Appendix F:
Hydrology and Water Quality Supporting Information

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F.1 - Preliminary Hydrology Study

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PRELIMINARY HYDROLOGY STUDY
1661 and 1673 W. BROADWAY
ANAHEIM, CA
TTM No. 19141
OTH2020-01342
DEV2020-00248

DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT SERVICES
APPROVED
Esperanza Rios, Associate Engineer
8/23/2021, 2:59:52 PM
ANAH-OTH2021-01342
Esperanza Rios

Project Address:

1661 and 1673 W. Broadway
Anaheim, CA 92802

Prepared For:

City Ventures Homebuilding, LLC
3121 Michelson Drive, Suite 150
Irvine, CA 92612
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Prepared By:

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Prepared: February 2021
Revised: July 2021

TABLE OF CONTENTS

Preliminary Hydrology Study
for
1661 and 1673 W. Broadway
Anaheim, CA, 92802

ACKNOWLEDGEMENT AND SIGNATURE PAGE

This Preliminary Hydrology Study was prepared by C&V Consulting, Inc. under the supervision of Ryan Bittner, P.E.

Ryan Bittner, R.C.E. 61867
Principal, C&V Consulting, Inc.

7-26-21
Date

1.0 SITE DESCRIPTION

The proposed development encompasses two (2) parcels consisting of approximately 1.55 gross acres and is located at 1661 and 1673 W. Broadway, in the City of Anaheim, County of Orange. The site is bounded by W. Broadway and single family homes to the south, a commercial strip mall, Shalom Mission Baptist Church, and the YMCA to the west, the Los Olivos apartment homes to the north, and The Hawaiian Apartments and Passion Bread of Life Christian Church to the east. The site is currently occupied by three (3) existing buildings. Most of the site is currently paved with asphalt concrete utilized for parking and drive aisles. Concrete walkways and planters exist throughout the site as well. Perimeter fencing exists along the east and west property lines of the site. Along the north property line there is a perimeter wall. The proposed development will consist of five attached residential buildings with associated drive aisles, parking, open space recreational area, landscaping, and a primary entry driveway.

2.0 EXISTING CONDITIONS

The site is currently occupied by the Cornelia Connelly High School. Per the City of Anaheim Title 18 Zoning Map, revised July 23, 2020, the site is identified as C-G, General Commercial. This zone is defined as land used for "a variety of land uses, including some identified for the Neighborhood Center Commercial zone. Areas designated as C-G General Commercial do not necessarily serve the adjacent neighborhood or surrounding clusters of neighborhoods."

The site is not located within a specific plan area. According to the City of Anaheim Planning and Building Department review letter of the conceptual site plan, dated November 10, 2020 (Case No. PRE2020-00013/ DEV2020-00248), the site will require the site will require a General Plan Amendment (GPA) to Mid Density Residential and a Zoning Reclassification (RCP) to Multiple-Family Residential (RM-3.5).

Based on site topography, the existing project site contains approximately 88% impervious coverage. In the current condition, the site generally sheet flows overland in the southerly direction towards the public right-of-way of W. Broadway. Runoff entering W. Broadway continues to flow west into an existing City of Anaheim public 42" Reinforced concrete storm drain pipe by way of catch basins located in W. Broadway. Runoff continues in the public storm drain until S. Dale Avenue where it is enters the Carbon Creek Channel. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay.

According to the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area, the site is located within Drainage Basin 8. Drainage Basin 8 has a tributary drainage area of approximately 1100 acres consisting of 2 Drainage Areas. The project site is located within the Drainage Area 8-1 which is defined by the City of Anaheim to drain into an existing storm drain that conveys runoff to Carbon Creek. Stormwater runoff entering W. Broadway continues to flow west into an existing City of Anaheim public 42" reinforced concrete storm drain pipe which turns into a 90" reinforced concrete storm drain pipe slightly east of the intersection of W. Broadway and S. Gilbert Street. At Magnolia Avenue runoff continues into a 96" Reinforced concrete pipe where it eventually enters the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay. The storm drain line that runs in Broadway has a capacity of 455 cfs which is

equivalent to 45% of the 10-year storm event. Refer to Appendix E for portions of the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area.

The Orange County Flood Control District (OCFCD) Drainage Facilities Maps were utilized to verify the drainage pattern of site runoff. The topographic survey was utilized to identify existing onsite high points and overall site conveyance of storm water runoff. The entire site runoff was quantified based on the longest hydraulic path from the most remote high point to drop inlet low point. Refer to Appendix E for the applicable OCFCD Drainage Facilities Maps. Refer to the "Existing Conditions Hydrology Map" located within Appendix A of this study for additional information.

3.0 PURPOSE OF STUDY

The preliminary hydrology study will estimate the amount of stormwater runoff generated from the project site in the existing and proposed conditions. This study will determine whether detention or other peak flow mitigation methods will be required by comparing the proposed and existing condition peak flow rates for the 10-, 25-, and 100-year storm events.

4.0 PROPOSED CONDITIONS

The proposed development will consist of 1.55 acres and provide a total of 34 attached, multi-family residential condominiums. The 2-, 3-, and 4-bedroom units will range in square footage between 1,100 and 1,671. Associated resident and guest parking areas, a private drive aisle, recreational areas, sidewalks, and landscaped areas are also proposed within the development. Based on the proposed land use of the residential lot, the imperviousness was assumed to be 80% per the Orange County Hydrology Manual, Figure C-4. Actual imperviousness will be calculated during final engineering, and hydrology calculations will be updated.

The residential site will be graded to convey stormwater as surface flow to one (1) proposed curb-inlet catch basin near the southern property line of the site. The proposed catch basin will convey low flows to the proposed infiltration system designed to infiltrate the entire water quality Design Capture Volume (DCV). During storm events that produce a larger runoff volume than the DCV, storm water will pond in the proposed catch basin and into a proposed storm drain pipe that will convey the overflow into a junction structure and then into the existing 42" public storm drain pipe in W. Broadway. Emergency (secondary) overflow will pond around the proposed catch basin and sheet flow into the right-of-way of W. Broadway over the proposed driveway.

Upon entering the public storm drain, site runoff will follow the historic drainage pattern and drain to Carbon Creek Channel.

Refer to "Proposed Conditions Preliminary Hydrology Map" in Appendix A within this study for additional information.

5.0 METHODOLOGY

The project site was analyzed using the Orange County Hydrology Manual 1986 and released addendums. The initial subareas were analyzed for acreage, land-use, soil type, peak flow rate and time of concentration according to the Rational Method described in the manual.

In this preliminary hydrology study, the recommended values per the Orange County Hydrology Manual 1986 were utilized for the percentage of impervious area of the proposed condition. Assumptions for impervious cover are shown in the Hydrology Calculations in Appendix B.

6.0 RESULTS

Drainage Tributary to West Broadway

Drainage Area	Area (ac)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)	T_c (min)
Existing Conditions					
X1	0.4	1.23	1.46	1.88	6.68
X2	1.15	3.09	3.76	4.94	3.79
Total	**1.55**	**4.16**	**5.07**	**6.66**	**7.78**
Proposed Conditions					
P1	0.07	0.24	0.28	0.36	5.52
P2	1.48	3.11	3.81	5.00	11.39
Total	**1.55**	**3.25**	**3.99**	**5.24**	**11.39**

Note: All time of concentrations indicated above refer to the 100-year storm event.

Catch Basin Sizing

Catch basin Sizing was analyzed for the 100-year storm event peak flow. If ponding occurs at this catch basin during larger storm events. Runoff will overtop the driveway and run into W. Broadway. Catch basin sizing and a Ponding Exhibit are provided in Appendix F of this report.

100-Year Water Surface Elevations

Water surface elevations for the 100-year storm event peak flow rates will verify that the proposed finish floor elevations are set at least 1 foot above the water surface elevation. A ponding exhibit has been prepared based on the 100-year water surface elevation tributary to each subarea. Refer to Appendix H.

Pipe Sizing

Onsite underground storm drain pipe will be analyzed for the 100-year storm event peak flow rate utilizing WSPG software and provided during final engineering.

7.0 CONCLUSION

The results from this preliminary hydrology study demonstrate that the proposed condition of the project site will generate a slightly lower volume to W. Broadway than the existing condition. Downstream facilities will not be hydrologically or hydraulically impacted by the proposed condition of the project site. Refer to Appendix B for Peak Runoff Calculations.

Proposed habitable structures have been designed to be at least 1' above the 100- year water surface elevation at designated sump location onsite. Proper emergency overflow has been established at the sump locations.

8.0 DESIGN ASSUMPTIONS

1. The property is located in the City of Anaheim, Orange County rainfall region.

2. 100-year storm event flood level protection analysis required for habitable structures per the requirements of the Orange County Flood Control District Design Manual.

3. Site located within Hydrologic Soil Type "A" per the USDA Web Soil Survey Data, (See Appendix D of this report for reference). Although the Orange County WQMP TGD indicates the project site is within Soil Type "B" on the NRCS Hydrologic Soil Groups map, Soil Type "B" was used for hydrology calculations in order to be conservative.

4. Existing Conditions use the AES Land use of "Commercial" corresponding to 90% impervious cover. Proposed conditions use the AES land use of "Condominiums" corresponding to 80% impervious cover.

5. Peak flow rates and time of concentrations were calculated using Rational Method described in Orange County Hydrology Manual 1986.

6. Per FEMA Flood Map No. 06059C0128J, the project is located within Zone X, "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." Refer to Appendix J for a copy of the FEMA Flood Map and additional information regarding the flood elevation.

```

## 9.0 REFERENCES


**1.** Orange County Hydrology Manual 1986

**2.** Orange County Flood Control District Design Manual 2000

**3.** NRCS Web Soil Survey

**4.** City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area 2010

**5.** City of Anaheim, Street and Storm Drain Improvements. Plan Number 18368

**6.** Orange County Drainage Facilities Map No. 13 and Carbon Creek Channel As-Built Plans

**7.** FEMA Firm Map Number 06059C0128J, December 3, 2009 and LOMR-F, Case No. No. 13-09-2281A dated September 19, 2013

**8.** Orange County Technical Guidance Document Figure XVI-2a, NRCS Hydrologic Soils Groups
```

APPENDIX A
HYDROLOGY MAPS

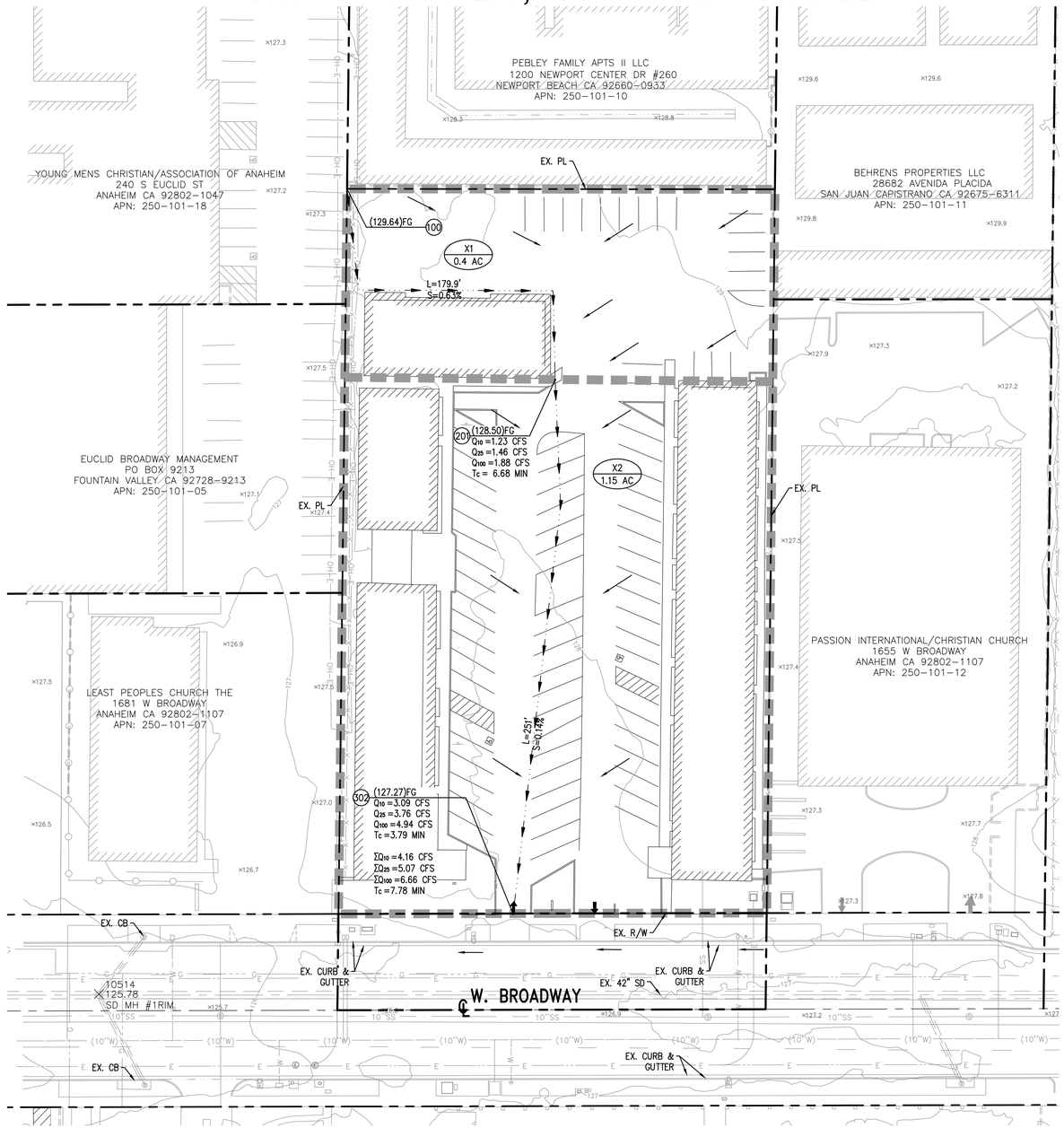
Existing Conditions Hydrology Map

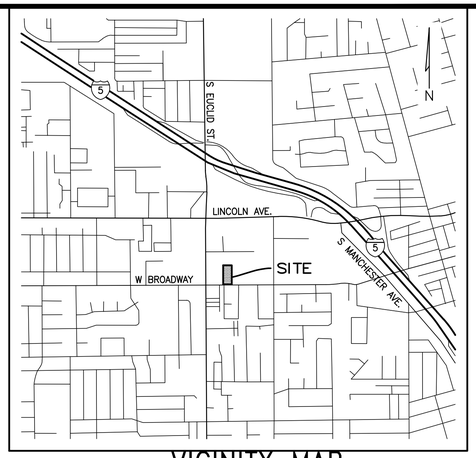
EXISTING CONDITIONS HYDROLOGY MAP

TTM 19141

1661 AND 1673 W. BROADWAY

CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE AREA BOUNDARY
- LONGEST FLOW PATH
- FLOW DIRECTION
- XX — DRAINAGE AREA ID
- X.XX AC — DRAINAGE AREA IN ACRES
- 100 — INITIAL SUBAREA NODE
- (00.0) FS — SPOT ELEVATION
- Q_{100} =X.XX CFS — PEAK RUNOFF (CFS)
- Tc =X.X MIN — TIME OF CONCENTRATION (MIN)

SCALE: 1" = 30'

0 15 30 60

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

CITY VENTURES HOMEBUILDING, LLC
3121 MICHELSON DRIVE, SUITE 150
IRVINE, CA 92612
PHONE (949) 258-7540

SOILS ENGINEER :

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 NORTH MAPLE STREET, SUITE 108
CORONA, CA 92880
PHONE (951) 509-7090

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
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INFO@CVC-INC.NET
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REGISTERED PROFESSIONAL ENGINEER — RAY J. BITTNER — No. 68167 — CIVIL — STATE OF CALIFORNIA

TENTATIVE TRACT NO. 19141
EXISTING CONDITIONS HYDROLOGY MAP

DATE: 4/15/2021

SHEET 1 OF 1

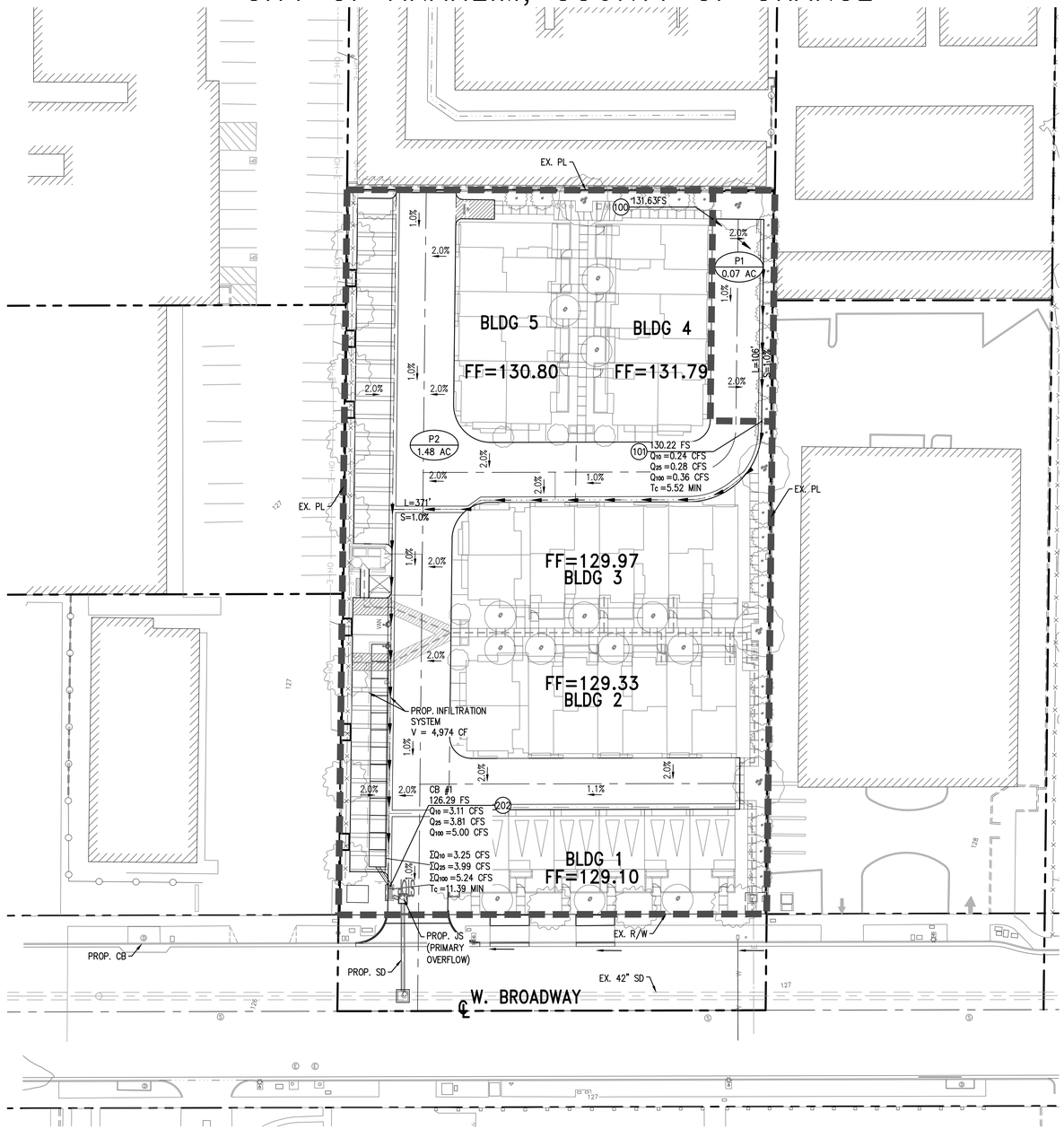
SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

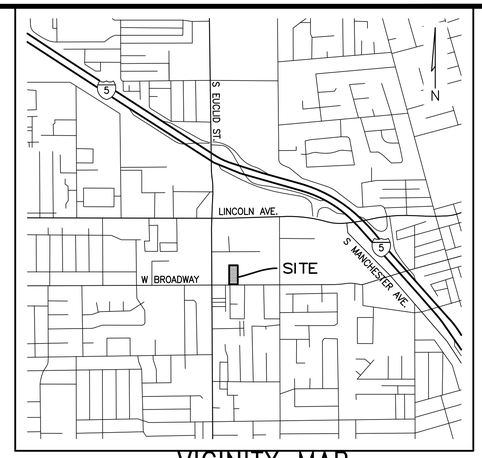
CITY OF ANAHEIM

Proposed Conditions Hydrology Map

PROPOSED CONDITIONS HYDROLOGY MAP

TTM 19141
1661 AND 1673 W. BROADWAY
CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE AREA BOUNDARY
- LONGEST FLOW PATH
- FLOW DIRECTION
- XX / X.XX AC — DRAINAGE AREA ID / DRAINAGE AREA IN ACRES
- 100 — INITIAL SUBAREA NODE
- (00.0) FS — SPOT ELEVATION
- Q100 = X.XX CFS — PEAK RUNOFF (CFS)
- Tc = X.X MIN — 100-YR TIME OF CONCENTRATION (MIN)

SCALE: 1" = 30'

0 15 30 60

NOTES:

1. DURING THE CONSTRUCTION PHASE OF THIS PROJECT, THE INFILTRATION SYSTEM SHALL BE PHYSICALLY SEPARATED/PROTECTED FROM RUNOFF AND/OR ANY OTHER MATERIAL/LIQUID/DEBRIS.
2. AREA DRAIN SYSTEM WILL BE DESIGNED DURING FINAL ENGINEERING. AREA DRAINS WILL COLLECT AND CONVEY RUNOFF FROM LANDSCAPED AREAS DIRECTLY TO INFILTRATION SYSTEMS.
3. ROOF DRAINAGE IS ASSUMED TO BE CONSISTENT WITH THAT OF A PITCHED ROOF. ROOF DOWNSPOUT LOCATIONS TO BE VERIFIED BY ARCHITECT DURING FINAL ENGINEERING.

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

CITY VENTURES HOMEBUILDING, LLC
3121 MICHELSON DRIVE, SUITE 150
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REGISTERED PROFESSIONAL ENGINEER
RYAN J. BITTNER
No. 68167
CIVIL
STATE OF CALIFORNIA

TENTATIVE TRACT NO. 19141
PROPOSED CONDITIONS HYDROLOGY MAP

DATE: 4/29/2021

SHEET 1 OF 1

SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

CITY OF ANAHEIM

APPENDIX B
HYDROLOGY CALCULATIONS

Existing & Proposed Conditions Hydrology Calculations (10-year Storm Event)

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2014 Advanced Engineering Software (aes)
             Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                                *
* ANAHEIM                                                                *
* EXISTING Q10                                                           *
 **************************************************************************

  FILE NAME: C146X10.DAT
  TIME/DATE OF STUDY: 07:07 04/15/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    201.00 IS CODE =  21
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  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
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  ELEVATION DATA: UPSTREAM(FEET) =    129.64  DOWNSTREAM(FEET) =    128.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.678
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.439
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.40      0.30     0.100    36    6.68
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.23
  TOTAL AREA(ACRES) =      0.40   PEAK FLOW RATE(CFS) =      1.23

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  DOWNSTREAM NODE ELEVATION(FEET) =    127.27
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.080
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.20
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.012
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   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.15      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.41
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =   13.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.74   Tc(MIN.) =    8.42
  SUBAREA AREA(ACRES) =    1.15       SUBAREA RUNOFF(CFS) =    3.09
  EFFECTIVE AREA(ACRES) =    1.55     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       4.16

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
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```
            ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOOD WIDTH(FEET) =   13.00
  FLOW VELOCITY(FEET/SEC.) =   3.71   DEPTH*VELOCITY(FT*FT/SEC) =   0.74
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  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      8.42
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       4.16
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
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```
******************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                                *
* ANAHEIM                                                                *
* PROPOSED Q10                                                           *
 ************************************************************************

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==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
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============================================================================
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  ELEVATION DATA: UPSTREAM(FEET) =    131.63  DOWNSTREAM(FEET) =    130.22

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.516
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.837
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.07      0.30     0.350    36    5.52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.07   PEAK FLOW RATE(CFS) =      0.24

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  FLOW PROCESS FROM NODE    101.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  130.22  DOWNSTREAM ELEVATION(FEET) =  126.29
  STREET LENGTH(FEET) =   371.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.280
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.280

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.84
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
         NOTE: STREET FLOW EXCEEDS TOP OF CURB.
         THE FOLLOWING STREET FLOW RESULTS ARE BASED ON THE ASSUMPTION
         THAT NEGLIBLE FLOW OCCURS OUTSIDE OF THE STREET CHANNEL.
         THAT IS, ALL FLOW ALONG THE PARKWAY, ETC., IS NEGLECTED.
    STREET FLOW DEPTH(FEET) =  0.84
    HALFSTREET FLOOD WIDTH(FEET) =    3.93
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   6.67   Tc(MIN.) =   12.19
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.437
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS             B        1.48      0.30     0.350    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    3.11
  EFFECTIVE AREA(ACRES) =      1.55    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       3.25

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.07   HALFSTREET FLOOD WIDTH(FEET) =   4.76
  FLOW VELOCITY(FEET/SEC.) =  1.08   DEPTH*VELOCITY(FT*FT/SEC.) =   1.16
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  371.0 FT WITH ELEVATION-DROP =   3.9 FT, IS    3.6 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    202.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    202.00 =     477.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.6  TC(MIN.) =     12.19
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =       3.25
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Existing & Proposed Conditions Hydrology Calculations (25-year Storm Event)

```
************************************************************************
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                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                               *
* ANAHEIM                                                               *
* EXISTING Q25                                                          *
 ************************************************************************

  FILE NAME: C146X25.DAT
  TIME/DATE OF STUDY: 07:08 04/15/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    201.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   180.00
  ELEVATION DATA: UPSTREAM(FEET) =    129.64  DOWNSTREAM(FEET) =    128.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.678
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.095
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.40      0.30     0.100    36    6.68
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.46
  TOTAL AREA(ACRES) =      0.40   PEAK FLOW RATE(CFS) =      1.46

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    302.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    128.50
  DOWNSTREAM NODE ELEVATION(FEET) =    127.27
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.080
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.20
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.667
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.15      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.26
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.91
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =   13.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.44   Tc(MIN.) =    8.12
  SUBAREA AREA(ACRES) =    1.15       SUBAREA RUNOFF(CFS) =    3.76
  EFFECTIVE AREA(ACRES) =    1.55     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       5.07

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
```

```
            ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOOD WIDTH(FEET) =   13.00
  FLOW VELOCITY(FEET/SEC.) =   4.53   DEPTH*VELOCITY(FT*FT/SEC) =   0.91
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    302.00 =     431.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      8.12
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       5.07
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                               *
* ANAHEIM                                                               *
* PROPOSED Q25                                                          *
 ************************************************************************

  FILE NAME: C146P25.DAT
  TIME/DATE OF STUDY: 08:13 04/15/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   106.00
  ELEVATION DATA: UPSTREAM(FEET) =    131.63  DOWNSTREAM(FEET) =    130.22

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.516
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.563
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.07      0.30     0.350    36    5.52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.07   PEAK FLOW RATE(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  130.22  DOWNSTREAM ELEVATION(FEET) =  126.29
  STREET LENGTH(FEET) =   371.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.280
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.280

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.24
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
         NOTE: STREET FLOW EXCEEDS TOP OF CURB.
         THE FOLLOWING STREET FLOW RESULTS ARE BASED ON THE ASSUMPTION
         THAT NEGLIBLE FLOW OCCURS OUTSIDE OF THE STREET CHANNEL.
         THAT IS, ALL FLOW ALONG THE PARKWAY, ETC., IS NEGLECTED.
    STREET FLOW DEPTH(FEET) =  0.91
    HALFSTREET FLOOD WIDTH(FEET) =    4.20
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.98
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.89
  STREET FLOW TRAVEL TIME(MIN.) =   6.31   Tc(MIN.) =   11.83
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.963
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS             B        1.48      0.30     0.350    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    3.81
  EFFECTIVE AREA(ACRES) =      1.55    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       3.99

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.17   HALFSTREET FLOOD WIDTH(FEET) =   5.11
  FLOW VELOCITY(FEET/SEC.) =  1.15   DEPTH*VELOCITY(FT*FT/SEC.) =   1.34
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  371.0 FT WITH ELEVATION-DROP =   3.9 FT, IS    4.3 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    202.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    202.00 =     477.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.6  TC(MIN.) =     11.83
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =       3.99
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Existing & Proposed Conditions Hydrology Calculations (100-year Storm Event)

```
************************************************************************
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                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                              *
* ANAHEIM                                                              *
* EXISTING Q100                                                        *
 ************************************************************************

  FILE NAME: C146X100.DAT
  TIME/DATE OF STUDY: 07:10 04/15/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    201.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   180.00
  ELEVATION DATA: UPSTREAM(FEET) =    129.64  DOWNSTREAM(FEET) =    128.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.678
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.242
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.40      0.30     0.100    36    6.68
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.88
  TOTAL AREA(ACRES) =      0.40   PEAK FLOW RATE(CFS) =      1.88

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    302.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    128.50
  DOWNSTREAM NODE ELEVATION(FEET) =    127.27
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.080
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.20
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.802
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.15      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.25
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.79
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =   13.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.10   Tc(MIN.) =    7.78
  SUBAREA AREA(ACRES) =    1.15       SUBAREA RUNOFF(CFS) =    4.94
  EFFECTIVE AREA(ACRES) =    1.55     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       6.66

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
```

ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.

