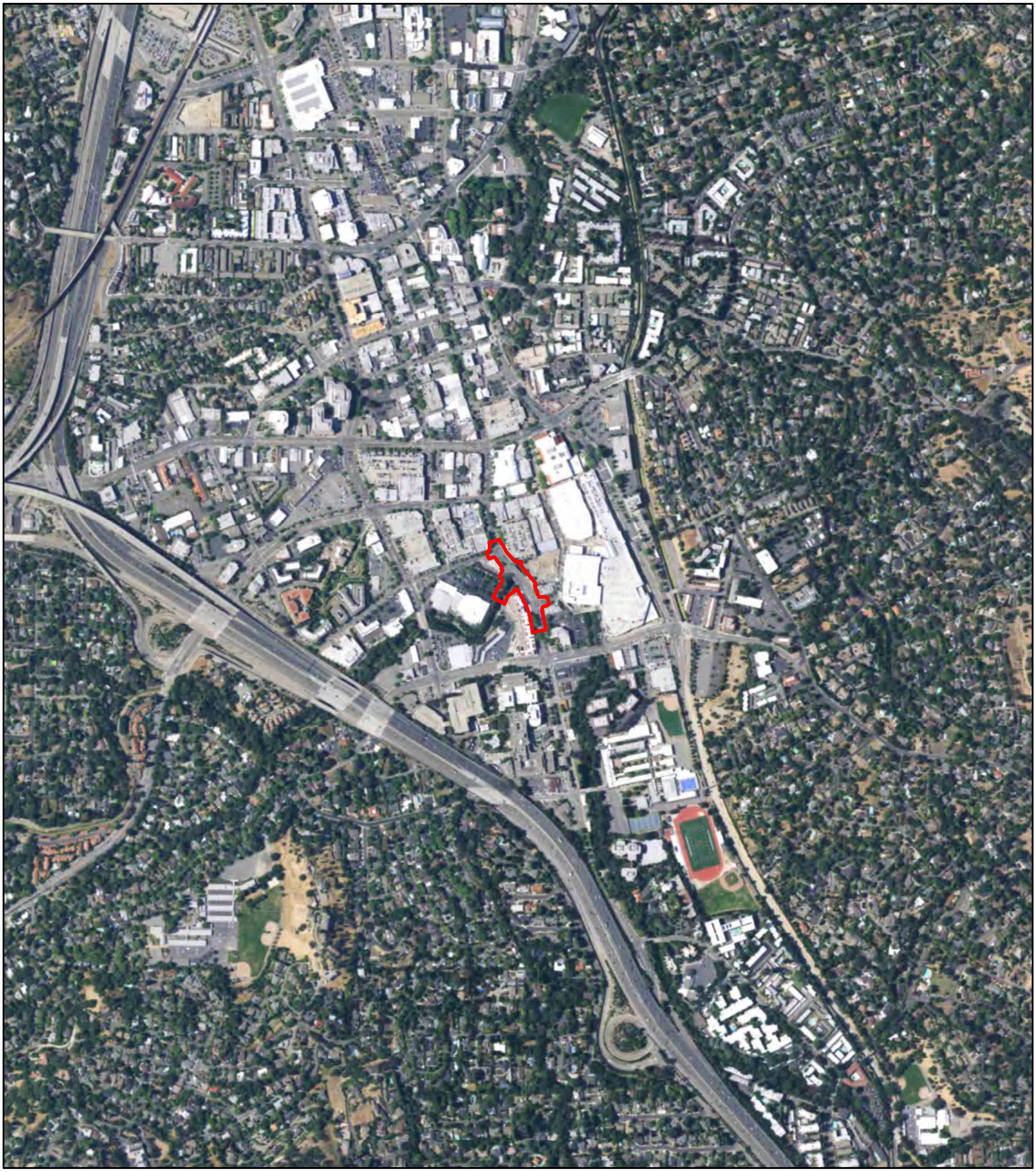
SOURCE: ESRI World Street Map (2017)

FIGURE 1

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Regional Location

I:\Qce1702\GIS\Reports\Figure1_Regional.mxd (10/6/2017)



LEGEND

Project Area

0 500 1000

FEET

SOURCE: ESRI NAIP2016

FIGURE 2

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Project Vicinity

LSA

Legend

Project Area

Project Design

Construction Staging Areas

Sensitive Receptor (R-1, 2, and 3)

N

0 75 150
FEET

FIGURE 3

Las Trampas Creek Bridge at
South Main Street Replacement Project
Walnut Creek, Contra Costa County, California
Caltrans District 4
Federal Project No. BRLA - 5225 (026)

Location of Sensitive Receptor

SOURCE: Basemap - NAIP2016; Design - Quincy Engineering (01/2018); Mapping - LSA (01/2018)

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APPENDIX H

TRAFFIC IMPACT ASSESSMENT

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FINAL MEMORANDUM

Date: May 31, 2021

To: Robert Ferguson, Quincy Engineering

From: Ian Barnes, PE, Fehr & Peers

Subject: Focused Transportation Impact Assessment for the Las Trampas Creek Bridge Replacement Project in Walnut Creek, California

WC17-3400.00

INTRODUCTION AND PROJECT DESCRIPTION

This memorandum presents the results of a focused transportation impact analysis for the Las Trampas Creek Bridge Replacement Project (the "Project") in Walnut Creek, California. The Project aims to replace the existing Las Trampas Creek Bridge along South Main Street between Botelho Drive and Broadway Plaza. The existing bridge is four lanes wide (two lanes in each direction), with 5-foot sidewalk on each side of the bridge.

The Project, when completed, would provide a cross section of four 12-foot traffic lanes (two lanes in each direction), a 4-foot median, an 8-foot shoulder on each side of the roadway, and a 10-foot wide sidewalk on each side of the bridge. The Project would also be designed to accommodate the existing northbound left turn pocket at Botelho Drive/South Main Street and the southbound left turn pocket at Broadway Plaza/South Main Street intersections, similar to the existing bridge design.

After completion, the Project would provide the same vehicular capacity and multimodal access as under Existing Conditions. However, construction activities are anticipated to temporarily reduce available vehicular capacity and multimodal access along South Main Street. Two construction alternatives are proposed at this stage:

- **Construction Alternative 1:** Full closure of the Las Trampas Creek Bridge. During construction, vehicles, pedestrians, bicyclists and transit vehicles would need to detour around the closure using parallel roadways such as South California Boulevard and South Broadway.

- **Construction Alternative 2:** Half closure of the bridge, whereby one side of the bridge will be demolished and reconstructed at a time. One lane of traffic flow will be provided for both the northbound and southbound direction, but some temporary sidewalk closures may be necessary. Construction will be accomplished in two phases. During construction, traffic volumes on South Main Street are not anticipated to increase or decrease as all existing intersection turning movements at intersections near the Project site will continue to be permitted. The following is a brief description of the two construction phases associated with Construction Alternative 2.

The selection of a Construction Alternative is subject to the decision of City decision-making bodies such as the City of Walnut Creek Transportation Commission. The duration and work hours for each construction alternative have not yet been defined; the analysis in this memorandum assumes that the effects of construction activities can occur any time throughout the day.

Construction Alternative 2, Phase 1 – Traffic Shift to East Side of Bridge

In Phase 1 of Construction Alternative 2, northbound and southbound traffic will be directed to use the east side of the bridge while the west side of the bridge is demolished and reconstructed. One lane will be provided for each direction of travel. All existing vehicle turning movements will be allowed at the Botelho Drive/South Main Street and Broadway Plaza/South Main Street intersections, but the number of through lanes will be reduced (from two to one).

Pedestrian circulation will be maintained throughout the duration of Construction Alternative 2. In Phase 1, pedestrians will be directed to use the sidewalk on the east side of the bridge.

Two options under Phase 1 were evaluated to maintain vehicular circulation and minimize potential Project impacts. A brief description of the options is summarized below in **Table 1** while conceptual layouts of the two options for Phase 1 are provided in **Appendix A**.

TABLE 1: CONSTRUCTION ALTERNATIVE 2 PHASE 1 LANE CONFIGURATIONS

South Main Street Segment/Intersection	Southbound (Travel Direction: Down Table)		Northbound (Travel Direction: Up Table)	
	Option 1: Lane Drops	**Option 2: Trap Turn Lanes**	**Option 1: Lane Drops**	**Option 2: Trap Turn Lanes**
Segment: Olympic Boulevard to Botelho Drive	*Lane drop to 1 lane*	*Right lane trap into RT pocket*	*Conform to Existing*	*Conform to Existing*
Intersection: Botelho Drive/South Main Street	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH lane, 1 RT lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane
Segment: Botelho Drive to Broadway Plaza (Las Trampas Creek Bridge)	*1 lane*	*1 lane*	*1 lane*	*1 lane*
Intersection: Broadway Plaza/South Main Street	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane
Segment: Broadway Plaza to Newell Avenue	*Conform to Existing*	*Conform to Existing*	*Lane drop to 1 lane*	*Left lane trap into LT pocket*

Notes: LT = left turn, TH = through, RT = right turn.
Source: Fehr & Peers, 2021.

Construction Alternative 2, Phase 2 – Traffic Shift to West Side of Bridge

In Phase 2 of Construction Alternative 2, northbound and southbound traffic will be directed to use the west side of the bridge while the east side of the bridge is demolished and reconstructed. One lane will be provided for each direction of travel. All existing vehicle turning movements will be allowed at the Botelho Drive/South Main Street and Broadway Plaza/South Main Street intersections, but the number of through lanes will be reduced (from two to one).

Pedestrian circulation will be maintained throughout the duration of Construction Alternative 2. In Phase 2, pedestrians will be directed to use the sidewalk on the west side of the bridge.

Two options under Phase 2 were evaluated to maintain vehicular circulation and minimize potential Project impacts. A brief description of the options is summarized below in **Table 2** while conceptual layouts of the two options for Phase 2 are provided in **Appendix A**.

TABLE 2: CONSTRUCTION ALTERNATIVE 2 PHASE 2 LANE CONFIGURATIONS

South Main Street Segment/Intersection	Southbound (Travel Direction: Down Table)		Northbound (Travel Direction: Up Table)	
	Option 1: Lane Drops	**Option 2: Trap Turn Lanes**	**Option 1: Lane Drops**	**Option 2: Trap Turn Lanes**
Segment: Olympic Boulevard to Botelho Drive	*Lane drop to 1 lane*	*Right lane trap into RT pocket*	*Conform to Existing*	*Conform to Existing*
Intersection: Botelho Drive/South Main Street	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH lane, 1 RT lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane
Segment: Botelho Drive to Broadway Plaza (Las Trampas Creek Bridge)	*1 lane*	*1 lane*	*1 lane*	*1 lane*
Intersection: Broadway Plaza/South Main Street	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH-RT shared lane	1 LT lane, 1 TH lane, 1 RT lane
Segment: Broadway Plaza to Newell Avenue	*Conform to Existing*	*Conform to Existing*	*Lane drop to 1 lane*	*Right lane trap into RT pocket*

Notes: LT = left turn, TH = through, RT = right turn.
Source: Fehr & Peers, 2021.

The remainder of this memorandum details the study purpose, analysis parameters, Existing Conditions, Construction Conditions, and multimodal access and circulation recommendations.

STUDY PURPOSE

The purpose of this study is to:

- Evaluate and identify potentially significant CEQA adverse impacts of the construction phases of the proposed Project on the surrounding transportation system and recommend measures to mitigate significant CEQA impacts, if necessary.
- Provide recommendations to improve multimodal access and circulation during Project construction.

Figure 1 shows the location of the Project site, the surrounding transportation network, and study intersections. All figures are provided at the end of this memorandum.

ANALYSIS APPROACH

Study Area and Analysis Scenarios

The transportation assessment includes weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period analyses to coincide with the time periods when Project area vehicular traffic demands are greatest. Study intersections were identified in consultation with City staff after reviewing Project characteristics such as construction limits and considering intersections where traffic operations may be influenced by construction activities. This study evaluates the following intersections, all of which are controlled and maintained by the City of Walnut Creek:

1. Mount Diablo Boulevard/South Main Street-North Main Street
2. Olympic Boulevard/South Main Street
3. Botelho Drive/South Main Street
4. Broadway Plaza/South Main Street
5. Newell Avenue/South Main Street
6. Mount Diablo Boulevard/South California Boulevard-North California Boulevard
7. Olympic Boulevard/South California Boulevard
8. Botelho Drive/South California Boulevard
9. Newell Avenue/South California Boulevard
10. Mount Diablo Boulevard/South Broadway
11. Newell Avenue/South Broadway

The study intersections were evaluated during the morning (AM) and evening (PM) peak hour for the following scenarios:

- ***Existing Conditions:*** Existing volumes obtained from intersection turning movement counts collected in late August 2017 (when local schools were in session).
- ***Construction Alternative 1:*** Existing Conditions volumes redistributed around the street grid network accounting for the full closure of the Las Trampas Creek Bridge.
- ***Construction Alternative 2 Phase 1 Conditions:*** Existing Conditions volumes with Phase 1 Construction Alternative 2 Option 1 (lane drops) and Phase 1 Construction Alternative 2 Option 2 (trap turn lanes) roadway configurations.
- ***Construction Alternative 2 Phase 2 Conditions:*** Existing Conditions volumes with Phase 2 Construction Alternative 2 Option 1 (lane drops) and Phase 2 Construction Alternative 2 Option 2 (trap turn lanes) roadway configurations.

Vehicular Traffic Analysis Method

The operations of roadway facilities are described with the term level of service ("LOS", a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver). Six levels are defined from LOS A, as free-flow operating conditions, to LOS F, or over-capacity operating conditions. LOS E represents "at-capacity" operations. When traffic volumes exceed intersection capacity, stop-and-go conditions result, and operations are designated as LOS F. The City's LOS standard for intersections in the Core area of Walnut Creek (defined as an area bound by Walden Road, I-680 and the Iron Horse Trail) is mid-LOS E (volume-to-capacity ratio of 0.90 to 0.94). All study intersections are located in the Core area.

Signalized Intersections

The LOS method identified by the Contra Costa Transportation Authority for signalized intersections is the method described in Chapter 18 of the *2010 Highway Capacity Manual* (2010 HCM) (Transportation Research Board). This method bases signalized intersection operations on the average vehicular control delay.

Control delay includes initial deceleration delay, queue move-up time, stopped delay, and acceleration delay. The average control delay for signalized intersections is calculated using the Synchro 9 analysis software and is correlated to a LOS designation as shown in **Table 3**.

TABLE 3: SIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Delay in Seconds
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	> 10.0 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20.0 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35.0 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.	> 80.0

Source: 2010 Highway Capacity Manual.

CEQA Impact Significance Criteria

The determination of significance for CEQA project impacts is based on applicable policies, regulations, goals, and guidelines defined by the City of Walnut Creek in the City's General Plan, along with guidance from CCTA. The impact criteria for this study are based on the City of Walnut Creek General Plan, and are presented below. These impact criteria have been applied in other recent TIAs for projects in the City of Walnut Creek.

Pedestrian System

The Project would create a significant CEQA impact related to the pedestrian system if any of the following criteria are met:

- The Project design would not provide or would permanently eliminate pedestrian facilities to connect to the area circulation system, or
- The Project design would create hazardous conditions for pedestrians, or

- The Project conflicts with existing or planned pedestrian facilities.

Bicycle System

The Project would create a significant CEQA impact related to the bicycle system if any of the following criteria are met:

- The Project design would not provide or would permanently eliminate bicycle facilities that connect to the area circulation system, or
- The Project conflicts with existing or planned bicycle facilities, or
- The Project design would create hazardous conditions for bicyclists.

Transit System

The Project would create a significant CEQA impact related to transit service if either of the following criteria are met:

- The Project would substantially increase travel times for existing transit routes, or
- The Project results in a rerouting of existing transit service or,
- The Project conflicts with existing or planned transit facilities.

Signalized Intersections (Informational, non-CEQA analysis)

As noted by Senate Bill 743 and CEQA Guidelines Section 15064.3, impacts related to automobile congestion are considered to be ***less-than-significant*** by statute under CEQA. However, LOS analysis can still be performed as an informational, not-for-CEQA analysis to assess if the roadway system will operate well over the course of the project. The LOS standard for Core area intersections is mid-LOS E, which corresponds to a volume-to-capacity ratio of 0.90 to 0.94. The volume-to-capacity method is based on the CCTALOS methodology, which has been superseded by the methods in the 2010 HCM. Using the volume-to-capacity ratios as a guide to convert the LOS standard to a delay-based metric, the Project would cause a substantial adverse effect if one of the two following criteria are met:

- The reduction in roadway capacity along South Main Street during construction results in the degradation of intersection operations from acceptable operations (mid-LOS E/67.5 seconds of delay or better) to unacceptable operations (LOS E operations above 67.5 seconds of delay or LOS F operations)

- The reduction in roadway capacity along South Main Street during construction results in the exacerbation of unacceptable operations (LOS E operations above 67.5 seconds of delay or LOS F operations) by increasing the average control delay at the intersection by more than 5.0 seconds.

EXISTING CONDITIONS

This section describes the existing conditions of the roadway facilities, pedestrian facilities, bicycle facilities, and transit service in the study area. It also presents existing traffic volumes and operations of the study intersection.

Existing Street System

The study area street system includes the following roadways.

South Main Street is a north-south roadway in the study area that runs from Astrid Drive in the north (with a continuation farther north as Contra Costa Boulevard) to Castle Hill Road in the south (with a continuation farther south as Danville Boulevard). The Transportation Element of the *Walnut Creek General Plan 2025* designates South Main Street as an arterial south of Newell Avenue and a collector north of Newell Avenue. In the Project vicinity, South Main Street is two lanes in each direction with a posted speed limit of 25 miles-per-hour. The roadway carries an average daily traffic (ADT) volume of approximately 9,000 vehicles per day.

Newell Avenue is a four-lane east-west arterial that runs south of the Project site, providing the southernmost connection between South Main Street, South California Boulevard, and South Broadway. Newell Avenue runs from Olympic Boulevard in the west to San Miguel Drive in the east. The posted speed limit near the Project site is 30 miles-per-hour.

Broadway Plaza is a two-lane north-south local roadway that runs from South Main Street to Mount Diablo Boulevard. The roadway provides access to the central portion of the Broadway Plaza development and provides access to the Broadway Plaza parking garages.

Botelho Drive is a two-lane east-west local roadway that runs from Alpine Road in the west to South Main Street in the east. The roadway provides access to retail uses in the southern portion of the Downtown core. In the Project vicinity, the posted speed limit is 25 miles-per-hour.

Olympic Boulevard is a two-lane east-west local roadway that runs from the Town of Lafayette in the west to South Main Street in the east. Between South California Boulevard and South Main Street, the roadway is designated as a local roadway; west of South California Boulevard, Olympic

Boulevard is designated as an arterial. The roadway provides access to retail uses in the southern portion of the Downtown core. In Project vicinity, the posted speed limit is 25 miles-per-hour.

Mount Diablo Boulevard is a four-lane east-west arterial roadway that runs from State Route 24 in the west to San Miguel Drive in the east. The roadway is the primary conveyor of east-west trips between the Downtown Area and State Route 24. In Project vicinity, the posted speed limit is 30 miles-per-hour.

South California Boulevard is a four-lane north-south arterial roadway that runs from North Main Street in the north to Newell Avenue in the south. The roadway provides a western bypass of the core of the Downtown district (which is centered on the Main Street corridor). In the Project vicinity, the speed limit of the facility is 30 miles-per-hour and on-street parking is permitted on some blocks.

South Broadway is a four-lane north-south arterial roadway that runs from Parkside Drive in the north to Rudgear Road in the south. The roadway provides an eastern bypass of the core of the Downtown district (which is centered on the Main Street corridor). In the Project vicinity, the speed limit of the facility is 30 miles-per-hour and on-street parking is permitted on some blocks.

Existing Transit Service

Transit service in the Project area is provided by the Central Contra Costa Transit Authority, doing business as County Connection. County Connection provides local and regional bus service in Central Contra Costa County, and connects the Project site to regional transit providers such as BART and Amtrak. **Table 4** summarizes hours of operation and service frequencies for the routes near the Project site reflective of a Year 2017/pre-COVID-19 pandemic condition. **Figure 2** presents the routings of these transit lines in the study area.

TABLE 4: EXISTING TRANSIT SERVICES

Route	Description	Weekdays		Weekends	
		Operating Hours	Headway (min)	Operating Hours	Headway (min)
County Connection					
4	BART Walnut Creek to Broadway Plaza (Downtown Walnut Creek Trolley)	7:00 AM – 9:45 PM	15	9:15 AM – 6:50 PM	20

TABLE 4: EXISTING TRANSIT SERVICES

Route	Description	Weekdays		Weekends	
		Operating Hours	Headway (min)	Operating Hours	Headway (min)
5	Creekside Drive to BART Walnut Creek (via California Boulevard, Newell Avenue and South Main Street)	5:45 AM to 7:00 PM	20	N/A	N/A
21/321	BART Walnut Creek to San Ramon Transit Center (via California Boulevard, Newell Avenue and South Main Street)	5:30 AM to 11:20 PM	30	7:20 AM to 10:30 PM	60-120

Source: County Connection, March 2018.

Existing Pedestrian Facilities

Pedestrian facilities include trails, sidewalks, crosswalks, and pedestrian signals. Continuous sidewalks are provided along both sides of South Main Street in the study area. All study intersections have full sets of crosswalks provided. Additionally, the intersection of Olympic Boulevard/South Main Street includes a pedestrian scramble phase that allows for diagonal crossings of the intersection.

Existing Bicycle Facilities

The 2009 Contra Costa Countywide Bicycle and Pedestrian Plan identifies the following bikeway classifications, consistent with Chapter 1000 of the Caltrans *Highway Design Manual*:

- *Bike Paths (Class I)* are paved facilities that are physically separated from motor-vehicle traffic. They typically provide for two-way travel and are especially attractive to less-experienced and recreational users due to the separation from traffic.

- *Bike Lanes (Class II)* provide a striped and stenciled lane for one-way travel on either side of a street. Next to moving and/or parked cars. Bike lanes make for more predictable traffic movement by demarcating a path of travel for cyclists that is also clearly visible to drivers.

- *Bike Routes (Class III)* are on-street facilities shared by bicycles and motor vehicles that are used, generally, when bike lanes are not feasible. The travel lane may be made wider to accommodate vehicles and bikes and "sharrows" are often used to demarcate the lane's shared nature.

- *Multi-use trails* are similar to Class I bike paths that provide for two-way traffic and are physically separated from streets and cars. The trail may be paved or unpaved and may be designed for a variety of users besides bicyclists.

Additionally, Chapter 1000 of the Caltrans *Highway Design Manual* notes an additional class of bikeways:

- *Cycle Tracks/Separated Bikeways (Class IV)* provide a right-of-way designated exclusively for bicycle travel within a roadway and are protected from other vehicle traffic by physical barriers, including, but not limited to, grade separation, flexible posts, inflexible vertical barriers such as raised curbs, or parked cars

Bicycle facilities are generally not provided along the study area roadways, except along South California Boulevard from Olympic Boulevard to Mount Diablo Boulevard. Shared lane markings (also known as "sharrows") are provided along Newell Avenue and South California Boulevard in the Project vicinity. Nearby bicycle facilities include the Iron Horse Trail (a Class I facility) as well as the aforementioned intermittent Class II bike lanes along California Boulevard.

Existing Intersection Volumes and Lane Configurations

Fehr & Peers collected weekday mid-week morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection turning movement counts at Study Intersections 1-5 in late August 2017 on clear days with area schools in-session. Existing traffic volumes for Intersections 6-11 were developed based on the StreetLight Data traffic count database, which allows for the retrospective estimation of traffic volumes to pre-COVID conditions (in this case Year 2017 to be consistent with the Intersection 1-5 data).

For the study intersections, the 60-minute period with the highest traffic volumes during the count period was identified. The morning peak hour is generally from 7:30 to 8:30 AM, and the PM peak hour is generally from 5:00 to 6:00 PM. Existing lane configurations and traffic controls were obtained through field observations. The peak hour volumes are presented on **Figure 3** along with the existing lane configurations and traffic controls. Detailed traffic count data are contained in **Appendix B**.

Existing Intersection Levels of Service

Existing intersection lane configurations, traffic control, and peak hour turning movement volumes were used to calculate the LOS for the study intersections during each peak hour. The results of the

LOS analysis using the Synchro 9 software program for Existing Conditions are presented in **Table 5**. **Appendix C** contains the corresponding LOS calculation sheets.

Under Existing Conditions, all study intersections operate acceptably with respect to the City's mid-LOS E standard.

TABLE 5: EXISTING INTERSECTION LEVELS OF SERVICE

	Intersection	Peak Hour	Control	Delay[1]	LOS[2]	LOS Standard
1	Mount Diablo Boulevard/South Main Street-North Main Street	AM PM	Signalized	29.0 39.3	C D	Mid-E (67.5 s)
2	Olympic Boulevard/ South Main Street	AM PM	Signalized	4.6 5.2	A A	Mid-E (67.5 s)
3	Botelho Drive/ South Main Street	AM PM	Signalized	5.0 12.0	A B	Mid-E (67.5 s)
4	Broadway Plaza/ South Main Street	AM PM	Signalized	4.4 9.9	A A	Mid-E (67.5 s)
5	Newell Avenue/ South Main Street	AM PM	Signalized	32.0 58.9	C E	Mid-E (67.5 s)
6	Mount Diablo Boulevard/South California Boulevard-North California Boulevard	AM PM	Signalized	34.7 54.5	C D	Mid-E (67.5 s)
7	Olympic Boulevard/ South California Boulevard	AM PM	Signalized	23.3 48.5	C D	Mid-E (67.5 s)
8	Botelho Drive/ South California Boulevard	AM PM	Signalized	11.4 13.0	B B	Mid-E (67.5 s)
9	Newell Avenue/ South California Boulevard	AM PM	Signalized	30.6 45.5	C D	Mid-E (67.5 s)
10	Mount Diablo Boulevard/ South Broadway	AM PM	Signalized	37.0 52.8	D D	Mid-E (67.5 s)
11	Newell Avenue/ South Broadway	AM PM	Signalized	31.0 42.1	C D	Mid-E (67.5 s)

Notes:
1. Average control delay in seconds per vehicle
2. LOS = level of service per HCM 2010 methodology
Source: Fehr & Peers, 2021.

CONSTRUCTION CONDITIONS

This section presents the impacts of the proposed Project on the surrounding transportation system under Construction Conditions. Construction Conditions are defined as Existing Conditions plus the changes to roadway configurations, system capacity, and traffic volumes during the Project construction phases. Substantial adverse effects of the project under the construction alternatives are then identified by comparing the level of service results under Construction Conditions to those under Existing Conditions.

Construction Alternative 1 Level of Service Analysis

The following subsections outline the LOS analysis for Construction Alternative 1. CEQA impact analysis for the pedestrian, bicycle and transit modes are presented later in this memorandum.

Construction Alternative 1 Lane Configurations and Volumes

As noted previously in the Project Description section, under the Construction Alternative 1 scenario the Las Trampas Creek Bridge would be closed, demolished and rebuilt in a single process. The effect on the transportation system is that users across all modes would need to detour around the closure using alternate routes. Therefore, the Construction Conditions analysis assumes that traffic volumes would be redistributed onto parallel routes (such as South Broadway and South California Boulevard) and onto connecting routes (Mount Diablo Boulevard, Botelho Avenue, Olympic Boulevard, Newell Avenue, etc.) to reach their destination. An analysis of location-based services "Big Data" aided in the traffic volume redistribution. Additionally, lane configurations at Botelho Avenue/South Main Street and Broadway Plaza/South Main Street would need to be reconfigured to reflect the closure of South Main Street between the two intersections. Redistributed traffic volumes and revised lane configurations for Construction Alternative 1 Conditions are presented on **Figure 4**.

Construction Alternative 1 Intersection Levels of Service

Level of service calculations were conducted to evaluate intersection operations under Construction Alternative 1 Conditions. The results of the LOS analysis are summarized in **Table 6**. The corresponding LOS calculation sheets are included in **Appendix C**.

Results of the Construction Alternative 1 LOS analysis indicate that several intersections would operate deficiently (with respect to the City's mid-LOS E standard) without adjustments to signal timings, signal phasing, or lane configurations. The following intersections are projected to be substantially affected by the project if further improvement measures are not implemented to address the deficiencies.

- Broadway Plaza/South Main Street (above mid-LOS E in the PM peak hour)
- Newell Avenue/South Main Street (LOS F in the PM peak hour)
- Newell Avenue/South California Boulevard (LOS F in the PM peak hour)

TABLE 6: CONSTRUCTION ALTERNATIVE 1 CONDITIONS INTERSECTION LEVELS OF SERVICE

Intersection		Peak Hour	Existing Conditions		Construction Alternative 1 Conditions	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]
1	Mount Diablo Boulevard/South Main Street-North Main Street	AM PM	29.0 39.3	C D	39.6 65.2	D E
2	Olympic Boulevard/ South Main Street	AM PM	4.6 5.2	A A	8.6 5.8	A A
3	Botelho Drive/ South Main Street	AM PM	5.0 12.0	A B	5.9 8.1	A A
4	Broadway Plaza/ South Main Street	AM PM	4.4 9.9	A A	9.3 **73.1**	A **E**
5	Newell Avenue/ South Main Street	AM PM	32.0 58.9	C E	64.2 **287.0**	E **F**
6	Mount Diablo Boulevard/South California Boulevard-North California Boulevard	AM PM	34.7 54.5	C D	36.5 58.2	D E
7	Olympic Boulevard/ South California Boulevard	AM PM	23.3 48.5	C D	25.4 48.6	C D
8	Botelho Drive/ South California Boulevard	AM PM	11.4 13.0	B B	13.3 31.4	B C
9	Newell Avenue/ South California Boulevard	AM PM	30.6 45.5	C D	41.3 **195.2**	D **F**
10	Mount Diablo Boulevard/ South Broadway	AM PM	37.0 52.8	D D	59.2 66.5	E E

TABLE 6: CONSTRUCTION ALTERNATIVE 1 CONDITIONS
INTERSECTION LEVELS OF SERVICE

Intersection		Peak Hour	Existing Conditions		Construction Alternative 1 Conditions	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]
11	Newell Avenue/ South Broadway	AM PM	31.0 42.1	C D	34.6 45.4	C D

Notes:
1. Average control delay in seconds per vehicle
2. LOS = level of service per HCM 2010 methodology
Bold indicated deficient operations below the City's mid-LOS E standard. **Bold and highlighted** indicates a substantial adverse effect for which improvement measures are proposed.
Source: Fehr & Peers, 2021.

Construction Alternative 1 Intersection Improvement Measures

As indicated in **Table 6**, three intersections are anticipated to be substantially adversely affected during Construction Alternative 1 and improvement measures would be needed to bring the intersections back to acceptable operating conditions (per the City's mid-LOS E standard). The following temporary improvement measures are proposed for these intersections:

- Intersection 4 – Broadway Plaza/South Main Street:
  - Set cycle length to 70 seconds
  - Retime signal phase splits to reflect shifted traffic demand
  - Set through movements to pedestrian recall to promote efficient pedestrian movements
  - Improvement measures return PM peak hour intersection operations to an acceptable LOS A (5.2 seconds of delay)
- Intersection 5 – Newell Avenue/South Main Street:
  - Restripe northbound approach to include two northbound left-turn lanes, one through lane and one right-turn lane
  - Set southbound left turn phase to be a lagging phase[1]
  - Turn off signal coordination (i.e. set signal to free running mode)
  - Retime signal phase splits to reflect shifted traffic demand

[1] If concurrent left-turn phases are desired, the City should conduct a heavy vehicle turning movement analysis to ensure that the two left turn movements do not physically conflict with each other.

    - Improvement measures return PM peak hour intersection operations to an acceptable LOS C (32.8 seconds of delay); similar improvements in operations occur in the AM peak hour as a related benefit
- Intersection 9 – Newell Avenue/South California Boulevard:
    - Install right-turn overlap phase for westbound right turn movement
    - Retime signal phase splits to reflect shifted traffic demand
    - Consider a leading pedestrian interval for the crosswalk across the northern approach of the intersection
    - Improvement measures return PM peak hour intersection operations to an acceptable LOS D (43.6 seconds of delay)

It is noted that the improvement measures above are generally low-cost (e.g. retiming of existing signal equipment and new roadway paint), and that the improvement measures would result in all study intersections operating acceptably throughout the course of Construction Alternative 1.

Construction Alternative 2 Level of Service Analysis

The following subsections outline the LOS analysis for Construction Alternative 2. CEQA impact analysis for the pedestrian, bicycle and transit modes are presented later in this memorandum.

Construction Alternative 2 Lane Configurations and Volumes

As noted previously in the Project Description section, under the Construction Alternative 2 scenario the number of travel lanes on the Las Trampas Creek Bridge would be reduced, but all existing turning movements at the study intersections would continue to be permitted. Therefore, for this study the Construction Alternative 2 Conditions analysis does not assume that study area traffic volumes would divert to other routes, and thus intersection operations for study intersections along the South California Boulevard and South Broadway corridors would likely be unaffected by the project. Construction Conditions intersection turning movement volumes and lane configurations are shown on **Figure 5**.

While the Project construction phases are not anticipated to result in changes to traffic volumes, the provision of lane drops or trap lanes may affect lane utilization at the intersections immediately upstream of the lane drops or trap lanes. The Construction Conditions analysis assumes the following lane utilization factor adjustments[2] under the lane drop and trap lane scenarios to account for uneven use of the lanes.

- Intersection #1: Newell Avenue/South Main Street, northbound through movement
    - Option 1 – Northbound lane drop between Newell Avenue and Broadway Plaza: modify lane utilization factor from 0.95 to 0.80
    - Option 2 – One northbound lane traps into a turn lane at Broadway Plaza/South Main Street intersection: modify lane utilization factor from 0.95 to 0.90
- Intersection #4: Olympic Boulevard/South Main Street, southbound through movement
    - Option 1 – Southbound lane drop between Olympic Boulevard and Botelho Drive: modify lane utilization factor from 0.95 to 0.80
    - Option 2 – One southbound lane traps into a turn lane for the Botelho Drive/South Main Street intersection: modify lane utilization factor from 0.95 to 0.90

As noted above, the lane utilization adjustment for Option 1 is larger than the adjustment for Option 2. This larger adjustment reflects that the proposed lane drops in Option 1 occur immediately after the intersection, whereas the trap lanes in Option 2 allow for merging to occur further downstream of the intersections where the adjustments were made.

Construction Alternative 2 Intersection Levels of Service

Level of service calculations were conducted to evaluate intersection operations under Construction Alternative 2 Conditions. The results of the LOS analysis are summarized in **Table 7**. The corresponding LOS calculation sheets are included in **Appendix C**.

Results of the Construction Alternative 2 Conditions LOS analysis indicate that all intersections continue operate acceptably with respect to the City LOS standard of mid-LOS E. As noted previously, because the project is not anticipated to results in shifts in traffic, no effect on operations is expected for intersections along the South California Boulevard and South Broadway corridors (Intersections 6-11).

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[2] The Lane Utilization Factor is a parameter in Highway Capacity Manual intersection analysis that is adjusted to account for situations where there is uneven traffic distribution in a multilane movement. A lower Lane Utilization Factor values represent that traffic is more uneven, and thus the calculated delay is higher. The default Lane Utilization Factor value for a two-lane movement (i.e. two through lanes at an intersection) is 0.95.

TABLE 7: CONSTRUCTION ALTERNATIVE 2 CONDITIONS INTERSECTION LEVELS OF SERVICE

Intersection		Peak Hour	Existing Conditions		Construction Alternative 2 Conditions			
					Option 1 - Lane Drops		Option 2 – Trap Turn Lanes	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
Construction Phase 1 – Traffic Shifted to East Half of Bridge								
1	Mount Diablo Boulevard/South Main Street-North Main Street	AM PM	29.0 39.3	C D	34.2 50.7	C D	34.2 50.7	C D
2	Olympic Boulevard/ South Main Street	AM PM	4.6 5.2	A A	4.1 7.2	A A	4.1 7.1	A A
3	Botelho Drive/ South Main Street	AM PM	5.0 12.0	A B	5.7 12.9	A B	5.7 12.8	A B
4	Broadway Plaza/ South Main Street	AM PM	4.4 9.9	A A	5.7 7.2	A A	5.7 7.2	A A
5	Newell Avenue/ South Main Street	AM PM	32.0 58.9	C E	33.7 44.6	C D	33.7 44.4	C D
6	Mount Diablo Boulevard/South California Boulevard-North California Boulevard	AM PM	34.7 54.5	C D	34.7 54.5	C D	34.7 54.5	C D
7	Olympic Boulevard/ South California Boulevard	AM PM	23.3 48.5	C D	23.3 48.5	C D	23.3 48.5	C D
8	Botelho Drive/ South California Boulevard	AM PM	11.4 13.0	B B	11.4 13.0	B B	11.4 13.0	B B

TABLE 7: CONSTRUCTION ALTERNATIVE 2 CONDITIONS INTERSECTION LEVELS OF SERVICE

Intersection		Peak Hour	Existing Conditions		Construction Alternative 2 Conditions			
					Option 1 - Lane Drops		Option 2 – Trap Turn Lanes	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
9	Newell Avenue/ South California Boulevard	AM PM	30.6 45.5	C D	30.6 45.5	C D	30.6 45.5	C D
10	Mount Diablo Boulevard/ South Broadway	AM PM	37.0 52.8	D D	37.0 52.8	D D	37.0 52.8	D D
11	Newell Avenue/ South Broadway	AM PM	31.0 42.1	C D	31.0 42.1	C D	31.0 42.1	C D
Construction Phase 2 – Traffic Shifted to West Half of Bridge								
1	Mount Diablo Boulevard/South Main Street-North Main Street	AM PM	29.0 39.3	C D	34.2 50.7	C D	34.2 50.7	C D
2	Olympic Boulevard/ South Main Street	AM PM	4.6 5.2	A A	4.1 7.2	A A	4.1 7.1	A A
3	Botelho Drive/ South Main Street	AM PM	5.0 12.0	A B	5.7 12.9	A B	5.7 12.8	A B
4	Broadway Plaza/ South Main Street	AM PM	4.4 9.9	A A	5.7 7.2	A A	5.7 6.8	A A
5	Newell Avenue/ South Main Street	AM PM	32.0 58.9	C E	33.7 44.6	C D	33.7 44.4	C D

TABLE 7: CONSTRUCTION ALTERNATIVE 2 CONDITIONS INTERSECTION LEVELS OF SERVICE

Intersection		Peak Hour	Existing Conditions		Construction Alternative 2 Conditions			
					Option 1 - Lane Drops		Option 2 – Trap Turn Lanes	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
6	Mount Diablo Boulevard/South California Boulevard-North California Boulevard	AM PM	34.7 54.5	C D	34.7 54.5	C D	34.7 54.5	C D
7	Olympic Boulevard/ South California Boulevard	AM PM	23.3 48.5	C D	23.3 48.5	C D	23.3 48.5	C D
8	Botelho Drive/ South California Boulevard	AM PM	11.4 13.0	B B	11.4 13.0	B B	11.4 13.0	B B
9	Newell Avenue/ South California Boulevard	AM PM	30.6 45.5	C D	30.6 45.5	C D	30.6 45.5	C D
10	Mount Diablo Boulevard/ South Broadway	AM PM	37.0 52.8	D D	37.0 52.8	D D	37.0 52.8	D D
11	Newell Avenue/ South Broadway	AM PM	31.0 42.1	C D	31.0 42.1	C D	31.0 42.1	C D

Notes:
1. Average control delay in seconds per vehicle.
2. LOS = Level of Service per HCM 2010 methodology.
Source: Fehr & Peers, 2021.

MULTIMODAL CEQA REVIEW

This section presents the CEQA analysis of the pedestrian, bicycle and transit modes under the Construction Alternative 1 and Construction Alternative 2 scenarios.

Construction Alternative 1 Pedestrian, Bicycle and Transit Impacts

The construction phase of Construction Alternative 1 will remove the Las Trampas Bridge, and would result in a substantial disruption to pedestrian, bicycle and pubic transit travel. While the effects of the project are temporary, the disruption to these modes represents a ***significant CEQA impact***, and requires mitigation measures.

For the pedestrian mode, detour and wayfinding signage should be installed in the vicinity of the construction area to route pedestrians on the most efficient detour routes around the construction site. It is likely that the detour route for pedestrians would utilize sidewalks and pathways in the Broadway Plaza area – these pathways must be verified to be ADA-compliant. Signage along the route should be provided to ensure the continuity of the route. Providing an ADA-compliant detour, along with the wayfinding signage, would reduce the impact to the pedestrian mode to a level that is ***less-than-significant with mitigation*** under CEQA**.**

For the bicycle mode, detour and wayfinding signage should be installed in the vicinity of the construction area to route bicyclists around the closure area. Unlike the pedestrian mode, however, the detour routes should be marked only along public roadways, including (but not necessarily limited to) South Main Street, Newell Avenue, South California Boulevard, South Broadway, Botelho Avenue, and Mount Diablo Boulevard. In locations without Class II bicycle lanes, "Share the Road" signage (WC11-1 and W16-1P) and shared use markings ("sharrows") should be provided. Providing detour signage along the detour routes would reduce the impact to the bicycle mode to a level that is ***less-than-significant with mitigation*** under CEQA**.**

For the transit mode, the City of Walnut Creek must coordinate with County Connection to reroute Route 4 around the closure area using South Main Street, Newell Avenue, South California Boulevard and Botelho Avenue to reconnect the route on its current path. Temporary transit stop facilities should be provided along the route to preserve transit access along the corridor – existing Route 5 and Route 21/321 stops may be used on a temporary basis, if available. Signage indicating the route detour at stops along Route 4 must be provided, as well as signage inside the transit vehicles. Providing the detour route, along with appropriate temporary bus stops and signage, would reduce the impact to the transit mode to a level that is ***less-than-significant with mitigation*** under CEQA.

Construction Alternative 2 Pedestrian, Bicycle and Transit Impacts

The construction phase of the Construction Alternative 2 will result in the closure of one of the two sidewalks on the Las Trampas Creek Bridge for extended periods of time. Detours around the closure are planned to be provided using the remaining open sidewalk on the bridge as well as the existing signalized crosswalks at the Botelho Drive/South Main Street and Broadway Plaza/South Main Street intersections. The overall additional distance and travel time needed to use the detour is relatively minor given the detour path is parallel to the desired pathway. Therefore, Construction Alternative 2's impacts to pedestrians under Construction Alternative 2 Conditions are ***less-than-significant*** under CEQA. Recommendations to enhance the pedestrian detour system during construction are provided later in this memorandum.

As noted previously, the South Main Street corridor is not a designated bicycle facility. Since the construction phase of Construction Alternative 2 maintains access for all modes through the corridor, Construction Alternative 2 is not anticipated result in detours for bicyclists. Therefore, the impacts to bicyclists under Construction Alternative 2 Conditions are ***less-than-significant*** under CEQA**.** Recommendations to enhance the bicyclist experience during construction are provided later in this memorandum.

County Connection Route 4 runs through the Project site and is potentially affected by construction activities. The proposed construction plan maintains full access at the Broadway Plaza/South Main Street and Botelho Drive/South Main Street intersections, so re-routes would not be required. Minor delays due to truck in/out movements at the construction site may be occur. Therefore, Construction Alternative 2's impacts to the transit system are ***less-than-significant*** under CEQA.

Construction Alternative 2 Transportation Recommendations

The following section provides additional recommendations to promote multimodal circulation and access during the construction phase of Construction Alternative 2. Note that the recommendations below are not CEQA-required mitigations, unlike the CEQA-required mitigations presented for Construction Alternative 1.

Construction Alternative 2 Pedestrian Circulation and Access Recommendations

As noted previously, detours will be required to route pedestrians around the proposed sidewalk closures during the construction phase of Construction Alternative 2. The follow recommendations are proposed to enhance the pedestrian experience during periods where detours would be required:

- Ensure that all portions of the detour route meet ADA standards for design parameters (including sidewalk widths, curb ramps and other ADA-compliant design features).
- Provide typical advance signage of sidewalk closures (such as R9-11 and R9-11a signs) and detour route signage (such as M4-9b signs) throughout the detour route.
- Provide additional wayfinding signage to guide pedestrians around closure areas and to their destinations

Construction Alternative 2 Bicycle Circulation and Access Recommendations

Bicycle circulation through the Project site is not anticipated to be affected by Construction Alternative 2 activities as South Main Street will remain open. The follow recommendations are proposed to enhance the bicyclist experience during periods where detours would be required:

- Provide "Share the Road" signage throughout the Project area (W11-1 and W16-1P signs)
- Provide shared use markings ("sharrows") in the Project area
- Provide wayfinding signage suggesting alternate routes for bicyclists around the construction area

Construction Alternative 2 Freight and Passenger Loading Recommendations

Generally, parking and passenger/freight loading is prohibited along South Main Street between Broadway Plaza and Botelho Drive. Three on-street parking spaces are provided along northbound South Main Street adjacent to Stanford's Restaurant – these parking spaces are likely to be removed throughout the course of construction. On-street parking along the southbound side of South Main Street between Olympic Boulevard and Botelho Drive may be removed during construction as well. Additional off-street parking is provided nearby the Project site at the Broadway Plaza garages as well as the Agora development garage; these areas of off-street parking supply should be adequate to diminish the effects of losing three on-street spaces.

Construction Alternative 2 may require the temporary closure of the driveway serving the one-way alley behind Gott's Roadside restaurant; closures may affect freight loading services and trash removal services. These services would need to use driveways along Botelho Drive to access the delivery/trash access point for the restaurant.

Most other businesses in the area surrounding the Project site have dedicated off-street loading areas. If additional on-street passenger and freight loading zones are desired, these could be designated along roadways connecting to the South Main Street corridor, such as Broadway Plaza and Botelho Drive. Removal of some on-street parking spaces may be required to accommodate these loading zones, or the loading zones could be time-restricted to periods where on-street parking is underutilized. The final construction plans should be reviewed to ensure that turning radii along the roadway system are adequate to accommodate heavy trucks and buses.

This concludes our assessment of multimodal transportation impacts, circulation and access for the Las Trampas Creek Bridge Replacement Project. Please call Ian Barnes at (925) 357-3388 with questions.

ATTACHMENTS

Figure 1 Project Study Area
Figure 2 Project Area Transit Lines
Figure 3 Existing Conditions Peak Hour Traffic Volumes, Lane Configurations and Intersection Control
Figure 4 Construction Alternative 1 Conditions Peak Hour Traffic Volumes, Lane Configurations and Intersection Control
Figure 5 Construction Alternative 1 Conditions Peak Hour Traffic Volumes, Lane Configurations and Intersection Control

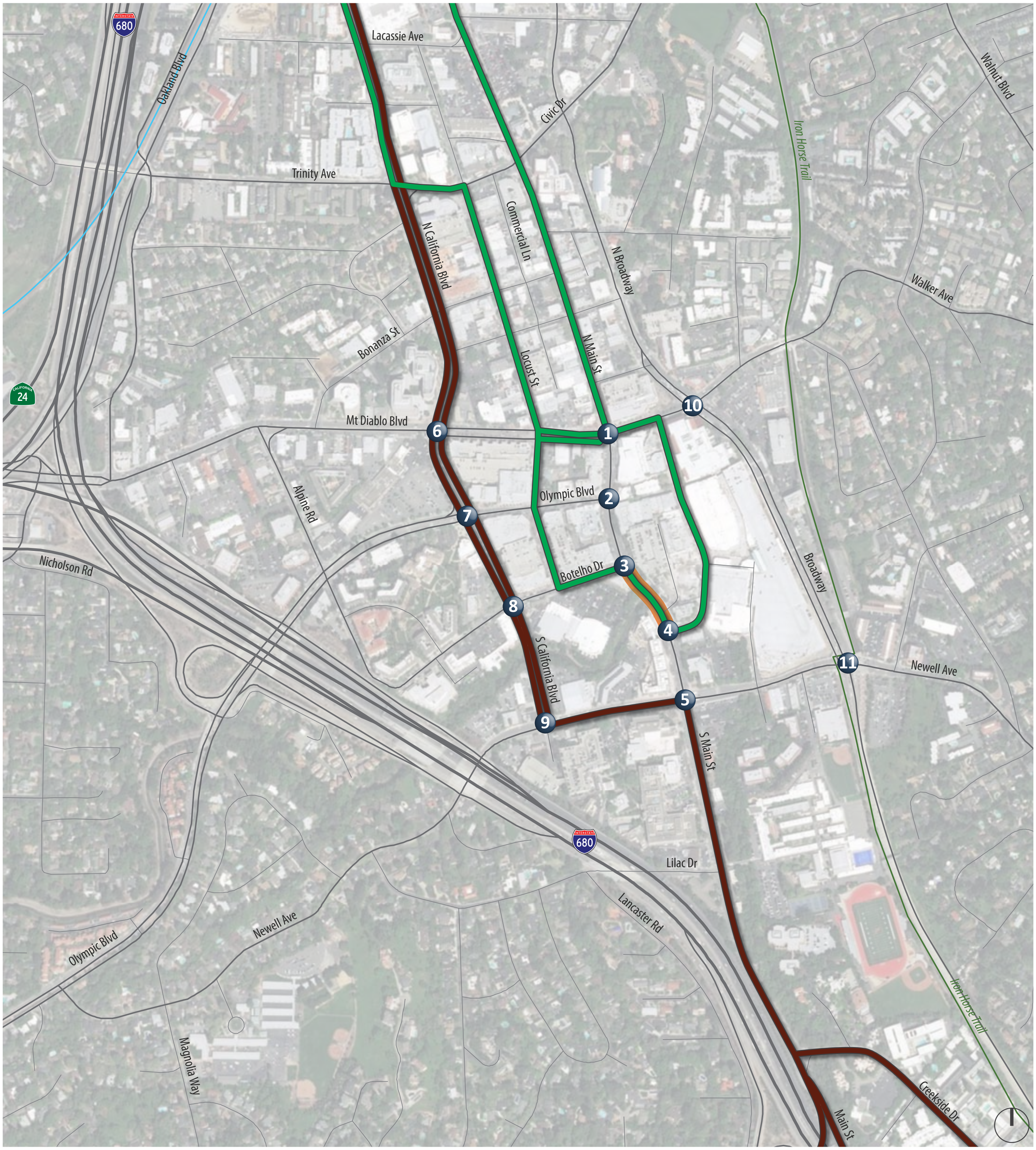
Appendix A Conceptual Layouts of Construction Alternative 2 Phased Traffic Patterns and Lane Geometries
Appendix B Intersection Turning Movement Count Data Sheets
Appendix C Synchro HCM 2010 Output Sheets

Project Site # Study Intersection

Figure 1

Project Study Area

WC17-3400_1_StudyArea

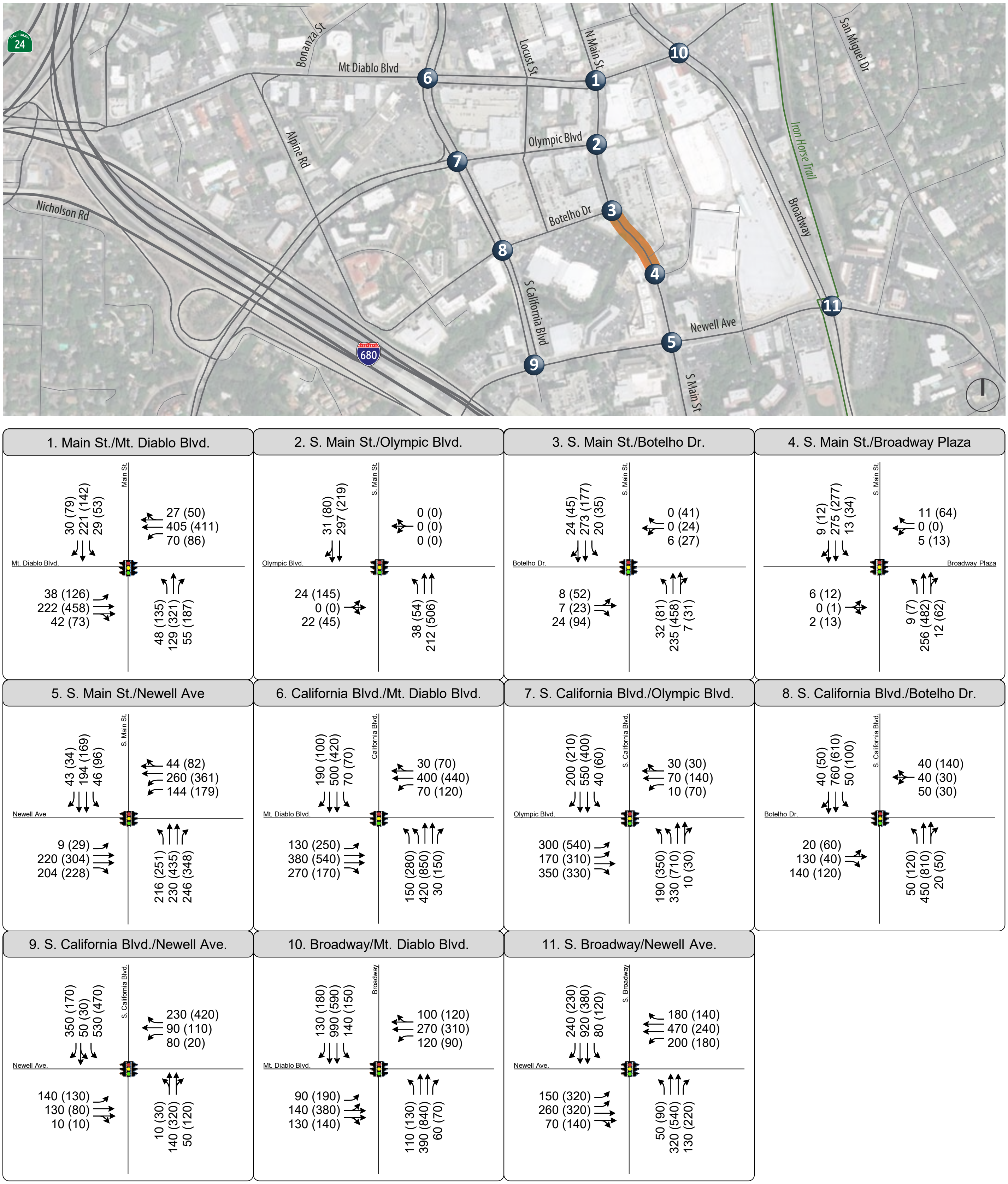


Project Site
Study Intersection
County Connection Routes 5/21/321
County Connection Route 4 ("The Free Ride")

Figure 2

Project Area Transit Lines

WC17-3400_2_Transit

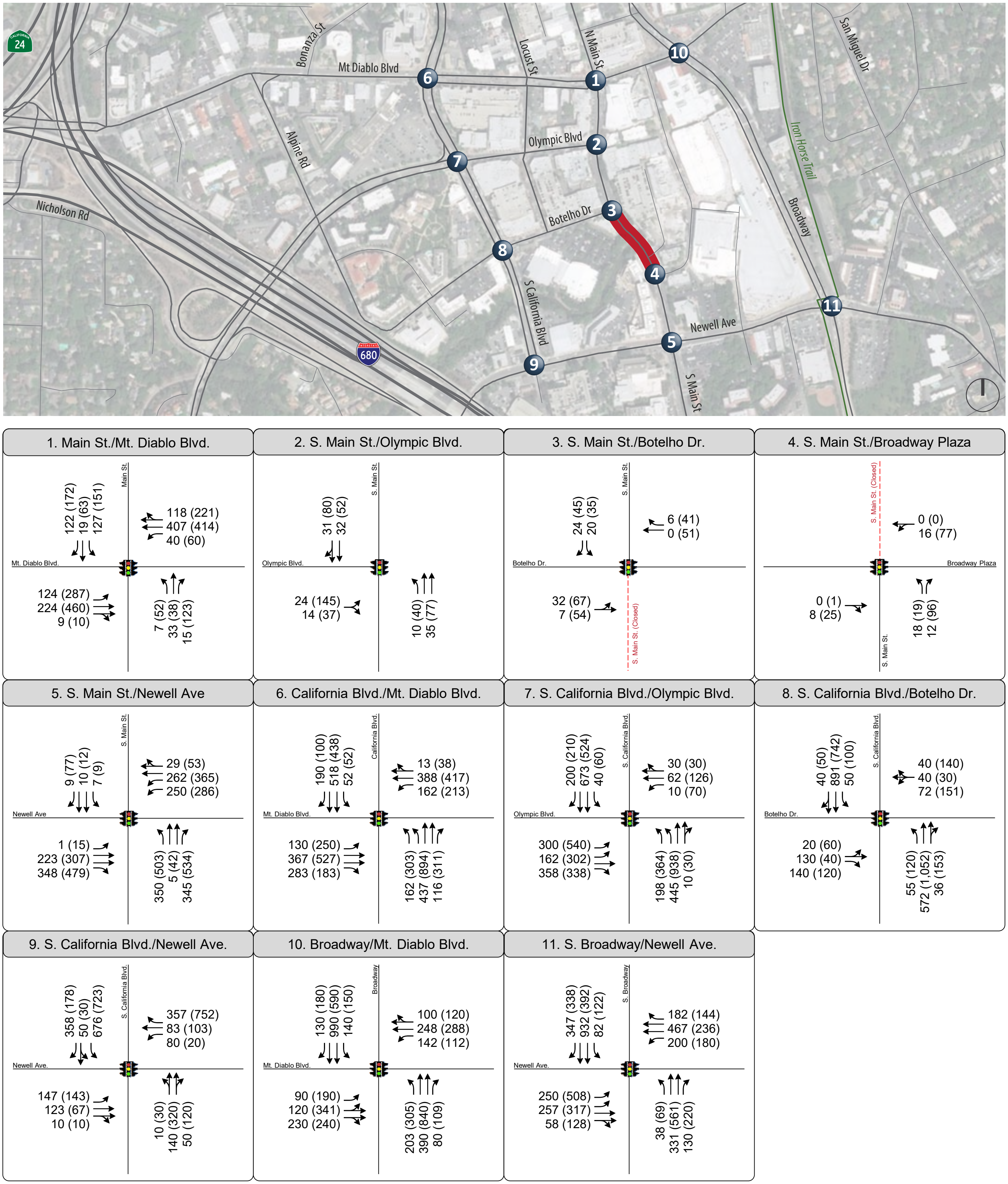


XX (YY) AM (PM) Peak Hour Traffic Volumes | Signalized Intersection | Project Site | # Study Intersection

Figure 3

Existing Conditions Peak Hour Intersection Traffic Volumes, Lane Configurations and Traffic Controls

WC17-3400_3_Vol-Ex

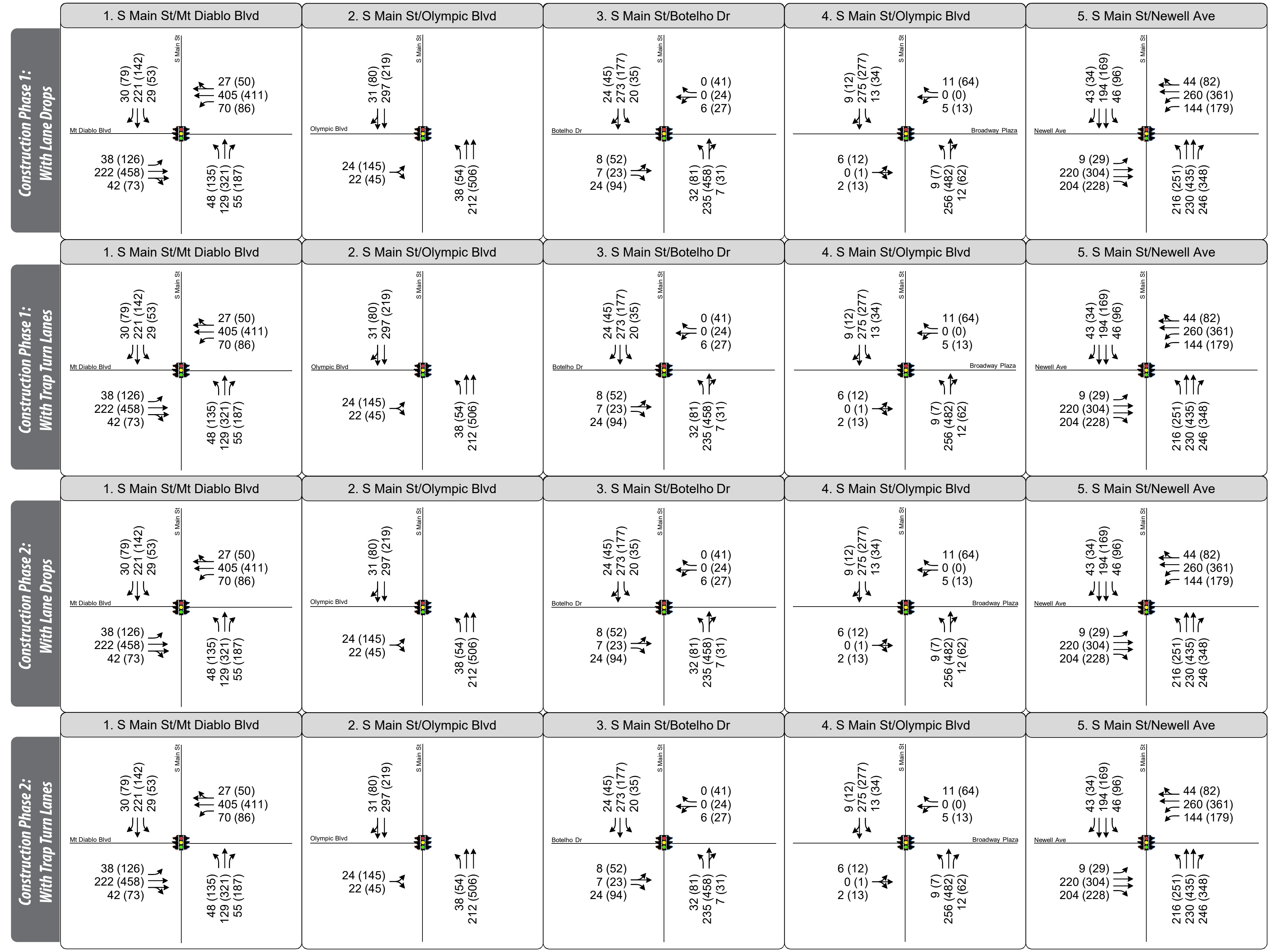


XX (YY) AM (PM) Peak Hour Traffic Volumes | Signalized Intersection | Project Roadway Closure Area | # Study Intersection

Figure 4

Construction Alternative 1 Conditions Peak Hour Intersection Traffic Volumes, Lane Configurations and Traffic Controls

WC17-3400_4_Vol-ConAlt1



Note: AM and PM peak hour intersection traffic volumes, lane configurations and traffic controls unchanged at Study Intersections 6-11 under Construction Alternative 2 Conditions.

XX (YY) AM (PM) Peak Hour Traffic Volumes — Signalized Intersection

Project Site — # Study Intersection

Figure 5

Construction Alternative 2 Conditions Peak Hour
Intersection Traffic Volumes, Lane Configurations and Traffic Controls

WC17-3400_5_Vol-Ex+P

APPENDIX A:

CONCEPTUAL LAYOUTS OF CONSTRUCTION ALTERNATIVE 2 PHASED TRAFFIC PATTERNS AND LANE GEOMETRIES

STAGE 1 - TRAFFIC ON DOWNSTREAM SIDE ON E□ISTING BRIDGE, CONSTRUCTION ON UPSTREAM HALF

CONCEPT SKETCH

1" = 50'

STAGE 1 - TRAFFIC ON DOWNSTREAM SIDE ON E□ISTING BRIDGE, CONSTRUCTION ON UPSTREAM HALF
CONCEPT SKETCH (TRAP OPTION)
1" = 50'

STAGE 2 - TRAFFIC ON UPSTREAM SIDE ON NEW BRIDGE, CONSTRUCTION ON DOWNSTREAM HALF
CONCEPT SKETCH
1" = 50'

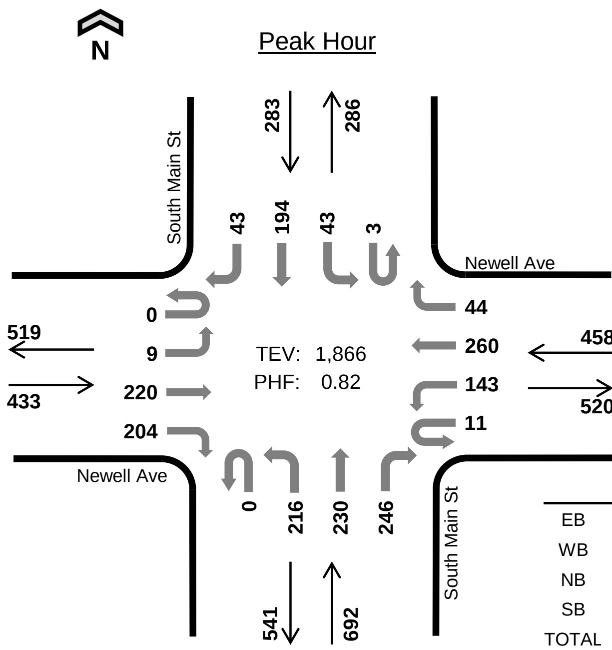
STAGE 2 - TRAFFIC ON UPSTREAM SIDE ON NEW BRIDGE, CONSTRUCTION ON DOWNSTREAM HALF
CONCEPT SKETCH (TRAP OPTION)
1" = 50'

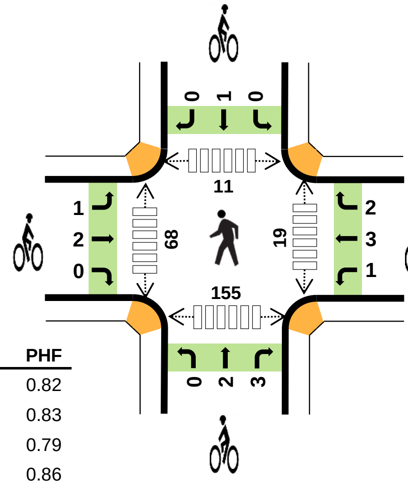
APPENDIX B:

INTERSECTION TURNING MOVEMENT COUNT DATA SHEETS

South Main St
Newell Ave

Date: 08-29-2017
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:30 AM to 8:30 AM





	HV %:	PHF
EB	1.6%	0.82
WB	2.4%	0.83
NB	2.0%	0.79
SB	2.1%	0.86
TOTAL	2.0%	0.82

Two-Hour Count Summaries

Interval Start		Newell Ave Eastbound UT	LT	TH	RT	Newell Ave Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM		0	0	11	13	2	8	30	3	0	28	31	17	0	6	38	4	191	0
7:15 AM		0	1	28	23	0	19	33	3	0	21	37	38	0	8	43	10	264	0
7:30 AM		0	0	41	56	5	37	59	12	0	49	45	56	0	16	48	13	437	0
7:45 AM		0	1	59	72	1	57	65	15	0	69	77	72	0	12	62	8	570	1,462
8:00 AM		0	3	55	37	3	19	84	5	0	48	61	77	0	9	50	13	464	1,735
8:15 AM		0	5	65	39	2	30	52	12	0	50	47	41	3	6	34	9	395	1,866
8:30 AM		0	4	55	40	1	18	51	5	0	49	47	48	0	15	40	9	382	1,811
8:45 AM		0	4	39	36	1	26	37	7	1	58	50	49	1	13	40	9	371	1,612
Count Total		0	18	353	316	15	214	411	62	1	372	395	398	4	85	355	75	3,074	0
Peak Hour	All	0	9	220	204	11	143	260	44	0	216	230	246	3	43	194	43	1,866	0
	HV	0	2	0	5	0	1	8	2	0	7	1	6	0	0	2	4	38	0
	HV%	-	22%	0%	2%	0%	1%	3%	5%	-	3%	0%	2%	0%	0%	1%	9%	2%	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	2	4	7	0	*13*	1	0	0	0	*1*	0	5	0	3	*8*
7:15 AM	2	4	4	2	*12*	2	1	1	0	*4*	6	4	4	10	*24*
7:30 AM	2	7	2	2	*13*	0	1	0	0	*1*	6	16	5	21	*48*
7:45 AM	1	1	2	0	*4*	0	1	0	0	*1*	10	15	3	39	*67*
8:00 AM	3	1	7	4	*15*	2	2	2	1	*7*	0	20	0	41	*61*
8:15 AM	1	2	3	0	*6*	1	2	3	0	*6*	3	17	3	54	*77*
8:30 AM	2	2	3	0	*7*	0	1	0	0	*1*	2	6	3	27	*38*
8:45 AM	1	1	3	2	*7*	0	0	0	0	*0*	6	7	1	37	*51*
Count Total	14	22	31	10	*77*	6	8	6	1	*21*	33	90	19	232	*374*
Peak Hour	7	11	14	6	*38*	3	6	5	1	*15*	19	68	11	155	*253*

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Newell Ave				Newell Ave				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	2	0	0	3	1	0	2	4	1	0	0	0	0	13	0
7:15 AM	0	0	2	0	0	3	1	0	0	1	2	1	0	1	1	0	12	0
7:30 AM	**0**	**0**	**0**	**2**	**0**	**0**	**6**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**13**	0
7:45 AM	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**4**	42
8:00 AM	**0**	**2**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**4**	**0**	**3**	**0**	**0**	**2**	**2**	**15**	44
8:15 AM	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**6**	**38**
8:30 AM	0	0	0	2	0	0	1	1	0	2	0	1	0	0	0	0	7	32
8:45 AM	0	0	1	0	0	0	0	1	0	2	0	1	0	0	2	0	7	35
Count Total	0	2	3	9	0	4	13	5	0	14	7	10	0	1	5	4	77	0
Peak Hour	**0**	**2**	**0**	**5**	**0**	**1**	**8**	**2**	**0**	**7**	**1**	**6**	**0**	**0**	**2**	**4**	**38**	**0**

Two-Hour Count Summaries - Bikes

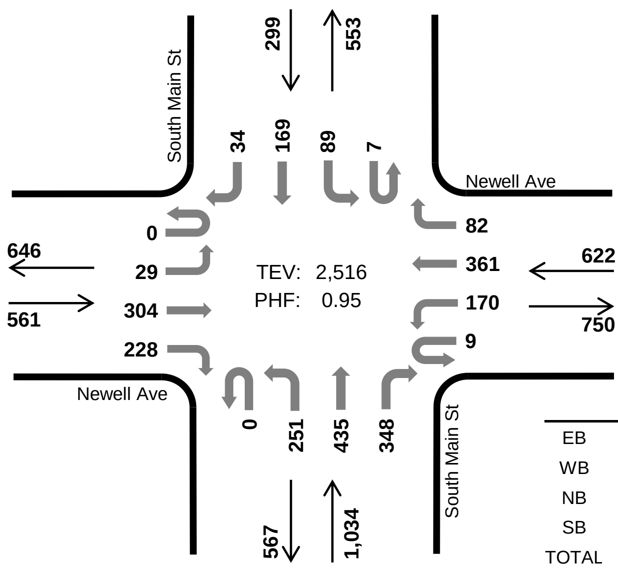
Interval Start	Newell Ave			Newell Ave			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	1	0
7:15 AM	0	2	0	0	0	1	0	1	0	0	0	0	4	0
7:30 AM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	0
7:45 AM	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	7
8:00 AM	**1**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**1**	**0**	**7**	13
8:15 AM	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**6**	**15**
8:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	1	15
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Count Total	1	5	0	1	3	4	0	3	3	0	1	0	21	0
Peak Hour	**1**	**2**	**0**	**1**	**3**	**2**	**0**	**2**	**3**	**0**	**1**	**0**	**15**	**0**

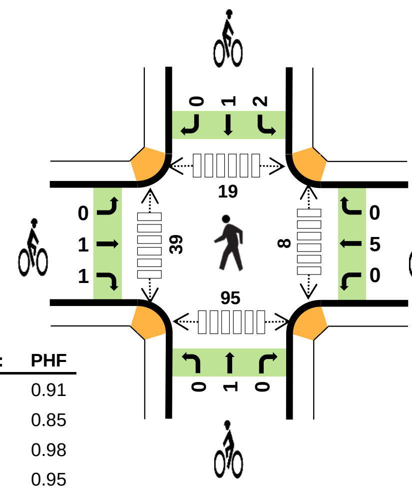
Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Newell Ave

Date: 08-29-2017
Count Period: 4:00 PM to 7:00 PM
Peak Hour: 5:00 PM to 6:00 PM

Peak Hour





	HV %:	PHF
EB	1.1%	0.91
WB	0.2%	0.85
NB	0.8%	0.98
SB	0.0%	0.95
TOTAL	0.6%	0.95

Three-Hour Count Summaries

Interval Start		Newell Ave Eastbound UT	LT	TH	RT	Newell Ave Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
5:00 PM		0	8	80	59	1	55	103	23	0	69	109	76	1	16	45	7	652	0
5:15 PM		0	8	85	61	4	34	106	24	0	70	105	89	3	22	37	11	659	0
5:30 PM		0	5	72	56	1	42	69	20	0	51	114	97	1	28	39	10	605	0
5:45 PM		0	8	67	52	3	39	83	15	0	61	107	86	2	23	48	6	600	2,516
Peak Hour	All	0	29	304	228	9	170	361	82	0	251	435	348	7	89	169	34	2,516	0
	HV	0	1	1	4	0	0	1	0	0	6	1	1	0	0	0	0	15	0
	HV%	-	3%	0%	2%	0%	0%	0%	0%	-	2%	0%	0%	0%	0%	0%	0%	1%	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
5:00 PM	1	0	4	0	*5*	0	1	0	1	*2*	2	9	3	57	*71*
5:15 PM	2	1	2	0	*5*	1	1	0	0	*2*	1	12	9	17	*39*
5:30 PM	2	0	1	0	*3*	1	2	1	2	*6*	2	4	5	13	*24*
5:45 PM	1	0	1	0	*2*	0	1	0	0	*1*	3	14	2	8	*27*
Peak Hour	6	1	8	0	*15*	2	5	1	3	*11*	8	39	19	95	*161*

Three-Hour Count Summaries

Interval Start		Newell Ave Eastbound UT	LT	TH	RT	Newell Ave Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
4:00 PM		0	8	62	65	1	30	71	23	0	61	101	75	0	18	33	11	559	0
4:15 PM		0	6	61	68	1	20	97	23	0	53	108	88	1	21	43	7	597	0
4:30 PM		0	10	51	51	2	24	76	11	0	54	109	74	1	14	37	8	522	0
4:45 PM		0	11	68	40	4	32	73	18	1	47	106	66	2	15	36	7	526	2,204
5:00 PM		**0**	**8**	**80**	**59**	**1**	**55**	**103**	**23**	**0**	**69**	**109**	**76**	**1**	**16**	**45**	**7**	**652**	2,297
5:15 PM		**0**	**8**	**85**	**61**	**4**	**34**	**106**	**24**	**0**	**70**	**105**	**89**	**3**	**22**	**37**	**11**	**659**	2,359
5:30 PM		**0**	**5**	**72**	**56**	**1**	**42**	**69**	**20**	**0**	**51**	**114**	**97**	**1**	**28**	**39**	**10**	**605**	2,442
5:45 PM		**0**	**8**	**67**	**52**	**3**	**39**	**83**	**15**	**0**	**61**	**107**	**86**	**2**	**23**	**48**	**6**	**600**	**2,516**
6:00 PM		0	8	77	41	1	35	100	18	0	60	91	95	1	14	49	13	603	2,467
6:15 PM		0	4	55	51	3	35	86	13	0	60	96	80	1	13	37	4	538	2,346
6:30 PM		0	3	53	28	1	29	71	22	0	43	85	73	0	14	32	7	461	2,202
6:45 PM		0	5	53	40	2	33	59	18	0	48	49	63	1	24	28	10	433	2,035
Count Total		0	84	784	612	24	408	994	228	1	677	1,180	962	14	222	464	101	6,755	0
Peak Hour	**All**	**0**	**29**	**304**	**228**	**9**	**170**	**361**	**82**	**0**	**251**	**435**	**348**	**7**	**89**	**169**	**34**	**2,516**	**0**
	HV	**0**	**1**	**1**	**4**	**0**	**0**	**1**	**0**	**0**	**6**	**1**	**1**	**0**	**0**	**0**	**0**	**15**	**0**
	HV%	**-**	**3%**	**0%**	**2%**	**0%**	**0%**	**0%**	**0%**	**-**	**2%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**	**0**

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	2	1	3	1	*7*	1	2	1	1	*5*	7	11	3	9	*30*
4:15 PM	2	4	2	0	*8*	1	0	0	0	*1*	1	7	4	18	*30*
4:30 PM	3	3	0	0	*6*	1	1	1	0	*3*	1	14	4	22	*41*
4:45 PM	3	1	1	0	*5*	2	0	0	1	*3*	0	7	1	14	*22*
5:00 PM	**1**	**0**	**4**	**0**	***5***	**0**	**1**	**0**	**1**	***2***	**2**	**9**	**3**	**57**	*71*
5:15 PM	**2**	**1**	**2**	**0**	***5***	**1**	**1**	**0**	**0**	***2***	**1**	**12**	**9**	**17**	*39*
5:30 PM	**2**	**0**	**1**	**0**	***3***	**1**	**2**	**1**	**2**	***6***	**2**	**4**	**5**	**13**	*24*
5:45 PM	**1**	**0**	**1**	**0**	***2***	**0**	**1**	**0**	**0**	***1***	**3**	**14**	**2**	**8**	***27***
6:00 PM	1	0	5	0	*6*	1	2	2	0	*5*	3	7	2	13	*25*
6:15 PM	1	1	1	1	*4*	3	1	2	0	*6*	3	5	5	7	*20*
6:30 PM	2	0	1	0	*3*	2	0	2	0	*4*	3	6	2	6	*17*
6:45 PM	0	0	1	0	*1*	2	0	1	1	*4*	5	4	1	2	*12*
Count Total	20	11	22	2	*55*	15	11	10	6	*42*	31	100	41	186	*358*
Peak Hour	**6**	**1**	**8**	**0**	***15***	**2**	**5**	**1**	**3**	***11***	**8**	**39**	**19**	**95**	***161***

Three-Hour Count Summaries - Heavy Vehicles

Interval Start	Newell Ave				Newell Ave				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	1	0	1	0	1	0	0	0	2	0	1	0	0	0	1	7	0
4:15 PM	0	0	1	1	0	0	3	1	0	2	0	0	0	0	0	0	8	0
4:30 PM	0	0	0	3	0	2	1	0	0	0	0	0	0	0	0	0	6	0
4:45 PM	0	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	5	26
5:00 PM	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**5**	24
5:15 PM	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	21
5:30 PM	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	18
5:45 PM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**15**
6:00 PM	0	0	0	1	0	0	0	0	0	3	1	1	0	0	0	0	6	16
6:15 PM	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	4	15
6:30 PM	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	3	15
6:45 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	14
Count Total	0	3	3	14	0	4	6	1	0	16	2	4	0	0	1	1	55	0
Peak Hour	**0**	**1**	**1**	**4**	**0**	**0**	**1**	**0**	**0**	**6**	**1**	**1**	**0**	**0**	**0**	**0**	**15**	**0**

Three-Hour Count Summaries - Bikes

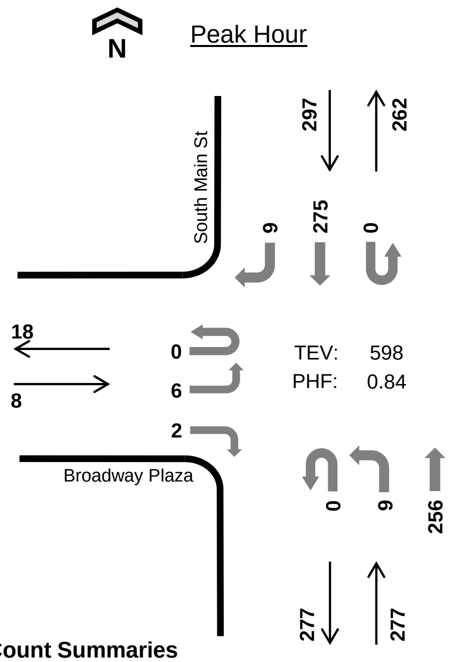
Interval Start	Newell Ave			Newell Ave			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	1	0	0	1	1	0	1	0	0	1	0	5	0
4:15 PM	0	1	0	0	0	0	0	0	0	0	0	0	1	0
4:30 PM	0	0	1	0	1	0	0	0	1	0	0	0	3	0
4:45 PM	0	1	1	0	0	0	0	0	0	0	1	0	3	12
5:00 PM	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	9
5:15 PM	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	10
5:30 PM	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**6**	13
5:45 PM	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**11**
6:00 PM	0	1	0	0	2	0	0	0	2	0	0	0	5	14
6:15 PM	0	2	1	0	1	0	0	1	1	0	0	0	6	18
6:30 PM	0	1	1	0	0	0	0	2	0	0	0	0	4	16
6:45 PM	0	2	0	0	0	0	0	1	0	0	1	0	4	19
Count Total	0	10	5	0	10	1	0	6	4	2	4	0	42	0
Peak Hour	**0**	**1**	**1**	**0**	**5**	**0**	**0**	**1**	**0**	**2**	**1**	**0**	**11**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

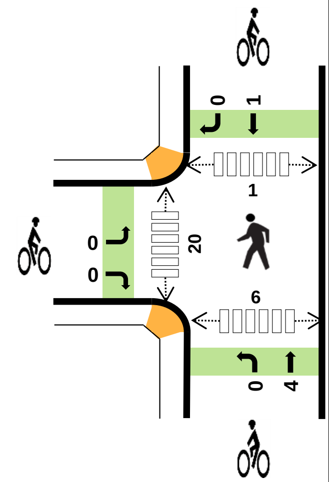
South Main St
Broadway Plaza

Peak Hour

Date: 08-29-2017
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:30 AM to 8:30 AM



	HV %:	PHF
EB	12.5%	0.67
WB	-	0.57
NB	1.8%	0.82
SB	3.0%	0.83
TOTAL	2.6%	0.84



Two-Hour Count Summaries

Interval Start	Broadway Plaza Eastbound UT	LT	TH	RT	0 Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	0	0	1	0	0	0	2	0	0	34	3	1	0	48	1	90	0
7:15 AM	0	1	0	1	0	0	0	0	0	0	40	2	0	3	64	0	111	0
7:30 AM	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**1**	**52**	**1**	**0**	**3**	**69**	**0**	**131**	0
7:45 AM	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**78**	**4**	**0**	**3**	**84**	**2**	**177**	509
8:00 AM	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**3**	**0**	**1**	**71**	**3**	**0**	**2**	**71**	**4**	**158**	577
8:15 AM	**0**	**1**	**0**	**1**	**0**	**2**	**0**	**5**	**0**	**5**	**55**	**4**	**0**	**5**	**51**	**3**	**132**	**598**
8:30 AM	0	0	0	1	0	1	0	2	1	1	47	3	0	4	65	1	126	593
8:45 AM	0	0	0	1	0	1	0	5	0	3	52	4	0	7	60	4	137	553
Count Total	0	7	0	6	0	0	0	0	1	13	429	24	1	27	512	15	1,035	0
Peak Hour All	**0**	**6**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**9**	**256**	**12**	**0**	**13**	**275**	**9**	**582**	**0**
Peak Hour HV	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**0**	**2**	**6**	**1**	**15**	**0**
Peak Hour HV%	**-**	**17%**	**-**	**0%**	**-**	**-**	**-**	**-**	**-**	**0%**	**2%**	**8%**	**-**	**15%**	**2%**	**11%**	**3%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	0	0	5	0	*5*	0	0	0	0	*0*	1	5	0	0	*6*
7:15 AM	0	0	2	2	*4*	0	0	2	0	*2*	5	4	0	0	*9*
7:30 AM	**0**	**0**	**2**	**1**	***3***	**0**	**0**	**1**	**0**	***1***	**4**	**6**	**0**	**0**	***10***
7:45 AM	**1**	**0**	**0**	**2**	***3***	**0**	**0**	**0**	**1**	***1***	**3**	**5**	**1**	**2**	***11***
8:00 AM	**0**	**0**	**2**	**5**	***7***	**0**	**0**	**1**	**1**	***2***	**1**	**6**	**0**	**2**	***9***
8:15 AM	**0**	**0**	**1**	**1**	***2***	**0**	**0**	**3**	**0**	***3***	**1**	**3**	**0**	**2**	***6***
8:30 AM	0	0	1	0	*1*	0	0	1	0	*1*	1	2	1	0	*4*
8:45 AM	0	0	1	2	*3*	0	0	0	0	*0*	4	5	2	0	*11*
Count Total	1	0	14	13	*28*	0	0	8	2	*10*	20	36	4	6	*66*
Peak Hr	**1**	**0**	**5**	**9**	***15***	**0**	**0**	**5**	**2**	***7***	**9**	**20**	**1**	**6**	***36***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Broadway Plaza				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	5	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	4	0
7:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**4**	0
7:45 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**3**	16
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**5**	**0**	**8**	19
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**6**	**21**
8:30 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	18
8:45 AM	0	0	0	0	0	0	0	3	0	0	1	0	0	0	2	0	6	21
Count Total	0	1	0	0	0	0	0	0	0	0	11	3	0	2	10	1	28	0
Peak Hour	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**0**	**2**	**6**	**1**	**15**	**0**

Two-Hour Count Summaries - Bikes

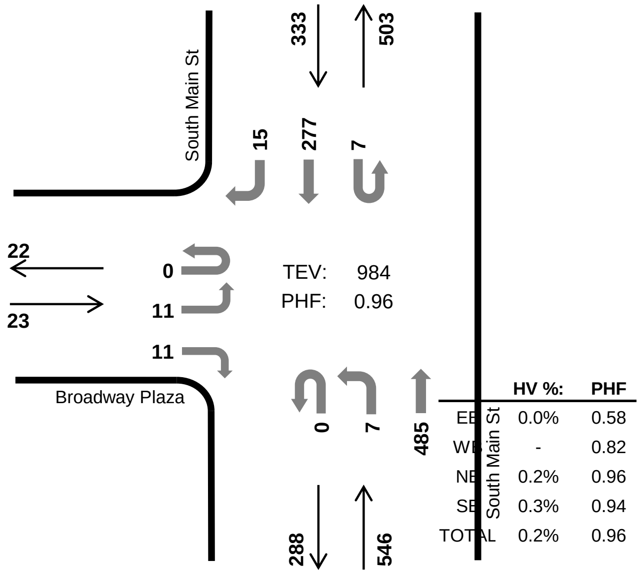
Interval Start	Broadway Plaza			0			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	2	0	0	0	0	2	0
7:30 AM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	5
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**2**	7
8:15 AM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**0**	**0**	**0**	**0**	**4**	**9**
8:30 AM	0	0	0	0	0	0	0	1	0	0	0	0	1	8
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Count Total	0	0	0	0	0	0	0	7	1	1	1	0	10	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**1**	**1**	**0**	**7**	**0**

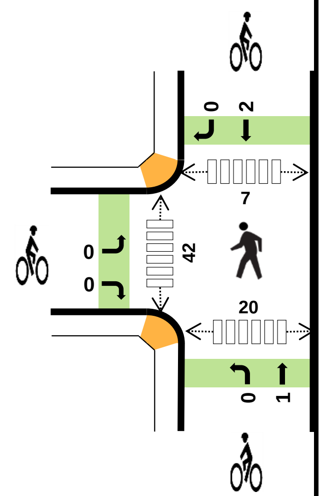
Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Broadway Plaza

Date: 08-29-2017
Count Period: 4:00 PM to 7:00 PM
Peak Hour: 5:15 PM to 6:15 PM

N Peak Hour





Three-Hour Count Summaries

Interval Start		Broadway Plaza Eastbound UT	LT	TH	RT	0 Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
5:15 PM		0	4	1	2	0	2	0	17	0	3	118	18	0	9	77	3	254	0
5:30 PM		0	0	0	2	0	4	0	14	0	2	127	13	2	7	69	3	243	0
5:45 PM		0	6	0	4	0	4	0	21	0	1	123	14	1	9	69	4	256	0
6:00 PM		0	1	0	3	0	5	0	15	0	1	117	9	4	9	62	5	231	984
Peak Hour	All	0	11	1	11	0	0	0	0	0	7	485	54	7	34	277	15	902	0
	HV	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0
	HV%	-	0%	0%	0%	-	-	-	-	-	0%	0%	2%	0%	3%	0%	0%	0%	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
5:15 PM	0	0	0	0	*0*	0	0	0	0	*0*	6	7	1	5	*19*
5:30 PM	0	0	0	0	*0*	0	0	1	2	*3*	4	15	0	6	*25*
5:45 PM	0	0	1	0	*1*	0	0	0	0	*0*	15	9	5	4	*33*
6:00 PM	0	0	0	1	*1*	0	0	0	0	*0*	4	11	1	5	*21*
Peak Hour	0	0	1	1	*2*	0	0	1	2	*3*	29	42	7	20	*98*

Three-Hour Count Summaries

Interval Start	Broadway Plaza				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	3	0	0	0	3	0	18	0	1	127	9	1	7	55	4	228	0
4:15 PM	0	1	0	1	0	5	0	13	0	1	126	12	2	7	65	5	238	0
4:30 PM	0	4	0	1	0	3	0	13	0	5	115	11	2	8	56	4	222	0
4:45 PM	0	3	0	4	0	2	0	10	0	1	120	16	4	14	53	2	229	917
5:00 PM	0	2	0	5	0	3	0	12	1	0	114	17	1	5	62	2	224	913
5:15 PM	**0**	**4**	**1**	**2**	**0**	**2**	**0**	**17**	**0**	**3**	**118**	**18**	**0**	**9**	**77**	**3**	**254**	929
5:30 PM	**0**	**0**	**0**	**2**	**0**	**4**	**0**	**14**	**0**	**2**	**127**	**13**	**2**	**7**	**69**	**3**	**243**	950
5:45 PM	**0**	**6**	**0**	**4**	**0**	**4**	**0**	**21**	**0**	**1**	**123**	**14**	**1**	**9**	**69**	**4**	**256**	977
6:00 PM	**0**	**1**	**0**	**3**	**0**	**5**	**0**	**15**	**0**	**1**	**117**	**9**	**4**	**9**	**62**	**5**	**231**	**984**
6:15 PM	0	0	0	1	0	3	0	8	0	1	116	7	0	10	50	2	198	928
6:30 PM	0	1	1	1	0	2	0	13	0	0	97	9	2	11	48	1	186	871
6:45 PM	0	0	0	5	0	3	0	15	0	1	64	9	0	16	57	5	175	790
Count Total	0	25	2	29	0	0	0	0	1	17	1,364	144	19	112	723	40	2,476	0
Peak Hour All	**0**	**11**	**1**	**11**	**0**	**0**	**0**	**0**	**0**	**7**	**485**	**54**	**7**	**34**	**277**	**15**	**902**	**0**
Peak Hour HV	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**
Peak Hour HV%	**-**	**0%**	**0%**	**0%**	**-**	**-**	**-**	**-**	**-**	**0%**	**0%**	**2%**	**0%**	**3%**	**0%**	**0%**	**0%**	**0**

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	0	0	0	*0*	0	0	2	1	*3*	6	8	0	12	*26*
4:15 PM	0	0	2	0	*2*	0	0	0	0	*0*	9	7	3	3	*22*
4:30 PM	0	0	0	0	*0*	0	0	0	0	*0*	1	11	3	4	*19*
4:45 PM	0	0	1	0	*1*	0	0	0	1	*1*	2	13	1	0	*16*
5:00 PM	0	0	1	0	*1*	0	0	0	1	*1*	7	9	5	4	*25*
5:15 PM	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***	**6**	**7**	**1**	**5**	*19*
5:30 PM	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**1**	**2**	***3***	**4**	**15**	**0**	**6**	*25*
5:45 PM	**0**	**0**	**1**	**0**	***1***	**0**	**0**	**0**	**0**	***0***	**15**	**9**	**5**	**4**	*33*
6:00 PM	**0**	**0**	**0**	**1**	***1***	**0**	**0**	**0**	**0**	***0***	**4**	**11**	**1**	**5**	*21*
6:15 PM	0	0	0	1	*1*	0	0	1	0	*1*	11	10	8	7	*36*
6:30 PM	0	0	0	0	*0*	0	0	2	0	*2*	6	11	6	7	*30*
6:45 PM	0	0	0	0	*0*	0	0	1	1	*2*	13	22	2	11	*48*
Count Total	0	0	5	2	*7*	0	0	7	6	*13*	84	133	35	68	*320*
Peak Hr	**0**	**0**	**1**	**1**	***2***	**0**	**0**	**1**	**2**	***3***	**29**	**42**	**7**	**20**	***98***

Three-Hour Count Summaries - Heavy Vehicles

Interval Start	Broadway Plaza				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	3	0
4:15 PM	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	3	0
4:30 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0
4:45 PM	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	10
5:00 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	9
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	8
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	7
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	7
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**7**
6:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	7
6:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	7
6:45 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	6
Count Total	0	0	0	0	0	0	0	0	0	0	2	3	0	1	1	0	7	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**

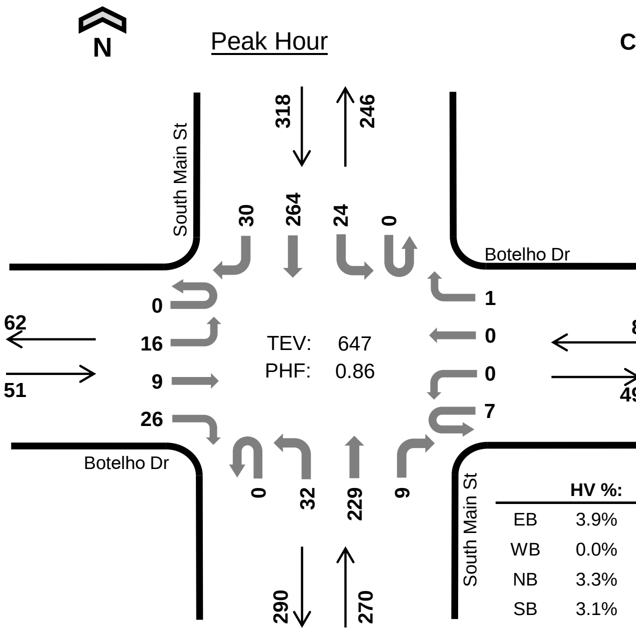
Three-Hour Count Summaries - Bikes

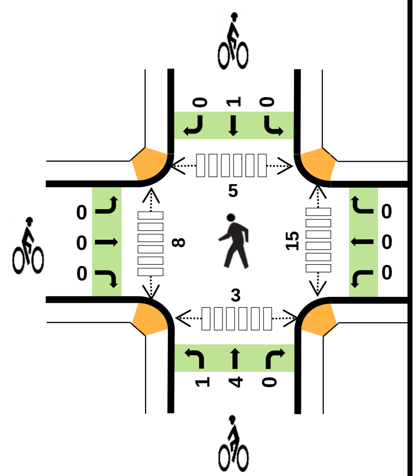
Interval Start	Broadway Plaza			0			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	2	0	0	1	0	3	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	4
5:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	2
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	2
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**3**	5
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	4
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
6:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	4
6:30 PM	0	0	0	0	0	0	0	2	0	0	0	0	2	3
6:45 PM	0	0	0	0	0	0	0	1	0	0	1	0	2	5
Count Total	0	0	0	0	0	0	0	7	0	0	6	0	13	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**3**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Botelho Dr

Date: 08-29-2017
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:45 AM to 8:45 AM





	HV %:	PHF
EB	3.9%	0.75
WB	0.0%	0.67
NB	3.3%	0.79
SB	3.1%	0.89
TOTAL	3.2%	0.86

Two-Hour Count Summaries

Interval Start		Botelho Dr Eastbound				Botelho Dr Westbound				South Main St Northbound				South Main St Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM		0	2	0	2	0	0	0	0	0	3	32	0	0	3	50	5	97	0
7:15 AM		0	3	0	5	0	0	0	0	0	7	31	0	0	3	63	2	114	0
7:30 AM		0	0	1	4	0	0	0	0	0	9	43	1	0	3	70	5	136	0
7:45 AM		**0**	**4**	**2**	**6**	**2**	**0**	**0**	**0**	**0**	**5**	**78**	**2**	**0**	**3**	**81**	**5**	**188**	535
8:00 AM		**0**	**0**	**1**	**7**	**1**	**0**	**0**	**0**	**0**	**8**	**62**	**1**	**0**	**6**	**70**	**7**	**163**	601
8:15 AM		**0**	**4**	**3**	**7**	**3**	**0**	**0**	**0**	**0**	**10**	**52**	**3**	**0**	**8**	**52**	**7**	**149**	636
8:30 AM		**0**	**8**	**3**	**6**	**1**	**0**	**0**	**1**	**0**	**9**	**37**	**3**	**0**	**7**	**61**	**11**	**147**	**647**
8:45 AM		0	3	5	11	0	0	0	0	0	7	46	5	1	8	56	6	148	607
Count Total		0	24	15	48	7	0	0	1	0	58	381	15	1	41	503	48	1,142	0
Peak Hour	**All**	**0**	**16**	**9**	**26**	**7**	**0**	**0**	**1**	**0**	**32**	**229**	**9**	**0**	**24**	**264**	**30**	**647**	**0**
	HV	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**0**	**8**	**2**	**21**	**0**
	HV%	**-**	**6%**	**0%**	**4%**	**0%**	**-**	**-**	**0%**	**-**	**9%**	**3%**	**0%**	**-**	**0%**	**3%**	**7%**	**3%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	0	3	2	*5*	0	0	0	0	*0*	3	3	0	0	*6*
7:15 AM	0	0	3	2	*5*	0	0	2	0	*2*	4	2	0	0	*6*
7:30 AM	0	0	3	1	*4*	0	0	2	0	*2*	3	5	2	1	*11*
7:45 AM	**0**	**0**	**1**	**3**	***4***	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**0**	**1**	*3*
8:00 AM	**0**	**0**	**2**	**5**	***7***	**0**	**0**	**0**	**1**	***1***	**7**	**3**	**0**	**0**	*10*
8:15 AM	**0**	**0**	**4**	**2**	***6***	**0**	**0**	**4**	**0**	***4***	**2**	**2**	**0**	**1**	*5*
8:30 AM	**2**	**0**	**2**	**0**	***4***	**0**	**0**	**1**	**0**	***1***	**4**	**3**	**5**	**1**	***13***
8:45 AM	0	0	4	2	*6*	0	0	0	1	*1*	2	2	2	1	*7*
Count Total	2	0	22	17	*41*	0	0	9	2	*11*	27	20	9	5	*61*
Peak Hour	**2**	**0**	**9**	**10**	***21***	**0**	**0**	**5**	**1**	***6***	**15**	**8**	**5**	**3**	***31***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Botelho Dr				Botelho Drr				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	5	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	5	0
7:30 AM	0	0	0	0	0	0	0	0	0	1	2	0	0	0	1	0	4	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**1**	**4**	18
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**5**	**0**	**7**	20
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**1**	**1**	**6**	21
8:30 AM	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**4**	**21**
8:45 AM	0	0	0	0	0	0	0	0	0	1	3	0	0	0	2	0	6	23
Count Total	0	1	0	1	0	0	0	0	0	5	17	0	0	0	15	2	41	0
Peak Hour	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**0**	**8**	**2**	**21**	**0**

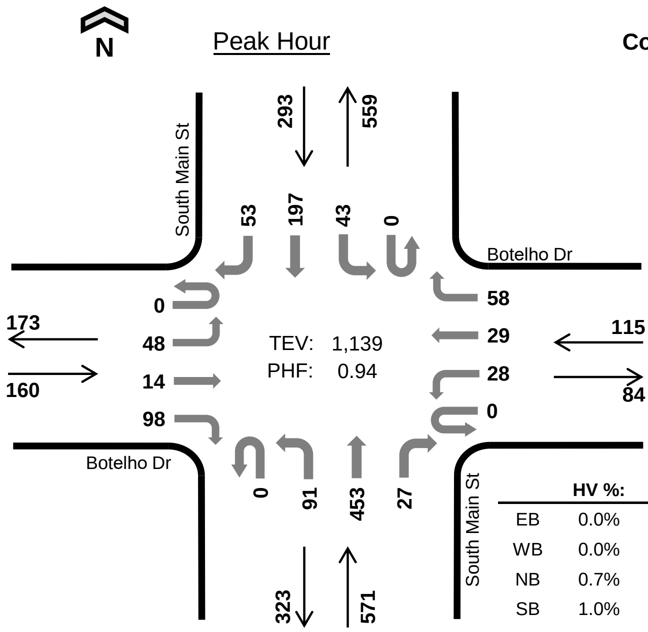
Two-Hour Count Summaries - Bikes

Interval Start	Botelho Dr			Botelho Dr			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	1	1	0	0	0	0	2	0
7:30 AM	0	0	0	0	0	0	2	0	0	0	0	0	2	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	4
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	5
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	7
8:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**6**
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	1	7
Count Total	0	0	0	0	0	0	4	5	0	0	1	1	11	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**1**	**0**	**6**	**0**

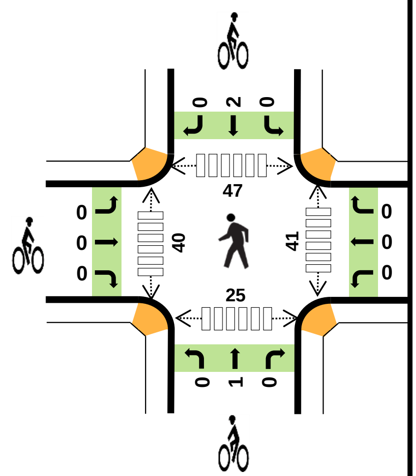
Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Botelho Dr

Date: 08-29-2017
Count Period: 4:00 PM to 7:00 PM
Peak Hour: 5:15 PM to 6:15 PM



	HV %:	PHF
EB	0.0%	0.87
WB	0.0%	0.76
NB	0.7%	0.94
SB	1.0%	0.79
TOTAL	0.6%	0.94



Three-Hour Count Summaries

Interval Start		Botelho Dr Eastbound UT	LT	TH	RT	Botelho Dr Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
5:15 PM		0	9	3	27	0	11	6	11	0	21	117	7	0	7	54	11	284	0
5:30 PM		0	9	3	24	0	6	8	10	0	17	115	8	0	13	44	12	269	0
5:45 PM		0	16	3	27	0	6	7	12	0	28	117	7	0	7	39	13	282	0
6:00 PM		0	14	5	20	0	5	8	25	0	25	104	5	0	16	60	17	304	1,139
Peak Hour	All	0	48	14	98	0	28	29	58	0	91	453	27	0	43	197	53	1,139	0
	HV	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	2	7	0
	HV%	-	0%	0%	0%	-	0%	0%	0%	-	4%	0%	0%	-	0%	1%	4%	1%	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
5:15 PM	0	0	1	1	*2*	0	0	0	0	*0*	10	9	12	9	*40*
5:30 PM	0	0	1	0	*1*	0	0	1	2	*3*	10	4	12	10	*36*
5:45 PM	0	0	1	0	*1*	0	0	0	0	*0*	11	14	17	4	*46*
6:00 PM	0	0	1	2	*3*	0	0	0	0	*0*	10	13	6	2	*31*
Peak Hour	0	0	4	3	*7*	0	0	1	2	*3*	41	40	47	25	*153*

Three-Hour Count Summaries

Interval Start	Botelho Dr Eastbound UT	LT	TH	RT	Botelho Dr Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
4:00 PM	0	14	2	21	0	9	11	11	0	22	105	9	0	10	31	10	255	0
4:15 PM	0	10	6	18	0	6	8	10	0	29	116	5	0	10	49	12	279	0
4:30 PM	0	16	2	17	0	6	8	15	0	27	102	2	0	11	42	9	257	0
4:45 PM	0	14	9	18	0	5	7	11	0	20	119	4	0	13	47	13	280	1,071
5:00 PM	0	18	14	16	0	4	3	8	0	15	109	9	0	8	40	9	253	1,069
5:15 PM	**0**	**9**	**3**	**27**	**0**	**11**	**6**	**11**	**0**	**21**	**117**	**7**	**0**	**7**	**54**	**11**	**284**	1,074
5:30 PM	**0**	**9**	**3**	**24**	**0**	**6**	**8**	**10**	**0**	**17**	**115**	**8**	**0**	**13**	**44**	**12**	**269**	1,086
5:45 PM	**0**	**16**	**3**	**27**	**0**	**6**	**7**	**12**	**0**	**28**	**117**	**7**	**0**	**7**	**39**	**13**	**282**	1,088
6:00 PM	**0**	**14**	**5**	**20**	**0**	**5**	**8**	**25**	**0**	**25**	**104**	**5**	**0**	**16**	**60**	**17**	**304**	**1,139**
6:15 PM	0	15	6	17	0	5	10	19	1	12	103	9	0	9	38	16	260	1,115
6:30 PM	0	15	6	17	0	6	6	20	0	21	84	10	0	8	34	11	238	1,084
6:45 PM	0	13	6	25	0	4	7	12	0	15	62	7	0	7	42	5	205	1,007
Count Total	0	163	65	247	0	73	89	164	1	252	1,253	82	0	119	520	138	3,166	0
Peak Hour All	**0**	**48**	**14**	**98**	**0**	**28**	**29**	**58**	**0**	**91**	**453**	**27**	**0**	**43**	**197**	**53**	**1,139**	**0**
Peak Hour HV	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**1**	**2**	**7**	**0**
Peak Hour HV%	**-**	**0%**	**0%**	**0%**	**-**	**0%**	**0%**	**0%**	**-**	**4%**	**0%**	**0%**	**-**	**0%**	**1%**	**4%**	**1%**	**0**

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	0	0	2	1	*3*	0	0	2	1	*3*	6	14	16	4	*40*
4:15 PM	0	0	2	0	*2*	0	0	0	1	*1*	5	5	11	4	*25*
4:30 PM	0	0	1	0	*1*	0	0	0	0	*0*	8	6	15	3	*32*
4:45 PM	0	0	3	0	*3*	0	0	0	1	*1*	4	10	10	8	*32*
5:00 PM	0	0	1	0	*1*	0	0	0	2	*2*	8	6	12	2	*28*
5:15 PM	**0**	**0**	**1**	**1**	***2***	**0**	**0**	**0**	**0**	***0***	**10**	**9**	**12**	**9**	*40*
5:30 PM	**0**	**0**	**1**	**0**	***1***	**0**	**0**	**1**	**2**	***3***	**10**	**4**	**12**	**10**	*36*
5:45 PM	**0**	**0**	**1**	**0**	***1***	**0**	**0**	**0**	**0**	***0***	**11**	**14**	**17**	**4**	*46*
6:00 PM	**0**	**0**	**1**	**2**	***3***	**0**	**0**	**0**	**0**	***0***	**10**	**13**	**6**	**2**	***31***
6:15 PM	0	0	1	1	*2*	0	0	1	0	*1*	15	8	11	5	*39*
6:30 PM	0	0	1	0	*1*	0	0	2	0	*2*	9	10	9	7	*35*
6:45 PM	0	0	1	0	*1*	0	0	1	1	*2*	11	13	11	3	*38*
Count Total	0	0	16	5	*21*	0	0	7	8	*15*	107	112	142	61	*422*
Peak Hour	**0**	**0**	**4**	**3**	***7***	**0**	**0**	**1**	**2**	***3***	**41**	**40**	**47**	**25**	***153***

Three-Hour Count Summaries - Heavy Vehicles

Interval Start	Botelho Dr				Botelho Dr				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	3	0
4:15 PM	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	0
4:30 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
4:45 PM	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	3	9
5:00 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	7
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	7
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	7
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	5
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**3**	**7**
6:15 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	7
6:30 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	7
6:45 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	7
Count Total	0	0	0	0	0	0	0	0	0	12	4	0	0	0	2	3	21	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**1**	**2**	**7**	**0**

Three-Hour Count Summaries - Bikes

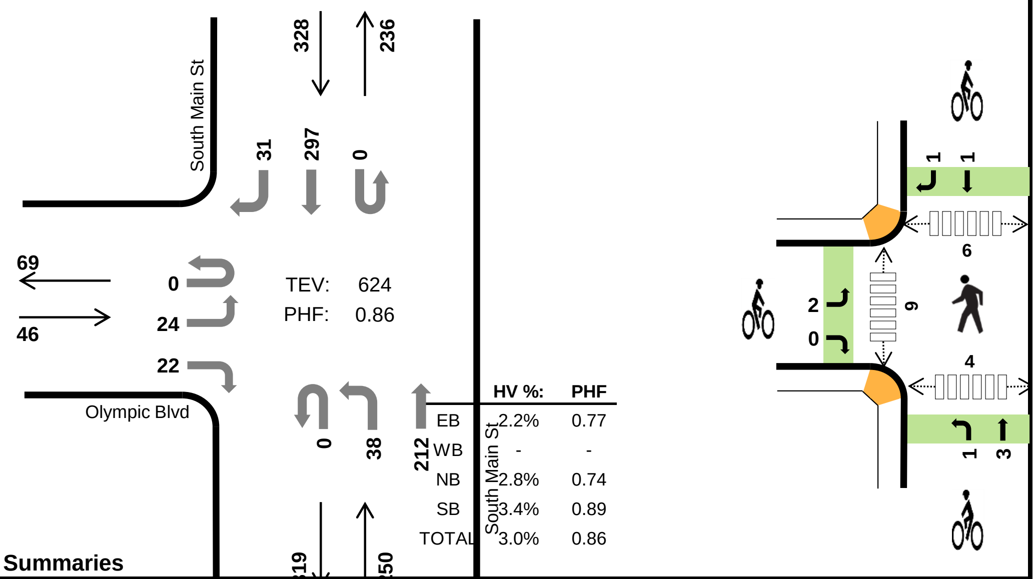
Interval Start	Botelho Dr			Botelho Dr			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	2	0	0	1	0	3	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	5
5:00 PM	0	0	0	0	0	0	0	0	0	0	2	0	2	4
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**3**	6
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	5
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
6:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	4
6:30 PM	0	0	0	0	0	0	1	1	0	0	0	0	2	3
6:45 PM	0	0	0	0	0	0	0	1	0	0	1	0	2	5
Count Total	0	0	0	0	0	0	1	6	0	0	8	0	15	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**3**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Olympic Blvd

Peak Hour

Date: 08-29-2017
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:30 AM to 8:30 AM



Two-Hour Count Summaries

Interval Start	Olympic Blvd Eastbound UT	LT	TH	RT	0 Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	7	0	2	0	0	0	0	0	8	26	0	0	0	57	3	103	0
7:15 AM	0	4	0	4	0	0	0	0	0	2	31	0	0	0	64	3	108	0
7:30 AM	**0**	**5**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**5**	**41**	**0**	**0**	**0**	**72**	**7**	**139**	0
7:45 AM	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**72**	**0**	**0**	**0**	**90**	**2**	**182**	532
8:00 AM	**0**	**6**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**10**	**56**	**0**	**0**	**0**	**73**	**9**	**160**	589
8:15 AM	**0**	**8**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**10**	**43**	**0**	**0**	**0**	**62**	**13**	**143**	**624**
8:30 AM	0	8	0	5	0	0	0	0	0	6	37	0	0	0	69	9	134	619
8:45 AM	0	11	0	4	0	0	0	0	0	7	45	0	0	0	70	10	147	584
Count Total	0	54	0	37	0	0	0	0	0	61	351	0	0	0	557	56	1,116	0
Peak Hour All	**0**	**24**	**0**	**22**	**0**	**0**	**0**	**0**	**0**	**38**	**212**	**0**	**0**	**0**	**297**	**31**	**624**	**0**
Peak Hour HV	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**	**0**	**0**	**0**	**11**	**0**	**19**	**0**
Peak Hour HV%	**-**	**4%**	**-**	**0%**	**-**	**-**	**-**	**-**	**-**	**3%**	**3%**	**-**	**-**	**-**	**4%**	**0%**	**3%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	1	0	3	2	*6*	0	0	0	0	*0*	0	3	0	0	*3*
7:15 AM	1	0	3	2	*6*	1	0	1	0	*2*	0	3	0	2	*5*
7:30 AM	**1**	**0**	**2**	**1**	***4***	**1**	**0**	**0**	**0**	***1***	**0**	**0**	**0**	**2**	*2*
7:45 AM	**0**	**0**	**1**	**3**	***4***	**1**	**0**	**0**	**0**	***1***	**0**	**0**	**4**	**1**	*5*
8:00 AM	**0**	**0**	**2**	**5**	***7***	**0**	**0**	**0**	**1**	***1***	**0**	**5**	**2**	**0**	*7*
8:15 AM	**0**	**0**	**2**	**2**	***4***	**0**	**0**	**4**	**1**	***5***	**0**	**4**	**0**	**1**	***5***
8:30 AM	0	0	2	1	*3*	0	0	0	0	*0*	0	7	4	1	*12*
8:45 AM	0	0	3	2	*5*	1	0	0	1	*2*	0	7	3	6	*16*
Count Total	3	0	18	18	*39*	4	0	5	3	*12*	0	29	13	13	*55*
Peak Hr	**1**	**0**	**7**	**11**	***19***	**2**	**0**	**4**	**2**	***8***	**0**	**9**	**6**	**4**	***19***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Olympic Blvd				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	1	0	0	0	0	0	0	0	1	2	0	0	0	2	0	6	0
7:15 AM	0	1	0	0	0	0	0	0	0	0	3	0	0	0	2	0	6	0
7:30 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**4**	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**3**	**0**	**4**	20
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**5**	**0**	**7**	21
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**4**	**19**
8:30 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3	18
8:45 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	5	19
Count Total	0	3	0	0	0	0	0	0	0	2	16	0	0	0	17	1	39	0
Peak Hour	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**	**0**	**0**	**0**	**11**	**0**	**19**	**0**

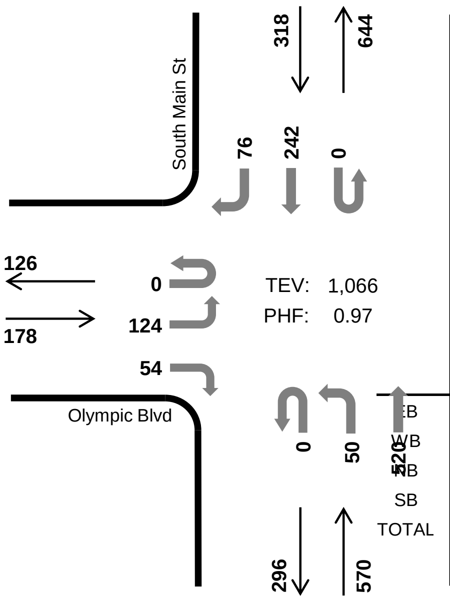
Two-Hour Count Summaries - Bikes

Interval Start	Olympic Blvd			0			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	1	0	0	0	0	0	0	1	0	0	0	0	2	0
7:30 AM	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	0
7:45 AM	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	4
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	5
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**1**	**5**	**8**
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	7
8:45 AM	1	0	0	0	0	0	0	0	0	0	1	0	2	8
Count Total	4	0	0	0	0	0	1	4	0	0	2	1	12	0
Peak Hour	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**1**	**1**	**8**	**0**

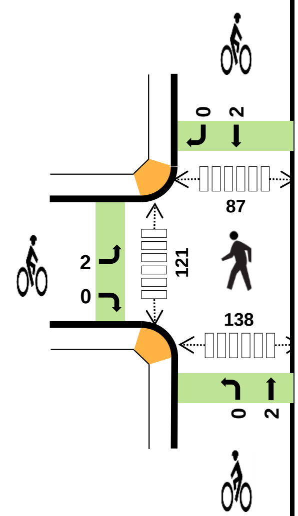
Note: U-Turn volumes for bikes are included in Left-Turn, if any.

South Main St
Olympic Blvd

Date: 08-29-2017
Count Period: 4:00 PM to 7:00 PM
Peak Hour: 5:15 PM to 6:15 PM



	HV %:	PHF
EB	0.0%	0.84
WB	-	-
NB	0.0%	0.94
SB	0.3%	0.84
TOTAL	0.1%	0.97



Three-Hour Count Summaries

Interval Start		Olympic Blvd				0				South Main St				South Main St				15-min Total	Rolling One Hour
		Eastbound				Westbound				Northbound				Southbound					
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
5:15 PM		0	43	0	8	0	0	0	0	0	8	131	0	0	0	60	19	269	0
5:30 PM		0	32	0	21	0	0	0	0	0	10	123	0	0	0	45	23	254	0
5:45 PM		0	33	0	8	0	0	0	0	0	15	137	0	0	0	59	17	269	0
6:00 PM		0	16	0	17	0	0	0	0	0	17	129	0	0	0	78	17	274	1,066
Peak Hour	All	0	124	0	54	0	0	0	0	0	50	520	0	0	0	242	76	1,066	0
	HV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
	HV%	-	0%	-	0%	-	-	-	-	-	0%	0%	-	-	-	0%	0%	0%	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
5:15 PM	0	0	0	0	*0*	0	0	0	0	*0*	0	33	18	32	*83*
5:30 PM	0	0	0	0	*0*	2	0	2	2	*6*	0	23	27	27	*77*
5:45 PM	0	0	0	0	*0*	0	0	0	0	*0*	0	44	11	39	*94*
6:00 PM	0	0	0	1	*1*	0	0	0	0	*0*	0	21	31	40	*92*
Peak Hour	0	0	0	1	*1*	2	0	2	2	*6*	0	121	87	138	*346*

Three-Hour Count Summaries

Interval Start	Olympic Blvd				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	38	0	12	0	0	0	0	0	10	113	0	1	0	41	18	233	0
4:15 PM	0	40	0	10	0	0	0	0	0	18	134	0	0	0	60	26	288	0
4:30 PM	0	31	0	8	0	0	0	0	0	14	112	0	0	0	54	27	246	0
4:45 PM	0	31	0	14	0	0	0	0	0	14	129	0	0	0	57	21	266	1,033
5:00 PM	0	37	0	8	0	0	0	0	0	21	115	0	0	0	55	21	257	1,057
5:15 PM	**0**	**43**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**8**	**131**	**0**	**0**	**0**	**60**	**19**	**269**	1,038
5:30 PM	**0**	**32**	**0**	**21**	**0**	**0**	**0**	**0**	**0**	**10**	**123**	**0**	**0**	**0**	**45**	**23**	**254**	1,046
5:45 PM	**0**	**33**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**15**	**137**	**0**	**0**	**0**	**59**	**17**	**269**	1,049
6:00 PM	**0**	**16**	**0**	**17**	**0**	**0**	**0**	**0**	**0**	**17**	**129**	**0**	**0**	**0**	**78**	**17**	**274**	**1,066**
6:15 PM	0	33	0	12	0	0	0	0	0	13	125	0	0	0	47	24	254	1,051
6:30 PM	0	28	0	12	0	0	0	0	0	23	98	0	0	0	43	20	224	1,021
6:45 PM	0	30	0	11	0	0	0	0	0	12	71	0	0	0	37	19	180	932
Count Total	0	392	0	141	0	0	0	0	0	175	1,417	0	1	0	636	252	3,014	0
Peak Hour All	**0**	**124**	**0**	**54**	**0**	**0**	**0**	**0**	**0**	**50**	**520**	**0**	**0**	**0**	**242**	**76**	**1,066**	**0**
Peak Hour HV	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**
Peak Hour HV%	**-**	**0%**	**-**	**0%**	**-**	**-**	**-**	**-**	**-**	**0%**	**0%**	**-**	**-**	**-**	**0%**	**0%**	**0%**	**0**

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	0	1	1	*2*	0	0	1	1	*2*	0	39	13	32	*84*
4:15 PM	0	0	1	1	*2*	0	0	0	1	*1*	0	34	23	30	*87*
4:30 PM	1	0	0	0	*1*	1	0	0	0	*1*	0	28	22	49	*99*
4:45 PM	0	0	2	0	*2*	0	0	0	1	*1*	0	41	29	37	*107*
5:00 PM	0	0	0	2	*2*	2	0	0	1	*3*	0	17	19	43	*79*
5:15 PM	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***	**0**	**33**	**18**	**32**	*83*
5:30 PM	**0**	**0**	**0**	**0**	***0***	**2**	**0**	**2**	**2**	***6***	**0**	**23**	**27**	**27**	*77*
5:45 PM	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***	**0**	**44**	**11**	**39**	*94*
6:00 PM	**0**	**0**	**0**	**1**	***1***	**0**	**0**	**0**	**0**	***0***	**0**	**21**	**31**	**40**	***92***
6:15 PM	0	0	0	1	*1*	0	0	1	0	*1*	0	23	26	29	*78*
6:30 PM	0	0	0	0	*0*	0	0	1	0	*1*	0	46	36	34	*116*
6:45 PM	0	0	0	0	*0*	0	0	0	2	*2*	0	31	28	57	*116*
Count Total	1	0	4	6	*11*	5	0	5	8	*18*	0	380	283	449	*1,112*
Peak Hr	**0**	**0**	**0**	**1**	***1***	**2**	**0**	**2**	**2**	***6***	**0**	**121**	**87**	**138**	***346***

Three-Hour Count Summaries - Heavy Vehicles

Interval Start	Olympic Blvd				0				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0
4:30 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
4:45 PM	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	7
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	7
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	5
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	4
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	2
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Count Total	0	1	0	0	0	0	0	0	0	1	3	0	0	0	5	1	11	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**

Three-Hour Count Summaries - Bikes

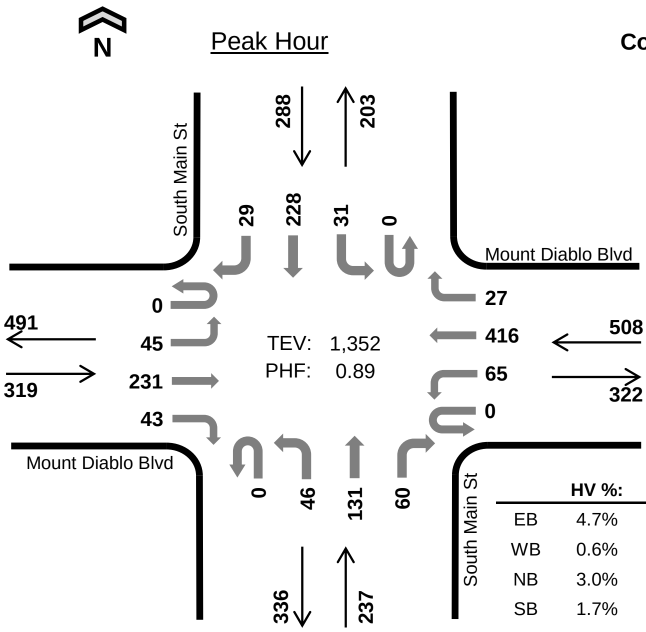
Interval Start	Olympic Blvd			0			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	1	0	0	1	0	2	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0
4:30 PM	1	0	0	0	0	0	0	0	0	0	0	0	1	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	5
5:00 PM	1	0	1	0	0	0	0	0	0	0	1	0	3	6
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	5
5:30 PM	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**6**	10
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	9
6:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**
6:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	7
6:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	2
6:45 PM	0	0	0	0	0	0	0	0	0	0	1	1	2	4
Count Total	4	0	1	0	0	0	0	5	0	0	7	1	18	0
Peak Hour	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**6**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

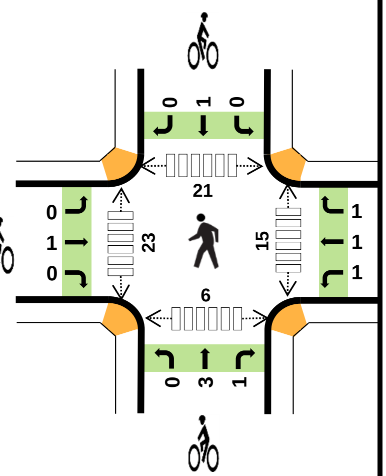
Project Manager: (415) 310-6469 project.manager.ca@idaxdata.com

South Main St
Mount Diablo Blvd

Date: 08-29-2017
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	4.7%	0.93
WB	0.6%	0.88
NB	3.0%	0.78
SB	1.7%	0.94
TOTAL	2.2%	0.89