```
  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOOD WIDTH(FEET) =   13.00
  FLOW VELOCITY(FEET/SEC.) =   5.94   DEPTH*VELOCITY(FT*FT/SEC) =   1.19
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    302.00 =     431.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      7.78
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       6.66
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CVEN146                                                               *
* ANAHEIM                                                               *
* PROPOSED Q100                                                         *
 ************************************************************************

  FILE NAME: C146P100.DAT
  TIME/DATE OF STUDY: 08:15 04/15/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```
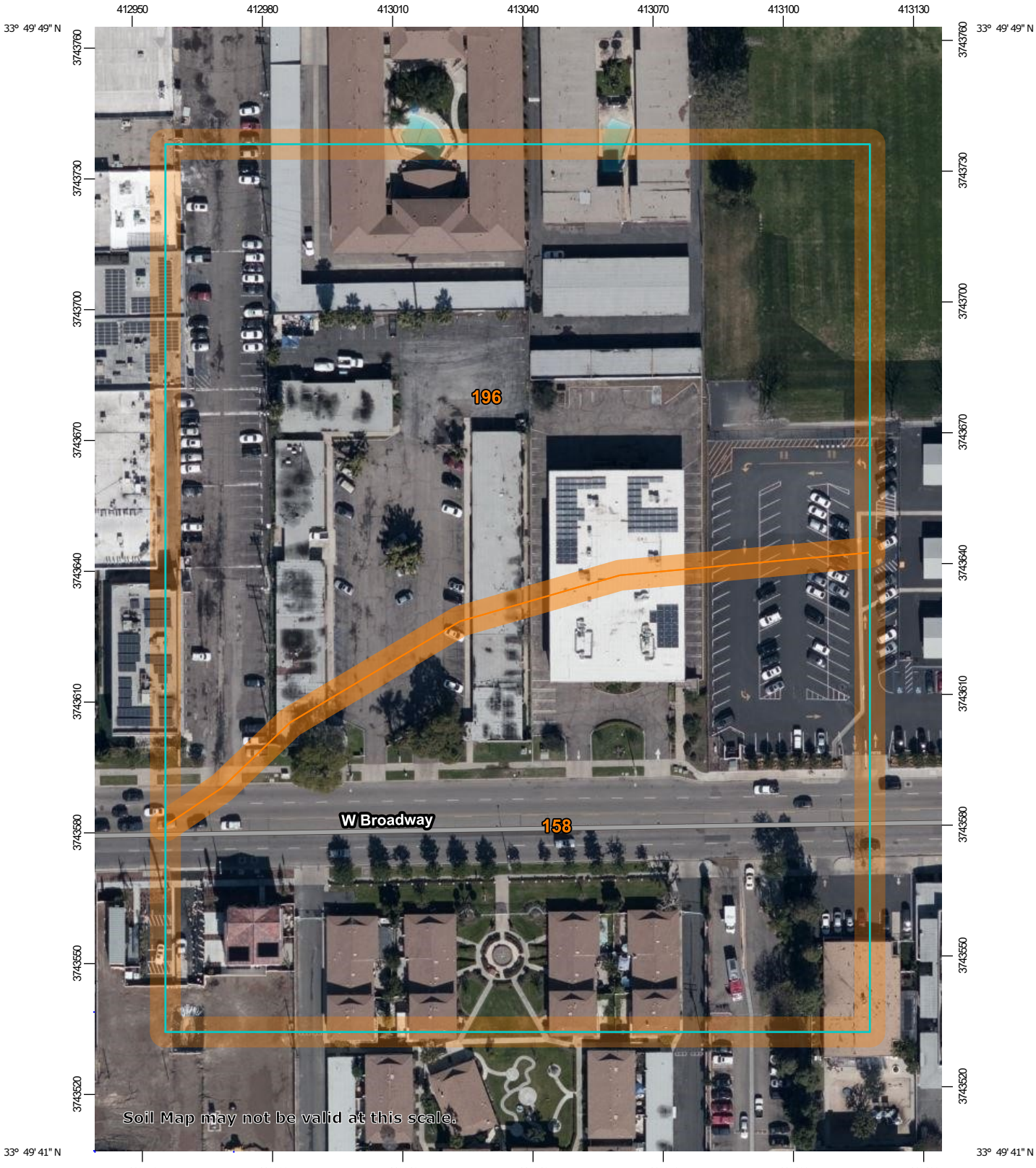

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   106.00
  ELEVATION DATA: UPSTREAM(FEET) =    131.63  DOWNSTREAM(FEET) =    130.22

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.516
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.849
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  CONDOMINIUMS               B        0.07      0.30     0.350    36    5.52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.07   PEAK FLOW RATE(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  130.22  DOWNSTREAM ELEVATION(FEET) =  126.29
  STREET LENGTH(FEET) =   371.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.280
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.280

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.94
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
         NOTE: STREET FLOW EXCEEDS TOP OF CURB.
         THE FOLLOWING STREET FLOW RESULTS ARE BASED ON THE ASSUMPTION
         THAT NEGLIBLE FLOW OCCURS OUTSIDE OF THE STREET CHANNEL.
         THAT IS, ALL FLOW ALONG THE PARKWAY, ETC., IS NEGLECTED.
    STREET FLOW DEPTH(FEET) =  1.02
    HALFSTREET FLOOD WIDTH(FEET) =    4.60
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
  STREET FLOW TRAVEL TIME(MIN.) =   5.87   Tc(MIN.) =   11.39
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.861
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  CONDOMINIUMS             B        1.48      0.30     0.350    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    5.00
  EFFECTIVE AREA(ACRES) =      1.55    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       5.24

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.31   HALFSTREET FLOOD WIDTH(FEET) =   5.62
  FLOW VELOCITY(FEET/SEC.) =  1.23   DEPTH*VELOCITY(FT*FT/SEC.) =   1.62
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  371.0 FT WITH ELEVATION-DROP =   3.9 FT, IS    5.6 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    202.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    202.00 =     477.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.6  TC(MIN.) =     11.39
  EFFECTIVE AREA(ACRES) =      1.55  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.350
  PEAK FLOW RATE(CFS)   =       5.24
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX C
USDA Soil Map and
Orange County TGD Figure XVI-2a

Soil Map—Orange County and Part of Riverside County, California
(1661 W. Broadway, Anaheim)



Map Scale: 1:1,260 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 13, 2018—Feb 8, 2019

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
158	Hueneme fine sandy loam, drained	3.7	44.6%
196	San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	4.5	55.4%
Totals for Area of Interest		**8.2**	**100.0%**

Orange County and Part of Riverside County, California

158—Hueneme fine sandy loam, drained

Map Unit Setting

National map unit symbol: hcn3
Elevation: 0 to 430 feet
Mean annual precipitation: 15 inches
Mean annual air temperature: 64 degrees F
Frost-free period: 300 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hueneme and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hueneme

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Stratified alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 27 inches: fine sandy loam
H2 - 27 to 60 inches: stratified sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: A
Hydric soil rating: Yes

Minor Components

San emigdio, fine sandy loam
Percent of map unit: 5 percent
Hydric soil rating: No

Bolsa, silt loam, drained
Percent of map unit: 5 percent
Hydric soil rating: No

Hueneme, fine sandy loam
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

Orange County and Part of Riverside County, California

196—San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hcpb
Elevation: 10 to 700 feet
Mean annual precipitation: 12 to 81 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 270 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

San emigdio and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of San Emigdio

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 7 inches: fine sandy loam
H2 - 7 to 40 inches: stratified gravelly loamy coarse sand to very fine sandy loam
H3 - 40 to 44 inches: silty clay loam
H4 - 44 to 61 inches: stratified gravelly loamy coarse sand to very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: R019XD029CA
Hydric soil rating: No

Minor Components

Metz, loamy sand

Percent of map unit: 5 percent
Hydric soil rating: No

Sorrento, sandy loam

Percent of map unit: 5 percent
Hydric soil rating: No

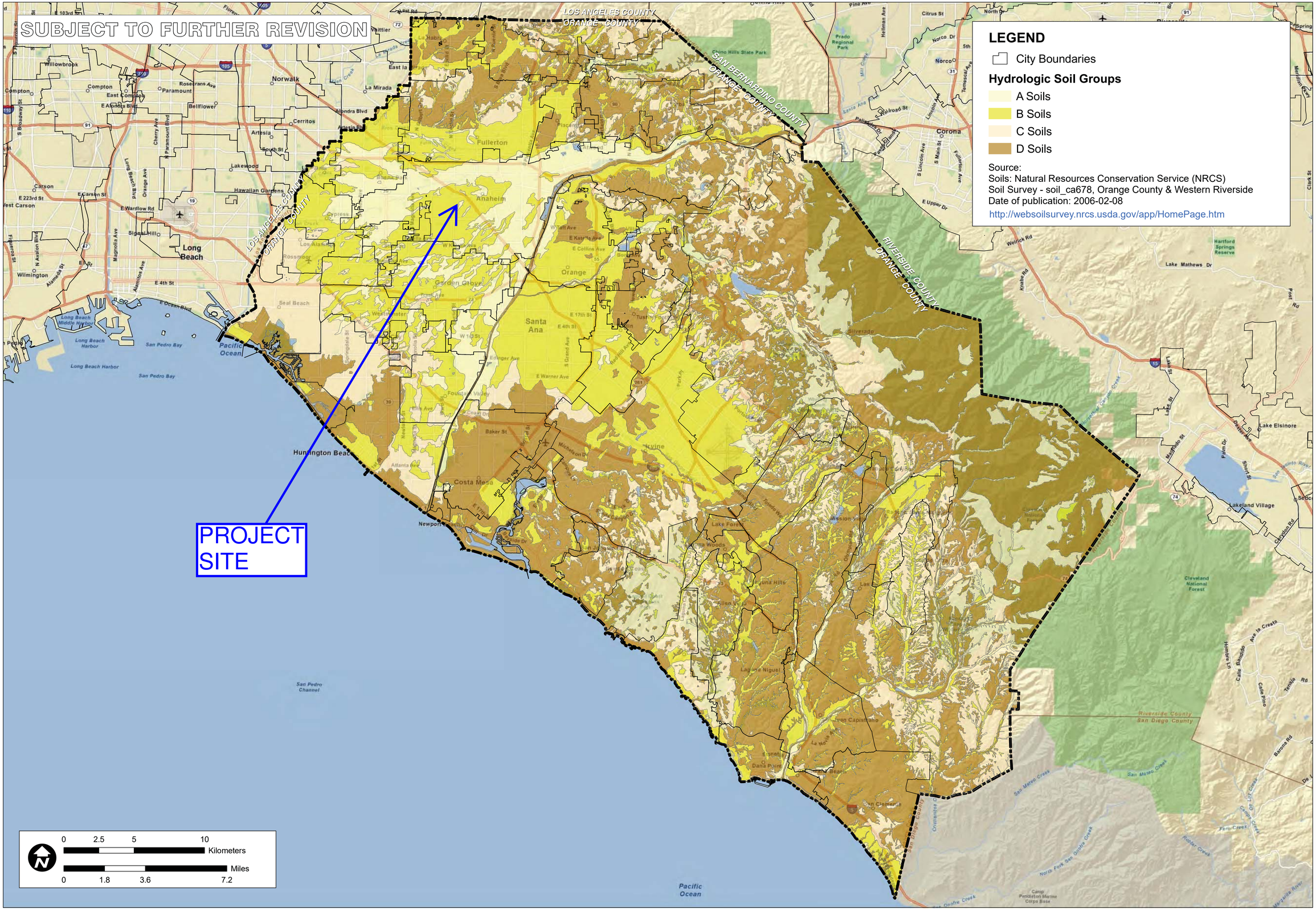
Hueneme, fine sandy loam

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

SUBJECT TO FURTHER REVISION



LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers

0 1.8 3.6 7.2 Miles

TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2a

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Reasability_20110215\9526E_FigureXVI2a_HydrosSoilk_20110215.mxd

APPENDIX D
Portions of the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area

9. Drainage Basin 8

Drainage Basin 8 drains approximately 1100 acres, and is generally bounded by Lincoln Avenue on the north, the I-5 Freeway on the northeast, Orange Avenue on the south, and Dale Avenue on the west. As shown in Figure 9, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Basin 8 consists of 2 Areas 8-1 and 8-2. Area 8-1 has an existing storm drain which outlets to Carbon Creek. Area 8-2 is a small area which drains directly to Carbon Creek.

9.1 Hydrologic Analysis

The hydrologic analysis for Basin 8 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 8 is included in Appendix B. The following table highlights the flow rates at key drainage nodes for Areas within Basin 8 that have street flow and/or existing storm drains. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.

Table 11 – Basin 8 Summary of Hydrology

Drainage Area	Node	Location	Drainage Area (ac)	10-Year Flow (cfs)	25-Year Flow (cfs)	100-Year Flow (cfs)
8-1	802	Loara St and Broadway	31	55	65	85
8-1	807	Empire St and Broadway	378	435	530	690
8-1	810	Brookhurst St and Broadway	636	620	765	1000
8-1	814	Magnolia Ave and Broadway	985	940	1175	1515
8-1	817	Dale Ave at Carbon Creek	1084	960	1195	1555
8-1	822	Euclid St and Lincoln Ave	13	20	25	35
8-1	826	Empire St and Lincoln Ave	193	245	295	385
8-1	833	Valley St and Orange Ave	109	95	125	165
8-1	842	Kathryn Dr and Lincoln Ave	16	16	20	25
8-1	853	Gilbert St and Orange Ave	95	105	135	180
8-1	862	Gilbert St, 500 ft South of Lincoln Ave	19	30	40	50
8-1	872	Magnolia Ave and Orange Ave	68	75	95	125
8-1	882	Shields Dr and Orange Ave	51	60	75	100
8-2	892	350 ft East of Dale Ave at Carbon Creek	11	18	25	30

9.2 Analysis of Existing Improvements

Storm water within Basin 8 is conveyed through a combination of existing storm drains and street flow. One area, Area 8-1, has an existing storm drain system. The main storm drain begins at Broadway and Loara Street and drains west in Broadway to Dale Avenue. At Dale Avenue, the storm drain turns north then outlets into Carbon Creek. This drain varies in size from a 36-inch to 96-inch RCP and has a capacity of 455 cfs which is equivalent to 45 percent of a 10-year storm.

Several lateral storm drains connect to the main line in Broadway. These laterals are located in Shields Drive, Magnolia Avenue, Gilbert Street, Brookhurst Street, Archer Street, Valley Street, and Empire Street/Lincoln Avenue. The Shields Drive storm drain is a 36-inch RCP and has a capacity of 18 cfs which is equivalent to 30 percent of a 10-year storm. The Magnolia Avenue storm drain is a 54-inch RCP and has a capacity of 35 cfs which is equivalent to 40 percent of a 10-year storm. The Gilbert Street storm drain north of Broadway varies in size from a 27-inch to 39-inch RCP and has a capacity of 35 cfs which is equivalent to 60 percent of a 10-year storm.

The Gilbert Street storm drain south of Broadway is a 45-inch RCP and has a capacity of 5 cfs which is equivalent to 5 percent of a 10-year storm. The Brookhurst Street storm drain varies in size from a 27-inch to 57-inch RCP and has a capacity of 70 cfs which is equivalent to 100 percent of a 10-year storm. The Archer Street storm drain is a 36-inch RCP and has a capacity of 30 cfs which is equivalent to 100 percent of a 10-year storm. The Valley Street storm drain varies in size from a 39-inch to 60-inch RCP and has a capacity of 125 cfs which is equivalent to 100 percent of a 10-year storm. The Empire Street/Lincoln Avenue storm drain varies in size from a 30-inch to 72-inch RCP and has a capacity of 230 cfs which is equivalent to 75 percent of a 10-year storm.

9.3 Proposed Improvements

In order to satisfy the City's requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended for Area 8-1. In order to satisfy the City's flooded width criteria in Area 8-1, 15,075 feet of parallel storm drain is recommended in Broadway. The recommend storm drain varies is size from 42-inch RCP to 15-foot x 8-foot RCB.

Additionally, in order to satisfy the City's requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria in Area 3-1, parallel storm drains in Shields Drive, Magnolia Avenue, Gilbert Street, Valley Street, and Empire Street/Lincoln Avenue are also proposed. In Shields Drive, 1,350 feet of 48-inch parallel RCP is proposed, 1,410 feet of 48-inch parallel RCP is proposed in Magnolia Avenue, 780 feet of 24-inch to 36-inch parallel RCP is proposed in north Gilbert Street, 1,330 feet of 54-inch to 7-foot x 4-foot parallel storm drain is proposed in south Gilbert Street, 1,390 feet of 30-inch to 42-inch parallel RCP is proposed in Valley Street, and 5,320 feet of 24-inch to 54-inch parallel RCP is proposed in Empire Street/Lincoln Avenue.

To satisfy the City's flooded width criteria in Area 8-1, an extension of the existing storm drain in Gilbert Street is proposed consisting of 1,500 feet of 54-inch RCP, an extension of the existing storm drain in Kathryn Drive is proposed consisting of 1,200 feet of 36-inch RCP, an extension of the existing storm drain in Valley Street is proposed consisting of 1,800

feet of 60-inch RCP, and an extension of the existing storm drain in Lincoln Avenue is proposed consisting of 980 feet of 36-inch RCP. The proposed improvements for Basin 8 are shown in Figure 9, the hydraulic calculations are included in Appendix E and the street flow calculations in Appendix F.

9.4 Cost Estimates

The estimated costs summarized in Table 12 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 8 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year's total cost over the 2010 total costs. Summarized in Table 12 are the construction cost estimates by project location for Area 8-in Basin 8.

Table 12 – Basin 8 Cost Estimate

Area	Storm Drain ID	Street	Type of Facility	Length (feet)	Estimated Cost (2010 Dollars)
8-1	SD 8-1_01 (P)	Broadway St.	Parallel 42-inch to 66-inch RCP and 8' by 8' to 15' by 8' RCB	14,930	$44,534,000
8-1	SD 8-1_02 (P)	Shields Dr.	Parallel 48-inch RCP	1,340	$1,899,000
8-1	SD 8-1_03 (P)	Magnolia Ave.	Parallel 48-inch RCP	1,405	$1,987,000
8-1	SD 8-1_04 (P)	Gilbert St. north of Broadway	Parallel 24-inch/36-inch RCP	825	$767,000
8-1	SD 8-1_05 (P)	Gilbert St. south of Broadway	Parallel 7' by 4' RCB	1,370	$3,441,000
8-1	SD 8-1_06 (P)	Orange Ave.	New 54-inch RCP	1,510	$2,507,000
8-1	SD 8-1_08 (P)	Valley St.	Parallel 30-inch/42-inch RCP	1,465	$1,690,000
8-1	SD 8-1_09 (P)	Orange Ave.	New 60--inch RCP	1,795	$3,345,000
8-1	SD 8-1_10 (P)	Camellia St/Lincoln Ave.	Parallel 42-inch/54-inch RCP	3,420	$5,294,000
TOTAL FOR BASIN 8					$65,464,000

Legend

- Anaheim City Limits
- Street Right of Way
- 5-1 Drainage Area

Proposed Storm Drains

- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains

- 30 Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral

SD 1-1_01 (P) Proposed Pipeline ID
Drainage Area_Line No. (Proposed)

Note: Priority 2 proposed improvements will parallel existing storm drains unless otherwise noted

N

0 750 1,500 Feet

1 inch equals 1,500 feet

Figure 9 Drainage Basin 8

Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area

CH2MHILL

\\CHERON\Projects\AnaheimCaCityOf\381357\GIS\Maps January 22, 2010

APPENDIX E
Orange County Drainage Facilities Maps

E 6036406.802

N 2260745.312

E 6057907.005

N 2260745.263

N 2244945.134

E 6036406.959

N 2244945.106

E 6057907.140

12

13

14

13

PROJECT SITE

FULLERTON

ANAHEIM

CITY OF FULLERTON

CITY OF ANAHEIM

GILBERT RETARDING BASIN
BOIB01

BOIB02
CRESCENT
RETARDING BASIN

BOIB03
RAYMOND
RETARDING
BASIN

BOIP01

BOIP02

BOIP03

BOI

BOIP08

ALL LATERALS ARE 18" RCP ON BALLAST LANE AND OUTRIGGER WAY.

COUNTY OF ORANGE

NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@ocpw.ocgov.com

N

0 200 400 600 800
FEET

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	DEC. 20 2010	13	MAPS-113-3

- Channel Drainage Area Boundary
- Major Sub-Area Drainage Boundary
- Minor Sub-Area Drainage Boundary
- Existing O.C.F.C.D. Facility
- Existing Local Facility
- Existing Retarding Basin or Reservoir
- Natural Watercourse
- City Limits
- G G Greenbelt
- P.S. P.S. Pump Station
- Catch Basin (length in feet)
- Drop Inlet or Other Entry
- OCFCD Basins or Reservoirs

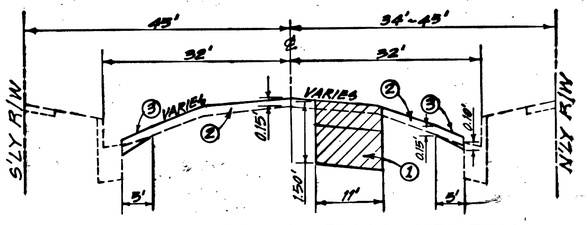
Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

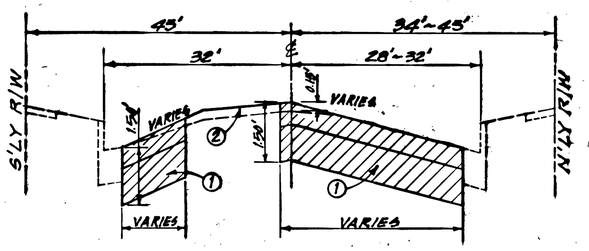
O.C.F.C.D.	LOCAL	
		Earth Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Rectangular Channel (base width by height in feet)
		Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
		Reinforced Concrete Pipe (RCP) (diameter in inches)
		Metal Sheet Channel (MSC) (Base width by pile height in feet /Sheet pile total length)
		Corrugated Metal Pipe (CMP) (diameter in inches)
		Concrete Pipe (diameter in inches)
		Concrete Oval Pipe (width by height in inches)
		Steel Pipe (diameter in inches)
		Reinforced Concrete Arch (base span by height in inches)
		Corrugated Metal Arch (base span by height in inches)

QUANTITY ESTIMATE

1	CLEAR AND GRUB	LUMP SUM	
2	SHEETING SHORING AND BRACING	LUMP SUM	
3	EXCAVATION	4155 ~~4075~~	C.Y. ⚠1
4	42" R.C.P. ~ 1500-D	495	L.F.
5	36" R.C.P. ~ 1800-D	662	L.F.
6	24" R.C.P. ~ 2000-D	144	L.F.
7	18" R.C.P. ~ 2000-D	101	L.F.
8	MANHOLE No 4	2	EA.
9	MANHOLE No 2	1	EA.
10	JUNCTION STRUCTURE No 2	4	EA.
11	TRANSITION STRUCTURE	1	EA.
~~12~~	~~A.P.W.A. CATCH BASIN No 1, W = 20'~~	0 ~~1~~	EA. ⚠1
13	CATCH BASIN No 1, W = 20'	4 ~~3~~	EA. ⚠1
14	CATCH BASIN No 1, W = 10'	2	EA.
15	CATCH BASIN No 1, W = 6'	2	EA.
16	P.C.C. COLLAR	4	EA.
17	4" P.C.C. SIDEWALK AND RAMP	1900 ~~1850~~	S.F. ⚠1
18	10" P.C.C. VALLEY CROSS GUTTER	288	S.F.
19	ASPHALT CONCRETE	3796 ~~3515~~	TONS ⚠1
20	BASE MATERIAL	4693 ~~5160~~	TONS ⚠1
21	HEATER REMIX	7730 ~~7760~~	S.Y. ⚠1
22	REJUVENATING AGENT	846 ~~774~~	GAL. ⚠1
23	TRAFFIC LOOPS	33	EA.
24	A.C. PLANING	1585 ~~1683~~	L.F. ⚠1
25	CURB AND GUTTER, TYPE "A"	261 ~~222~~	L.F. ⚠1
26	MOD. SPRINKLER SYSTEM	LUMP SUM	
27	ADJUST MANHOLE TO GRADE	11 ~~12~~	EA. ⚠1
28	ADJUST WATER VALVE BOX TO GRADE	25 ~~20~~	EA. ⚠1
29	8" P.C.C. APRON	644 ~~576~~	S.F. ⚠1
30	P.C.C. CURB TYPE "C"	78 ~~72~~	L.F. ⚠1



BROADWAY ~ TYPICAL SECTION
NOT TO SCALE



CONSTRUCTION NOTES

1. CONST. 0.50' A.C. OVER 1.0' B.M. ~ REMOVE EXIST.
2. CONST. 0.15' A.C. OVERLAY OVER REJUVENATING AGENT OVER HEATER REMIX.
3. PLANE 5' WIDE AT CONCRETE JOINLINE. PLANE 10' WIDE AT A.C. JOINLINE.

CITY OF ANAHEIM

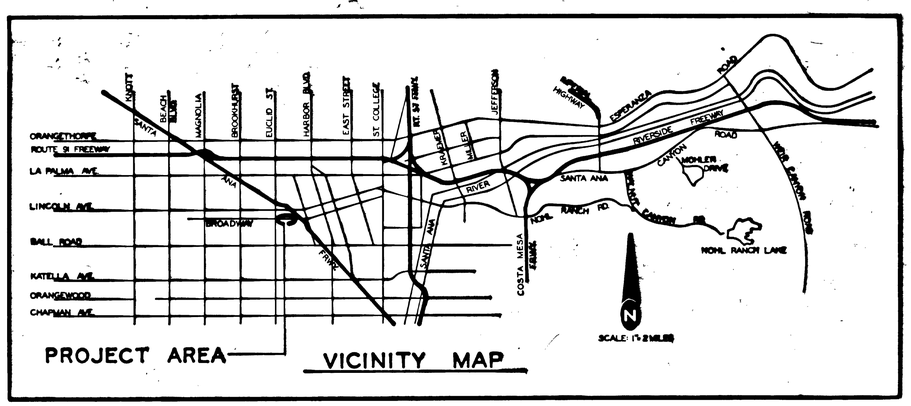
BROADWAY

PLANS FOR THE CONSTRUCTION OF
STREET & STORM DRAIN IMPROVEMENTS
FROM 66' E/o MABLE ST. TO 260' E/o EUCLID ST.

ACCOUNT NO. 12-793-6325-365GO
10-793-6325-365MO
51-483-6993-23351

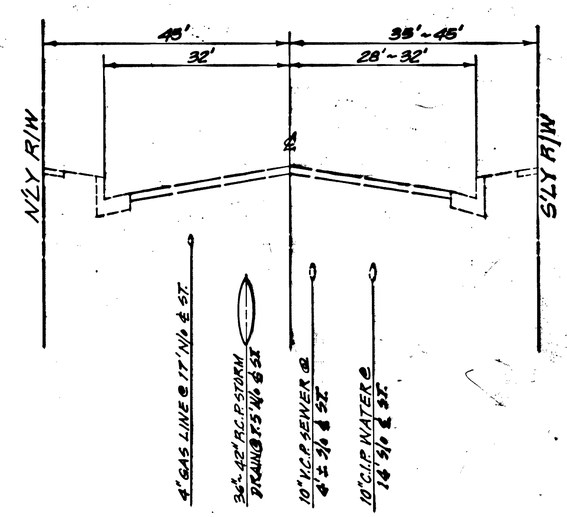
NOTES

1. ⟨1⟩ DENOTES DETAIL NUMBER / ⟨1⟩ DENOTES PLAN NUMBER
2. ALL STATIONING IS ALONG CENTERLINE OF PIPE.
3. EXISTING ELEVATIONS ARE TO BE VERIFIED AT TIME OF CONSTRUCTION AND IF NECESSARY ALL OTHER ELEVATIONS SHALL BE ADJUSTED BY THE FIELD ENGINEER.
4. ALL CURVES ON MAINLINE LATERAL SHALL BE INSTALLED USING BEVELLED PIPE WHERE NECESSARY. NO ADDITIONAL COMPENSATION WILL BE ALLOWED.
5. THE CONTRACTOR SHALL NOTIFY THE FOLLOWING AGENCIES TWO WORKING DAYS PRIOR TO CONSTRUCTION:
   - UNDERGROUND SERVICE ALERT ——— 1-800-422-4133
   - CITY OF ANAHEIM FIELD INSPECTION ——— 714-254-5126
   - SOUTHERN CALIFORNIA GAS COMPANY: ——— 714-634-3258
6. NOTIFY CITY OF ANAHEIM WATER UTILITY, THOM COUGHRAN AT 254-6859, 15 DAYS PRIOR TO CONSTRUCTION FOR RELOCATION AND RECONSTRUCTION OF WATER SERVICES.
7. ALL TREES, SHRUBS, SIGNS, FENCES, WATER METERS, ETC. TO BE PROTECTED UNLESS NOTED OTHERWISE.