Two-Hour Count Summaries

Interval Start	Mount Diablo Blvd Eastbound UT	LT	TH	RT	Mount Diablo Blvd Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	3	26	6	0	12	72	11	0	12	16	10	0	4	42	6	220	0
7:15 AM	0	10	20	6	0	10	99	6	0	6	15	10	0	2	52	6	242	0
7:30 AM	0	7	44	8	0	21	95	4	0	9	24	8	0	5	48	6	279	0
7:45 AM	**0**	**12**	**62**	**8**	**0**	**24**	**111**	**9**	**0**	**15**	**38**	**23**	**0**	**8**	**62**	**7**	**379**	1,120
8:00 AM	**0**	**13**	**50**	**12**	**0**	**19**	**108**	**6**	**0**	**15**	**37**	**12**	**0**	**4**	**60**	**10**	**346**	1,246
8:15 AM	**0**	**6**	**66**	**14**	**0**	**6**	**91**	**8**	**0**	**9**	**30**	**12**	**0**	**12**	**51**	**7**	**312**	1,316
8:30 AM	**0**	**14**	**53**	**9**	**0**	**16**	**106**	**4**	**0**	**7**	**26**	**13**	**0**	**7**	**55**	**5**	**315**	**1,352**
8:45 AM	0	18	61	9	0	18	89	13	0	12	27	16	0	10	52	8	333	1,306
Count Total	0	83	382	72	0	126	771	61	0	85	213	104	0	52	422	55	2,426	0
Peak Hour All	**0**	**45**	**231**	**43**	**0**	**65**	**416**	**27**	**0**	**46**	**131**	**60**	**0**	**31**	**228**	**29**	**1,352**	**0**
Peak Hour HV	**0**	**0**	**10**	**5**	**0**	**2**	**1**	**0**	**0**	**4**	**2**	**1**	**0**	**0**	**4**	**1**	**30**	**0**
Peak Hour HV%	**-**	**0%**	**4%**	**12%**	**-**	**3%**	**0%**	**0%**	**-**	**9%**	**2%**	**2%**	**-**	**0%**	**2%**	**3%**	**2%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	2	2	3	3	*10*	0	0	0	0	*0*	0	3	0	1	*4*
7:15 AM	3	4	3	2	*12*	1	1	2	1	*5*	2	6	2	3	*13*
7:30 AM	3	2	3	1	*9*	0	0	1	0	*1*	4	0	2	0	*6*
7:45 AM	**5**	**0**	**2**	**2**	***9***	**0**	**0**	**1**	**0**	***1***	**5**	**5**	**3**	**4**	*17*
8:00 AM	**3**	**3**	**1**	**2**	***9***	**0**	**1**	**0**	**1**	***2***	**7**	**6**	**6**	**0**	*19*
8:15 AM	**4**	**0**	**2**	**1**	***7***	**0**	**2**	**3**	**0**	***5***	**2**	**5**	**7**	**2**	*16*
8:30 AM	**3**	**0**	**2**	**0**	***5***	**1**	**0**	**0**	**0**	***1***	**1**	**7**	**5**	**0**	***13***
8:45 AM	8	4	3	1	*16*	1	1	1	0	*3*	3	2	8	8	*21*
Count Total	31	15	19	12	*77*	3	5	8	2	*18*	24	34	33	18	*109*
Peak Hour	**15**	**3**	**7**	**5**	***30***	**1**	**3**	**4**	**1**	***9***	**15**	**23**	**21**	**6**	***65***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Mount Diablo Blvd				Mount Diablo Blvd				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	2	0	0	0	1	1	0	0	2	1	0	0	2	1	10	0
7:15 AM	0	1	1	1	0	0	4	0	0	0	1	2	0	0	1	1	12	0
7:30 AM	0	1	2	0	0	0	2	0	0	0	2	1	0	0	1	0	9	0
7:45 AM	**0**	**0**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**9**	40
8:00 AM	**0**	**0**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**9**	39
8:15 AM	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**7**	34
8:30 AM	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**5**	**30**
8:45 AM	0	4	3	1	0	0	3	1	0	1	1	1	0	0	1	0	16	37
Count Total	0	6	18	7	0	2	11	2	0	5	8	6	0	0	9	3	77	0
Peak Hour	**0**	**0**	**10**	**5**	**0**	**2**	**1**	**0**	**0**	**4**	**2**	**1**	**0**	**0**	**4**	**1**	**30**	**0**

Two-Hour Count Summaries - Bikes

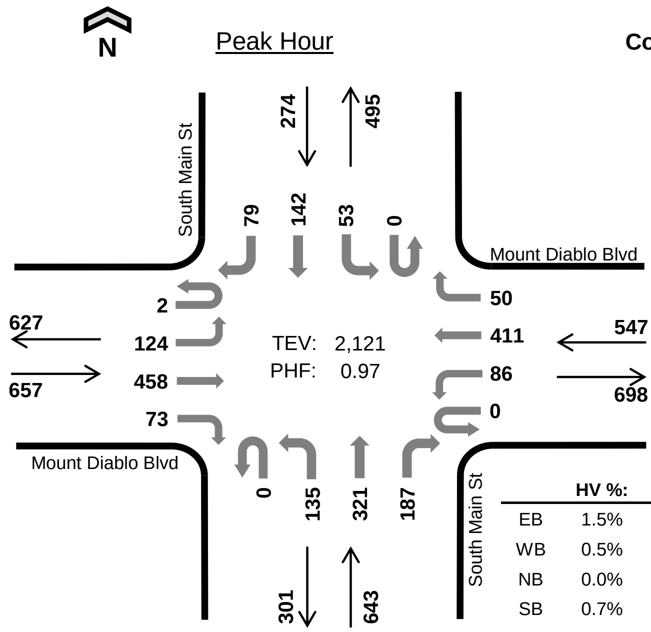
Interval Start	Mount Diablo Blvd			Mount Diablo Blvd			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	1	0	0	0	1	0	1	1	0	0	1	5	0
7:30 AM	0	0	0	0	0	0	0	0	1	0	0	0	1	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	7
8:00 AM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	9
8:15 AM	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**5**	9
8:30 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**9**
8:45 AM	0	1	0	1	0	0	0	0	1	0	0	0	3	11
Count Total	0	3	0	2	1	2	0	4	4	0	1	1	18	0
Peak Hour	**0**	**1**	**0**	**1**	**1**	**1**	**0**	**3**	**1**	**0**	**1**	**0**	**9**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

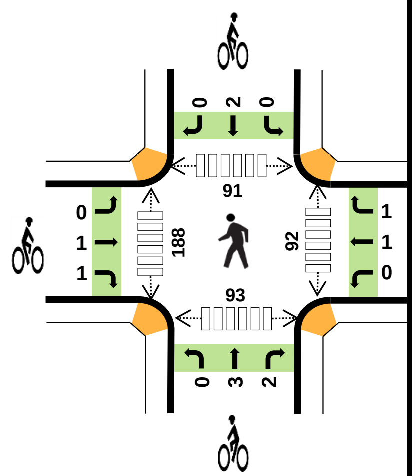
South Main St
Mount Diablo Blvd

Date: 08-29-2017
Count Period: 4:00 PM to 7:00 PM
Peak Hour: 5:00 PM to 6:00 PM

Peak Hour



	HV %:	PHF
EB	1.5%	0.95
WB	0.5%	0.88
NB	0.0%	0.96
SB	0.7%	0.94
TOTAL	0.7%	0.97



Three-Hour Count Summaries

Interval Start		Mount Diablo Blvd Eastbound UT	LT	TH	RT	Mount Diablo Blvd Westbound UT	LT	TH	RT	South Main St Northbound UT	LT	TH	RT	South Main St Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
5:00 PM		0	27	119	23	0	23	119	14	0	26	82	44	0	13	32	20	542	0
5:15 PM		0	31	123	18	0	20	96	7	0	32	82	54	0	11	39	16	529	0
5:30 PM		1	32	102	13	0	19	92	11	0	40	79	40	0	15	37	21	502	0
5:45 PM		1	34	114	19	0	24	104	18	0	37	78	49	0	14	34	22	548	2,121
Peak Hour	All	2	124	458	73	0	86	411	50	0	135	321	187	0	53	142	79	2,121	0
	HV	0	4	5	1	0	1	2	0	0	0	0	0	0	1	0	1	15	0
	HV%	0%	3%	1%	1%	-	1%	0%	0%	-	0%	0%	0%	-	2%	0%	1%	1%	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
5:00 PM	3	2	0	0	*5*	0	0	1	1	*2*	26	43	19	27	*115*
5:15 PM	2	1	0	2	*5*	1	0	0	0	*1*	19	43	20	23	*105*
5:30 PM	2	0	0	0	*2*	1	1	4	1	*7*	23	44	24	20	*111*
5:45 PM	3	0	0	0	*3*	0	1	0	0	*1*	24	58	28	23	*133*
Peak Hour	10	3	0	2	*15*	2	2	5	2	*11*	92	188	91	93	*464*

Project Manager: (415) 310-6469
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Three-Hour Count Summaries

Interval Start	Mount Diablo Blvd				Mount Diablo Blvd				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	22	98	17	0	25	98	3	0	31	76	45	0	11	24	19	469	0
4:15 PM	0	30	107	16	0	12	73	10	0	24	97	51	0	13	54	16	503	0
4:30 PM	0	22	72	13	0	20	91	8	0	25	73	44	0	11	47	17	443	0
4:45 PM	0	23	105	18	0	17	103	8	0	33	90	50	0	14	47	14	522	1,937
5:00 PM	**0**	**27**	**119**	**23**	**0**	**23**	**119**	**14**	**0**	**26**	**82**	**44**	**0**	**13**	**32**	**20**	**542**	2,010
5:15 PM	**0**	**31**	**123**	**18**	**0**	**20**	**96**	**7**	**0**	**32**	**82**	**54**	**0**	**11**	**39**	**16**	**529**	2,036
5:30 PM	**1**	**32**	**102**	**13**	**0**	**19**	**92**	**11**	**0**	**40**	**79**	**40**	**0**	**15**	**37**	**21**	**502**	2,095
5:45 PM	**1**	**34**	**114**	**19**	**0**	**24**	**104**	**18**	**0**	**37**	**78**	**49**	**0**	**14**	**34**	**22**	**548**	**2,121**
6:00 PM	0	25	101	20	0	29	75	12	0	23	76	49	0	8	43	19	480	2,059
6:15 PM	0	20	114	21	0	11	81	11	0	39	78	40	0	10	41	20	486	2,016
6:30 PM	0	13	89	17	0	15	103	6	0	28	63	37	0	13	28	19	431	1,945
6:45 PM	0	17	109	17	1	8	84	7	0	26	37	35	0	16	31	25	413	1,810
Count Total	2	296	1,253	212	1	223	1,119	115	0	364	911	538	0	149	457	228	5,868	0
Peak Hour All	**2**	**124**	**458**	**73**	**0**	**86**	**411**	**50**	**0**	**135**	**321**	**187**	**0**	**53**	**142**	**79**	**2,121**	**0**
Peak Hour HV	**0**	**4**	**5**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**15**	**0**
Peak Hour HV%	**0%**	**3%**	**1%**	**1%**	**-**	**1%**	**0%**	**0%**	**-**	**0%**	**0%**	**0%**	**-**	**2%**	**0%**	**1%**	**1%**	**0**

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	3	0	1	0	*4*	0	0	1	1	*2*	23	45	24	20	*112*
4:15 PM	3	0	1	0	*4*	0	0	0	1	*1*	29	32	12	23	*96*
4:30 PM	3	0	1	2	*6*	1	1	1	0	*3*	30	32	17	13	*92*
4:45 PM	2	1	1	0	*4*	1	0	0	2	*3*	21	32	25	25	*103*
5:00 PM	**3**	**2**	**0**	**0**	***5***	**0**	**0**	**1**	**1**	***2***	**26**	**43**	**19**	**27**	*115*
5:15 PM	**2**	**1**	**0**	**2**	***5***	**1**	**0**	**0**	**0**	***1***	**19**	**43**	**20**	**23**	*105*
5:30 PM	**2**	**0**	**0**	**0**	***2***	**1**	**1**	**4**	**1**	***7***	**23**	**44**	**24**	**20**	*111*
5:45 PM	**3**	**0**	**0**	**0**	***3***	**0**	**1**	**0**	**0**	***1***	**24**	**58**	**28**	**23**	***133***
6:00 PM	3	0	0	2	*5*	1	1	0	0	*2*	30	42	19	19	*110*
6:15 PM	2	1	0	1	*4*	1	3	1	0	*5*	32	29	18	29	*108*
6:30 PM	2	2	0	0	*4*	0	1	1	0	*2*	17	61	29	30	*137*
6:45 PM	2	0	0	0	*2*	0	0	0	2	*2*	33	54	18	17	*122*
Count Total	30	7	4	7	*48*	6	8	9	8	*31*	307	515	253	269	*1,344*
Peak Hour	**10**	**3**	**0**	**2**	***15***	**2**	**2**	**5**	**2**	***11***	**92**	**188**	**91**	**93**	***464***

Three-Hour Count Summaries - Heavy Vehicles

Interval Start	Mount Diablo Blvd				Mount Diablo Blvd				South Main St				South Main St				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	4	0
4:15 PM	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0
4:30 PM	0	1	1	1	0	0	0	0	0	0	0	1	0	1	0	1	6	0
4:45 PM	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	4	18
5:00 PM	**0**	**1**	**1**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	19
5:15 PM	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**5**	20
5:30 PM	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	16
5:45 PM	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**15**
6:00 PM	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	1	5	15
6:15 PM	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	4	14
6:30 PM	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	4	16
6:45 PM	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	15
Count Total	0	13	14	3	0	1	5	1	0	0	2	2	0	2	2	3	48	0
Peak Hour	**0**	**4**	**5**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**15**	**0**

Three-Hour Count Summaries - Bikes

Interval Start	Mount Diablo Blvd			Mount Diablo Blvd			South Main St			South Main St			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	1	0	0	1	0	2	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0
4:30 PM	0	1	0	0	1	0	0	0	1	0	0	0	3	0
4:45 PM	0	1	0	0	0	0	0	0	0	0	1	1	3	9
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**2**	9
5:15 PM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	9
5:30 PM	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**3**	**1**	**0**	**1**	**0**	**7**	13
5:45 PM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**11**
6:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	2	11
6:15 PM	0	1	0	0	3	0	0	1	0	0	0	0	5	15
6:30 PM	0	0	0	0	1	0	0	1	0	0	0	0	2	10
6:45 PM	0	0	0	0	0	0	0	0	0	0	2	0	2	11
Count Total	0	5	1	0	7	1	0	6	3	0	7	1	31	0
Peak Hour	**0**	**1**	**1**	**0**	**1**	**1**	**0**	**3**	**2**	**0**	**2**	**0**	**11**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

APPENDIX C:

SYNCHRO HCM 2010 OUTPUT SHEETS

EXISTING CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Future Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1710	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	42	247	47	78	450	30	53	143	61	32	246	33
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	58	758	141	340	1425	95	72	538	726	45	524	436
Arrive On Green	0.04	0.29	0.28	0.22	0.48	0.47	0.05	0.33	0.31	0.03	0.32	0.32
Sat Flow, veh/h	1566	2605	485	1566	2969	197	1566	1644	1349	1566	1644	1369
Grp Volume(v), veh/h	42	146	148	78	236	244	53	143	61	32	246	33
Grp Sat Flow(s),veh/h/ln	1566	1562	1528	1566	1562	1604	1566	1644	1349	1566	1644	1369
Q Serve(g_s), s	2.9	8.0	8.4	4.5	10.2	10.3	3.7	7.0	0.0	2.2	13.2	1.9
Cycle Q Clear(g_c), s	2.9	8.0	8.4	4.5	10.2	10.3	3.7	7.0	0.0	2.2	13.2	1.9
Prop In Lane	1.00		0.32	1.00		0.12	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	58	454	445	340	750	770	72	538	726	45	524	436
V/C Ratio(X)	0.72	0.32	0.33	0.23	0.31	0.32	0.73	0.27	0.08	0.72	0.47	0.08
Avail Cap(c_a), veh/h	164	454	445	340	750	770	178	538	726	121	524	436
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.95	0.95	0.95	0.77	0.77	0.77	0.96	0.96	0.96	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.4	30.5	30.8	35.5	17.5	17.6	51.8	27.3	12.7	53.0	30.0	26.2
Incr Delay (d2), s/veh	6.0	1.8	1.9	0.1	0.8	0.8	5.1	1.2	0.2	7.6	3.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	3.7	3.8	2.0	4.6	4.7	1.7	3.4	0.9	1.1	6.5	0.7
LnGrp Delay(d),s/veh	58.4	32.3	32.7	35.6	18.4	18.4	56.9	28.4	12.9	60.6	33.0	26.5
LnGrp LOS	E	C	C	D	B	B	E	C	B	E	C	C
Approach Vol, veh/h		336			558			257			311	
Approach Delay, s/veh		35.7			20.8			30.6			35.2	
Approach LOS		D			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.6	55.8	8.6	38.1	28.4	35.0	7.6	39.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	4.9	12.3	5.7	15.2	6.5	10.4	4.2	9.0
Green Ext Time (p_c), s	0.0	5.4	0.0	0.5	0.1	3.0	0.0	0.4

Intersection Summary			
HCM 2010 Ctrl Delay			29.0
HCM 2010 LOS			C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Future Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1710	1710	1693	1710	1644	1644	0	0	1644	1710
Adj Flow Rate, veh/h	29	0	27	0	0	0	46	255	0	0	358	37
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.83	0.90	0.83	0.90	0.90	0.90	0.83	0.83	0.90	0.90	0.83	0.83
Percent Heavy Veh, %	4	1	4	1	1	1	4	4	0	0	4	4
Cap, veh/h	31	0	29	0	9	0	776	1585	0	0	1448	149
Arrive On Green	0.08	0.00	0.10	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.51	0.50
Sat Flow, veh/h	761	0	708	0	1693	0	870	3206	0	0	2936	293
Grp Volume(v), veh/h	56	0	0	0	0	0	46	255	0	0	195	200
Grp Sat Flow(s),veh/h/ln	1469	0	0	0	1693	0	870	1562	0	0	1562	1585
Q Serve(g_s), s	0.7	0.0	0.0	0.0	0.0	0.0	0.6	0.8	0.0	0.0	1.3	1.3
Cycle Q Clear(g_c), s	0.7	0.0	0.0	0.0	0.0	0.0	1.9	0.8	0.0	0.0	1.3	1.3
Prop In Lane	0.52		0.48	0.00		0.00	1.00		0.00	0.00		0.18
Lane Grp Cap(c), veh/h	60	0	0	0	9	0	776	1585	0	0	792	804
V/C Ratio(X)	0.94	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.00	0.00	0.25	0.25
Avail Cap(c_a), veh/h	2332	0	0	0	2240	0	1725	4995	0	0	2498	2534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	8.3	0.0	0.0	0.0	0.0	0.0	3.0	2.4	0.0	0.0	2.5	2.5
Incr Delay (d2), s/veh	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.6	0.6
LnGrp Delay(d),s/veh	29.1	0.0	0.0	0.0	0.0	0.0	3.1	2.5	0.0	0.0	2.7	2.8
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		56			0			301			395	
Approach Delay, s/veh		29.1			0.0			2.6			2.8	
Approach LOS		C						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		4.9		13.2		0.0		13.2
Change Period (Y+Rc), s		* 4.2		* 5.2		4.2		* 5.2
Max Green Setting (Gmax), s		* 29		* 28		24.0		* 28
Max Q Clear Time (g_c+I1), s		2.7		3.3		0.0		3.9
Green Ext Time (p_c), s		0.2		4.4		0.0		3.2

Intersection Summary	
HCM 2010 Ctrl Delay	4.6
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Future Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.98		1.00	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1644	1710	1644	1644	1644	1644	1710	1644	1644	1710
Adj Flow Rate, veh/h	10	9	31	8	0	0	42	305	9	26	355	31
Adj No. of Lanes	0	1	1	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	345	113	196	489	0	204	84	1379	41	67	1260	109
Arrive On Green	0.15	0.15	0.15	0.15	0.00	0.00	0.05	0.45	0.44	0.04	0.43	0.43
Sat Flow, veh/h	640	776	1345	1094	0	1398	1566	3095	91	1566	2900	252
Grp Volume(v), veh/h	19	0	31	8	0	0	42	153	161	26	190	196
Grp Sat Flow(s),veh/h/ln	1416	0	1345	1094	0	1398	1566	1562	1624	1566	1562	1590
Q Serve(g_s), s	0.0	0.0	0.4	0.1	0.0	0.0	0.6	1.3	1.3	0.4	1.7	1.7
Cycle Q Clear(g_c), s	0.2	0.0	0.4	0.3	0.0	0.0	0.6	1.3	1.3	0.4	1.7	1.7
Prop In Lane	0.53		1.00	1.00		1.00	1.00		0.06	1.00		0.16
Lane Grp Cap(c), veh/h	458	0	196	489	0	204	84	696	723	67	679	691
V/C Ratio(X)	0.04	0.00	0.16	0.02	0.00	0.00	0.50	0.22	0.22	0.39	0.28	0.28
Avail Cap(c_a), veh/h	2820	0	2491	2493	0	2589	2327	1929	2006	2327	1929	1963
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	8.1	0.0	8.2	8.2	0.0	0.0	10.1	3.7	3.7	10.2	4.0	4.0
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.0	1.7	0.2	0.2	1.4	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.2	0.0	0.0	0.0	0.3	0.6	0.6	0.2	0.7	0.8
LnGrp Delay(d),s/veh	8.1	0.0	8.3	8.2	0.0	0.0	11.8	3.9	3.9	11.5	4.2	4.2
LnGrp LOS	A		A	A			B	A	A	B	A	A
Approach Vol, veh/h		50			8			356			412	
Approach Delay, s/veh		8.2			8.2			4.8			4.7	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.7	3.7	12.5		5.7	3.4	12.7
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		40.0	32.0	* 26		40.0	32.0	* 26
Max Q Clear Time (g_c+I1), s		2.3	2.6	3.7		2.4	2.4	3.3
Green Ext Time (p_c), s		0.0	0.1	2.9		0.0	0.0	2.3

Intersection Summary	
HCM 2010 Ctrl Delay	5.0
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Future Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.95		1.00	1.00		0.99	1.00		0.92	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1693	1710	1710	1598	1598	1693	1598	1710	1598	1601	1710
Adj Flow Rate, veh/h	7	0	2	6	0	14	10	332	16	17	357	10
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.77	0.90	0.77	0.90	0.77	0.77	0.77	0.77	0.90
Percent Heavy Veh, %	1	1	1	7	1	7	1	7	7	7	7	1
Cap, veh/h	306	0	14	357	0	99	17	1418	68	51	1586	44
Arrive On Green	0.05	0.00	0.05	0.07	0.00	0.07	0.01	0.48	0.44	0.03	0.53	0.45
Sat Flow, veh/h	904	0	258	1254	0	1338	1612	2937	141	1522	3016	84
Grp Volume(v), veh/h	9	0	0	6	0	14	10	171	177	17	180	187
Grp Sat Flow(s),veh/h/ln	1162	0	0	1254	0	1338	1612	1518	1560	1522	1521	1580
Q Serve(g_s), s	0.2	0.0	0.0	0.0	0.0	0.2	0.2	1.6	1.7	0.3	1.6	1.6
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.1	0.0	0.2	0.2	1.6	1.7	0.3	1.6	1.6
Prop In Lane	0.78		0.22	1.00		1.00	1.00		0.09	1.00		0.05
Lane Grp Cap(c), veh/h	320	0	0	382	0	99	17	733	753	51	799	831
V/C Ratio(X)	0.03	0.00	0.00	0.02	0.00	0.14	0.58	0.23	0.24	0.33	0.22	0.23
Avail Cap(c_a), veh/h	1544	0	0	1327	0	1145	1425	1951	2004	1314	1954	2030
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.3	0.0	0.0	10.9	0.0	10.8	12.3	3.8	3.8	11.8	3.2	3.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.2	10.8	0.2	0.2	1.4	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.7	0.7	0.1	0.7	0.7
LnGrp Delay(d),s/veh	11.3	0.0	0.0	11.0	0.0	11.0	23.1	4.0	4.0	13.2	3.4	3.4
LnGrp LOS	B			B		B	C	A	A	B	A	A
Approach Vol, veh/h		9			20			358			384	
Approach Delay, s/veh		11.3			11.0			4.5			3.8	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.5	3.3	16.1		5.5	4.3	15.0
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	4.0	5.0
Max Green Setting (Gmax), s		* 21	22.0	30.0		* 26	21.0	30.0
Max Q Clear Time (g_c+I1), s		2.2	2.2	3.6		2.3	2.3	3.7
Green Ext Time (p_c), s		0.0	0.0	3.6		0.0	0.0	3.7

Intersection Summary	
HCM 2010 Ctrl Delay	4.4
HCM 2010 LOS	A

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Future Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.84	1.00		0.87	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1644	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	12	289	268	189	342	58	284	303	324	61	255	57
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	43	826	597	281	862	143	323	1430	625	122	1030	454
Arrive On Green	0.03	0.26	0.26	0.09	0.33	0.33	0.21	0.46	0.46	0.08	0.33	0.33
Sat Flow, veh/h	1566	3124	1178	3038	2618	436	1566	3124	1365	1566	3124	1377
Grp Volume(v), veh/h	12	289	268	189	201	199	284	303	324	61	255	57
Grp Sat Flow(s),veh/h/ln	1566	1562	1178	1519	1562	1492	1566	1562	1365	1566	1562	1377
Q Serve(g_s), s	0.8	8.3	17.2	6.6	10.9	11.3	19.3	6.4	18.6	4.1	6.6	3.2
Cycle Q Clear(g_c), s	0.8	8.3	17.2	6.6	10.9	11.3	19.3	6.4	18.6	4.1	6.6	3.2
Prop In Lane	1.00		1.00	1.00		0.29	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	43	826	597	281	514	491	323	1430	625	122	1030	454
V/C Ratio(X)	0.28	0.35	0.45	0.67	0.39	0.40	0.88	0.21	0.52	0.50	0.25	0.13
Avail Cap(c_a), veh/h	131	880	618	282	514	491	399	1430	625	199	1030	454
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.81	0.89	0.89	0.89	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	52.4	32.8	20.1	48.3	28.4	28.6	42.3	17.9	21.2	48.6	26.9	25.8
Incr Delay (d2), s/veh	1.0	0.1	0.2	4.5	0.2	0.2	15.0	0.3	3.1	1.2	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.6	5.6	3.0	4.7	4.7	9.7	2.8	7.5	1.8	2.9	1.3
LnGrp Delay(d),s/veh	53.4	32.9	20.3	52.8	28.6	28.7	57.4	18.2	24.3	49.8	27.5	26.3
LnGrp LOS	D	C	C	D	C	C	E	B	C	D	C	C
Approach Vol, veh/h		569			589			911			373	
Approach Delay, s/veh		27.4			36.4			32.6			30.9	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.8	39.2	25.7	39.3	13.0	32.1	11.6	53.4
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.8	13.3	21.3	8.6	8.6	19.2	6.1	20.6
Green Ext Time (p_c), s	0.0	0.8	0.3	2.9	0.0	1.4	0.0	5.6

Intersection Summary	
HCM 2010 Ctrl Delay	32.0
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	380	270	70	400	30	150	420	30	70	500	190
Future Volume (veh/h)	130	380	270	70	400	30	150	420	30	70	500	190
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.95	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1710	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	135	396	281	73	417	31	156	438	31	73	521	198
Adj No. of Lanes	1	2	1	1	2	0	2	2	1	1	2	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	173	1237	538	155	1133	84	242	1004	427	130	676	389
Arrive On Green	0.11	0.39	0.39	0.03	0.13	0.12	0.11	0.32	0.32	0.08	0.29	0.29
Sat Flow, veh/h	1581	3154	1371	1581	2974	220	2214	3154	1342	1581	2324	1338
Grp Volume(v), veh/h	135	396	281	73	220	228	156	438	31	73	521	198
Grp Sat Flow(s),veh/h/ln	1581	1577	1371	1581	1577	1617	1107	1577	1342	1581	1162	1338
Q Serve(g_s), s	9.1	9.6	12.3	5.0	14.1	14.2	7.4	12.1	1.3	4.9	22.5	9.9
Cycle Q Clear(g_c), s	9.1	9.6	12.3	5.0	14.1	14.2	7.4	12.1	1.3	4.9	22.5	9.9
Prop In Lane	1.00		1.00	1.00		0.14	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	173	1237	538	155	601	616	242	1004	427	130	676	389
V/C Ratio(X)	0.78	0.32	0.52	0.47	0.37	0.37	0.64	0.44	0.07	0.56	0.77	0.51
Avail Cap(c_a), veh/h	230	1237	538	230	601	616	262	1004	427	144	676	389
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.96	0.96	0.96	0.94	0.94	0.94	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.7	23.2	13.1	50.4	35.9	36.0	46.9	29.7	13.0	48.6	35.6	17.4
Incr Delay (d2), s/veh	8.2	0.7	3.6	2.1	1.6	1.6	5.4	1.3	0.3	1.7	8.3	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	4.3	5.6	2.3	6.4	6.7	2.5	5.4	0.7	2.2	8.0	4.7
LnGrp Delay(d),s/veh	55.8	23.9	16.7	52.5	37.6	37.6	52.3	31.0	13.4	50.3	43.9	22.1
LnGrp LOS	E	C	B	D	D	D	D	C	B	D	D	C
Approach Vol, veh/h		812			521			625			792	
Approach Delay, s/veh		26.7			39.7			35.4			39.1	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	44.9	15.0	35.0	13.8	46.1	12.0	38.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	35.0	12.0	30.0	15.0	35.0	9.0	33.0
Max Q Clear Time (g_c+I1), s	11.1	16.2	9.4	24.5	7.0	14.3	6.9	14.1
Green Ext Time (p_c), s	0.1	4.7	0.2	2.9	0.1	6.7	0.0	5.1

Intersection Summary	
HCM 2010 Ctrl Delay	34.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	300	170	350	10	70	30	190	330	10	40	550	200
Future Volume (veh/h)	300	170	350	10	70	30	190	330	10	40	550	200
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		0.98	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	337	191	393	11	79	34	213	371	11	45	618	225
Adj No. of Lanes	2	1	1	1	2	0	2	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	610	460	389	115	349	141	592	1406	42	175	976	496
Arrive On Green	0.18	0.25	0.25	0.06	0.14	0.14	0.17	0.40	0.39	0.10	0.33	0.33
Sat Flow, veh/h	3442	1863	1574	1774	2443	987	3442	3507	104	1774	2980	1514
Grp Volume(v), veh/h	337	191	393	11	56	57	213	187	195	45	618	225
Grp Sat Flow(s),veh/h/ln	1721	1863	1574	1774	1770	1660	1721	1770	1842	1774	1490	1514
Q Serve(g_s), s	6.1	5.9	11.9	0.4	1.9	2.1	3.8	4.9	4.9	1.6	12.1	5.4
Cycle Q Clear(g_c), s	6.1	5.9	11.9	0.4	1.9	2.1	3.8	4.9	4.9	1.6	12.1	5.4
Prop In Lane	1.00		1.00	1.00		0.59	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	610	460	389	115	253	237	592	709	738	175	976	496
V/C Ratio(X)	0.55	0.42	1.01	0.10	0.22	0.24	0.36	0.26	0.26	0.26	0.63	0.45
Avail Cap(c_a), veh/h	1112	765	646	310	695	652	1102	773	804	439	1171	595
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	21.7	12.6	30.2	26.1	26.1	25.1	13.8	13.8	28.6	19.6	8.3
Incr Delay (d2), s/veh	0.3	0.2	27.0	0.1	0.2	0.2	0.1	0.3	0.3	0.3	1.1	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	3.1	8.4	0.2	0.9	1.0	1.8	2.4	2.5	0.8	5.1	2.9
LnGrp Delay(d),s/veh	26.1	21.9	39.7	30.4	26.2	26.3	25.2	14.1	14.1	28.9	20.7	9.2
LnGrp LOS	C	C	F	C	C	C	C	B	B	C	C	A
Approach Vol, veh/h		921			124			595			888	
Approach Delay, s/veh		31.0			26.6			18.1			18.2	
Approach LOS		C			C			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	15.0	13.4	14.8	25.5	8.0	20.4	9.8	30.5				
Change Period (Y+Rc), s	4.0	4.6	4.0	5.0	4.6	* 4.6	4.0	5.0				
Max Green Setting (Gmax), s	21.0	26.0	21.0	25.0	11.0	* 27	16.0	28.0				
Max Q Clear Time (g_c+I1), s	8.1	4.1	5.8	14.1	2.4	13.9	3.6	6.9				
Green Ext Time (p_c), s	0.8	0.2	0.5	5.8	0.0	1.3	0.0	4.2				
Intersection Summary												
HCM 2010 Ctrl Delay			23.3									
HCM 2010 LOS			C									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	130	140	50	40	40	50	450	20	50	760	40
Future Volume (veh/h)	20	130	140	50	40	40	50	450	20	50	760	40
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	24	153	165	59	47	47	59	529	24	59	894	47
Adj No. of Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	103	361	338	160	120	84	507	1556	71	650	1769	93
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.10	0.52	0.50	0.10	0.52	0.50
Sat Flow, veh/h	138	1675	1568	328	554	391	1774	3002	136	1774	3414	179
Grp Volume(v), veh/h	177	0	165	153	0	0	59	229	324	59	463	478
Grp Sat Flow(s),veh/h/ln	1812	0	1568	1273	0	0	1774	1304	1834	1774	1770	1824
Q Serve(g_s), s	0.0	0.0	5.2	1.9	0.0	0.0	0.8	5.8	5.8	0.8	9.6	9.6
Cycle Q Clear(g_c), s	4.6	0.0	5.2	6.5	0.0	0.0	0.8	5.8	5.8	0.8	9.6	9.6
Prop In Lane	0.14		1.00	0.39		0.31	1.00		0.07	1.00		0.10
Lane Grp Cap(c), veh/h	464	0	338	364	0	0	507	676	951	650	917	945
V/C Ratio(X)	0.38	0.00	0.49	0.42	0.00	0.00	0.12	0.34	0.34	0.09	0.51	0.51
Avail Cap(c_a), veh/h	1088	0	895	852	0	0	1036	1233	1734	1653	2147	2213
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.0	0.0	19.3	19.4	0.0	0.0	5.5	7.9	7.9	4.9	8.8	8.8
Incr Delay (d2), s/veh	0.5	0.0	1.1	0.8	0.0	0.0	0.0	0.4	0.3	0.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	2.3	2.2	0.0	0.0	0.4	2.1	3.0	0.4	4.8	4.9
LnGrp Delay(d),s/veh	19.6	0.0	20.4	20.2	0.0	0.0	5.5	8.3	8.2	4.9	9.4	9.4
LnGrp LOS	B		C	C			A	A	A	A	A	A
Approach Vol, veh/h		342			153			612			1000	
Approach Delay, s/veh		19.9			20.2			8.0			9.2	
Approach LOS		B			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		15.7	8.3	32.0		15.7	8.3	32.0
Change Period (Y+Rc), s		4.6	3.5	5.0		4.6	3.5	5.0
Max Green Setting (Gmax), s		31.0	21.5	66.0		31.0	36.5	51.0
Max Q Clear Time (g_c+I1), s		7.2	2.8	11.6		8.5	2.8	7.8
Green Ext Time (p_c), s		1.5	0.1	15.4		0.6	0.1	6.8

Intersection Summary	
HCM 2010 Ctrl Delay	11.4
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	130	10	80	90	230	10	140	50	530	50	350
Future Volume (veh/h)	140	130	10	80	90	230	10	140	50	530	50	350
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.98		0.93	1.00		0.94	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1845	1900	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	165	153	12	94	106	271	12	165	59	666	0	412
Adj No. of Lanes	1	2	0	1	1	1	0	2	0	2	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	468	956	74	517	505	398	29	401	146	1104	0	483
Arrive On Green	0.10	0.29	0.29	0.08	0.27	0.27	0.17	0.17	0.16	0.31	0.00	0.31
Sat Flow, veh/h	1757	3285	255	1757	1845	1455	174	2409	877	3514	0	1538
Grp Volume(v), veh/h	165	81	84	94	106	271	127	0	109	666	0	412
Grp Sat Flow(s),veh/h/ln	1757	1752	1787	1757	1845	1455	1836	0	1623	1757	0	1538
Q Serve(g_s), s	6.1	3.3	3.4	3.5	4.2	15.9	5.9	0.0	5.8	15.3	0.0	24.0
Cycle Q Clear(g_c), s	6.1	3.3	3.4	3.5	4.2	15.9	5.9	0.0	5.8	15.3	0.0	24.0
Prop In Lane	1.00		0.14	1.00		1.00	0.09		0.54	1.00		1.00
Lane Grp Cap(c), veh/h	468	510	520	517	505	398	306	0	270	1104	0	483
V/C Ratio(X)	0.35	0.16	0.16	0.18	0.21	0.68	0.41	0.00	0.40	0.60	0.00	0.85
Avail Cap(c_a), veh/h	521	510	520	601	621	490	695	0	615	1331	0	582
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.5	25.2	25.2	21.1	26.8	31.0	35.7	0.0	35.7	27.7	0.0	30.7
Incr Delay (d2), s/veh	0.2	0.1	0.1	0.1	0.1	1.7	0.3	0.0	0.4	0.2	0.0	8.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	1.6	1.7	1.7	2.2	6.6	3.0	0.0	2.6	7.4	0.0	11.3
LnGrp Delay(d),s/veh	20.6	25.2	25.3	21.2	26.8	32.7	36.0	0.0	36.0	27.9	0.0	39.5
LnGrp LOS	C	C	C	C	C	C	D		D	C		D
Approach Vol, veh/h		330			471			236			1078	
Approach Delay, s/veh		22.9			29.1			36.0			32.3	
Approach LOS		C			C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.1	29.9		33.8	10.4	31.6		19.7
Change Period (Y+Rc), s	4.0	5.0		5.0	4.0	5.0		5.0
Max Green Setting (Gmax), s	11.0	31.0		35.0	11.0	25.0		35.0
Max Q Clear Time (g_c+I1), s	8.1	17.9		26.0	5.5	5.4		7.9
Green Ext Time (p_c), s	0.0	0.9		2.5	0.1	0.3		0.5

Intersection Summary		
HCM 2010 Ctrl Delay		30.6
HCM 2010 LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	140	130	120	270	100	110	390	60	140	990	130
Future Volume (veh/h)	90	140	130	120	270	100	110	390	60	140	990	130
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	101	157	146	135	303	112	124	438	0	157	1112	0
Adj No. of Lanes	1	2	0	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	265	279	229	283	426	153	151	1520	680	192	1587	738
Arrive On Green	0.15	0.15	0.14	0.16	0.17	0.17	0.08	0.43	0.00	0.11	0.45	0.00
Sat Flow, veh/h	1774	1863	1529	1774	2524	910	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	101	157	146	135	210	205	124	438	0	157	1112	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1529	1774	1770	1665	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	5.7	8.7	10.0	7.7	12.4	12.9	7.6	8.9	0.0	9.6	28.1	0.0
Cycle Q Clear(g_c), s	5.7	8.7	10.0	7.7	12.4	12.9	7.6	8.9	0.0	9.6	28.1	0.0
Prop In Lane	1.00		1.00	1.00		0.55	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	265	279	229	283	298	281	151	1520	680	192	1587	738
V/C Ratio(X)	0.38	0.56	0.64	0.48	0.70	0.73	0.82	0.29	0.00	0.82	0.70	0.00
Avail Cap(c_a), veh/h	463	487	399	448	462	435	152	1520	680	192	1587	738
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.98	0.98	1.00	1.00	1.00	0.93	0.93	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	42.6	43.8	44.9	42.4	43.5	43.7	50.0	20.6	0.0	48.4	24.6	0.0
Incr Delay (d2), s/veh	0.9	1.8	2.9	0.5	1.1	1.4	25.8	0.4	0.0	22.2	2.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	4.6	4.4	3.8	6.2	6.1	4.8	4.5	0.0	5.9	14.2	0.0
LnGrp Delay(d),s/veh	43.4	45.6	47.8	42.9	44.7	45.1	75.8	21.1	0.0	70.6	27.2	0.0
LnGrp LOS	D	D	D	D	D	D	E	C		E	C	
Approach Vol, veh/h		404			550			562			1269	
Approach Delay, s/veh		45.8			44.4			33.1			32.6	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.7	12.9	54.8		20.6	15.0	52.7
Change Period (Y+Rc), s		5.0	3.5	5.0		5.0	3.5	5.0
Max Green Setting (Gmax), s		28.0	9.5	27.0		28.0	11.5	25.0
Max Q Clear Time (g_c+I1), s		14.9	9.6	30.1		12.0	11.6	10.9
Green Ext Time (p_c), s		1.0	0.0	0.0		1.5	0.0	2.4

Intersection Summary		
HCM 2010 Ctrl Delay		37.0
HCM 2010 LOS		D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	260	70	200	470	180	50	320	130	80	920	240
Future Volume (veh/h)	150	260	70	200	470	180	50	320	130	80	920	240
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.79	1.00		0.83	1.00		1.00	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	176	306	82	235	553	212	59	376	0	94	1082	282
Adj No. of Lanes	2	2	0	1	2	1	1	2	1	1	2	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	253	729	187	293	1262	451	95	1166	555	122	1258	526
Arrive On Green	0.07	0.28	0.28	0.17	0.36	0.34	0.05	0.33	0.00	0.07	0.36	0.36
Sat Flow, veh/h	3442	2629	674	1774	3539	1312	1774	3539	1583	1774	3539	1481
Grp Volume(v), veh/h	176	202	186	235	553	212	59	376	0	94	1082	282
Grp Sat Flow(s),veh/h/ln	1721	1770	1533	1774	1770	1312	1774	1770	1583	1774	1770	1481
Q Serve(g_s), s	4.7	8.8	9.5	12.0	11.2	11.9	3.1	7.5	0.0	4.9	26.8	14.3
Cycle Q Clear(g_c), s	4.7	8.8	9.5	12.0	11.2	11.9	3.1	7.5	0.0	4.9	26.8	14.3
Prop In Lane	1.00		0.44	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	253	491	425	293	1262	451	95	1166	555	122	1258	526
V/C Ratio(X)	0.70	0.41	0.44	0.80	0.44	0.47	0.62	0.32	0.00	0.77	0.86	0.54
Avail Cap(c_a), veh/h	941	548	474	511	1320	473	414	1313	621	395	1313	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.7	27.8	28.1	37.9	23.1	24.2	43.7	23.7	0.0	43.2	28.2	24.2
Incr Delay (d2), s/veh	1.3	0.2	0.3	1.9	0.1	0.3	2.5	0.2	0.0	9.8	6.1	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	4.3	4.0	6.0	5.5	4.3	1.6	3.7	0.0	2.7	14.1	6.0
LnGrp Delay(d),s/veh	44.0	28.0	28.3	39.8	23.2	24.5	46.2	24.0	0.0	53.1	34.3	25.5
LnGrp LOS	D	C	C	D	C	C	D	C		D	C	C
Approach Vol, veh/h		564			1000			435			1458	
Approach Delay, s/veh		33.1			27.4			27.0			33.8	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.1	36.7	8.0	38.5	18.6	29.2	10.5	36.1
Change Period (Y+Rc), s	* 4.2	* 4.2	4.0	5.0	* 4.2	* 4.2	4.0	5.0
Max Green Setting (Gmax), s	* 26	* 34	21.0	35.0	* 26	* 28	21.0	35.0
Max Q Clear Time (g_c+I1), s	6.7	13.9	5.1	28.8	14.0	11.5	6.9	9.5
Green Ext Time (p_c), s	0.3	2.0	0.1	4.7	0.4	0.9	0.2	3.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.0
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Future Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.97	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1710	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	140	509	81	96	457	56	150	357	208	59	158	88
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	170	804	127	158	838	102	183	569	599	87	481	399
Arrive On Green	0.22	0.60	0.58	0.10	0.30	0.29	0.12	0.35	0.34	0.06	0.29	0.29
Sat Flow, veh/h	1566	2681	424	1566	2793	340	1566	1644	1351	1566	1644	1366
Grp Volume(v), veh/h	140	295	295	96	254	259	150	357	208	59	158	88
Grp Sat Flow(s),veh/h/ln	1566	1562	1543	1566	1562	1572	1566	1644	1351	1566	1644	1366
Q Serve(g_s), s	11.1	15.8	16.2	7.6	17.7	17.9	12.2	23.6	0.0	4.8	9.8	6.3
Cycle Q Clear(g_c), s	11.1	15.8	16.2	7.6	17.7	17.9	12.2	23.6	0.0	4.8	9.8	6.3
Prop In Lane	1.00		0.27	1.00		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	170	469	463	158	469	472	183	569	599	87	481	399
V/C Ratio(X)	0.82	0.63	0.64	0.61	0.54	0.55	0.82	0.63	0.35	0.68	0.33	0.22
Avail Cap(c_a), veh/h	253	469	463	253	469	472	241	569	599	157	481	399
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.88	0.73	0.73	0.73	0.73	0.73	0.73	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.7	21.4	21.7	56.0	38.0	38.2	56.0	35.5	24.0	60.3	36.0	34.8
Incr Delay (d2), s/veh	7.1	5.6	5.8	1.0	3.3	3.3	8.9	3.8	1.2	3.4	1.8	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	7.5	7.5	3.4	8.1	8.2	5.7	11.3	5.1	2.2	4.7	2.5
LnGrp Delay(d),s/veh	56.8	27.0	27.5	57.0	41.3	41.5	64.9	39.3	25.2	63.7	37.8	36.1
LnGrp LOS	E	C	C	E	D	D	E	D	C	E	D	D
Approach Vol, veh/h		730			609			715			305	
Approach Delay, s/veh		32.9			43.9			40.6			42.3	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.1	42.0	18.2	41.0	17.1	42.0	11.2	48.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	20.0	37.0	19.0	36.0	20.0	* 37	12.0	* 43
Max Q Clear Time (g_c+I1), s	13.1	19.9	14.2	11.8	9.6	18.2	6.8	25.6
Green Ext Time (p_c), s	0.1	4.8	0.1	0.5	0.1	6.5	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	39.3
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Future Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1710	1710	1693	1710	1644	1644	0	0	1644	1710
Adj Flow Rate, veh/h	175	0	54	0	0	0	65	610	0	0	264	96
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.83	0.90	0.83	0.90	0.90	0.90	0.83	0.83	0.90	0.90	0.83	0.83
Percent Heavy Veh, %	1	1	1	1	1	1	4	4	0	0	4	4
Cap, veh/h	235	0	73	0	6	0	683	1686	0	0	1214	430
Arrive On Green	0.25	0.00	0.24	0.00	0.00	0.00	0.54	0.54	0.00	0.00	0.54	0.50
Sat Flow, veh/h	1159	0	358	0	1693	0	898	3206	0	0	2332	796
Grp Volume(v), veh/h	229	0	0	0	0	0	65	610	0	0	181	179
Grp Sat Flow(s),veh/h/ln	1517	0	0	0	1693	0	898	1562	0	0	1562	1483
Q Serve(g_s), s	3.9	0.0	0.0	0.0	0.0	0.0	1.1	3.1	0.0	0.0	1.7	1.8
Cycle Q Clear(g_c), s	3.9	0.0	0.0	0.0	0.0	0.0	3.0	3.1	0.0	0.0	1.7	1.8
Prop In Lane	0.76		0.24	0.00		0.00	1.00		0.00	0.00		0.54
Lane Grp Cap(c), veh/h	308	0	0	0	6	0	683	1686	0	0	843	800
V/C Ratio(X)	0.74	0.00	0.00	0.00	0.00	0.00	0.10	0.36	0.00	0.00	0.21	0.22
Avail Cap(c_a), veh/h	1561	0	0	0	1452	0	1161	3348	0	0	1674	1590
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.9	0.0	0.0	0.0	0.0	0.0	4.2	3.7	0.0	0.0	3.4	3.6
Incr Delay (d2), s/veh	1.3	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.0	0.0	0.7	0.8
LnGrp Delay(d),s/veh	11.2	0.0	0.0	0.0	0.0	0.0	4.3	3.9	0.0	0.0	3.5	3.8
LnGrp LOS	B						A	A			A	A
Approach Vol, veh/h		229			0			675			360	
Approach Delay, s/veh		11.2			0.0			3.9			3.6	
Approach LOS		B						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		9.9		18.1		0.0		18.1
Change Period (Y+Rc), s		* 4.2		* 5.2		4.2		* 5.2
Max Green Setting (Gmax), s		* 29		* 28		24.0		* 28
Max Q Clear Time (g_c+I1), s		5.9		3.8		0.0		5.1
Green Ext Time (p_c), s		0.9		4.0		0.0		7.8

Intersection Summary	
HCM 2010 Ctrl Delay	5.2
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Future Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.99	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1644	1710	1644	1644	1644	1644	1710	1644	1644	1710
Adj Flow Rate, veh/h	68	30	122	35	31	53	105	595	40	45	230	58
Adj No. of Lanes	0	1	1	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	238	72	480	196	120	486	123	1117	75	46	809	199
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.08	0.38	0.37	0.03	0.33	0.32
Sat Flow, veh/h	211	204	1366	135	341	1383	1566	2963	199	1566	2466	606
Grp Volume(v), veh/h	98	0	122	66	0	53	105	313	322	45	143	145
Grp Sat Flow(s),veh/h/ln	415	0	1366	476	0	1383	1566	1562	1600	1566	1562	1509
Q Serve(g_s), s	1.6	0.0	2.4	0.5	0.0	1.0	2.5	5.8	5.8	1.1	2.5	2.7
Cycle Q Clear(g_c), s	11.5	0.0	2.4	10.9	0.0	1.0	2.5	5.8	5.8	1.1	2.5	2.7
Prop In Lane	0.69		1.00	0.53		1.00	1.00		0.12	1.00		0.40
Lane Grp Cap(c), veh/h	310	0	480	315	0	486	123	589	603	46	512	495
V/C Ratio(X)	0.32	0.00	0.25	0.21	0.00	0.11	0.85	0.53	0.53	0.97	0.28	0.29
Avail Cap(c_a), veh/h	1226	0	1470	1249	0	1489	1348	1135	1162	1348	1135	1096
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.2	0.0	8.6	9.2	0.0	8.1	16.9	9.0	9.0	18.0	9.2	9.3
Incr Delay (d2), s/veh	0.2	0.0	0.1	0.1	0.0	0.0	6.2	0.7	0.7	30.7	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.9	0.5	0.0	0.4	1.3	2.6	2.6	0.8	1.1	1.1
LnGrp Delay(d),s/veh	12.4	0.0	8.7	9.3	0.0	8.2	23.1	9.8	9.8	48.7	9.5	9.6
LnGrp LOS	B		A	A		A	C	A	A	D	A	A
Approach Vol, veh/h		220			119			740			333	
Approach Delay, s/veh		10.4			8.8			11.7			14.9	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		16.9	6.0	15.3		16.9	4.1	17.2
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		40.0	32.0	* 26		40.0	32.0	* 26
Max Q Clear Time (g_c+I1), s		12.9	4.5	4.7		13.5	3.1	7.8
Green Ext Time (p_c), s		0.3	0.2	2.1		0.1	0.1	4.8

Intersection Summary		
HCM 2010 Ctrl Delay		12.0
HCM 2010 LOS		B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Future Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	1.00		0.98	1.00		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1693	1710	1710	1598	1598	1693	1598	1710	1598	1601	1710
Adj Flow Rate, veh/h	13	1	14	17	0	83	8	626	81	44	360	13
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.77	0.90	0.77	0.90	0.77	0.77	0.77	0.77	0.90
Percent Heavy Veh, %	1	1	1	1	1	7	1	7	7	7	7	7
Cap, veh/h	187	34	70	365	0	210	5	1409	182	89	1722	62
Arrive On Green	0.10	0.10	0.12	0.16	0.00	0.16	0.00	0.53	0.50	0.06	0.58	0.52
Sat Flow, veh/h	361	340	702	1229	0	1333	1612	2679	346	1522	2990	108
Grp Volume(v), veh/h	28	0	0	17	0	83	8	354	353	44	183	190
Grp Sat Flow(s),veh/h/ln	1403	0	0	1229	0	1333	1612	1518	1506	1522	1521	1576
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	2.0	0.1	5.0	5.1	1.0	2.0	2.1
Cycle Q Clear(g_c), s	0.6	0.0	0.0	0.3	0.0	2.0	0.1	5.0	5.1	1.0	2.0	2.1
Prop In Lane	0.46		0.50	1.00		1.00	1.00		0.23	1.00		0.07
Lane Grp Cap(c), veh/h	292	0	0	400	0	210	5	798	792	89	876	908
V/C Ratio(X)	0.10	0.00	0.00	0.04	0.00	0.40	1.73	0.44	0.45	0.49	0.21	0.21
Avail Cap(c_a), veh/h	1092	0	0	1210	0	1114	969	1391	1380	959	1394	1444
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.2	0.0	0.0	13.0	0.0	13.2	17.5	5.1	5.2	15.9	3.6	3.6
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.4	392.0	0.6	0.6	1.6	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	157.2	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.1	0.0	0.7	0.9	2.2	2.2	0.4	0.9	0.9
LnGrp Delay(d),s/veh	14.3	0.0	0.0	13.0	0.0	13.7	566.7	5.7	5.8	17.5	3.7	3.8
LnGrp LOS	B			B		B	F	A	A	B	A	A
Approach Vol, veh/h		28			100			715			417	
Approach Delay, s/veh		14.3			13.5			12.0			5.2	
Approach LOS		B			B			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		8.5	3.3	23.1		8.5	5.1	21.4				
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	4.0	5.0				
Max Green Setting (Gmax), s		* 28	22.0	30.0		* 26	21.0	30.0				
Max Q Clear Time (g_c+I1), s		4.0	2.1	4.1		2.6	3.0	7.1				
Green Ext Time (p_c), s		0.2	0.0	3.6		0.1	0.1	8.0				
Intersection Summary												
HCM 2010 Ctrl Delay			9.9									
HCM 2010 LOS			A									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Future Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.85	1.00		0.87	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1644	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	38	400	300	236	475	108	330	572	458	126	222	45
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	66	841	319	304	808	182	385	929	404	164	492	213
Arrive On Green	0.04	0.27	0.27	0.10	0.33	0.33	0.25	0.30	0.30	0.10	0.16	0.16
Sat Flow, veh/h	1566	3124	1183	3038	2460	553	1566	3124	1357	1566	3124	1355
Grp Volume(v), veh/h	38	400	300	236	300	283	330	572	458	126	222	45
Grp Sat Flow(s),veh/h/ln	1566	1562	1183	1519	1562	1450	1566	1562	1357	1566	1562	1355
Q Serve(g_s), s	3.1	13.9	32.3	9.9	20.7	21.2	26.2	20.5	25.5	10.2	8.4	2.4
Cycle Q Clear(g_c), s	3.1	13.9	32.3	9.9	20.7	21.2	26.2	20.5	25.5	10.2	8.4	2.4
Prop In Lane	1.00		1.00	1.00		0.38	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	66	841	319	304	513	477	385	929	404	164	492	213
V/C Ratio(X)	0.58	0.48	0.94	0.78	0.58	0.59	0.86	0.62	1.13	0.77	0.45	0.21
Avail Cap(c_a), veh/h	108	841	319	351	513	477	385	1202	522	217	865	375
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.85	0.85	0.85	0.93	0.93	0.93	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	61.1	39.8	46.5	57.1	36.3	36.5	46.8	39.3	19.8	56.7	49.7	19.8
Incr Delay (d2), s/veh	2.5	1.6	34.0	7.1	4.4	5.0	21.0	0.9	83.3	7.8	0.9	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	6.2	13.5	4.4	9.5	9.2	13.5	8.9	19.4	4.8	3.7	1.4
LnGrp Delay(d),s/veh	63.6	41.5	80.5	64.2	40.7	41.5	67.8	40.2	103.1	64.4	50.6	20.5
LnGrp LOS	E	D	F	E	D	D	E	D	F	E	D	C
Approach Vol, veh/h		738			819			1360			393	
Approach Delay, s/veh		58.5			47.7			68.1			51.6	
Approach LOS		E			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	45.7	35.0	23.5	16.2	38.0	16.8	41.7
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	5.1	23.2	28.2	10.4	11.9	34.3	12.2	27.5
Green Ext Time (p_c), s	0.0	1.3	0.2	2.7	0.1	0.0	0.1	10.0

Intersection Summary	
HCM 2010 Ctrl Delay	58.9
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	250	540	170	120	440	70	280	850	150	70	420	100
Future Volume (veh/h)	250	540	170	120	440	70	280	850	150	70	420	100
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.95	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1710	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	260	562	177	125	458	73	292	885	156	73	438	104
Adj No. of Lanes	1	2	1	1	2	0	2	2	1	1	2	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	294	1117	485	160	732	116	324	922	391	158	572	327
Arrive On Green	0.19	0.35	0.35	0.10	0.27	0.26	0.05	0.10	0.10	0.10	0.25	0.25
Sat Flow, veh/h	1581	3154	1369	1581	2719	431	2214	3154	1337	1581	2324	1327
Grp Volume(v), veh/h	260	562	177	125	264	267	292	885	156	73	438	104
Grp Sat Flow(s),veh/h/ln	1581	1577	1369	1581	1577	1573	1107	1577	1337	1581	1162	1327
Q Serve(g_s), s	20.8	18.2	7.9	10.0	19.1	19.4	17.1	36.3	7.7	5.7	22.8	5.7
Cycle Q Clear(g_c), s	20.8	18.2	7.9	10.0	19.1	19.4	17.1	36.3	7.7	5.7	22.8	5.7
Prop In Lane	1.00		1.00	1.00		0.27	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	294	1117	485	160	425	423	324	922	391	158	572	327
V/C Ratio(X)	0.88	0.50	0.37	0.78	0.62	0.63	0.90	0.96	0.40	0.46	0.77	0.32
Avail Cap(c_a), veh/h	389	1117	485	268	425	423	324	922	391	158	572	327
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.82	0.82	0.82	0.75	0.75	0.75	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.5	33.0	12.5	57.0	41.7	41.9	60.9	58.0	14.2	55.2	45.5	18.8
Incr Delay (d2), s/veh	14.2	1.6	2.1	6.7	5.5	5.7	22.1	17.6	2.3	0.8	9.4	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.3	8.1	4.3	4.7	9.0	9.1	6.2	18.2	5.3	2.5	8.0	3.0
LnGrp Delay(d),s/veh	65.7	34.6	14.6	63.7	47.2	47.6	83.0	75.6	16.4	56.0	54.9	21.3
LnGrp LOS	E	C	B	E	D	D	F	E	B	E	D	C
Approach Vol, veh/h		999			656			1333			615	
Approach Delay, s/veh		39.2			50.5			70.3			49.4	
Approach LOS		D			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	27.2	38.0	22.0	35.0	16.1	49.1	16.0	41.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	31.0	33.0	18.0	30.0	21.0	43.0	12.0	36.0
Max Q Clear Time (g_c+I1), s	22.8	21.4	19.1	24.8	12.0	20.2	7.7	38.3
Green Ext Time (p_c), s	0.4	4.3	0.0	2.2	0.2	8.4	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	54.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	540	310	330	70	140	30	350	710	30	60	400	210
Future Volume (veh/h)	540	310	330	70	140	30	350	710	30	60	400	210
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.97	1.00		0.98	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	607	348	371	79	157	34	393	798	34	67	449	236
Adj No. of Lanes	2	1	1	1	2	0	2	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	698	497	420	117	375	79	484	1196	51	138	845	427
Arrive On Green	0.20	0.27	0.27	0.07	0.13	0.12	0.14	0.35	0.34	0.08	0.28	0.28
Sat Flow, veh/h	3442	1863	1574	1774	2896	610	3442	3455	147	1774	2980	1508
Grp Volume(v), veh/h	607	348	371	79	94	97	393	409	423	67	449	236
Grp Sat Flow(s),veh/h/ln	1721	1863	1574	1774	1770	1736	1721	1770	1832	1774	1490	1508
Q Serve(g_s), s	22.2	21.9	29.4	5.7	6.4	6.7	14.4	25.5	25.5	4.7	16.5	17.3
Cycle Q Clear(g_c), s	22.2	21.9	29.4	5.7	6.4	6.7	14.4	25.5	25.5	4.7	16.5	17.3
Prop In Lane	1.00		1.00	1.00		0.35	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	698	497	420	117	229	225	484	613	634	138	845	427
V/C Ratio(X)	0.87	0.70	0.88	0.68	0.41	0.43	0.81	0.67	0.67	0.49	0.53	0.55
Avail Cap(c_a), veh/h	847	673	569	177	381	374	741	613	634	177	845	427
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.97	0.97	0.97	0.63	0.63	0.63	0.80	0.80	0.80
Uniform Delay (d), s/veh	50.2	43.0	45.7	59.4	52.0	52.3	54.2	36.1	36.2	57.5	39.3	39.6
Incr Delay (d2), s/veh	7.3	0.9	9.9	2.5	0.4	0.5	1.4	3.6	3.5	0.8	1.9	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.2	11.4	14.0	2.9	3.1	3.2	7.0	13.1	13.6	2.3	7.0	7.7
LnGrp Delay(d),s/veh	57.5	43.9	55.6	61.9	52.4	52.7	55.6	39.7	39.7	58.2	41.2	43.6
LnGrp LOS	E	D	E	E	D	D	E	D	D	E	D	D
Approach Vol, veh/h		1326			270			1225			752	
Approach Delay, s/veh		53.4			55.3			44.8			43.5	
Approach LOS		D			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.4	19.8	21.3	39.8	11.5	37.7	13.1	48.0
Change Period (Y+Rc), s	4.0	4.6	4.0	5.0	4.0	4.6	4.0	5.0
Max Green Setting (Gmax), s	31.0	26.4	27.0	28.0	12.0	45.4	12.0	43.0
Max Q Clear Time (g_c+I1), s	24.2	8.7	16.4	19.3	7.7	31.4	6.7	27.5
Green Ext Time (p_c), s	1.2	0.4	0.9	4.0	0.0	1.7	0.0	8.1

Intersection Summary	
HCM 2010 Ctrl Delay	48.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	40	120	30	30	140	120	810	50	100	610	50
Future Volume (veh/h)	60	40	120	30	30	140	120	810	50	100	610	50
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	71	47	141	35	35	165	141	953	59	118	718	59
Adj No. of Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	248	143	350	99	70	246	575	1521	94	468	1688	139
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.21	0.12	0.52	0.50	0.12	0.51	0.50
Sat Flow, veh/h	704	640	1568	153	314	1101	1774	2946	182	1774	3302	271
Grp Volume(v), veh/h	118	0	141	235	0	0	141	422	590	118	385	392
Grp Sat Flow(s),veh/h/ln	1344	0	1568	1568	0	0	1774	1304	1824	1774	1770	1804
Q Serve(g_s), s	0.0	0.0	4.9	3.9	0.0	0.0	2.1	14.7	14.7	1.8	8.6	8.6
Cycle Q Clear(g_c), s	4.5	0.0	4.9	8.5	0.0	0.0	2.1	14.7	14.7	1.8	8.6	8.6
Prop In Lane	0.60		1.00	0.15		0.70	1.00		0.10	1.00		0.15
Lane Grp Cap(c), veh/h	391	0	350	416	0	0	575	673	942	468	904	922
V/C Ratio(X)	0.30	0.00	0.40	0.57	0.00	0.00	0.25	0.63	0.63	0.25	0.43	0.43
Avail Cap(c_a), veh/h	791	0	807	860	0	0	972	1090	1525	1294	1898	1935
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.7	0.0	21.0	22.6	0.0	0.0	6.0	11.0	11.0	7.3	9.7	9.7
Incr Delay (d2), s/veh	0.4	0.0	0.7	1.2	0.0	0.0	0.1	1.4	1.0	0.1	0.5	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	2.2	3.9	0.0	0.0	1.0	5.4	7.5	0.8	4.3	4.4
LnGrp Delay(d),s/veh	21.1	0.0	21.8	23.8	0.0	0.0	6.0	12.3	12.0	7.4	10.1	10.2
LnGrp LOS	C		C	C			A	B	B	A	B	B
Approach Vol, veh/h		259			235			1153			895	
Approach Delay, s/veh		21.5			23.8			11.4			9.8	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.2	10.8	35.4		17.2	10.5	35.7
Change Period (Y+Rc), s		4.6	3.5	5.0		4.6	3.5	5.0
Max Green Setting (Gmax), s		31.0	21.5	66.0		31.0	36.5	51.0
Max Q Clear Time (g_c+I1), s		6.9	4.1	10.6		10.5	3.8	16.7
Green Ext Time (p_c), s		1.1	0.2	11.7		1.0	0.2	14.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	80	10	20	110	420	30	320	120	470	30	170
Future Volume (veh/h)	130	80	10	20	110	420	30	320	120	470	30	170
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.98		0.94	1.00		0.96	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1845	1900	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	153	94	12	24	129	494	35	376	141	578	0	200
Adj No. of Lanes	1	2	0	1	1	1	0	2	0	2	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	424	1134	142	532	591	470	51	562	222	829	0	360
Arrive On Green	0.09	0.36	0.35	0.04	0.32	0.32	0.24	0.24	0.23	0.24	0.00	0.24
Sat Flow, veh/h	1757	3121	390	1757	1845	1467	212	2333	921	3514	0	1528
Grp Volume(v), veh/h	153	52	54	24	129	494	302	0	250	578	0	200
Grp Sat Flow(s),veh/h/ln	1757	1752	1759	1757	1845	1467	1834	0	1633	1757	0	1528
Q Serve(g_s), s	5.7	2.0	2.1	0.9	5.3	33.0	15.4	0.0	14.2	15.5	0.0	11.9
Cycle Q Clear(g_c), s	5.7	2.0	2.1	0.9	5.3	33.0	15.4	0.0	14.2	15.5	0.0	11.9
Prop In Lane	1.00		0.22	1.00		1.00	0.12		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	424	637	639	532	591	470	442	0	393	829	0	360
V/C Ratio(X)	0.36	0.08	0.08	0.05	0.22	1.05	0.68	0.00	0.64	0.70	0.00	0.55
Avail Cap(c_a), veh/h	477	637	639	661	591	470	659	0	587	1262	0	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.5	21.5	21.6	21.8	25.6	35.0	35.5	0.0	35.3	36.0	0.0	34.6
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.0	0.1	55.4	0.7	0.0	0.6	0.4	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	1.0	1.0	0.4	2.7	20.6	7.9	0.0	6.5	7.5	0.0	5.0
LnGrp Delay(d),s/veh	19.7	21.5	21.6	21.8	25.6	90.4	36.2	0.0	36.0	36.4	0.0	35.1
LnGrp LOS	B	C	C	C	C	F	D		D	D		D
Approach Vol, veh/h		259			647			552			778	
Approach Delay, s/veh		20.5			75.0			36.1			36.1	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.9	36.0		27.3	7.5	40.4		27.8
Change Period (Y+Rc), s	4.0	5.0		5.0	4.0	5.0		5.0
Max Green Setting (Gmax), s	11.0	31.0		35.0	11.0	25.0		35.0
Max Q Clear Time (g_c+I1), s	7.7	35.0		17.5	2.9	4.1		17.4
Green Ext Time (p_c), s	0.0	0.0		2.2	0.0	0.2		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	45.5
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	190	380	140	90	310	120	130	840	70	150	590	180
Future Volume (veh/h)	190	380	140	90	310	120	130	840	70	150	590	180
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	213	427	157	101	348	135	146	944	79	169	663	202
Adj No. of Lanes	1	2	0	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	360	526	191	313	457	174	165	980	428	201	1025	466
Arrive On Green	0.41	0.41	0.38	0.18	0.18	0.18	0.09	0.28	0.28	0.11	0.29	0.30
Sat Flow, veh/h	1774	2587	940	1774	2484	945	1774	3539	1546	1774	3539	1567
Grp Volume(v), veh/h	213	306	278	101	246	237	146	944	79	169	663	202
Grp Sat Flow(s),veh/h/ln	1774	1863	1664	1774	1770	1659	1774	1770	1546	1774	1770	1567
Q Serve(g_s), s	12.2	18.9	19.5	6.5	17.1	17.7	10.6	34.2	5.1	12.1	21.3	13.5
Cycle Q Clear(g_c), s	12.2	18.9	19.5	6.5	17.1	17.7	10.6	34.2	5.1	12.1	21.3	13.5
Prop In Lane	1.00		0.56	1.00		0.57	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	360	378	338	313	326	305	165	980	428	201	1025	466
V/C Ratio(X)	0.59	0.81	0.82	0.32	0.75	0.78	0.88	0.96	0.18	0.84	0.65	0.43
Avail Cap(c_a), veh/h	423	444	397	409	422	396	246	980	428	259	1025	466
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.83	1.00	1.00	1.00	0.82	0.82	0.82	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.4	36.4	37.6	46.8	50.3	50.8	58.3	46.3	35.8	56.5	40.4	36.9
Incr Delay (d2), s/veh	1.3	7.8	9.7	0.2	3.8	5.1	13.8	18.6	0.8	14.2	3.2	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	10.3	9.8	3.2	8.7	8.5	5.8	19.2	2.3	6.8	10.9	6.2
LnGrp Delay(d),s/veh	35.7	44.2	47.3	47.0	54.1	55.9	72.0	65.0	36.6	70.6	43.5	39.8
LnGrp LOS	D	D	D	D	D	E	E	E	D	E	D	D
Approach Vol, veh/h		797			584			1169			1034	
Approach Delay, s/veh		43.0			53.6			63.9			47.2	
Approach LOS		D			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		26.9	16.1	41.6		29.4	17.7	40.0
Change Period (Y+Rc), s		5.0	3.5	5.0		5.0	3.5	5.0
Max Green Setting (Gmax), s		29.0	18.5	35.0		29.0	18.5	35.0
Max Q Clear Time (g_c+I1), s		19.7	12.6	23.3		21.5	14.1	36.2
Green Ext Time (p_c), s		1.0	0.1	4.3		2.2	0.1	0.0

Intersection Summary			
HCM 2010 Ctrl Delay			52.8
HCM 2010 LOS			D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	320	140	180	240	140	90	540	220	120	380	230
Future Volume (veh/h)	320	320	140	180	240	140	90	540	220	120	380	230
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.76	1.00		0.76	1.00		0.94	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	376	376	165	212	282	165	106	635	259	141	447	271
Adj No. of Lanes	2	2	0	1	2	1	1	2	1	1	2	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	437	540	227	251	893	296	141	1481	850	166	1557	659
Arrive On Green	0.13	0.24	0.24	0.14	0.25	0.24	0.08	0.42	0.42	0.09	0.44	0.44
Sat Flow, veh/h	3442	2205	927	1774	3539	1210	1774	3539	1490	1774	3539	1497
Grp Volume(v), veh/h	376	298	243	212	282	165	106	635	259	141	447	271
Grp Sat Flow(s),veh/h/ln	1721	1770	1362	1774	1770	1210	1774	1770	1490	1774	1770	1497
Q Serve(g_s), s	14.8	21.1	22.6	16.1	8.9	16.4	8.1	17.5	12.7	10.8	11.2	17.1
Cycle Q Clear(g_c), s	14.8	21.1	22.6	16.1	8.9	16.4	8.1	17.5	12.7	10.8	11.2	17.1
Prop In Lane	1.00		0.68	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	437	433	333	251	893	296	141	1481	850	166	1557	659
V/C Ratio(X)	0.86	0.69	0.73	0.84	0.32	0.56	0.75	0.43	0.30	0.85	0.29	0.41
Avail Cap(c_a), veh/h	648	433	333	350	903	300	219	1481	850	257	1557	659
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.82	0.82	0.82	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.88	0.88
Uniform Delay (d), s/veh	59.0	47.3	48.0	57.7	41.9	45.5	62.2	28.4	16.0	61.6	24.8	26.4
Incr Delay (d2), s/veh	4.4	3.2	5.6	9.4	0.1	1.3	3.0	0.3	0.3	13.1	0.4	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	10.7	9.0	8.5	4.4	5.6	4.1	8.6	5.3	5.9	5.6	7.3
LnGrp Delay(d),s/veh	63.5	50.5	53.6	67.1	42.0	46.9	65.2	28.7	16.3	74.7	25.2	28.1
LnGrp LOS	E	D	D	E	D	D	E	C	B	E	C	C
Approach Vol, veh/h		917			659			1000			859	
Approach Delay, s/veh		56.6			51.3			29.4			34.2	
Approach LOS		E			D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	21.5	37.8	14.0	64.7	22.6	36.8	16.9	61.8				
Change Period (Y+Rc), s	* 4.2	* 4.2	4.0	5.0	* 4.2	* 4.2	4.0	5.0				
Max Green Setting (Gmax), s	* 26	* 34	16.0	45.0	* 26	* 28	20.0	41.0				
Max Q Clear Time (g_c+I1), s	16.8	18.4	10.1	19.1	18.1	24.6	12.8	19.5				
Green Ext Time (p_c), s	0.5	1.1	0.1	6.1	0.3	0.6	0.2	8.0				
Intersection Summary												
HCM 2010 Ctrl Delay			42.1									
HCM 2010 LOS			D									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

CONSTRUCTION ALTERNATIVE 1 CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	124	224	9	40	407	118	7	33	15	127	19	122
Future Volume (veh/h)	124	224	9	40	407	118	7	33	15	127	19	122
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1710	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	138	249	10	44	452	131	8	37	17	141	21	136
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	164	889	36	747	1604	461	16	538	1090	121	663	554
Arrive On Green	0.10	0.29	0.28	0.48	0.67	0.66	0.01	0.33	0.31	0.08	0.40	0.40
Sat Flow, veh/h	1566	3055	122	1566	2384	685	1566	1644	1349	1566	1644	1375
Grp Volume(v), veh/h	138	127	132	44	295	288	8	37	17	141	21	136
Grp Sat Flow(s),veh/h/ln	1566	1562	1615	1566	1562	1507	1566	1644	1349	1566	1644	1375
Q Serve(g_s), s	9.5	6.9	7.0	1.7	8.4	8.6	0.6	1.7	0.0	8.5	0.8	7.2
Cycle Q Clear(g_c), s	9.5	6.9	7.0	1.7	8.4	8.6	0.6	1.7	0.0	8.5	0.8	7.2
Prop In Lane	1.00		0.08	1.00		0.45	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	164	454	470	747	1051	1014	16	538	1090	121	663	554
V/C Ratio(X)	0.84	0.28	0.28	0.06	0.28	0.28	0.49	0.07	0.02	1.17	0.03	0.25
Avail Cap(c_a), veh/h	164	454	470	747	1051	1014	178	538	1090	121	663	554
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	0.96	0.47	0.47	0.47	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.4	30.1	30.2	15.5	7.3	7.4	54.1	25.5	2.4	50.7	19.8	21.7
Incr Delay (d2), s/veh	28.6	1.5	1.4	0.0	0.3	0.3	8.1	0.2	0.0	133.0	0.1	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	3.1	3.3	0.7	3.7	3.6	0.3	0.8	0.1	8.1	0.4	2.9
LnGrp Delay(d),s/veh	76.9	31.6	31.6	15.5	7.6	7.7	62.3	25.7	2.5	183.8	19.9	22.8
LnGrp LOS	E	C	C	B	A	A	E	C	A	F	B	C
Approach Vol, veh/h		397			627			62			298	
Approach Delay, s/veh		47.3			8.2			24.1			98.8	
Approach LOS		D			A			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	78.0	4.7	47.3	58.0	35.0	13.0	39.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	11.5	10.6	2.6	9.2	3.7	9.0	10.5	3.7
Green Ext Time (p_c), s	0.0	7.0	0.0	0.3	0.0	2.7	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	39.6
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	14	0	0	0	10	35	0	0	32	31
Future Volume (veh/h)	24	0	14	0	0	0	10	35	0	0	32	31
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1710	1710	1693	1710	1644	1644	0	0	1644	1710
Adj Flow Rate, veh/h	29	0	17	0	0	0	12	42	0	0	39	37
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.83	0.90	0.83	0.90	0.90	0.90	0.83	0.83	0.90	0.90	0.83	0.83
Percent Heavy Veh, %	4	1	4	1	1	1	4	4	0	0	4	4
Cap, veh/h	32	0	19	0	9	0	977	1595	0	0	824	677
Arrive On Green	0.07	0.00	0.09	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.51	0.50
Sat Flow, veh/h	940	0	551	0	1693	0	1163	3206	0	0	1695	1325
Grp Volume(v), veh/h	46	0	0	0	0	0	12	42	0	0	38	38
Grp Sat Flow(s),veh/h/ln	1490	0	0	0	1693	0	1163	1562	0	0	1562	1376
Q Serve(g_s), s	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.3
Cycle Q Clear(g_c), s	0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.2	0.3
Prop In Lane	0.63		0.37	0.00		0.00	1.00		0.00	0.00		0.96
Lane Grp Cap(c), veh/h	51	0	0	0	9	0	977	1595	0	0	798	703
V/C Ratio(X)	0.90	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.05	0.05
Avail Cap(c_a), veh/h	2382	0	0	0	2274	0	2256	5028	0	0	2514	2215
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	8.3	0.0	0.0	0.0	0.0	0.0	2.3	2.2	0.0	0.0	2.2	2.3
Incr Delay (d2), s/veh	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
LnGrp Delay(d),s/veh	26.6	0.0	0.0	0.0	0.0	0.0	2.3	2.2	0.0	0.0	2.2	2.3
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		46			0			54			76	
Approach Delay, s/veh		26.6			0.0			2.2			2.3	
Approach LOS		C						A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		4.8		13.2		0.0		13.2				
Change Period (Y+Rc), s		* 4.2		* 5.2		4.0		* 5.2				
Max Green Setting (Gmax), s		* 29		* 28		24.2		* 28				
Max Q Clear Time (g_c+I1), s		2.6		2.4		0.0		2.3				
Green Ext Time (p_c), s		0.1		0.4		0.0		0.7				
Intersection Summary												
HCM 2010 Ctrl Delay			8.6									
HCM 2010 LOS			A									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	7	0	0	0	6	0	0	0	20	0	24
Future Volume (veh/h)	32	7	0	0	0	6	0	0	0	20	0	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	1.00		0.98	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1644	1710	1644	1644	1644	1644	1710	1644	1644	1710
Adj Flow Rate, veh/h	42	9	0	0	0	8	0	0	0	26	0	31
Adj No. of Lanes	0	1	1	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	533	35	216	0	254	211	9	1076	0	76	835	724
Arrive On Green	0.15	0.15	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.05	0.00	0.52
Sat Flow, veh/h	1044	224	1398	0	1644	1368	1566	3206	0	1566	1562	1354
Grp Volume(v), veh/h	51	0	0	0	0	8	0	0	0	26	0	31
Grp Sat Flow(s),veh/h/ln	1268	0	1398	0	1644	1368	1566	1562	0	1566	1562	1354
Q Serve(g_s), s	0.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.2
Cycle Q Clear(g_c), s	0.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.2
Prop In Lane	0.82		1.00	0.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	567	0	216	0	254	211	9	1076	0	76	835	724
V/C Ratio(X)	0.09	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.34	0.00	0.04
Avail Cap(c_a), veh/h	3277	0	3203	0	3768	3135	2880	4773	0	2880	2387	2069
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.6	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	8.1	0.0	2.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
LnGrp Delay(d),s/veh	6.6	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	9.1	0.0	2.0
LnGrp LOS	A					A				A		A
Approach Vol, veh/h		51			8			0			57	
Approach Delay, s/veh		6.6			6.4			0.0			5.3	
Approach LOS		A			A						A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		5.2	0.0	12.4		5.2	3.4	9.1				
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2				
Max Green Setting (Gmax), s		40.0	32.0	* 26		40.0	32.0	* 26				
Max Q Clear Time (g_c+I1), s		2.1	0.0	2.2		2.6	2.3	0.0				
Green Ext Time (p_c), s		0.0	0.0	0.1		0.0	0.0	0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			5.9									
HCM 2010 LOS			A									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	8	16	0	0	18	0	12	0	0	0
Future Volume (veh/h)	0	0	8	16	0	0	18	0	12	0	0	0
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.93	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1693	1710	1710	1598	1598	1693	1598	1710	1598	1598	0
Adj Flow Rate, veh/h	0	0	9	21	0	0	20	0	16	0	0	0
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.77	0.90	0.77	0.90	0.77	0.77	0.77	0.77	0.90
Percent Heavy Veh, %	1	1	1	7	1	7	1	7	7	7	7	0
Cap, veh/h	0	0	80	423	0	110	34	886	740	8	1252	0
Arrive On Green	0.00	0.00	0.06	0.08	0.00	0.00	0.02	0.00	0.53	0.00	0.00	0.00
Sat Flow, veh/h	0	0	1439	1113	0	1358	1612	1518	1268	1522	3116	0
Grp Volume(v), veh/h	0	0	9	21	0	0	20	0	16	0	0	0
Grp Sat Flow(s),veh/h/ln	0	0	1439	1113	0	1358	1612	1518	1268	1522	1518	0
Q Serve(g_s), s	0.0	0.0	0.1	0.3	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.1	0.4	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Prop In Lane	0.00		1.00	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	0	80	451	0	110	34	886	740	8	1252	0
V/C Ratio(X)	0.00	0.00	0.11	0.05	0.00	0.00	0.59	0.00	0.02	0.00	0.00	0.00
Avail Cap(c_a), veh/h	0	0	1860	1635	0	1449	1777	2433	2032	1639	4867	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	9.0	8.9	0.0	0.0	9.7	0.0	2.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	9.2	8.9	0.0	0.0	15.6	0.0	2.0	0.0	0.0	0.0
LnGrp LOS			A	A			B		A			
Approach Vol, veh/h		9			21			36			0	
Approach Delay, s/veh		9.2			8.9			9.6			0.0	
Approach LOS		A			A			A				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		5.3	3.4	11.2		5.3	0.0	14.7				
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	4.0	5.0				
Max Green Setting (Gmax), s		* 21	22.0	30.0		* 26	21.0	30.0				
Max Q Clear Time (g_c+I1), s		2.4	2.2	0.0		2.1	0.0	2.1				
Green Ext Time (p_c), s		0.0	0.0	0.0		0.0	0.0	0.1				
Intersection Summary												
HCM 2010 Ctrl Delay			9.3									
HCM 2010 LOS			A									
Notes												

User approved pedestrian interval to be less than phase max green.
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	223	348	250	262	29	350	5	345	7	10	9
Future Volume (veh/h)	1	223	348	250	262	29	350	5	345	7	10	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.85	1.00		0.88	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1644	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	1	293	458	329	345	38	461	7	454	9	13	12
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	20	880	689	282	1014	110	399	1529	669	45	824	362
Arrive On Green	0.01	0.28	0.28	0.09	0.36	0.36	0.25	0.49	0.49	0.03	0.26	0.26
Sat Flow, veh/h	1566	3124	1191	3038	2800	305	1566	3124	1366	1566	3124	1372
Grp Volume(v), veh/h	1	293	458	329	190	193	461	7	454	9	13	12
Grp Sat Flow(s),veh/h/ln	1566	1562	1191	1519	1562	1543	1566	1562	1366	1566	1562	1372
Q Serve(g_s), s	0.1	8.2	30.8	10.2	9.7	10.0	28.0	0.1	28.0	0.6	0.3	0.7
Cycle Q Clear(g_c), s	0.1	8.2	30.8	10.2	9.7	10.0	28.0	0.1	28.0	0.6	0.3	0.7
Prop In Lane	1.00		1.00	1.00		0.20	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	20	880	689	282	565	558	399	1529	669	45	824	362
V/C Ratio(X)	0.05	0.33	0.66	1.17	0.34	0.34	1.16	0.00	0.68	0.20	0.02	0.03
Avail Cap(c_a), veh/h	131	880	689	282	565	558	399	1529	669	199	824	362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.76	0.76	0.76	0.84	0.84	0.84	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.7	31.3	19.4	49.9	25.5	25.6	41.0	14.4	21.5	52.2	29.9	30.1
Incr Delay (d2), s/veh	0.3	0.1	1.5	103.0	0.1	0.1	95.1	0.0	5.5	0.8	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	3.5	10.7	8.3	4.2	4.3	22.6	0.1	11.5	0.3	0.2	0.3
LnGrp Delay(d),s/veh	54.0	31.4	20.9	152.9	25.6	25.7	136.1	14.4	27.0	53.0	30.0	30.3
LnGrp LOS	D	C	C	F	C	C	F	B	C	D	C	C
Approach Vol, veh/h		752			712			922			34	
Approach Delay, s/veh		25.0			84.4			81.5			36.2	
Approach LOS		C			F			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	4.2	42.8	31.0	32.0	13.0	34.0	6.2	56.8
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.1	12.0	30.0	2.7	12.2	32.8	2.6	30.0
Green Ext Time (p_c), s	0.0	0.8	0.0	0.1	0.0	0.0	0.0	2.6

Intersection Summary	
HCM 2010 Ctrl Delay	64.2
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	367	283	162	388	13	162	437	116	52	518	190
Future Volume (veh/h)	130	367	283	162	388	13	162	437	116	52	518	190
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.95	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1710	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	135	382	295	169	404	14	169	455	121	54	540	198
Adj No. of Lanes	1	2	1	1	2	0	2	2	1	1	2	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	173	1149	499	211	1206	42	227	1004	427	119	676	389
Arrive On Green	0.11	0.36	0.36	0.04	0.13	0.13	0.10	0.32	0.32	0.08	0.29	0.29
Sat Flow, veh/h	1581	3154	1369	1581	3109	108	2214	3154	1342	1581	2324	1338
Grp Volume(v), veh/h	135	382	295	169	205	213	169	455	121	54	540	198
Grp Sat Flow(s),veh/h/ln	1581	1577	1369	1581	1577	1639	1107	1577	1342	1581	1162	1338
Q Serve(g_s), s	9.1	9.6	14.2	11.7	13.0	13.1	8.2	12.6	5.2	3.6	23.6	9.3
Cycle Q Clear(g_c), s	9.1	9.6	14.2	11.7	13.0	13.1	8.2	12.6	5.2	3.6	23.6	9.3
Prop In Lane	1.00		1.00	1.00		0.07	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	173	1149	499	211	612	636	227	1004	427	119	676	389
V/C Ratio(X)	0.78	0.33	0.59	0.80	0.33	0.34	0.75	0.45	0.28	0.45	0.80	0.51
Avail Cap(c_a), veh/h	230	1149	499	230	612	636	262	1004	427	144	676	389
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.89	0.92	0.92	0.92	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.7	25.3	15.5	51.2	35.0	35.0	48.0	29.9	14.0	48.7	36.0	15.2
Incr Delay (d2), s/veh	8.2	0.8	5.1	15.4	1.3	1.3	10.0	1.4	1.5	1.0	9.6	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	4.3	6.3	6.0	5.9	6.2	2.8	5.7	2.7	1.6	8.5	4.7
LnGrp Delay(d),s/veh	55.8	26.1	20.5	66.6	36.3	36.3	58.0	31.2	15.5	49.7	45.6	19.9
LnGrp LOS	E	C	C	E	D	D	E	C	B	D	D	B
Approach Vol, veh/h		812			587			745			792	
Approach Delay, s/veh		29.0			45.0			34.8			39.4	
Approach LOS		C			D			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	45.7	14.3	35.0	17.6	43.1	11.3	38.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	35.0	12.0	30.0	15.0	35.0	9.0	33.0
Max Q Clear Time (g_c+I1), s	11.1	15.1	10.2	25.6	13.7	16.2	5.6	14.6
Green Ext Time (p_c), s	0.1	4.5	0.2	2.5	0.1	6.3	0.0	5.9

Intersection Summary	
HCM 2010 Ctrl Delay	36.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	300	162	358	10	62	30	198	445	10	40	673	200
Future Volume (veh/h)	300	162	358	10	62	30	198	445	10	40	673	200
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		0.98	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	337	182	402	11	70	34	222	500	11	45	756	225
Adj No. of Lanes	2	1	1	1	2	0	2	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	591	457	386	98	322	146	575	1485	33	172	1042	530
Arrive On Green	0.17	0.25	0.25	0.06	0.14	0.14	0.17	0.42	0.41	0.10	0.35	0.35
Sat Flow, veh/h	3442	1863	1574	1774	2352	1062	3442	3539	78	1774	2980	1516
Grp Volume(v), veh/h	337	182	402	11	51	53	222	250	261	45	756	225
Grp Sat Flow(s),veh/h/ln	1721	1863	1574	1774	1770	1644	1721	1770	1847	1774	1490	1516
Q Serve(g_s), s	6.4	5.8	12.3	0.4	1.8	2.0	4.1	6.8	6.8	1.7	15.7	5.5
Cycle Q Clear(g_c), s	6.4	5.8	12.3	0.4	1.8	2.0	4.1	6.8	6.8	1.7	15.7	5.5
Prop In Lane	1.00		1.00	1.00		0.65	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	591	457	386	98	243	225	575	743	775	172	1042	530
V/C Ratio(X)	0.57	0.40	1.04	0.11	0.21	0.23	0.39	0.34	0.34	0.26	0.73	0.42
Avail Cap(c_a), veh/h	1076	740	625	300	673	625	1066	748	780	425	1133	577
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.0	22.4	13.4	31.9	27.2	27.3	26.3	13.9	13.9	29.7	20.1	8.3
Incr Delay (d2), s/veh	0.3	0.2	38.6	0.2	0.2	0.2	0.2	0.4	0.4	0.3	2.4	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	3.0	9.7	0.2	0.9	0.9	2.0	3.3	3.5	0.8	6.8	2.9
LnGrp Delay(d),s/veh	27.3	22.6	52.0	32.1	27.4	27.5	26.5	14.3	14.3	30.0	22.5	9.1
LnGrp LOS	C	C	F	C	C	C	C	B	B	C	C	A
Approach Vol, veh/h		921			115			733			1026	
Approach Delay, s/veh		37.2			27.9			18.0			19.9	
Approach LOS		D			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	13.3	14.9	27.8	7.5	20.8	9.9	32.8
Change Period (Y+Rc), s	4.0	4.6	4.0	5.0	4.6	* 4.6	4.0	5.0
Max Green Setting (Gmax), s	21.0	26.0	21.0	25.0	11.0	* 27	16.0	28.0
Max Q Clear Time (g_c+I1), s	8.4	4.0	6.1	17.7	2.4	14.3	3.7	8.8
Green Ext Time (p_c), s	0.8	0.2	0.5	4.8	0.0	1.3	0.0	5.5

Intersection Summary	
HCM 2010 Ctrl Delay	25.4
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	130	140	72	40	40	55	572	36	50	891	40
Future Volume (veh/h)	20	130	140	72	40	40	55	572	36	50	891	40
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	1.00		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	24	153	165	85	47	47	65	673	42	59	1048	47
Adj No. of Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	91	387	360	171	93	66	445	1601	100	560	1859	83
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.10	0.54	0.53	0.09	0.54	0.53
Sat Flow, veh/h	136	1686	1569	404	408	289	1774	2944	184	1774	3445	154
Grp Volume(v), veh/h	177	0	165	179	0	0	65	298	417	59	538	557
Grp Sat Flow(s),veh/h/ln	1823	0	1569	1101	0	0	1774	1304	1824	1774	1770	1829
Q Serve(g_s), s	0.0	0.0	6.2	5.7	0.0	0.0	1.0	9.2	9.3	0.9	13.7	13.8
Cycle Q Clear(g_c), s	5.5	0.0	6.2	11.2	0.0	0.0	1.0	9.2	9.3	0.9	13.7	13.8
Prop In Lane	0.14		1.00	0.47		0.26	1.00		0.10	1.00		0.08
Lane Grp Cap(c), veh/h	478	0	360	330	0	0	445	709	992	560	955	987
V/C Ratio(X)	0.37	0.00	0.46	0.54	0.00	0.00	0.15	0.42	0.42	0.11	0.56	0.56
Avail Cap(c_a), veh/h	899	0	736	646	0	0	856	1013	1416	1368	1763	1823
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.4	0.0	22.7	24.9	0.0	0.0	6.6	9.2	9.2	5.8	10.4	10.4
Incr Delay (d2), s/veh	0.5	0.0	0.9	1.4	0.0	0.0	0.1	0.6	0.4	0.0	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	2.8	3.3	0.0	0.0	0.5	3.4	4.8	0.4	6.8	7.0
LnGrp Delay(d),s/veh	22.9	0.0	23.6	26.2	0.0	0.0	6.7	9.8	9.6	5.8	11.1	11.1
LnGrp LOS	C		C	C			A	A	A	A	B	B
Approach Vol, veh/h		342			179			780			1154	
Approach Delay, s/veh		23.2			26.2			9.4			10.9	
Approach LOS		C			C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		19.2	9.2	39.8		19.2	8.9	40.1
Change Period (Y+Rc), s		4.6	3.5	5.0		4.6	3.5	5.0
Max Green Setting (Gmax), s		31.0	21.5	66.0		31.0	36.5	51.0
Max Q Clear Time (g_c+I1), s		8.2	3.0	15.8		13.2	2.9	11.3
Green Ext Time (p_c), s		1.4	0.1	19.1		0.7	0.1	9.3

Intersection Summary		
HCM 2010 Ctrl Delay		13.3
HCM 2010 LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	147	123	10	80	83	357	10	140	50	676	50	358
Future Volume (veh/h)	147	123	10	80	83	357	10	140	50	676	50	358
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.98		0.93	1.00		0.94	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1845	1900	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	173	145	12	94	98	420	12	165	59	837	0	421
Adj No. of Lanes	1	2	0	1	1	1	0	2	0	2	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	458	1058	86	542	557	442	28	386	140	1090	0	477
Arrive On Green	0.09	0.32	0.32	0.07	0.30	0.30	0.16	0.16	0.16	0.31	0.00	0.31
Sat Flow, veh/h	1757	3270	267	1757	1845	1463	174	2407	876	3514	0	1538
Grp Volume(v), veh/h	173	77	80	94	98	420	127	0	109	837	0	421
Grp Sat Flow(s),veh/h/ln	1757	1752	1785	1757	1845	1463	1836	0	1621	1757	0	1538
Q Serve(g_s), s	6.9	3.3	3.4	3.8	4.2	30.0	6.6	0.0	6.5	23.0	0.0	27.7
Cycle Q Clear(g_c), s	6.9	3.3	3.4	3.8	4.2	30.0	6.6	0.0	6.5	23.0	0.0	27.7
Prop In Lane	1.00		0.15	1.00		1.00	0.09		0.54	1.00		1.00
Lane Grp Cap(c), veh/h	458	567	578	542	557	442	294	0	260	1090	0	477
V/C Ratio(X)	0.38	0.14	0.14	0.17	0.18	0.95	0.43	0.00	0.42	0.77	0.00	0.88
Avail Cap(c_a), veh/h	494	567	578	615	557	442	623	0	550	1193	0	522
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.8	25.5	25.6	22.0	27.4	36.4	40.4	0.0	40.4	33.3	0.0	34.9
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.1	0.1	30.2	0.4	0.0	0.4	2.4	0.0	14.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	1.6	1.7	1.8	2.1	15.8	3.4	0.0	2.9	11.5	0.0	13.7
LnGrp Delay(d),s/veh	20.9	25.6	25.6	22.1	27.5	66.6	40.7	0.0	40.8	35.7	0.0	49.3
LnGrp LOS	C	C	C	C	C	E	D		D	D		D
Approach Vol, veh/h		330			612			236			1258	
Approach Delay, s/veh		23.1			53.5			40.8			40.3	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.9	36.0		36.9	10.6	38.3		20.9
Change Period (Y+Rc), s	4.0	5.0		5.0	4.0	5.0		5.0
Max Green Setting (Gmax), s	11.0	31.0		35.0	11.0	25.0		35.0
Max Q Clear Time (g_c+I1), s	8.9	32.0		29.7	5.8	5.4		8.6
Green Ext Time (p_c), s	0.0	0.0		2.1	0.1	0.3		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	41.3
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	120	230	142	248	100	203	390	80	140	990	130
Future Volume (veh/h)	90	120	230	142	248	100	203	390	80	140	990	130
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	101	135	258	160	279	112	228	438	0	157	1112	0
Adj No. of Lanes	1	2	0	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	370	389	321	274	402	157	152	1330	595	192	1394	652
Arrive On Green	0.21	0.21	0.20	0.15	0.16	0.16	0.09	0.38	0.00	0.11	0.39	0.00
Sat Flow, veh/h	1774	1863	1539	1774	2463	960	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	101	135	258	160	198	193	228	438	0	157	1112	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1539	1774	1770	1654	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	5.3	6.9	17.7	9.3	11.7	12.3	9.5	9.8	0.0	9.6	30.8	0.0
Cycle Q Clear(g_c), s	5.3	6.9	17.7	9.3	11.7	12.3	9.5	9.8	0.0	9.6	30.8	0.0
Prop In Lane	1.00		1.00	1.00		0.58	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	370	389	321	274	289	270	152	1330	595	192	1394	652
V/C Ratio(X)	0.27	0.35	0.80	0.58	0.69	0.71	1.50	0.33	0.00	0.82	0.80	0.00
Avail Cap(c_a), veh/h	463	487	402	448	462	432	152	1330	595	192	1394	652
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.81	1.00	1.00	1.00	0.87	0.87	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.9	37.5	42.3	43.6	43.8	44.0	50.7	24.7	0.0	48.4	29.7	0.0
Incr Delay (d2), s/veh	0.3	0.4	7.5	0.7	1.1	1.3	253.4	0.6	0.0	22.2	4.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	3.6	8.2	4.6	5.8	5.7	15.3	4.9	0.0	5.9	15.9	0.0
LnGrp Delay(d),s/veh	37.2	37.9	49.8	44.4	44.8	45.3	304.1	25.3	0.0	70.6	34.6	0.0
LnGrp LOS	D	D	D	D	D	D	F	C		E	C	
Approach Vol, veh/h		494			551			666			1269	
Approach Delay, s/veh		44.0			44.9			120.7			39.0	
Approach LOS		D			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.1	13.0	48.7		27.2	15.0	46.7
Change Period (Y+Rc), s		5.0	3.5	5.0		5.0	3.5	5.0
Max Green Setting (Gmax), s		28.0	9.5	27.0		28.0	11.5	25.0
Max Q Clear Time (g_c+I1), s		14.3	11.5	32.8		19.7	11.6	11.8
Green Ext Time (p_c), s		1.0	0.0	0.0		1.4	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	59.2
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	250	257	58	200	467	182	38	331	130	82	932	347
Future Volume (veh/h)	250	257	58	200	467	182	38	331	130	82	932	347
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.81	1.00		0.82	1.00		1.00	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	294	302	68	235	549	214	45	389	0	96	1096	408
Adj No. of Lanes	2	2	0	1	2	1	1	2	1	1	2	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	373	829	180	291	1217	432	82	1110	529	124	1230	514
Arrive On Green	0.11	0.30	0.30	0.16	0.34	0.33	0.05	0.31	0.00	0.07	0.35	0.35
Sat Flow, veh/h	3442	2758	598	1774	3539	1302	1774	3539	1583	1774	3539	1479
Grp Volume(v), veh/h	294	190	180	235	549	214	45	389	0	96	1096	408
Grp Sat Flow(s),veh/h/ln	1721	1770	1587	1774	1770	1302	1774	1770	1583	1774	1770	1479
Q Serve(g_s), s	8.2	8.3	8.9	12.6	11.9	13.0	2.4	8.4	0.0	5.2	28.9	24.5
Cycle Q Clear(g_c), s	8.2	8.3	8.9	12.6	11.9	13.0	2.4	8.4	0.0	5.2	28.9	24.5
Prop In Lane	1.00		0.38	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	373	532	477	291	1217	432	82	1110	529	124	1230	514
V/C Ratio(X)	0.79	0.36	0.38	0.81	0.45	0.50	0.55	0.35	0.00	0.78	0.89	0.79
Avail Cap(c_a), veh/h	900	532	477	489	1263	449	396	1256	594	378	1256	525
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.8	27.0	27.2	39.7	25.1	26.4	46.0	26.1	0.0	45.1	30.4	29.0
Incr Delay (d2), s/veh	1.4	0.2	0.2	2.0	0.1	0.3	2.1	0.3	0.0	9.9	8.4	8.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	4.1	3.9	6.3	5.8	4.7	1.2	4.1	0.0	2.9	15.4	11.2
LnGrp Delay(d),s/veh	44.3	27.2	27.4	41.8	25.2	26.7	48.2	26.4	0.0	55.0	38.8	37.5
LnGrp LOS	D	C	C	D	C	C	D	C		D	D	D
Approach Vol, veh/h		664			998			434			1600	
Approach Delay, s/veh		34.8			29.4			28.6			39.4	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	36.9	7.5	39.3	19.2	32.6	10.9	35.9
Change Period (Y+Rc), s	* 4.2	* 4.2	4.0	5.0	* 4.2	* 4.2	4.0	5.0
Max Green Setting (Gmax), s	* 26	* 34	21.0	35.0	* 26	* 28	21.0	35.0
Max Q Clear Time (g_c+I1), s	10.2	15.0	4.4	30.9	14.6	10.9	7.2	10.4
Green Ext Time (p_c), s	0.5	2.0	0.0	3.4	0.4	0.8	0.2	3.6

Intersection Summary	
HCM 2010 Ctrl Delay	34.6
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	287	460	10	60	414	221	52	38	123	151	63	172
Future Volume (veh/h)	287	460	10	60	414	221	52	38	123	151	63	172
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.97	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1710	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	319	511	11	67	460	246	58	42	137	168	70	191
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	253	937	20	241	585	311	84	569	672	157	658	550
Arrive On Green	0.32	0.60	0.58	0.15	0.30	0.29	0.05	0.35	0.34	0.10	0.40	0.40
Sat Flow, veh/h	1566	3123	67	1566	1951	1035	1566	1644	1351	1566	1644	1375
Grp Volume(v), veh/h	319	255	267	67	368	338	58	42	137	168	70	191
Grp Sat Flow(s),veh/h/ln	1566	1562	1628	1566	1562	1424	1566	1644	1351	1566	1644	1375
Q Serve(g_s), s	21.0	12.6	12.7	4.9	28.0	28.4	4.7	2.2	0.0	13.0	3.5	12.6
Cycle Q Clear(g_c), s	21.0	12.6	12.7	4.9	28.0	28.4	4.7	2.2	0.0	13.0	3.5	12.6
Prop In Lane	1.00		0.04	1.00		0.73	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	253	469	488	241	469	427	84	569	672	157	658	550
V/C Ratio(X)	1.26	0.54	0.55	0.28	0.78	0.79	0.69	0.07	0.20	1.07	0.11	0.35
Avail Cap(c_a), veh/h	253	469	488	253	469	427	241	569	672	157	658	550
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.84	0.84	0.84	0.37	0.37	0.37	0.99	0.99	0.99	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.0	20.7	20.8	48.6	41.6	42.1	60.5	28.5	18.6	58.5	24.4	27.1
Incr Delay (d2), s/veh	141.4	3.8	3.6	0.1	4.9	5.6	3.8	0.3	0.7	92.7	0.3	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.9	5.9	6.1	2.1	12.7	11.9	2.1	1.1	2.9	9.6	1.6	5.0
LnGrp Delay(d),s/veh	185.4	24.5	24.4	48.7	46.6	47.7	64.2	28.8	19.3	151.2	24.7	28.9
LnGrp LOS	F	C	C	D	D	D	E	C	B	F	C	C
Approach Vol, veh/h		841			773			237			429	
Approach Delay, s/veh		85.5			47.3			31.9			76.1	
Approach LOS		F			D			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.0	42.0	10.0	55.0	24.0	42.0	17.0	48.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	20.0	37.0	19.0	36.0	20.0	* 37	12.0	* 43
Max Q Clear Time (g_c+I1), s	23.0	30.4	6.7	14.6	6.9	14.7	15.0	4.2
Green Ext Time (p_c), s	0.0	3.5	0.1	0.5	0.1	6.1	0.0	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	65.2
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	37	0	0	0	40	77	0	0	52	80
Future Volume (veh/h)	145	0	37	0	0	0	40	77	0	0	52	80
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1710	1710	1693	1710	1644	1644	0	0	1644	1710
Adj Flow Rate, veh/h	175	0	45	0	0	0	48	93	0	0	63	96
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.83	0.90	0.83	0.90	0.90	0.90	0.83	0.83	0.90	0.90	0.83	0.83
Percent Heavy Veh, %	1	1	1	1	1	1	4	4	0	0	4	4
Cap, veh/h	237	0	61	0	8	0	794	1473	0	0	736	645
Arrive On Green	0.25	0.00	0.24	0.00	0.00	0.00	0.47	0.47	0.00	0.00	0.47	0.42
Sat Flow, veh/h	1212	0	312	0	1693	0	1079	3206	0	0	1644	1367
Grp Volume(v), veh/h	220	0	0	0	0	0	48	93	0	0	63	96
Grp Sat Flow(s),veh/h/ln	1524	0	0	0	1693	0	1079	1562	0	0	1562	1367
Q Serve(g_s), s	2.9	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.0	0.0	0.5	0.9
Cycle Q Clear(g_c), s	2.9	0.0	0.0	0.0	0.0	0.0	1.5	0.4	0.0	0.0	0.5	0.9
Prop In Lane	0.80		0.20	0.00		0.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h	298	0	0	0	8	0	794	1473	0	0	736	645
V/C Ratio(X)	0.74	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.09	0.15
Avail Cap(c_a), veh/h	2028	0	0	0	1894	0	1782	4332	0	0	2166	1896
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	7.6	0.0	0.0	0.0	0.0	0.0	3.7	3.1	0.0	0.0	3.1	3.6
Incr Delay (d2), s/veh	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.2	0.4
LnGrp Delay(d),s/veh	9.0	0.0	0.0	0.0	0.0	0.0	3.8	3.1	0.0	0.0	3.2	3.8
LnGrp LOS	A						A	A			A	A
Approach Vol, veh/h		220			0			141			159	
Approach Delay, s/veh		9.0			0.0			3.3			3.5	
Approach LOS		A						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		8.4		13.2		0.0		13.2
Change Period (Y+Rc), s		* 4.2		* 5.2		4.0		* 5.2
Max Green Setting (Gmax), s		* 29		* 28		24.2		* 28
Max Q Clear Time (g_c+I1), s		4.9		2.9		0.0		3.5
Green Ext Time (p_c), s		0.9		1.6		0.0		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	5.8
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	67	54	0	0	51	41	0	0	0	35	0	45
Future Volume (veh/h)	67	54	0	0	51	41	0	0	0	35	0	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.98	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1644	1644	1710	1644	1644	1644	1644	1710	1644	1644	1710
Adj Flow Rate, veh/h	87	70	0	0	66	53	0	0	0	45	0	58
Adj No. of Lanes	0	1	1	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	417	172	322	0	379	317	8	903	0	52	736	637
Arrive On Green	0.23	0.23	0.00	0.00	0.23	0.23	0.00	0.00	0.00	0.03	0.00	0.46
Sat Flow, veh/h	603	747	1398	0	1644	1376	1566	3206	0	1566	1562	1352
Grp Volume(v), veh/h	157	0	0	0	66	53	0	0	0	45	0	58
Grp Sat Flow(s),veh/h/ln	1350	0	1398	0	1644	1376	1566	1562	0	1566	1562	1352
Q Serve(g_s), s	1.2	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.6	0.0	0.5
Cycle Q Clear(g_c), s	1.9	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.6	0.0	0.5
Prop In Lane	0.55		1.00	0.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	589	0	322	0	379	317	8	903	0	52	736	637
V/C Ratio(X)	0.27	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.00	0.87	0.00	0.09
Avail Cap(c_a), veh/h	2866	0	2780	0	3271	2737	2492	4195	0	2492	2097	1816
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.6	0.0	0.0	0.0	6.2	6.2	0.0	0.0	0.0	9.7	0.0	3.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	14.6	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.4	0.0	0.2
LnGrp Delay(d),s/veh	6.7	0.0	0.0	0.0	6.3	6.3	0.0	0.0	0.0	24.2	0.0	3.1
LnGrp LOS	A				A	A				C		A
Approach Vol, veh/h		157			119			0			103	
Approach Delay, s/veh		6.7			6.3			0.0			12.3	
Approach LOS		A			A						B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.6	0.0	12.5		7.6	3.7	8.8
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		40.0	32.0	* 26		40.0	32.0	* 26
Max Q Clear Time (g_c+I1), s		2.6	0.0	2.5		3.9	2.6	0.0
Green Ext Time (p_c), s		0.3	0.0	0.3		0.1	0.1	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	8.1
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1	25	77	0	0	19	0	96	0	0	0
Future Volume (veh/h)	0	1	25	77	0	0	19	0	96	0	0	0
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.93	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1693	1710	1710	1598	1598	1693	1598	1710	1598	1598	1710
Adj Flow Rate, veh/h	0	1	28	100	0	0	21	0	125	0	0	0
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.77	0.90	0.77	0.90	0.77	0.77	0.77	0.77	0.90
Percent Heavy Veh, %	1	1	1	1	1	7	1	7	7	7	7	7
Cap, veh/h	0	5	144	485	0	263	7	812	675	7	1145	0
Arrive On Green	0.00	0.10	0.14	0.19	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00
Sat Flow, veh/h	0	50	1397	1072	0	1358	1612	1518	1262	1522	3116	0
Grp Volume(v), veh/h	0	0	29	100	0	0	21	0	125	0	0	0
Grp Sat Flow(s),veh/h/ln	0	0	1447	1072	0	1358	1612	1518	1262	1522	1518	0
Q Serve(g_s), s	0.0	0.0	0.4	1.7	0.0	0.0	0.1	0.0	1.2	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.4	2.1	0.0	0.0	0.1	0.0	1.2	0.0	0.0	0.0
Prop In Lane	0.00		0.97	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	0	150	534	0	263	7	812	675	7	1145	0
V/C Ratio(X)	0.00	0.00	0.19	0.19	0.00	0.00	2.88	0.00	0.19	0.00	0.00	0.00
Avail Cap(c_a), veh/h	0	0	1636	1864	0	1795	1532	2198	1827	1515	4397	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	8.7	8.6	0.0	0.0	11.1	0.0	2.9	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.1	0.0	0.0	874.5	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.2	0.5	0.0	0.0	2.9	0.0	0.4	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	8.9	8.7	0.0	0.0	885.6	0.0	3.1	0.0	0.0	0.0
LnGrp LOS			A	A			F		A			
Approach Vol, veh/h		29			100			146			0	
Approach Delay, s/veh		8.9			8.7			130.1			0.0	
Approach LOS		A			A			F				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.3	3.5	11.3		7.3	0.0	14.8
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	4.0	5.0
Max Green Setting (Gmax), s		* 28	22.0	30.0		* 26	21.0	30.0
Max Q Clear Time (g_c+I1), s		4.1	2.1	0.0		2.4	0.0	3.2
Green Ext Time (p_c), s		0.3	0.0	0.0		0.1	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	73.1
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	307	479	286	365	53	503	42	534	9	12	77
Future Volume (veh/h)	15	307	479	286	365	53	503	42	534	9	12	77
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.85	1.00		0.88	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1644	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	20	404	630	376	480	70	662	55	703	12	16	101
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	49	841	319	351	953	138	385	788	341	207	438	189
Arrive On Green	0.03	0.27	0.27	0.12	0.35	0.35	0.25	0.25	0.25	0.13	0.14	0.14
Sat Flow, veh/h	1566	3124	1183	3038	2687	388	1566	3124	1352	1566	3124	1350
Grp Volume(v), veh/h	20	404	630	376	277	273	662	55	703	12	16	101
Grp Sat Flow(s),veh/h/ln	1566	1562	1183	1519	1562	1513	1566	1562	1352	1566	1562	1350
Q Serve(g_s), s	1.6	14.1	35.0	15.0	18.1	18.4	32.0	1.7	22.7	0.9	0.6	5.7
Cycle Q Clear(g_c), s	1.6	14.1	35.0	15.0	18.1	18.4	32.0	1.7	22.7	0.9	0.6	5.7
Prop In Lane	1.00		1.00	1.00		0.26	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	49	841	319	351	554	537	385	788	341	207	438	189
V/C Ratio(X)	0.41	0.48	1.98	1.07	0.50	0.51	1.72	0.07	2.06	0.06	0.04	0.53
Avail Cap(c_a), veh/h	108	841	319	351	554	537	385	1202	520	217	865	374
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.56	0.56	0.56	0.90	0.90	0.90	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.8	39.9	47.5	57.5	32.9	33.0	49.0	37.0	23.2	49.3	48.3	20.7
Incr Delay (d2), s/veh	1.1	1.1	446.3	66.2	2.9	3.1	333.7	0.1	486.9	0.0	0.0	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.2	50.9	9.5	8.2	8.2	49.5	0.8	55.3	0.4	0.3	3.3
LnGrp Delay(d),s/veh	62.9	41.0	493.8	123.7	35.8	36.1	382.7	37.0	510.1	49.4	48.4	24.0
LnGrp LOS	E	D	F	F	D	D	F	D	F	D	D	C
Approach Vol, veh/h		1054			926			1420			129	
Approach Delay, s/veh		312.1			71.6			432.4			29.4	
Approach LOS		F			E			F			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	7.1	49.1	35.0	21.2	18.2	38.0	20.4	35.8				
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2				
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49				
Max Q Clear Time (g_c+I1), s	3.6	20.4	34.0	7.7	17.0	37.0	2.9	24.7				
Green Ext Time (p_c), s	0.0	1.2	0.0	0.8	0.0	0.0	0.0	7.0				
Intersection Summary												
HCM 2010 Ctrl Delay			287.0									
HCM 2010 LOS			F									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	250	527	183	213	417	38	303	894	311	52	438	100
Future Volume (veh/h)	250	527	183	213	417	38	303	894	311	52	438	100
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.95	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1710	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	260	549	191	222	434	40	316	931	324	54	456	104
Adj No. of Lanes	1	2	1	1	2	0	2	2	1	1	2	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	294	1092	474	254	936	86	324	922	391	158	572	327
Arrive On Green	0.19	0.35	0.35	0.16	0.32	0.31	0.05	0.10	0.10	0.10	0.25	0.25
Sat Flow, veh/h	1581	3154	1368	1581	2917	268	2214	3154	1337	1581	2324	1327
Grp Volume(v), veh/h	260	549	191	222	234	240	316	931	324	54	456	104
Grp Sat Flow(s),veh/h/ln	1581	1577	1368	1581	1577	1607	1107	1577	1337	1581	1162	1327
Q Serve(g_s), s	20.8	17.9	9.9	17.8	15.4	15.5	18.5	38.0	19.1	4.1	23.9	5.6
Cycle Q Clear(g_c), s	20.8	17.9	9.9	17.8	15.4	15.5	18.5	38.0	19.1	4.1	23.9	5.6
Prop In Lane	1.00		1.00	1.00		0.17	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	294	1092	474	254	506	516	324	922	391	158	572	327
V/C Ratio(X)	0.88	0.50	0.40	0.87	0.46	0.47	0.98	1.01	0.83	0.34	0.80	0.32
Avail Cap(c_a), veh/h	389	1092	474	268	506	516	324	922	391	158	572	327
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.70	0.70	0.70	0.66	0.66	0.66	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.5	33.6	16.6	53.2	35.2	35.3	61.6	58.7	21.1	54.5	46.0	18.2
Incr Delay (d2), s/veh	14.2	1.7	2.5	18.9	2.1	2.1	34.8	26.6	12.7	0.5	11.0	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.3	8.0	4.8	9.1	7.0	7.2	7.3	20.0	11.8	1.8	8.5	3.0
LnGrp Delay(d),s/veh	65.7	35.3	19.1	72.1	37.3	37.4	96.4	85.3	33.9	55.0	57.0	20.7
LnGrp LOS	E	D	B	E	D	D	F	F	C	D	E	C
Approach Vol, veh/h		1000			696			1571			614	
Approach Delay, s/veh		40.1			48.5			76.9			50.7	
Approach LOS		D			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	27.2	44.7	22.0	35.0	23.9	48.0	16.0	41.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	31.0	33.0	18.0	30.0	21.0	43.0	12.0	36.0
Max Q Clear Time (g_c+I1), s	22.8	17.5	20.5	25.9	19.8	19.9	6.1	40.0
Green Ext Time (p_c), s	0.4	4.5	0.0	1.9	0.1	8.4	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	58.2
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	540	302	338	70	126	30	364	938	30	60	524	210
Future Volume (veh/h)	540	302	338	70	126	30	364	938	30	60	524	210
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		0.98	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	607	339	380	79	142	34	409	1054	34	67	589	236
Adj No. of Lanes	2	1	1	1	2	0	2	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	698	507	428	117	383	89	500	1210	39	138	831	420
Arrive On Green	0.20	0.27	0.27	0.07	0.13	0.13	0.15	0.35	0.34	0.08	0.28	0.28
Sat Flow, veh/h	3442	1863	1575	1774	2838	659	3442	3496	113	1774	2980	1507
Grp Volume(v), veh/h	607	339	380	79	87	89	409	533	555	67	589	236
Grp Sat Flow(s),veh/h/ln	1721	1863	1575	1774	1770	1727	1721	1770	1840	1774	1490	1507
Q Serve(g_s), s	22.2	21.1	30.1	5.7	5.8	6.1	15.0	36.7	36.7	4.7	23.1	17.4
Cycle Q Clear(g_c), s	22.2	21.1	30.1	5.7	5.8	6.1	15.0	36.7	36.7	4.7	23.1	17.4
Prop In Lane	1.00		1.00	1.00		0.38	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	698	507	428	117	239	233	500	613	637	138	831	420
V/C Ratio(X)	0.87	0.67	0.89	0.68	0.36	0.38	0.82	0.87	0.87	0.49	0.71	0.56
Avail Cap(c_a), veh/h	847	673	569	177	381	372	741	613	637	177	831	420
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.98	0.98	0.98	0.09	0.09	0.09	0.65	0.65	0.65
Uniform Delay (d), s/veh	50.2	42.1	45.4	59.4	51.2	51.4	53.9	39.8	39.8	57.5	42.1	40.1
Incr Delay (d2), s/veh	7.3	0.6	10.6	2.5	0.3	0.4	0.3	1.7	1.7	0.6	3.3	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.2	10.9	14.3	2.9	2.9	2.9	7.2	18.2	18.9	2.3	9.9	7.7
LnGrp Delay(d),s/veh	57.5	42.7	56.0	61.9	51.5	51.8	54.2	41.5	41.5	58.1	45.5	43.6
LnGrp LOS	E	D	E	E	D	D	D	D	D	E	D	D
Approach Vol, veh/h		1326			255			1497			892	
Approach Delay, s/veh		53.3			54.8			45.0			45.9	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.4	20.5	21.9	39.2	11.5	38.4	13.1	48.0
Change Period (Y+Rc), s	4.0	4.6	4.0	5.0	4.0	4.6	4.0	5.0
Max Green Setting (Gmax), s	31.0	26.4	27.0	28.0	12.0	45.4	12.0	43.0
Max Q Clear Time (g_c+I1), s	24.2	8.1	17.0	25.1	7.7	32.1	6.7	38.7
Green Ext Time (p_c), s	1.2	0.3	0.9	1.9	0.0	1.6	0.0	3.4

Intersection Summary			
HCM 2010 Ctrl Delay			48.6
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	40	120	151	30	140	120	1052	153	100	742	50
Future Volume (veh/h)	60	40	120	151	30	140	120	1052	153	100	742	50
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	71	47	141	178	35	165	141	1238	180	118	873	59
Adj No. of Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	262	160	503	214	40	157	409	1377	199	243	1711	116
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.31	0.08	0.51	0.50	0.08	0.51	0.50
Sat Flow, veh/h	643	502	1573	506	126	489	1774	2694	390	1774	3356	227
Grp Volume(v), veh/h	118	0	141	378	0	0	141	596	822	118	460	472
Grp Sat Flow(s),veh/h/ln	1145	0	1573	1121	0	0	1774	1304	1780	1774	1770	1814
Q Serve(g_s), s	0.0	0.0	6.8	25.4	0.0	0.0	3.7	42.0	42.7	3.1	17.6	17.6
Cycle Q Clear(g_c), s	7.2	0.0	6.8	32.6	0.0	0.0	3.7	42.0	42.7	3.1	17.6	17.6
Prop In Lane	0.60		1.00	0.47		0.44	1.00		0.22	1.00		0.13
Lane Grp Cap(c), veh/h	423	0	503	411	0	0	409	667	910	243	902	925
V/C Ratio(X)	0.28	0.00	0.28	0.92	0.00	0.00	0.34	0.89	0.90	0.49	0.51	0.51
Avail Cap(c_a), veh/h	423	0	503	411	0	0	646	678	926	744	1181	1210
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	25.9	38.3	0.0	0.0	11.9	22.4	22.7	21.3	16.5	16.6
Incr Delay (d2), s/veh	0.4	0.0	0.3	25.8	0.0	0.0	0.2	14.6	12.2	0.6	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.0	3.0	13.6	0.0	0.0	1.8	17.8	23.9	1.7	8.7	9.0
LnGrp Delay(d),s/veh	26.1	0.0	26.2	64.1	0.0	0.0	12.1	37.0	34.9	21.9	17.2	17.2
LnGrp LOS	C		C	E			B	D	C	C	B	B
Approach Vol, veh/h		259			378			1559			1050	
Approach Delay, s/veh		26.2			64.1			33.6			17.7	
Approach LOS		C			E			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		35.6	11.4	55.0		35.6	11.2	55.1				
Change Period (Y+Rc), s		4.6	3.5	5.0		4.6	3.5	5.0				
Max Green Setting (Gmax), s		31.0	21.5	66.0		31.0	36.5	51.0				
Max Q Clear Time (g_c+I1), s		9.2	5.7	19.6		34.6	5.1	44.7				
Green Ext Time (p_c), s		1.1	0.2	14.6		0.0	0.2	5.4				
Intersection Summary												
HCM 2010 Ctrl Delay			31.4									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	67	10	20	103	752	30	320	120	723	30	178
Future Volume (veh/h)	143	67	10	20	103	752	30	320	120	723	30	178
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.98		0.93	1.00		0.96	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1845	1900	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	168	79	12	24	121	885	35	376	141	876	0	209
Adj No. of Lanes	1	2	0	1	1	1	0	2	0	2	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	346	1022	151	483	527	417	49	539	213	1012	0	442
Arrive On Green	0.09	0.34	0.33	0.04	0.29	0.29	0.23	0.23	0.22	0.29	0.00	0.29
Sat Flow, veh/h	1757	3046	451	1757	1845	1459	212	2332	921	3514	0	1535
Grp Volume(v), veh/h	168	45	46	24	121	885	302	0	250	876	0	209
Grp Sat Flow(s),veh/h/ln	1757	1752	1745	1757	1845	1459	1834	0	1631	1757	0	1535
Q Serve(g_s), s	7.5	2.0	2.1	1.1	5.8	33.0	17.5	0.0	16.1	27.3	0.0	13.0
Cycle Q Clear(g_c), s	7.5	2.0	2.1	1.1	5.8	33.0	17.5	0.0	16.1	27.3	0.0	13.0
Prop In Lane	1.00		0.26	1.00		1.00	0.12		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	346	588	585	483	527	417	424	0	377	1012	0	442
V/C Ratio(X)	0.49	0.08	0.08	0.05	0.23	2.12	0.71	0.00	0.66	0.87	0.00	0.47
Avail Cap(c_a), veh/h	369	588	585	593	527	417	588	0	523	1126	0	492
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	26.2	26.3	27.2	31.5	41.2	40.8	0.0	40.5	39.0	0.0	33.9
Incr Delay (d2), s/veh	0.4	0.0	0.0	0.0	0.1	512.9	1.1	0.0	0.7	6.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	1.0	1.0	0.5	3.0	72.6	9.0	0.0	7.3	14.1	0.0	5.5
LnGrp Delay(d),s/veh	24.9	26.2	26.3	27.2	31.6	554.1	41.9	0.0	41.3	45.1	0.0	34.2
LnGrp LOS	C	C	C	C	C	F	D		D	D		C
Approach Vol, veh/h		259			1030			552			1085	
Approach Delay, s/veh		25.4			480.4			41.6			43.0	
Approach LOS		C			F			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.5	36.0		36.3	7.8	41.7		29.7
Change Period (Y+Rc), s	4.0	5.0		5.0	4.0	5.0		5.0
Max Green Setting (Gmax), s	11.0	31.0		35.0	11.0	25.0		35.0
Max Q Clear Time (g_c+I1), s	9.5	35.0		29.3	3.1	4.1		19.5
Green Ext Time (p_c), s	0.0	0.0		2.0	0.0	0.2		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	195.2
HCM 2010 LOS	F