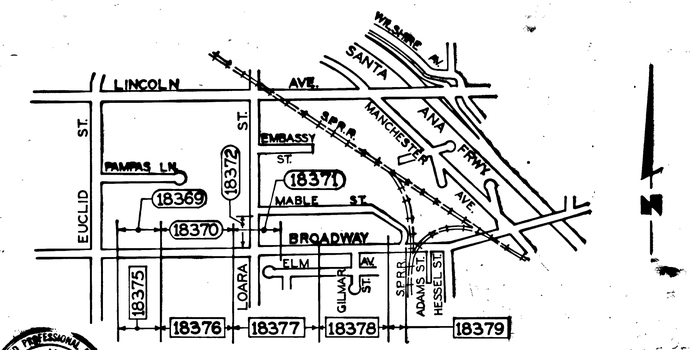
PROJECT AREA — VICINITY MAP

BROADWAY
TYPICAL SECTION
NO SCALE



STORM DRAIN IMPROVEMENT PLAN NUMBERS

STREET IMPROVEMENT PLAN NUMBERS



LOCATION MAP
NO SCALE

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HEPP
C27923
EXP 9-31-94
CIVIL
STATE OF CALIFORNIA

Ralph M. Hepp

AS CONSTRUCTED
A.B.C. DAT 4-12-96

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
⚠1	A.B.C.	REVISED QUANTITY ITEMS PER FINAL PAYMENT.	[illegible]	6/4/96

REFERENCES

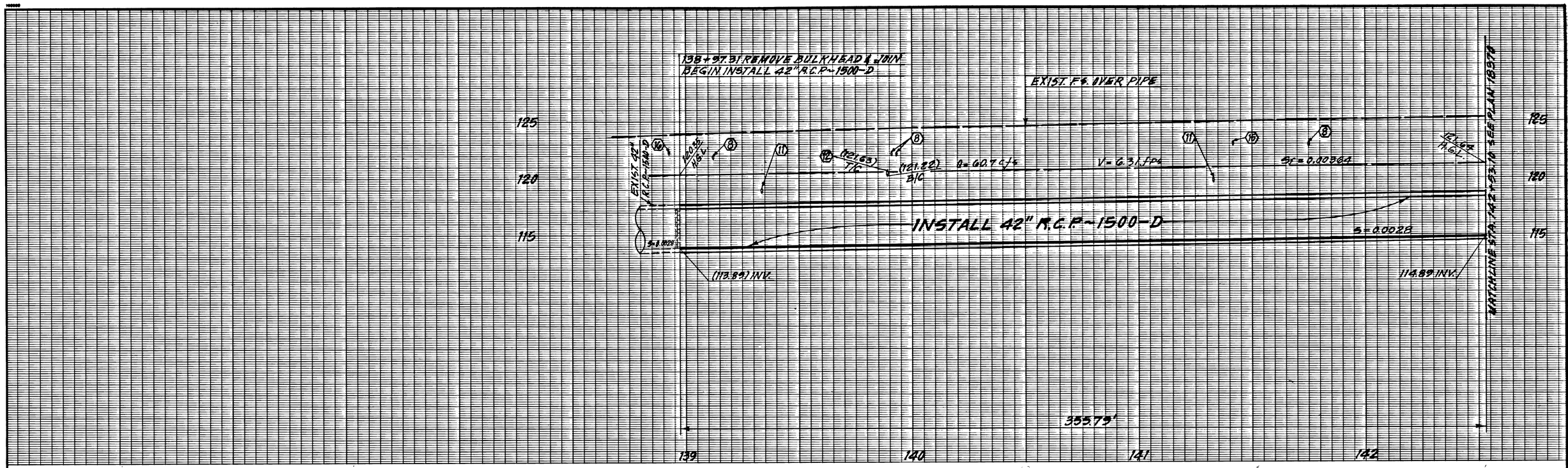
FIELD BOOKS	PAGES	BENCH MARK NO.	ELEVATION	
129 129 A-1	1 THRU 3 7	5A-18-85	122.87	FOR NOTES TO CONTRACTOR SEE PLAN 18368 FOR STANDARD DETAILS SEE 110, 301, 302, 308, 311, 312, 313, 314, 315, 317, 318, 410, 424, 428, 444, 519, A.P.W.A. 307-0 PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

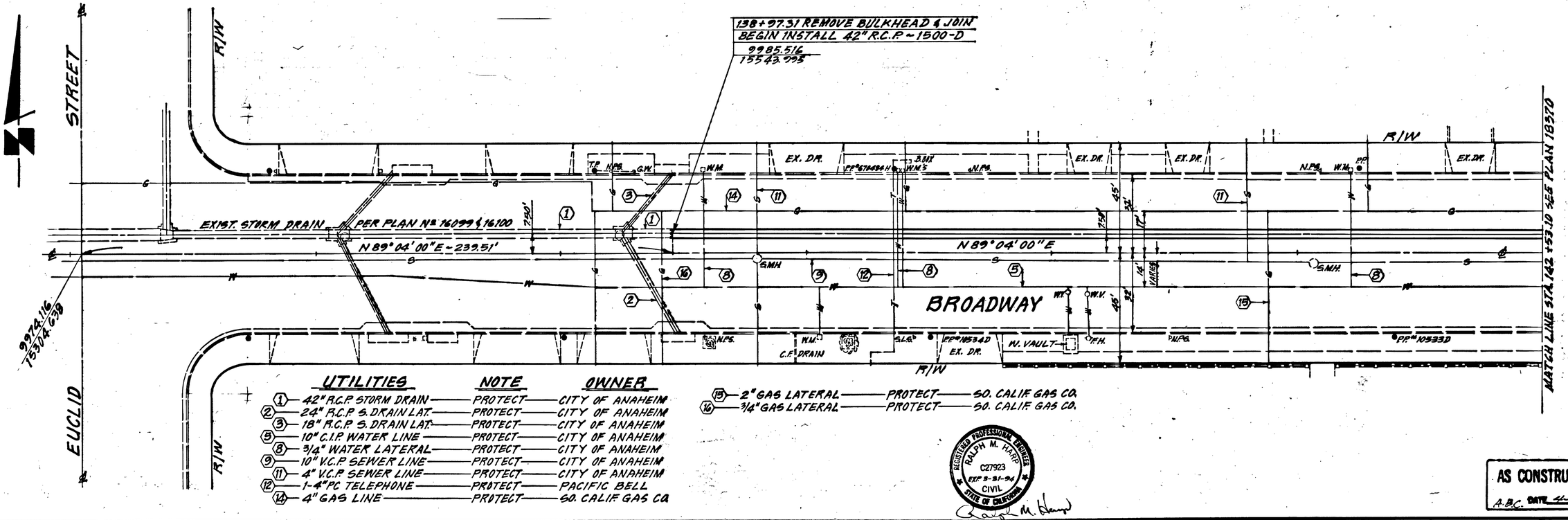
		DATE
DRAWN BY	A.B.C. & K.R.B.	7-19-91
CHECKED BY	S. BHULLAR	9-10-91
APPROVED		
APPROVED	DEPUTY CITY ENGINEER	9-16-91
APPROVED	D.P.W./CITY ENGINEER	9-16-91

STREET & STORM DRAIN IMPROVEMENTS
BROADWAY
FROM 66' E/o MABLE ST. TO 260' E/o EUCLID ST.
CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO. 12-793-6325-365GO 10-793-6325-365MO
SHEET 1 OF 13
PLAN NUMBER 18368

18368





UTILITIES	NOTE	OWNER
(1) 42" R.C.P. STORM DRAIN	PROTECT	CITY OF ANAHEIM
(2) 24" R.C.P. S. DRAIN LAT.	PROTECT	CITY OF ANAHEIM
(3) 18" R.C.P. S. DRAIN LAT.	PROTECT	CITY OF ANAHEIM
(5) 10" C.I.P. WATER LINE	PROTECT	CITY OF ANAHEIM
(8) 3/4" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(9) 10" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(11) 4" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(12) 1-4"PC TELEPHONE	PROTECT	PACIFIC BELL
(14) 4" GAS LINE	PROTECT	SO. CALIF. GAS CO.
(15) 2" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(16) 3/4" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HARP
C27923
EXP 3-31-94
CIVIL
STATE OF CALIFORNIA

AS CONSTRUCTED
A.B.C. DATE 4-18-92

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
1	A.B.C	ADDED W.S. ELEV.	[illegible]	5/21/92

REFERENCES

FIELD BOOKS	PAGES	BENCH MARK NO. 5A-18-83	FOR NOTES TO CONTRACTOR SEE PLAN 18368
129	1	ELEVATION 122.87	FOR STANDARD DETAILS SEE 3/9
			PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

		DATE
SCALE: HORZ. 1" = 20' VERT. 1" = 4'		
DRAWN BY	A.B.C. & K.R.B.	7-19-91
CHECKED BY	S. BHULLAR	9-10-91

FOR APPROVALS OF THIS PROJECT SEE PLAN NO. 18368

STORM DRAIN IMPROVEMENT
BROADWAY
FROM 595' TO 240' E/o EUCLID STREET
CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO.
12-793-6325-365GO
10-793-6325-365MO
SHEET 2 OF 13
PLAN NUMBER 18369

142+61.05 CONST STD. J.S. Nº 2, C=3.23'

143+90.51 END INSTALL 42"R.C.P.-1500-D
143+92.97 CONST. STD. M.H. Nº 4, C=4.37'
143+96.53 BEGIN INSTALL 36"R.C.P.-1800-D

144+98.98 ⚠1
~~143+05.57~~ CONST. STD. J.S. Nº 2, C=3.13'

EXIST. F.S. OVER PIPE

146+58.72 END INSTALL 36"R.C.P.-1800-D
146+61.05 CONST. STD. MANHOLE Nº 2
146+63.38 BEGIN INSTALL 36"R.C.P.-1800-D

MATCHLINE STA. 142+53.10 SEE PLAN 18369

MATCHLINE STA. 148+53.10 SEE PLAN 18371

INSTALL 42"R.C.P.-1500-D

INSTALL 36"R.C.P.-1800-D

INSTALL 36"R.C.P.-1800-D

S=0.0028

S=0.0016

S=0.0020

114.92 INV.

114.89 INV.

115.27 INV.

115.80 INV.

115.97 INV.

~~115.38 INV.~~

116.22 INV.

116.23 INV.

116.61 INV.

5.56

2.46'

2.33'

2.33'

7.95'

131.92'

106.01'
~~122.38~~

162.07'
~~195.14~~

192.05'

600.00'

143 144 145 146 147 148

UTILITIES — NOTE — OWNER

(5)	10" C.I.P. WATER LINE	PROTECT	CITY OF ANAHEIM
(7)	3" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(8)	3/4" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(9)	10" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(13)	BURIED CABLE TEL.	PROTECT	PACIFIC BELL
(29)	3" GAS LINE	PROTECT	SO. CALIF. GAS CO.
(15)	2" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(16)	3/4" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(17)	15 KV ELECTRICAL	PROTECT	CITY OF ANAHEIM
(27)	ABANDONED BU. CA. TEL.	PROTECT	PACIFIC BELL
(28)	6" V.C.P. SEWER LAT.	PROTECT	CITY OF ANAHEIM

144+05.09

(125.04) 7.90 C.F. | 124.65 10'C.F. | 124.03 10'C.F. | (125.14) 7.60 C.F.

142+79.70

(124.80) 7.44 C.F. | 124.60 10'C.F. | 124.63 10'C.F. | (124.86) 7.44 C.F.

145+29.00

(125.57) 7.80 C.F. | 125.38 10'C.F. | 125.41 10'C.F. | (125.60) 7.80 C.F.

N 29° 04' 00" E

N 89° 04' 00" E

S 60° 56' 00" E

S 60° 56' 00" E

BROADWAY

R/W

EX. DR.

CONST. STD. P.C.C. SIDEWALK (110 S.F.)

C.F. DRAIN

N.P.S.

W.M.

G.M.

W.V.

S.M.H.

T.P.# 735680 H

T.P.# 760113 H

T.P.

P.P.# 1053 D

P.P.# 1051 D

P.P.# 5220

P.P.# 1052 D

F.H.

W.M. VAULT

FL.S.

142+79.70 CONST. STD. C.B. Nº 1
W=10', V=4.5', TYPE "A" L.D.
INSTALL 18"R.C.P.-2000-D (41 L.F.)
9951.751
15926.985
18373

142+61.05 CONST. STD.
J.S. Nº 2, C=3.23'
9991.441
15907.684

144+05.09 CONST. STD. C.B. Nº 1
W=20', V=5', TYPE "A" L.D.
INSTALL 24"R.C.P.-2000-D (21 L.F.)
10014.785
16051.375
2
18373

143+90.51 END INSTALL 42"R.C.P.-1500-D
143+92.97 CONST. STD. M.H. Nº 4 C=4.37'
143+96.53 BEGIN INSTALL 36"R.C.P.-1800-D
9993.590
16039.594

144+98.98 ⚠1
~~143+05.57~~ CONST. STD.
J.S. Nº 2, C=3.13'
9995.~~435~~ 317
16~~52.580~~ 45.582 ⚠1

22.07 ⚠1

145+~~29.00~~ CONST. STD. C.B. Nº 1
W=10', V=4.5', TYPE "A" L.D.
INSTALL 18"R.C.P.-2000-D (49 L.F.)
9955.~~##~~ 619
16~~156.290~~ 69.325 ⚠1
3
18373

146+58.72 END INSTALL 36"R.C.P.-1800-D
146+61.05 CONST. STD. MANHOLE Nº 2
146+63.38 BEGIN INSTALL 36"R.C.P.-1800-D
9997.957
16307.630

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HARP
C27923
EXP. 3-31-94
CIVIL
STATE OF CALIFORNIA

AS CONSTRUCTED
A.B.C. DATE 4-15-92

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
⚠1	A.B.C.	MOVED C.B. DET. Nº 3 & ADDED GAS LAT. PER AS BUILT PLANS. ADDED W.S. ELEV.	[illegible]	4-15-92

REFERENCES

FIELD BOOKS	PAGES	BENCH MARK NO. 5A-18-83	FOR NOTES TO CONTRACTOR SEE PLAN 18368
129	2	ELEVATION 122.87	FOR STANDARD DETAILS SEE 301, 302, 308, 311, 312, 313, 314, 318, 319
			PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

SCALE: HORZ. 1"=20' VERT. 1"=4'
DRAWN BY A.B.C. & K.K.M. DATE 7-19-91
CHECKED BY S. BAUTISTA DATE 9-10-91

FOR APPROVALS OF THIS PROJECT SEE PLAN NO. 18368

STORM DRAIN IMPROVEMENT
BROADWAY
FROM 1195' E/o TO 595' E/o EUCLID STREET

CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO.
12-793-6325-365GO
10-793-6325-365MO

SHEET 3 OF 13

PLAN NUMBER 18370

18350

APPENDIX F
Hydraulic Calculations

Catch Basin Sizing

Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 15 2021

CB #1 Sizing Q100

Combination Inlet

Location	= Sag
Curb Length (ft)	= 7.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= 9.00
Grate Width (ft)	= 2.00
Grate Length (ft)	= 7.00

Gutter

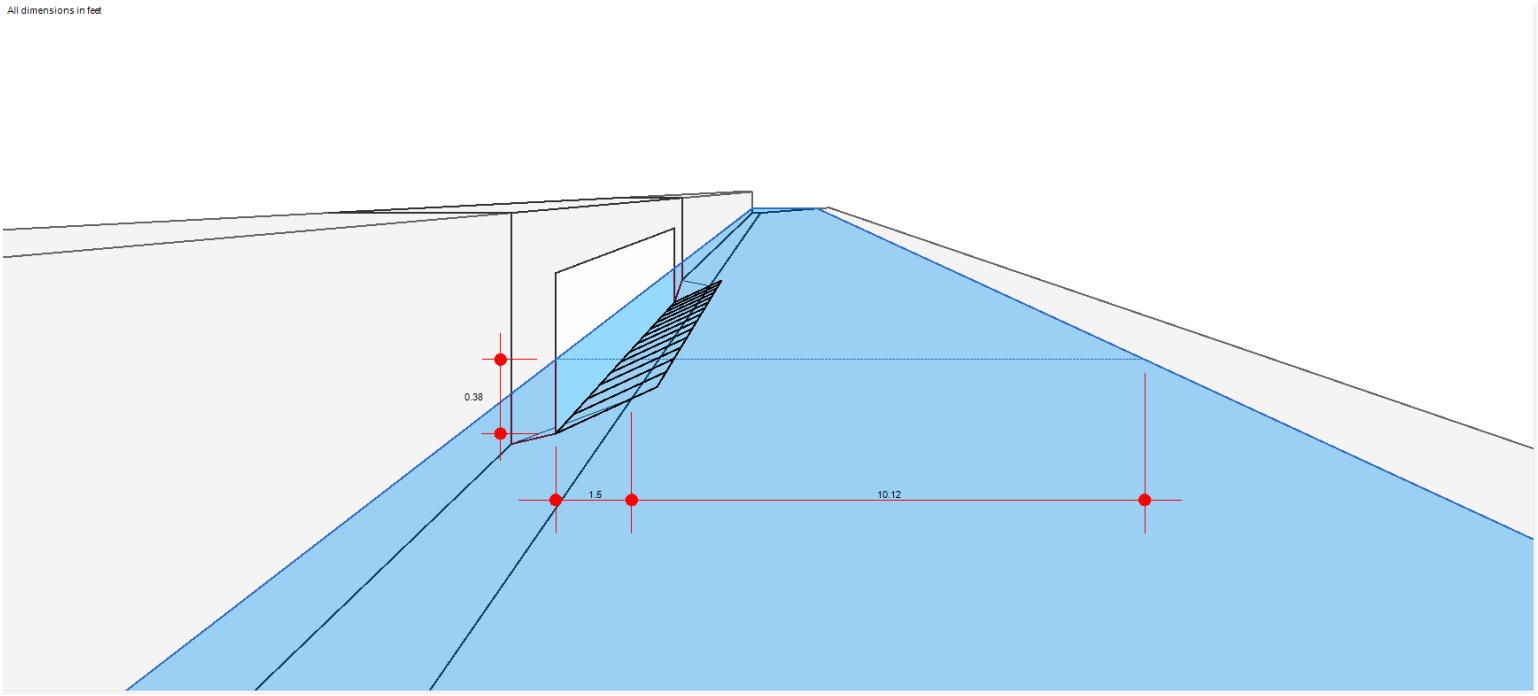
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 5.24

Highlighted

Q Total (cfs)	= 5.24
Q Capt (cfs)	= 5.24
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 4.61
Efficiency (%)	= 100
Gutter Spread (ft)	= 11.62
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



100-Year Ponding Calculations

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 15 2021

Q100_CB # 1 Depth of Flow

User-defined

Invert Elev (ft)	= 126.25
Slope (%)	= 0.80
N-Value	= 0.013

Calculations

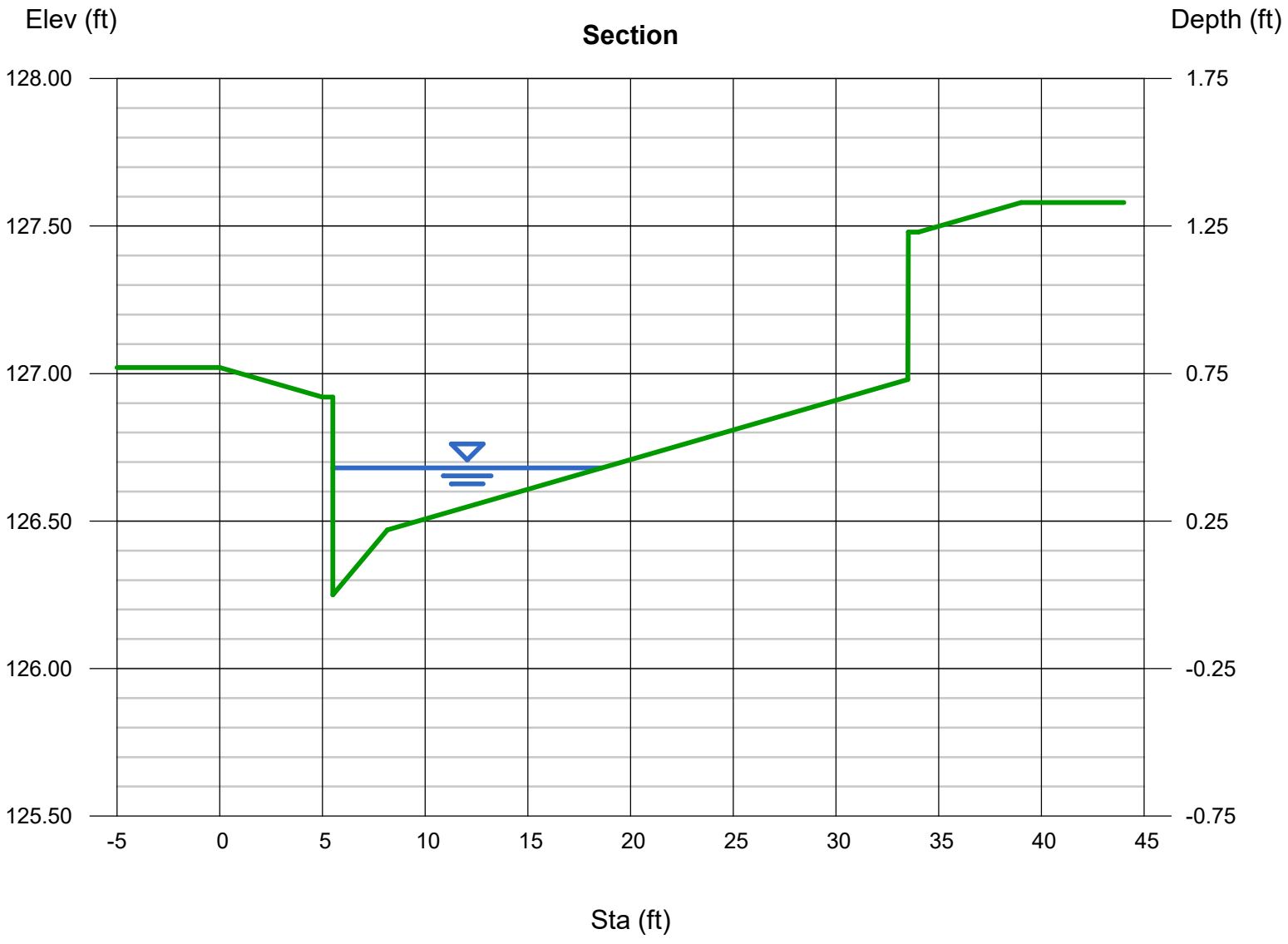
Compute by:	Known Q
Known Q (cfs)	= 5.24

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 5.240
Area (sqft)	= 1.94
Velocity (ft/s)	= 2.69
Wetted Perim (ft)	= 13.53
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 13.09
EGL (ft)	= 0.54

(Sta, El, n)-(Sta, El, n)...

(0.00, 127.02)-(5.00, 126.92, 0.013)-(5.50, 126.92, 0.013)-(5.51, 126.25, 0.013)-(8.16, 126.47, 0.013)-(33.50, 126.98, 0.013)-(33.52, 127.48, 0.013)
-(34.02, 127.48, 0.013)-(39.02, 127.58, 0.013)

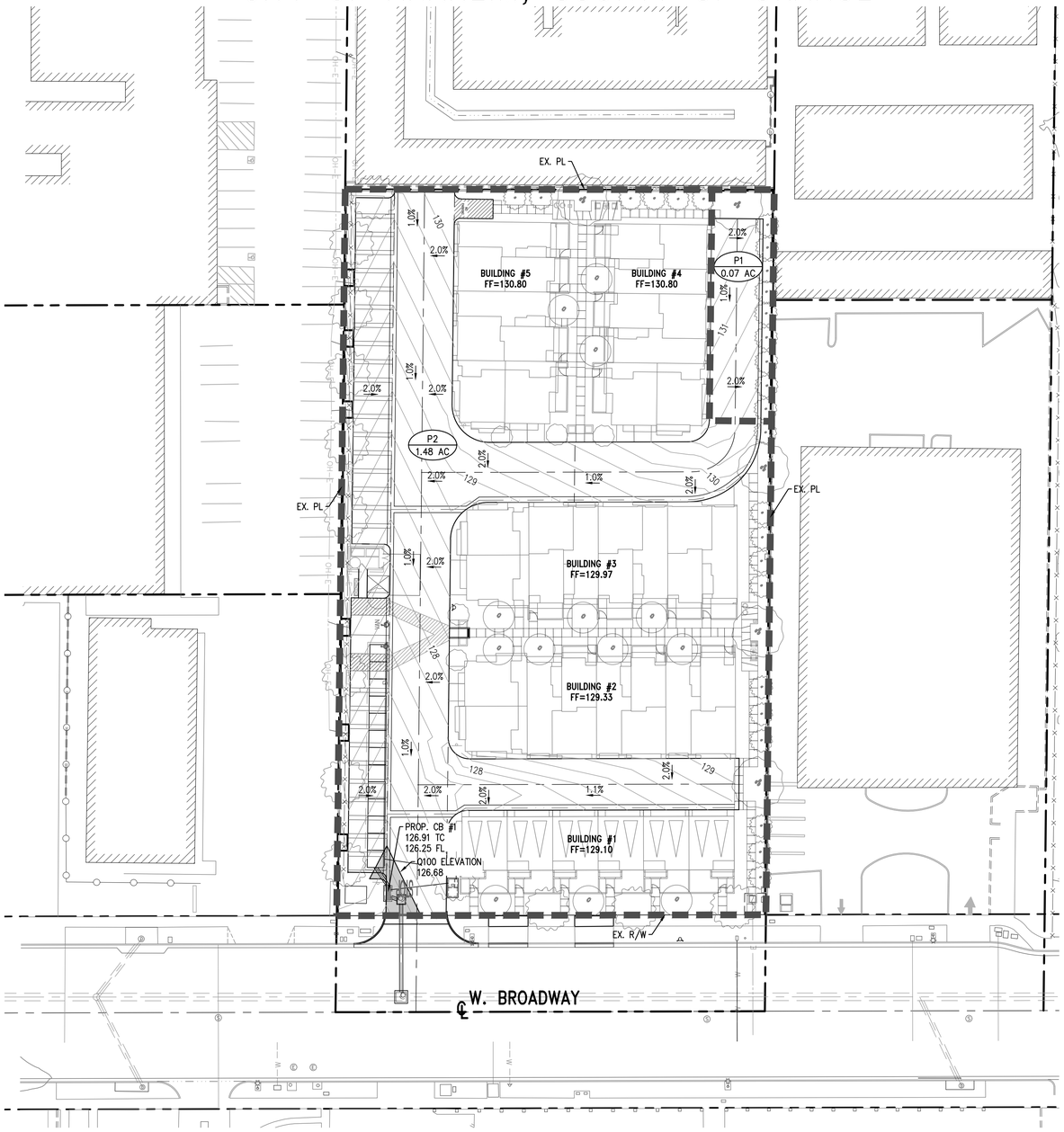


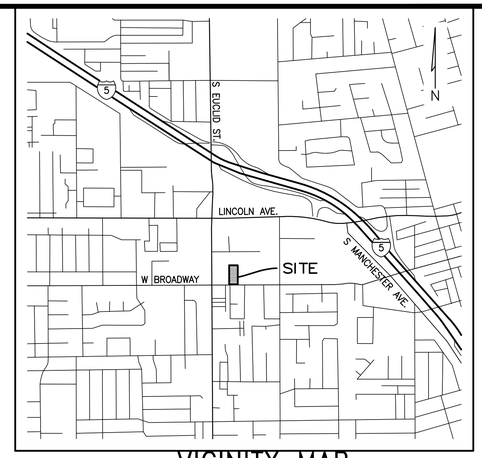
PONDING EXHIBIT

TTM 19141

1661 AND 1673 W. BROADWAY

CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE AREA BOUNDARY
- LONGEST FLOW PATH
- FLOW DIRECTION
- XX — DRAINAGE AREA ID
- X.XX AC — DRAINAGE AREA IN ACRES

SCALE: 1" = 30'

0 15 30 60

NOTES:

1. DURING THE CONSTRUCTION PHASE OF THIS PROJECT, THE INFILTRATION SYSTEM SHALL BE PHYSICALLY SEPARATED/PROTECTED FROM RUNOFF AND/OR ANY OTHER MATERIAL/LIQUID/DEBRIS.
2. AREA DRAIN SYSTEM WILL BE DESIGNED DURING FINAL ENGINEERING. AREA DRAINS WILL COLLECT AND CONVEY RUNOFF FROM LANDSCAPED AREAS DIRECTLY TO INFILTRATION SYSTEMS.
3. ROOF DRAINAGE IS ASSUMED TO BE CONSISTENT WITH THAT OF A PITCHED ROOF. ROOF DOWNSPOUT LOCATIONS TO BE VERIFIED BY ARCHITECT DURING FINAL ENGINEERING.

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

CITY VENTURES HOMEBUILDING, LLC
3121 MICHELSON DRIVE, SUITE 150
IRVINE, CA 92612
PHONE (949) 258-7540

SOILS ENGINEER :

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 NORTH MAPLE STREET, SUITE 108
CORONA, CA 92880
PHONE (951) 509-7090

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER
RYAN J. BITTNER
No. 68167
CIVIL
STATE OF CALIFORNIA

TENTATIVE TRACT NO. 19141
PONDING EXHIBIT
PRELIMINARY HYDROLOGY

DATE: 4/29/2021

SHEET 1 OF 1

SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

CITY OF ANAHEIM

F.2 - Preliminary Water Quality Management Plan

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DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT SERVICES
APPROVED
Esperanza Rios, Associate Engineer
8/23/2021, 3:04:05 PM
ANAH-OTH2021-01341
Esperanza Rios

OTH2020-01341

City of Anaheim
County of Orange/Santa Ana Region Priority Project
Preliminary Water Quality Management Plan (WQMP)

Project Name:

1661 and 1673 W. Broadway

DEV2020-00248

1661 AND 1673 W. BROADWAY, ANAHEIM, CA 92802

TTM 19141, APN: 250-101-08, 250-101-09

Prepared for:

City Ventures Homebuilding, LLC

3121 Michelson Drive, Suite 150

Irvine, CA 92612

(949) 258-7540

Prepared by:

C&V Consulting, Inc./ Ryan Bittner, P.E.

9830 Irvine Center Drive

Irvine, Ca 92630

(949) 916-3800/ rbittner@cvc-inc.net

Prepared February 2021
Revised July 2021

Project Owner's Certification			
Planning Application No. (If applicable)	DEV2020-00248 OTH2021-01341	Grading Permit No.	TBD
		RCP No.	TBD
Tract/Parcel Map and Lot(s) No.	TTM 19141, Lot 1	Building Permit No.	TBD
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			1661 and 1673 W. Broadway Anaheim, CA 92802 APNs: 250-101-08, 250-101-09

This Preliminary Water Quality Management Plan (WQMP) has been prepared for City Ventures Homebuilding, LLC by C&V Consulting, Inc. The WQMP is intended to comply with the requirements of the City of Anaheim and County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Kim Prijatel	
Title	Senior Vice President of Development
Company	City Ventures Homebuilding, LLC
Address	3121 Michelson Drive, Suite 150, Irvine, CA 92612
Email	kprijatel@cityventures.com
Telephone #	(949) 258-7540

I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.

Owner Signature		Date	7/27/21

Preparer (Engineer): Ryan Bittner, P.E.			
Title	Principal	PE Registration #	68167
Company	C&V Consulting, Inc.		
Address	9830 Irvine Center Drive, CA 92630		
Email	rbittner@cvc-inc.net		
Telephone #	(949) 916-3800		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature		Date	7-26-21
Place Stamp Here			

Contents

Page No.

Attachments

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Project Infomation			
Permit/Application No. (If applicable)	DEV2020-00248 OTH2021-01341	Grading Permit No. & RCP No.	TBD
Address of Project Site (or Tract Map and Lot Number if no address) and APN	1661 and 1673 W. Broadway, Anaheim, CA 92802 TTM: 19141 APN: 250-101-08, 250-101-09		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Conditions of Approval have not been issued at this time. Water Quality Conditions of Approval will be provided in the Final WQMP.		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	This is a Conceptual WQMP to support entitlement processing.		
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	Heavy Metals (Technical TMDL[1]) and Indicator Bacteria		

[1] This TMDL has been adopted for Coyote/San Gabriel River by the Los Angeles Regional Water Quality Control Board (Region 4); however, it applies to the areas of Orange County that drain to Coyote Creek and San Gabriel River

Section II Project Description

II.1 Project Description

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.			
Project Area (ft^2): 67,704	Number of Dwelling Units: 34		SIC Code: n/a	
Project Area	Pervious		Impervious	
	Area (square feet)	Percentage	Area (square feet)	Percentage
Pre-Project Conditions	8,125	12%	59,579	88%
Post-Project Conditions**	0	0%	67,704	100%

Drainage Patterns/Connections	The proposed residential development will consist of 1.55 acres. The existing site is relatively flat. The elevation of the existing site ranges from approximately 129′ to 127.2′ above mean sea level. In the current condition, the site generally sheet flows overland in the southerly direction towards the public right-of-way of W. Broadway. Stormwater entering W. Broadway continues to flow west through catch basins and into an existing City of Anaheim public 42″ Reinforced Concrete Storm Drain pipe. This drainage facility conveys runoff west to the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay. Refer to Attachment D of this report for a copy of the OCFCD Drainage Facilities Maps. The proposed residential development will consist of one (1) Drainage Management Area. The proposed drainage system will collect and convey stormwater runoff to the proposed infiltration system designed to retain and infiltrate the entire Design Capture Volume within a drawdown time of 48 hours. During larger storm events and when the infiltration system is at capacity, stormwater will overflow within the proposed onsite catch basin and be conveyed offsite via junction structures into the existing public 42″ storm drain in W. Broadway. The proposed onsite catch basin will be equipped with a Connecter Pipe Screen (CPS) device for certified full capture system requirements and storm drain signage will be implemented. Refer to Attachment B of this report for the Preliminary WQMP Exhibit. **Post-Project perviousness was assumed to be 100% to produce a conservative value for preliminary design. During final engineering, actual pervious coverage will be calculated as landscape plans become available.

Narrative Project Description: (Use as much space as necessary.)	The proposed 1.55-acre site is currently occupied by three commercial buildings, planters, and asphalt concrete parking/drive aisles. Existing landscaped areas amount to approximately 12% pervious coverage within this area. Perimeter fencing exists along the east and west property lines of the site. Along the north property line there is a perimeter wall. The proposed residential development will consist of five (5) 3-story, multi-family residential buildings which will consist of 34 total units. Units will consist of 2-, 3-, and 4-bedroom layouts and will range in between 1,062 and 1,633 square feet. Associated parking areas will consist of 68 private garage spaces, 31 open stalls, and 2 ADA stalls. In addition, the residential development will include a private drive aisle, recreational areas, sidewalks, and landscaped open-space areas. The drive aisle will be asphalt concrete pavement and sidewalks will be Portland cement concrete (PCC). Landscaped areas are assumed to amount to approximately 20% pervious coverage. During final engineering, actual project perviousness will be calculated. Best Management Practice (BMP) selection for treatment of stormwater has been described in Section IV of this report. Implementation of BMPs will address the pollutants of concern associated with multi-family residential development. The project will be serviced by onsite private water system and onsite private sanitary sewer system that will be maintained by a homeowner's association. The proposed private water system will have four points of connection to the existing City maintained water line within W. Broadway (2 for domestic, 1 for irrigation, and 1 for fire). The proposed public sewer system will be gravity fed to one of point connection to an existing public City 8" sewer main located within W. Broadway. Long-term maintenance is planned to be handled by a Homeowner's Association appointed by City Ventures Homebuilding, LLC. Refer to Attachment B of this report for a copy of the Preliminary WQMP Exhibit.

II.2 Potential Stormwater Pollutants

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	Expected by proposed landscaped areas.
Nutrients	E ☒	N ☐	Expected by proposed landscaped areas.
Heavy Metals	E ☐	N ☒	Per TGD, Table 2.1 this pollutant is not expected for attached residential developments.
Pathogens (Bacteria/Virus)	E ☒	N ☐	Expected by proposed residence and pets.
Pesticides	E ☒	N ☐	Expected by proposed landscaped areas.
Oil and Grease	E ☒	N ☐	Expected by uncovered parking areas.
Toxic Organic Compounds	E ☐	N ☒	Per TGD, Table 2.1 this pollutant is not expected for attached residential developments.
Trash and Debris	E ☒	N ☐	Expected by proposed residence.

II.3 Hydrologic Conditions of Concern

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below.

Per the TGD Figure 1, Susceptibility Analysis of San Gabriel-Coyote Creek dated February 2013, the project site is indicated as a potential area of erosion, habitat, and physical structure susceptibility. The project site indirectly drains to the San Gabriel River, however it is downstream of the unstable portion of the river. Therefore, HCOCs do not exist. Refer to Attachment A for the TGD Figure.

II.4 Post Development Drainage Characteristics

Post–development drainage will be consistent with a proposed attached Multi-Family Residential project. The tributary areas and direction of run-off flows for the proposed site are delineated on the attached Preliminary WQMP Exhibit based on the grading and drainage design. Refer to the Preliminary WQMP Exhibit in Attachment B of this report.

In the current condition, the site generally sheet flows overland in the southerly direction towards the public right-of-way of W. Broadway. Stormwater runoff entering W. Broadway continues to flow west into an existing City of Anaheim public catch basin and then into an existing public city 42" Reinforced concrete storm drain pipe. The public storm drain continues west in W. Broadway to S. Dale Avenue where it enters the Carbon Creek Channel. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay.

Proposed drainage runoff will be collected by a series of area drains and by a proposed sump curb inlet catch basin within the proposed private drive aisle and conveyed to a BioClean Urban Pond infiltration system designed to retain and infiltrate the entire DCV. Pre-treatment of the roof and street surface runoff DCV will be provided by proposed Modular Wetlands Systems (MWS) Biofiltration vault prior to entering the infiltration system. During storm events that produce a runoff volume greater than the DCV, stormwater will overflow within the proposed catch basin and be conveyed offsite through a junction structure to the existing public city 42" storm drain in W. Broadway.

The proposed drainage pattern matches the existing historical drainage pattern from the site. Runoff from this area historically flows in the westerly direction and ultimately enters Carbon Creek Channel which flows in the southeasterly direction towards the Pacific Ocean.

II.5 Property Ownership/Management

The property is currently owned by City Ventures Homebuilding, LLC. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment G of this report and should be executed as part of any ownership transfer after construction is complete.

City Ventures Homebuilding, LLC will appoint a Homeowner's Association (HOA) to provide long term BMP maintenance for the proposed development. Refer to Section V of this report for additional information.

Section III Site Description

III.1 Physical Setting

Name of Planned Community/Planning Area (if applicable)	City of Anaheim
Location/Address	1661 and 1673 W. Broadway
	Anaheim, CA 92804
General Plan Land Use Designation	Office-Low
Existing Zoning	C-G General Commercial
Proposed Zoning	Multi-Family Residential, RM-3.5
Acreage of Project Site	1.55 acres
Predominant Soil Type	Per TGD, Figure XVI-2a, NRCS Hydrologic Soils Groups the site is located within Soil Type B. Refer to Attachment A of this report for a copy of the map. **For site specific soil information, refer to Section III.2 and Attachment F of this report.**

III.2 Site Characteristics

Site Characteristics	
Precipitation Zone	The site falls under the 0.90" per the TGD, Figure XVI-1, Rainfall Zones map. Refer to Attachment A of this report for a copy of the map.
Topography	The existing site is relatively flat. The elevation of the existing site ranges from approximately 129' to 127.2' above mean sea level. In the current condition, the site generally sheet flows overland in the southerly direction towards the public right-of-way of W. Broadway.
Drainage Patterns/Connections	The existing site is currently occupied by three commercial buildings and has approximately 12% pervious cover. The existing site sheet flows overland towards the project's southern perimeter. The site drains south towards the public right of way of W. Broadway. Stormwater entering W. Broadway continues to flow west through catch basins and into an existing City of Anaheim public 42" Reinforced Concrete Storm Drain pipe. This drainage facility conveys runoff west to the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay. The proposed development will maintain the existing drainage condition.
Soil Type, Geology, and Infiltration Properties	Per the Geotechnical and Infiltration Evaluation prepared by Alta California Geotechnical Inc, dated January 4, 2021, the site's geotechnical properties are described as the following: "Based on our literature review and subsurface investigation, the site is underlain by undocumented artificial fill and alluvium. These geologic units are briefly described below." "The artificial fill observed at the site consists mainly of light tan brown to brown, silty sand in a dry to moist, medium dense condition. The unit was logged to a depth of 7.0 feet below the ground surface." "The alluvium observed at the site consists mainly of gray, light brown gray, and light tan gray sand, silty sand, and silty clay in a dry to moist medium dense to dense and firm condition. The unit was logged to a depth of 31.0 feet below the ground surface." "Expansion index testing was performed on samples taken during our subsurface investigation. Based on the results, it is anticipated that the majority of materials onsite are 'very low' to 'low' in expansion potential (0≤EI≤50, Appendix C) when tested per ASTM D:4829" Refer to Attachment F of this report for a copy of the geotechnical report.

<table>
<tr>
<td>Hydrogeologic (Groundwater) Conditions</td>
<td>Per the Geotechnical and Infiltration Evaluation prepared by Alta California Geotechnical Inc, dated January 4, 2021, the site's groundwater conditions are described as the following:

"Groundwater was not encountered to a depth of 31.0 feet below the ground surface during our subsurface investigation. The most recent well data recorded in October of 2020 from Well No. 338229N1179374W002 located within 0.75 miles of the site indicates that current groundwater levels in the area are approximately 87.0 feet below the ground surface. Based on state- provided information, the historic – high groundwater is greater than 50 feet below the ground surface (CDMG, 1997)"

"It is anticipated that groundwater will not be encountered during construction. It is possible that perched water conditions could be encountered depending on the time of year construction occurs."

Per additional research on the GeoTracker database, there are no known contaminated sites within 250 feet of the project site. Refer to Attachment D for a copy of the project site located on the GeoTracker map.</td>
</tr>
<tr>
<td>Geotechnical Conditions (relevant to infiltration)</td>
<td>Per the Geotechnical Investigation Report prepared by Alta California Geotechnical Inc, dated January 4, 2021, the site's geotechnical infiltration properties are described as the following:

"Infiltration testing was undertaken using two (2) five foot deep borings (P-1 and P-2). The testing was performed on December 11, 2020 in general accordance with the County of Orange WQMP standards. The two test wells were presoaked at least 24 hours prior to testing. During testing, the water level readings were recorded every 30 minutes until the readings stabilized. The data was then adjusted to provide an infiltration rate utilizing the Porchet Method. The resulting infiltration rates are presented in Table 3-1. The results do not include a factor of safety. Recommendations for infiltration BMP design are presented in Section 6.3"

<table>
<tr><th colspan="3">Table 3-1-Summary of Infiltration Testing
(No Factor of Safety)</th></tr>
<tr><th>Test Designation</th><th>P-1</th><th>P-2</th></tr>
<tr><td>Approximate Depth of Test</td><td>5 ft</td><td>5 ft</td></tr>
<tr><td>Time Interval</td><td>30 minutes</td><td>30 minutes</td></tr>
<tr><td>Radius of Test Hole</td><td>4 inches</td><td>4 inches</td></tr>
<tr><td>Tested Infiltration Rate</td><td>0.61 (in/hr)</td><td>0.68 (in/hr)</td></tr>
</table>

Per the Summary of Additional Infiltration Testing prepared by Alta California Geotechnical Inc, dated February 3, 2021, the site's geotechnical infiltration properties are described as the following:

"Two additional infiltration tests were conducted on February 2, 2021 at the locations show on Plate 1, identified as P-3 and P-4. P-1 and P-2 were presented</td>
</tr>
</table>

<table>
<tr><td></td><td>in the referenced report. The locations of the additional infiltration testing where determined by C&V Consulting. The infiltration tests were conducted in sand lenses of the young alluvial fan deposits, and boring logs are presented in Appendix A. Infiltration testing utilized deep percolation test methods in general conformance with the Count of Orange Technical Guidance Document standards."

"A Summary of the test results is presented in Table A. The results do not include a factor of safety."

<table>
<tr><th colspan="3">Table A-Summary of Infiltration Testing
(No Factor of Safety)</th></tr>
<tr><th>Test Designation</th><th>P-3</th><th>P-4</th></tr>
<tr><td>Approximate Depth of Test</td><td>10 ft</td><td>15 ft</td></tr>
<tr><td>Time Interval</td><td>30 minutes</td><td>30 minutes</td></tr>
<tr><td>Radius of Test Hole</td><td>4 inches</td><td>4 inches</td></tr>
<tr><td>Tested Infiltration Rate</td><td>0.8 (in/hr)</td><td>3.7 (in/hr)</td></tr>
</table>

Refer to Attachment F of this report for a copy of the referenced geotechnical recommendations.</td></tr>
<tr><td>Off-Site Drainage</td><td>No off-site drainage enters the property.</td></tr>
<tr><td>Utility and Infrastructure Information</td><td>Utilities are proposed to be underground. No special setbacks are needed or proposed. Proposed domestic water, storm drain, sanitary sewer and underground fire water system will be private and maintained by the appointed HOA.</td></tr>
</table>

III.3 Watershed Description

Receiving Waters	Site runoff drains towards the surrounding rights-of-way of the site and enters the existing Carbon Creek Channel. Carbon Creek Channel conveys all site runoff in the southwesterly direction and converges with Coyote Creek which drains to San Gabriel River and eventually the Pacific Ocean at San Pedro Bay. The site is located within the San Gabriel-Coyote Creek Watershed.
303(d) Listed Impairments	**San Gabriel River, Reach 1 –** Temperature, pH **San Gabriel River Estuary –** Nickel, Dissolved Oxygen, Copper, Indicator Bacteria, Dioxin **San Pedro Bay –** Chlordane, DDT, PCBs, Sediment Toxicity
Applicable TMDLs	**San Gabriel River Estuary –** Selenium, Metals, Bacteria **San Gabriel River -** Bacteria
Pollutants of Concern for the Project	Anticipated and Potential Pollutants of Concern for Attached Residential Development is Suspended Solid/Sediments, Nutrients, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease and Trash & Debris.
Environmentally Sensitive and Special Biological Significant Areas	The project is not located within any known Environmentally Sensitive Areas (ESA) or Areas of Special Biological Significance (ASBS).

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?	YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	There are currently no approved WIHMPs for the Santa Ana Region.	

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Per 7.II-2.4.2.2 of the MWQMP, HCOCs exist when the proposed condition of the site generates a decrease in the time of concentration beyond 5% and an increase in runoff volume beyond 5% for the 2-year storm event, thus potentially increasing downstream erosion. Since the project proposes to utilize infiltration BMPs which will infiltrate a volume that is greater than the increase in runoff volume, the project will not contribute to erosion of downstream drainage facilities. In addition, although the project site drains to the San Gabriel River, the site is located downstream of the unstable portion of the river.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	According to Section 7.II-2.4.3 of the MWQMP Priority Projects must biotreat/biofilter the 85th percentile, 24-hour storm event (Design Capture Volume). A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment be provided for the remaining design capture. This project proposes to utilize infiltration BMPs to treat the required stormwater runoff volume. Biotreatment BMPs will also be utilized as a form of pre-treatment prior to entering the proposed infiltration systems.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or off-site prior to discharge to waters of the US. Since the project proposes to satisfy LID performance criteria, therefore treatment control performance criteria is also fully satisfied. Sizing of treatment control BMPs (Biofiltration Systems) shall be based flow-based for the area being redeveloped to medium and high effectiveness for reducing the primary pollutants of concern, which will be considered in compliance. This project proposes to utilize a combination of infiltration BMPs and biotreatment BMPs to treat the required stormwater runoff. Refer to Attachment C for manufacturer's specifications for the proposed infiltration and biotreatment BMPs. Refer to Section IV.3.2, Infiltration BMPs and Section IV.3.4, Biotreatment BMPs for additional information regarding BMP selection.
Calculate LID design storm capture volume for Project.	Biotreatment BMPs will be utilized for pre-treatment of the required treatment flow rate, and infiltration BMPs will be utilized to retain/infiltrate the required treatment volume. Per the City of Anaheim, BMP Design Guidelines dated November 2019, Design Standard #1 for Pre-Treatment for Focused Infiltration, "if biotreatment is utilized as pre-treatment, it can be sized for… 50% of the design flow-rate in the case of proprietary and flow-based biotreatment BMPs for pre-treatment." The proposed project residential site will generate a total DCV of 4,557 cf. The DCV for the DMA was calculated as follows: DMA 1: V_{design} = 0.9*0.9 inches*1.55 acres*43,560 (sf/acre)*(1 foot/12 inches) = 4,557 cf Sheet flows from proposed drive aisles and parking areas will generate a total design flowrate of 0.12 cfs. The design flowrate corresponding to surface flows from streets

	and drive aisles within the DMA was calculated as follows: DMA 1: Q_{design} = 0.90*0.26 (in/hr)*1.03 acres*0.50 = 0.12 cfs See Attachment A of this report for DCV and treatment flow rate calculations.

IV.2. Site Design and Drainage

The site proposes one (1) Drainage Management Area as indicated on the Preliminary WQMP Exhibit. The DMA is based on the Preliminary Grading and Drainage design. The DMA will have an area drain system to collect and convey runoff from landscape, surface and roof drainage to the proposed treatment devices. Pervious coverages located throughout the site will promote impervious area dispersion from roof and sidewalk runoff.

Street surface runoff will be collected and conveyed through a curb inlet catch basin equipped with a Dvert System that will divert low flows to the proposed Modular Wetlands System (MWS) Biofiltration vault for pre-treatment of the DCV. Upon pre-treatment, flows will be returned to the catch basin via the Dvert system and conveyed to proposed BioClean Urban Pond infiltration system. The infiltration system is designed to retain and infiltrate the entire DCV within a drawdown time of 48 hours. During larger storm events and when the proposed infiltration BMPs are at capacity, stormwater will pond within the catch basin which will overflow through a proposed junction structure and storm drain pipe and into the existing city public 42" Storm drain line in W. Broadway.

The Modular Wetland System (MWS) Biofiltration vaults are designed to provide a 3-phase treatment train. Initially, when the stormwater enters the system, a trash rack, filter media and settling chamber will capture large trash/ debris and sediment in the stormwater before entering the planting media. This system is designed to treat stormwater flow horizontally. Before the stormwater enters the planting or "wetland" chamber, the runoff flows through the 2nd phase, a pre-filter cartridge which captures fines TSS, metals, nutrients and bacteria. The pre-filter chamber eliminates additional maintenance of the planting area. The wetland chamber is the 3rd phase of the system which provides final treatment through a combination of physical, chemical and biological processes. Refer to Section IV.3.4 of this report for sizing information of the Biofiltration Vault.

The BioClean Urban Pond infiltration system is an underground infiltration gallery consisting of a series of concrete rectangular modules underlain by a bed of gravel which promotes subsurface infiltration. The system will be designed to provide enough static volume within the modules and gravel bed to retain the entire DCV. The amount of surface area provided will be designed to ensure infiltration of the entire DCV within 48 hours. Refer to Section IV.3.2 of this report for sizing information for the infiltration system.

The depths of the proposed infiltration systems will provide a minimum clearance of 10′ between the bottom of the infiltration system and the relative high groundwater elevation.

Infiltration testing was conducted at 10′ and 15′ below the existing surface. The BioClean Urban Pond Infiltration system is designed to be approximately 7′ tall with a maximum of 8′ of cover. Infiltration test results at 15′ were used for preliminary design. Infiltration testing at the location of the Infiltration system should be conducted and calculations verified during final engineering.

Refer to the Preliminary WQMP Exhibit in Attachment B for the location of the proposed BMPs. Refer to Attachment C for manufacturer's specifications of the selected BMPs.

IV.3 LID BMP Selection and Project Conformance Analysis

IV.3.1 Hydrologic Source Controls (HSCs)

The full Design Capture Volume (DCV) is being treated with LID BMPs, therefore HSCs are not proposed.

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

** The entire DCV will be treated with an LID BMP, therefore HSC BMPs are not required.*

IV.3.2 Infiltration BMPs

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☒
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐

Based on site infiltration properties and Table 2.7, Infiltration BMP Feasibility, infiltration is feasible for the entire DCV for the proposed residential development. Infiltration testing will be reanalyzed during final engineering to confirm feasibility of infiltration BMPs in the proposed infiltration locations. The proposed development will utilize one a BioClean Urban Pond system to retain and infiltrate the entire DCV. The Urban Pond system is an underground infiltration gallery with several rectangular modules with an offset 3-legged design with two narrow legs running parallel and one wider leg running perpendicular. The proposed Urban Pond will have an open bottom and will be underlain by a gravel bed for infiltration.

In addition, one (1) Modular Wetland System Biofiltration vault will be utilized to provide pre-treatment of street runoff prior to entering the infiltration system.

The system will be designed to provide enough static volume to retain 100% of the DCV, and the gravel bed surface area will provide sufficient surface area infiltrate this entire volume within 48 hours.

Infiltration Calculations

Per the Summary of Additional Infiltration Testing prepared by Alta California Geotechnical, Inc. dated February 3, 2021, infiltration rates encountered on the project site range between 0.8 and 3.7 inches per hour.

Infiltration testing at location P-4 was at a depth comparable to the depth of the proposed infiltration system. The tested infiltration rate of 3.7 inches per hour was used in the calculations below.

After applying a minimum factor of safety of 2, the infiltration rate used for design, K_{design}, was equal to 1.85 inches per hour for DMA 1. Refer to Attachment A, Worksheet H of this report for factor of safety calculations, and refer to Attachment F of this report for infiltration testing information.

Infiltration volume was calculated using the following equation:

$V_{infiltration}$ *= (1/12)(Surface Area, sf)(*K_{design}*, in/hr)(Drawdown Time, hrs)*

DMA 1 – BioClean Urban Pond
DCV = 4,557 cf
Installed System effective depth = 6′
Installed System total depth (12″ gravel) = 7′
Installed System Volume = ***4,974cf > 4,557 cf*** ✓
Installed System Surface Area = 832 sf
$V_{infiltration,\ 48\ hr}$ *= (1/12)(832 sf)(1.85 in/hr)(48 hrs)*
= 6,157 cf > 4,557 cf ✓
Drawdown time =35.53 hrs
$V_{infiltration,\ 35.53\ hr}$ *= (1/12)(832 sf)(1.85 in/hr)(35.53 hrs) = 4,557 cf*

The table below summarizes the requirements and capacity of the infiltration system in each DMA:

DMA	Area (ac)	DCV (cf)	BioClean Urban Pond	Detention Capacity (cf)	Surface Area (sf)	Infiltration Over 48 Hours (cf)
1	1.55	4,557	Double Urban Pond 6′ I.D. Module Height	4,974	832	6,157

Refer to Table 2.7 Infiltration BMP Feasibility Worksheet located within Attachment A of this report. Refer to Attachment C of this report for more information on the BioClean Urban Pond infiltration system.

Conclusion:
The proposed BioClean Urban Pond for the DMA will provide more than enough static storage and infiltration volume for the entire DCV.

N/E Coordinates of BioClean Urban Pond:
DMA 1 BioClean Urban Pond: 6048332.8219E, 2249462.8058N

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Name	Included?
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Evapotranspiration, Rainwater Harvesting BMPs will not be utilized and have been determined to be infeasible for this site due to development type, density and available amount of landscaped area for irrigation purposes. Refer to Worksheet J for feasibility calculations within Attachment A of this report.

IV.3.4 Biotreatment BMPs

Name	Included?
Bioretention with underdrains	☐
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐

A Modular Wetland System (MWS) Biofiltration vault will be utilized at the catch basin to pre-treat low flows runoff prior to entering the proposed infiltration system. The MWS Biofiltration vault utilizes a 3-phase treatment train by collecting the stormwater runoff in a Pre-Treatment Chamber, Planting or "Wetland" Chamber and Discharge Chamber. Treated street runoff outlets to the proposed BioClean Urban Pond infiltration system which will infiltrate the entire DCV.

The MWS Biofiltration vault was sized using the area tributary to the catch basin and the treatment flow rate method per the Orange County Technical Guidance Document worksheets. Note that the tributary treatment area used for the MWS sizing calculation refers only to street runoff which is captured by the proposed catch basin. Landscape areas captured by area drains have been excluded from MWS sizing calculations since landscaping provides adequate pre-treatment of pollutants of concern in these areas. Landscape areas have been indicated on the Preliminary WQMP exhibit. Refer to Worksheet D in Attachment A for calculations. Refer to the Preliminary WQMP Exhibit in Attachment B for areas that were excluded from MWS sizing calculations.

DMA	Acreage Tributary to Proposed Catch Basins (ac)	Acreage Excluded from MWS Sizing (ac)	50% Reduction Treatment Flowrate, Q (cfs)	MWS Model	Treatment Capacity, Q (cfs)
1	1.03	0.52	0.121	MWS-L-4-8-V	0.122

** Project-specific details will be provided during final engineering. Refer to Attachment C for additional manufacturer information.*

Conclusion:
The utilization of a MWS Biofiltration vault at the proposed catch basin will provide more than the required pre-treatment flow rate for the tributary drainage area.

N/E Coordinates of Modular Wetlands Systems:
DMA 1 Modular Wetland System: 6048361.6697E, 22494493.6489N

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**
n/a	n/a

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs
Not Applicable for this project.