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	190	341	240	112	288	120	305	840	109	150	590	180
Future Volume (veh/h)	190	341	240	112	288	120	305	840	109	150	590	180
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	213	383	270	126	324	135	343	944	122	169	663	202
Adj No. of Lanes	1	2	0	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	395	451	313	304	435	177	246	1096	480	201	980	446
Arrive On Green	0.37	0.37	0.35	0.17	0.18	0.17	0.14	0.31	0.31	0.11	0.28	0.28
Sat Flow, veh/h	1774	2026	1406	1774	2430	989	1774	3539	1548	1774	3539	1567
Grp Volume(v), veh/h	213	352	301	126	234	225	343	944	122	169	663	202
Grp Sat Flow(s),veh/h/ln	1774	1863	1568	1774	1770	1649	1774	1770	1548	1774	1770	1567
Q Serve(g_s), s	12.3	22.5	23.3	8.2	16.3	16.9	18.0	32.6	7.7	12.1	21.7	13.8
Cycle Q Clear(g_c), s	12.3	22.5	23.3	8.2	16.3	16.9	18.0	32.6	7.7	12.1	21.7	13.8
Prop In Lane	1.00		0.90	1.00		0.60	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	395	415	349	304	317	295	246	1096	480	201	980	446
V/C Ratio(X)	0.54	0.85	0.86	0.41	0.74	0.76	1.40	0.86	0.25	0.84	0.68	0.45
Avail Cap(c_a), veh/h	423	444	374	409	422	393	246	1096	480	259	980	446
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.77	0.77	0.77	1.00	1.00	1.00	0.68	0.68	0.68	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.6	38.8	40.5	48.0	50.5	51.0	56.0	42.2	33.6	56.5	41.8	38.2
Incr Delay (d2), s/veh	0.9	10.8	14.1	0.3	2.8	4.0	194.5	6.3	0.9	14.2	3.7	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	12.8	11.3	4.1	8.2	8.0	22.1	17.0	3.4	6.8	11.1	6.4
LnGrp Delay(d),s/veh	36.5	49.6	54.6	48.4	53.3	55.1	250.5	48.5	34.5	70.6	45.6	41.5
LnGrp LOS	D	D	D	D	D	E	F	D	C	E	D	D
Approach Vol, veh/h		866			585			1409			1034	
Approach Delay, s/veh		48.1			52.9			96.5			48.9	
Approach LOS		D			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		26.3	22.0	40.0		31.9	17.7	44.3
Change Period (Y+Rc), s		5.0	3.5	5.0		5.0	3.5	5.0
Max Green Setting (Gmax), s		29.0	18.5	35.0		29.0	18.5	35.0
Max Q Clear Time (g_c+I1), s		18.9	20.0	23.7		25.3	14.1	34.6
Green Ext Time (p_c), s		1.0	0.0	4.2		1.5	0.1	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	66.5
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	508	317	128	180	236	144	69	561	220	122	392	338
Future Volume (veh/h)	508	317	128	180	236	144	69	561	220	122	392	338
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.81	1.00		0.76	1.00		0.93	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	598	373	151	212	278	169	81	660	259	144	461	398
Adj No. of Lanes	2	2	0	1	2	1	1	2	1	1	2	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	644	707	276	251	893	297	114	1261	753	169	1397	588
Arrive On Green	0.19	0.31	0.30	0.14	0.25	0.25	0.06	0.36	0.36	0.10	0.39	0.39
Sat Flow, veh/h	3442	2316	904	1774	3539	1210	1774	3539	1477	1774	3539	1490
Grp Volume(v), veh/h	598	282	242	212	278	169	81	660	259	144	461	398
Grp Sat Flow(s),veh/h/ln	1721	1770	1451	1774	1770	1210	1774	1770	1477	1774	1770	1490
Q Serve(g_s), s	23.6	18.2	19.2	16.1	8.8	16.9	6.2	20.4	14.7	11.0	12.5	30.5
Cycle Q Clear(g_c), s	23.6	18.2	19.2	16.1	8.8	16.9	6.2	20.4	14.7	11.0	12.5	30.5
Prop In Lane	1.00		0.62	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	644	540	443	251	893	297	114	1261	753	169	1397	588
V/C Ratio(X)	0.93	0.52	0.55	0.84	0.31	0.57	0.71	0.52	0.34	0.85	0.33	0.68
Avail Cap(c_a), veh/h	648	540	443	350	903	300	219	1261	753	257	1397	588
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.72	0.72	0.72	1.00	1.00	1.00	1.00	1.00	1.00	0.85	0.85	0.85
Uniform Delay (d), s/veh	55.2	39.6	40.1	57.7	41.9	45.7	63.3	35.1	21.0	61.5	29.1	34.5
Incr Delay (d2), s/veh	15.2	0.3	0.6	9.4	0.1	1.6	3.0	0.5	0.4	13.3	0.5	5.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.6	8.9	7.8	8.5	4.3	5.8	3.1	10.1	6.1	6.0	6.2	13.4
LnGrp Delay(d),s/veh	70.3	39.9	40.7	67.1	41.9	47.3	66.3	35.7	21.3	74.8	29.6	39.8
LnGrp LOS	E	D	D	E	D	D	E	D	C	E	C	D
Approach Vol, veh/h		1122			659			1000			1003	
Approach Delay, s/veh		56.3			51.4			34.4			40.1	
Approach LOS		E			D			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.8	37.8	11.9	58.5	22.6	45.1	17.2	53.2
Change Period (Y+Rc), s	* 4.2	* 4.2	4.0	5.0	* 4.2	* 4.2	4.0	5.0
Max Green Setting (Gmax), s	* 26	* 34	16.0	45.0	* 26	* 28	20.0	41.0
Max Q Clear Time (g_c+I1), s	25.6	18.9	8.2	32.5	18.1	21.2	13.0	22.4
Green Ext Time (p_c), s	0.0	1.1	0.1	5.2	0.3	0.9	0.2	7.7

Intersection Summary	
HCM 2010 Ctrl Delay	45.4
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1	25	77	0	0	19	0	96	0	0	0
Future Volume (veh/h)	0	1	25	77	0	0	19	0	96	0	0	0
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.93	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1710	1693	1710	1710	1598	1598	1693	1598	1710	1598	1598	1710
Adj Flow Rate, veh/h	0	1	28	100	0	0	21	0	125	0	0	0
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.77	0.90	0.77	0.90	0.77	0.77	0.77	0.77	0.90
Percent Heavy Veh, %	1	1	1	7	1	7	1	7	7	7	7	1
Cap, veh/h	0	5	140	589	0	294	280	662	549	9	94	0
Arrive On Green	0.00	0.10	0.15	0.22	0.00	0.00	0.17	0.00	0.38	0.00	0.00	0.00
Sat Flow, veh/h	0	50	1397	1084	0	1358	1612	1518	1258	1522	3116	0
Grp Volume(v), veh/h	0	0	29	100	0	0	21	0	125	0	0	0
Grp Sat Flow(s),veh/h/ln	0	0	1447	1084	0	1358	1612	1518	1258	1522	1518	0
Q Serve(g_s), s	0.0	0.0	0.3	1.3	0.0	0.0	0.2	0.0	1.2	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.3	1.6	0.0	0.0	0.2	0.0	1.2	0.0	0.0	0.0
Prop In Lane	0.00		0.97	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	0	145	651	0	294	280	662	549	9	94	0
V/C Ratio(X)	0.00	0.00	0.20	0.15	0.00	0.00	0.07	0.00	0.23	0.00	0.00	0.00
Avail Cap(c_a), veh/h	0	0	2513	2514	0	2438	467	2285	1894	352	4219	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	6.8	6.5	0.0	0.0	6.0	0.0	3.4	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.1	0.4	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	7.0	6.5	0.0	0.0	6.0	0.0	3.7	0.0	0.0	0.0
LnGrp LOS			A	A			A		A			
Approach Vol, veh/h		29			100			146			0	
Approach Delay, s/veh		7.0			6.5			4.0			0.0	
Approach LOS		A			A			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		6.7	7.0	3.5		6.7	0.0	10.5
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	4.0	5.0
Max Green Setting (Gmax), s		* 30	6.0	22.0		* 31	3.0	24.0
Max Q Clear Time (g_c+I1), s		3.6	2.2	0.0		2.3	0.0	3.2
Green Ext Time (p_c), s		0.3	0.0	0.0		0.1	0.0	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	5.2
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	307	479	286	365	53	503	42	534	9	12	77
Future Volume (veh/h)	15	307	479	286	365	53	503	42	534	9	12	77
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.86	1.00		0.90	1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1644	1644	1644	1644	1644	1710	1644	1644	1644	1644	1644	1644
Adj Flow Rate, veh/h	20	404	121	376	480	70	662	55	246	12	16	0
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	57	928	357	460	1117	162	772	405	333	278	535	239
Arrive On Green	0.04	0.30	0.30	0.15	0.41	0.41	0.25	0.25	0.25	0.18	0.17	0.00
Sat Flow, veh/h	1566	3124	1202	3038	2694	390	3038	1644	1352	1566	3124	1398
Grp Volume(v), veh/h	20	404	121	376	277	273	662	55	246	12	16	0
Grp Sat Flow(s),veh/h/ln	1566	1562	1202	1519	1562	1522	1519	1644	1352	1566	1562	1398
Q Serve(g_s), s	1.2	10.1	7.6	11.6	12.2	12.4	20.1	2.5	13.6	0.6	0.4	0.0
Cycle Q Clear(g_c), s	1.2	10.1	7.6	11.6	12.2	12.4	20.1	2.5	13.6	0.6	0.4	0.0
Prop In Lane	1.00		1.00	1.00		0.26	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	57	928	357	460	647	631	772	405	333	278	535	239
V/C Ratio(X)	0.35	0.44	0.34	0.82	0.43	0.43	0.86	0.14	0.74	0.04	0.03	0.00
Avail Cap(c_a), veh/h	146	1129	434	470	661	644	1004	849	698	291	1161	519
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	45.6	27.5	26.6	39.8	20.2	20.3	34.4	28.5	23.6	33.0	33.4	0.0
Incr Delay (d2), s/veh	1.4	0.1	0.2	9.9	0.2	0.2	4.9	0.2	4.6	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	4.4	2.5	5.5	5.3	5.3	9.0	1.2	5.5	0.3	0.2	0.0
LnGrp Delay(d),s/veh	47.0	27.6	26.8	49.7	20.3	20.4	39.3	28.7	28.1	33.1	33.5	0.0
LnGrp LOS	D	C	C	D	C	C	D	C	C	C	C	
Approach Vol, veh/h		545			926			963			28	
Approach Delay, s/veh		28.1			32.3			35.9			33.3	
Approach LOS		C			C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.5	43.1	27.6	19.6	17.9	31.8	20.4	26.8
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	3.2	14.4	22.1	2.4	13.6	12.1	2.6	15.6
Green Ext Time (p_c), s	0.0	1.3	1.5	0.1	0.1	1.5	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	32.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	143	67	10	20	103	752	30	320	120	723	30	178
Future Volume (veh/h)	143	67	10	20	103	752	30	320	120	723	30	178
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.98		0.93	1.00		0.96	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1845	1900	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	168	79	12	24	121	885	35	376	141	876	0	209
Adj No. of Lanes	1	2	0	1	1	1	0	2	0	2	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	346	1022	151	483	527	869	49	539	213	1012	0	442
Arrive On Green	0.09	0.34	0.33	0.04	0.29	0.29	0.23	0.23	0.22	0.29	0.00	0.29
Sat Flow, veh/h	1757	3046	451	1757	1845	1459	212	2332	921	3514	0	1535
Grp Volume(v), veh/h	168	45	46	24	121	885	302	0	250	876	0	209
Grp Sat Flow(s),veh/h/ln	1757	1752	1745	1757	1845	1459	1834	0	1631	1757	0	1535
Q Serve(g_s), s	7.5	2.0	2.1	1.1	5.8	33.0	17.5	0.0	16.1	27.3	0.0	13.0
Cycle Q Clear(g_c), s	7.5	2.0	2.1	1.1	5.8	33.0	17.5	0.0	16.1	27.3	0.0	13.0
Prop In Lane	1.00		0.26	1.00		1.00	0.12		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	346	588	585	483	527	869	424	0	377	1012	0	442
V/C Ratio(X)	0.49	0.08	0.08	0.05	0.23	1.02	0.71	0.00	0.66	0.87	0.00	0.47
Avail Cap(c_a), veh/h	369	588	585	593	527	869	588	0	523	1126	0	492
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	26.2	26.3	27.2	31.5	17.5	40.8	0.0	40.5	39.0	0.0	33.9
Incr Delay (d2), s/veh	0.4	0.0	0.0	0.0	0.1	35.3	1.1	0.0	0.7	6.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	1.0	1.0	0.5	3.0	36.0	9.0	0.0	7.3	14.1	0.0	5.5
LnGrp Delay(d),s/veh	24.9	26.2	26.3	27.2	31.6	52.8	41.9	0.0	41.3	45.1	0.0	34.2
LnGrp LOS	C	C	C	C	C	F	D		D	D		C
Approach Vol, veh/h		259			1030			552			1085	
Approach Delay, s/veh		25.4			49.7			41.6			43.0	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.5	36.0		36.3	7.8	41.7		29.7
Change Period (Y+Rc), s	4.0	5.0		5.0	4.0	5.0		5.0
Max Green Setting (Gmax), s	11.0	31.0		35.0	11.0	25.0		35.0
Max Q Clear Time (g_c+I1), s	9.5	35.0		29.3	3.1	4.1		19.5
Green Ext Time (p_c), s	0.0	0.0		2.0	0.0	0.2		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	43.6
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

CONSTRUCTION ALTERNATIVE 2 CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Future Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.66	1.00		0.84	1.00		0.94	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	11	268	40	176	317	41	263	280	160	56	237	22
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	27	841	249	278	934	118	294	1365	684	118	1270	530
Arrive On Green	0.02	0.24	0.24	0.08	0.31	0.31	0.17	0.46	0.46	0.07	0.36	0.36
Sat Flow, veh/h	1757	3505	1037	3408	3053	387	1757	2951	1480	1757	3505	1462
Grp Volume(v), veh/h	11	268	40	176	179	179	263	280	160	56	237	22
Grp Sat Flow(s),veh/h/ln	1757	1752	1037	1704	1752	1688	1757	1476	1480	1757	1752	1462
Q Serve(g_s), s	0.7	6.9	3.4	5.5	8.7	9.0	16.1	6.2	7.2	3.4	5.1	1.1
Cycle Q Clear(g_c), s	0.7	6.9	3.4	5.5	8.7	9.0	16.1	6.2	7.2	3.4	5.1	1.1
Prop In Lane	1.00		1.00	1.00		0.23	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	27	841	249	278	536	516	294	1365	684	118	1270	530
V/C Ratio(X)	0.40	0.32	0.16	0.63	0.33	0.35	0.90	0.21	0.23	0.48	0.19	0.04
Avail Cap(c_a), veh/h	128	949	281	279	536	516	431	1365	684	208	1270	530
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	53.6	34.4	33.0	48.9	29.5	29.6	44.9	17.6	17.8	49.4	24.0	22.7
Incr Delay (d2), s/veh	3.5	0.1	0.1	3.5	0.1	0.1	11.8	0.3	0.8	1.1	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.4	1.0	2.7	4.2	4.2	8.8	2.6	3.1	1.7	2.5	0.5
LnGrp Delay(d),s/veh	57.1	34.5	33.2	52.5	29.7	29.8	56.7	17.9	18.6	50.5	24.3	22.9
LnGrp LOS	E	C	C	D	C	C	E	B	B	D	C	C
Approach Vol, veh/h		319			534			703			315	
Approach Delay, s/veh		35.1			37.2			32.6			28.9	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	37.8	22.4	44.1	13.0	30.6	11.4	55.1
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.7	11.0	18.1	7.1	7.5	8.9	5.4	9.2
Green Ext Time (p_c), s	0.0	2.7	0.3	5.6	0.0	1.3	0.0	6.5

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Future Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.91		1.00	0.91		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	7	0	0	6	0	0	11	305	12	15	327	10
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	325	0	0	325	0	48	15	834	33	21	848	26
Arrive On Green	0.03	0.00	0.00	0.03	0.00	0.00	0.01	0.47	0.47	0.01	0.48	0.48
Sat Flow, veh/h	1307	0	0	1318	0	1568	1757	1759	69	1757	1778	54
Grp Volume(v), veh/h	7	0	0	6	0	0	11	0	317	15	0	337
Grp Sat Flow(s),veh/h/ln	1307	0	0	1318	0	1568	1757	0	1829	1757	0	1832
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.04	1.00		0.03
Lane Grp Cap(c), veh/h	325	0	0	325	0	48	15	0	867	21	0	874
V/C Ratio(X)	0.02	0.00	0.00	0.02	0.00	0.00	0.71	0.00	0.37	0.72	0.00	0.39
Avail Cap(c_a), veh/h	1544	0	0	1546	0	1554	1741	0	2465	1741	0	2543
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.9	0.0	0.0	11.9	0.0	0.0	12.5	0.0	4.2	12.4	0.0	4.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	0.4	15.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.4	0.2	0.0	1.5
LnGrp Delay(d),s/veh	11.9	0.0	0.0	11.9	0.0	0.0	32.3	0.0	4.6	28.2	0.0	4.6
LnGrp LOS	B			B			C		A	C		A
Approach Vol, veh/h		7			6			328			352	
Approach Delay, s/veh		11.9			11.9			5.5			5.6	
Approach LOS		B			B			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		5.0	3.2	17.0		5.0	3.3	17.0				
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0				
Max Green Setting (Gmax), s		* 25	25.0	35.0		* 25	25.0	34.0				
Max Q Clear Time (g_c+I1), s		2.1	2.2	5.0		2.1	2.2	4.8				
Green Ext Time (p_c), s		0.0	0.0	6.4		0.0	0.0	6.4				
Intersection Summary												
HCM 2010 Ctrl Delay			5.7									
HCM 2010 LOS			A									
Notes												

User approved pedestrian interval to be less than phase max green.
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Future Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.99	0.97		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	9	8	2	7	0	0	38	276	7	24	321	24
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	301	32	65	390	0	65	50	804	20	33	743	56
Arrive On Green	0.04	0.04	0.04	0.04	0.00	0.00	0.03	0.45	0.45	0.02	0.44	0.44
Sat Flow, veh/h	860	765	1552	1042	0	1568	1757	1789	45	1757	1690	126
Grp Volume(v), veh/h	17	0	2	7	0	0	38	0	283	24	0	345
Grp Sat Flow(s),veh/h/ln	1625	0	1552	1042	0	1568	1757	0	1835	1757	0	1817
Q Serve(g_s), s	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	2.1	0.3	0.0	2.7
Cycle Q Clear(g_c), s	0.2	0.0	0.0	0.3	0.0	0.0	0.4	0.0	2.1	0.3	0.0	2.7
Prop In Lane	0.53		1.00	1.00		1.00	1.00		0.02	1.00		0.07
Lane Grp Cap(c), veh/h	332	0	65	390	0	65	50	0	824	33	0	798
V/C Ratio(X)	0.05	0.00	0.03	0.02	0.00	0.00	0.76	0.00	0.34	0.73	0.00	0.43
Avail Cap(c_a), veh/h	3471	0	3208	3108	0	3242	2957	0	2646	2957	0	2621
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.6	0.0	9.6	9.8	0.0	0.0	10.0	0.0	3.7	10.2	0.0	4.0
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.0	8.5	0.0	0.2	11.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.1	0.2	0.0	1.4
LnGrp Delay(d),s/veh	9.7	0.0	9.6	9.8	0.0	0.0	18.6	0.0	4.0	21.1	0.0	4.4
LnGrp LOS	A		A	A			B		A	C		A
Approach Vol, veh/h		19			7			321			369	
Approach Delay, s/veh		9.7			9.8			5.7			5.5	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.9	3.6	13.3		3.9	3.4	13.5
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.3	2.4	4.7		2.2	2.3	4.1
Green Ext Time (p_c), s		0.1	0.0	4.1		0.1	0.0	4.1

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Future Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		1.00	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	28	0	0	0	0	0	44	247	0	0	345	27
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	38	0	0	0	9	0	800	1774	0	0	1536	120
Arrive On Green	0.02	0.00	0.00	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.51	0.51
Sat Flow, veh/h	1736	0	0	0	1845	0	992	3597	0	0	3403	236
Grp Volume(v), veh/h	28	0	0	0	0	0	44	247	0	0	167	205
Grp Sat Flow(s),veh/h/ln	1736	0	0	0	1845	0	992	1752	0	0	1476	1795
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	1.3	1.3
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.0	0.0	0.0	1.8	0.7	0.0	0.0	1.3	1.3
Prop In Lane	1.00		0.00	0.00		0.00	1.00		0.00	0.00		0.13
Lane Grp Cap(c), veh/h	38	0	0	0	9	0	800	1774	0	0	747	908
V/C Ratio(X)	0.75	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.22	0.23
Avail Cap(c_a), veh/h	2877	0	0	0	2224	0	1942	5810	0	0	2446	2975
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.7	0.0	0.0	0.0	0.0	0.0	3.2	2.6	0.0	0.0	2.7	2.7
Incr Delay (d2), s/veh	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.6	0.7
LnGrp Delay(d),s/veh	34.7	0.0	0.0	0.0	0.0	0.0	3.3	2.7	0.0	0.0	2.9	2.9
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		28			0			291			372	
Approach Delay, s/veh		34.7			0.0			2.8			2.9	
Approach LOS		C						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		15.3		4.6		15.3		0.0
Change Period (Y+Rc), s		* 5.2		* 4.2		* 5.2		4.2
Max Green Setting (Gmax), s		* 33		* 33		* 33		24.0
Max Q Clear Time (g_c+I1), s		3.8		2.3		3.3		0.0
Green Ext Time (p_c), s		6.3		0.1		6.3		0.0

Intersection Summary			
HCM 2010 Ctrl Delay			4.1
HCM 2010 LOS			A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Future Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94	1.00		0.98	1.00		0.95	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	44	255	38	80	466	28	55	148	12	33	254	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	56	434	63	827	1982	119	71	293	975	80	320	260
Arrive On Green	0.03	0.14	0.14	0.47	0.59	0.59	0.04	0.16	0.16	0.05	0.17	0.17
Sat Flow, veh/h	1757	3038	445	1757	3355	201	1757	1845	1491	1757	1845	1499
Grp Volume(v), veh/h	44	145	148	80	243	251	55	148	12	33	254	5
Grp Sat Flow(s),veh/h/ln	1757	1752	1731	1757	1752	1804	1757	1845	1491	1757	1845	1499
Q Serve(g_s), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Cycle Q Clear(g_c), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	56	250	247	827	1035	1066	71	293	975	80	320	260
V/C Ratio(X)	0.78	0.58	0.60	0.10	0.23	0.24	0.78	0.51	0.01	0.41	0.79	0.02
Avail Cap(c_a), veh/h	176	478	472	827	1035	1066	192	570	1199	128	503	409
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	44.1	44.2	16.1	10.7	10.7	52.3	42.3	7.6	51.1	43.6	37.7
Incr Delay (d2), s/veh	20.5	3.0	3.3	0.1	0.5	0.5	15.9	1.3	0.0	3.3	4.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	4.3	4.5	1.3	3.7	3.8	2.0	4.2	0.1	1.0	7.8	0.1
LnGrp Delay(d),s/veh	73.4	47.1	47.5	16.2	11.2	11.2	68.2	43.6	7.6	54.4	48.2	37.7
LnGrp LOS	E	D	D	B	B	B	E	D	A	D	D	D
Approach Vol, veh/h		337			574			215			292	
Approach Delay, s/veh		50.7			11.9			47.9			48.8	
Approach LOS		D			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	70.0	8.4	24.1	56.8	20.7	10.0	22.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	4.7	9.3	5.4	16.5	4.8	10.8	4.0	15.1
Green Ext Time (p_c), s	0.0	4.8	0.0	1.3	3.8	2.2	0.6	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Future Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.80	1.00		0.89	1.00		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	31	320	94	188	380	74	264	458	128	101	178	2
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	55	911	326	260	881	169	419	676	336	314	599	247
Arrive On Green	0.03	0.26	0.26	0.08	0.31	0.31	0.24	0.23	0.23	0.18	0.17	0.17
Sat Flow, veh/h	1757	3505	1254	3408	2873	550	1757	2951	1469	1757	3505	1442
Grp Volume(v), veh/h	31	320	94	188	229	225	264	458	128	101	178	2
Grp Sat Flow(s),veh/h/ln	1757	1752	1254	1704	1752	1671	1757	1476	1469	1757	1752	1442
Q Serve(g_s), s	2.3	9.7	7.8	7.0	13.6	14.0	17.5	18.4	6.8	6.5	5.8	0.1
Cycle Q Clear(g_c), s	2.3	9.7	7.8	7.0	13.6	14.0	17.5	18.4	6.8	6.5	5.8	0.1
Prop In Lane	1.00		1.00	1.00		0.33	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	55	911	326	260	538	512	419	676	336	314	599	247
V/C Ratio(X)	0.57	0.35	0.29	0.72	0.43	0.44	0.63	0.68	0.38	0.32	0.30	0.01
Avail Cap(c_a), veh/h	108	911	326	367	538	512	419	1108	552	314	938	386
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	62.1	39.2	38.5	58.7	35.9	36.1	44.4	45.7	21.6	46.5	47.1	20.5
Incr Delay (d2), s/veh	3.4	1.1	2.2	1.8	2.5	2.7	7.0	1.7	1.0	0.2	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	4.8	2.9	3.4	6.9	6.9	9.3	7.7	2.9	3.2	2.8	0.0
LnGrp Delay(d),s/veh	65.5	40.2	40.7	60.5	38.4	38.8	51.4	47.4	22.6	46.7	47.4	20.5
LnGrp LOS	E	D	D	E	D	D	D	D	C	D	D	C
Approach Vol, veh/h		445			642			850			281	
Approach Delay, s/veh		42.1			45.0			44.9			47.0	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	44.1	35.0	26.4	14.1	38.0	27.5	34.0
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	4.3	16.0	19.5	7.8	9.0	11.7	8.5	20.4
Green Ext Time (p_c), s	0.0	2.2	0.3	1.0	0.9	1.6	0.9	5.4

Intersection Summary	
HCM 2010 Ctrl Delay	44.6
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Future Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.90		0.93	0.90		0.93	1.00		0.94	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	13	1	3	14	0	5	7	507	60	36	292	11
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	252	28	23	317	0	136	10	881	104	44	1000	38
Arrive On Green	0.09	0.09	0.09	0.09	0.00	0.09	0.01	0.55	0.55	0.03	0.57	0.57
Sat Flow, veh/h	839	303	245	1290	0	1459	1757	1607	190	1757	1762	66
Grp Volume(v), veh/h	17	0	0	14	0	5	7	0	567	36	0	303
Grp Sat Flow(s),veh/h/ln	1388	0	0	1290	0	1459	1757	0	1798	1757	0	1828
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.3	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Prop In Lane	0.76		0.18	1.00		1.00	1.00		0.11	1.00		0.04
Lane Grp Cap(c), veh/h	303	0	0	317	0	136	10	0	986	44	0	1038
V/C Ratio(X)	0.06	0.00	0.00	0.04	0.00	0.04	0.71	0.00	0.58	0.82	0.00	0.29
Avail Cap(c_a), veh/h	1615	0	0	1574	0	1593	1439	0	2454	1439	0	2496
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	0.0	15.2	0.0	15.1	18.2	0.0	5.5	17.8	0.0	4.1
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	29.0	0.0	0.8	12.6	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	3.8	0.5	0.0	1.6
LnGrp Delay(d),s/veh	15.2	0.0	0.0	15.2	0.0	15.1	47.1	0.0	6.2	30.4	0.0	4.3
LnGrp LOS	B			B		B	D		A	C		A
Approach Vol, veh/h		17			19			574			339	
Approach Delay, s/veh		15.2			15.2			6.7			7.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.6	3.2	25.8		7.6	3.9	25.1
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 40	30.0	50.0		* 40	30.0	50.0
Max Q Clear Time (g_c+I1), s		2.3	2.1	5.1		2.3	2.7	9.6
Green Ext Time (p_c), s		0.1	0.0	10.5		0.1	0.0	10.2

Intersection Summary			
HCM 2010 Ctrl Delay			7.2
HCM 2010 LOS			A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Future Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.92		0.92	0.93		1.00	1.00		0.93	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	54	24	20	28	25	-5	84	477	29	36	184	31
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	442	171	474	352	276	515	107	700	43	43	565	95
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.00	0.06	0.41	0.41	0.02	0.37	0.37
Sat Flow, veh/h	910	521	1441	679	840	1568	1757	1713	104	1757	1519	256
Grp Volume(v), veh/h	78	0	20	53	0	-5	84	0	506	36	0	215
Grp Sat Flow(s),veh/h/ln	1431	0	1441	1519	0	1568	1757	0	1817	1757	0	1775
Q Serve(g_s), s	0.5	0.0	0.4	0.0	0.0	0.0	2.0	0.0	9.8	0.9	0.0	3.7
Cycle Q Clear(g_c), s	1.4	0.0	0.4	0.8	0.0	0.0	2.0	0.0	9.8	0.9	0.0	3.7
Prop In Lane	0.69		1.00	0.53		1.00	1.00		0.06	1.00		0.14
Lane Grp Cap(c), veh/h	613	0	474	628	0	515	107	0	742	43	0	660
V/C Ratio(X)	0.13	0.00	0.04	0.08	0.00	-0.01	0.79	0.00	0.68	0.84	0.00	0.33
Avail Cap(c_a), veh/h	1564	0	1451	1625	0	1578	1439	0	1276	1439	0	1246
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.1	0.0	9.8	9.9	0.0	0.0	19.8	0.0	10.4	20.8	0.0	9.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	1.1	14.6	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.2	0.4	0.0	0.0	1.1	0.0	5.0	0.6	0.0	1.8
LnGrp Delay(d),s/veh	10.1	0.0	9.8	9.9	0.0	0.0	24.5	0.0	11.5	35.4	0.0	9.9
LnGrp LOS	B		A	A			C		B	D		A
Approach Vol, veh/h		98			48			590			251	
Approach Delay, s/veh		10.0			11.0			13.3			13.5	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.0	5.6	20.1		17.0	4.0	21.6
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.8	4.0	5.7		3.4	2.9	11.8
Green Ext Time (p_c), s		0.6	0.1	4.9		0.6	0.0	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	12.9
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Future Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.80		0.66	1.00		1.00	0.92		1.00	1.00		0.85
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	149	0	46	0	0	0	56	522	0	0	226	50
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	205	0	63	0	6	0	629	1564	0	0	1143	244
Arrive On Green	0.21	0.00	0.21	0.00	0.00	0.00	0.45	0.45	0.00	0.00	0.45	0.45
Sat Flow, veh/h	988	0	305	0	1845	0	997	3597	0	0	2931	548
Grp Volume(v), veh/h	195	0	0	0	0	0	56	522	0	0	127	149
Grp Sat Flow(s),veh/h/ln	1293	0	0	0	1845	0	997	1752	0	0	1476	1634
Q Serve(g_s), s	4.2	0.0	0.0	0.0	0.0	0.0	1.1	2.9	0.0	0.0	1.6	1.7
Cycle Q Clear(g_c), s	4.2	0.0	0.0	0.0	0.0	0.0	2.8	2.9	0.0	0.0	1.6	1.7
Prop In Lane	0.76		0.24	0.00		0.00	1.00		0.00	0.00		0.34
Lane Grp Cap(c), veh/h	269	0	0	0	6	0	629	1564	0	0	658	729
V/C Ratio(X)	0.73	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.00	0.00	0.19	0.20
Avail Cap(c_a), veh/h	1419	0	0	0	1491	0	1245	3730	0	0	1571	1739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	11.1	0.0	0.0	0.0	0.0	0.0	5.9	5.4	0.0	0.0	5.0	5.1
Incr Delay (d2), s/veh	3.7	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	0.0	0.0	0.0	0.3	1.4	0.0	0.0	0.7	0.8
LnGrp Delay(d),s/veh	14.8	0.0	0.0	0.0	0.0	0.0	6.0	5.6	0.0	0.0	5.2	5.3
LnGrp LOS	B						A	A			A	A
Approach Vol, veh/h		195			0			578			276	
Approach Delay, s/veh		14.8			0.0			5.6			5.3	
Approach LOS		B						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.6		10.5		19.6		0.0
Change Period (Y+Rc), s		* 6.2		* 4.2		* 6.2		4.2
Max Green Setting (Gmax), s		* 32		* 33		* 32		24.3
Max Q Clear Time (g_c+I1), s		4.9		6.2		3.7		0.0
Green Ext Time (p_c), s		8.5		1.5		8.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	7.2
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Future Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	1.00		0.83	1.00		0.83	1.00		0.69
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	130	472	64	89	424	43	139	331	96	55	146	38
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	193	681	91	112	548	55	332	610	529	71	322	188
Arrive On Green	0.11	0.23	0.23	0.06	0.17	0.17	0.19	0.33	0.33	0.04	0.17	0.17
Sat Flow, veh/h	1757	2992	400	1757	3149	316	1757	1845	1297	1757	1845	1079
Grp Volume(v), veh/h	130	274	262	89	234	233	139	331	96	55	146	38
Grp Sat Flow(s),veh/h/ln	1757	1752	1640	1757	1752	1713	1757	1845	1297	1757	1845	1079
Q Serve(g_s), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Cycle Q Clear(g_c), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Prop In Lane	1.00		0.24	1.00		0.18	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	193	399	373	112	305	298	332	610	529	71	322	188
V/C Ratio(X)	0.68	0.69	0.70	0.80	0.77	0.78	0.42	0.54	0.18	0.78	0.45	0.20
Avail Cap(c_a), veh/h	270	499	467	270	499	487	332	610	529	162	511	299
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.79	0.79	0.79	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.6	46.0	46.2	60.0	51.2	51.4	46.4	35.5	25.7	61.8	48.1	45.9
Incr Delay (d2), s/veh	4.1	3.6	4.3	11.9	5.7	6.3	0.7	2.7	0.6	16.5	1.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	9.4	9.1	3.5	8.5	8.6	4.5	10.1	2.3	2.3	4.8	1.2
LnGrp Delay(d),s/veh	59.7	49.6	50.5	72.0	56.9	57.7	47.1	38.2	26.3	78.3	49.1	46.5
LnGrp LOS	E	D	D	E	E	E	D	D	C	E	D	D
Approach Vol, veh/h		666			556			566			239	
Approach Delay, s/veh		51.9			59.6			38.4			55.4	
Approach LOS		D			E			D			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	19.3	27.6	29.6	27.7	12.3	34.6	9.2	48.0				
Change Period (Y+Rc), s	5.0	* 5	5.0	* 5	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	20.0	* 37	19.0	* 36	20.0	37.0	12.0	43.0				
Max Q Clear Time (g_c+I1), s	11.2	18.9	11.1	11.2	8.5	21.1	6.0	21.0				
Green Ext Time (p_c), s	3.1	3.7	1.8	1.0	0.1	4.4	0.0	2.8				
Intersection Summary												
HCM 2010 Ctrl Delay			50.7									
HCM 2010 LOS			D									
Notes												

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Future Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.80	1.00		0.84	1.00		0.94	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	11	268	40	176	317	41	263	280	160	56	237	22
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	27	842	300	278	934	118	294	1535	684	118	1269	529
Arrive On Green	0.02	0.24	0.24	0.08	0.31	0.31	0.17	0.46	0.46	0.07	0.36	0.36
Sat Flow, veh/h	1757	3505	1250	3408	3053	387	1757	3320	1480	1757	3505	1462
Grp Volume(v), veh/h	11	268	40	176	179	179	263	280	160	56	237	22
Grp Sat Flow(s),veh/h/ln	1757	1752	1250	1704	1752	1688	1757	1660	1480	1757	1752	1462
Q Serve(g_s), s	0.7	6.9	2.8	5.5	8.7	9.0	16.1	5.4	7.2	3.4	5.1	1.1
Cycle Q Clear(g_c), s	0.7	6.9	2.8	5.5	8.7	9.0	16.1	5.4	7.2	3.4	5.1	1.1
Prop In Lane	1.00		1.00	1.00		0.23	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	27	842	300	278	536	517	294	1535	684	118	1269	529
V/C Ratio(X)	0.40	0.32	0.13	0.63	0.33	0.35	0.90	0.18	0.23	0.48	0.19	0.04
Avail Cap(c_a), veh/h	128	949	339	279	536	517	431	1535	684	208	1269	529
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	53.6	34.4	32.8	48.9	29.5	29.6	44.9	17.4	17.8	49.4	24.0	22.7
Incr Delay (d2), s/veh	3.5	0.1	0.1	3.5	0.1	0.1	11.8	0.3	0.8	1.1	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.4	1.0	2.7	4.2	4.2	8.8	2.5	3.1	1.7	2.5	0.5
LnGrp Delay(d),s/veh	57.1	34.5	32.9	52.5	29.6	29.8	56.7	17.6	18.6	50.5	24.3	22.9
LnGrp LOS	E	C	C	D	C	C	E	B	B	D	C	C
Approach Vol, veh/h		319			534			703			315	
Approach Delay, s/veh		35.0			37.2			32.5			28.9	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	37.9	22.4	44.0	13.0	30.6	11.4	55.0
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.7	11.0	18.1	7.1	7.5	8.9	5.4	9.2
Green Ext Time (p_c), s	0.0	2.6	0.3	5.6	0.0	1.2	0.0	6.5

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Future Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.91		1.00	0.91		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	7	0	0	6	0	0	11	305	12	15	327	10
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	325	0	0	325	0	48	15	834	33	21	848	26
Arrive On Green	0.03	0.00	0.00	0.03	0.00	0.00	0.01	0.47	0.47	0.01	0.48	0.48
Sat Flow, veh/h	1307	0	0	1318	0	1568	1757	1759	69	1757	1778	54
Grp Volume(v), veh/h	7	0	0	6	0	0	11	0	317	15	0	337
Grp Sat Flow(s),veh/h/ln	1307	0	0	1318	0	1568	1757	0	1829	1757	0	1832
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.04	1.00		0.03
Lane Grp Cap(c), veh/h	325	0	0	325	0	48	15	0	867	21	0	874
V/C Ratio(X)	0.02	0.00	0.00	0.02	0.00	0.00	0.71	0.00	0.37	0.72	0.00	0.39
Avail Cap(c_a), veh/h	1544	0	0	1546	0	1554	1741	0	2465	1741	0	2543
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.9	0.0	0.0	11.9	0.0	0.0	12.5	0.0	4.2	12.4	0.0	4.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	0.4	15.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.4	0.2	0.0	1.5
LnGrp Delay(d),s/veh	11.9	0.0	0.0	11.9	0.0	0.0	32.3	0.0	4.6	28.2	0.0	4.6
LnGrp LOS	B			B			C		A	C		A
Approach Vol, veh/h		7			6			328			352	
Approach Delay, s/veh		11.9			11.9			5.5			5.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.0	3.2	17.0		5.0	3.3	17.0
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 25	25.0	35.0		* 25	25.0	34.0
Max Q Clear Time (g_c+I1), s		2.1	2.2	5.0		2.1	2.2	4.8
Green Ext Time (p_c), s		0.0	0.0	6.4		0.0	0.0	6.4

Intersection Summary		
HCM 2010 Ctrl Delay		5.7
HCM 2010 LOS		A

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Future Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.99	0.97		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	9	8	2	7	0	0	38	276	7	24	321	24
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	306	32	65	397	0	65	50	786	20	33	792	648
Arrive On Green	0.04	0.04	0.04	0.04	0.00	0.00	0.03	0.44	0.44	0.02	0.43	0.43
Sat Flow, veh/h	860	765	1552	1042	0	1568	1757	1789	45	1757	1845	1510
Grp Volume(v), veh/h	17	0	2	7	0	0	38	0	283	24	321	24
Grp Sat Flow(s),veh/h/ln	1625	0	1552	1042	0	1568	1757	0	1834	1757	1845	1510
Q Serve(g_s), s	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	2.1	0.3	2.5	0.2
Cycle Q Clear(g_c), s	0.2	0.0	0.0	0.3	0.0	0.0	0.4	0.0	2.1	0.3	2.5	0.2
Prop In Lane	0.53		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	338	0	65	397	0	65	50	0	806	33	792	648
V/C Ratio(X)	0.05	0.00	0.03	0.02	0.00	0.00	0.76	0.00	0.35	0.73	0.41	0.04
Avail Cap(c_a), veh/h	3542	0	3274	3172	0	3308	3017	0	2700	3017	2715	2223
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.4	0.0	9.4	9.6	0.0	0.0	9.8	0.0	3.8	9.9	4.0	3.4
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.0	8.4	0.0	0.3	10.9	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.1	0.2	1.2	0.1
LnGrp Delay(d),s/veh	9.5	0.0	9.4	9.6	0.0	0.0	18.3	0.0	4.1	20.9	4.4	3.4
LnGrp LOS	A		A	A			B		A	C	A	A
Approach Vol, veh/h		19			7			321			369	
Approach Delay, s/veh		9.5			9.6			5.7			5.4	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.9	3.6	13.0		3.9	3.4	13.2
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.3	2.4	4.5		2.2	2.3	4.1
Green Ext Time (p_c), s		0.1	0.0	4.0		0.1	0.0	4.0

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Future Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		1.00	0.99		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	28	0	0	0	0	0	44	247	0	0	345	27
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	38	0	0	0	9	0	803	1768	0	0	1615	126
Arrive On Green	0.02	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.50	0.50
Sat Flow, veh/h	1736	0	0	0	1845	0	991	3597	0	0	3387	249
Grp Volume(v), veh/h	28	0	0	0	0	0	44	247	0	0	178	194
Grp Sat Flow(s),veh/h/ln	1736	0	0	0	1845	0	991	1752	0	0	1660	1792
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	1.2	1.2
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.0	0.0	0.0	1.7	0.7	0.0	0.0	1.2	1.2
Prop In Lane	1.00		0.00	0.00		0.00	1.00		0.00	0.00		0.14
Lane Grp Cap(c), veh/h	38	0	0	0	9	0	803	1768	0	0	837	904
V/C Ratio(X)	0.75	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.21	0.21
Avail Cap(c_a), veh/h	2889	0	0	0	2232	0	1953	5832	0	0	2763	2982
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.6	0.0	0.0	0.0	0.0	0.0	3.2	2.6	0.0	0.0	2.7	2.7
Incr Delay (d2), s/veh	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.5	0.6
LnGrp Delay(d),s/veh	34.6	0.0	0.0	0.0	0.0	0.0	3.2	2.7	0.0	0.0	2.9	2.9
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		28			0			291			372	
Approach Delay, s/veh		34.6			0.0			2.8			2.9	
Approach LOS		C						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		15.2		4.6		15.2		0.0
Change Period (Y+Rc), s		* 5.2		* 4.2		* 5.2		4.2
Max Green Setting (Gmax), s		* 33		* 33		* 33		24.0
Max Q Clear Time (g_c+I1), s		3.7		2.3		3.2		0.0
Green Ext Time (p_c), s		6.3		0.1		6.3		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	4.1
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Future Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94	1.00		0.98	1.00		0.95	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	44	255	38	80	466	28	55	148	12	33	254	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	56	434	63	827	1982	119	71	293	975	80	320	260
Arrive On Green	0.03	0.14	0.14	0.47	0.59	0.59	0.04	0.16	0.16	0.05	0.17	0.17
Sat Flow, veh/h	1757	3038	445	1757	3355	201	1757	1845	1491	1757	1845	1499
Grp Volume(v), veh/h	44	145	148	80	243	251	55	148	12	33	254	5
Grp Sat Flow(s),veh/h/ln	1757	1752	1731	1757	1752	1804	1757	1845	1491	1757	1845	1499
Q Serve(g_s), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Cycle Q Clear(g_c), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	56	250	247	827	1035	1066	71	293	975	80	320	260
V/C Ratio(X)	0.78	0.58	0.60	0.10	0.23	0.24	0.78	0.51	0.01	0.41	0.79	0.02
Avail Cap(c_a), veh/h	176	478	472	827	1035	1066	192	570	1199	128	503	409
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	44.1	44.2	16.1	10.7	10.7	52.3	42.3	7.6	51.1	43.6	37.7
Incr Delay (d2), s/veh	20.5	3.0	3.3	0.1	0.5	0.5	15.9	1.3	0.0	3.3	4.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	4.3	4.5	1.3	3.7	3.8	2.0	4.2	0.1	1.0	7.8	0.1
LnGrp Delay(d),s/veh	73.4	47.1	47.5	16.2	11.2	11.2	68.1	43.6	7.6	54.4	48.2	37.7
LnGrp LOS	E	D	D	B	B	B	E	D	A	D	D	D
Approach Vol, veh/h		337			574			215			292	
Approach Delay, s/veh		50.7			11.9			47.9			48.8	
Approach LOS		D			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	70.0	8.4	24.1	56.8	20.7	10.0	22.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	4.7	9.3	5.4	16.5	4.8	10.8	4.0	15.1
Green Ext Time (p_c), s	0.0	4.8	0.0	1.3	3.8	2.2	0.6	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Future Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.88	1.00		0.89	1.00		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	31	320	94	188	380	74	264	458	128	101	178	2
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	55	911	359	260	881	169	419	747	330	321	599	247
Arrive On Green	0.03	0.26	0.26	0.08	0.31	0.31	0.24	0.22	0.22	0.18	0.17	0.17
Sat Flow, veh/h	1757	3505	1380	3408	2873	550	1757	3320	1468	1757	3505	1442
Grp Volume(v), veh/h	31	320	94	188	229	225	264	458	128	101	178	2
Grp Sat Flow(s),veh/h/ln	1757	1752	1380	1704	1752	1671	1757	1660	1468	1757	1752	1442
Q Serve(g_s), s	2.3	9.7	7.0	7.0	13.6	14.0	17.5	16.1	6.9	6.5	5.8	0.1
Cycle Q Clear(g_c), s	2.3	9.7	7.0	7.0	13.6	14.0	17.5	16.1	6.9	6.5	5.8	0.1
Prop In Lane	1.00		1.00	1.00		0.33	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	55	911	359	260	538	512	419	747	330	321	599	247
V/C Ratio(X)	0.57	0.35	0.26	0.72	0.43	0.44	0.63	0.61	0.39	0.31	0.30	0.01
Avail Cap(c_a), veh/h	108	911	359	367	538	512	419	1246	551	321	938	386
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	62.1	39.2	38.2	58.7	35.9	36.1	44.4	45.3	21.9	46.0	47.1	20.5
Incr Delay (d2), s/veh	3.4	1.1	1.8	1.8	2.5	2.7	7.0	1.2	1.1	0.2	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	4.8	2.8	3.4	6.9	6.9	9.3	7.5	2.9	3.2	2.8	0.0
LnGrp Delay(d),s/veh	65.5	40.2	40.0	60.5	38.4	38.8	51.4	46.5	22.9	46.2	47.4	20.5
LnGrp LOS	E	D	D	E	D	D	D	D	C	D	D	C
Approach Vol, veh/h		445			642			850			281	
Approach Delay, s/veh		41.9			45.0			44.4			46.8	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	44.1	35.0	26.4	14.1	38.0	28.0	33.4
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	4.3	16.0	19.5	7.8	9.0	11.7	8.5	18.1
Green Ext Time (p_c), s	0.0	2.2	0.3	1.0	0.9	1.6	0.9	5.5

Intersection Summary		
HCM 2010 Ctrl Delay		44.4
HCM 2010 LOS		D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Future Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.90		0.93	0.90		0.93	1.00		0.94	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	13	1	3	14	0	5	7	507	60	36	292	11
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	252	28	23	317	0	136	10	881	104	44	1000	38
Arrive On Green	0.09	0.09	0.09	0.09	0.00	0.09	0.01	0.55	0.55	0.03	0.57	0.57
Sat Flow, veh/h	839	303	245	1290	0	1459	1757	1607	190	1757	1762	66
Grp Volume(v), veh/h	17	0	0	14	0	5	7	0	567	36	0	303
Grp Sat Flow(s),veh/h/ln	1388	0	0	1290	0	1459	1757	0	1798	1757	0	1828
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.3	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Prop In Lane	0.76		0.18	1.00		1.00	1.00		0.11	1.00		0.04
Lane Grp Cap(c), veh/h	303	0	0	317	0	136	10	0	986	44	0	1038
V/C Ratio(X)	0.06	0.00	0.00	0.04	0.00	0.04	0.71	0.00	0.58	0.82	0.00	0.29
Avail Cap(c_a), veh/h	1615	0	0	1574	0	1593	1439	0	2454	1439	0	2496
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	0.0	15.2	0.0	15.1	18.2	0.0	5.5	17.8	0.0	4.1
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	29.0	0.0	0.8	12.6	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	3.8	0.5	0.0	1.6
LnGrp Delay(d),s/veh	15.2	0.0	0.0	15.2	0.0	15.1	47.1	0.0	6.2	30.4	0.0	4.3
LnGrp LOS	B			B		B	D		A	C		A
Approach Vol, veh/h		17			19			574			339	
Approach Delay, s/veh		15.2			15.2			6.7			7.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.6	3.2	25.8		7.6	3.9	25.1
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 40	30.0	50.0		* 40	30.0	50.0
Max Q Clear Time (g_c+I1), s		2.3	2.1	5.1		2.3	2.7	9.6
Green Ext Time (p_c), s		0.1	0.0	10.5		0.1	0.0	10.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.2
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Future Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.92		0.92	0.93		1.00	1.00		0.93	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	54	24	20	28	25	-5	84	477	29	36	184	31
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	442	172	474	352	276	516	107	698	42	43	684	538
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.00	0.06	0.41	0.41	0.02	0.37	0.37
Sat Flow, veh/h	910	521	1442	679	840	1568	1757	1713	104	1757	1845	1450
Grp Volume(v), veh/h	78	0	20	53	0	-5	84	0	506	36	184	31
Grp Sat Flow(s),veh/h/ln	1432	0	1442	1519	0	1568	1757	0	1817	1757	1845	1450
Q Serve(g_s), s	0.5	0.0	0.4	0.0	0.0	0.0	2.0	0.0	9.7	0.9	3.0	0.6
Cycle Q Clear(g_c), s	1.4	0.0	0.4	0.8	0.0	0.0	2.0	0.0	9.7	0.9	3.0	0.6
Prop In Lane	0.69		1.00	0.53		1.00	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	614	0	474	629	0	516	107	0	740	43	684	538
V/C Ratio(X)	0.13	0.00	0.04	0.08	0.00	-0.01	0.79	0.00	0.68	0.84	0.27	0.06
Avail Cap(c_a), veh/h	1569	0	1455	1631	0	1583	1444	0	1280	1444	1299	1021
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.0	0.0	9.7	9.9	0.0	0.0	19.7	0.0	10.4	20.7	9.4	8.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	1.1	14.6	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.2	0.4	0.0	0.0	1.1	0.0	5.0	0.6	1.5	0.2
LnGrp Delay(d),s/veh	10.1	0.0	9.7	9.9	0.0	0.0	24.5	0.0	11.5	35.3	9.6	8.7
LnGrp LOS	B		A	A			C		B	D	A	A
Approach Vol, veh/h		98			48			590			251	
Approach Delay, s/veh		10.0			10.9			13.3			13.1	
Approach LOS		A			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.0	5.6	20.0		17.0	4.0	21.5
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.8	4.0	5.0		3.4	2.9	11.7
Green Ext Time (p_c), s		0.6	0.1	4.8		0.6	0.0	4.4

Intersection Summary		
HCM 2010 Ctrl Delay		12.8
HCM 2010 LOS		B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Future Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.79		0.79	1.00		1.00	0.92		1.00	1.00		0.85
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	149	0	46	0	0	0	56	522	0	0	226	50
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	208	0	64	0	6	0	637	1574	0	0	1216	259
Arrive On Green	0.20	0.00	0.20	0.00	0.00	0.00	0.45	0.45	0.00	0.00	0.45	0.45
Sat Flow, veh/h	1032	0	319	0	1845	0	997	3597	0	0	2892	576
Grp Volume(v), veh/h	195	0	0	0	0	0	56	522	0	0	135	141
Grp Sat Flow(s),veh/h/ln	1350	0	0	0	1845	0	997	1752	0	0	1660	1623
Q Serve(g_s), s	4.0	0.0	0.0	0.0	0.0	0.0	1.1	2.9	0.0	0.0	1.5	1.6
Cycle Q Clear(g_c), s	4.0	0.0	0.0	0.0	0.0	0.0	2.6	2.9	0.0	0.0	1.5	1.6
Prop In Lane	0.76		0.24	0.00		0.00	1.00		0.00	0.00		0.36
Lane Grp Cap(c), veh/h	272	0	0	0	6	0	637	1574	0	0	746	729
V/C Ratio(X)	0.72	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.00	0.00	0.18	0.19
Avail Cap(c_a), veh/h	1496	0	0	0	1505	0	1261	3765	0	0	1783	1744
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	11.1	0.0	0.0	0.0	0.0	0.0	5.7	5.3	0.0	0.0	4.9	5.0
Incr Delay (d2), s/veh	3.5	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	0.0	0.0	0.0	0.3	1.4	0.0	0.0	0.7	0.7
LnGrp Delay(d),s/veh	14.6	0.0	0.0	0.0	0.0	0.0	5.8	5.5	0.0	0.0	5.1	5.1
LnGrp LOS	B						A	A			A	A
Approach Vol, veh/h		195			0			578			276	
Approach Delay, s/veh		14.6			0.0			5.5			5.1	
Approach LOS		B						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.6		10.2		19.6		0.0
Change Period (Y+Rc), s		* 6.2		* 4.2		* 6.2		4.2
Max Green Setting (Gmax), s		* 32		* 33		* 32		24.3
Max Q Clear Time (g_c+I1), s		4.9		6.0		3.6		0.0
Green Ext Time (p_c), s		8.5		1.5		8.7		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		7.1
HCM 2010 LOS		A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Future Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	1.00		0.83	1.00		0.83	1.00		0.69
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	130	472	64	89	424	43	139	331	96	55	146	38
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	193	681	91	112	548	55	332	610	529	71	322	188
Arrive On Green	0.11	0.23	0.23	0.06	0.17	0.17	0.19	0.33	0.33	0.04	0.17	0.17
Sat Flow, veh/h	1757	2992	400	1757	3149	316	1757	1845	1297	1757	1845	1079
Grp Volume(v), veh/h	130	274	262	89	234	233	139	331	96	55	146	38
Grp Sat Flow(s),veh/h/ln	1757	1752	1640	1757	1752	1713	1757	1845	1297	1757	1845	1079
Q Serve(g_s), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Cycle Q Clear(g_c), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Prop In Lane	1.00		0.24	1.00		0.18	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	193	399	373	112	305	298	332	610	529	71	322	188
V/C Ratio(X)	0.68	0.69	0.70	0.80	0.77	0.78	0.42	0.54	0.18	0.78	0.45	0.20
Avail Cap(c_a), veh/h	270	499	467	270	499	487	332	610	529	162	511	299
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.79	0.79	0.79	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.6	46.0	46.2	60.0	51.2	51.4	46.4	35.5	25.7	61.8	48.1	45.9
Incr Delay (d2), s/veh	4.1	3.6	4.3	11.9	5.7	6.3	0.7	2.7	0.6	16.5	1.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	9.4	9.1	3.5	8.5	8.6	4.5	10.1	2.3	2.3	4.8	1.2
LnGrp Delay(d),s/veh	59.7	49.6	50.5	72.0	56.9	57.7	47.1	38.2	26.3	78.3	49.1	46.5
LnGrp LOS	E	D	D	E	E	E	D	D	C	E	D	D
Approach Vol, veh/h		666			556			566			239	
Approach Delay, s/veh		51.9			59.6			38.4			55.4	
Approach LOS		D			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.3	27.6	29.6	27.7	12.3	34.6	9.2	48.0
Change Period (Y+Rc), s	5.0	* 5	5.0	* 5	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	20.0	* 37	19.0	* 36	20.0	37.0	12.0	43.0
Max Q Clear Time (g_c+I1), s	11.2	18.9	11.1	11.2	8.5	21.1	6.0	21.0
Green Ext Time (p_c), s	3.1	3.7	1.8	1.0	0.1	4.4	0.0	2.8

Intersection Summary	
HCM 2010 Ctrl Delay	50.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Future Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.66	1.00		0.84	1.00		0.94	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	11	268	40	176	317	41	263	280	160	56	237	22
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	27	841	249	278	934	118	294	1365	684	118	1270	530
Arrive On Green	0.02	0.24	0.24	0.08	0.31	0.31	0.17	0.46	0.46	0.07	0.36	0.36
Sat Flow, veh/h	1757	3505	1037	3408	3053	387	1757	2951	1480	1757	3505	1462
Grp Volume(v), veh/h	11	268	40	176	179	179	263	280	160	56	237	22
Grp Sat Flow(s),veh/h/ln	1757	1752	1037	1704	1752	1688	1757	1476	1480	1757	1752	1462
Q Serve(g_s), s	0.7	6.9	3.4	5.5	8.7	9.0	16.1	6.2	7.2	3.4	5.1	1.1
Cycle Q Clear(g_c), s	0.7	6.9	3.4	5.5	8.7	9.0	16.1	6.2	7.2	3.4	5.1	1.1
Prop In Lane	1.00		1.00	1.00		0.23	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	27	841	249	278	536	516	294	1365	684	118	1270	530
V/C Ratio(X)	0.40	0.32	0.16	0.63	0.33	0.35	0.90	0.21	0.23	0.48	0.19	0.04
Avail Cap(c_a), veh/h	128	949	281	279	536	516	431	1365	684	208	1270	530
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	53.6	34.4	33.0	48.9	29.5	29.6	44.9	17.6	17.8	49.4	24.0	22.7
Incr Delay (d2), s/veh	3.5	0.1	0.1	3.5	0.1	0.1	11.8	0.3	0.8	1.1	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.4	1.0	2.7	4.2	4.2	8.8	2.6	3.1	1.7	2.5	0.5
LnGrp Delay(d),s/veh	57.1	34.5	33.2	52.5	29.7	29.8	56.7	17.9	18.6	50.5	24.3	22.9
LnGrp LOS	E	C	C	D	C	C	E	B	B	D	C	C
Approach Vol, veh/h		319			534			703			315	
Approach Delay, s/veh		35.1			37.2			32.6			28.9	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	37.8	22.4	44.1	13.0	30.6	11.4	55.1
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.7	11.0	18.1	7.1	7.5	8.9	5.4	9.2
Green Ext Time (p_c), s	0.0	2.7	0.3	5.6	0.0	1.3	0.0	6.5

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Future Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.91		1.00	0.91		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	7	0	0	6	0	0	11	305	12	15	327	10
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	325	0	0	325	0	48	15	834	33	21	848	26
Arrive On Green	0.03	0.00	0.00	0.03	0.00	0.00	0.01	0.47	0.47	0.01	0.48	0.48
Sat Flow, veh/h	1307	0	0	1318	0	1568	1757	1759	69	1757	1778	54
Grp Volume(v), veh/h	7	0	0	6	0	0	11	0	317	15	0	337
Grp Sat Flow(s),veh/h/ln	1307	0	0	1318	0	1568	1757	0	1829	1757	0	1832
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	2.8	0.2	0.0	3.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.04	1.00		0.03
Lane Grp Cap(c), veh/h	325	0	0	325	0	48	15	0	867	21	0	874
V/C Ratio(X)	0.02	0.00	0.00	0.02	0.00	0.00	0.71	0.00	0.37	0.72	0.00	0.39
Avail Cap(c_a), veh/h	1544	0	0	1546	0	1554	1741	0	2465	1741	0	2543
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.9	0.0	0.0	11.9	0.0	0.0	12.5	0.0	4.2	12.4	0.0	4.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	0.4	15.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.4	0.2	0.0	1.5
LnGrp Delay(d),s/veh	11.9	0.0	0.0	11.9	0.0	0.0	32.3	0.0	4.6	28.2	0.0	4.6
LnGrp LOS	B			B			C		A	C		A
Approach Vol, veh/h		7			6			328			352	
Approach Delay, s/veh		11.9			11.9			5.5			5.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.0	3.2	17.0		5.0	3.3	17.0
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 25	25.0	35.0		* 25	25.0	34.0
Max Q Clear Time (g_c+I1), s		2.1	2.2	5.0		2.1	2.2	4.8
Green Ext Time (p_c), s		0.0	0.0	6.4		0.0	0.0	6.4

Intersection Summary		
HCM 2010 Ctrl Delay		5.7
HCM 2010 LOS		A

Notes

User approved pedestrian interval to be less than phase max green.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Future Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.99	0.97		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	9	8	2	7	0	0	38	276	7	24	321	24
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	301	32	65	390	0	65	50	804	20	33	743	56
Arrive On Green	0.04	0.04	0.04	0.04	0.00	0.00	0.03	0.45	0.45	0.02	0.44	0.44
Sat Flow, veh/h	860	765	1552	1042	0	1568	1757	1789	45	1757	1690	126
Grp Volume(v), veh/h	17	0	2	7	0	0	38	0	283	24	0	345
Grp Sat Flow(s),veh/h/ln	1625	0	1552	1042	0	1568	1757	0	1835	1757	0	1817
Q Serve(g_s), s	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	2.1	0.3	0.0	2.7
Cycle Q Clear(g_c), s	0.2	0.0	0.0	0.3	0.0	0.0	0.4	0.0	2.1	0.3	0.0	2.7
Prop In Lane	0.53		1.00	1.00		1.00	1.00		0.02	1.00		0.07
Lane Grp Cap(c), veh/h	332	0	65	390	0	65	50	0	824	33	0	798
V/C Ratio(X)	0.05	0.00	0.03	0.02	0.00	0.00	0.76	0.00	0.34	0.73	0.00	0.43
Avail Cap(c_a), veh/h	3471	0	3208	3108	0	3242	2957	0	2646	2957	0	2621
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.6	0.0	9.6	9.8	0.0	0.0	10.0	0.0	3.7	10.2	0.0	4.0
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.0	8.5	0.0	0.2	11.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.1	0.2	0.0	1.4
LnGrp Delay(d),s/veh	9.7	0.0	9.6	9.8	0.0	0.0	18.6	0.0	4.0	21.1	0.0	4.4
LnGrp LOS	A		A	A			B		A	C		A
Approach Vol, veh/h		19			7			321			369	
Approach Delay, s/veh		9.7			9.8			5.7			5.5	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.9	3.6	13.3		3.9	3.4	13.5
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.3	2.4	4.7		2.2	2.3	4.1
Green Ext Time (p_c), s		0.1	0.0	4.1		0.1	0.0	4.1