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**
Connector Pipe Screen (CPS) Device	The proposed on-site catch basin will be equipped with a Connector Pipe Screen (CPS) device sized for the 1-year 1-hour storm event for the area tributary to the catch basin. Refer to Attachment C for manufacturer information.

IV.3.8 Non-structural Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Industrial Permit Compliance	☐	☒	Proposed residential project.
N7	Spill Contingency Plan	☐	☒	Proposed residential project.
N8	Underground Storage Tank Compliance	☐	☒	Proposed residential project.
N9	Hazardous Materials Disclosure Compliance	☒	☐	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	Proposed residential project.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Proposed residential project.

N1: Education for Property Owners, Tenants & Occupants

Project conditions of approval will require that the Homeowner's Association (HOA) periodically provide environmental awarness education materials, made available by the municipalities, to all of its members. Among other things, these materials will be descrive the use of chemcials (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Educational materials available from the County of Orange can be downloaded here:

http://www.ocwatersheds.com/PublicEd/resources/default.aspx

N2: Activity Restrictions

Conditions, covenants and restrictions (CC&Rs) must be prepared by the developer for the appointed HOA for the purpose of surface water quality protection. The CC&Rs shall incorporate the restrictions based on the Project WQMP.

N3: Common Area Landscape Management

All common landscaping and/ or open space areas shall have on-going landscape maintenance by an appointed professional landscaping maintenance company as selected by the HOA. Maintenance shall incorporate all current County Water Conservation Resolution usage and follow the Management Guidelines for Use of Fertilizers per the DAMP Section 5.5. Refer to Section 5 of this report for additional landscape maintenance requirements.

N4: BMP Maintenance

Refer to Section 5 and Attachment E of this report for additional non-structural BMP maintenance requirements, responsibility and frequency.

N5: Title 22 CCR Compliance

HOA is responsible for compliance with Title 22 of the California Code of Regulations (CCR) and relevant sections of the California Health & Safety Code regarding hazardous waste management is enforced by the County Environmental Heath and behalf of the State. Inforamtion regarding hazardous waste management must be provided to all employees, homeowners, tenants and occupants.

N9: Hazardous Materials Disclosure Compliance

HOA is responsible for compliance with the local agencies' ordinances enforced by City Fire Department for the management of hazardous materials including enforcement, waste handling, disposal regulations and documentation.

N10: Uniform Fire Code Implementation

HOA is responsible for compliance with Article 80 of the Uniform Fire Code enforced by the local fire protection agency.

N11: Common Area Litter Control

HOA to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. HOA to contract with landscape maintenance company to provide this service during regularly scheduled maintenance, which will consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposals violations by homeowners, tenants or occupants and reporting the violations to the HOA for investigation.

N12: Employee Training

HOA to provide Educational Materials and Property Management manuals to all employees upon initial hiring. Any updated information shall be provided to employees within a timely manner along with information on implementation.

N14: Common Area Catch Basin Inspections

HOA to inspect, clean and repair common area catch basins within the development to verify that the private drainage system is working properly. All trash/ debris and sediment build up is removed and any repairs/ replacements are conducted. Cleaning should take place in late summer/ early fall prior to the start of the raining season. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, sediment basins, open drainage channels, area drains, and lift stations. Records shall be kept onsite to document the annual maintenance.

N15: Street Sweeping of Private Streets & Parking Lots

HOA to schedule at a minimum street sweeping of private streets and parking areas prior to the start of the rainy seasons, in late summer or early fall. Additional sweeping may be required to remove landscaping foliage and/ or pollution.

IV.3.9 Structural Source Control BMPs

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No proposed outdoor storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	No proposed slopes or channels.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Not Applicable.
S6	Dock areas	☐	☒	No proposed dock areas.
S7	Maintenance bays	☐	☒	No proposed maintenance bay areas.
S8	Vehicle wash areas	☐	☒	No proposed vehicle wash areas.
S9	Outdoor processing areas	☐	☒	No proposed outdoor processing areas.
S10	Equipment wash areas	☐	☒	No proposed equipment wash areas.
S11	Fueling areas	☐	☒	No proposed fueling areas.
S12	Hillside landscaping	☐	☒	No proposed hillside landscaping areas.
S13	Wash water control for food preparation areas	☐	☒	No wash water control for food preparation areas.
S14	Community car wash racks	☐	☒	No proposed community car washing racks.

S1 (CASQA Fact Sheet SD-13): Storm Drain Stenciling & Signage

HOA to inspect, repair and/ or replace storm drain stenciling and signage immediately. Inspection of stenciling and signage shall occur at least once per month and prior to the start of the raining season. Storm Drain stenciling and signage with a reference that indicates "Drains to Ocean" per CASQA BMP SD-13 Fact Sheet is required.

S3 (CASQA Fact Sheet SD-32): Trash Storage Areas

HOA shall implement measures to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. HOA to implement the following methods to reduce the likelihood of contamination:

- Reduce leaking of liquid waste by using lines bins or dumpsters
- Minimize direct precipitation and rainfall from entering containers
- Post signs on dumpsters prohibiting dumping of hazardous materials

S4 (CASQA Fact Sheet SD-12): Use Efficient Irrigation Systems & Landscape Design

HOA shall implement the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm drain systems. HOA to implement the following methods to reduce excessive irrigation water runoff, where applicable:

- Employ rain shutoff devices to prevent irrigation after precipitation.
- Utilizing landscape specific irrigation water requirements
- Utilize flow reducers or shutoff valves triggered by pressure drop to control water loss due to broken sprinkler heads.
- Implement landscaping practices per the County Water Conservation Resolution or City agency equivalent.
- Group plants or landscaping with similar water consumption in order to promote surface infiltration.

Refer to CASQA BMP Fact Sheet SD-12 for additional information.

IV.4 Alternative Compliance Plan (Not Applicable)

IV.4.1 Water Quality Credits

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td colspan="2">☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td>☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td>Calculation of Water Quality Credits
(if applicable)</td><td colspan="4">Water Quality credits will not be utilized on this development site.</td></tr>
</table>

IV.4.2 Alternative Compliance Plan Information

Not applicable for this project.

Section V Inspection/Maintenance Responsibility for BMPs

The property is currently owned by City Ventures Homebuilding, LLC. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment G of this report and should be executed as part of any ownership transfer after construction is complete.

The owner will appoint a Homeowner's Association (HOA) to provide long term BMP maintenance for the proposed development upon completion of construction.

Owner/ Developer:
City Ventures Homebuilding, LLC
3121 Michelson Drive, Suite 150
Irvine, CA 92612
(949) 258-7540
Kim Prijatel, Senior Vice President of Development

Homeowner's Association
To be determined

The owner is aware of the maintenance responsibilities of the proposed BMPs. A funding mechanism is in place to maintain the BMPs at the frequency stated in the WQMP.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Education for Property Owners, Tenants, Occupants & Employees	Homeowner's Association (HOA)	HOA to provide education material, a copy of the approved WQMP and Operation & Maintenance Plan (O&M) to new property owners, tenants, occupants & employees.	At time of hiring, leasing and/ or home purchase.
Activity Restrictions	HOA	HOA employees notified of activities that are prohibited by homeowners.	Restrictions identified in Employee Manual and reviewed yearly by employees.
Common Area Landscape Management	HOA	HOA to hire professional landscape company to conduct maintenance of landscaping to meet current water efficiency and keep plants healthy and bio areas maintained with proper soil amendments.	Regular maintenance once a week and monthly inspection to determine deficiencies.
Trash and Waste Storage Area	HOA	HOA to maintain the integrity of the structural elements subject to damage such as screens, covers, and signs. Maintenance agreements between the local agency and owner/ operator may be required.	A minimum 2 inspections/ cleanings per year per manufacturer's specifications prior to October 1st (before rainy season)
BMP Maintenance	HOA	HOA to hire professional BMP maintenance company to conduct regular inspections, repairs and cleanings per manufacturer's	A minimum 2 inspections/ cleanings per year per manufacturer's specifications prior to

		specifications.	October 1st (before rainy season)
Title 22 CCR Compliance	HOA	The distribution of these materials will be the responsibility of the HOA at the time of hire, lease signing or home purchase per property owner, tenant or occupant or at the initial time of hiring.	At time of hiring, leasing and/ or home purchase.
Uniform Fire Code Implementation	HOA	HOA to comply with fire regulations and keep informed of the latest rules and requirements.	Comply with annual fire inspections and maintain building and access per the latest fire codes.
Common Area Litter Control	HOA	HOA to provide litter removal of site parking lot and landscape areas and to empty common area trash bins.	Once per week.
Employee Training	HOA	The distribution of these materials will be the reasonability of the HOA at the initial hiring of the employee.	At time of hiring.
Private Street & Parking Lot Sweeping	HOA	HOA to provide maintenance of Parking Lot and provide Street Sweeping services.	Weekly basis.
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	HOA	HOA to provide maintenance of landscaping to meet current water efficiency standards, and keep plants healthily.	Regular maintenance once a week and monthly inspection to determine any water deficiencies.

Common Area Catch Basin Inspections	HOA	HOA shall inspection common areas where catch basins are located within the surrounding area and remove any trash/ debris.	Inspections/ Cleaning shall occur at least twice per month.
Storm Drain System Stencilling & Signage	HOA	HOA to inspect and repair as needed all onsite storm drain stencilling & signage.	Inspection should occur at minimum twice per year.
Modular Wetlands System (MWS) Biofiltration Vaults	HOA	HOA will be required to hire a professional maintenance company to provide regular inspections, repairs and cleaning per manufacturer's specifications.	Inspections/ Cleanings should occur at least two times per year and before the start of the rainy season (October 1st). Refer to Attachment C for additional information and manufacturer's specifications.
Modular Trough Diversion System	HOA	HOA to inspect system and schedule maintenance when deficiencies are noted. Area near system to be kept free of debris and cleanings shall be scheduled to remove silt from trough as needed	Inspections should occur at least two times per year and before the start of the rainy season (October 1st).
Connector Pipe Screen (CPS) Device	HOA	HOA to inspect and schedule maintenance to remove debris bluid-up, repair/ replace screen and mechanism, and clean as needed within catch basin and screen area.	Inspections shall occur at least two times per year and once per year for maintenance services before the start of the rainy season (October 1st).
BioClean Urban Pond	HOA	HOA will be required to hire a professional maintenance company to provide regular inspection, repairs and cleaning per manufacturer's	Inspections/ cleanings should occur at least two times per year and before the start of the rainy season (October 1st). Refer to

		specifications. All trash/ debris and loose sediment/ silt shall be removed per manufacturer's specifications.	Attachment C for additional information and manufacturer's specifications.

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Refer to Attachment B of this report for the WQMP Exhibit which provides the location of all proposed BMPs and a site plan of the project.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be submitted.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Section VII Educational Materials

Refer to the Orange County Stormwater Program (www.ocwatersheds.com) for a library of materials available.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☒	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☐
Household Tips	☒	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☒		☐
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
Tips for the Home Improvement Projects	☒		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☒		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☒		☐

Attachment A

TGD Worksheets and Figures

Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	*Yes*	*No*
1	**Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.		X
Provide basis:			
2	Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): • The BMP can only be located less than 50 feet away from slopes steeper than 15 percent • The BMP can only be located less than eight feet from building foundations or an alternative setback. • A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis:			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis:			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	***Yes***	***No***
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?		X
Provide basis:			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.		X
Provide basis:			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence:	No
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis:	No
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis:	No
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	Infiltration is Feasible

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.55	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.9	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	4,557	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate			**N/A**	
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	3.7	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	2.0	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	1.85	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	48	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	7.4	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	616	sq-ft

$A_{provided}$ = 832sf >616sf ✓

$V_{provided}$ = 4,974cft >4,557cft ✓

D_{max}=7.4 ft <7 ft✓

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.00	
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.03 *	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.90	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.242	cfs

Supporting Calculations

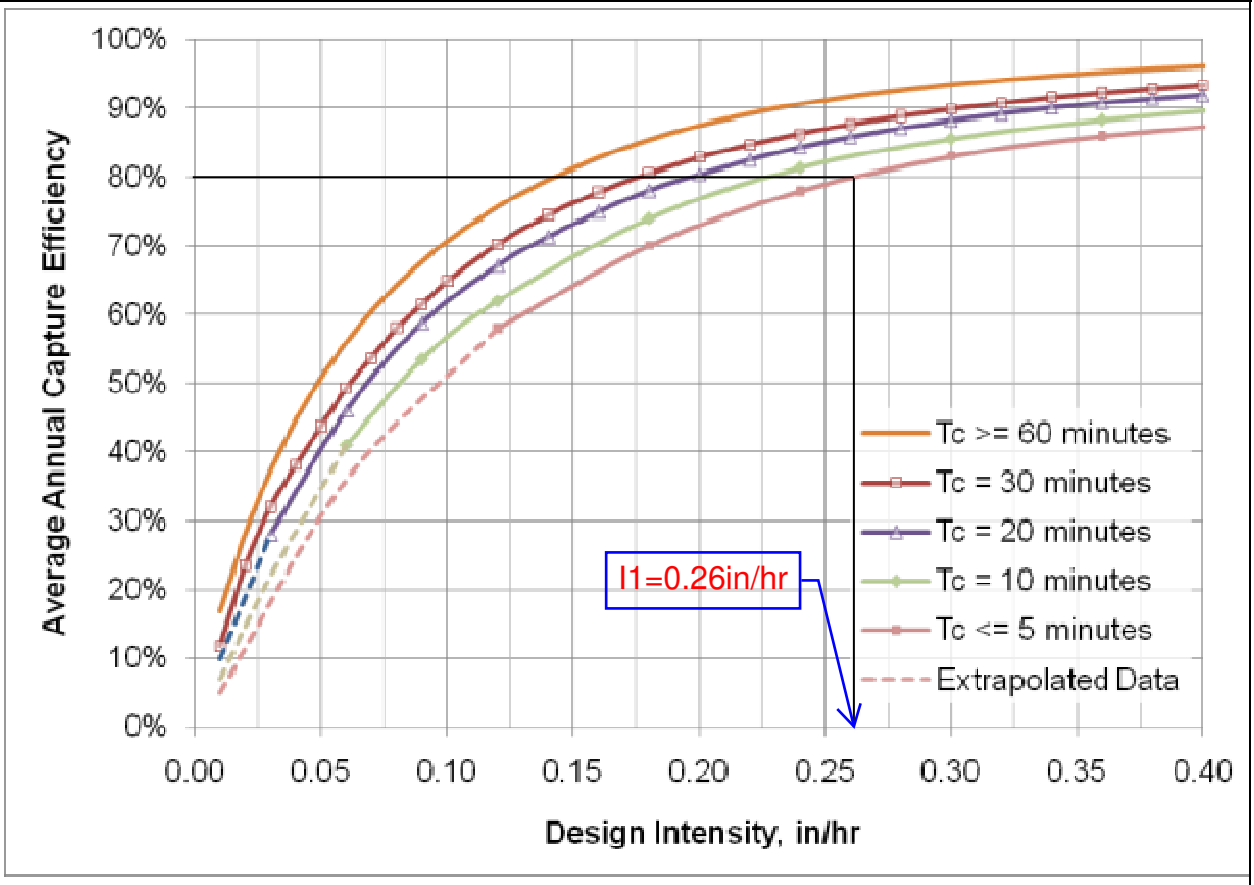
Describe system:
Surface runoff will be conveyed through the private street to the proposed curb inlet catch basin equipped with a Dvert System that diverts low flows to proposed Biofiltration Vault for water quality treatment before entering the proposed infiltration system.

*The tributary area utilized for design flowrate calculations refers to areas contributing to street runoff. Pretreatment for the remaining areas is provided through incorporating landscaping in open-space areas and proposed area drains.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example III.7.

Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet

DMA 1

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	2	0.75
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
B	Design	Tributary area size	0.25	1	0.25
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	1	0.25
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.0
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					1.75 → use 2
Obsrved Infiltration Rate, inch/hr, $K_{Observed}$ (corrected for test-specific bias)					3.7
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					1.85

Supporting Data

Briefly describe infiltration test and provide reference to test forms:
Per the Geotechnical Investigation Report prepared by Alta California Geotechnical Inc, dated January 4, 2021, the site's geotechnical infiltration properties are described as the following:

"Infiltration testing was undertaken using two (2) five foot deep borings (P-1 and P-2). The testing was performed on December 11, 2020 in general accordance with the County of Orange WQMP standards. The two test wells were presoaked at least 24 hours prior to testing. During testing, the water level readings were recorded every 30 minutes until the readings stabilized. The data was then adjusted to provide an infiltration rate utilizing the Porchet Method. The resulting infiltration rates are presented in Table 3-1. The results do not include a factor of safety. Recommendations for infiltration BMP design are presented in Section 6.3"

Table 3-1-Summary of Infiltration Testing (No Factor of Safety)

Test Designation	P-1	P-2
Approximate Depth of Test	5 ft	5 ft
Time Interval	30 minutes	30 minutes
Radius of Test Hole	4 inches	4 inches
Tested Infiltration Rate	0.61 (in/hr)	0.68 (in/hr)

Per the Summary of Additional Infiltration Testing prepared by Alta California Geotechnical Inc, dated February 3, 2021, the site's geotechnical infiltration properties are described as the following:

"Two additional infiltration tests were conducted on February 2, 2021 at the locations show on Plate 1, identified as P-3 and P-4. P-1 and P-2 were presented in the referenced report. The locations of the additional infiltration testing where determined by C&V Consulting. The infiltration

tests were conducted in sand lenses of the young alluvial fan deposits, and boring logs are presented in Appendix A. Infiltration testing utilized deep percolation test methods in general conformance with the Count of Orange Technical Guidance Document standards.

A Summary of the test results is presented in Table A. The results do not include a factor of safety.

Table A-Summary of Infiltration Testing (No Factor of Safety)

Test Designation	P-3	P-4
Approximate Depth of Test	10 ft	15 ft
Time Interval	30 minutes	30 minutes
Radius of Test Hole	4 inches	4 inches
Tested Infiltration Rate	0.8 (in/hr)	3.7 (in/hr)

Refer to Attachment F of this report for a copy of the referenced geotechnical recommendations.

Worksheet I: Summary of Groundwater-related Feasibility Criteria

1	Is project large or small? (as defined by Table VIII.2) circle one	Large	**Small**	
2	What is the tributary area to the BMP?	A	1.51	acres
3	What type of BMP is proposed?	Underground infiltration		
4	What is the infiltrating surface area of the proposed BMP?	A_{BMP}	832	sq-ft
5	What land use activities are present in the tributary area (list all) Multi-Family Residential			
6	What land use-based risk category is applicable?	L	**M**	H
7	If M or H, what pretreatment and source isolation BMPs have been considered and are proposed (describe all): Proposed MWS System Biofiltration Vaults will provide pretreatment for the Design Capture Volume prior to entering the proposed infiltration system. In addition, the proposed BioClean Urban Pond receives pretreated water and is underlain by a gravel bed for further pretreatment prior to infiltrating.			
8	What minimum separation to mounded seasonally high groundwater applies to the proposed BMP? See Section VIII.2 (circle one)	5 ft	**10 ft**	
9	Provide rationale for selection of applicable minimum separation to seasonally high mounded groundwater: Per the TGD Section VIII.2, the following applies to a subsurface infiltration gallery: "Separation to mounded seasonally high groundwater shall be at least 10 feet for infiltration devices that inject water below the subsurface and surface infiltration BMPs with tributary area and land use activities that are considered to pose a more significant risk to groundwater quality."			
10	What is separation from the infiltrating surface to seasonally high groundwater?	SHGWT	50	ft
11	What is separation from the infiltrating surface to mounded seasonally high groundwater?	Mounded SHGWT	n/a	ft
12	Describe assumptions and methods used for mounding analysis: Groundwater was not encountered to a depth of 31 feet below the ground surface. Historic groundwater levels in the area are approximately 87' below the ground surface. State provided information shows the historic high groundwater levels to be more than 50' below the surface/			
13	Is the site within a plume protection boundary (See Figure	Y	**N**	N/A

Worksheet I: Summary of Groundwater-related Feasibility Criteria

	VIII.2)?	
14	Is the site within a selenium source area or other natural plume area (See Figure VIII.2)?	Y **N** N/A
15	Is the site within 250 feet of a contaminated site?	Y **N** N/A
16	If site-specific study has been prepared, provide citation and briefly summarize relevant findings: n/a	
17	Is the site within 100 feet of a water supply well, spring, septic system?	Y **N** N/A
18	Is infiltration feasible on the site relative to groundwater-related criteria?	**Y** N
Provide rationale for feasibility determination:		

Note: if a single criterion or group of criteria would render infiltration infeasible, it is not necessary to evaluate every question in this worksheet.

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY

0.9
0.9
0.95
0.7
0.7
0.75
0.65
0.8
0.85
0.9
0.95
1
1.05

LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

Pacific Ocean
San Pedro Channel

TITLE: RAINFALL ZONES

ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT

JOB: ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526.E

PACE
Advanced Water Engineering

FIGURE
XVI-1

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Feasibility_20110215\9526E_Figure XVI-1_Rainfall Zones_20110215.mxd

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LOS ANGELES COUNTY
ORANGE COUNTY

/ (* (1 '

City Boundaries

+ \ G U R O R J L F 6 R L O * U R X S V

A Soils

B Soils

C Soils

D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers

0 1.8 3.6 7.2 Miles

P:\9526E\6-GIS\Mxd's\Reports\Infiltration\Re asability_20110215\9526E_Figure XVI2a_Hydro Soils_20110215.mxd

TITLE

NRCS HYDROLOGIC SOILS GROUPS

ORANGE COUNTY INFILTRATION STUDY

CA

JOB

ORANGE CO.

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE

XVI-2a

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LEGEND

- Depth To First Groundwater Contours
- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

0 2 4 8 Kilometers

0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2d

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Feasability_20110215\9526E_FigureXVI2d_DepthToGroundwaterOverview_20110215.mxd

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Plume Protection Boundaries

- North Basin Groundwater Protection Project
- South Basin Groundwater Protection Project
- El Toro Marine Base
- Tustin Marine Air Base
- Approximate Selenium Contamination Area

Note: Individual contamination sites are not plotted.
See State Water Resources Control Board Geotracker database (http://geotracker.waterboards.ca.gov),
Department of Toxic Substance Control Envirostor database (http://www.envirostor.dtsc.ca.gov) and other applicable sources for current listing of active contaminated sites.

Groundwater basin and plume protection boundaries for South Orange County are not shown on this exhibit at this time

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY
GROUNDWATER PROTECTION
AREAS

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2f

P:\9526E\6-GIS\Mxd's\Reports\Infiltration\Feasability_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreaSheet\Map_20110215.mxd

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

Tidel Influence

- <= Mean High Water Line (4.28')

Water Body

- Basin
- Lake
- Reservoir

Other Lands

- Airport/Military

Los Angeles County

Humble Reservoir

Orange County

Valencia Reservoir

Fullerton Reservoir

Loftus Diversion Channel

Desilting Basin

Brea Creek Reservoir

Fullerton Reservoir

Fullerton Reservoir

Hillcrest Park Reservoir

Fullerton Airport

Brea

Fullerton

Placentia Retarding Basin

La Jolla Recharge Basin

Miller Retarding Basin

Kraemer Basin

Raymond Retarding Basin

Gilbert Retarding Basin

Crescent Retarding Basin

Anaheim

Santa River Watershed

Cypress Retarding Basin

Channel in Retarding Basin

Rossmoor Retarding Basin

Los Alamitos Naval Air Station

Los Alamitos Retarding Basin

Seal Beach Naval Weapons Station

Seal Beach

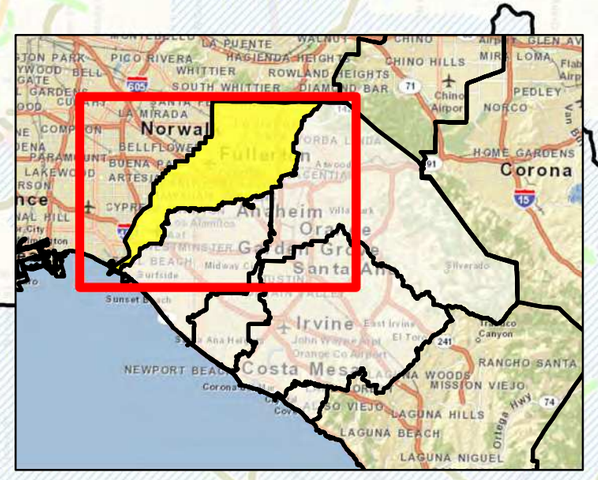
Pacific Ocean

Anaheim Bay-Huntington Harbor Watershed

PROJECT SITE

Newport Bay-Newport Coastal Streams Watershed

0 8,000 16,000 Feet



TITLE: SUSCEPTIBILITY ANALYIS SAN GABRIEL-COYOTE CREEK

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING ORANGE CO. CA

SCALE	1" = 8000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

1

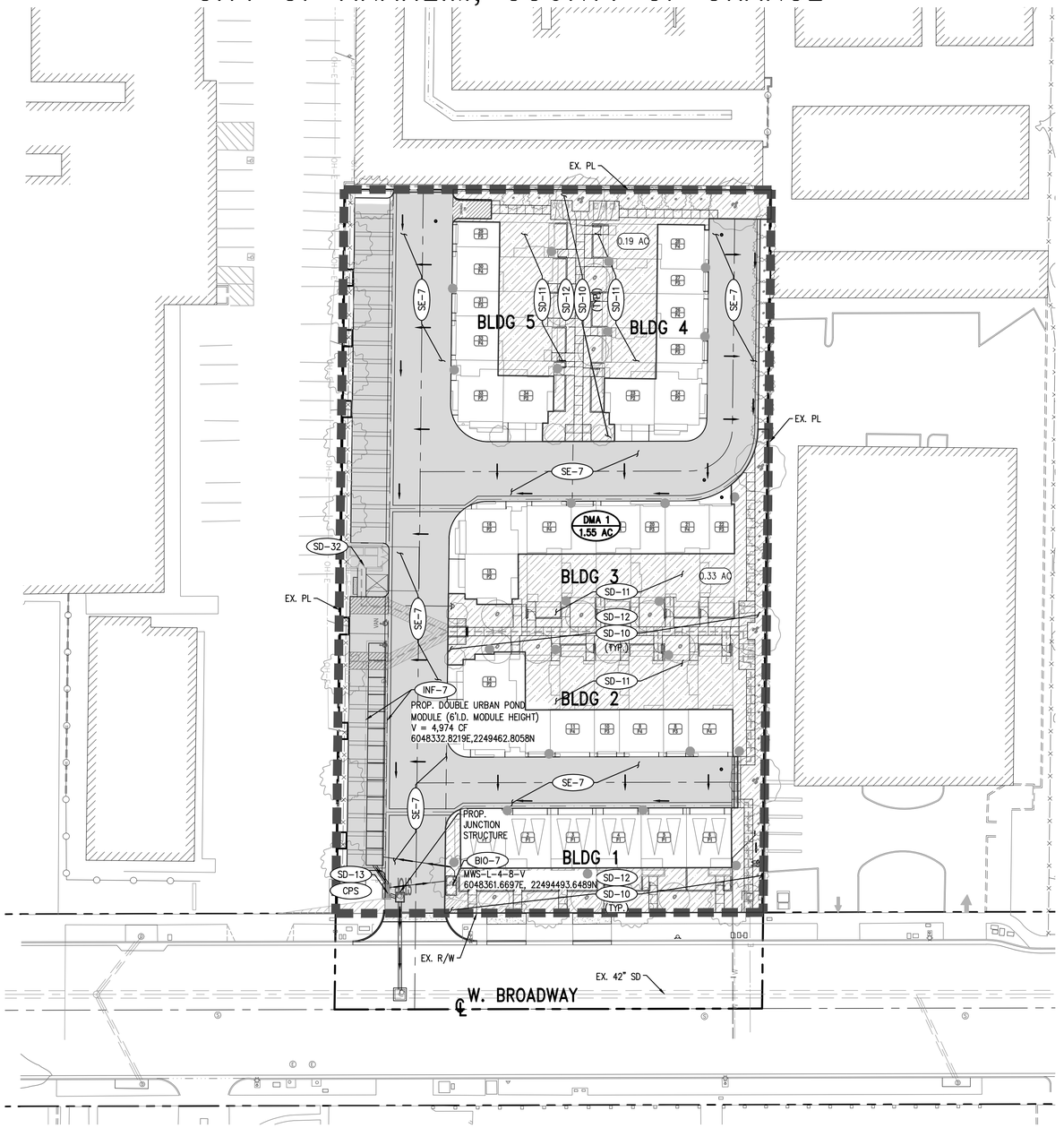
P:\9526E\6-GIS\Mxds\Susceptability Maps_20100505\9526E_SanGabrielCoyoteCreekSusceptibility_20100430.mxd

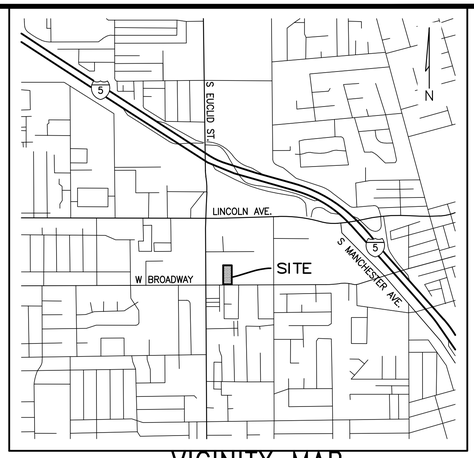
Attachment B

Preliminary WQMP Exhibit

PRELIMINARY WQMP EXHIBIT

TR 19141
1661 AND 1673 W. BROADWAY
CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- PROPOSED RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE MANAGEMENT AREA (DMA)
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- DRAINAGE FLOW ARROWS
- PROPOSED MWS BIOFILTRATION VAULT
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPING
- PROPOSED ASPHALT CONCRETE (AC) PAVEMENT
- PROPOSED TURF
- PROPOSED PCC PAVEMENT
- PROPOSED DECORATIVE PAVEMENT
- EXCLUDED FROM MWS SIZING CALCULATIONS, PRETREATED BY LANDSCAPE

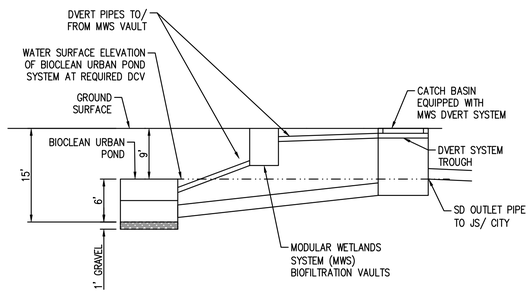
- DMA X / X.XX AC — DRAINAGE MANAGEMENT AREA (DMA) / ACREAGE
- X.X AC — ACREAGE OF AREA EXCLUDED FROM MWS SIZING CALCULATIONS
- ROOF DOWNSPOUT

BEST MANGEMENT PRACTICES (BMPS)

- SD-10 — SITE DESIGN & LANDSCAPE PLANNING
- SD-11 — ROOF RUNOFF CONTROLS
- SD-12 — EFFICIENT IRRIGATION
- SD-13 — STORM DRAIN SIGNAGE
- SE-7 — STREET SWEEPING & VACUUMING
- INF-5 — UNDERGROUND INFILTRATION – BIOCLEAN URBAN POND
- BIO-7 — PROPRIETARY BIOTREATMENT – MODULAR WETLANDS SYSTEM (MWS) BIOFILTRATION VAULT
- CPS — CONNECTOR PIPE SCREEN (CPS) DEVICE FOR FULL TRASH CAPTURE REQUIREMENTS

SCALE: 1" = 30'

0 15 30 60



BIOCLEAN URBAN POND SYSTEM SCHEMATIC DETAIL

NTS

NOTES:

1. DURING THE CONSTRUCTION PHASE OF THIS PROJECT, THE INFILTRATION SYSTEM SHALL BE PHYSICALLY SEPARATED/PROTECTED FROM RUNOFF AND/OR ANY OTHER MATERIAL/LIQUID/DEBRIS.
2. AREA DRAIN SYSTEM WILL BE DESIGNED DURING FINAL ENGINEERING. AREA DRAINS WILL COLLECT AND CONVEY RUNOFF FROM LANDSCAPED AREAS DIRECTLY TO INFILTRATION SYSTEMS.
3. ROOF DRAINAGE IS ASSUMED TO BE CONSISTENT WITH THAT OF A PITCHED ROOF. ROOF DOWNSPOUT LOCATIONS TO BE VERIFIED BY ARCHITECT DURING FINAL ENGINEERING.

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

CITY VENTURES HOMEBUILDING, LLC
3121 MICHELSON DRIVE, SUITE 150
IRVINE, CA 92612
PHONE (949) 258-7540

SOILS ENGINEER :

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 NORTH MAPLE STREET, SUITE 108
CORONA, CA 92880
PHONE (951) 509-7090

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER — RYAN J. BITTNER — No. 68167 — CIVIL — STATE OF CALIFORNIA

TENTATIVE TRACT NO. 19141
PRELIMINARY WQMP EXHIBIT

DATE: 5/11/2021

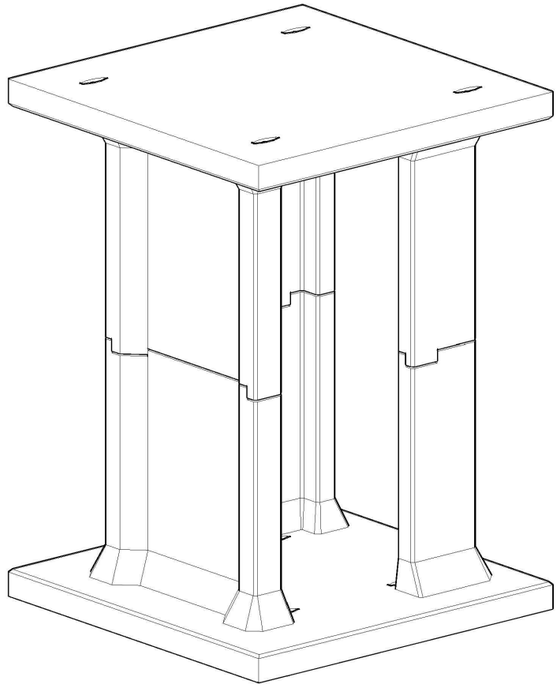
SHEET 1 OF 1

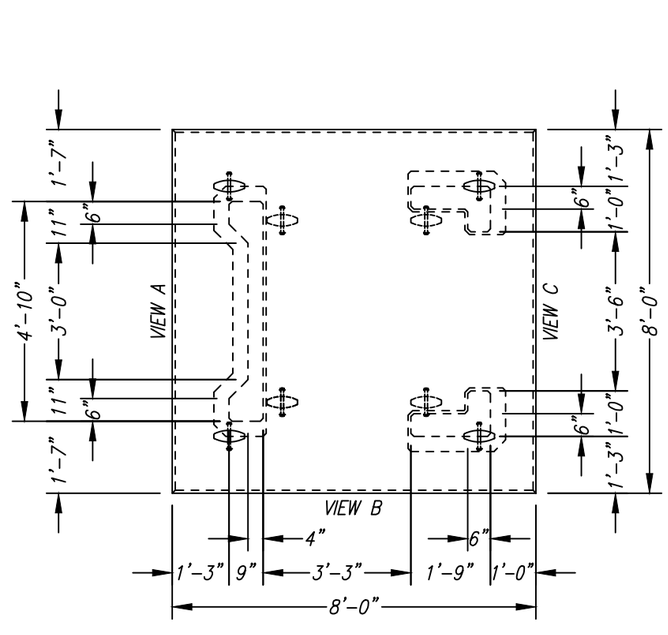
SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

CITY OF ANAHEIM

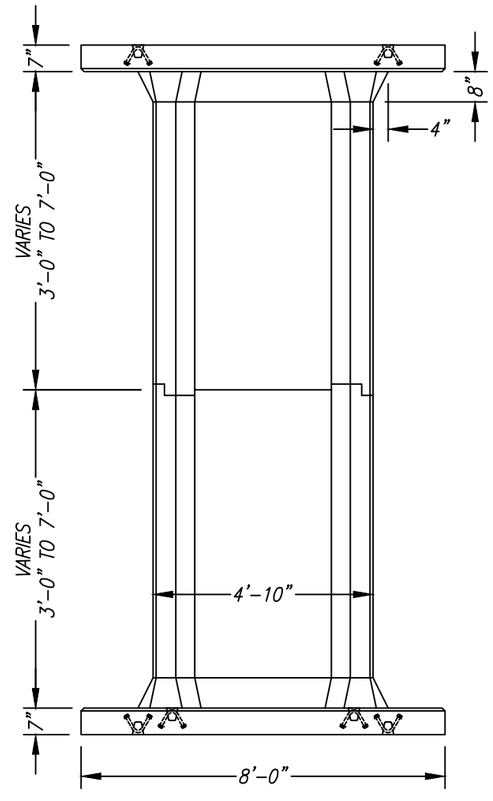
Attachment C

Site BMPs

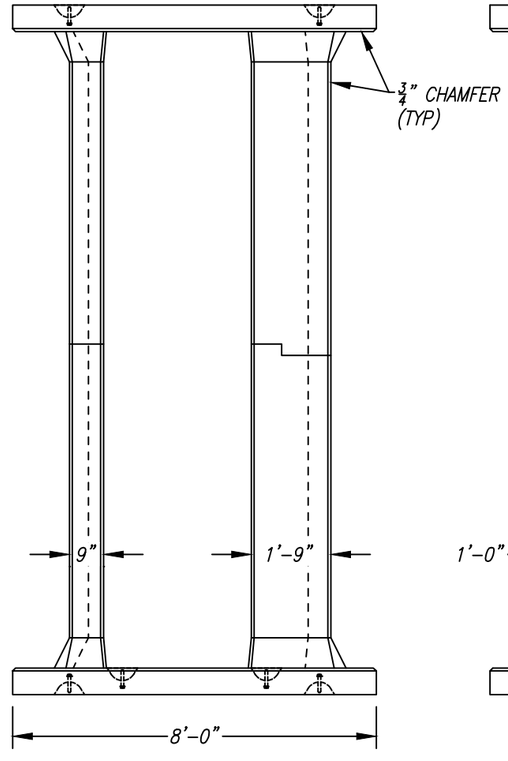




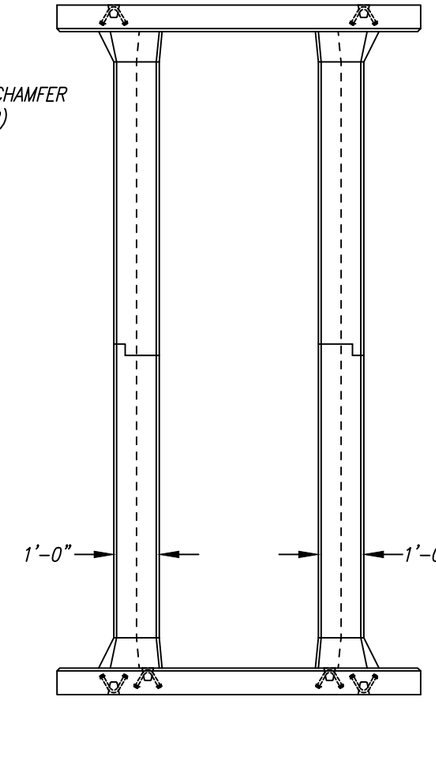
TOP VIEW



ELEVATION VIEW A



ELEVATION VIEW B



ELEVATION VIEW C

1:40 SCALE

7/30/19SSERTICH

BioClean
A Forterra Company

URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - INTERIOR

Bio Clean

A Forterra Company

UrbanPond™

A Stormwater Storage Solution

OVERVIEW

The Bio Clean UrbanPond™ is a technological breakthrough in underground stormwater management.

Its unique square tessellation assembly provides superior strength and material efficiency over traditional rectangular modules. Each module utilizes an offset 3-legged design with two narrow legs running parallel and one wider leg running perpendicular. This unique geometry allows for maximum strength and minimum material usage. The standard design is rated for H-20 loading.

UrbanPond has high void percentages to maximize stormwater volume, and its robust precast form allows systems to be buried deeper without the need for specialized backfill, increased wall thicknesses, or extra rebar reinforcement.

A BREAKTHROUGH SYSTEM FOR MANAGING STORMWATER RUNOFF

ADVANTAGES

- THE SQUARE TESSELLATION PROVIDES SUPERIOR STRENGTH AND LOAD CAPACITY
- DESIGNED TO MEET H-20 LOADING REQUIREMENTS
- CAN BE INSTALLED DEEPER WITHOUT THE NEED TO INCREASE WALL THICKNESS OR ADD ADDITIONAL REBAR
- EVERY MODULE DRAINS DOWN FULLY
- HIGHER VOID PERCENTAGES AND INCREASED MATERIAL EFFICIENCY FOR BEST IN CLASS COST PER CUBIC FOOT STORAGE
- LIGHTER WEIGHT, EASIER TO INSTALL
- A LINKUP SLAB ALLOWS ELIMINATION OF SOME MODULES, FURTHER DECREASING COST AND INSTALLATION TIME

APPLICATIONS

UrbanPond is engineered specifically for:

Detention with controlled discharge utilizing built-in outlet orifice structures.

Retention for long-term retention of runoff onsite to meet strict stormwater requirements.

Harvesting self-contained treatment and reuse of stormwater for irrigation and grey water needs.

Capture & Infiltration of runoff back into underlying native soils for recharge needs.

Treatment utilized as an underground extended detention basin or pond for advanced treatment of stormwater - integrates well with treatment train components (biofiltration, separation, etc.).

Flood Control of peak storm events to minimize downstream flooding and erosion.

Low Impact Development to maximize land use with underground storage - construct an urban infill without a pond at grade.

SPECIFICATIONS

UrbanPond is available with inside heights ranging from 3 feet to 14 feet, in 6 inch increments. Single UrbanPond Modules are available with inside heights ranging from 3 feet to 7 feet, in 6 inch increments, and the Double UrbanPond Modules are available up to 14 feet.

The system's internal offset leg configuration provides channel-less water distribution for stormwater entering and exiting the system.

SINGLE URBANPOND MODULE

I.D. Module Height (ft.)	Module Storage Capacity (cu. ft.)
3	179
4	238
5	298
6	357
7	417

Available in 6 inch increments.

DOUBLE URBANPOND MODULE

I.D. Module Height (ft.)	Module Storage Capacity (cu. ft.)
6	357
7	417
8	477
9	536
10	596
11	655
12	715
13	775
14	834

Available in 6 inch increments.

CONFIGURATIONS

UrbanPond is a modular precast concrete structure that can be assembled from one to several hundred modules in various shapes and configurations to meet site specific constraints and volume requirements.

Each UrbanPond module is 8 feet wide x 8 feet long (outside dimension) - specifically designed to fit on a standard flatbed truck. UrbanPond can be configured in a combination of modules from as low as 3 feet to as high as 14 feet (inside height).

View looking down with top slabs removed.

URBANPOND ASSEMBLY

The UrbanPond is based on a square tessellation. A tessellation is created when a shape is repeated over and over again covering a plane without any gaps or overlaps. Because of the self-supporting characteristic of tessellated-shaped structures, Bio Clean has been able to further reduce material usage and costs up to 20% without sacrificing structural strength.

As shown in the image to the left, the offset leg configuration of the modules creates a very open and channel-less internal space.

In any configuration, each module provides access walkways greater than 3 feet wide for easy access to every module.

SINGLE URBANPOND MODULE

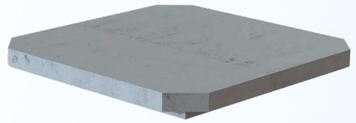
Available in heights from 3 ft. to 7 ft.

RISER TO GRADE

For easy maintenance and inspection access.

LINKUP SLAB

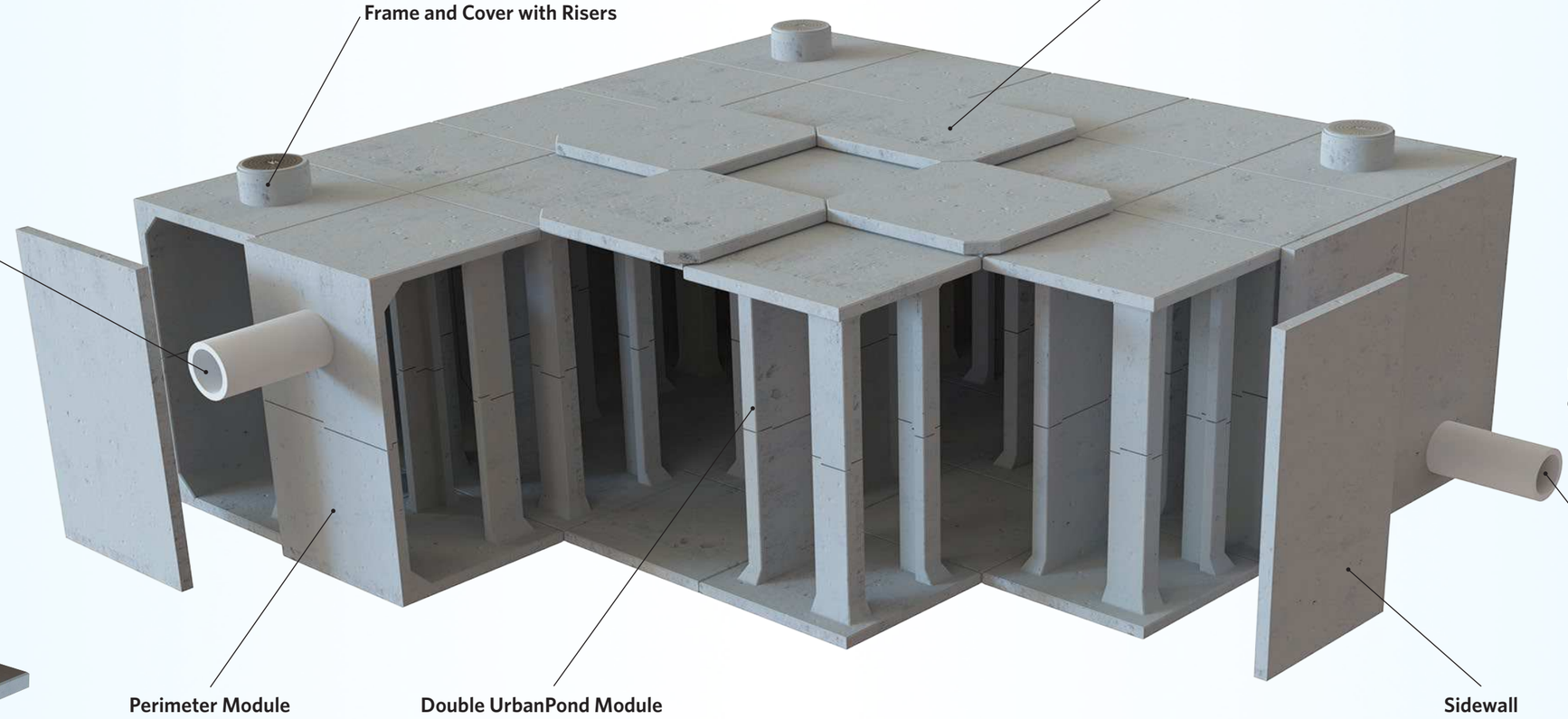
LinkUP Slabs span the open cavities like a checkerboard.



DOUBLE URBANPOND MODULE

Available in heights from 6 ft. to 14 ft.

UrbanPond can be engineered with optional infiltration openings.



PERIMETER MODULE

Built-in perimeter wall

INSTALLATION

Each Single UrbanPond module is 8 ft. wide by 8 ft. long (O.D.) and easily fits onto a flatbed truck. This size maximizes the space on each truck load. A 12 foot Double UrbanPond module (two pieces) weighs only 20,000 lbs. total, or only 10,000 lbs.

As many as 4 individual pieces can be delivered on a single truckload to reduce shipping costs and minimize crane requirements during install. Most units can be installed using a simple backhoe due to low weights.

MAINTENANCE

UrbanPond is designed to be easily accessed and maintained from finished surface via multiple access ports. Using a standard vacuum truck, each access point is conveniently located, as ports are strategically placed throughout the assembly.

Modules can be modified to act as clear wells or pretreatment chambers for capturing trash, debris, and sediment. This consolidates maintenance requirements to a select few modules. Standard manholes, hinged manholes, and other access hatches are available.

Section [_____]
Stormwater Storage System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for underground stormwater storage systems for detention, retention, or infiltration of stormwater runoff. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to identify devices complying with this specification.

01.02.00 Description
Stormwater storage systems (SWSS) are used for detention, retention, or infiltration of storm water. The SWSS is a modular precast concrete storage system composed of multiple modules comprised of a top slab, multiple support legs and walls, maintenance access ports, and optional inlet and/or outlet pipes.

Underground detention systems are used for temporarily collecting stormwater runoff and releasing it at a specified rate. Underground retention systems are used for storing a permanent volume of stormwater runoff. This water can be re-used for a variety of purposes. Underground infiltration allows collected stormwater runoff to recharge into the underlying soils. The SWSS is a precast concrete engineered system composed of interconnected modules.

01.03.00 Manufacturer
The manufacturer of the SWSS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which has a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SWSS shall be manufactured by Bio Clean A Forterra Company, or assigned distributors or licensees. Bio Clean A Forterra Company, can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: 760-433-7640
Fax: 760-433-3176
www.biocleanenvironmental.com

01.04.00 Submittals

01.04.01 Submittal drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Submittal drawings are to detail the SWSS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on submittal drawings
- Design loading
- Maximum and minimum depth of cover
- Seasonal high ground water level (if applicable)

01.04.03 Inspection and maintenance documentation submitted upon request.
01.04.04 Professional Engineer stamped and signed drawings available upon request and may require additional time for review.
01.04.05 Data sheets and installation instructions for lifting inserts, anchors, and other devices are available upon request.
01.04.06 Data sheets and installation instructions for accessory items, such as sealants, gaskets, pipe entry connectors, steps, racks, and other items installed after delivery shall be included with the submittal package.
01.04.07 Design data for loading and material specifications shall be shown on the submittal drawings. This shall include:

- Live load used in design
- Vertical and lateral earth loads used in design
- Depth of soil fill on the structure
- Water table depth used in calculations

01.05.00 Work Included

01.05.01 Specification requirements for installation of UrbanPond.
01.05.02 Manufacturer to supply components of the UrbanPond modules.

01.06.00 Reference Standards

Where applicable, the latest editions of the following standards shall form a part of this specification to the extent referenced. The publications referenced to in the text of this guide specification are by the basic designation only.

AASHTO – American Association of State Highway and Transportation Officials
ACI – American Concrete Institute
ASTM – American Society for Testing Materials
AWS – American Welding Society
CRSI – Concrete Reinforcing Steel Institute
NPCA – National Precast Concrete Association

AASHTO	Standard Specifications for Highway Bridges
AASHTO	Standard Specification for Transportation Materials and Methods for Sampling and Testing
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 517.2R	Accelerated Curing of Concrete at Atmospheric Pressure
ASTM A 36	Specification for Carbon Structural Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM A 184	Specification for Fabricated Deformed Steel Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 496	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706	Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM A 884	Specification for Epoxy-Coated Steel and Welded Wire Fabric for Reinforcement
ASTM A 1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C 76	Specification for reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C 125	Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Specifications for Portland Cement
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 403	Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 566	Test Method for Total Evaporable Moisture content of Aggregate by Drying
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 617	Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM C 857	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C 858	Specification for Underground Precast Concrete Utility Structures
ASTM C 877	Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
ASTM C 890	Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C 891	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 1018	Test method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading)
ASTM C 1037	Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1227	Standard Specification for Precast Concrete Septic Tanks
ASTM C 1231	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders
ASTM C 1240	Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete due to Alkali-Silica Reaction

ASTM C 1399	Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
ASTM C 1550	Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel)
ASMT C 1582	Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM C 1613	Standard Specification for Precast Concrete Grease Interceptors
ASTM G 109	Standard Test Method for Determining the Effects of Chemical Admixtures of the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
AWS D 1.1	Structural Welding Code - Steel
CRSI	Manual of Standard Practice
CRSI	Placing Reinforcing Bars
NPCA	Quality Control Manual for Precast Concrete Plants

01.07.00 General Requirements

01.07.01 The precast concrete modules shall be designed and produced by an experienced and acceptable concrete manufacturer.

01.07.02 The detention, retention, or infiltration modules shall have length and width dimensions of 8' x 8', with an adjustable inside height, and three supporting legs.

01.07.03 The modules shall be able to withstand H20 loading with full impact at 6" minimum cover over the top of the modules.

01.07.04 Groundwater at or below the invert of system.

01.07.05 Lateral soil pressures to be based on active earth pressure. Lateral soil pressure = 35 pcf for 120 pcf backfill unit weight.

01.07.06 Vertical soil pressures: Live load = HS20-44. Dead load = 120 pcf cover fill unit weight.

01.07.07 Engineer to verify geotechnical requirements.

01.08.00 Design

01.08.01 Precast concrete modules shall be designed to withstand design conditions in accordance with the applicable industry design standards. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete modules shall be indicated on the submittal drawings, and designed by a licensed professional engineer.

01.08.02 Joints and sealants between adjacent modules shall be of the type and configuration on the submittal drawings, meeting specified design and performance requirements.

01.08.03 Concrete mix shall be self-consolidating to minimize bugholes and not segregate.

01.08.04 Selections of proportions for concrete mix shall be based on current self-consolidating concrete mix design techniques. At a minimum, ACI 211.1 shall be used.

01.08.05 Mix designs for each strength and type of concrete that will be used are available upon request. Submitted mix designs shall include the quantity, type, brand and applicable data sheets for all design constituents as well as documentation indicating conformance with applicable reference specifications.

01.08.06 Concrete modules shall have a 28-day compressive strength of 6,000 psi for self-consolidating concrete.

01.08.07 Concrete that will be exposed to freezing and thawing shall contain air and shall have a water-cement ratio of 0.45 or less. Concrete which will not be exposed to freezing, but which is required to be leak resistant, shall have a water-cement ratio of 0.48 or less. For corrosion protection, reinforced concrete exposed to deicer salts, brackish water or seawater shall have a water-cement ratio of 0.40 or less.

01.08.08 The air content of concrete that will be exposed to freezing conditions shall be within the limits given below:

Nominal Maximum Aggregate Size (in)	Air Content %	
	Severe Exposure	Moderate Exposure
3/8	6.0 to 9.0	4.5 to 7.5
1/2	5.5 to 8.5	4.0 to 7.0
3/4	4.5 to 7.5	3.5 to 6.5
1	4.5 to 7.5	3.0 to 6.0
1-1/2	4.5 to 7.0	3.0 to 6.0
For specified compressive strengths greater than 5,000 psi, air content may be reduced 1%.		

PART 2 - PRODUCTS

02.01.00 Stormwater Storage

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

02.01.01 Size – As indicated on plans.

02.01.02 Concrete – Manufacturer's approved mix design providing a minimum compressive strength of 6,000 psi at 28 days.

02.01.03 Reinforcing bars – per ASTM A 615 or ASTM A 706, Grade 60.

02.01.04 Reinforcing mesh – per ASTM A 1064, Grade 80.

02.01.05 Cover for reinforcing bars – per ACI 318.

02.02.00 Accessory Items

02.02.01 Joint Wrap – Minimum 8" wide, self-adhesive, flexible joint sealant. Recommend ConSeal CS-212 or equivalent.

02.02.02 Geotextile – Non-woven, 180 lb tensile strength, minimum 7.0 ounce per square yard typical weight.

02.03.00 Concrete Foundation Slab (Provided by Contractor)

When indicated on the plans, contractor shall provide a poured-in-place, reinforced concrete foundation slab.

02.03.01	The foundation slab shall extend a minimum of 1 foot in each direction beyond the footprint of the UrbanPond modules.
02.03.02	Minimum compressive strength of 4,000 psi at 28 days, or as required by site-specific geotechnical engineer recommendations.
02.03.03	Reinforcing bar design as indicated on the plans.

02.04.00 Membrane Liner

When indicated on the plans, a membrane liner for watertight applications is required. The liner shall be placed in between an inner and outer layer of geotextile fabric per Section 02.02.02.

02.04.01	Double-scrim reinforced containment liner with high puncture resistance, UV resistance, and burst strength of 1,250 psi. Recommended BTL 40 or approved equal.
02.04.02	Geotextile fabric of equal area shall be placed on both the interior and exterior faces of the membrane liner to prevent punctures.
02.04.03	Pipe boots supplied by liner manufacturer required for all pipe penetrations.
02.04.04	Liner size or shape may require a liner manufacturer's representative be present for field installations.
02.04.05	Liner to be approved by Enginer of Record.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01	Function - The SWSS is a pre-engineered storage device capable of capturing and retaining stormwater for an extended period of time and is designed to be installed sub-surface and handle various surface load conditions.
03.01.02	Loading - The SWSS must be tested in the field using a full scale stacked internal modules at its maximum height of 14' (ID) and applying loads consistent with AASHTO HL93 requirements and pass all tests as followed without any signs of cracking or failure: • Single wheel center of slab at 2' fill distributed – 28,000 lbs test load • Single wheel center of slab at 2' fill – 35,000 lbs test load • Single wheel center of slab at 8' fill distributed – 98,800 lbs test load • Single wheel "edge" of slab at 2' fill distributed – 28,000 lbs test load • Edge loading – 70,000 lbs load test
03.01.03	Storage Capacity of SWSS as indicated on the plans.

PART 4 - EXECUTION

04.01.00 General

The installation of the SWSS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the UrbanPond modules and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation – Site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Joint Wrap – Seal exterior vertical and horizontal seams with joint wrap in accordance with ASTM C 891. Prepare surfaces and install joint wrap in accordance with manufacturer's instructions.

04.02.03 Field modifications to the modules will invalidate the product warranty and are strictly prohibited without prior written consent from Bio Clean.