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑↑			↑↱	
Traffic Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Future Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		1.00	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	28	0	0	0	0	0	44	247	0	0	345	27
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	38	0	0	0	9	0	800	1774	0	0	1536	120
Arrive On Green	0.02	0.00	0.00	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.51	0.51
Sat Flow, veh/h	1736	0	0	0	1845	0	992	3597	0	0	3403	236
Grp Volume(v), veh/h	28	0	0	0	0	0	44	247	0	0	167	205
Grp Sat Flow(s),veh/h/ln	1736	0	0	0	1845	0	992	1752	0	0	1476	1795
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	1.3	1.3
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.0	0.0	0.0	1.8	0.7	0.0	0.0	1.3	1.3
Prop In Lane	1.00		0.00	0.00		0.00	1.00		0.00	0.00		0.13
Lane Grp Cap(c), veh/h	38	0	0	0	9	0	800	1774	0	0	747	908
V/C Ratio(X)	0.75	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.22	0.23
Avail Cap(c_a), veh/h	2877	0	0	0	2224	0	1942	5810	0	0	2446	2975
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.7	0.0	0.0	0.0	0.0	0.0	3.2	2.6	0.0	0.0	2.7	2.7
Incr Delay (d2), s/veh	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.6	0.7
LnGrp Delay(d),s/veh	34.7	0.0	0.0	0.0	0.0	0.0	3.3	2.7	0.0	0.0	2.9	2.9
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		28			0			291			372	
Approach Delay, s/veh		34.7			0.0			2.8			2.9	
Approach LOS		C						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		15.3		4.6		15.3		0.0
Change Period (Y+Rc), s		* 5.2		* 4.2		* 5.2		4.2
Max Green Setting (Gmax), s		* 33		* 33		* 33		24.0
Max Q Clear Time (g_c+I1), s		3.8		2.3		3.3		0.0
Green Ext Time (p_c), s		6.3		0.1		6.3		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		4.1
HCM 2010 LOS		A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Future Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94	1.00		0.98	1.00		0.95	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	44	255	38	80	466	28	55	148	12	33	254	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	56	434	63	827	1982	119	71	293	975	80	320	260
Arrive On Green	0.03	0.14	0.14	0.47	0.59	0.59	0.04	0.16	0.16	0.05	0.17	0.17
Sat Flow, veh/h	1757	3038	445	1757	3355	201	1757	1845	1491	1757	1845	1499
Grp Volume(v), veh/h	44	145	148	80	243	251	55	148	12	33	254	5
Grp Sat Flow(s),veh/h/ln	1757	1752	1731	1757	1752	1804	1757	1845	1491	1757	1845	1499
Q Serve(g_s), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Cycle Q Clear(g_c), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	56	250	247	827	1035	1066	71	293	975	80	320	260
V/C Ratio(X)	0.78	0.58	0.60	0.10	0.23	0.24	0.78	0.51	0.01	0.41	0.79	0.02
Avail Cap(c_a), veh/h	176	478	472	827	1035	1066	192	570	1199	128	503	409
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	44.1	44.2	16.1	10.7	10.7	52.3	42.3	7.6	51.1	43.6	37.7
Incr Delay (d2), s/veh	20.5	3.0	3.3	0.1	0.5	0.5	15.9	1.3	0.0	3.3	4.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	4.3	4.5	1.3	3.7	3.8	2.0	4.2	0.1	1.0	7.8	0.1
LnGrp Delay(d),s/veh	73.4	47.1	47.5	16.2	11.2	11.2	68.2	43.6	7.6	54.4	48.2	37.7
LnGrp LOS	E	D	D	B	B	B	E	D	A	D	D	D
Approach Vol, veh/h		337			574			215			292	
Approach Delay, s/veh		50.7			11.9			47.9			48.8	
Approach LOS		D			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	70.0	8.4	24.1	56.8	20.7	10.0	22.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	4.7	9.3	5.4	16.5	4.8	10.8	4.0	15.1
Green Ext Time (p_c), s	0.0	4.8	0.0	1.3	3.8	2.2	0.6	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Future Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.80	1.00		0.89	1.00		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	31	320	94	188	380	74	264	458	128	101	178	2
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	55	911	326	260	881	169	419	676	336	314	599	247
Arrive On Green	0.03	0.26	0.26	0.08	0.31	0.31	0.24	0.23	0.23	0.18	0.17	0.17
Sat Flow, veh/h	1757	3505	1254	3408	2873	550	1757	2951	1469	1757	3505	1442
Grp Volume(v), veh/h	31	320	94	188	229	225	264	458	128	101	178	2
Grp Sat Flow(s),veh/h/ln	1757	1752	1254	1704	1752	1671	1757	1476	1469	1757	1752	1442
Q Serve(g_s), s	2.3	9.7	7.8	7.0	13.6	14.0	17.5	18.4	6.8	6.5	5.8	0.1
Cycle Q Clear(g_c), s	2.3	9.7	7.8	7.0	13.6	14.0	17.5	18.4	6.8	6.5	5.8	0.1
Prop In Lane	1.00		1.00	1.00		0.33	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	55	911	326	260	538	512	419	676	336	314	599	247
V/C Ratio(X)	0.57	0.35	0.29	0.72	0.43	0.44	0.63	0.68	0.38	0.32	0.30	0.01
Avail Cap(c_a), veh/h	108	911	326	367	538	512	419	1108	552	314	938	386
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	62.1	39.2	38.5	58.7	35.9	36.1	44.4	45.7	21.6	46.5	47.1	20.5
Incr Delay (d2), s/veh	3.4	1.1	2.2	1.8	2.5	2.7	7.0	1.7	1.0	0.2	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	4.8	2.9	3.4	6.9	6.9	9.3	7.7	2.9	3.2	2.8	0.0
LnGrp Delay(d),s/veh	65.5	40.2	40.7	60.5	38.4	38.8	51.4	47.4	22.6	46.7	47.4	20.5
LnGrp LOS	E	D	D	E	D	D	D	D	C	D	D	C
Approach Vol, veh/h		445			642			850			281	
Approach Delay, s/veh		42.1			45.0			44.9			47.0	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	44.1	35.0	26.4	14.1	38.0	27.5	34.0
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	4.3	16.0	19.5	7.8	9.0	11.7	8.5	20.4
Green Ext Time (p_c), s	0.0	2.2	0.3	1.0	0.9	1.6	0.9	5.4

Intersection Summary	
HCM 2010 Ctrl Delay	44.6
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Future Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.90		0.93	0.90		0.93	1.00		0.94	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	13	1	3	14	0	5	7	507	60	36	292	11
Adj No. of Lanes	0	1	0	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	252	28	23	317	0	136	10	881	104	44	1000	38
Arrive On Green	0.09	0.09	0.09	0.09	0.00	0.09	0.01	0.55	0.55	0.03	0.57	0.57
Sat Flow, veh/h	839	303	245	1290	0	1459	1757	1607	190	1757	1762	66
Grp Volume(v), veh/h	17	0	0	14	0	5	7	0	567	36	0	303
Grp Sat Flow(s),veh/h/ln	1388	0	0	1290	0	1459	1757	0	1798	1757	0	1828
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.3	0.0	0.1	0.1	0.0	7.6	0.7	0.0	3.1
Prop In Lane	0.76		0.18	1.00		1.00	1.00		0.11	1.00		0.04
Lane Grp Cap(c), veh/h	303	0	0	317	0	136	10	0	986	44	0	1038
V/C Ratio(X)	0.06	0.00	0.00	0.04	0.00	0.04	0.71	0.00	0.58	0.82	0.00	0.29
Avail Cap(c_a), veh/h	1615	0	0	1574	0	1593	1439	0	2454	1439	0	2496
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	0.0	15.2	0.0	15.1	18.2	0.0	5.5	17.8	0.0	4.1
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	29.0	0.0	0.8	12.6	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	3.8	0.5	0.0	1.6
LnGrp Delay(d),s/veh	15.2	0.0	0.0	15.2	0.0	15.1	47.1	0.0	6.2	30.4	0.0	4.3
LnGrp LOS	B			B		B	D		A	C		A
Approach Vol, veh/h		17			19			574			339	
Approach Delay, s/veh		15.2			15.2			6.7			7.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.6	3.2	25.8		7.6	3.9	25.1
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 40	30.0	50.0		* 40	30.0	50.0
Max Q Clear Time (g_c+I1), s		2.3	2.1	5.1		2.3	2.7	9.6
Green Ext Time (p_c), s		0.1	0.0	10.5		0.1	0.0	10.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.2
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Future Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.92		0.92	0.93		1.00	1.00		0.93	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	54	24	20	28	25	-5	84	477	29	36	184	31
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	442	171	474	352	276	515	107	700	43	43	565	95
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.00	0.06	0.41	0.41	0.02	0.37	0.37
Sat Flow, veh/h	910	521	1441	679	840	1568	1757	1713	104	1757	1519	256
Grp Volume(v), veh/h	78	0	20	53	0	-5	84	0	506	36	0	215
Grp Sat Flow(s),veh/h/ln	1431	0	1441	1519	0	1568	1757	0	1817	1757	0	1775
Q Serve(g_s), s	0.5	0.0	0.4	0.0	0.0	0.0	2.0	0.0	9.8	0.9	0.0	3.7
Cycle Q Clear(g_c), s	1.4	0.0	0.4	0.8	0.0	0.0	2.0	0.0	9.8	0.9	0.0	3.7
Prop In Lane	0.69		1.00	0.53		1.00	1.00		0.06	1.00		0.14
Lane Grp Cap(c), veh/h	613	0	474	628	0	515	107	0	742	43	0	660
V/C Ratio(X)	0.13	0.00	0.04	0.08	0.00	-0.01	0.79	0.00	0.68	0.84	0.00	0.33
Avail Cap(c_a), veh/h	1564	0	1451	1625	0	1578	1439	0	1276	1439	0	1246
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.1	0.0	9.8	9.9	0.0	0.0	19.8	0.0	10.4	20.8	0.0	9.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	1.1	14.6	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.2	0.4	0.0	0.0	1.1	0.0	5.0	0.6	0.0	1.8
LnGrp Delay(d),s/veh	10.1	0.0	9.8	9.9	0.0	0.0	24.5	0.0	11.5	35.4	0.0	9.9
LnGrp LOS	B		A	A			C		B	D		A
Approach Vol, veh/h		98			48			590			251	
Approach Delay, s/veh		10.0			11.0			13.3			13.5	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.0	5.6	20.1		17.0	4.0	21.6
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.8	4.0	5.7		3.4	2.9	11.8
Green Ext Time (p_c), s		0.6	0.1	4.9		0.6	0.0	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	12.9
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Future Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.80		0.66	1.00		1.00	0.92		1.00	1.00		0.85
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	149	0	46	0	0	0	56	522	0	0	226	50
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	205	0	63	0	6	0	629	1564	0	0	1143	244
Arrive On Green	0.21	0.00	0.21	0.00	0.00	0.00	0.45	0.45	0.00	0.00	0.45	0.45
Sat Flow, veh/h	988	0	305	0	1845	0	997	3597	0	0	2931	548
Grp Volume(v), veh/h	195	0	0	0	0	0	56	522	0	0	127	149
Grp Sat Flow(s),veh/h/ln	1293	0	0	0	1845	0	997	1752	0	0	1476	1634
Q Serve(g_s), s	4.2	0.0	0.0	0.0	0.0	0.0	1.1	2.9	0.0	0.0	1.6	1.7
Cycle Q Clear(g_c), s	4.2	0.0	0.0	0.0	0.0	0.0	2.8	2.9	0.0	0.0	1.6	1.7
Prop In Lane	0.76		0.24	0.00		0.00	1.00		0.00	0.00		0.34
Lane Grp Cap(c), veh/h	269	0	0	0	6	0	629	1564	0	0	658	729
V/C Ratio(X)	0.73	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.00	0.00	0.19	0.20
Avail Cap(c_a), veh/h	1419	0	0	0	1491	0	1245	3730	0	0	1571	1739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	11.1	0.0	0.0	0.0	0.0	0.0	5.9	5.4	0.0	0.0	5.0	5.1
Incr Delay (d2), s/veh	3.7	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	0.0	0.0	0.0	0.3	1.4	0.0	0.0	0.7	0.8
LnGrp Delay(d),s/veh	14.8	0.0	0.0	0.0	0.0	0.0	6.0	5.6	0.0	0.0	5.2	5.3
LnGrp LOS	B						A	A			A	A
Approach Vol, veh/h		195			0			578			276	
Approach Delay, s/veh		14.8			0.0			5.6			5.3	
Approach LOS		B						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.6		10.5		19.6		0.0
Change Period (Y+Rc), s		* 6.2		* 4.2		* 6.2		4.2
Max Green Setting (Gmax), s		* 32		* 33		* 32		24.3
Max Q Clear Time (g_c+I1), s		4.9		6.2		3.7		0.0
Green Ext Time (p_c), s		8.5		1.5		8.6		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		7.2
HCM 2010 LOS		A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Future Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	1.00		0.83	1.00		0.83	1.00		0.69
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	130	472	64	89	424	43	139	331	96	55	146	38
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	193	681	91	112	548	55	332	610	529	71	322	188
Arrive On Green	0.11	0.23	0.23	0.06	0.17	0.17	0.19	0.33	0.33	0.04	0.17	0.17
Sat Flow, veh/h	1757	2992	400	1757	3149	316	1757	1845	1297	1757	1845	1079
Grp Volume(v), veh/h	130	274	262	89	234	233	139	331	96	55	146	38
Grp Sat Flow(s),veh/h/ln	1757	1752	1640	1757	1752	1713	1757	1845	1297	1757	1845	1079
Q Serve(g_s), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Cycle Q Clear(g_c), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Prop In Lane	1.00		0.24	1.00		0.18	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	193	399	373	112	305	298	332	610	529	71	322	188
V/C Ratio(X)	0.68	0.69	0.70	0.80	0.77	0.78	0.42	0.54	0.18	0.78	0.45	0.20
Avail Cap(c_a), veh/h	270	499	467	270	499	487	332	610	529	162	511	299
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.79	0.79	0.79	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.6	46.0	46.2	60.0	51.2	51.4	46.4	35.5	25.7	61.8	48.1	45.9
Incr Delay (d2), s/veh	4.1	3.6	4.3	11.9	5.7	6.3	0.7	2.7	0.6	16.5	1.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	9.4	9.1	3.5	8.5	8.6	4.5	10.1	2.3	2.3	4.8	1.2
LnGrp Delay(d),s/veh	59.7	49.6	50.5	72.0	56.9	57.7	47.1	38.2	26.3	78.3	49.1	46.5
LnGrp LOS	E	D	D	E	E	E	D	D	C	E	D	D
Approach Vol, veh/h		666			556			566			239	
Approach Delay, s/veh		51.9			59.6			38.4			55.4	
Approach LOS		D			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.3	27.6	29.6	27.7	12.3	34.6	9.2	48.0
Change Period (Y+Rc), s	5.0	* 5	5.0	* 5	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	20.0	* 37	19.0	* 36	20.0	37.0	12.0	43.0
Max Q Clear Time (g_c+I1), s	11.2	18.9	11.1	11.2	8.5	21.1	6.0	21.0
Green Ext Time (p_c), s	3.1	3.7	1.8	1.0	0.1	4.4	0.0	2.8

Intersection Summary	
HCM 2010 Ctrl Delay	50.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Future Volume (veh/h)	9	220	204	144	260	44	216	230	246	46	194	43
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.80	1.00		0.84	1.00		0.94	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	11	268	40	176	317	41	263	280	160	56	237	22
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	27	842	300	278	934	118	294	1535	684	118	1269	529
Arrive On Green	0.02	0.24	0.24	0.08	0.31	0.31	0.17	0.46	0.46	0.07	0.36	0.36
Sat Flow, veh/h	1757	3505	1250	3408	3053	387	1757	3320	1480	1757	3505	1462
Grp Volume(v), veh/h	11	268	40	176	179	179	263	280	160	56	237	22
Grp Sat Flow(s),veh/h/ln	1757	1752	1250	1704	1752	1688	1757	1660	1480	1757	1752	1462
Q Serve(g_s), s	0.7	6.9	2.8	5.5	8.7	9.0	16.1	5.4	7.2	3.4	5.1	1.1
Cycle Q Clear(g_c), s	0.7	6.9	2.8	5.5	8.7	9.0	16.1	5.4	7.2	3.4	5.1	1.1
Prop In Lane	1.00		1.00	1.00		0.23	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	27	842	300	278	536	517	294	1535	684	118	1269	529
V/C Ratio(X)	0.40	0.32	0.13	0.63	0.33	0.35	0.90	0.18	0.23	0.48	0.19	0.04
Avail Cap(c_a), veh/h	128	949	339	279	536	517	431	1535	684	208	1269	529
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	53.6	34.4	32.8	48.9	29.5	29.6	44.9	17.4	17.8	49.4	24.0	22.7
Incr Delay (d2), s/veh	3.5	0.1	0.1	3.5	0.1	0.1	11.8	0.3	0.8	1.1	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.4	1.0	2.7	4.2	4.2	8.8	2.5	3.1	1.7	2.5	0.5
LnGrp Delay(d),s/veh	57.1	34.5	32.9	52.5	29.6	29.8	56.7	17.6	18.6	50.5	24.3	22.9
LnGrp LOS	E	C	C	D	C	C	E	B	B	D	C	C
Approach Vol, veh/h		319			534			703			315	
Approach Delay, s/veh		35.0			37.2			32.5			28.9	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	37.9	22.4	44.0	13.0	30.6	11.4	55.0
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2	4.0	* 4.2
Max Green Setting (Gmax), s	8.0	* 31	27.0	* 28	9.0	* 30	13.0	* 42
Max Q Clear Time (g_c+I1), s	2.7	11.0	18.1	7.1	7.5	8.9	5.4	9.2
Green Ext Time (p_c), s	0.0	2.6	0.3	5.6	0.0	1.2	0.0	6.5

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Future Volume (veh/h)	6	0	2	5	0	11	9	256	12	13	275	9
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.91		1.00	0.91		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1845	1845	1845	1900
Adj Flow Rate, veh/h	7	0	0	6	0	0	11	305	12	15	327	10
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	326	0	0	326	0	48	16	872	708	21	846	26
Arrive On Green	0.03	0.00	0.00	0.03	0.00	0.00	0.01	0.47	0.47	0.01	0.48	0.48
Sat Flow, veh/h	1307	0	0	1318	0	1568	1757	1845	1499	1757	1778	54
Grp Volume(v), veh/h	7	0	0	6	0	0	11	305	12	15	0	337
Grp Sat Flow(s),veh/h/ln	1307	0	0	1318	0	1568	1757	1845	1499	1757	0	1832
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.6	0.1	0.2	0.0	3.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	0.2	2.6	0.1	0.2	0.0	3.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	326	0	0	326	0	48	16	872	708	21	0	871
V/C Ratio(X)	0.02	0.00	0.00	0.02	0.00	0.00	0.71	0.35	0.02	0.72	0.00	0.39
Avail Cap(c_a), veh/h	1548	0	0	1551	0	1559	1747	2495	2028	1747	0	2551
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.9	0.0	0.0	11.9	0.0	0.0	12.4	4.2	3.5	12.4	0.0	4.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.3	0.0	15.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.0	0.2	0.0	1.5
LnGrp Delay(d),s/veh	11.9	0.0	0.0	11.9	0.0	0.0	32.2	4.5	3.5	28.2	0.0	4.6
LnGrp LOS	B			B			C	A	A	C		A
Approach Vol, veh/h		7			6			328			352	
Approach Delay, s/veh		11.9			11.9			5.4			5.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.0	3.2	17.0		5.0	3.3	16.9
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 25	25.0	35.0		* 25	25.0	34.0
Max Q Clear Time (g_c+I1), s		2.1	2.2	5.0		2.1	2.2	4.6
Green Ext Time (p_c), s		0.0	0.0	6.3		0.0	0.0	6.3

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Future Volume (veh/h)	8	7	24	6	0	0	32	235	7	20	273	24
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.99	0.97		1.00	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	9	8	2	7	0	0	38	276	7	24	321	24
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	306	32	65	397	0	65	50	786	20	33	792	648
Arrive On Green	0.04	0.04	0.04	0.04	0.00	0.00	0.03	0.44	0.44	0.02	0.43	0.43
Sat Flow, veh/h	860	765	1552	1042	0	1568	1757	1789	45	1757	1845	1510
Grp Volume(v), veh/h	17	0	2	7	0	0	38	0	283	24	321	24
Grp Sat Flow(s),veh/h/ln	1625	0	1552	1042	0	1568	1757	0	1834	1757	1845	1510
Q Serve(g_s), s	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	2.1	0.3	2.5	0.2
Cycle Q Clear(g_c), s	0.2	0.0	0.0	0.3	0.0	0.0	0.4	0.0	2.1	0.3	2.5	0.2
Prop In Lane	0.53		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	338	0	65	397	0	65	50	0	806	33	792	648
V/C Ratio(X)	0.05	0.00	0.03	0.02	0.00	0.00	0.76	0.00	0.35	0.73	0.41	0.04
Avail Cap(c_a), veh/h	3542	0	3274	3172	0	3308	3017	0	2700	3017	2715	2223
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.4	0.0	9.4	9.6	0.0	0.0	9.8	0.0	3.8	9.9	4.0	3.4
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.0	8.4	0.0	0.3	10.9	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.1	0.2	1.2	0.1
LnGrp Delay(d),s/veh	9.5	0.0	9.4	9.6	0.0	0.0	18.3	0.0	4.1	20.9	4.4	3.4
LnGrp LOS	A		A	A			B		A	C	A	A
Approach Vol, veh/h		19			7			321			369	
Approach Delay, s/veh		9.5			9.6			5.7			5.4	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.9	3.6	13.0		3.9	3.4	13.2
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.3	2.4	4.5		2.2	2.3	4.1
Green Ext Time (p_c), s		0.1	0.0	4.0		0.1	0.0	4.0

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Future Volume (veh/h)	24	0	22	0	0	0	38	212	0	0	297	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		1.00	0.99		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	28	0	0	0	0	0	44	247	0	0	345	27
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	38	0	0	0	9	0	803	1768	0	0	1615	126
Arrive On Green	0.02	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.50	0.50
Sat Flow, veh/h	1736	0	0	0	1845	0	991	3597	0	0	3387	249
Grp Volume(v), veh/h	28	0	0	0	0	0	44	247	0	0	178	194
Grp Sat Flow(s),veh/h/ln	1736	0	0	0	1845	0	991	1752	0	0	1660	1792
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	1.2	1.2
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.0	0.0	0.0	1.7	0.7	0.0	0.0	1.2	1.2
Prop In Lane	1.00		0.00	0.00		0.00	1.00		0.00	0.00		0.14
Lane Grp Cap(c), veh/h	38	0	0	0	9	0	803	1768	0	0	837	904
V/C Ratio(X)	0.75	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.21	0.21
Avail Cap(c_a), veh/h	2889	0	0	0	2232	0	1953	5832	0	0	2763	2982
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	9.6	0.0	0.0	0.0	0.0	0.0	3.2	2.6	0.0	0.0	2.7	2.7
Incr Delay (d2), s/veh	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.5	0.6
LnGrp Delay(d),s/veh	34.6	0.0	0.0	0.0	0.0	0.0	3.2	2.7	0.0	0.0	2.9	2.9
LnGrp LOS	C						A	A			A	A
Approach Vol, veh/h		28			0			291			372	
Approach Delay, s/veh		34.6			0.0			2.8			2.9	
Approach LOS		C						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		15.2		4.6		15.2		0.0
Change Period (Y+Rc), s		* 5.2		* 4.2		* 5.2		4.2
Max Green Setting (Gmax), s		* 33		* 33		* 33		24.0
Max Q Clear Time (g_c+I1), s		3.7		2.3		3.2		0.0
Green Ext Time (p_c), s		6.3		0.1		6.3		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	4.1
HCM 2010 LOS	A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Future Volume (veh/h)	38	222	42	70	405	27	48	129	55	29	221	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94	1.00		0.98	1.00		0.95	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	44	255	38	80	466	28	55	148	12	33	254	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	56	434	63	827	1982	119	71	293	975	80	320	260
Arrive On Green	0.03	0.14	0.14	0.47	0.59	0.59	0.04	0.16	0.16	0.05	0.17	0.17
Sat Flow, veh/h	1757	3038	445	1757	3355	201	1757	1845	1491	1757	1845	1499
Grp Volume(v), veh/h	44	145	148	80	243	251	55	148	12	33	254	5
Grp Sat Flow(s),veh/h/ln	1757	1752	1731	1757	1752	1804	1757	1845	1491	1757	1845	1499
Q Serve(g_s), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Cycle Q Clear(g_c), s	2.7	8.5	8.8	2.8	7.2	7.3	3.4	8.1	0.0	2.0	14.5	0.3
Prop In Lane	1.00		0.26	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	56	250	247	827	1035	1066	71	293	975	80	320	260
V/C Ratio(X)	0.78	0.58	0.60	0.10	0.23	0.24	0.78	0.51	0.01	0.41	0.79	0.02
Avail Cap(c_a), veh/h	176	478	472	827	1035	1066	192	570	1199	128	503	409
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	44.1	44.2	16.1	10.7	10.7	52.3	42.3	7.6	51.1	43.6	37.7
Incr Delay (d2), s/veh	20.5	3.0	3.3	0.1	0.5	0.5	15.9	1.3	0.0	3.3	4.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	4.3	4.5	1.3	3.7	3.8	2.0	4.2	0.1	1.0	7.8	0.1
LnGrp Delay(d),s/veh	73.4	47.1	47.5	16.2	11.2	11.2	68.1	43.6	7.6	54.4	48.2	37.7
LnGrp LOS	E	D	D	B	B	B	E	D	A	D	D	D
Approach Vol, veh/h		337			574			215			292	
Approach Delay, s/veh		50.7			11.9			47.9			48.8	
Approach LOS		D			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	70.0	8.4	24.1	56.8	20.7	10.0	22.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	5.0	* 5
Max Green Setting (Gmax), s	11.0	39.0	12.0	30.0	20.0	* 30	8.0	* 34
Max Q Clear Time (g_c+I1), s	4.7	9.3	5.4	16.5	4.8	10.8	4.0	15.1
Green Ext Time (p_c), s	0.0	4.8	0.0	1.3	3.8	2.2	0.6	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Traffic Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Future Volume (veh/h)	29	304	228	179	361	82	251	435	348	96	169	34
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.88	1.00		0.89	1.00		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	31	320	94	188	380	74	264	458	128	101	178	2
Adj No. of Lanes	1	2	1	2	2	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	55	911	359	260	881	169	419	747	330	321	599	247
Arrive On Green	0.03	0.26	0.26	0.08	0.31	0.31	0.24	0.22	0.22	0.18	0.17	0.17
Sat Flow, veh/h	1757	3505	1380	3408	2873	550	1757	3320	1468	1757	3505	1442
Grp Volume(v), veh/h	31	320	94	188	229	225	264	458	128	101	178	2
Grp Sat Flow(s),veh/h/ln	1757	1752	1380	1704	1752	1671	1757	1660	1468	1757	1752	1442
Q Serve(g_s), s	2.3	9.7	7.0	7.0	13.6	14.0	17.5	16.1	6.9	6.5	5.8	0.1
Cycle Q Clear(g_c), s	2.3	9.7	7.0	7.0	13.6	14.0	17.5	16.1	6.9	6.5	5.8	0.1
Prop In Lane	1.00		1.00	1.00		0.33	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	55	911	359	260	538	512	419	747	330	321	599	247
V/C Ratio(X)	0.57	0.35	0.26	0.72	0.43	0.44	0.63	0.61	0.39	0.31	0.30	0.01
Avail Cap(c_a), veh/h	108	911	359	367	538	512	419	1246	551	321	938	386
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	62.1	39.2	38.2	58.7	35.9	36.1	44.4	45.3	21.9	46.0	47.1	20.5
Incr Delay (d2), s/veh	3.4	1.1	1.8	1.8	2.5	2.7	7.0	1.2	1.1	0.2	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	4.8	2.8	3.4	6.9	6.9	9.3	7.5	2.9	3.2	2.8	0.0
LnGrp Delay(d),s/veh	65.5	40.2	40.0	60.5	38.4	38.8	51.4	46.5	22.9	46.2	47.4	20.5
LnGrp LOS	E	D	D	E	D	D	D	D	C	D	D	C
Approach Vol, veh/h		445			642			850			281	
Approach Delay, s/veh		41.9			45.0			44.4			46.8	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	44.1	35.0	26.4	14.1	38.0	28.0	33.4
Change Period (Y+Rc), s	4.0	* 4.2	4.0	* 4.2	* 4.2	* 4.2	* 4.2	* 4.2
Max Green Setting (Gmax), s	8.0	* 40	31.0	* 35	* 14	* 34	* 17	* 49
Max Q Clear Time (g_c+I1), s	4.3	16.0	19.5	7.8	9.0	11.7	8.5	18.1
Green Ext Time (p_c), s	0.0	2.2	0.3	1.0	0.9	1.6	0.9	5.5

Intersection Summary	
HCM 2010 Ctrl Delay	44.4
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Future Volume (veh/h)	12	1	13	13	0	64	7	482	62	34	277	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.90		0.93	0.90		0.93	1.00		0.94	1.00		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1845	1845	1845	1845	1845	1845	1900
Adj Flow Rate, veh/h	13	1	3	14	0	5	7	507	60	36	292	11
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	261	29	23	328	0	138	10	977	783	45	968	36
Arrive On Green	0.09	0.09	0.09	0.09	0.00	0.09	0.01	0.53	0.53	0.03	0.55	0.55
Sat Flow, veh/h	834	312	246	1290	0	1464	1757	1845	1478	1757	1762	66
Grp Volume(v), veh/h	17	0	0	14	0	5	7	507	60	36	0	303
Grp Sat Flow(s),veh/h/ln	1392	0	0	1290	0	1464	1757	1845	1478	1757	0	1828
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.1	6.2	0.7	0.7	0.0	3.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.3	0.0	0.1	0.1	6.2	0.7	0.7	0.0	3.1
Prop In Lane	0.76		0.18	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	313	0	0	328	0	138	10	977	783	45	0	1004
V/C Ratio(X)	0.05	0.00	0.00	0.04	0.00	0.04	0.71	0.52	0.08	0.81	0.00	0.30
Avail Cap(c_a), veh/h	1704	0	0	1659	0	1685	1516	2654	2125	1516	0	2630
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.4	0.0	0.0	14.4	0.0	14.3	17.3	5.3	4.0	16.9	0.0	4.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	28.8	0.6	0.1	12.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.1	0.0	0.0	0.1	3.3	0.3	0.5	0.0	1.6
LnGrp Delay(d),s/veh	14.4	0.0	0.0	14.4	0.0	14.4	46.0	5.9	4.1	28.9	0.0	4.5
LnGrp LOS	B			B		B	D	A	A	C		A
Approach Vol, veh/h		17			19			574			339	
Approach Delay, s/veh		14.4			14.4			6.2			7.1	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.5	3.2	24.1		7.5	3.9	23.4
Change Period (Y+Rc), s		* 4.2	3.0	5.0		* 4.2	3.0	5.0
Max Green Setting (Gmax), s		* 40	30.0	50.0		* 40	30.0	50.0
Max Q Clear Time (g_c+I1), s		2.3	2.1	5.1		2.3	2.7	8.2
Green Ext Time (p_c), s		0.1	0.0	9.8		0.1	0.0	9.7

Intersection Summary		
HCM 2010 Ctrl Delay		6.8
HCM 2010 LOS		A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Future Volume (veh/h)	52	23	94	27	24	41	81	458	31	35	177	45
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.92		0.92	0.93		1.00	1.00		0.93	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	54	24	20	28	25	-5	84	477	29	36	184	31
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	442	172	474	352	276	516	107	698	42	43	684	538
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.00	0.06	0.41	0.41	0.02	0.37	0.37
Sat Flow, veh/h	910	521	1442	679	840	1568	1757	1713	104	1757	1845	1450
Grp Volume(v), veh/h	78	0	20	53	0	-5	84	0	506	36	184	31
Grp Sat Flow(s),veh/h/ln	1432	0	1442	1519	0	1568	1757	0	1817	1757	1845	1450
Q Serve(g_s), s	0.5	0.0	0.4	0.0	0.0	0.0	2.0	0.0	9.7	0.9	3.0	0.6
Cycle Q Clear(g_c), s	1.4	0.0	0.4	0.8	0.0	0.0	2.0	0.0	9.7	0.9	3.0	0.6
Prop In Lane	0.69		1.00	0.53		1.00	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	614	0	474	629	0	516	107	0	740	43	684	538
V/C Ratio(X)	0.13	0.00	0.04	0.08	0.00	-0.01	0.79	0.00	0.68	0.84	0.27	0.06
Avail Cap(c_a), veh/h	1569	0	1455	1631	0	1583	1444	0	1280	1444	1299	1021
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.0	0.0	9.7	9.9	0.0	0.0	19.7	0.0	10.4	20.7	9.4	8.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	1.1	14.6	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.2	0.4	0.0	0.0	1.1	0.0	5.0	0.6	1.5	0.2
LnGrp Delay(d),s/veh	10.1	0.0	9.7	9.9	0.0	0.0	24.5	0.0	11.5	35.3	9.6	8.7
LnGrp LOS	B		A	A			C		B	D	A	A
Approach Vol, veh/h		98			48			590			251	
Approach Delay, s/veh		10.0			10.9			13.3			13.1	
Approach LOS		A			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		17.0	5.6	20.0		17.0	4.0	21.5
Change Period (Y+Rc), s		3.0	3.0	* 4.2		3.0	3.0	* 4.2
Max Green Setting (Gmax), s		43.0	35.0	* 30		43.0	35.0	* 30
Max Q Clear Time (g_c+I1), s		2.8	4.0	5.0		3.4	2.9	11.7
Green Ext Time (p_c), s		0.6	0.1	4.8		0.6	0.0	4.4

Intersection Summary	
HCM 2010 Ctrl Delay	12.8
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Future Volume (veh/h)	145	0	45	0	0	0	54	506	0	0	219	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.79		0.79	1.00		1.00	0.92		1.00	1.00		0.85
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1900	1900	1845	1900	1845	1845	0	0	1845	1900
Adj Flow Rate, veh/h	149	0	46	0	0	0	56	522	0	0	226	50
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	0	2	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	0	0	3	3
Cap, veh/h	208	0	64	0	6	0	637	1574	0	0	1216	259
Arrive On Green	0.20	0.00	0.20	0.00	0.00	0.00	0.45	0.45	0.00	0.00	0.45	0.45
Sat Flow, veh/h	1032	0	319	0	1845	0	997	3597	0	0	2892	576
Grp Volume(v), veh/h	195	0	0	0	0	0	56	522	0	0	135	141
Grp Sat Flow(s),veh/h/ln	1350	0	0	0	1845	0	997	1752	0	0	1660	1623
Q Serve(g_s), s	4.0	0.0	0.0	0.0	0.0	0.0	1.1	2.9	0.0	0.0	1.5	1.6
Cycle Q Clear(g_c), s	4.0	0.0	0.0	0.0	0.0	0.0	2.6	2.9	0.0	0.0	1.5	1.6
Prop In Lane	0.76		0.24	0.00		0.00	1.00		0.00	0.00		0.36
Lane Grp Cap(c), veh/h	272	0	0	0	6	0	637	1574	0	0	746	729
V/C Ratio(X)	0.72	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.00	0.00	0.18	0.19
Avail Cap(c_a), veh/h	1496	0	0	0	1505	0	1261	3765	0	0	1783	1744
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	11.1	0.0	0.0	0.0	0.0	0.0	5.7	5.3	0.0	0.0	4.9	5.0
Incr Delay (d2), s/veh	3.5	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.0	0.0	0.0	0.0	0.3	1.4	0.0	0.0	0.7	0.7
LnGrp Delay(d),s/veh	14.6	0.0	0.0	0.0	0.0	0.0	5.8	5.5	0.0	0.0	5.1	5.1
LnGrp LOS	B						A	A			A	A
Approach Vol, veh/h		195			0			578			276	
Approach Delay, s/veh		14.6			0.0			5.5			5.1	
Approach LOS		B						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.6		10.2		19.6		0.0
Change Period (Y+Rc), s		* 6.2		* 4.2		* 6.2		4.2
Max Green Setting (Gmax), s		* 32		* 33		* 32		24.3
Max Q Clear Time (g_c+I1), s		4.9		6.0		3.6		0.0
Green Ext Time (p_c), s		8.5		1.5		8.7		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		7.1
HCM 2010 LOS		A

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Future Volume (veh/h)	126	458	73	86	411	50	135	321	187	53	142	79
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	1.00		0.83	1.00		0.83	1.00		0.69
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	130	472	64	89	424	43	139	331	96	55	146	38
Adj No. of Lanes	1	2	0	1	2	0	1	1	1	1	1	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	193	681	91	112	548	55	332	610	529	71	322	188
Arrive On Green	0.11	0.23	0.23	0.06	0.17	0.17	0.19	0.33	0.33	0.04	0.17	0.17
Sat Flow, veh/h	1757	2992	400	1757	3149	316	1757	1845	1297	1757	1845	1079
Grp Volume(v), veh/h	130	274	262	89	234	233	139	331	96	55	146	38
Grp Sat Flow(s),veh/h/ln	1757	1752	1640	1757	1752	1713	1757	1845	1297	1757	1845	1079
Q Serve(g_s), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Cycle Q Clear(g_c), s	9.2	18.6	19.1	6.5	16.5	16.9	9.1	19.0	6.3	4.0	9.2	3.9
Prop In Lane	1.00		0.24	1.00		0.18	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	193	399	373	112	305	298	332	610	529	71	322	188
V/C Ratio(X)	0.68	0.69	0.70	0.80	0.77	0.78	0.42	0.54	0.18	0.78	0.45	0.20
Avail Cap(c_a), veh/h	270	499	467	270	499	487	332	610	529	162	511	299
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.79	0.79	0.79	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.6	46.0	46.2	60.0	51.2	51.4	46.4	35.5	25.7	61.8	48.1	45.9
Incr Delay (d2), s/veh	4.1	3.6	4.3	11.9	5.7	6.3	0.7	2.7	0.6	16.5	1.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	9.4	9.1	3.5	8.5	8.6	4.5	10.1	2.3	2.3	4.8	1.2
LnGrp Delay(d),s/veh	59.7	49.6	50.5	72.0	56.9	57.7	47.1	38.2	26.3	78.3	49.1	46.5
LnGrp LOS	E	D	D	E	E	E	D	D	C	E	D	D
Approach Vol, veh/h		666			556			566			239	
Approach Delay, s/veh		51.9			59.6			38.4			55.4	
Approach LOS		D			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.3	27.6	29.6	27.7	12.3	34.6	9.2	48.0
Change Period (Y+Rc), s	5.0	* 5	5.0	* 5	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	20.0	* 37	19.0	* 36	20.0	37.0	12.0	43.0
Max Q Clear Time (g_c+I1), s	11.2	18.9	11.1	11.2	8.5	21.1	6.0	21.0
Green Ext Time (p_c), s	3.1	3.7	1.8	1.0	0.1	4.4	0.0	2.8

Intersection Summary	
HCM 2010 Ctrl Delay	50.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

APPENDIX I

WATER QUALITY ASSESSMENT REPORT

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Las Trampas Creek Bridge at South Main Street Replacement Project
City of Walnut Creek, California

Water Quality Assessment Report

Prepared for:

CITY OF WALNUT CREEK

QUINCY ENGINEERING

Prepared by:

WRECO

November 2018

Las Trampas Creek Bridge at South Main Street Replacement Project
City of Walnut Creek, California

Water Quality Assessment Report

Submitted to:
City of Walnut Creek

This report has been prepared by or under the supervision of the following Senior Environmental Scientist. The Senior Environmental Scientist attests to the technical information contained herein and has judged the qualifications of any technical specialists providing technical data upon which recommendations, conclusions, and decisions are based.

Tony Jones, B.S., J.D., QSD.
Senior Environmental Scientist

11/8/18
Date

November 2018

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EXECUTIVE SUMMARY

The City of Walnut Creek (City) is proposing to replace the five-span reinforced concrete "T"-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek. The Las Trampas Creek Bridge at South Main Street Replacement Project (Project) is located on South Main Street approximately 0.1 miles south of Olympic Boulevard in the City of Walnut Creek, Contra Costa County (County), California. The Project site is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is one-half block north of the Kaiser Permanente Hospital. See Figure 1-3 for the Project Location Map, Project Vicinity Map, and the Project Aerial Map.

The purpose of this Project is to improve public safety by replacing the existing structurally deficient and functionally obsolete (as defined by the California Department of Transportation [Caltrans]) bridge with a new bridge that meets current American Association of State Highway and Transportation Officials standards. The Project will be 88.53 percent federally funded under the Highway Bridge Program and 11.47 percent funded by local matching funds. Caltrans will provide Project oversight as required through Caltrans Local Assistance.

The new bridge will be constructed over the course of two construction seasons beginning in 2021 and will be staged to maintain use of the bridge and avoid impacts on nearby roads that would result from road closures and detours. Each construction season is anticipated to begin in January and end in December; all in-water work will be completed between June 1 and October 15 each year.

The purpose of this Water Quality Assessment Report (WQAR) is to fulfill the requirements of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), and to provide information for National Pollutant Discharge Elimination System (NPDES) permitting. This document includes a discussion of the proposed Project, the physical setting of the Project area, and the regulatory framework with respect to water quality. It also provides data on surface water and groundwater resources within the Project area (where available); identifies water quality impairments, beneficial uses, and potential water quality impacts/benefits associated with the proposed Project; and recommends avoidance and minimization measures for potentially adverse impacts.

The Project lies within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). Las Trampas Creek is the receiving water body and flows directly under the existing and proposed bridge. At the Project location, Las Trampas Creek is a concrete-lined channel that flows underground immediately downstream of the South Main Street bridge crossing. Walnut Creek begins 0.25 miles downstream of the Project area. Runoff from the Project is conveyed through storm drain facilities that outfall directly to Las Trampas Creek.

The Project is not located within a Groundwater Basin, according to the SFBRWQCB *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)*, effective May 4, 2017. Depth to groundwater near the Project area ranges from approximately 14 to 16 feet below ground surface (bgs), and groundwater flow direction is typically to the northwest. Permanent impacts to groundwater are not anticipated.

Permanent impacts to water resources may occur during installation of bridge piles. The Project would introduce fill within Las Trampas Creek for the abutments and the pier of the new bridge. The proposed bridge would be longer and wider than the existing bridge and would not result in substantial fill in the creek. A 404 Nationwide Permit with the United States Army Corps of Engineers (USACE) would be required for the Project. Other permanent impacts to water quality are anticipated to be minimal due to the small addition of impervious area and because Las Trampas Creek is a concrete-lined channel at the Project location.

Temporary impacts to water quality during construction include sediment-laden discharge from excavation activities, pollutant-laden discharge from storage or work areas, and discharge of contaminated groundwater during dewatering activities. Temporary impacts to Las Trampas Creek and Walnut Creek would be avoided and minimized by implementing construction site project features (or best management practices [BMPs]) and groundwater treatment measures described below.

Based on information available at the time of this report, the Project has the potential to disturb more than 1 acre of soil. Assuming the Project's disturbed soil area (DSA) exceeds 1 acre, the Project would be subject to the State Water Resources Control Board (SWRCB) Construction General Permit (CGP) (Order No. 2012-0006-DWQ). The Project's Contractor would develop and implement a *Storm Water Pollution Prevention Plan* (SWPPP) to comply with the conditions of the CGP. The SWPPP would detail the measures to address the temporary water quality impacts resulting from construction activities associated with this Project. The SWPPP would also include the development of a Construction Site Monitoring Program that presents procedures and methods related to the visual monitoring, sampling, and analysis plans.

Dewatering is anticipated for this Project both during shallow excavations near the creek bottom and deeper foundation excavations. The Project's *Initial Site Assessment/Preliminary Site Investigation* (ISA/PSI) report identified potential contaminants in aquifers from a pre-existing dry-cleaning facility adjacent to the Project. To minimize the potential for increased groundwater contamination, steel casings may be required for installation of cast-in-drilled-hole (CIDH) piles.

Groundwater at the Project site is not suitable for discharge onsite relative to Water Quality Objectives or Effluent Limitations listed in the SFBRWQCB *Basin Plan*. Contaminated groundwater would be transported off-site and discharged to the Contra Costa Sanitary District under permit or treated on-site under the SFBRWQCB Volatile Organic Compound (VOC) and Fuel NPDES General Permit (Order No. R2-2017-0048) prior to discharging to Las Trampas Creek.

The Project would have approximately 0.25 acres of temporary impacts to jurisdictional waters, based on the disturbance area for bridge demolition and replacement. The Project may affect, but is not likely to adversely affect, the western pond turtle due to the loss of habitat. The grading of the Project has been minimized to the maximum extent practicable in order to avoid jurisdictional features.

Estimates of the DSA and existing, added, removed, and replaced impervious areas are provided in the table below.

Table ES-1. Conservative-estimate DSA and Impervious Areas

Water Quality Areas	Area (sq. ft)	Area (acre)
DSA	43,708	1.00
Existing Impervious Area	38,853	0.89
Added Impervious Area	4,097	0.09
Removed Impervious Area	482	0.01
Replaced Impervious Surface	38,371	0.88

Source: Quincy Engineering

The Project does not propose additional traffic lanes and would therefore not trigger permanent treatment measures. However, the Project may still consider green infrastructure designs in coordination with the City of Walnut Creek, if feasible. Design features may include bioretention cells, tree wells, curb-cuts, and/or pervious pavement and could be incorporated into other areas of construction such as sidewalks, shoulders, and medians.

The Project is expected to obtain a Section 401 Water Quality Certification from the SFBRWQCB, a Nationwide 404 Permit from the USACE, and a 1602 Lake and Streambed Alteration Agreement from the California Department of Fish and Wildlife (CDFW). The Project may be required to secure an SFBRWQCB VOC and Fuel NPDES General Permit (Order No. R2-2017-0048) for onsite groundwater treatment and discharge to Las Trampas Creek. These permits often have conditions for water quality that would be incorporated into the Project SWPPP as construction site Project features or BMP controls.

The general approach of the Project is to avoid impacts. The Project would have minimal impacts to water quality if source control measures and construction site project features (or BMPs) are incorporated in compliance with the applicable NPDES permits.

Acronyms

bgs	below ground surface
BMP	Best Management Practice
BSA	Biological Study Area
Caltrans	California Department of Transportation
CASQA	California Stormwater Quality Association
CCCWP	Contra Costa Clean Water Program
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGP	Construction General Permit
CIDH	cast-in-drilled-hole
City	City of Walnut Creek
CWA	Clean Water Act
DSA	disturbed soil area
FEMA	Federal Emergency Management Agency
ft	foot/feet
ISA	Initial Site Assessment
K	soil erodibility factor
LS	length-slope factor
mi	mile(s)
MRP	San Francisco Bay Municipal Regional Permit
MS4	Municipal Separate Stormwater Sewer System
NEPA	National Environmental Policy Act
NES	Natural Environment Study
No.	number
NPDES	National Pollutant Discharge Elimination System
PSI	Preliminary Site Investigation
R	rainfall erosivity factor
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (Region 2)
sq.	square
SMARTS	Stormwater Multiple Application Report and Tracking System
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compounds
WDR	Waste Discharge Requirement
WPCP	Water Pollution Control Plan
WQAR	Water Quality Assessment Report
WQO	Water Quality Objective

1 INTRODUCTION

1.1 Approach to Water Quality Assessment Report

The purpose of this Water Quality Assessment Report (WQAR) is to fulfill the requirements of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), and to provide information for National Pollutant Discharge Elimination System (NPDES) permitting as related to the Las Trampas Creek Bridge at South Main Street Replacement Project (Project). This document includes a discussion of the proposed Project, the physical setting of the Project area, and the regulatory framework with respect to water quality. It also provides data on surface water and groundwater resources within the Project area, where available; identifies water quality impairments, beneficial uses, and potential water quality impacts/benefits associated with the proposed Project; and recommends protective measures for water quality.

1.2 Project Description

The City of Walnut Creek (City) is proposing to replace the five-span reinforced concrete “T”-beam/slab bridge structure (Bridge No. 28C0075) over Las Trampas Creek. The Project is located on South Main Street approximately 0.1 miles south of Olympic Boulevard in the City of Walnut Creek, Contra Costa County (County), California. The Project site is in the popular South Main Street/Broadway Plaza shopping area between Botelho Drive and Newell Avenue and is one-half block north of the Kaiser Permanente Hospital. See Figure 1-3 for the Project Location Map, Project Vicinity Map, and the Project Aerial Map.

The Project will be 88.53 percent federally funded under the Highway Bridge Program and 11.47 percent funded by local matching funds. The California Department of Transportation (Caltrans) will provide Project oversight as required through Caltrans Local Assistance.

1.2.1 Existing Bridge

The existing bridge is approximately 131 feet (ft) long on bent style abutments and 74.5 to 81 ft wide (including sidewalks). The existing north approach roadway clear width is approximately 62.7-ft-wide, which includes five traffic lanes and a 4.2-ft-wide raised median. The existing south approach roadway clear width is approximately 69.9-ft-wide, which includes five traffic lanes, a parking lane, and a 6-ft-wide raised median. The difference between the two approaches is the parking lane on the south approach. The super elevation transitions from approximately 3 percent at the Botelho Drive intersection to 5 percent at the Broadway Plaza intersection.

The alignment of the roadway on the approach to the bridge is constrained by an adjacent multi-story parking garage, office buildings, restaurants, and the new Agora at South Main apartments and retail space. Driveway access to these features are currently located on all four corners of the bridge. Numerous utilities are mounted on both sides and underneath the bridge and at each end of the bridge. Storm drainage systems and retaining walls are also located on each end of the bridge.

1.2.2 Proposed Bridge

The proposed bridge is approximately 104-ft-long and 103.5-ft-wide to accommodate two 12-ft-wide traffic lanes in each direction, two 8-ft-wide shoulders in each direction, a 4- to 5-ft-wide raised median, two 10-ft-wide sidewalks on each side of the bridge, and left-turn pockets approaching the intersections of Botelho Drive and Broadway Plaza. The two-span bridge will be supported by a 4-ft-diameter pier column in the center, which is aligned with the existing nose wall of the adjacent downstream culvert structure. The preferred alternative includes a precast/prestressed voided slab superstructure with a depth of 2.25 feet.

The proposed roadway approaches are planned to be slightly realigned from their existing condition between the intersection of Botelho Drive and Broadway Plaza. Roadway approaches are anticipated to be less than 200-ft-long on either side of the proposed bridge. The proposed vertical profile of the roadway is planned to be similar to the existing to minimize cut/fill requirements adjacent to the proposed bridge. The roadway edges would conform to the existing sidewalks and driveways with as minimal an impact as possible.

1.2.3 Construction

There is a total of two abutments and four bents to be removed. The 60.9-ft-wide by 200-ft-long northern approach will be excavated to 5-feet-deep to expose existing utilities and allow for reconstruction of the road base; the 79.5-ft-wide by 200-ft-long southern approach will be excavated to 5 feet deep to expose existing utilities and allow for reconstruction of the road base.

The new bridge will be constructed with two 110-ft-wide by 5-ft-thick by 6-ft-deep abutments with multiple 4- to 6-ft diameter cast-in-drilled-hole (CIDH) concrete piles up to 120-ft-deep, two new roadway approaches in largely the same alignment as the existing approaches, and a central bent with multiple 4- to 6-ft-diameter CIDH concrete piles up to 120-feet-deep. The abutments would be constructed with a cast-in-place concrete stem wall buried approximately 5 feet below original grade.

A water diversion system will be required to divert Las Trampas Creek through the area for the duration of construction and provide Contractor access around the bridge site. Temporary cofferdams will be constructed both upstream and downstream of the bridge. The cofferdams will be constructed with a combination of clean crushed rock and sandbags. The cofferdam will have an impervious membrane made up of plastic sheeting to keep the water from seeping into the work area. Temporary culverts consisting of approximately 12-inch-diameter to 36-inch-diameter corrugated steel or high-density polyethylene (HDPE) pipes will be used to divert the flows away from the work area and downstream. After the cofferdams are constructed, sump pumps will be used to dewater the site, if necessary.

The Project will remove concrete-filled sand bags embedded in the banks adjacent to the bridge, as well as the concrete-lined streambed. Disturbance to soils behind and beneath these features will be up to 1 foot deep. Erosion control elements such as a new concrete streambed slope paving will be constructed. Roadway elements such as sidewalks, driveways, and a median will be reconstructed throughout the Area of Potential Effects to 2-feet-deep. The Project will remove

15 to 20 existing trees and plant 20 trees to a depth of 3 feet. Street signs and traffic signals associated with the new bridge and realigned roadway will also be installed.

An access ramp would be required for heavy equipment entry into the channel, especially for pier construction. Imported borrow would be required to create this ramp. The location of this access ramp is anticipated to be on the northwest corner of the bridge, between the bridge and Gott's Roadside Restaurant. This ramp will need to be constructed prior to any pier work during the first season. It is anticipated that this access ramp will be removed, and the channel restored back to its original slope and grade at the end of the first season of construction. This ramp would be built again at the beginning of the second season of construction.

Temporary shoring will likely be required to construct the new abutments and the pier within the channel. Shoring will likely consist of sheet piles or CIDH soldier piles. The CIDH pile installation at the center pier would also require a temporary work pad to be constructed in the channel to provide adequate width for the Contractor's equipment (e.g., drill rig, pile oscillator, crane, excavator). The temporary work pad would be placed above the stream diversion pipes. Additional measures may be required to protect the stream diversion pipes from being crushed by the construction equipment, such as trench plates.

Utilities at the Project site include underground electrical, telephone, cable, and water. Existing conduits under South Main Street will be excavated to 5 feet deep and removed or relocated. Conduits mounted on either side of the bridge will likely be relocated to the sidewalks of the proposed bridge.

Staging areas will be located entirely within paved parking areas in the Project vicinity. No ground disturbance is anticipated in these areas.

1.2.4 Project Schedule

The new bridge will be constructed over the course of two construction seasons beginning in 2021 and will be staged to maintain use of the bridge and avoid the high impacts on nearby roads that would result from road closures and detours. Each construction season is anticipated to begin in January and end in December; all in-water work will be completed between June 1 and October 15 each year.

During the first season, the west portion of the bridge (currently carrying southbound traffic) will be removed and vehicular and pedestrian traffic directed to the east half of the bridge (currently carrying northbound traffic). During the second season of construction, pedestrian and vehicular traffic will be redirected to the new half of the bridge while construction is completed. During each season of construction, traffic lanes along South Main Street will be reconfigured to align with the detours on either side of the bridge.

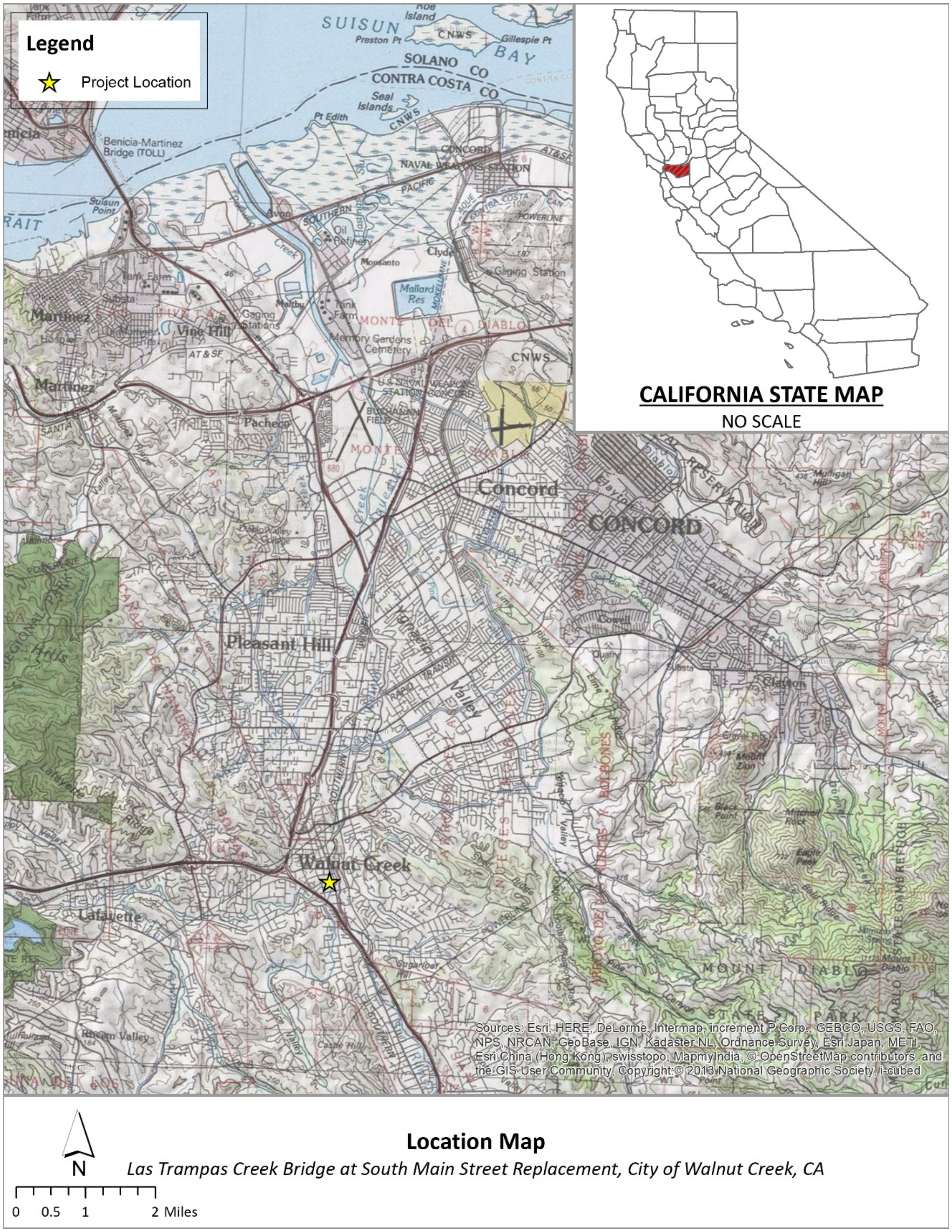

Figure 1. Project Location Map

Source: United States Geological Survey (USGS)

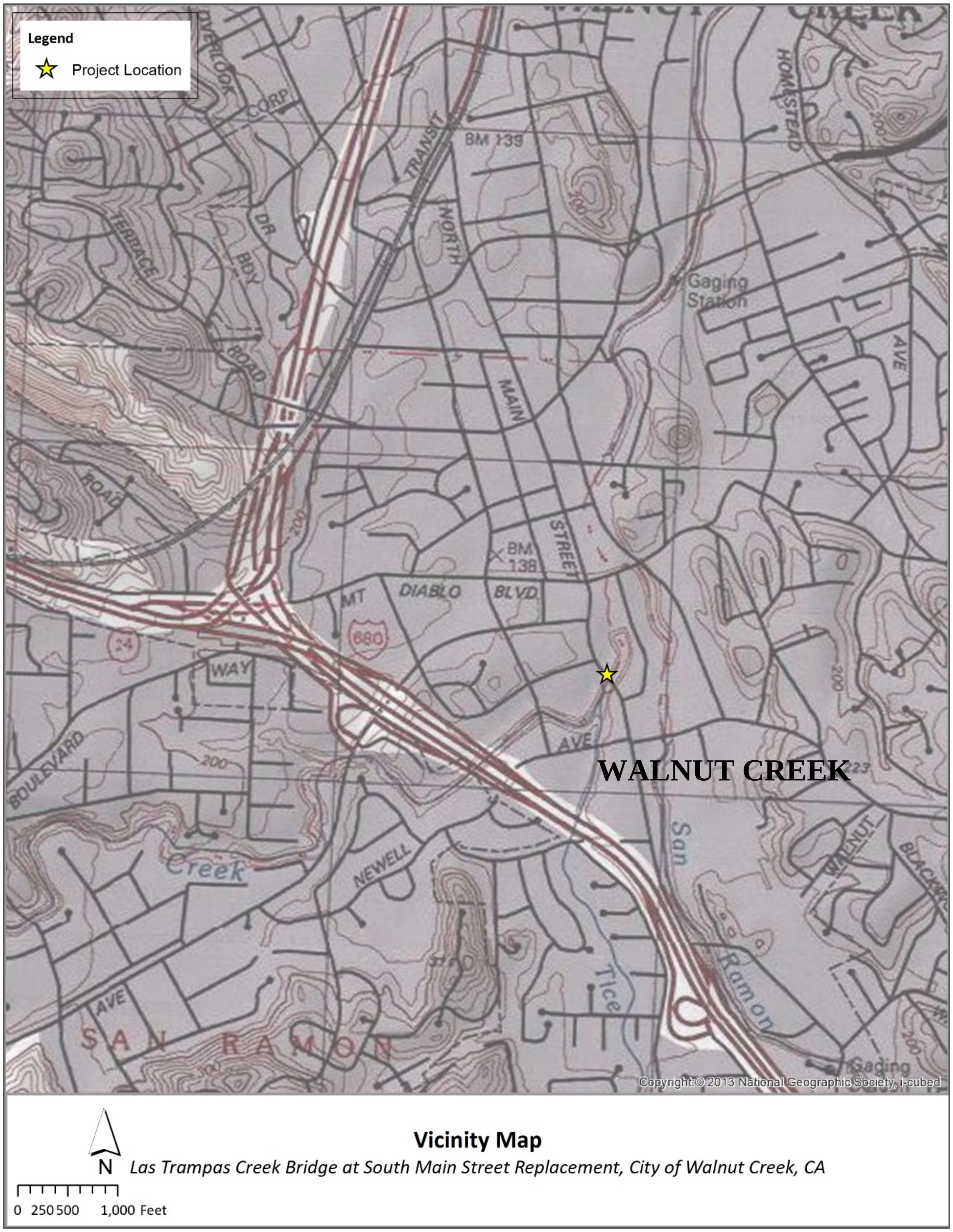

Figure 2. Project Vicinity Map

Source: USGS

Study Area Map

Las Trampas Creek Bridge at South Main Street Replacement, City of Walnut Creek, CA

Figure 3. Study Area Map

Source: Environmental Systems Research Institute

1.3 Project Purpose and Need

There are multiple cracks and spalls with exposed rebar in the soffit. rendering the bridge Structurally Deficient (SD) and Functionally Obsolete (FO). The reinforced concrete T-Girder/Slab structure has been classified SD and FO with an overall sufficiency rating of 47.4 as defined by Caltrans. There are numerous cracks with efflorescence in the soffit and regions of severe spalling with exposed rusted rebar.

The purpose of this Project is to improve public access by replacing the existing SD and FO bridge with a new bridge that meets current American Association of State Highway and Transportation Officials standards.

1.4 Project History

The existing bridge is a reinforced concrete “T”-beam bridge built in 1919. In 1950, the bridge was widened on the south side with a reinforced concrete “T”-beam superstructure; in 1956, the bridge was widened on the south side again with a reinforced concrete slab superstructure.

1.5 Construction General Permit Risk Assessment

Based on information available at the time of this report, the Project has the potential to disturb more than 1 acre of soil. Assuming the final disturbed soil area (DSA) exceeds 1 acre, the Project would require a State Water Resources Control Board (SWRCB) Construction General Permit (CGP) (Order No. 2012-0006-DWQ). The Project would be required to prepare and submit a *Storm Water Pollution Prevention Plan* (SWPPP). To determine the applicable monitoring and sampling requirements during construction, the SWPPP would include the determination of the Project’s risk level. The risk level is determined from the combined receiving water risk and sediment risk.

Assuming the Project is covered by the CGP, the Project would be classified as Risk Level 2. The sediment risk factor was determined from the product of the rainfall runoff erosivity factor (R), the soil erodibility factor (K), and the length-slope factor (LS). The R, K, and LS values were obtained using the US Environmental Protection Agency (USEPA) Rainfall Erosivity Factor Calculator, Caltrans Water Quality Planning Tool, and U.S. Department of Agriculture (USDA) Web Soil Survey, respectively. The factors used to determine the sediment risk are summarized in Table 1.