04.02.04 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.
Deposit backfill equally around all sides of modules at the same time and same elevation.
Prevent wedging action against modules by stepping or serrating slopes.

04.02.05 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of SWSS.
Compact in even lifts.
Do not disrupt or damage joint wrap during backfilling and compaction.

04.02.06 Concrete Structures – After backfill has been inspected by the governing agency and approved, the concrete structures shall be lifted and placed in proper position per plans.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – SWSS shall be shipped to the job site, and are the responsibility of the contractor to offload the units and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SWSS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor. SWSS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Inspection and Maintenance

04.04.01 Inspection – After installation, the contractor shall demonstrate that the SWSS has been properly installed at the correct location(s), elevations, and with appropriate components. The contractor shall demonstrate that the SWSS has been installed per the manufacturer's specifications and recommendations. All components shall be inspected by a qualified person once at least once per year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of at least once a year or as site conditions require. The maintenance shall be performed by someone qualified.

04.04.03 Material Disposal - All debris, trash, organics, and sediments removed from the UrbanPond system shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The Manufacturer shall guarantee the UrbanPond modules against all manufacturing defects in materials and workmanship for a period of (3) years from the date of delivery to the job site. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SWSS is limited to the recommended application for which it was designed.

[End of This Section]

Bio Clean

A Forterra Company

UrbanPond™

A Stormwater Storage Solution

INSPECTION & MAINTENANCE MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938

stormwater@forterrabp.com | biocleanenvironmental.com

URBAN POND INSPECTION & MAINTENANCE

Inspection and maintenance of the Urban Pond underground detention, retention, or infiltration system is vital for the performance and life cycle of the stormwater management system. All local, state, and federal permits and regulations must be followed for system compliance. Manway access locations are provided on each system for ease of ingress and egress for routine inspection and maintenance activities. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed and providing protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific conditions. Inspection after the first significant rainfall event and at quarterly intervals is typical. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP can exceed its storage capacity, become blocked, or damaged, which can negatively affect its continued performance.

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the underground detention, retention, or infiltration system:

- Bio Clean Environmental Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The key to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Urban Pond underground detention, retention, or infiltration system are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order

to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long term inspection and maintenance interval requirements.

The Urban Pond underground detention, retention, or infiltration system can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
- Observe the upstream drainage area and look for sources of pollution, sediment, trash and debris.
- Observe the inside of the system through the access manholes. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its modules.
- Look for any out of the ordinary obstructions in the inflow and outflow pipes. Check pipes for movement or leakage. Write down any observations on the inspection form.
- Observe any movement of modules.
- Observe concrete for cracks and signs of deterioration.
- In detention and retention systems inspect for any signs of leakage.
- In infiltration systems inspect for any signs of blockage or reasons that the soils are not infiltrating.
- Through observation and/or digital photographs, estimate the amount of floatable debris accumulated in the system. Record this information on the inspection form. Next, utilizing a tape measure or measuring stick, estimate the amount of sediment accumulated in the system. Sediment depth may vary throughout the system, depending on the flow path. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Damaged inlet and outlet pipes.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatables.
- Excessive accumulation of sediment of more than 6” in depth.
- Damaged joint sealant.

Maintenance Equipment

While maintenance can be done fully by hand it is recommended that a vacuum truck be utilized to minimize time requirements required to maintain the Urban Pond underground detention, retention, or infiltration system:

- Bio Clean Environmental Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Vacuum truck
- Trash can
- Pressure washer
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system. Entry into the system will be required if maintenance is required.

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of the system and any upstream detention systems designed to drain down over an extended period of time. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Once all safety measures have been set up cleaning of the system can proceed as follows:

- Using an extension on a boom on the vacuum truck, position the hose over the opened manway and lower into the system. Remove all floating debris, standing water (as needed) and sediment from the system. A power washer can be used to assist if sediments have become hardened and stuck to the walls and columns. Repeat the same procedure at each manway until the system has been fully maintained. Be sure not to pressure wash the infiltration area as it may scour.

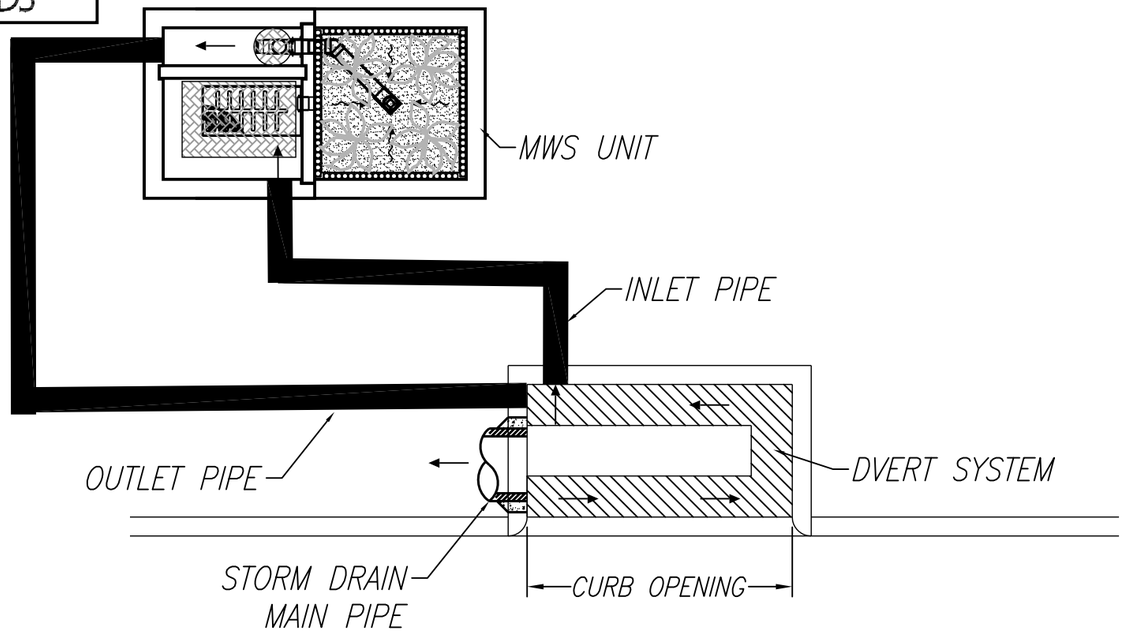
If maintenance requires entry into the vault:

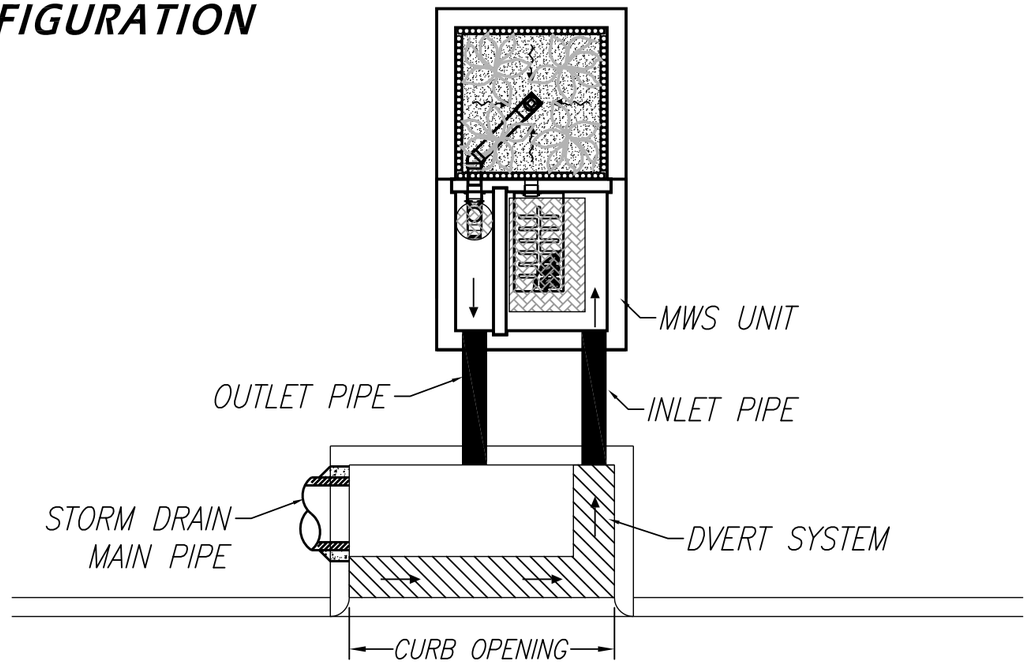
- Following rules for confined space entry use a gas meter to detect the presence of any hazardous gases. If hazardous gases are present do not enter the vault. Follow appropriate confined space procedures, such as utilizing venting system, to address the hazard. Once it is determined to be safe, enter utilizing appropriate entry equipment such as a ladder and tripod with harness.

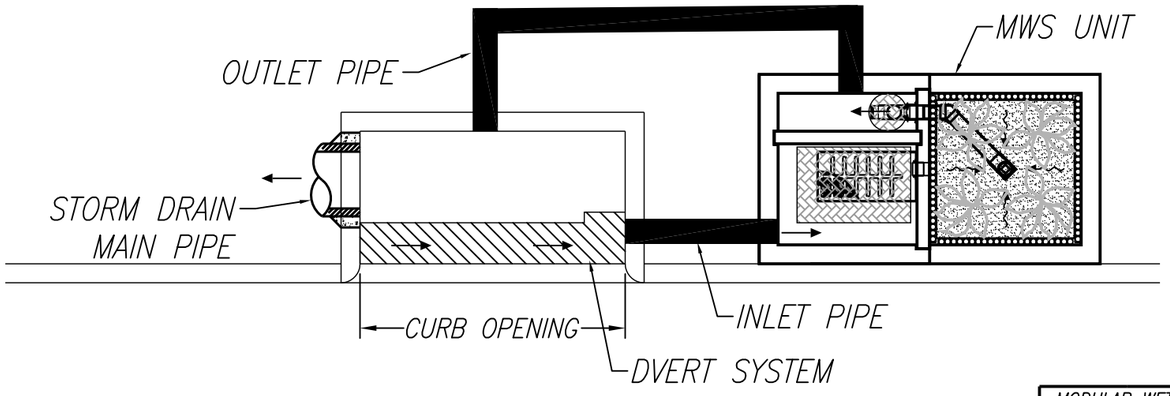
- The last step is to close up and replace all manhole covers and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.

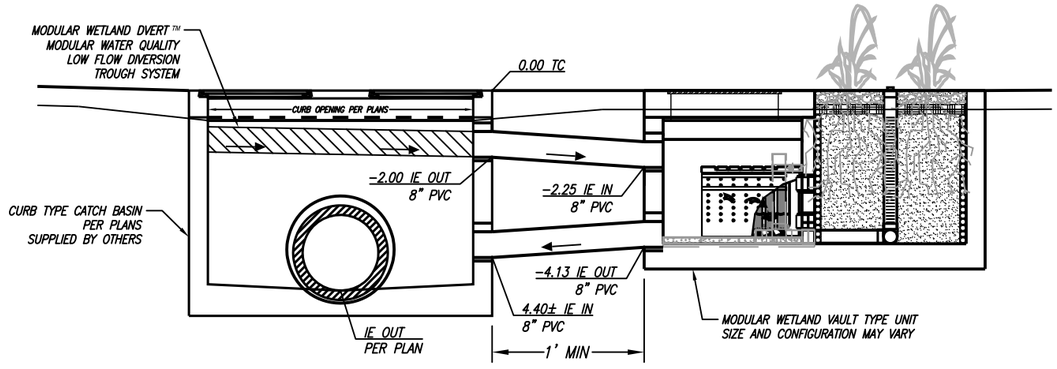
For Maintenance Services please contact Bio Clean at 760-433-7640, or email info@biocleanenvironmental.com.

MODULAR WETLAND SYSTEMS - LINEAR 2.0
STANDARD DVERT CONFIGURATION









MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN		
EDITED		

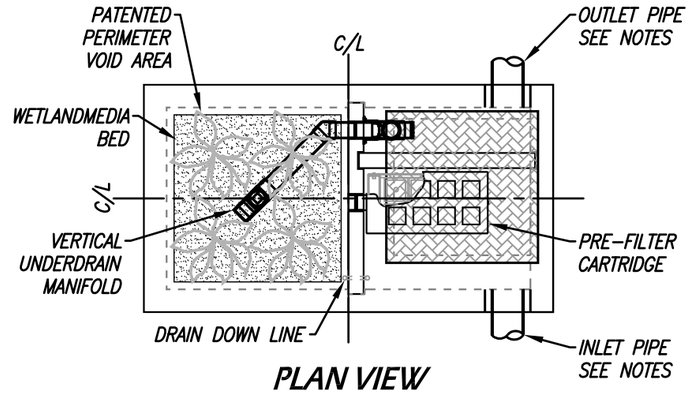
COMMENTS:

TITLE: MWS LINEAR 2.0 DVERT SETUP

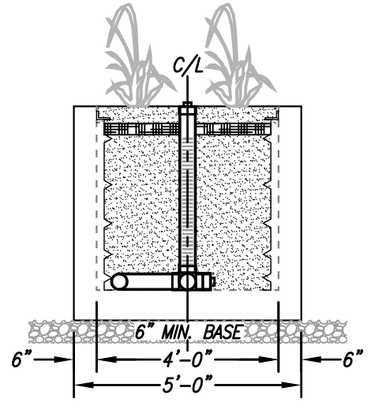
SIZE	DWG. NO.	REV

SCALE NTS | UNITS = INCHES | SHEET 1 OF 1

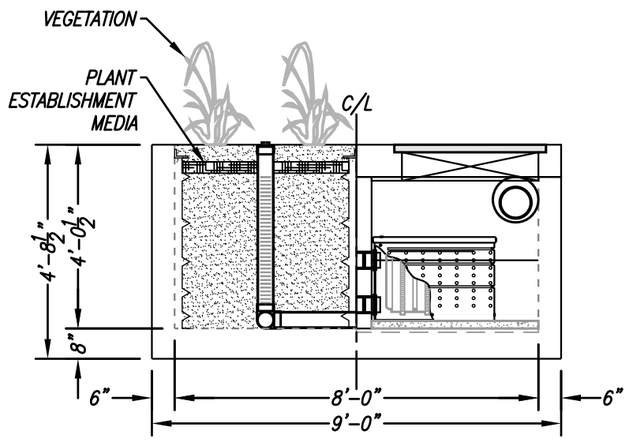
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.03
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.53"
MAXIMUM PICK WEIGHT (LBS)			15000
NOTES:			



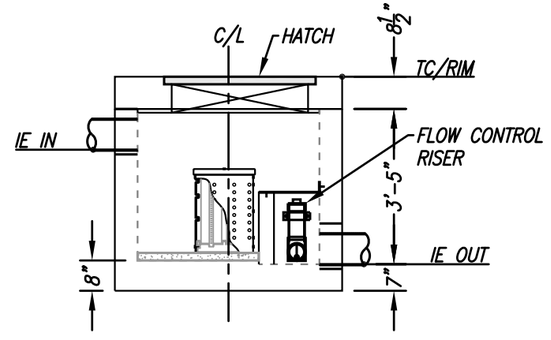
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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MWS-L-4-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

MWS Linear 2.0 HGL Sizing Calculations

MWS MODEL SIZE	WETLAND PERMITER LENGTH	LOADING RATE GPM/SF	HGL HEIGHT																												
			SHALLOW MODELS																			STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS									
			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.65	3.70	3.75	3.80	3.85	3.90	3.95
MWS-L-4-4	6.70	1.0	0.022	0.023	0.025	0.026	0.028	0.029	0.031	0.032	0.034	0.035	0.037	0.038	0.040	0.042	0.043	0.045	0.046	0.048	0.049	0.051	**0.052**	0.054	0.055	0.056	0.057	0.058	0.058	0.059	0.060	0.061
~~**MWS-L-4-6**~~	~~10.00~~	~~1.0~~	~~0.032~~	~~0.035~~	~~0.037~~	~~0.039~~	~~0.042~~	~~0.044~~	~~0.046~~	~~0.048~~	~~0.051~~	~~0.053~~	~~0.055~~	~~0.058~~	~~0.060~~	~~0.062~~	~~0.065~~	~~0.067~~	~~0.069~~	~~0.072~~	~~0.074~~	~~0.076~~	**0.078**	~~0.081~~	~~0.083~~	~~0.084~~	~~0.085~~	~~0.087~~	~~0.088~~	~~0.089~~	~~0.090~~	~~0.091~~
MWS-L-4-6	9.30	1.0	0.030	0.032	0.034	0.036	0.038	0.041	0.043	0.045	0.047	0.049	0.051	0.053	0.055	0.058	0.060	0.062	0.064	0.066	0.068	0.070	**0.073**	0.075	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084
MWS-L-4-8	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124	0.126	0.127	0.129	0.131	0.132	0.134
MWS-L-4-13	18.40	1.0	0.059	0.063	0.068	0.072	0.076	0.080	0.084	0.089	0.093	0.097	0.101	0.106	0.110	0.114	0.118	0.122	0.127	0.131	0.135	0.139	**0.144**	0.148	0.152	0.154	0.156	0.158	0.160	0.163	0.165	0.167
MWS-L-4-15	22.40	1.0	0.072	0.077	0.082	0.087	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.165	0.170	**0.175**	0.180	0.185	0.188	0.190	0.193	0.195	0.198	0.200	0.203
MWS-L-4-17	26.40	1.0	0.085	0.091	0.097	0.103	0.109	0.115	0.121	0.127	0.133	0.139	0.145	0.151	0.158	0.164	0.170	0.176	0.182	0.188	0.194	0.200	**0.206**	0.212	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239
MWS-L-4-19	30.40	1.0	0.098	0.105	0.112	0.119	0.126	0.133	0.140	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.209	0.216	0.223	0.230	**0.237**	0.244	0.251	0.255	0.258	0.262	0.265	0.269	0.272	0.276
MWS-L-4-21	34.40	1.0	0.111	0.118	0.126	0.134	0.142	0.150	0.158	0.166	0.174	0.182	0.189	0.197	0.205	0.213	0.221	0.229	0.237	0.245	0.253	0.261	**0.268**	0.276	0.284	0.288	0.292	0.296	0.300	0.304	0.308	0.312
MWS-L-6-8	18.80	1.0	0.060	0.065	0.069	0.073	0.078	0.082	0.086	0.091	0.095	0.099	0.104	0.108	0.112	0.116	0.121	0.125	0.129	0.134	0.138	0.142	**0.147**	0.151	0.155	0.157	0.160	0.162	0.164	0.166	0.168	0.170
MWS-L-8-8	29.60	1.0	0.095	0.102	0.109	0.115	0.122	0.129	0.136	0.143	0.149	0.156	0.163	0.170	0.177	0.183	0.190	0.197	0.204	0.211	0.217	0.224	**0.231**	0.238	0.245	0.248	0.251	0.255	0.258	0.262	0.265	0.268
MWS-L-8-12	44.40	1.0	0.143	0.153	0.163	0.173	0.183	0.194	0.204	0.214	0.224	0.234	0.245	0.255	0.265	0.275	0.285	0.296	0.306	0.316	0.326	0.336	**0.346**	0.357	0.367	0.372	0.377	0.382	0.387	0.392	0.397	0.402
MWS-L-8-16	59.20	1.0	0.190	0.204	0.217	0.231	0.245	0.258	0.272	0.285	0.299	0.312	0.326	0.340	0.353	0.367	0.380	0.394	0.408	0.421	0.435	0.448	**0.462**	0.476	0.489	0.496	0.503	0.509	0.516	0.523	0.530	0.537
MWS-L-8-20	74.00	1.0	0.238	0.255	0.272	0.289	0.306	0.323	0.340	0.357	0.374	0.391	0.408	0.425	0.442	0.459	0.476	0.493	0.509	0.526	0.543	0.560	**0.577**	0.594	0.611	0.620	0.628	0.637	0.645	0.654	0.662	0.671
MWS-L-10-20 or MWS-L-8-24	88.80	1.0	0.285	0.306	0.326	0.346	0.367	0.387	0.408	0.428	0.448	0.469	0.489	0.509	0.530	0.550	0.571	0.591	0.611	0.632	0.652	0.673	**0.693**	0.713	0.734	0.744	0.754	0.764	0.774	0.785	0.795	0.805
4'x'4 media cage	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124						

SPECIFICATIONS

MWS – Linear

Hybrid Stormwater Filtration System

Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049

www.modularwetlands.com
P 760-433-7640
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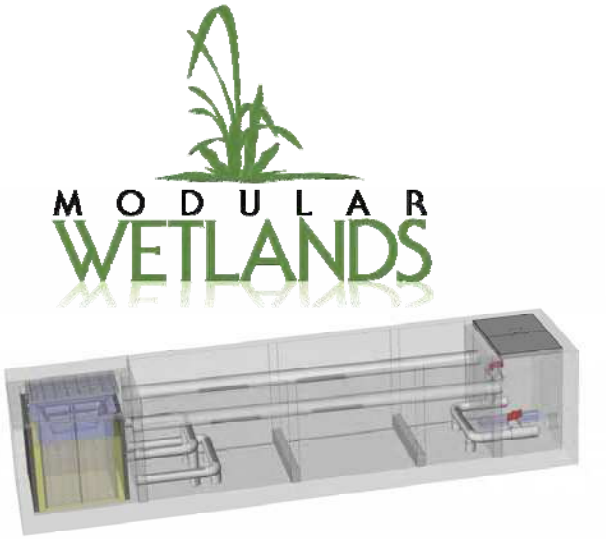
MWS – Linear

Hybrid Stormwater Filtration System



Save valuable space with small footprint for urban sites.

Improve BMP aesthetics with attractive native and tropical landscape plants.

Reduce lifetime costs with safer and less expensive maintenance

"The MWS – Linear hybrid stormwater treatment system is described as a self contained treatment train. This system utilizes an innovative combination of l treatment processes. Stormwater runoff flows into the system via pipe or curb/grate type catch basin opening. Polluted runoff first encounters a screening device to remove larger pollutants and then enters a hydrodynamic separation chamber which settles out the sediments and larger suspended solids. Next the runoff is treated by a revolutionary filter media, BioMediaGREEN that removes fines and associated pollutants, including bacteria. From there runoff enters of bioretention filter in the form of a subsurface flow vegetated gravel wetland. Within the wetland physical, chemical, and biological mechanisms remove the remaining particulate and dissolved pollutants. The purified runoff leaves the system via the discharge chamber. In the discharge chamber the rate of discharge is controlled by valves set to a desired rate".

Tested Pollutant Removal Efficiencies:

TSS Removal	Dissolved Lead Removal	Dissolved Copper Removal	TPH	E. coli Removal	Turbidity Removal
98%	81%	92%	99%	60.2%	92%

"Nature and Harmony Working Together in Perfect Harmony"

SPECIFICATIONS – MWS- LINEAR

Track Record: The MWS- Linear Hybrid Stormwater Treatment System is manufactured by a company whom is regularly engaged in the engineering design and production of treatment systems for stormwater.

Coverage: The MWS- Linear is designed to treat the water quality volume or water quality flow. For flow based design, high flow bypass is internal, for volume based design, high flow bypass is external and prior to pre-detention system. For offline volume based designs the MWS - Linear has the ability to treat the entire water quality volume when used with pre-storage and properly sized.

Non-Corrosive Materials: The MWS – Linear is designed with non-corrosive materials. All internal piping is SD35 PVC. Catch basin filter components, including mounting hardware, fasteners, support brackets, filtration material, and support frame are constructed of non-corrosive materials (316 stainless steel, and UV protected/marine grade fiberglass). Fasteners are stainless steel. Primary filter mesh is 316 stainless steel welded screens. Filtration basket screens for coarse, medium and fine filtration is ¾" x 1 ¾"expanded, 10 x 10 mesh, and 35 x 35 mesh, respectively. No polypropylene, monofilament netting or fabrics shall be used in this system. Media Protective Panels are constructed of UV protected/marine grade fiberglass. Mounts are constructed of stainless steel. BioMediaGREEN is an inert rock substrate and is non-corrosive. Perimeter filter structure is constructed of lightweight injection molded plastic. Mounting brackets are constructed of SD40 PVC and are mounted with 3/8" diameter stainless steel redheads. Drain down filter cover is constructed of UV protected/marine grade fiberglass and stainless steel hinge and mount.

Weight: Each complete unit weighs approximately 29,000 to 40,000 pounds and requires a boom crane to install. Details of this are provided in the installation section of the MWS-Linear Design Kit.

Transportation: The Modular Wetland System – Linear is designed to be transported on a standard flat bed truck. The unit easily fits on a flat bed truck without the need of special permitting.

Alternative Technology Configurations: The Modular Wetland System – Linear is modular is design. Each module will be up to 22 feet long and 5 feet wide. The system can be made in lengths varying from 13 to 100s of feet long. For lengths longer than 22 feet the system will shipped in modules and assembled on site. The Modular Wetland System – Linear has many alternative configurations. This allows the system to be adapted to many site conditions. Runoff can enter the system through a pipe, and/or a built in curb or grate type opening.

Energy Requirements: The Modular Wetland System – Linear is completely passive and requires no external energy sources.

Buoyancy Issues: Buoyancy is only a an issue when ground water levels rise above the bottom of the Modular Wetland System – Linear's concrete structure. With 8.5 cubic yards of wetland media there is no concern of floatation. As a precaution a footing can also be built into the systems concrete structure.

Durability: The structure of the box will be precast concrete. The concrete will be 28 day compressive strength fc = 5,000 psi. Steel reinforcing will be ASTM A – C857. Structure will support an H20 loading as indicted by AASHTO. The joint between the concrete sections will ship lap and joint sealed with ram-nek. Filter (excluding oil absorbent media) and support structures are of proven durability. The filter and mounting structures are of sufficient strength to support water, sediment, and debris loads when the filter is full, with no slippage, breaking, or tearing. All filters are warranted for a minimum of five (5) years.

Oil Absorbent Media: The MWS – Linear utilizes both physical and biological mechanisms to capture and filter oil and grease. A skimmer and boom system will be positioned on the internal perimeter of the catch basin insert. The primary filtration media, BioMediaGreen, utilized in the perimeter and drain down filters, has excellent hydrocarbon removal abilities. Within the wetland filter biological processes capture and

break down oil and grease. Much of the breakdown and transformation of oil and grease is performed by natural occurring bacteria.

Overflow Protection: The grate and curb type MWS – Linear are designed with an internal bypass consisting of two SD PVC pipes which direct high flows around the perimeter and wetland filter, directly into the discharge chamber. For the volume based vault type configuration, bypass should be located prior to the pre-detention system. For peak flows that exceed internal bypass capacity, external bypass is use.

Filter Bypass: Runoff will bypass filtration (BioMediaGREEN and wetland filter) components of the MWS - Linear. The system will still provide screening and settling during higher flow rates for internally bypassed flows. External bypass will bypass of treatment processes.

Pollutant Removal Efficiency: The MWS - Linear is capable of removing over 90% of the net annual total suspended solids (TSS) load based on a 20-micron particle size. Annual TSS removal efficiency models are based on documented removal efficiency performance from full-scale laboratory tests on BioMediaGreen and quarter-scale laboratory tests on the MWS – Linear flow based system.

POLLUTANT	REMOVAL EFFICIENCY
Trash & Litter	99%
TPH (mg/L)	99%
TSS (mg/L)	98%
E. Coli (MPN/100ml)	60%
Turbidity (NTU)	92%
Dissolved Metals (mg/L)	76%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Non-Scouring: During heavy storm events the runoff bypasses perimeter and wetland filter components. The system will not re-suspend solids at design flows.

Uniqueness: The Modular Wetland System – Linear is a complete self contained treatment train that incorporates capture, screening, sedimentation, filtration, bioretention, high flow bypass, and flow control into a single modular structure. This system provides four stages of treatment making it the only 4 stage treatment train stormwater filtration system, therefore making it unique to the industry. Other systems do not incorporate all the necessary attributes to make it a complete stormwater management device as with the Modular Wetland System – Linear. Therefore, no equal exists for this system.

Pretreatment & Preconditioning: Since the Modular Wetland System – Linear is a complete capture and treatment train stormwater management system no external pretreatment of preconditioning is necessary.

SPECIFICATIONS – BioMediaGREEN

BioMediaGREEN is a proprietary engineered filter media. Made of a unique combination of the inert naturally occurring material this product is non-combustible and do not pose a fire hazard, stable and non-reactive, and is also biodegradable. It is stable with no known adverse environmental effects.

This product has been tested in long-term carcinogenicity studies [inhalation and intraperitoneal injection (i.p.)] with no significant increase in lung tumors or abdominal tumors. Short-term biopersistent (inhalation and intra-tracheal injection) studies have shown that the products disappear very rapidly from the lung.

In October 2001, IARC classified this product as Group 3, "not classifiable as to its carcinogenicity to humans". The 2001 decision was based on the latest epidemiological studies and animal inhalation studies that show no relation between inhalation exposure and the development of tumors.

The product can typically be disposed of in an ordinary landfill (local regulations may apply). If you are unsure of the regulations, contact your local Public Health Department or the local office of the Environmental Protection Agency (EPA).