Table 1. Sediment Risk Factors

R	K	LS	R*K*LS (tons/acre)	Sediment Risk
98.72	0.24	2.24	53.07	Medium (>15, <75 tons/acre)

According to the *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)* (SFBRWQCB, 2017b), Las Trampas Creek does not have all three beneficial uses of cold freshwater habitat, fish migration, and fish spawning, which results in a low receiving water risk. The combined medium sediment risk and low receiving water risk would result in the Project being classified as Risk Level 2. The SWRCB’s *Risk Determination Worksheet* is included in Appendix A.

For Risk Level 2 projects, in addition to implementation of standard construction site best management practices (BMPs), the Contractor would be required to perform quarterly non-stormwater discharge visual inspections, and rain event visual inspections pre-storm, daily during a storm event, and post-storm. Risk Level 2 projects are also required to implement Rain Event Action Plans and comply with Numeric Action Level effluent limits for pH and turbidity. This assessment may be updated as more detailed Project information becomes available.

2 REGULATORY SECTION

2.1 Federal Requirements

2.1.1 Clean Water Act

In 1972, the United States (US) Congress passed the Federal Water Pollution Control Act, which later came to be known as the Clean Water Act (CWA). This legislation, enforced by the US Environmental Protection Agency (USEPA), established the contemporary legal foundation and structure for regulating water quality throughout the US. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The list below summarizes some of its more important sections:

- Sections 303 and 304 provide for water quality standards, criteria, and guidelines for all surface Waters of the US. Waters of the US include all navigable water bodies and all water bodies that drain into a navigable water body.
- Section 401 requires an applicant for any federal project that proposes an activity that may result in a discharge to waters of the US to obtain certification from the state that the discharge will comply with other provisions of the CWA (most frequently in tandem with a Section 404 permit request). Section 401 certifications are discussed further in Section 2.2.4.
- Section 402 established the NPDES, a permitting system for the discharge of any pollutant (except for dredge or fill material) into Waters of the US. The SWRCB enacts and enforces the Federal NPDES program and all water quality programs and regulations that cross regional boundaries. The nine California Regional Water Quality Control Boards (RWQCBs) enact, administer, and enforce all programs, including NPDES permitting, within their jurisdictional boundaries. Section 402(p) requires permits for discharges of stormwater from industrial, construction, and Municipal Separate Storm Sewer Systems (MS4s).
- Section 404 establishes a permit program for the discharge of dredge or fill material into Waters of the US, including wetlands. This permit program is administered by the United States Army Corps of Engineers (USACE).

The USACE issues two types of 404 permits: General and Individual. There are two types of General permits: Regional and Nationwide permits. Regional permits are issued for a general category of activities when they are similar in nature and cause minimal environmental effect. Nationwide permits are issued to authorize a variety of minor project activities with no more than minimal effects. There are also two types of Individual permits: Standard Individual permit and Letter of Permission. Ordinarily, projects that do not meet the criteria for a Nationwide Permit may be permitted under one of USACE's Individual permits. For Standard Individual permit, the USACE decision to approve is based on compliance with USEPA Section 404 (b)(1) Guidelines (USEPA CFR 40 Part 230), and whether permit approval is in the public interest.

The 404(b)(1) Guidelines were developed by the USEPA in conjunction with USACE and allow the discharge of dredged or fill material into the aquatic system ("Waters of the U.S.") only if there is no practicable alternative which would have less adverse effects. The Guidelines state that USACE may not issue a permit if there is a least environmentally damaging practicable alternative, to the proposed discharge that would have less effects on “Waters of the U.S.,” and not have any other significant adverse environmental consequences. Per the Guidelines, documentation is needed that a sequence of avoidance, minimization, and compensation measures have been followed, in that order. The Guidelines also restrict permitting activities that violate water quality or toxic effluent standards, jeopardize the continued existence of listed species, violate marine sanctuary protections, or cause “significant degradation” to “Waters of the US.” In addition, every permit from the USACE, even if not subject to the 404(b)(1) Guidelines, must meet general requirements (see 33 CFR 320.4.).

2.2 State Laws and Requirements

2.2.1 Porter-Cologne Water Quality Control Act

California’s Porter-Cologne Act, enacted in 1969, provides the legal basis for water quality regulation within California. This Act requires a “Report of Waste Discharge” for any discharge of waste (liquid, solid, or gaseous) to land or surface waters that may impair beneficial uses for surface and/or groundwater of the State. It predates the CWA and regulates discharges to “Waters of the State.” “Waters of the State” include more than just “Waters of the U.S.,” such as groundwater and surface waters that are not considered “Waters of the U.S.” Additionally, it prohibits discharges of “waste” as defined and this definition is broader than the CWA definition of “pollutant.” Discharges under the Porter-Cologne Act are permitted by Waste Discharge Requirements (WDRs) and may be required even when the discharge is already permitted or exempt under the CWA.

The SWRCB and RWQCBs are responsible for establishing the water quality standards as required by the CWA and regulating discharges to protect beneficial uses of water bodies. Details regarding water quality standards in a project area are contained in the applicable RWQCB Basin Plan. In California, Regional Boards designate beneficial uses for all waterbody segments in their jurisdictions, and then set standards necessary to protect these uses.

Consequently, the water quality standards developed for particular waterbody segments are based on the designated use and vary depending on such use. Waterbody segments that fail to meet standards for specific pollutants are included in a Statewide List in accordance with CWA Section 303(d). If a Regional Board determines that waters are impaired for one or more constituents and the standards cannot be met through point source or non-source point controls (NPDES permits or Waste Discharge Requirements), the CWA requires the establishment of Total Maximum Daily Loads (TMDLs). TMDLs specify allowable pollutant loads from all sources (point, non-point, and natural) for a given watershed.

2.2.2 State Water Resources Control Board and Regional Water Quality Control Boards

The SWRCB adjudicates water rights, sets water pollution control policy, and issues water board orders on matters of statewide application, and oversees water quality functions throughout the state by approving Basin Plans, TMDLs, and NPDES permits. RWCQBs are responsible for protecting beneficial uses of water resources within their regional jurisdiction using planning, permitting, and enforcement authorities to meet this responsibility.

2.2.3 National Pollutant Discharge Elimination System NPDES Program

2.2.3.1 Municipal Separate Storm Sewer Systems (MS4)

Section 402(p) of the CWA requires the issuance of NPDES permits for five categories of stormwater discharges, including MS4s. The USEPA defines an MS4 as “any conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human-made channels, and storm drains) owned or operated by a state, city, town, county, or other public body having jurisdiction over stormwater, that are designed or used for collecting or conveying storm water.”

Phase I regulations require operators of medium and large MS4s to obtain stormwater permits. On December 8, 1999, the USEPA promulgated regulations, known as Phase II regulations, requiring permits for stormwater discharges from Small MS4s and from construction sites disturbing between 1 and 5 acres of land. A small MS4 is an MS4 that is not permitted under the municipal Phase I regulations.

In 2005, the SWRCB adopted the Phase II statewide general permit for Small MS4s (Order No. 2003-0005-DWQ) to efficiently regulate numerous stormwater discharges under a single permit. The current permit was issued on February 5, 2013, and became effective on July 1, 2013. The permit required that agencies regulate post-construction development (Provision E.12) through the following program elements:

- Site design measures (Provision E.12.b),
- Regulated projects (Provision E.12.c),
- Source control measures (Provision E.12.d),
- Low-Impact Development design standards (Provision E.12.e),
- Hydromodification measures (Provision E.12.f),
- Enforceable mechanisms (Provision E.12.g),
- Operation and maintenance of stormwater control measures (Provision E.12.h),
- Post-construction BMP condition assessment (Provision E.12.i),
- Planning and development review process (Provision E.12.j),
- Post-construction stormwater management requirements based on assessment and maintenance of watershed processes (Provision E.12.k), and
- Alternative post-construction stormwater management program (Provision E.12.l).

2.2.3.2 Construction General Permit

The CGP (NPDES No. CAS000002, SWRCB Order No. 2009-0009-DWQ, adopted on November 16, 2010) became effective on February 14, 2011 and was amended by Order No. 2010-0014-DWQ and Order No. 2012-0006-DWQ. The permit regulates stormwater discharges from construction sites which result in a DSA of 1 acre or greater, and/or are smaller sites that are part of a larger common plan of development.

For all projects subject to the CGP, the applicant is required to hire a Qualified SWPPP Developer (QSD) to develop and implement an effective SWPPP. All project registration documents, including the SWPPP, are required to be uploaded into the SWRCB's on-line Stormwater Multiple Application and Report Tracking System (SMARTS), at least 30 days prior to construction.

The CGP separates projects into risk levels 1, 2, or 3. Risk levels are determined during the planning and design phases and are based on potential erosion and transport to receiving waters. Requirements apply according to the risk level determined.

2.2.4 401 Permitting

Under Section 401 of the CWA, any project requiring a federal license or permit that may result in a discharge to a Water of the US must obtain a 401 Certification, which certifies that the project would be compliant with State water quality standards. The most common federal permit triggering 401 Certification is a CWA Section 404 permit, issued by the USACE. The 401 permit certifications are obtained from the appropriate RWQCB, dependent on the project location, and are required before the USACE issues a 404 permit.

In some cases, the RWQCB may have specific concerns with discharges associated with a project. As a result, the RWQCB may prescribe a set of requirements known as Waste Discharge Requirements (WDRs) under the State Water Code (Porter-Cologne Act). WDRs may specify the inclusion of additional project features, effluent limitations, monitoring, and plan submittals that are to be implemented for protecting or benefiting water quality. WDRs can be issued to address both permanent and temporary discharges of a project.

2.3 Regional and Local Requirements

2.3.1 RWQCB Basin Plan

The Project is within the jurisdiction of the San Francisco Bay RWQCB (SFBRWQCB). The *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)* (SFBRWQCB, 2017b) states the goals and policies, beneficial uses, and water quality objectives that apply to water bodies throughout the San Francisco Bay region. The *Basin Plan* has been adopted by the SWRCB, USEPA, and Office of Administrative Law.

2.3.2 MS4

Contra Costa County is an approved permittee under the San Francisco Bay Municipal Regional permit (MRP), Order No. R2-2015-0049.

The City of Walnut Creek is a member of the Contra Costa Clean Water Program (CCCWP). The CCCWP developed the *Stormwater C.3 Guidebook* in 2017 to summarize the requirements of the MRP and provide guidance for low-impact development (LID) design strategies and specific BMP selection criteria. The guidebook provides technical guidance for project designs that require the implementation of permanent stormwater BMPs and hydromodification assessment, susceptibility, and management measures throughout Contra Costa County.

2.3.3 RWQCB Section 401 Water Quality Certification

A Section 401 Water Quality Certification would be required by the SFBRWQCB for work within Las Trampas Creek. Additional requirements, such as project features, effluent limitations, monitoring, and/or plan submittals, may be prescribed by the SFBRWQCB to protect or benefit water quality.

2.3.4 RWQCB Dewatering Permit

The SFBRWQCB’s Volatile Organic Compound (VOC) and Fuel General Permit (Order No. R2-2017-0048), covers discharge or reuse of extracted and treated groundwater resulting from the cleanup of groundwater polluted by VOCs, fuel leaks, and other related wastes at active cleanup sites, including construction sites.

2.3.5 City of Walnut Creek Municipal Code

If not covered by the CGP, the Project would adhere to the City’s stormwater management and discharge control requirements. Title 9, chapter 16, provision 9-16.109 (j) of the *Walnut Creek Municipal Code* states: “All construction projects shall incorporate site-specific BMPs, which can be a combination of BMPs from the California *BMP Handbook, Construction,* January 2003, the Caltrans *Stormwater Quality Handbooks*, *Construction Site Best Management Practices Manual*, March 2003, the San Francisco Bay Regional Water Quality Control Board *Erosion and Sediment Control Field Manual*, 2002, the City's grading and erosion control ordinance, and other generally accepted engineering practices for erosion control as required by the Director. The Director may establish controls on the rate, volume, and duration of stormwater runoff from new developments as may be appropriate to minimize the discharge and transport of pollutants.”

3 AFFECTED ENVIRONMENT/EXISTING CONDITIONS

3.1 General Setting

The Project site is located at the crossing of South Main Street and Las Trampas Creek in downtown Walnut Creek in Contra Costa County, approximately 16 miles east of the City of Oakland. The Project site is situated on the southern end of the Walnut Creek Valley, between Briones Hills and Shell Ridge near the base of Mount Diablo. The natural slope of the valley is gradual to the north; however, the Project site and vicinity are relatively level. The Project area is in downtown Walnut Creek, just southwest of the Broadway Plaza shopping area.

3.1.1 Land Use

Land use within the Project watershed is primarily residential, but also includes parks and recreation, open space, and agricultural lands. Commercial land use is mainly along Interstate 680 and State Route 24 (WRECO, 2018a). Current land use designations immediately adjacent to the Project location include “retail sales,” “restaurant,” “residential,” and “shopping center” (Contra Costa County, 2018).

3.1.2 Topography

According to the Walnut Creek, California *7.5-Minute Topographic Quadrangle* map, the elevation of the Project site is approximately 137 feet above mean sea level (EDR, 2017). Regional drainage is sloped moderately to the north-northwest.

3.1.3 Regional Hydrology

Las Trampas Creek originates at Las Trampas Ridge and generally flows in a northeastern direction. Las Trampas Creek receives water from Lafayette Creek, Grizzly Creek, Tice Creek, and an unnamed tributary (see Figure 4). Lafayette Creek joins with Las Trampas Creek in downtown Lafayette, and Tice Creek converges to Las Trampas Creek in the downtown area of the City, approximately 130-ft upstream of the Project site. Las Trampas Creek drains a watershed of approximately 27.2 square miles (sq. mi) at the Project site. The watershed map is shown in Figure 4.

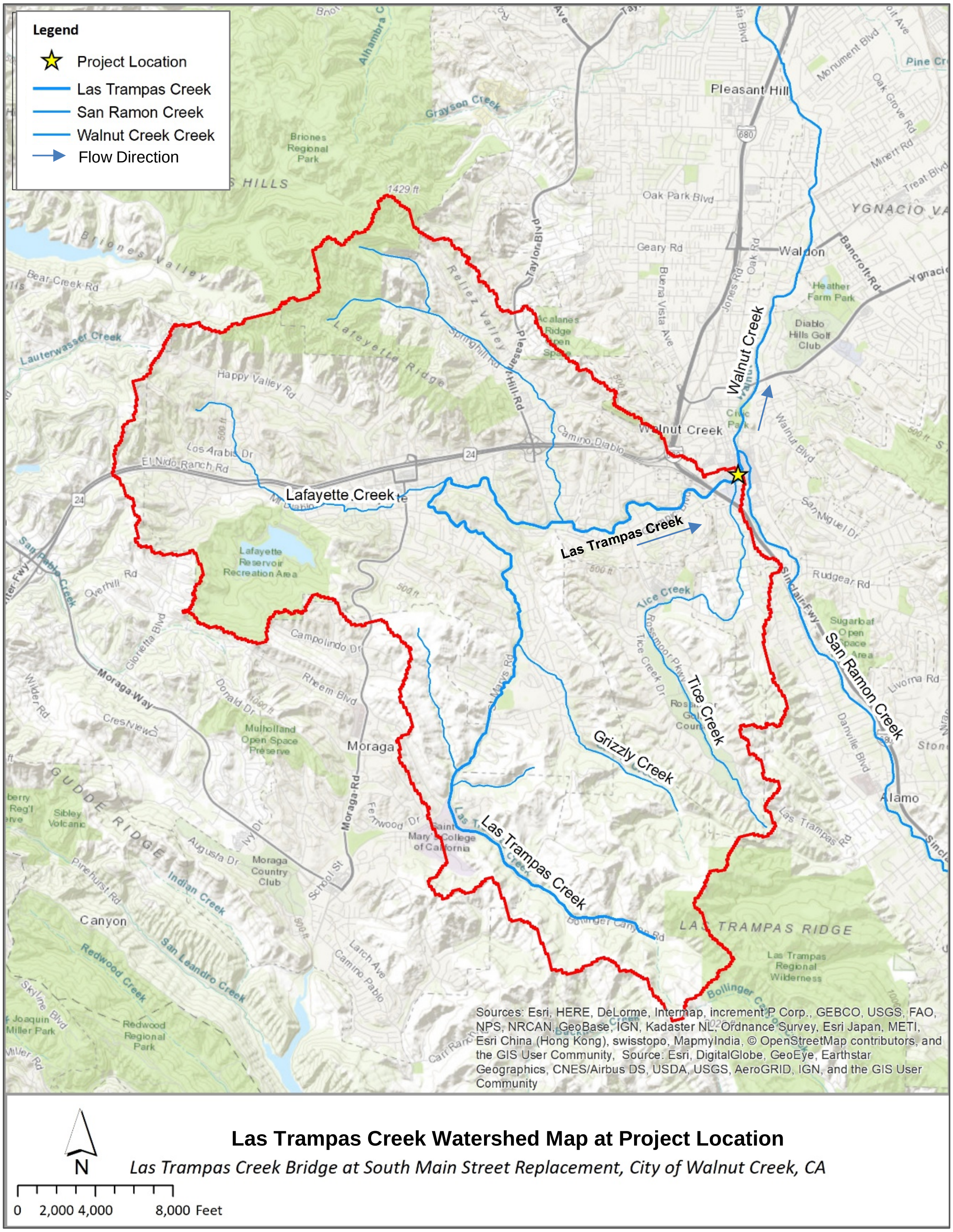

Figure 4. Las Trampas Creek Watershed Map at Project Location

Source: USGS

3.1.4 Local Hydrology

At the Project location, Las Trampas Creek is a concrete-lined channel that flows underground immediately downstream of the South Main Street bridge crossing. Las Trampas Creek converges with San Ramon Creek at Liberty Bell Plaza approximately 0.25 miles downstream of the Project area to form Walnut Creek. San Ramon Creek is not affected by the Project.

Most of the impervious surfaces within and adjacent to the Project area direct surface water to storm drain facilities that are directed to Las Trampas Creek outfalls.

3.1.5 Climate and Precipitation

The Project site is located in an area with a Mediterranean climate characterized by long, dry, hot summers, and cool, wet winters. The average annual precipitation is approximately 25 inches, the average annual high temperature 69.1ºF, and the average annual minimum temperature 48.6ºF (US Climate Data, 2018).

3.1.6 Floodplains

The Project is located on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) number 06013C0293F, effective March 21, 2017. The Project site is located in shaded Zone A, which represents areas subject to flooding by the 100-year flood event determined by approximate methods where BFEs are not shown. The existing bridge is located downstream of an area classified by FEMA as Special Flood Hazard Area Zone AE, which represents areas subject to flooding by the 100-year flood event determined by detailed methods where base flood elevations are shown. The channel would be flowing full at the existing bridge site during the 100-year storm. The area upstream of the Project site is also within a regulatory floodway. The area downstream of the Project site is located in shaded Zone X, which represents areas between the limits of the base flood (100-year) and the 0.2-annual-chance (or 500-year) flood. Additional information is provided in the Project's *Location Hydraulic Study* (WRECO, 2018c).

3.1.7 Groundwater

The Project is not located within a Groundwater Basin, according to the SFBRWQCB *Basin Plan*. Based on the SWRCB's GeoTracker database, depth-to-groundwater near the Project area ranges from approximately 14 to 16 feet below ground surface (bgs), and groundwater flow direction is typically to the northwest. Regional groundwater flows are estimated to be west-northwest. Soil borings taken during geotechnical exploration on August 2 and September 6, 2017 showed groundwater at depths of 18 to 24.5 feet and groundwater elevations of 124.9 to 131.6 feet (WRECO, 2018b).

3.1.8 Soils and Geology

Subsurface soils in the Project area generally consist of sandy fine-grained sediment, silt and clay, to a depth of approximately 15 feet bgs. Below 15 feet, sediments are primarily sand, grading fine to coarse, and include less than 5-foot intervals of clayey sand or silty sand. Dominant soil types were identified as Clear Lake and Conejo. Clear Lake soils have a clay texture consisting of fine-grained soils, silts and clays, are poorly drained with very slow infiltration rates, have a high-water table, or are shallow to an impervious layer. Conejo soils have clay loam texture, consisting of fine-grained soils, silts and clays, well drained, with slow infiltration rates, soils with layers impeding downward movement of water, or soils with moderately fine or fine textures (WRECO, 2018b).

According to the USDA Web Soil Survey, Conejo clay loam soils and Clear Lake clay soils in the Project vicinity have a soil erosion potential (K factor) of 0.20 and 0.24, respectively. Both soil types have a hydrologic soil group rating of C, indicating slow infiltration and transmission rates. Web Soil Survey maps are included in Appendix B.

3.1.9 Hazardous Materials

The Project's ISA/PSI report (WRECO, 2018b) identified potential subsurface contamination in aquifers from a former dry-cleaning facility located at 1305 South Main Street (now the Agora building). The ISA/PSI concluded that releases of dry cleaner solvent (Perchloroethylene or PCE) from the former dry cleaner has resulted in continued residual concentrations of PCE and its breakdown products dichloroethylene (DCE) and vinyl chloride in shallow soil along the western boundary of the Project site, and in groundwater at the site measured at approximately 22 feet bgs. In 2013-2014, remedial action was taken to remove approximately 7,775 cubic yards of impacted soil around the Project site and groundwater treatment.

3.1.10 Biological Considerations

According to the Project's *Natural Environment Study* (NES) (Caltrans 2018), the Biological Study Area (BSA) consists primarily of paved roadways and sidewalks, with surrounding areas consisting of urban development and landscaping. Approximately 0.33 acres of stream and 0.01 acres of culvert were identified as potentially jurisdictional waters within the BSA. No wetlands were identified.

Las Trampas Creek provides marginal movement habitat for western pond turtle (Actinemys marmorata), a California Species of Special Concern. There is no habitat for special-status plants within the Project footprint.

The BSA and Project vicinity do not provide essential fish habitat for salmon. Suitable spawning habitat may occur upstream of the Project site. However, two drop structures in Walnut Creek, downstream of the BSA, prohibit salmonids from moving upstream into Las Trampas Creek and through the BSA.

3.2 Water Quality Objectives and Beneficial Uses

3.2.1 Surface Waters

The *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)*(SFB-RWQCB, 2017b) identifies general water quality objectives (WQOs) for inland surface waters on bacteria, bioaccumulation, biostimulatory substances, color, dissolved oxygen, floating material, oil and grease, population and community ecology, pH, radioactivity, salinity, sediment, settleable material, suspended material, sulfide, tastes and odors, temperature, toxicity, turbidity, un-ionized ammonia, and chemical constituents.

Table 2 lists the beneficial uses for Las Trampas Creek and Walnut Creek. Las Trampas Creek is the receiving water body for this Project. Beneficial uses for Walnut Creek are also listed due to its close proximity to the Project (0.25 miles downstream of the Project). San Ramon Creek is not affected by the Project.

Table 2. Surface Water Bodies and Beneficial Uses

Waterbody	AGR	MUN	FRSH	GWR	IND	PROC	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPWN	WARM	WILD	REC-1	REC-2	NAV
Walnut Creek									E			E	E	E	E	E	E	E	
Las Trampas Creek									E				E		E	E	E	E	

Source: SFBRWQCB

Las Trampas Creek has beneficial uses of cold freshwater habitat, preservation of rare and endangered species, warm freshwater habitat, wildlife habitat, contact water recreation, and non-contact water recreation. Walnut Creek has the same beneficial uses as Las Trampas Creek, with an additional beneficial use of fish spawning.

See Appendix C for water quality objectives and beneficial uses from the *Basin Plan*.

3.2.2 Groundwaters

General water quality objectives established for groundwaters in the *Basin Plan* include limits on bacteria, organic and inorganic chemical constituents, radioactivity, and taste and odors. These objectives do not need necessary improvement, so they are not required to follow regulations under the CWA.

3.3 Existing Water Quality

3.3.1 List of Impaired Waters

Las Trampas Creek is not listed in the CWA Section 303(d) List as an impaired water body.

Walnut Creek begins 0.25 miles downstream of the Project and is impaired for diazinon, according to CWA Section 303(d) List and the *2014/2016 Integrated Report* (SWRCB 2017). The impairment is from an unknown source but is being addressed by the *Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks* TMDL developed in 2005 and adopted by the USEPA in 2007.

3.3.2 Contaminated Groundwater

Groundwater samples taken during the Project's ISA/PSI identified RWQCB Tier 1 Environmental Screening Level (ESL) exceedances for TPHg, TPHd, TPHmo, ethylbenzene, xylenes, DCE, TCE, and vinyl chloride. Most of these constituents exceeded the RWQCB Water Quality Objectives (WQOs), CA Toxics Rule, and USEPA National Toxics Rule criteria for surface water. Detailed information is provided in the Project's ISA/PSI Report (WRECO, 2018b).

4 ENVIRONMENTAL CONSEQUENCES AND PROJECT IMPACTS

The following sections present the potential permanent and temporary water quality impacts from the Project activities and standard BMPs that would be implemented to reduce impacts.

4.1 Introduction

Permanent impacts to water resources may occur during installation of bridge piles. The Project would introduce fill within Las Trampas Creek for the abutments and the pier of the new bridge. The proposed bridge would be longer and wider than the existing bridge and would not result in substantial fill in the creek. A 404 Nationwide Permit with the USACE is expected to be required for the Project.

Permanent impacts to water quality may result from the addition of impervious area, which can result in increased, concentrated flow. The widening of the Las Trampas Creek bridge at South Main Street and the roadway approach area would not substantially increase the impervious surface area within the Las Trampas Creek watershed at the Project site. The added impervious area resulting from the proposed Project would be minimal compared to the watershed of Las Trampas Creek at the Project location, given that the total watershed area of Las Trampas Creek at the Project site is approximately 27.2 square miles.

Temporary impacts to water quality during construction include sediment-laden discharge from excavation activities, pollutant-laden discharge from storage or work areas, and discharge of contaminated groundwater during dewatering activities. Temporary impacts to Las Trampas Creek and Walnut Creek would be avoided and minimized by implementing construction site project features (or BMPs) and groundwater treatment measures described below. The Project is expected to obtain a Section 401 Water Quality Certification from the SFBRWQCB and a 1602 Lake and Streambed Alteration Agreement from the CDFW for work within Las Trampas Creek. The Project may be required to obtain a VOC and Fuel NPDES General Permit from the SFBRWQCB for discharge of contaminated groundwater into Las Trampas Creek.

Based on information available at the time of this report, the Project has the potential to disturb more than 1 acre of soil. Assuming the Project‘s DSA exceeds 1 acre, the Project’s Contractor would develop and implement a SWPPP to comply with the conditions of the CGP. The SWPPP would detail measures to address the temporary water quality impacts resulting from construction activities associated with this Project. The SWPPP would also include the development of a Construction Site Monitoring Program that presents procedures and methods related to the visual monitoring, sampling, and analysis plans.

The Project may disturb up to 1 acres of soil and create or replace up to 0.97 acres of impervious surface. The Project’s new impervious surfaces are primarily associated with the widening of the existing bridge, sidewalks, and roadway. The conservative estimates of DSAs and existing, added, removed, and replaced impervious areas associated with the Project are provided in Table 3.

Table 3. Conservative DSA and Impervious Areas

Water Quality Areas	Area (sq. ft)	Area (acre)
DSA	43,708	1.00
Existing Impervious Area	38,853	0.89
Added Impervious Area	4,097	0.09
Removed Impervious Area	482	0.01
Replaced Impervious Surface	38,371	0.88

Source: Quincy Engineering

The Project does not propose additional traffic lanes and therefore would not trigger a need for permanent treatment measures. However, the Project may still consider green infrastructure designs in coordination with the City of Walnut Creek, if feasible. Design features may include bioretention cells, tree wells, curb-cuts, and/or pervious pavement and could be incorporated into other areas of construction such as sidewalks, shoulders, and medians.

Temporary impacts to the physical, chemical, and biological characteristics of the aquatic environment are anticipated to be minimal with the implementation of source control measures and construction site project features (or BMPs).

4.2 Potential Impacts to Water Quality

4.2.1 Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

The widening of the Las Trampas Creek bridge at South Main Street and the roadway approach area would not substantially increase the impervious surface area within the Las Trampas Creek watershed at the Project site. The added impervious area resulting from the proposed Project would be minimal compared to the watershed of Las Trampas Creek at the Project location, given that the total watershed area of Las Trampas Creek at the Project site is approximately 27.2 square miles.

The Project would introduce fill within Las Trampas Creek for the abutments and the pier of the new bridge. The proposed bridge would be longer and wider than the existing bridge and would not result in substantial fill in the creek. A 1602 Lake and Streambed Alteration Agreement with the CDFW, 404 Nationwide Permit with the USACE, and 401 Water Quality Certification with the RWQCB are expected to be required for the Project. See the Project's *Location Hydraulic Study* (WRECO, 2018c) for additional information.

4.2.1.1 Currents, Circulation, and Drainage Patterns

The Las Trampas Creek hydrograph would be minimally affected by the Project's overall increase in impervious area.

4.2.1.2 Suspended Particulates (Turbidity)

While the added impervious area could result in an increase of sediment-laden flow directly discharging to receiving waterbodies, the proposed added impervious area is minimal in comparison to the existing impervious area. The potential increase in sediment-laden flows is expected to be minimal. Additionally, any stormwater impacts would be avoided through reconstruction of permanent erosion control measures.

The Project does not propose additional traffic lanes and would therefore not trigger permanent treatment measures. However, the Project may still consider green infrastructure designs in coordination with the City of Walnut Creek to remove sediment from stormwater runoff before discharging into Las Trampas Creek, if feasible. Design features may include bioretention cells, tree wells, curb-cuts, and/or pervious pavement and could be incorporated into other areas of construction such as sidewalks, shoulders, and medians.

4.2.1.3 Oil, Grease, and Chemical Pollutants

The Project would result in a minor increase of pollutant concentrations along the new bridge. Heavy metals associated with vehicle tire and brake wear, oil and grease, and exhaust emissions are the primary pollutants associated with transportation corridors. Generally, roadway runoff can contain the following pollutants: total suspended solids, nitrate nitrogen, total Kjeldahl nitrogen, phosphorus, ortho-phosphate, copper, lead, and zinc.

The Project would not trigger permanent treatment measures, but may still consider green infrastructure designs to remove pollutants from stormwater runoff, if feasible.

4.2.1.4 Flood Control Functions

The added impervious area resulting from the proposed Project would be minimal compared to the watershed of Las Trampas Creek at the Project location, given that the total watershed area of Las Trampas Creek at the Project site is approximately 27.2 square miles. Therefore, the peak 100-year flow at the Project site would not increase substantially from this Project.

Las Trampas Creek is a concrete-lined channel at the Project location. Permanent impacts to baseflow are not anticipated.

4.2.1.5 Erosion and Accretion Patterns

The proposed bridge would not alter the concrete-lined channel in the Project vicinity. Therefore, scour is not anticipated for the proposed alternatives (WRECO, 2018a).

4.2.1.6 Groundwater

Dewatering is anticipated for this Project. Permanent or long-term impacts to groundwater are not anticipated.

4.2.2 Permanent Anticipated Biological Changes to the Aquatic Environment

According to the Project's NES (Caltrans, 2018), the proposed Project would have minimal impacts on biological resources as the BSA is located within a dense urban area and the bed and banks of Las Trampas Creek are lined with concrete at the bridge location. The Project would have 0.01 acres of permanent impacts to jurisdictional waters. The permanent impact is based on the approximate area to be filled for installation of the central bent. The grading footprint of the Project has been minimized to the maximum extent practicable in order to avoid jurisdictional features.

Las Trampas Creek provides marginal movement habitat for western pond turtle (*Actinemys Marmorata*), a California Species of Special Concern. There is no habitat for special-status plants within the Project footprint. The proposed Project would have no effect on federal- or state-listed species.

The Project is expected to obtain a 1602 Lake and Streambed Alteration Agreement from the CDFW. Avoidance and minimization measures for unavoidable impacts to jurisdictional waters, trees, and special-status species are provided in the NES (Caltrans, 2018).

4.3 Temporary Impacts to Water Quality

4.3.1 Stormwater

The Project has an estimated DSA of up to 1.00 acres and has the potential to cause water quality impacts during construction. Stormwater runoff over DSAs could potentially cause sediment-laden flows to enter storm drainage facilities or cause sheet flow discharges into Las Trampas Creek, increasing the turbidity, decreasing the clarity, and potentially impacting the beneficial uses of Las Trampas Creek and Walnut Creek. Generally, as DSAs increase, the potential for temporary water quality impacts also increase. Additional sources of sediment include uncovered or improperly covered active and non-active stockpiles, non-stabilized slopes and construction staging areas, and construction equipment not properly maintained or cleaned.

Stormwater runoff from excavated areas between the former drycleaner site and the Project and areas along sanitary sewer lines should be presumed to be impacted by VOCs. Stockpiles of soils excavated adjacent to the former drycleaner must be managed as VOC-impacted soil until screened.

The Project would remove concrete-filled sand bags embedded in the banks upstream of the bridge. The embankment on the northwest corner in this area would be used to provide Contractor access. All concrete-filled sand bags at the northwest bank would be replaced with a concrete-lined embankment prior to completion of the Project.

Temporary impacts to water quality during construction can be minimized by implementing temporary construction site project features (or BMPs). Typical construction site project features that may be considered for the Project are listed in Table 4. The selected BMPs are consistent with the practices required under the CGP. The actual minimum temporary BMPs necessary for the Project to comply with the CGP (if applicable), and County and City standards would be determined during the design phase.

Assuming the Project is covered by the CGP, the Project's Contractor would develop and implement a SWPPP to comply with the conditions of the CGP. The Contractor would submit the SWPPP for approval by the City prior to the start of construction. The SWPPP would detail the measures to address the temporary water quality impacts resulting from construction activities associated with this Project. The SWPPP would also include the development of a Construction Site Monitoring Program that presents procedures and methods related to the visual monitoring, sampling, and analysis plans. A Notice of Intent would need to be filed with the SWRCB's SMARTS prior to any soil disturbance work. In addition, all dischargers must electronically file Permit Registration Documents, a Notice of Termination, changes of information, sampling and monitoring information, annual reporting, and other required compliance documents through SMARTS.

All stormwater discharges from the Project area must comply with the WQOs described in the SFBRWQCB *Basin Plan* to prevent adverse effects to the beneficial uses of Las Trampas Creek and Walnut Creek. The *Basin Plan* is included in Appendix C.

Table 4. Construction Site Project Features (BMPs)

BMP	Purpose
Soil Stabilization	
Move-In/Move-Out	Mobilization locations where permanent erosion control or revegetation to sustain slopes is required within the project.
Temporary Cover	Plastic covers for stockpiles.
Sediment Control	
Temporary Fiber Rolls	Degradable fibers rolled tightly and placed on the toe and face of slopes to intercept runoff.
Temporary Silt Fence	Linear, permeable fabric barriers to intercept sediment-laden sheet flow. Placed downslope of exposed soil areas, along channels and project perimeter.
Temporary Drainage Inlet Protection	Runoff detainment devices used at storm drain inlets that is subject to runoff from construction activities.
Tracking Control	
Temporary Construction Entrances/Exits	Points of entrance/exit to a construction site that are stabilized to reduce the tracking of mud and dirt onto public roads.
Street Sweeping	Removal of tracked sediment to prevent them entering a storm drain or watercourse.
Non-Stormwater Management	
Dewatering Operations • Non-stormwater use for dust control • Desilting basins/tanks • Transport to publicly owned treatment works	Dewatering activities associated with stormwater and non- stormwater to prevent the discharge of pollutants from construction site.
Clear Water Diversion • Cofferdams • Berms	System designed to intercept and divert surface water upstream around a construction area and discharge downstream with minimal water quality impacts.
All other anticipated non-stormwater management measures are covered under Job Site Management.	
Waste Management and Materials Pollution Control	
Temporary Concrete Washout Facilities	Specified vehicle washing areas to contain concrete waste materials.
All other anticipated waste management and materials pollution control measures are covered under Job Site Management.	
Job Site Management	
General measures covered under job site management include:	Non-stormwater management consists of:
• spill prevention and control • materials management • stockpile management • waste management • hazardous waste management • contaminated soil • concrete waste • sanitary and septic waste and liquid waste	• water control and conservation • illegal connection and discharge detection and reporting • vehicle and equipment cleaning • vehicle and equipment fueling and maintenance • paving, sealing, saw cutting and grinding operations • thermoplastic striping and pavement markers • concrete curing and concrete finishing
Miscellaneous job site management includes:	
• training of employees and subcontractors • proper selection, deployment and repair of construction site Best Management Practices	

Source: Caltrans

4.3.2 Groundwater

Because of groundwater contamination issues, well pumping of groundwater would not be allowed. Only pumping of nuisance surface water would be allowed.

Dewatering is anticipated for this Project both during shallow excavations near the creek bottom and deeper foundation excavations. The Project's ISA/PSI report identified potential contaminants in aquifers from a pre-existing dry-cleaning facility adjacent to the Project. To minimize the potential for increased groundwater contamination, steel casings may be required for installation of CIDH piles. Steel casings would create barriers across the subsurface soil strata to minimize the potential for vertical cross contamination of multiple aquifers. The casings would likely need to be advanced to at least 45 feet bgs. Additionally, geotechnical testing may be implemented to narrow the range for the required casing depth (Quincy, 2018).

Groundwater at the Project site is not suitable for discharge on-site relative to WQOs or Effluent Limitations listed in the SFBRWQCB *Basin Plan*. Groundwater encountered during demolition of the existing bridge or construction of the proposed bridge would be collected, stored, and tested on-site prior to disposal. Contaminated groundwater would be transported off-site and discharged to the Contra Costa Sanitary District under permit or treated on-site under the SFBRWQCB VOC and Fuel NPDES General Permit (Order No. R2-2017-0048) prior to discharging to Las Trampas Creek. All necessary permits would be obtained prior to the start of construction.

Open excavations that encounter groundwater would be managed to minimize the duration and rate of groundwater extraction. In addition, dewatering would be limited to small areas surrounding new bridge piers and abutments.

Dewatering activities have a high potential to contribute sediment and other pollutants to surface water. Dewatering system components and water quality concerns associated with dewatering operations would be described in detail in the Project's *Dewatering Plan*. Both the California Stormwater Quality Association (CASQA) *Construction BMP Online Handbook* and Caltrans *Field Guide to Construction Site Dewatering* (Caltrans, 2014) describe standards to properly design and size dewatering systems.

4.3.3 Physical/Chemical Characteristics of the Aquatic Environment

Work is anticipated within and adjacent to Las Trampas Creek to install the new bridge. The Project is expected to obtain a Section 401 Certification from the SFBRWQCB for activities that may result in a discharge to Water of the US.

Las Trampas Creek is expected to be flowing within the Project year-round and a creek diversion system would be required to divert the flow through the Project area during construction. The creek diversion system would be sized properly to avoid construction impacts, as described by CASQA *Construction BMP Online Handbook* or the *Field Guide to Construction Site Dewatering* (Caltrans, 2014). This would involve hydrologic modeling of summer flows and construction of temporary cofferdams upstream and downstream of the bridge. The cofferdams will be constructed with a combination of clean crushed rock and sandbags. The cofferdam will have an impervious membrane made up of plastic sheeting to keep the water from seeping into the work area. Temporary culverts consisting of approximately 12-inch-diameter to 36-inch-diameter corrugated steel or HDPE pipes will be used to divert the flows away from the work area and downstream. The diversion would not substantially alter baseflows within or downstream of the Project area. Limited pooling is anticipated upstream due to the diversion impoundment. After the cofferdams are constructed, sump pumps will be used to dewater the site, if necessary.

Temporary shoring would be required to construct the new abutments and the pier within the channel. Shoring would likely involve sheet piles or CIDH soldier piles. The CIDH pile installation at the center pier would also require a temporary work pad to be constructed in the channel to provide adequate width for the Contractor's equipment (e.g., drill rig, pile oscillator, crane, excavator).

An access ramp would be required for heavy equipment entry into the channel, especially for pier construction. Imported borrow would be required to create this ramp. The location of this access ramp is anticipated to be on the northwest corner of the bridge, between the bridge and Gott’s Roadside Restaurant.

The Project would remove concrete-filled sand bags embedded in the banks adjacent to the bridge, as well as the concrete-lined streambed. Disturbance to soils behind and beneath these features would be up to 1 foot.

The Project would reduce potential impacts to Las Trampas Creek and Walnut Creek by implementing the following measures, as discussed in the *Foundation Type Selection and Construction Best Management Practices Memo (*Quincy, 2018):

- Minimizing existing bridge foundation removal
- Minimizing proposed abutment excavation
- Minimizing utility relocations
- Minimizing open excavation timing
- Minimizing slope protection replacement

Work over water is required to construct the Project. Construction materials, equipment, and debris may be accidentally discharged into Las Trampas Creek. Construction site Project features or BMPs for material and equipment use over water, such as material containment and collection systems, would be implemented to prevent discharges of construction material, demolition debris, equipment, and liquid and sanitary wastes to the receiving water. A description and design drawings of the proposed material containment and collection system should be submitted with the Project SWPPP or *Water Pollution Control Plan* (WPCP). The SWPPP or WPCP would include waste management and non-stormwater BMPs to prevent the discharge of liquid waste to Las Trampas Creek.

If fueling or maintenance of construction vehicles occurs within the Project site during construction, there is a risk of accidental spills or releases of fuels, oils, or other potentially toxic materials. An accidental release of these materials may pose a threat to water quality if contaminants enter storm drains, open channels, or receiving bodies. The magnitude of the impact from an accidental release depends on the amount and type of material spilled.

Source control measures applicable to the Project would be implemented, including measures for accidental spills or leaks, parking/storage areas and maintenance, outdoor storage of equipment or materials, vehicle and equipment cleaning, vehicle and equipment repair and maintenance, and unauthorized non-stormwater discharges.

All stormwater and non-stormwater discharges from the Project area must comply with the WQOs described in the SFBRWQCB *Basin Plan* to prevent adverse effects to the beneficial uses of Las Trampas Creek and Walnut Creek. Construction site Project features or BMPs to prevent noncompliant discharges would be described in the Project SWPPP or WPCP.

4.3.4 Temporary Biological Characteristics of the Aquatic Environment

The proposed Project would have minimal impacts on biological resources as the BSA is located within a dense urban area and the bed and banks of Las Trampas Creek are lined with concrete at the bridge location.

According to the Project's NES, there would be approximately 0.25 acres of temporary impacts to jurisdictional waters. Temporary impacts are based on a temporary disturbance area of 135 feet by 80 feet for bridge demolition and replacement. The grading of the Project has been minimized to the maximum extent practicable in order to avoid jurisdictional features. Refer to the Project's NES for additional avoidance and minimization measures to protect portions of the stream not included in Project impacts.

There is no habitat for special-status plants within the Project footprint. The proposed Project would have no effect on federal- or state-listed species. The Project may affect, but is not likely to adversely affect, the western pond turtle due to the loss of habitat. Impacts to western pond turtle would be minimal and temporary. A qualified biologist would conduct a pre-construction survey for western pond turtles immediately prior to the start of work.

Sump pumps used for dewatering would incorporate wire mesh screens with holes no larger than 0.2 inches and would be placed over the pump intake. The pump would be placed in a screened basket to minimize inadvertent aquatic interactions.

4.3.5 Long-Term Impacts During Operation and Maintenance

Long-term impacts during operation and maintenance of these BMPs are anticipated to be minimal.

5 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

5.1 Avoidance and or Minimization Measures for Water Resources

The Project is expected to obtain a Section 401 Water Quality Certification from the SFBRWQCB, a Nationwide 404 Permit from the USACE, and a 1602 Lake and Streambed Alteration Agreement from the CDFW. These permits often have conditions for water quality that would be incorporated into the Project documents, including the Project SWPPP, as construction site Project features or BMP controls.

5.2 Avoidance and or Minimization Measures for Stormwater and Groundwater

5.2.1 Temporary Dewatering Activities

Groundwater extracted from temporary dewatering activities may contain contaminated groundwater or groundwater that may release contaminated plumes when disturbed. The Project may be required to secure an SFBRWQCB VOC and Fuel NPDES General Permit (Order No. R2-2017-0048) for onsite groundwater treatment and discharge to Las Trampas Creek.

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Appendix A Risk Level Determination

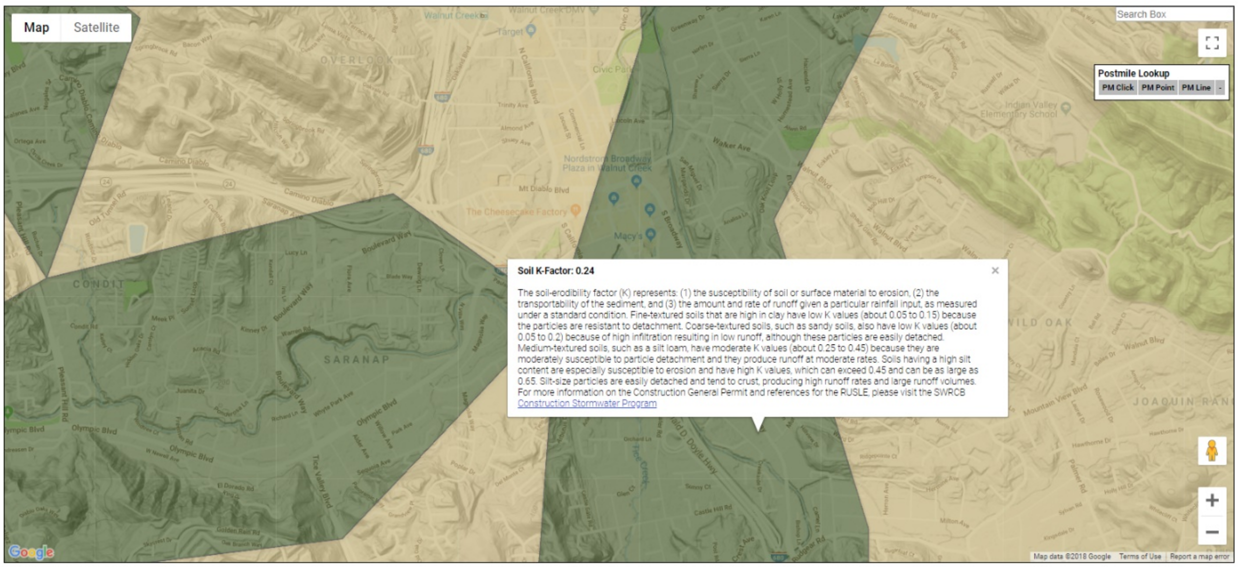
Facility Information

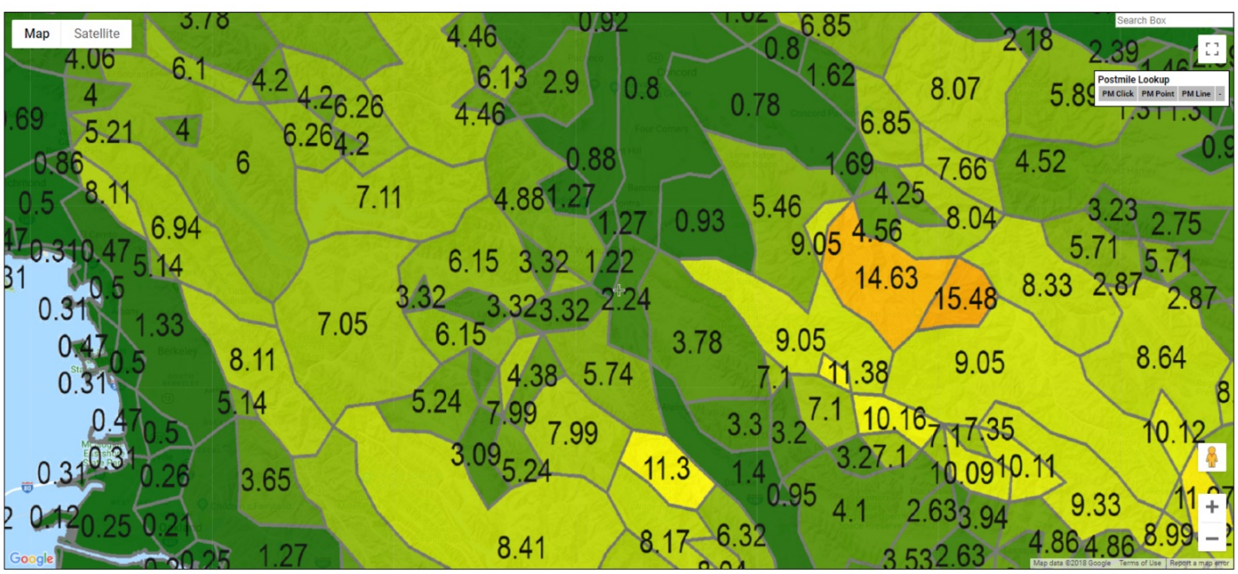
- Start Date: 01/01/2021
- End Date: 12/31/2022
- Address: 1275 S Main St, Walnut Creek, CA 94596
- Latitude: 37.8950
- Longitude: -122.0597

Erosivity Index Calculator Results

An erosivity index value Of 98.72 has determined for the construction period of **01/01/2021 - 12/31/2022**.

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements.**





	A	B	C
1	**Sediment Risk Factor Worksheet**		**Entry**
2	**A) R Factor**		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	**R Factor Value**		98.72
6	**B) K Factor (weighted average, by area, for all site soils)**		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	**K Factor Value**		0.24
10	**C) LS Factor (weighted average, by area, for all slopes)**		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	**LS Factor Value**		2.24
14			
15	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**	53.071872	
16	**Site Sediment Risk Factor**	**Medium**	
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	yes/no	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?:	yes	High
http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml		
OR		
A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan)		
http://www.waterboards.ca.gov/waterboards_map.shtml		

Combined Risk Level Matrix

		Sediment Risk		
		Low	**Medium**	**High**
Receiving Water Risk	**Low**	Level 1	Level 2	
	High	Level 2		Level 3

Project Sediment Risk:	**Medium**
Project RW Risk:	**High**
Project Combined Risk:	**Level 2**

Appendix B Web Soil Survey

K Factor, Rock Free—Contra Costa County, California
(K Factor, Rock Free)

Map Scale: 1:2,240 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Lines

- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Points

- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Contra Costa County, California
Survey Area Data: Version 14, Sep 25, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 11, 2015—Jun 17, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

K Factor, Rock Free

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BaA	Botella clay loam, 0 to 2 percent slopes, MLRA 14	.32	0.7	3.2%
Cc	Clear Lake clay, 0 to 15 percent slopes, MLRA 15	.24	10.9	48.9%
CeA	Conejo clay loam, 0 to 2 percent slopes, MLRA 14	.20	9.2	41.4%
TaD	Tierra loam, 9 to 15 percent slopes, MLRA 14	.28	1.4	6.4%
Totals for Area of Interest			**22.3**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Hydrologic Soil Group—Contra Costa County, California
(Hydrologic Soil Group)

Map Scale: 1:2,240 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Contra Costa County, California
Survey Area Data: Version 14, Sep 25, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 11, 2015—Jun 17, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BaA	Botella clay loam, 0 to 2 percent slopes, MLRA 14	C	0.7	3.2%
Cc	Clear Lake clay, 0 to 15 percent slopes, MLRA 15	C	10.9	48.9%
CeA	Conejo clay loam, 0 to 2 percent slopes, MLRA 14	C	9.2	41.4%
TaD	Tierra loam, 9 to 15 percent slopes, MLRA 14	D	1.4	6.4%
Totals for Area of Interest			**22.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C Water Quality Objectives and Beneficial Uses

CHAPTER 2: BENEFICIAL USES

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the state. Aquatic ecosystems and underground aquifers provide many different benefits to the people of the state. The beneficial uses described in detail in this chapter define the resources, services, and qualities of these aquatic systems that are the ultimate goals of protecting and achieving high water quality. The Water Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges in the region. Beneficial uses of waters of the State presented here serve as a basis for establishing water quality objectives and discharge prohibitions to attain these goals.

Beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist. Existing beneficial uses that have not been formally designated in this Basin Plan are protected whether or not they are identified. While the tables in this Chapter list a large, representative portion of the water bodies in our region, it is not practical to list each and every water body.

2.1 DEFINITIONS OF BENEFICIAL USES

The following definitions (in italic) for beneficial uses are applicable throughout the entire state. A brief description of the most important water quality requirements for each beneficial use follows each definition (in alphabetical order by abbreviation).

2.1.1 AGRICULTURAL SUPPLY (AGR)

Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

The criteria discussed under municipal and domestic water supply (MUN) also effectively protect farmstead uses. To establish water quality criteria for livestock water supply, the Water Board must consider the relationship of water to the total diet, including water freely drunk, moisture content of feed, and interactions between irrigation water quality and feed quality. The University of California Cooperative Extension has developed threshold and limiting concentrations for livestock and irrigation water. Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these hazards.

2.1.2 AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS)

Areas designated by the State Water Board.

These include marine life refuges, ecological reserves, and designated areas where the preservation and enhancement of natural resources requires special protection. In these areas, alteration of natural water quality is undesirable. The areas that have been designated as ASBS in this Region are Bird Rock, Point Reyes Headland Reserve and Extension, Double Point, Duxbury Reef Reserve and Extension, Farallon Islands, and James V. Fitzgerald Marine Reserve, depicted in Figure 2-1. The California Ocean Plan prohibits waste discharges into, and requires wastes to be discharged at a sufficient distance from, these areas to assure maintenance of natural water quality conditions. These areas have been designated as a subset of State Water Quality Protection Areas as per the Public Resources Code.

2.1.3 COLD FRESHWATER HABITAT (COLD)

Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold freshwater habitats generally support trout and may support anadromous salmon and steelhead fisheries as well. Cold water habitats are commonly well-oxygenated. Life within these waters is relatively intolerant to environmental stresses. Often, soft waters feed cold water habitats. These waters render fish more susceptible to toxic metals, such as copper, because of their lower buffering capacity.

2.1.4 COMMERCIAL AND SPORT FISHING (COMM)

Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

To maintain fishing, the aquatic life habitats where fish reproduce and seek their food must be protected. Habitat protection is under descriptions of other beneficial uses.

2.1.5 ESTUARINE HABITAT (EST)

Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

Estuarine habitat provides an essential and unique habitat that serves to acclimate anadromous fishes (e.g., salmon, striped bass) migrating into fresh or marine water conditions. The protection of estuarine habitat is contingent upon (1) the maintenance of adequate Delta outflow to provide mixing and salinity control; and (2) provisions to protect wildlife habitat associated with marshlands and the Bay periphery (i.e., prevention of fill activities). Estuarine habitat is generally associated with moderate seasonal fluctuations in dissolved oxygen, pH, and temperature and with a wide range in turbidity.

2.1.6 FRESHWATER REPLENISHMENT (FRESH)

Uses of water for natural or artificial maintenance of surface water quantity or quality.

Fresh water inputs are important for maintaining salinity balance, flow, and/or water quantity for such surface water bodies as marshes, wetlands, and lakes.

2.1.7 GROUNDWATER RECHARGE (GWR)

Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers.

The requirements for groundwater recharge operations generally reflect the future use to be made of the water stored underground. In some cases, recharge operations may be conducted to prevent seawater intrusion. In these cases, the quality of recharged waters may not directly affect quality at the wellfield being protected. Recharge operations are often limited by excessive suspended sediment or turbidity that can clog the surface of recharge pits, basins, or wells.

Under the state Antidegradation Policy, the quality of some of the waters of the state is higher than established by adopted policies. It is the intent of this policy to maintain that existing higher water quality to the maximum extent possible.

Requirements for groundwater recharge, therefore, shall impose the Best Available Technology (BAT) or Best Management Practices (BMPs) for control of the discharge as necessary to assure the highest quality consistent with maximum benefit to the people of the state. Additionally, it must be recognized that groundwater recharge occurs naturally in many areas from streams and reservoirs. This recharge may have little impact on the quality of groundwaters under normal circumstances, but it may act to transport pollutants from the recharging water body to the groundwater. Therefore, groundwater recharge must be considered when requirements are established.

2.1.8 INDUSTRIAL SERVICE SUPPLY (IND)

Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

Most industrial service supplies have essentially no water quality limitations except for gross constraints, such as freedom from unusual debris.

2.1.9 MARINE HABITAT (MAR)

Uses of water that support marine ecosystems, including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

In many cases, the protection of marine habitat will be accomplished by measures that protect wildlife habitat generally, but more stringent criteria may be necessary for waterfowl marshes and other habitats, such as those for shellfish and marine fishes. Some marine habitats, such as important intertidal zones and kelp beds, may require special protection.

2.1.10 FISH MIGRATION (MIGR)

Uses of water that support habitats necessary for migration, acclimatization between fresh water and salt water, and protection of aquatic organisms that are temporary inhabitants of waters within the region.

The water quality provisions acceptable to cold water fish generally protect anadromous fish as well. However, particular attention must be paid to maintaining zones of passage. Any barrier to migration or free movement of migratory fish is harmful. Natural tidal movement in estuaries and unimpeded river flows are necessary to sustain migratory fish and their offspring. A water quality barrier, whether thermal, physical, or chemical, can destroy the integrity of the migration route and lead to the rapid decline of dependent fisheries.

Water quality may vary through a zone of passage as a result of natural or human- induced activities. Fresh water entering estuaries may float on the surface of the denser salt water or hug one shore as a result of density differences related to water temperature, salinity, or suspended matter.

2.1.11 MUNICIPAL AND DOMESTIC SUPPLY (MUN)

Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.

The principal issues involving municipal water supply quality are (1) protection of public health; (2) aesthetic acceptability of the water; and (3) the economic impacts associated with treatment- or quality-related damages.

The health aspects broadly relate to: direct disease transmission, such as the possibility of contracting typhoid fever or cholera from contaminated water; toxic effects, such as links between nitrate and methemoglobinemia (blue babies); and increased susceptibility to disease, such as links between halogenated organic compounds and cancer.

Aesthetic acceptance varies widely depending on the nature of the supply source to which people have become accustomed. However, the parameters of general concern are excessive hardness, unpleasant odor or taste, turbidity, and color. In each case, treatment can improve acceptability although its cost may not be economically justified when alternative water supply sources of suitable quality are available.

Published water quality objectives give limits for known health-related constituents and most properties affecting public acceptance. These objectives for drinking water include the U.S. Environmental Protection Agency Drinking Water Standards and the California State Department of Health Services criteria.

2.1.12 NAVIGATION (NAV)

Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Navigation is a designated use where water is used for shipping, travel, or other transportation by private, military, or commercial vessels.

2.1.13 INDUSTRIAL PROCESS SUPPLY (PROC)

Uses of water for industrial activities that depend primarily on water quality.

Water quality requirements differ widely for the many industrial processes in use today. So many specific industrial processes exist with differing water quality requirements that no meaningful criteria can be established generally for quality of raw water supplies. Fortunately, this is not a serious shortcoming, since current water treatment technology can create desired product waters tailored for specific uses.

2.1.14 PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)

Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.

The water quality criteria to be achieved that would encourage development and protection of rare and endangered species should be the same as those for protection of fish and wildlife habitats generally. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment and maintenance of particular quality criteria, which may vary slightly with the environmental needs of each particular species. Criteria for species using areas of special biological significance should likewise be derived from the general criteria for the habitat types involved, with special management diligence given where required.

2.1.15 WATER CONTACT RECREATION (REC1)

Uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs.

Water contact implies a risk of waterborne disease transmission and involves human health; accordingly, criteria required to protect this use are more stringent than those for more casual water-oriented recreation.

Excessive algal growth has reduced the value of shoreline recreation areas in some cases, particularly for swimming. Where algal growths exist in nuisance proportions, particularly bluegreen algae, all recreational water uses, including fishing, tend to suffer.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

Public access to drinking water reservoirs is limited or prohibited by reservoir owner/operators for purposes of protecting drinking water quality and public health. In some cases, access to reservoir tributaries is also prohibited. For these water bodies, REC-1 is designated as E*, for the purpose of protecting water quality. No right to public access is intended by this designation.

2.1.16 NONCONTACT WATER RECREATION (REC2)

Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where water ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Water quality considerations relevant to noncontact water recreation, such as hiking, camping, or boating, and those activities related to tide pool or other nature studies require protection of habitats and aesthetic features. In some cases, preservation of a natural wilderness condition is justified, particularly when nature study is a major dedicated use.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

2.1.17 SHELLFISH HARVESTING (SHELL)

Uses of water that support habitats suitable for the collection of crustaceans and filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.

Shellfish harvesting areas require protection and management to preserve the resource and protect public health. The potential for disease transmission and direct poisoning of humans is of considerable concern in shellfish regulation. The bacteriological criteria for the open ocean, bays, and estuarine waters where shellfish cultivation and harvesting occur should conform with the standards described in the National Shellfish Sanitation Program, Manual of Operation.

Toxic metals can accumulate in shellfish. Mercury and cadmium are two metals known to have caused extremely disabling effects in humans who consumed shellfish that concentrated these elements from industrial waste discharges. Other elements, radioactive isotopes, and certain toxins produced by particular plankton species also concentrate in shellfish tissue. Documented cases of paralytic shellfish poisoning are not uncommon in California.

2.1.18 FISH SPAWNING (SPWN)

Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Dissolved oxygen levels in spawning areas should ideally approach saturation levels. Free movement of water is essential to maintain well-oxygenated conditions around eggs deposited in sediments. Water temperature, size distribution and organic content of sediments, water depth, and current velocity are also important determinants of spawning area adequacy.

2.1.19 WARM FRESHWATER HABITAT (WARM)

Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

The warm freshwater habitats supporting bass, bluegill, perch, and other fish are generally lakes and reservoirs, although some minor streams will serve this purpose where stream flow is sufficient to sustain the fishery. The habitat is also important to a variety of nonfish species, such as frogs, crayfish, and insects, which provide food for fish and small mammals. This habitat is less sensitive to environmental changes, but more diverse than the cold freshwater habitat, and natural fluctuations in temperature, dissolved oxygen, pH, and turbidity are usually greater.

2.1.20 WILDLIFE HABITAT (WILD)

Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.

The two most important types of wildlife habitat are riparian and wetland habitats. These habitats can be threatened by development, erosion, and sedimentation, as well as by poor water quality.

The water quality requirements of wildlife pertain to the water directly ingested, the aquatic habitat itself, and the effect of water quality on the production of food materials. Waterfowl habitat is particularly sensitive to changes in water quality. Dissolved oxygen, pH, alkalinity, salinity, turbidity, settleable matter, oil, toxicants, and specific disease organisms are water quality characteristics particularly important to waterfowl habitat. Dissolved oxygen is needed in waterfowl habitats to suppress development of botulism organisms; botulism has killed millions of waterfowl. It is particularly important to maintain adequate circulation and aerobic conditions in shallow fringe areas of ponds or reservoirs where botulism has caused problems.

2.2 EXISTING AND POTENTIAL BENEFICIAL USES

2.2.1 SURFACE WATERS

Surface waters in the Region consist of non-tidal wetlands, rivers, streams, and lakes (collectively described as inland surface waters), estuarine wetlands known as baylands, estuarine waters, and coastal waters. In this Region, estuarine waters consist of the Bay system including intertidal, tidal, and subtidal habitats from the Golden Gate to the Region’s boundary near Pittsburg and the lower portions of streams that are affected by tidal hydrology, such as the Napa and Petaluma rivers in the north and Coyote and San Francisquito creeks in the south.

Inland surface waters support or could support most of the beneficial uses described above. The specific beneficial uses for inland streams include municipal and domestic supply (MUN), agricultural supply (AGR), commercial and sport fishing (COMM), freshwater replenishment (FRESH), industrial process supply (PRO), groundwater recharge (GWR), preservation of rare and endangered species (RARE), water contact recreation (REC1), noncontact water recreation (REC2), wildlife habitat (WILD), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish migration (MIGR), and fish spawning (SPWN).

The San Francisco Bay Estuary supports estuarine habitat (EST), industrial service supply (IND), and navigation (NAV) in addition to COMM, RARE, REC1, REC2, WILD, MIGR, and SPWN.

Coastal waters’ beneficial uses include water contact recreation (REC1); noncontact water recreation (REC2); industrial service supply (IND); navigation (NAV); marine habitat (MAR); shellfish harvesting (SHELL); commercial and sport fishing (COMM); wildlife habitat (WILD), fish migration (MIGR), fish spawning (SPWN), and preservation of rare and endangered species (RARE). In addition, the California coastline within the Region is endowed with exceptional scenic beauty.

The beneficial uses of any specifically identified water body generally apply to all its tributaries. In some cases a beneficial use may not be applicable to the entire body of water, such as navigation in Richardson Bay or shellfish harvesting in the Pacific Ocean. In these cases, the Water Board's judgment regarding water quality control measures necessary to protect beneficial uses will be applied.

Beneficial uses of streams that have intermittent flows, as is typical of many streams in the region, must be protected throughout the year and are designated as "existing."

Beneficial uses of each significant water body have been identified and are organized according to the seven major Hydrologic Planning Areas within the Region (Figure 2-2). The maps locating each water body (Figures 2-3 through 2-9b) were produced using a geographical information system (GIS) at the Water Board. The maps use the hydrologic basin information compiled by the California Interagency Watershed map, with supplemental information from the Oakland Museum of California Creek and Watershed Map series, the Contra Costa County Watershed Atlas, and the San Francisco Estuary Institute EcoAtlas. More detailed representations of each location can be created using this GIS version.

Table 2-1 contains the beneficial uses for many surface water bodies in the Region, organized geographically by the Region's seven Hydrologic Planning Areas. Within each Hydrologic Planning Area, water bodies are listed geographically, with tributaries indented below their receiving water body. In cases where a water body shares the same name with another water body (e.g., Redwood Creek), the location of the water body (county and/or other identifier) is given in parentheses. An alternative name for a water body, where known, is also shown in parentheses. In Table 2-1, beneficial uses are indicated as follows:

E – indicates the beneficial use exists in the water body.

E* – indicates public access to the water body is limited or prohibited for purposes of protecting drinking water quality and public health. REC-1 is designated as E* for the purpose of protecting water quality. No right to public access is intended by this designation.

P – indicates the water body could potentially support the beneficial use.

2.2.2 GROUNDWATER

Groundwater is defined as subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated. Where groundwater occurs in a saturated geologic unit that contains sufficient permeable thickness to yield significant quantities of water to wells and springs, it can be defined as an aquifer. A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers.

Water-bearing geologic units occur within groundwater basins in the Region that do not meet the definition of an aquifer. For instance, there are shallow, low permeability zones throughout the Region that have extremely low water yields. Groundwater may also occur outside of currently identified basins. Therefore, for basin planning purposes, the term "groundwater" includes all subsurface waters, whether or not these waters meet the classic definition of an aquifer or occur within identified groundwater basins.

The California Department of Water Resources (DWR) evaluated the characteristics of groundwater basins in the Region and throughout the state and summarized the results in California's Groundwater, Bulletin 118 (2003). Of special importance to the Region are the 28 groundwater basins and seven sub-basins classified by DWR that produce, or potentially could produce, significant amounts of groundwater (Figures 2-10 and 2-10A-D). The Water Board maintains a GIS for all water bodies in the Region and has the capacity to present information on each basin at a much higher level of resolution than is depicted in Figures 2-10A-D.

Existing and potential beneficial uses applicable to groundwater in the Region include municipal and domestic water supply (MUN), industrial water supply (IND), industrial process supply (PRO), agricultural water supply (AGR), groundwater recharge (GWR), and freshwater replenishment to surface waters (FRESH). Table 2-2 lists the 28 identified groundwater basins and seven sub-basins located in the Region and their existing and potential beneficial uses.

Unless otherwise designated by the Water Board, all groundwater is considered suitable, or potentially suitable, for municipal or domestic water supply (MUN). In making any exceptions, the Water Board will consider the criteria referenced in State Water Board Resolution No. 88-63 and Water Board Resolution No. 89-39, "Sources of Drinking Water," where:

- The total dissolved solids exceed 3,000 milligrams per liter (mg/L) (5,000 microSiemens per centimeter, μS/cm, electrical conductivity), and it is not reasonably expected by the Water Board that the groundwater could supply a public water system; or
- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices (BMPs) or best economically achievable treatment practices; or
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day; or
- The aquifer is regulated as a geothermal energy-producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations (CFR) Part 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Part 261.3.

2.2.3 WETLANDS

Federal administrative law (e.g., 40 CFR Part 122.2, revised December 22, 1993) defines wetlands as waters of the United States. National waters include waters of the State of California, defined by the Porter-Cologne Act as "any water, surface or underground, including saline waters, within the boundaries of the State" (California Water Code §13050[e]). Wetland water quality control is therefore clearly within the jurisdiction of the State Water Board and Regional Water Boards.

Wetlands are further defined in 40 CFR 122.2 as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The Water Board recognizes that wetlands frequently include areas commonly referred to as saltwater marshes, freshwater marshes, open or closed brackish water marshes, mudflats, sandflats, unvegetated seasonally ponded areas, vegetated shallows, sloughs, wet meadows, playa lakes, natural ponds, vernal pools, diked baylands, seasonal wetlands, floodplains, and riparian woodlands.

Mudflats make up one of the largest and most important habitat types in the Estuary. Snails, clams, worms, and other animals convert the rich organic matter in the mud bottom to food for fish, crabs, and birds.

Mudflats generally support a variety of edible shellfish, and many species of fish rely heavily on the mudflats during at least a part of their life cycle. Additionally, San Francisco Bay mudflats are one of the most important habitats on the coast of California for millions of migrating shorebirds.

Another important characteristic of the Estuary is the fresh, brackish, and salt water marshes around the Bay's margins. These highly complex communities are recognized as vital components of the Bay system's ecology. Most marshes around the Bay have been destroyed through filling and development. The protection, preservation, and restoration of the remaining marsh communities are essential for maintaining the ecological integrity of the Estuary.

Identifying wetlands may be complicated by such factors as the seasonality of rainfall in the Region. Therefore, in identifying wetlands considered waters of the United States, the Water Board will consider such indicators as hydrology, hydrophytic plants, and/or hydric soils for the purpose of mapping and inventorying wetlands. The Water Board will, in general, rely on the federal manual for wetland delineation in the Region when issuing Clean Water Act Section 401 water quality certifications (U.S. Army Corps of Engineers (Corps) Wetlands Delineation Manual, 1987). In the rare cases where the U.S. EPA and Corps guidelines disagree on the boundaries for federal jurisdictional wetlands, the Water Board will rely on the wetlands delineation made by the U.S. EPA or the California Department of Fish and Game (CDFG). For the purpose of mapping and inventorying wetlands, the Water Board will rely on the protocols and naming conventions of the National Wetlands Inventory (NWI) prepared by the U.S. Fish and Wildlife Service (USFWS).

Many individual wetlands provide multiple benefits depending on the wetland type and location. There are many potential beneficial uses of wetlands, including Wildlife Habitat (WILD); Preservation of Rare and Endangered Species (RARE); Shellfish Harvesting (SHELL); Water Contact Recreation (REC1); Noncontact Water Recreation (REC2); Commercial, and Sport Fishing (COMM); Marine Habitat (MAR); Fish Migration (MIGR); Fish Spawning (SPAWN); and Estuarine Habitat (EST). Some of these general beneficial uses can be further described in terms of their component wetland function. For example, many wetlands that provide groundwater recharge (GWR) also provide flood control, pollution control, erosion control, and stream baseflow.

Table 2-3 shows how beneficial uses are associated with different wetland types. Table 2-4 lists and specifies beneficial uses for 34 significant wetland areas within the Region; generalized locations of these wetlands are shown in Figure 2-11. It should be noted that most of the wetlands listed in Table 2-4 are saltwater marshes, and that the list is not comprehensive.

The Water Board has participated in completing the Baylands Ecosystem Habitat Goals Report (1999) and the Baylands Ecosystem Species and Community Profiles (2000), which were written by scientists and managers in the Region in order to recommend sound wetland restoration strategies. Other efforts around the Bay to locate wetland sites include San Francisco Estuary Institute's (SFEI) EcoAtlas Baylands Maps (Baylands Maps) and Bay Area Wetlands Project Tracker (Wetlands Tracker), and the Wetland Tracker managed by the San Francisco Bay Joint Venture. Because of the large number of small and non-contiguous wetlands, it is not practical to delineate and specify beneficial uses of every wetland area. Therefore, beneficial uses may be determined site specifically, as needed. Chapter 4 of this Plan contains additional information on the process used to determine beneficial uses for specific wetland sites.

FIGURES

TABLES

Legend for Figures 2-3 to 2-9b

Watershed boundaries

Basin boundary

Watershed boundary

Hydrologic features

Streams / creeks listed in Table 2-1

Other streams / tributaries

Bay or ocean

Lake, reservoir or other water body

Other features

County boundary

Major road or highway

Urban area

Wetlands

Marshlands

Salt pond

Tidal flats

Storage or treatment basin

Undeveloped fill

Sand dune

Other baylands

All maps are in Universal Transverse Mercator projection (Zone 10), North American Datum 1983.

Map sources:

Basin boundaries: California Interagency Watershed Map of 1999 (CalWater 2.2.1).

Watershed boundaries: California Interagency Watershed Map of 1999 (CalWater 2.2.1); Contra Costa County Watershed Atlas; Creek and Watershed Map of Oakland and Berkeley (Oakland Museum of California); Creek and Watershed Map of Milpitas and North San Jose (Oakland Museum of California); Creek and Watershed Map of Palo Alto and Vicinity (Oakland Museum of California); Creek and Watershed Map of Fremont and Vicinity (Oakland Museum of California); Creek and Watershed Map of the Pleasanton and Dublin Area (Oakland Museum of California).

Hydrologic features: National Hydrologic Dataset (1:24000 scale) for hydrologic unit numbers 18050001 (Suisun), 18050002 (San Pablo), 18050003 (Santa Clara), 18050004 (South Bay), 18050005 (Marin Coastal) and 18050006 (San Mateo Coastal).

Wetlands: San Francisco Estuary Institute EcoAtlas (v. 1.50b4).

County boundaries: California Spatial Information Library.

Major roads and highways: GDT 2004.

Urban areas: Association of Bay Area Governments Land Use / Land Cover dataset, 1996, land use category 1 (urban areas).

Figure 2-9b Suisun Basin

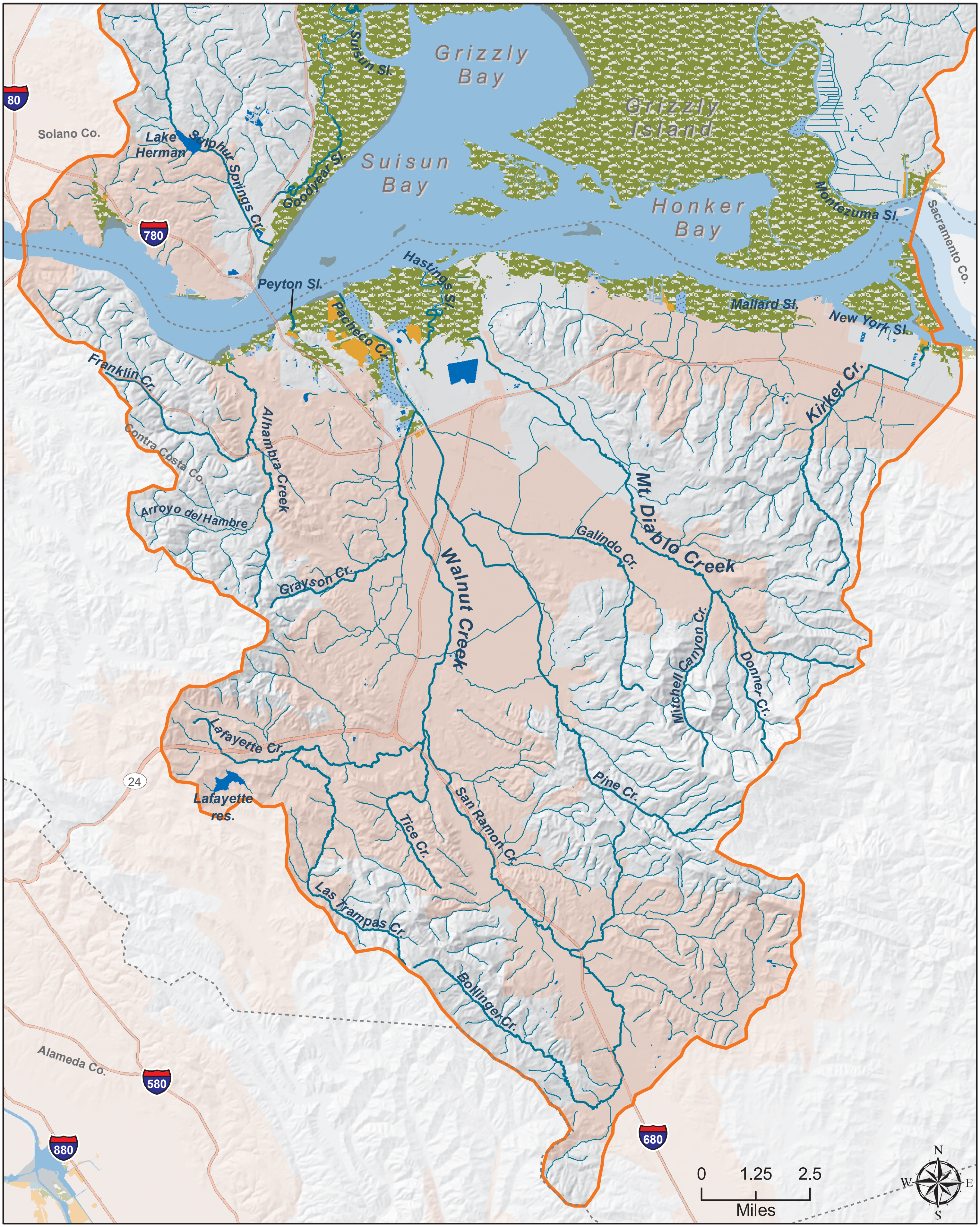


Figure 2-10D Groundwater Basins: East and South Bay

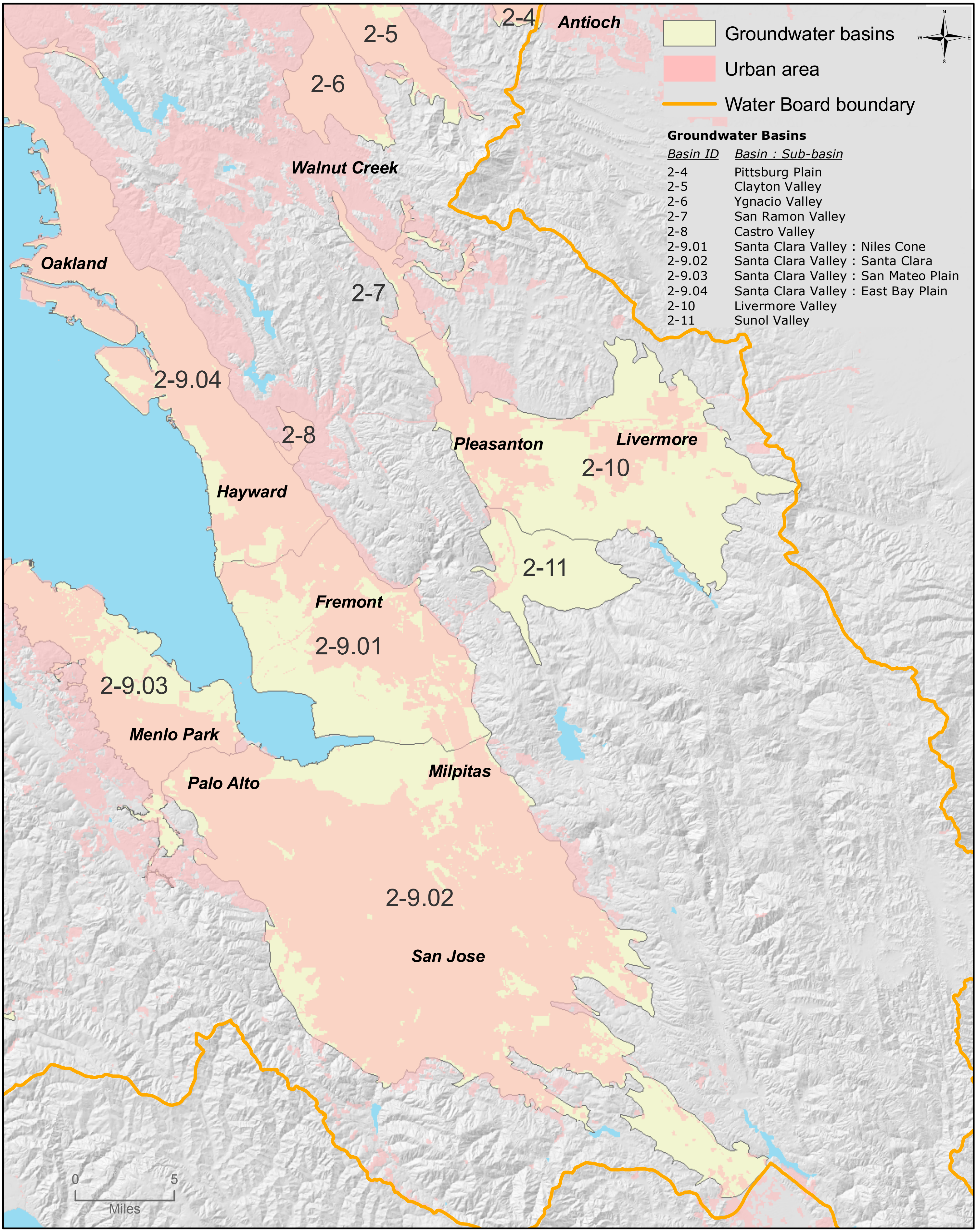


Table 2-1: Existing and Potential Beneficial Uses of Water Bodies in the San Francisco Bay Region

Human Consumptive Uses ←→ | Aquatic Life Uses ←→ | Wildlife Use | Recreational Uses

MARIN COASTAL BASIN

COUNTY Waterbody	AGR	MUN	FRSH	GWR	IND	PROC	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPWN	WARM	WILD	REC-1	REC-2	NAV
MARIN COUNTY																			
Pacific Ocean (Marin)					E		E	E			E	E	E	E		E	E	E	E
Abbotts Lagoon											E					E	E	E	
Drakes Estero							E	E			E	E	E	E		E	E	E	
East Schooner Creek								E	E			E	E	E	E	E	E	E	
Home Ranch Creek									E			E	E	E	E	E	E	E	
Limantour Estero							E	E			E	E	E	E		E	E	E	
Glenbrook Creek									E			E	E		E	E	E	E	
Muddy Hollow Creek									E			E	E	E	E	E	E	E	
Santa Maria Creek (Marin)									E			E	E	E	E	E	E	E	
Coast Creek								E	E			E	E	E	E	E	E	E	
Alamere Creek									E							E	E	E	
Wildcat Lake															E	E	E	E	
Crystal Lake									E					E	E	E	E	E	
Bass Lake							E								E	E	E	E	
Pelican Lake															E	E	E	E	
Arroyo Hondo (Marin)		E							E						E	E	E	E	
Bolinas Lagoon							E	E			E	E	E	E		E	E	E	E
Pine Gulch Creek		E							E			E	E	E	E	E	E	E	
Copper Mine Gulch Creek									E			E	E	E	E	E	E	E	
Wilkins Gulch Creek									E			E	E		E	E	E	E	

E: Existing beneficial use E*: Water quality objectives apply; water contact recreation is prohibited or limited to protect public health P: Potential beneficial use

SUISUN BASIN

COUNTY Waterbody	AGR	MUN	FRSH	GWR	IND	PROC	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPWN	WARM	WILD	REC-1	REC-2	NAV
SOLANO COUNTY, continued																			
Volanti Slough							E			E			E			E	E	E	
Montezuma Slough							E			E		E	E	E	E	E	E	E	E
Nurse Slough							E			E		E	E			E	E	E	
Denverton Slough							E			E		E	E			E	E	E	
Denverton Creek													E	E	E	E	E	E	
CONTRA COSTA COUNTY																			
Alhambra Creek									E			E	E		E	E	E	E	
Franklin Creek									E			E	E	E	E	E	E	E	
Arroyo del Hambre									E						E	E	E	E	
Peyton Slough					E		E			E		E	E			E	E	E	
Pacheco Creek															E	E	E	E	
Walnut Creek									E			E	E	E	E	E	E	E	
Grayson Creek									E			E	E		E	E	E	E	
Pine Creek									E			E	E	E	E	E	E	E	
Galindo Creek									E						E	E	E	E	
San Ramon Creek															E	E	E	E	
Bollinger Canyon Creek									E					E	E	E	E	E	
Las Trampas Creek									E				E		E	E	E	E	
Tice Creek													E		E	E	E	E	
Lafayette Creek									E						E	E	E	E	
Lafayette Reservoir		E					E		E					E	E	E	E*	E	
Hastings Slough										E			E			E	E	E	
Mt. Diablo Creek									E			E	E	E	E	E	E	E	
Mitchell Creek									E			E	E	E	E	E	E	E	
Donner Creek									E					E	E	E	E	E	
Mallard Slough (Contra Costa)							E			E		E	E			E	E	E	
Kirker Creek													E		E	E	E	E	
New York Slough							E			E		E	E			E	E	E	E

E: Existing beneficial use E*: Water quality objectives apply; water contact recreation is prohibited or limited to protect public health P: Potential beneficial use

Table 2-2: Existing and Potential Beneficial Uses in Groundwater in Identified Basins

County	Groundwater Basin Name[1]	Groundwater Sub-Basin[1]	Basin Number[1]	MUN[2]	PROC[3]	IND[4]	AGR[5]	FRESH[6]
Alameda	Castro Valley	--	2-8	P	P	P	P	--
Alameda	Santa Clara Valley	Niles Cone	2-9.01	E	E	E	E	--
Alameda and Contra Costa	Santa Clara Valley	East Bay Plain	2-9.04	E	E	E	E	--
Alameda and Contra Costa	Livermore Valley	--	2-10	E	E	E	E	--
Alameda	Sunol Valley	--	2-11	E	E	E	E	--
Contra Costa	Pittsburg Plain	--	2-4	P	P	P	P	--
Contra Costa	Clayton Valley	--	2-5	E	P	P	P	--
Contra Costa	Ygnacio Valley	--	2-6	P	P	P	P	--
Contra Costa	San Ramon Valley	--	2-7	E	P	P	E	--
Contra Costa	Arroyo del Hambre Valley	--	2-31	P	P	P	P	--
Marin	Sand Point Area	--	2-27	E	P	P	P	--
Marin	Ross Valley	--	2-28	E	P	P	E	--
Marin	San Rafael Valley	--	2-29	P	P	P	P	--
Marin	Novato Valley	--	2-30	P	P	P	P	--
Napa	Napa-Sonoma Valley	Napa Valley	2-2.01	E	E	E	E	--
Napa and Solano	Napa-Sonoma Valley	Napa-Sonoma Lowlands	2-2.03	E	E	E	E	--
San Francisco and San Mateo	Visitacion Valley	--	2-32	P	E	E	P	--
San Francisco and San Mateo	Islais Valley A[7]	--	2-33A	P	E	E	P	--
San Francisco	Islais Valley B[7]	--	2-33B	P	P	P	E	--
San Francisco	South San Francisco	--	2-37	P	E	E	P	--
San Francisco and San Mateo	Westside A[7]	--	2-35A	E	P	P	E	--
San Francisco	Lobos	--	2-38	E	P	P	E	--
San Francisco	Marina	--	2-39	E	P	P	E	--
San Francisco	Downtown	--	2-40	E	P	P	E	--
San Francisco	Westside B[7]	--	2-35B	P	P	P	E	--
San Mateo	Westside C[7]	--	2-35C	E	P	P	E	--

County	Groundwater Basin Name[1]	Groundwater Sub-Basin[1]	Basin Number[1]	MUN[2]	PROC[3]	IND[4]	AGR[5]	FRESH[6]
San Mateo	Westside D[7]	--	2-35D	E	E	E	P	--
San Mateo	Santa Clara Valley	San Mateo Plain	2-9.03	E	E	E	P	--
San Mateo and Santa Clara	Santa Clara Valley[8]	Santa Clara	2-9.02	E	E	E	E	--
San Mateo	Half Moon Bay Terrace	--	2-22	E	P	P	E	--
San Mateo	San Gregorio Valley	--	2-24	E	P	P	E	--
San Mateo	Pescadero Valley	--	2-26	E	P	P	E	--
San Mateo	San Pedro Valley	--	2-36	P	P	P	P	--
Solano	Suisun-Fairfield Valley	--	2-3	E	E	E	E	--
Sonoma and Marin	Petaluma Valley	--	2-1	E	P	P	E	--
Sonoma	Napa-Sonoma Valley	Sonoma Valley	2-2.02	E	P	P	E	--
Sonoma and Marin	Wilson Grove Formation Highlands	--	1.59	E	P	P	E	--
Sonoma and Marin	Wilson Grove Formation Highlands	--	1.59	See RB1 Basin Plan[9]				
Sonoma	Kenwood Valley	--	2-19	E	P	P	E	--
Sonoma	Napa – Sonoma Volcanic Highlands	--	2-23	X	X	X	X	X
Santa Clara	Gilroy – Hollister Valley	Llagas Area	3-3.01	See RB3 Basin Plan[10]				

Notes:

1. Department of Water Resources (DWR) Bulletin 118 “California Groundwater”, 2003.
2. MUN = Municipal and domestic water supply.
3. PROC = Industrial process water supply.
4. IND = Industrial service water supply.
5. AGR = Agricultural water supply.
6. FRESH = Freshwater replenishment to surface water; designation will be determined at a later date; for the interim, a site-by-site determination will be made.
7. The existing and potential beneficial uses for groundwater basins listed in the 1995 Basin Plan (Table 2-3) were assigned to the new groundwater basins based on the geographic location of the old basins compared to the new basins. The basin names, such as Westside A,

Westside B, etc., are informal names assigned by the Water Board to preserve the beneficial use designations in the 1995 Basin Plan and do not represent sub-basins identified by the Department of Water Resources.

8. The Santa Clara Valley groundwater basin/Santa Clara groundwater sub-basin is also known as Coyote Valley.
9. This groundwater basin is also located in the North Coast Region (RB1); beneficial uses of groundwater are specified in the Basin Plan for RB1.
10. This groundwater basin is also located in the Central Coast Region (RB3); beneficial uses of groundwater are specified in the Basin Plan for RB3.

E = Existing beneficial uses; based on best available information.
P = Potential beneficial uses; based on best available information.
X = This groundwater basin was not listed in the 1995 Basin Plan; designation will be determined at a later date; for the interim, a site-by-site determination will be made.
See DWR Bulletin 118 (2003) for groundwater basin characteristics.

CHAPTER 3: WATER QUALITY OBJECTIVES

The overall goals of water quality regulation are to protect and maintain thriving aquatic ecosystems and the resources those systems provide to society and to accomplish these in an economically and socially sound manner. California's regulatory framework uses water quality objectives both to define appropriate levels of environmental quality and to control activities that can adversely affect aquatic systems.

3.1 WATER QUALITY OBJECTIVES

There are two types of objectives: narrative and numerical. Narrative objectives present general descriptions of water quality that must be attained through pollutant control measures and watershed management. They also serve as the basis for the development of detailed numerical objectives.

Historically, numerical objectives were developed primarily to limit the adverse effect of pollutants in the water column. Two decades of regulatory experience and extensive research in environmental science have demonstrated that beneficial uses are not fully protected unless pollutant levels in all parts of the aquatic system are also monitored and controlled. The Regional Board is actively working towards an integrated set of objectives, including numerical sediment objectives, that will ensure the protection of all current and potential beneficial uses.

Numerical objectives typically describe pollutant concentrations, physical/chemical conditions of the water itself, and the toxicity of the water to aquatic organisms. These objectives are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effect on organisms using the aquatic system as habitat, on people consuming those organisms or water, and on other current or potential beneficial uses (as described in Chapter 2).

The technical bases of the region's water quality objectives include extensive biological, chemical, and physical partitioning information reported in the scientific literature, national water quality criteria, studies conducted by other agencies, and information gained from local environmental and discharge monitoring (as described in Chapter 6). The Regional Board recognizes that limited information exists in some cases, making it difficult to establish definitive numerical objectives, but the Regional Board believes its conservative approach to setting objectives has been proper. In addition to the technical review, the overall feasibility of reaching objectives in terms of technological, institutional, economic, and administrative factors is considered at many different stages of objective derivation and implementation of the water quality control plan.

Together, the narrative and numerical objectives define the level of water quality that shall be maintained within the region. In instances where water quality is better than that prescribed by the objectives, the state Antidegradation Policy applies (State Board Resolution 68-16: Statement of Policy With Respect to Maintaining High Quality of Waters in California). This policy is aimed at protecting relatively uncontaminated aquatic systems where they exist and preventing further degradation. The state's Antidegradation Policy is consistent with the federal Antidegradation Policy, as interpreted by the State Water Resources Control Board in State Board Order No. 86-17.

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, the Regional Board will conduct a case-by-case analysis of the benefits and costs of preventing further degradation. In cases where this analysis indicates that beneficial uses will be adversely impacted by allowing further degradation, then the Regional Board will not allow controllable water quality factors to cause any further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the state and that may be reasonably controlled.

The Regional Board establishes and enforces waste discharge requirements for point and nonpoint source of pollutants at levels necessary to meet numerical and narrative water quality objectives. In setting waste discharge requirements, the Regional Board will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives.

In general, the objectives are intended to govern the concentration of pollutant constituents in the main water mass. The same objectives cannot be applied at or immediately adjacent to submerged effluent discharge structures. Zones of initial dilution within which higher concentrations can be tolerated will be allowed for such discharges.

For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from submerged outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.

For shallow water submerged discharges, surface discharges, and nonbuoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum-induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution.

Compliance with water quality objectives may be prohibitively expensive or technically impossible in some cases. The Regional Board will consider modification of specific water quality objectives as long as the discharger can demonstrate that the alternate objective will protect existing beneficial uses, is scientifically defensible, and is consistent with the state Antidegradation Policy. This exception clause properly indicates that the Regional Board will conservatively compare benefits and costs in these cases because of the difficulty in quantifying beneficial uses.

These water quality objectives are considered necessary to protect the present and potential beneficial uses described in Chapter 2 of this Plan and to protect existing high quality waters of the state. These objectives will be achieved primarily through establishing and enforcing waste discharge requirements and by implementing this water quality control plan.

3.2 OBJECTIVES FOR OCEAN WATERS

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan) and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revision to them will apply to ocean waters. These plans describe objectives and effluent limitations for ocean waters.

3.3 OBJECTIVES FOR SURFACE WATERS

The following objectives apply to all surface waters within the region, except the Pacific Ocean.

3.3.1 BACTERIA

Table 3-1 provides a summary of the bacterial water quality objectives and identifies the sources of those objectives. Table 3-2 summarizes U.S. EPA's water quality criteria for water contact recreation based on the frequency of use a particular area receives. These criteria will be used to differentiate between pollution sources or to supplement objectives for water contact recreation.

3.3.3.1 Implementation Provisions for Water Contact Recreation Bacteria Objectives

Water quality objectives for bacteria in Table 3-1 shall be strictly applied except when otherwise provided for in a TMDL. In the context of a TMDL, the Water Board may implement the objectives in fresh and marine waters by using a "reference system and antidegradation approach" as discussed below. Implementation of water quality objectives for bacteria using a "reference system and antidegradation approach" requires control of bacteria from all anthropogenic sources so that bacteriological water quality is consistent with that of a reference system. A reference system is defined as an area (e.g., a subwatershed or catchment) and associated monitoring point(s) that is minimally impacted by human activities that potentially affect bacteria densities in the reference receiving water body.

This approach recognizes that there are natural sources of bacteria (defined as non-anthropogenic sources) that may cause or contribute to exceedances of the objectives for indicator bacteria. It also avoids requiring treatment or diversion of water bodies or treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Water Board, could have the potential to adversely affect valuable aquatic life and wildlife beneficial uses supported by water bodies in the region.

Under the reference system approach, a certain frequency of exceedance of the single-sample objectives shall be permitted. The permitted number of exceedances shall be based on the observed exceedance frequency in a selected reference system(s) or the targeted water body, whichever is less. The "reference system and antidegradation approach" ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system(s).

The appropriateness of this approach, the specific exceedance frequencies to be permitted under it, and the permittees to whom it would apply will be evaluated within the context of TMDL development for a specific water body, and decided by the Water Board when considering adoption of a TMDL. These implementation provisions may only be used within the context of a TMDL addressing municipal stormwater (including discharges regulated under statewide municipal NPDES waste discharge requirements), discharges from confined animal facilities, and discharges from nonpoint sources.

3.3.2 BIOACCUMULATION

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

3.3.3 BIOSTIMULATORY SUBSTANCES

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

3.3.4 COLOR

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

3.3.5 DISSOLVED OXYGEN

For all tidal waters, the following objectives shall apply:

In the Bay:

Downstream of Carquinez Bridge	5.0 mg/l minimum
Upstream of Carquinez Bridge	7.0 mg/l minimum

For nontidal waters, the following objectives shall apply:

Waters designated as:

Cold water habitat	7.0 mg/l minimum
Warm water habitat	5.0 mg/l minimum

The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.

Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/l and 7 mg/l are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

3.3.6 FLOATING MATERIAL

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.7 OIL AND GREASE

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

3.3.8 POPULATION AND COMMUNITY ECOLOGY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.9 pH

The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.

3.3.10 RADIOACTIVITY

Radionuclides shall not be present in concentrations that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations (CCR), which is incorporated by reference into this Plan. This incorporation is prospective, including future changes to the incorporated provisions as the changes take effect (see Table 3-5).

3.3.11 SALINITY

Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.

3.3.12 SEDIMENT

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.

3.3.13 SETTLEABLE MATERIAL

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

3.3.14 SUSPENDED MATERIAL

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.15 SULFIDE

All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment.

Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.

3.3.16 TASTES AND ODORS

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

3.3.17 TEMPERATURE

Temperature objectives for enclosed bays and estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California," including any revisions to the plan.

In addition, the following temperature objectives apply to surface waters:

- The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.
- The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°F (2.8°C) above natural receiving water temperature

3.3.18 TOXICITY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test.

There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

Attainment of this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, or toxicity tests (including those described in Chapter 4), or other methods selected by the Water Board. The Water Board will also consider other relevant information and numeric criteria and guidelines for toxic substances developed by other agencies as appropriate.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.19 TURBIDITY

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.

3.3.20 UN-IONIZED AMMONIA

The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits (in mg/l as N):

Annual Median	0.025
Maximum, Central Bay (as depicted in Figure 2-5) and upstream	0.16
Maximum, Lower Bay (as depicted in Figures 2-6 and 2-7):	0.4

The intent of this objective is to protect against the chronic toxic effects of ammonia in the receiving waters. An ammonia objective is needed for the following reasons:

- Ammonia (specifically un-ionized ammonia) is a demonstrated toxicant. Ammonia is generally accepted as one of the principle toxicants in municipal waste discharges. Some industries also discharge significant quantities of ammonia.

- Exceptions to the effluent toxicity limitations in Chapter 4 of the Plan allow for the discharge of ammonia in toxic amounts. In most instances, ammonia will be diluted or degraded to a nontoxic state fairly rapidly. However, this does not occur in all cases, the South Bay being a notable example. The ammonia limit is recommended in order to preclude any build up of ammonia in the receiving water.
- A more stringent maximum objective is desirable for the northern reach of the Bay for the protection of the migratory corridor running through Central Bay, San Pablo Bay, and upstream reaches.

3.3.21 OBJECTIVES FOR SPECIFIC CHEMICAL CONSTITUENTS

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use. Water quality objectives for selected toxic pollutants for surface waters are given in Tables 3-3, 3-3A, 3-3B, 3-3C, 3-4 and 3-4A.

The Water Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Site-specific objectives to be considered by the Water Board shall be developed in accordance with the provisions of the federal Clean Water Act, the State Water Code, State Board water quality control plans, and this Plan. These site-specific objectives will take into consideration factors such as all available scientific information and monitoring data and the latest U.S. EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. The objectives in Tables 3-3 and 3-4 apply throughout the region except as otherwise indicated in the tables or when site-specific objectives for the pollutant parameter have been adopted. Site-specific objectives have been adopted for copper in segments of San Francisco Bay (see Figure 7.2-1-01), for nickel in South San Francisco Bay (Table 3-3A), and for cyanide in all San Francisco Bay segments (Table 3-3C). Objectives for mercury that apply to San Francisco Bay are listed in Table 3-3B. Objectives for mercury that apply to Walker Creek, Soulajule Reservoir, and their tributaries, and to waters of the Guadalupe River watershed are listed in Table 3-4A.

South San Francisco Bay south of the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Water Board. Controlling urban and upland runoff sources is critical to the success of maintaining water quality in this portion of the Bay. Site-specific water quality objectives have been adopted for dissolved copper and nickel in this Bay segment. Site-specific objectives may be appropriate for other pollutants of concern, but this determination will be made on a case-by-case basis, and after it has been demonstrated that all other reasonable treatment, source control and pollution prevention measures have been exhausted. The Water Board will determine whether revised water quality objectives and/or effluent limitations are appropriate based on sound technical information and scientific studies, stakeholder input, and the need for flexibility to address priority problems in the watershed.

3.3.22 CONSTITUENTS OF CONCERN FOR MUNICIPAL AND AGRICULTURAL WATER SUPPLIES

At a minimum, surface waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Table 64431-A (Inorganic Chemicals) of Section 64431, and Table 64433.2-A (Fluoride) of Section 64433.2, Table 64444-A (Organic Chemicals) of Section 64444, and Table 64449-A (SMCLs-Consumer Acceptance Limits) and 64449-B (SMCLs-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. Table 3-5 contains water quality objectives for municipal supply, including the MCLs contained in various sections of Title 22 as of the adoption of this plan.

At a minimum, surface waters designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

3.4 OBJECTIVES FOR GROUNDWATER

Groundwater objectives consist primarily of narrative objectives combined with a limited number of numerical objectives. Additionally, the Water Board will establish basin- and/or site-specific numerical groundwater objectives as necessary. For example, the Water Board has groundwater basin-specific objectives for the Alameda Creek watershed above Niles to include the Livermore-Amador Valley as shown in Table 3-7.

The maintenance of existing high quality of groundwater (i.e., "background") is the primary groundwater objective.

In addition, at a minimum, groundwater shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor in excess of the objectives described below unless naturally occurring background concentrations are greater. Under existing law, the Water Board regulates waste discharges to land that could affect water quality, including both groundwater and surface water quality. Waste discharges that reach groundwater are regulated to protect both groundwater and any surface water in continuity with groundwater. Waste discharges that affect groundwater that is in continuity with surface water cannot cause violations of any applicable surface water standards.

3.4.1 BACTERIA

In groundwater with a beneficial use of municipal and domestic supply, the median of the most probable number of coliform organisms over any seven-day period shall be less than 1.1 most probable number per 100 milliliters (MPN/100 mL) (based on multiple tube fermentation technique; equivalent test results based on other analytical techniques as specified in the National Primary Drinking Water Regulation, 40 CFR, Part 141.21 (f), revised June 10, 1992, are acceptable).

3.4.2 ORGANIC AND INORGANIC CHEMICAL CONSTITUENTS

All groundwater shall be maintained free of organic and inorganic chemical constituents in concentrations that adversely affect beneficial uses. To evaluate compliance with water quality objectives, the Water Board will consider all relevant and scientifically valid evidence, including relevant and scientifically valid numerical criteria and guidelines developed and/or published by other agencies and organizations (e.g., U.S. Environmental Protection Agency (U.S. EPA), the State Water Board, California Department of Health Services (DHS), U.S. Food and Drug

Administration, National Academy of Sciences, California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA), U.S. Agency for Toxic Substances and Disease Registry, Cal/EPA Department of Toxic Substances Control (DTSC), and other appropriate organizations.)

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) of Section 64431, Table 64433.2-A (Fluoride) of Section 64433.2, and Table 64444-A (Organic Chemicals) of Section 64444. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

Groundwater with a beneficial use of agricultural supply shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use. In determining compliance with this objective, the Water Board will consider as evidence relevant and scientifically valid water quality goals from sources such as the Food and Agricultural Organizations of the United Nations; University of California Cooperative Extension, Committee of Experts; and McKee and Wolf's "Water Quality Criteria," as well as other relevant and scientifically valid evidence. At a minimum, groundwater designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

Groundwater with a beneficial use of freshwater replenishment shall not contain concentrations of chemicals in amounts that will adversely affect the beneficial use of the receiving surface water.

Groundwater with a beneficial use of industrial service supply or industrial process supply shall not contain pollutant levels that impair current or potential industrial uses.

3.4.3 RADIOACTIVITY

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the MCLs specified in Table 4 (Radioactivity) of Section 64443 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.4.4 TASTE AND ODOR

Groundwater designated for use as domestic or municipal supply (MUN) shall not contain taste- or odor-producing substances in concentrations that cause a nuisance or adversely affect beneficial uses. At a minimum, groundwater designated for use as domestic or municipal supply shall not contain concentrations in excess of the SMCLs specified in Tables 64449-A (Secondary MCLs-Consumer Acceptance Limits) and 64449-B (Secondary MCLs-Ranges) of Section 64449 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.5 OBJECTIVES FOR THE DELTA

The objectives contained in the State Water Board's 1995 "Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary" and any revisions thereto shall apply to the waters of the Sacramento-San Joaquin Delta and adjacent waters as specified in that plan.

3.6 OBJECTIVES FOR ALAMEDA CREEK WATERSHED

The water quality objectives contained in Table 3-7 apply to the surface and groundwaters of the Alameda Creek watershed above Niles.

Wastewater discharges that cause the surface water limits in Table 3-7 to be exceeded may be allowed if they are part of an overall wastewater resource operational program developed by those agencies affected and approved by the Water Board.

TABLES

Table 3-1: Water Quality Objectives for Bacteria[a]

Beneficial Use	Fecal Coliform (MPN/100ml)	Total Coliform (MPN/100ml)	Enterococcus (MPN/100ml)[g]
Water Contact Recreation	geometric mean < 200 90th percentile < 400	median < 240 no sample > 10,000	geometric mean < 35 no sample > 104
Shellfish Harvesting[b]	median < 14 90th percentile < 43	median < 70 90th percentile < 230[c]	
Non-contact Water Recreation[d]	mean < 2000 90th percentile < 4000		
Municipal Supply: - Surface Water[e] - Groundwater	 geometric mean < 20	 geometric mean < 100 < 1.1[f]	

Notes:

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

b. Source: National Shellfish Sanitation Program.

c. Based on a five-tube decimal dilution test or 300 MPN/100 ml when a three-tube decimal dilution test is used.

d. Source: Report of the Committee on Water Quality Criteria, National Technical Advisory Committee, 1968.

e. Source: California Department of Public Health recommendation.

f. Based on multiple tube fermentation technique; equivalent test results based on other analytical techniques, as specified in the National Primary Drinking Water Regulation, 40 CFR, Part 141.21(f), revised June 10, 1992, are acceptable.

g. Applicable to marine and estuarine waters only. Numeric values are based on Section 7958 of Title 17 of the California Code of Regulations, 69FR 67217 et seq., and 40 CFR Part 131.41 (effective date December 16, 2004).

Table 3-2: U.S. EPA Bacteriological Criteria for Water Contact Recreation[1,2] (in colonies per 100 ML)

	Fresh Water		Salt Water
	Enterococci	E. Coli	Enterococci
Steady State (all areas)	33	126	35
Maximum at:			
- designated beach	61	235	104
- moderately used area	89	298	124
- lightly used area	108	406	276
- infrequently used area	151	576	500

NOTES:

1. The criteria were published in the Federal Register, Vol. 51, No. 45 / Friday, March 7, 1986 / 8012-8016. The Criteria are based on:
   (a) Cabelli, V.J. 1983. Health Effects Criteria for Marine Recreational Waters. U.S. EPA, EPA 600/1-80-031, Cincinnati, Ohio, and
   (b) Dufour, A.P. 1984. Health Effects Criteria for Fresh Recreational Waters. U.S. EPA, EPA 600/1-84-004, Cincinnati Ohio.

2. The U.S. EPA criteria apply to water contact recreation only. The criteria provide for a level of production based on the frequency of usage of a given water contact recreation area. The criteria may be employed in special studies within this region to differentiate between pollution sources or to supplement the current coliform objectives for water contact recreation.

Table 3-3: Marine[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average	24-hr Average
Arsenic[b, c, d]	36	69	
Cadmium[b, c, d]	9.3	42	
Chromium VI[b, c, d, e]	50	1100	
Copper[c, d, f]			
Cyanide[g]			
Lead[b, c, d]	8.1	210	
Mercury[h]	0.025	2.1	
Nickel[b, c, d]	8.2	74	
Selenium[i]			
Silver[b, c, d]		1.9	
Tributyltin[j]			
Zinc[b, c, d]	81	90	
PAHs[k]			15

NOTES:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all marine waters except for the South Bay south of Dumbarton Bridge (where the California Toxics Rule (CTR) applies) or as specified in note h (below). For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater (Table 3-4) or marine objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. According to the CTR, these objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. This objective may be met as total chromium.

f. Water quality objectives for copper were promulgated by the CTR and may be updated by U.S. EPA without amending the Basin Plan. Note: at the time of writing, the values are 3.1 ug/l (4-day average) and 4.8 ug/l (1-hr. average). The most recent version of the CTR should be consulted before applying these values.

g. Cyanide criteria were promulgated in the National Toxics Rule (NTR) (Note: at the time of writing, the values are 1.0 µg/l (4-day average) and 1.0 µg/l (1-hr. average)) and apply, except that site-specific marine water quality objectives for cyanide have been adopted for San Francisco Bay as set forth in Table 3-3C.

h. Source: U.S. EPA Ambient Water Quality Criteria for Mercury (1984). The 4-day average value for mercury does not apply to San Francisco Bay; instead, the water quality objectives specified in Table 3-3B apply. The 1-hour average value continues to apply to San Francisco Bay.

i. Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.0 ug/l (4-day average) and 20 ug/l (1-hr. average).

j. Tributyltin is a compound used as an antifouling ingredient in marine paints and toxic to aquatic life in low concentrations. U.S. EPA has published draft criteria for protection of aquatic life (Federal Register: December 27, 2002, Vol. 67, No. 249, Page 79090-79091). These criteria are cited for advisory purposes. The draft criteria may be revised.

k. The 24-hour average aquatic life protection objective for total PAHs is retained from the 1995 Basin Plan. Source: U.S. EPA 1980.

Table 3-3A: Water Quality Objectives for Copper and Nickel in San Francisco Bay Segments (ug/L)

Compound	4-day Average (CCC)[1]	1-hr Average (CMC)[2]	Extent of Applicability
Copper	6.9	10.8	The portion of Lower San Francisco Bay south of the line representing the Hayward Shoals shown on Figure 7.1. and South San Francisco Bay
Copper	6.0	9.4	The portion of the delta located in the San Francisco Bay Region, Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, and the portion of Lower San Francisco Bay north of the line representing the Hayward Shoals on Figure 7.1.
Nickel	11.9	62.4*	South San Francisco Bay

[1]Criteria Continuous Concentration

[2]Criteria Maximum Concentration

*Handbook of Water Quality Standards, 2nd ed. 1994 in Section 3.7.6 states that the CMC = Final AcuteValue/2; 62.4 is the Final Acute Value (resident species database)/2; so the site-specific CMC is lower than the California Toxics Rule value because we are using the resident species database instead of the National Species Database.

Table 3-3B: Marine[a] Water Quality Objectives for Mercury in San Francisco Bay[b]		
Protection of Human Health	0.2 mg mercury per kg fish tissue	Average wet weight concentration measured in the edible portion of trophic level 3 and trophic level 4 fish[c]
Protection of Aquatic Organisms and Wildlife	0.03 mg mercury per kg fish	Average wet weight concentration measured in whole fish 3–5 cm in length

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

b. Objectives apply to all segments of San Francisco Bay, including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Richardson Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay (including the Lower South Bay)~~.~~

c. Compliance shall be determined by analysis of fish tissue as described in Chapter 6, Surveillance and Monitoring.

Table 3-3C: Marine [a] Water Quality Objectives for Cyanide in San Francisco Bay [b] (values in ug/l)		
Cyanide	Chronic Objective (4-day Average)	2.9
Cyanide	Acute Objective (1-hour Average)	9.4

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

b. Objectives apply to all segments of San Francisco Bay, including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay.

Table 3–4: Freshwater[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average
Arsenic[b, c, d]	150	340
Cadmium[b, d]	e	e
Chromium III[f]		
Chromium VI[b, c, d, g]	11	16
Copper[b, c, d]	9.0[h]	13[h]
Cyanide[i]		
Lead[b, c, d]	2.5[j]	65[j]
Mercury[k]	0.025	2.4
Nickel[b, c, d]	52[l]	470[l]
Selenium[m]		
Silver[b, c, d]		3.4[n]
Tributyltin[o]		
Zinc[b, c, d]	120[p]	120[p]

Notes:

a. Freshwaters are those in which the salinity is equal to or less than 1 part per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all freshwaters except for the South Bay south of Dumbarton Bridge, where the California Toxics Rule (CTR) applies. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the marine (Table 3-3) and freshwater objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. These objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. The objectives for cadmium and other noted metals are expressed by formulas where H = ln (hardness) as $CaCO_3$ in mg/l: The four-day average objective for cadmium is $e^{(0.7852\ H\ -\ 3.490)}$. This is 1.1 µg/l at a hardness of 100 mg/l as $CaCO_3$. The one-hour average objective for cadmium is $e^{(1.128\ H\ -\ 3.828)}$. This is 3.9 µg/l at a hardness of 100 mg/l as $CaCO_3$.

f. Chromium III criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 180 ug/l (4-day average) and 550 ug/l (1-hr. average). The objectives for chromium III are based on hardness. The values in this footnote assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for chromium III is $e^{(0.8190H+1.561)}$. The 1-hour average for chromium III is $e^{(0.8190\ H+3.688)}$.

g. This objective may be met as total chromium.

h. The objectives for copper are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for copper is $e^{(0.8545H-1.702)}$. The 1-hour average for copper is $e^{(0.9422H-1.700)}$.

i. Cyanide criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.2 ug/l (4-day average) and 22 ug/l (1-hr. average).

j. The objectives for lead are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(1.273H - 4.705)}$. The 1-hour average for lead is $e^{(1.273H - 1.460)}$.

k. Source: U.S. EPA Quality Criteria for Water 1986 (EPA 440/5-86-001), which established a mercury criterion of 0.012 ug/l. The Basin Plan set the objective at 0.025 based on considerations of the level of detection attainable at that time. The 4-day average value for mercury does not apply to Walker Creek and Soulajule Reservoir and their tributaries nor to waters of the Guadalupe River watershed; instead, the water quality objectives specified in Table 3-4A apply. The 1-hour average value continues to apply to waters specified in Table 3-4A.

l. The objectives for nickel are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(0.8460H + 0.0584)}$. The 1-hour average objective is $e^{(0.8460H + 2.255)}$.

m. Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.0 ug/l (4-day average) and 20 ug/l (1-hr. average).

n. The objective for silver is based on hardness. The table value assumes a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objective must be calculated using the following formula where H = ln (hardness): The 1-hour average objective for silver is $e^{(1.72H - 6.52)}$. U.S. EPA has not developed a 4-day criterion.

o. Tributyltin is a compound used as an antifouling ingredient in marine paints and toxic to aquatic life in low concentrations. U.S. EPA has published draft criteria for protection of aquatic life (Federal Register: December 27, 2002, Vol. 67, No. 249, Page 79090-79091). These criteria are cited for advisory purposes. The draft criteria may be revised.

p. The objectives for zinc are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for zinc is $e^{(0.8473 H + 0.884)}$. The 1-hour average for zinc is $e^{(0.8473 H + 0.884)}$.

Table 3-4A: Freshwater Water Quality Objectives for Mercury in Walker Creek, Soulajule Reservoir, and Their Tributaries; and in Waters of the Guadalupe River Watershed, Except Los Gatos Creek and its Tributaries Upstream of Vasona Dam, Lake Elsman, Lexington Reservoir, and Vasona Lake

Protection of Aquatic Organisms and Wildlife[a]	0.05 mg methylmercury per kg fish	Average wet weight concentration measured in whole trophic level 3 fish 5–15 cm in length
	0.1 mg methylmercury per kg fish	Average wet weight concentration measured in whole trophic level 3 fish 15 – 35 cm in length

a. The freshwater water quality objectives for the protection of aquatic organisms and wildlife also protect humans who consume fish from the Walker Creek and Guadalupe River watersheds.

Table 3-5: Water Quality Objectives for Municipal Supply

Parameter	Objective (in MG/L)
Physical:	
Color (units)[a]	15.0
Odor (number)[a]	3.0
Turbidity (NTU)[a]	5.0
pH[b]	6.0 - 8.5
TDS[c]	500.0
EC (mmhos/cm)[c]	900
Corrosivity	non-corrosive
Inorganic Parameters:	
Aluminum[d]	1.0[d] / 0.2[a]
Antimony[d]	0.006
Arsenic[d]	0.05
Asbestos[d]	7 MFL[e]
Barium[d]	1.0
Beryllium[d]	0.004
Chloride[c]	250.0
Cadmium[d]	0.005
Chromium[d]	0.05
Copper[a]	1.0
Cyanide[d]	0.15
Fluoride[f]	0.6 - 1.7[g]
Iron[a]	0.3
Lead[b]	0.05
Manganese[a]	0.05
Mercury[d]	0.002
Nickel[d]	0.1
Nitrate (as NO_3)[d]	45.0
Nitrate + Nitrite (as N)[d]	10.0
Nitrite (as N)[d]	1.0
Selenium[d]	0.05
Silver[b]	0.1
Sulfate[c]	250.0
Thallium[d]	0.002
Zinc[a]	5.0
Organic Parameters:	
MBAS (Foaming agents)[a]	0.5
Oil and grease[b]	none
Phenols[b]	0.001
Trihalomethanes[b]	0.1
Chlorinated Hydrocarbons:	
Endrin[h]	0.002
Lindane[h]	0.0002
Methoxychlor[h]	0.03
Toxaphene[h]	0.003
2,3,7,8-TCDD (Dioxin)[h]	3×10^{-8}
2,4-D[h]	0.07
2,4,4-TP Silvex[h]	0.05

Parameter	Objective (in MG/L)
Synthetic Organic Chemicals:	
Alachor[h]	0.002
Atrazine[h]	0.001
Bentazon[h]	0.018
Benzo(a)pyrene[h]	0.0002
Dalapon[h]	0.2
Dinoseb[h]	0.007
Diquat[h]	0.02
Endothall[h]	0.1
Ethylene dibromide[h]	0.00005
Glyphosate[h]	0.7
Heptachlor[h]	0.00001
Heptachlor epoxide[h]	0.00001
Hexachlorecyclopentadiene[h]	0.001
Molinate[h]	0.02
Oxarnyl[h]	0.05
Pentachlorophenol[h]	0.001
Picloram[h]	0.5
Polychlorinated Biphenyls[h]	0.0005
Simazine[h]	0.004
Thiobencarb[h]	0.07 / 0.001
Volatile Organic Chemicals:	
Benzene[h]	0.001
Carbon Tetrachloride[h]	0.005
1,2-Dibromo-3-chloropropane[h]	0.0002
1,2-Dichlorobenzene[h]	0.6
1,4-Dichlorobenzene[h]	0.005
1,1-Dichloroethane[h]	0.005
1,2-Dichloroethane[h]	0.0005
cis-1,2-Dichloroethlyene[h]	0.006
trans-1,2-Dichloroethylene[h]	0.01
1,1-Dichloroethylene[h]	0.006
Dichloromethane[h]	0.005
1,2-Dichloropropane[h]	0.005
1,3-Dichloropropene[h]	0.0005
Ethylbenzene[h]	0.7
Methyl-tert-butyl ether[h]	0.013 / 0.005
Monochlorobenzene[h]	0.07
Styrene[h]	0.1
1,1,2,2-Tetrachloroethane[h]	0.001
Tetrachloroethylene[h]	0.005
1,2,4-Trichlorobenzene[h]	0.005
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane[h]	0.005
Trichloroethylene[h]	0.005
Trichlorofluoromethane	0.15

Parameter	Objective (in MG/L)
Volatile Organic Chemicals (cont'd):	
1,1,2-Trichloro-1,2,2 trifluoromethane[h]	1.2
Toluene[h]	0.15
Vinyl Chloride[h]	0.0005
Xylenes (single or sum of isomers)[h]	1.750
Radioactivity:	
Combined Radium-226 and Radium-228[i]	5
Gross Alpha Particle Activity[i]	15
Tritium[i]	20,000
Strontium-90[i]	8
Gross Beta Particle Activity[i]	50
Uranium[i]	20

NOTES:

a. Secondary Maximum Contaminant Levels as specified in Table 64449- A of Section 64449, Title 22 of the California Code of Regulations, as June 3, 2005.

b. Table III-2, 1986 Basin Plan

c. Secondary Maximum Contaminant Levels as specified in Table 64449-B of Section 64449, Title 22 of the California Code of Regulations, as of June 3, 2005. (Levels indicated are "recommended" levels. Table 64449-B contains a complete list of upper and short-term ranges.)

d. Maximum Contaminant Levels as specified in Table 64431-A (Inorganic Chemicals) of Section 64431, Title 22 of the California Code of Regulations, as of June 3, 2005.

e. MFL = million fibers per liter; MCL for fibers exceeding 10 um in length.

f. Flouride objectives depend on temperature.

g. A complete list of optimum and limiting concentrations is specified in Table 64433.2-A of Section 64433.2, Title 22 of the California Code of Regulations, as of June 3, 2005.

h. Maximum Contaminant Levels as specified in Table 64444-A (Organic Chemicals) of Section 64444, Title 22 of the California Code of Regulations, as of June 3, 2005.

i. Maximum Contaminant Levels as specified in Table 4 (Radioactivity) of Section 64443, Title 22 of the California Code of Regulations, as of June 3, 2005.

j. Included Radium-226 but excludes Radon and Uranium.

MG/L Milligrams per liter
pCi/L pico Curries per liter

Table 3-6: Water Quality Objectives for Agricultural Supply[a] (in mg/l)

Parameter	Threshold	Limit	Limit for Livestock Watering
Physical:			
pH	5.5-8.3	4.5-9.0	
TDS			10,000.0
EC (mmhos / cm)		0.2-3.0	
Inorganic Parameters:			
Aluminum	5.0	20.0	5.0
Arsenic	0.1	2.0	0.2
Beryllium	0.1	0.5	
Boron	0.5	2.0	5.0
Chloride	142.0	355.0	
Cadmium	0.01	0.5	0.05
Chromium	0.1	1.0	1.0
Cobalt	0.05	5.0	1.0
Copper	0.2	5.0	0.5
Flouride	1.0	15.0	2.0
Iron	5.0	20.0	
Lead	5.0	10.0	0.1
Lithium		2.5[b]	
Manganese	0.2	10.0	
Molybdenum	0.01	0.05	0.5
Nickel	0.2	2.0	
$NO_3 + NO_2$ (as N)	5.0	30[c]	100.0
Selenium		0.02	0.05
Sodium adsorption ratio (adjusted)[d]	3.0	9.0	
Vanadium	0.1	1.0	0.1
Zinc	2.0	10.0	25

NOTES:

a. For an extensive discussion of water quality for agricultural purposes, see "A Compilation of Water Quality Goals," Central Valley Regional Water Quality Control Board, May 1993.

b. For citrus irrigation, maximum 0.075 mg/l.

c. For sensitive crops. Values are actually for NO_3-N + NH_4-N.

d. Adjusted SAR = $\{ Na /[(Ca + Mg)+2]^{0.5} \}\{1 + [8.4 – pHc]\}$, where pHc is a calculated value based on total cations, Ca + Mg, and CO_3 + HCO_3, in me/l. Exact calculations of pHc can be found in "Guidelines for Interpretation of Water Quality for Agriculture" prepared by the Univ. of California Cooperative Extension.

Table 3-7: Water Quality Objectives for the Alameda Creek Watershed Above Niles

SURFACE WATER QUALITY OBJECTIVES (ALAMEDA CREEK AND TRIBUTARIES)

TDS:	250 mg/l (90 day-arithmetic mean)
	360 mg/l (90 day-90^{th} percentile)
	500 mg/l (daily maximum)
Chlorides:	60 mg/l (90 day-arithmetic mean)
	100 mg/l (90 day-90^{th} percentile)
	250 mg/l (daily maximum)

GROUNDWATER QUALITY OBJECTIVES

(Concentration not to be exceeded more than 10 percent of the time during one year.)

Central Basin

TDS:	Ambient or 500 mg/l, whichever is lower
Nitrate (NO_3):	45 mg/l

Fringe Subbasins

TDS:	Ambient or 1000 mg/l, whichever is lower
Nitrate (NO_3):	45 mg/l

Upland and Highland Areas

California domestic water quality standards set forth in California Code of Regulations, Title 22 and current county standards.

Ambient water quality conditions at a proposed project area will be determined by Zone 7 of the Alameda County Flood Control and Water Conservation District at the time the project is proposed, with the cost borne by the project proponents. Ambient conditions apply to the water-bearing zone with the highest quality water.

Waters designated for use as domestic or municipal water supply shall not contain concentrations of chemicals in excess of natural concentrations or the limits specified in California Code of Regulations, Title 22, Chapter 15, particularly Tables 64431-A and 64431-B of Section 64431, Table 64444-A of Section 64444, and Table 4 of Section 64443.