Coverage: When properly installed BioMediaGREEN Filter Blocks provide sufficient contact time, at rated flows, of passing contaminate water. The BioMediaGREEN material will capture and retain most pollutants that pass through it. The BioMediaGREEN material is made of a proprietary blend of inert substances. The BioMediaGREEN Filter Blocks can be used in different treatment devices, including but not limited to flume filters, trench drain filters, downspout filters, catch basin inserts, water polishing units, and hydrodynamic separators.

Non-Corrosive Materials: The BioMediaGreen material is made of non-corrosive materials.

Durability: The BioMediaGREEN material has been chosen for its proven durability, with an expected life of 2 plus years. The BioMediaGREEN material is of sufficient strength to support water, sediment, and debris loads when the media is at maximum flow; with no slippage, breaking, or tearing. The BioMediaGREEN material has been tested through rigorous flow and loading conditions.

Oil Absorbent Media: The BioMediaGREEN material has been proven to capture and retain hydrocarbons.

Pollutant Removal Efficiency: The BioMediaGREEN Filter Blocks are designed to capture high levels of Hydrocarbons including but not limited to oils & grease, gasoline, diesel, and PAHs. BioMediaGREEN Filter Blocks have the physical ability to block and filter trash and litter, grass and foliage, sediments, TSS, particulate and dissolved metals, nutrients, and bacteria.

BioMediaGREEN technology is based on a proprietary blend of synthetic inert natural substances aimed at removal of various stormwater pollutants. BioMediaGREEN was created to have a very porous structure capable of selectively removing pollutants while

allowing high flow through rates for water. As pollutants are captured by its structure, BioMediaGREEN captures most pollutants and maintains porosity and filtering capabilities.

Field and laboratory tests have confirmed the BioMediaGREEN capability to capture large percentage of TSS, hydrocarbons, nutrients, and heavy metals. Microbial reduction efficiency will vary depending on colony size, flow rates and site specific conditions.

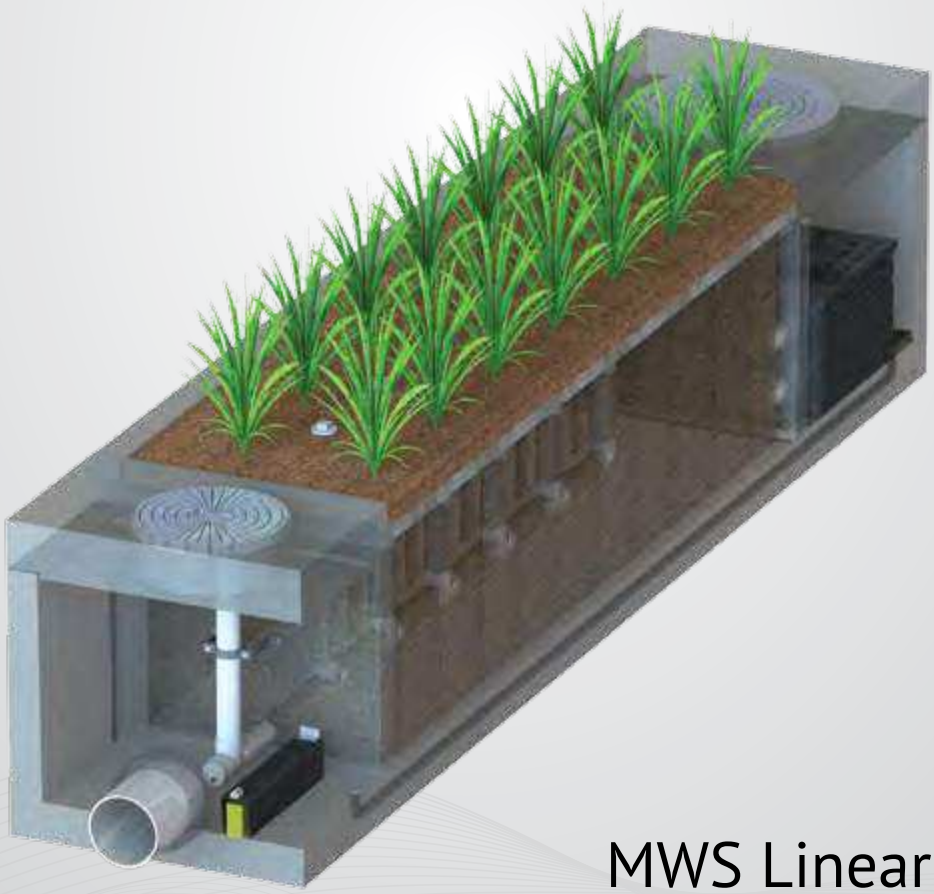
POLLUTANT	REMOVAL EFFICIENCY
Oil & Grease (mg/L)	90%
TPH (mg/L)	99%
TSS (mg/L)	85%
Turbidity (NTU)	99%
Total Phosphorus (mg/L)	69.6%
Dissolved Metals (mg/L)	75.6%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Replacement: Removal and replacement of the blocks is simple. Remove blocks from filtration system. Replace with new block of equal size.

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS Linear

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS Linear

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

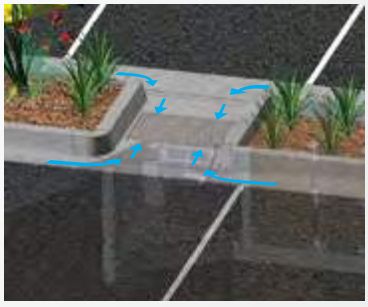
- Agriculture
- Reuse
- Low Impact Development
- Waste Water

Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.

Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.

Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

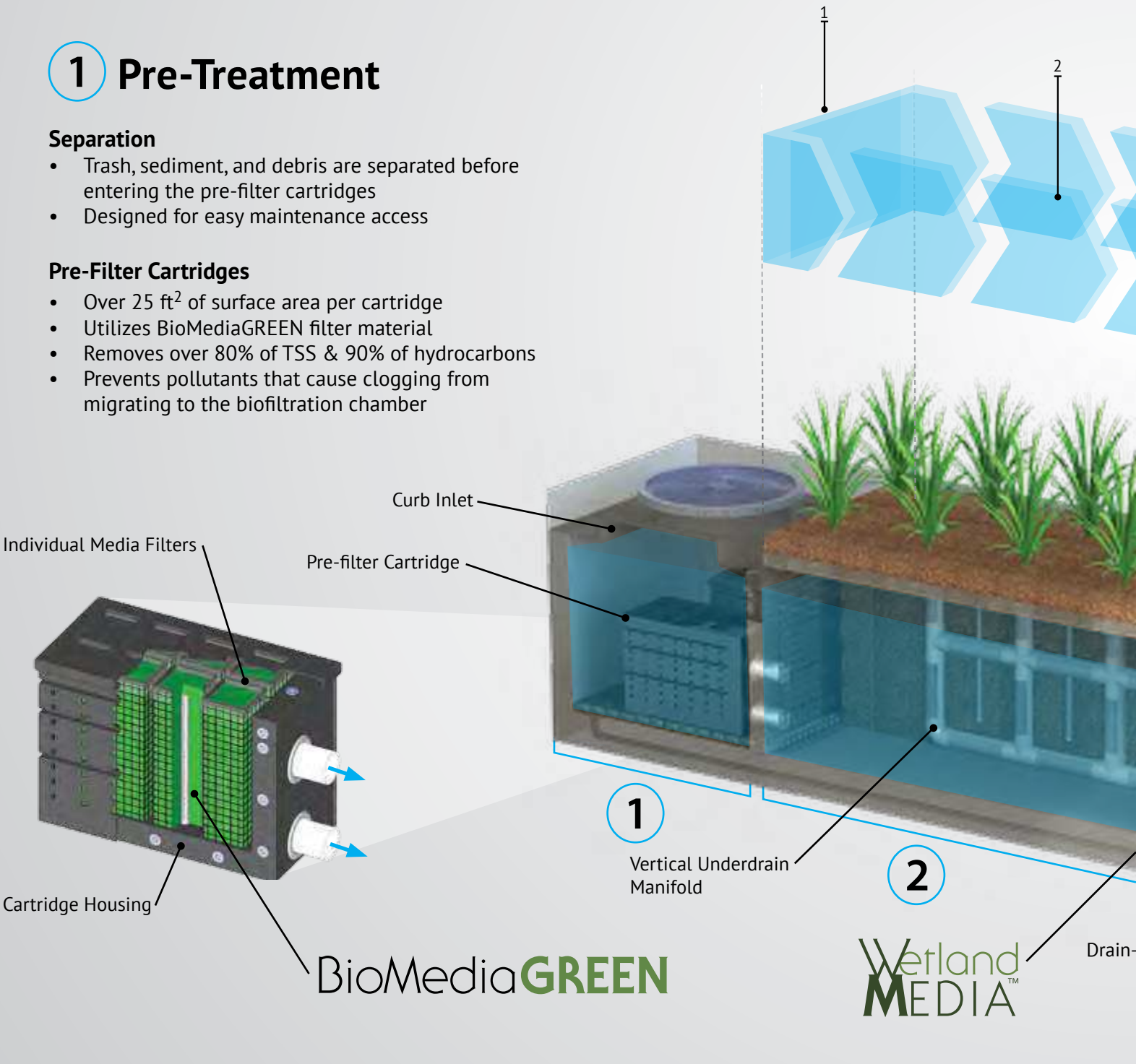
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



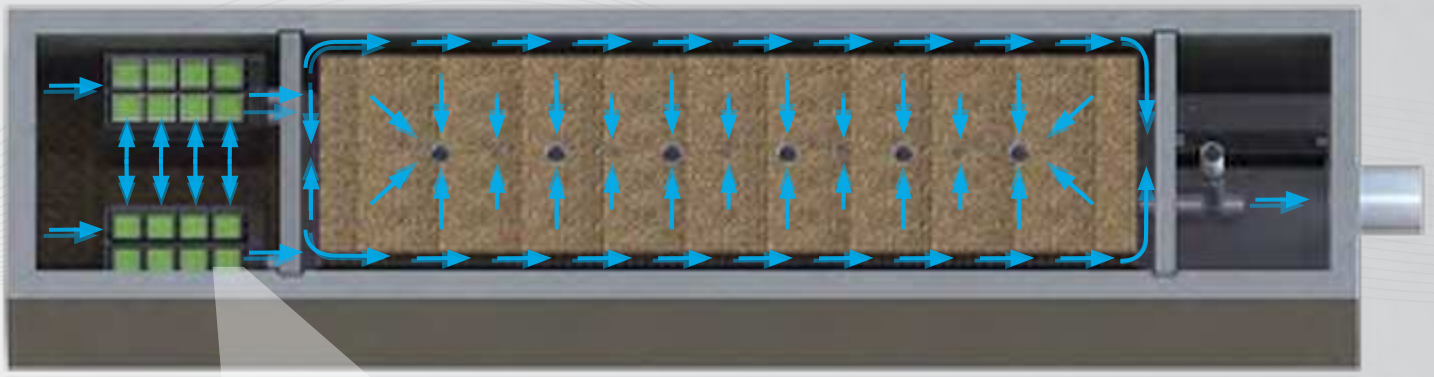


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

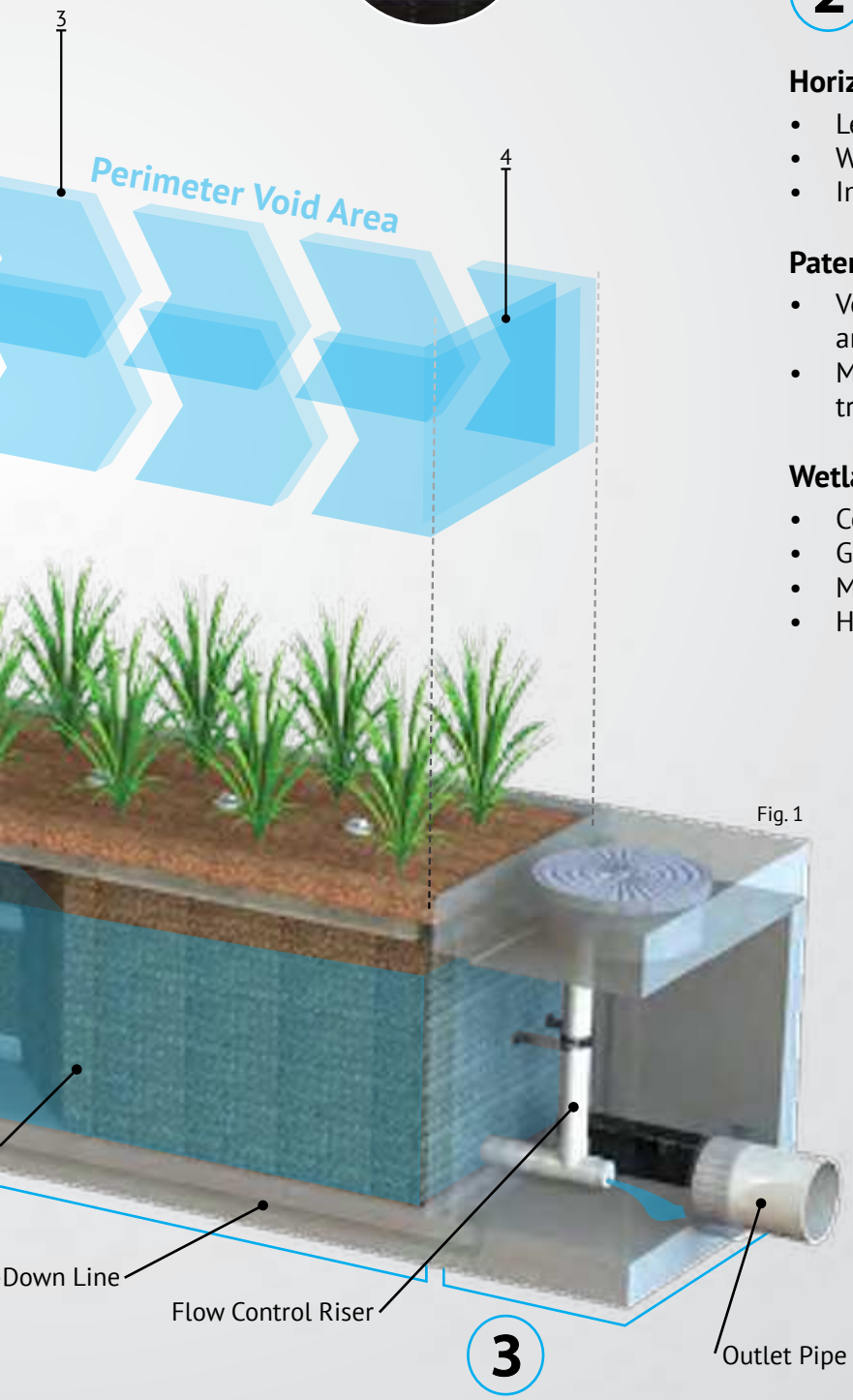


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

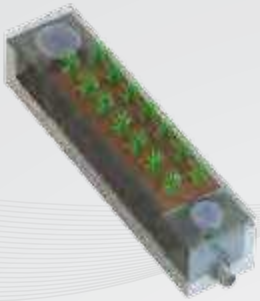
Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.



End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

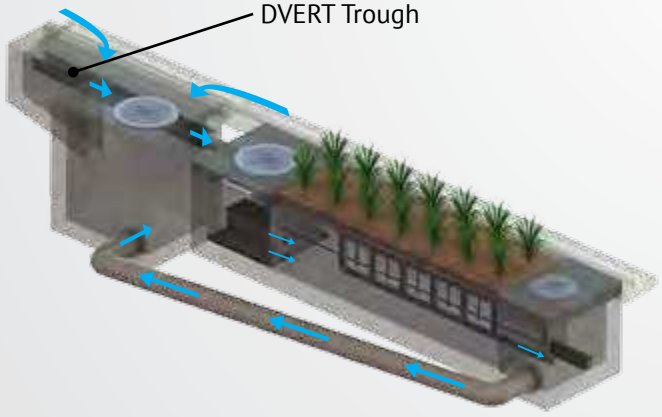
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State DOE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

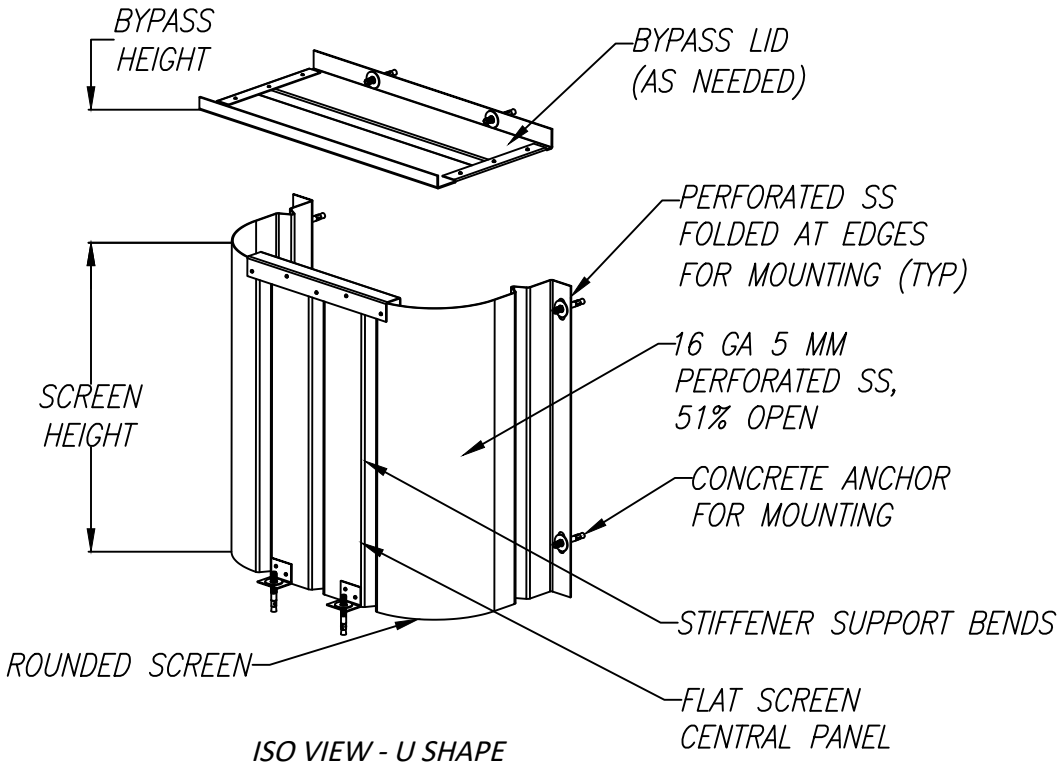
Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

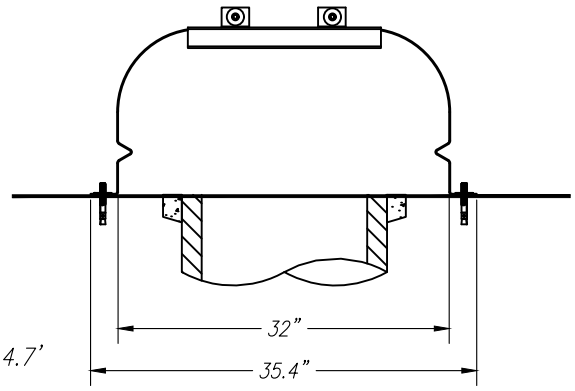
Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

CONNECTOR PIPE SCREEN (CPS)
U 4.7



ISO VIEW - U SHAPE

CPS U WITH 4.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	6.67
18	12.26
24	18.88
30	26.40
36	34.71
NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.	



TOTAL SCREEN LENGTH ~ 4.7'
SPAN LENGTH = 32"
COMPATIBLE WITH PIPES UP TO Ø24"

TOP SECTION VIEW - U SHAPE

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

Bio Clean

A Forterra Company

Bio Clean CPS

A Stormwater Trash Capture Solution

OPERATION & MAINTENANCE MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938

stormwater@forterrabp.com | biocleanenvironmental.com

OPERATION & MAINTENANCE

CPS devices should be maintained by individuals who are trained in proper disposal procedures, confined space entry and traffic safety regulations. When servicing a Bio Clean CPS device be sure to follow all safety and traffic control protocols as well as wearing all proper personal protection equipment such as gloves, safety glasses, hard-hat, safety vest and work boots.

Visual Inspection

1. Begin by inspecting the inflow of the catch basin where the Bio Clean CPS device is located. Check for any obstructions to inflow of the CB unit. If any large obstructions are found, have them removed. Once the inflow inspection is completed, remove the man-hole cover for further inspection. (Note: Confined Space Entry Procedures may apply if trained personnel intend to enter the interior space of any Catch Basin. Please follow all applicable confined space entry procedures)

2. Remove the manhole cover and visually estimate the amount and types of debris found in the CB unit. Look for any visual signs of damage that may compromise the CB unit to function properly. Inspect for any standing water in the CB unit as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods.

Cleaning Procedures and Frequencies

1. Like all other storm water BMP's, Bio Clean CPS devices require periodic maintenance. Routine inspection and maintenance intervals for all CPS devices are typically twice per year for inspections and once per year for maintenance service. Bio Clean CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area, such as certain downtown areas, retail/restaurant, or residential areas where a significant amount of vegetation/foliage is located. In such cases, Bio Clean CPS devices may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service, depending on pollutant load conditions.

2. To begin Bio Clean CPS cleaning procedures, conduct a visual inspection of the CPS device and the surrounding area to ensure a safe working environment. Setup appropriate barriers and signage as necessary to establish a work zone surrounding the catch basin. Once the work zone has been established, remove the manhole cover from the catch basin.

3. Once the manhole cover is removed from the basin the Bio Clean CPS is ready for servicing. All debris can be removed by either a vacuum truck or manually removing sediment and debris by hand.

4. Bio Clean CPS devices shall be cleaned using a pressure washer as may be necessary if any materials are found to cause occlusion or clogging of the screen.

Disposal

1. All trash and debris removed from the Bio Clean CPS unit shall be disposed of in accordance with local, state and federal regulation.

2. Solid waste disposal can be coordinated with local landfills. Liquids may need to be disposed of by wastewater treatment plant, municipal vacuum truck decant facility or approved facility.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Section [_____]
Stormwater Connector Pipe Screen

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Connector Pipe Screens used for collecting trash and debris inside catch basins. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Stormwater Connector Pipe Screens (CPS) are used to prevent trash and debris from entering the stormwater system during dry weather and moderate storm flows by keeping the trash inside the catch basin. The CPS is a screen placed permanently or temporarily in a catch basin at the location of the outlet pipe. The screen separates trash and debris from stormwater treatment flows. Flows that exceed the treatment flow rate bypass over the top of the screen. When the outlet pipe is located below a curb opening the CPS features a lid to prevent debris from passing behind the screen and flowing directly to the outlet pipe. The CPS shall be designed to retain all trash larger than 5 mm (0.197 inches) in the catch basin.

01.03.00 Manufacturer
The manufacturer of the CPS shall be one that is regularly engaged in the engineering, design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which has a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the CPS(s) shall be a screen device manufactured/distributed by Bio Clean Environmental Services, Inc., or assigned distributors or licensees. Bio Clean Environmental Services, Inc. can be reached at:

5796 Armada Drive, Suite 250
Carlsbad, CA 92008
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

01.04.00 Submittals

01.04.01 Submittal drawings will be provided with each order to the contractor and engineer of work.

01.04.02 Submittal drawings are to detail the CPS, its components and the sequence for installation, including:

- CPS configuration with primary dimensions
- Various CPS components
- Any accessory equipment

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of CPS.

01.05.02 Manufacturer to supply CPS(s):

- Screen
- Mounting hardware
- Bypass lid with supports (when required)

PART 2 – COMPONENTS

02.01.01 The CPS shall have a sufficient structural integrity to withstand a lateral force of standing water within the catch basin area when the screen becomes 100% clogged. The CPS unit shall be bolted to the catch basin walls.

02.01.02 The CPS shall be configured with deflector plates or screens preventing trash from falling between the screen and connector pipe. The deflector plate shall be designed to withstand a vertical load.

02.01.03 The gap at the bottom, sides, and joints of the CPS unit shall not exceed 5 mm (0.197 inches).

02.01.04 The CPS shall include vertical structural stiffeners extending the full length of the screen in the form as bends in the screen itself, a bolting surface to fasten the CPS to the wall of the catch basin, and support for the upper portion of the CPS unit referred to as the "bypass."

02.01.05 All parts/components of the CPS unit must be sized to fit through the catch basin's manhole opening.

02.01.06 The CPS frame shall be fabricated from 304 stainless steel.

02.01.07 The CPS screen shall be fabricated from perforated 304 stainless steel. The screen shall have a minimum thickness of 16 gauge. The geometrical opening shape shall have a diameter of 5 mm (0.197 inches).

02.01.08 The screen material used shall have at least 45% open area.

02.01.09 Any edge of the CPS that is not flush with the wall or floor of the catch basin shall be smooth with no prongs or jagged edges.

02.01.10 The assembly bolts, screws, nuts, and washers shall be fabricated entirely from 316 stainless steel. The concrete anchor bolts shall use a wedge anchor, with Type 316 stainless steel threaded rods, nuts, and washers.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The CPS has no moving internal components and functions based on gravity flow, unless otherwise specified. Stormwater runoff enters the catch basin through a curb opening and flows toward the connector pipe. The CPS is placed to intercept flows prior to exiting the catch basin through the connector pipe. The CPS must be able to be removed through the catch basin opening. Stormwater flow up to the peak treatment rate is processed through the screen. Flows in excess of the peak treatment rate will overtop the screen in a bypass. The lid (when required) shall be place high enough above the screen to allow for full bypass flow.

03.01.02 Pollutants - The CPS will remove and retain trash and debris larger than 5 mm in diameter entering the catch basin during frequent storm events and specified flow rates.

03.01.03 Treatment Flow Rate - The CPS operates through gravity flow. The CPS is to be sized so the screen is capable of passing the calculated project specific water quality flow rate per local standards. All treatment flow rates must include a 50% screen clogging factor.

03.01.04 Bypass Flow Rate – The CPS is designed to fit within the catch basin in a way not to affect the existing hydraulics and treat or bypass all flows. The bypass must be sized with a surface area greater than the outlet pipe size, thus the CPS shall not be a critical point of flow restriction.

PART 4 - EXECUTION

04.01.00 General

The installation and use of the CPS shall conform to all applicable national, state, municipal and local specifications.

04.02.00 Installation

The contractor shall furnish all labor, equipment, materials and incidentals required to install the CPS device(s) and appurtenances in accordance with the drawings, installation manual, and these specifications, and be inspected and approved by the local governing agency. Any damage to catch basin and surrounding infrastructure caused by the installation of the CPS is the responsibility of the installation contractor.

04.02.01 CPS and all components or accessories shall be inserted through the catch basin and properly secured per manufactures installation manual and these specifications.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – CPS shall be shipped to the contractor's address and is the responsibility of the contractor to transport the unit(s) to the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the CPS(s) and its components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted, and unloading has commenced shall be born by the contractor. The CPS(s) and its components shall always be stored indoors and transported inside the original shipping container(s) until the CPS(s) are ready to be installed. The CPS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the CPS has been properly installed at the correct location(s), elevations, and with appropriate supports and fasteners. All components associated with the CPS and its installation shall be subject to inspection by the engineer of work, governing agency, and the manufacture at the place of installation. In addition, the contractor shall demonstrate that the CPS has been installed per the manufacturer's specifications and recommendations. CPS(s) shall be physically inspected regularly in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP) and manufacture's recommendations. An inspection record shall be kept by the inspection operator. The record shall include the condition of the CPS and its appurtenances. The most current copy of the inspection record shall always be copied and placed in the owner's SWPPP.

04.04.02 Maintenance – The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The

manual has detailed information regarding the maintenance of the CPS(s). A detailed Maintenance Record shall be kept by the maintenance operator. The Maintenance Record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the CPS. The most current copy of the Maintenance Record shall always be copied and placed in the owner's Stormwater Pollution Prevention Plan (SWPPP) per governing agency. Upon cleaning: no trash or debris shall be located in the catch basin, on top of the bypass lid, or between the screen; no vegetation shall block the catch basin opening or connector pipe; and no trash or debris shall be located within the catch basin opening.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured and removed from the CPS shall be transported and disposed of at an approved facility for disposal in accordance with local and state regulations. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The manufacturer shall guarantee the CPS against all manufacturing defects in materials and workmanship for a period of (3) years from the date of delivery to the contractor. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The CPS is limited to recommended application for which it was designed.

[End of This Section]

INF-7: Underground Infiltration

Underground infiltration is a vault or chamber with an open bottom that used to store runoff and percolate into the subsurface. A number of vendors offer proprietary infiltration products that allow for similar or enhanced rates of infiltration and subsurface storage while offering durable prefrabricated structures. There are many varieties of proprietary infiltration BMPs that can be used for roads and parking lots, parks and open spaces, single and multi-family residential, or mixed-use and commercial uses.

Also known as:

- *Infiltration vault*
- *Recharge vault*

Underground Infiltration

Source: http://www.contech-cpi.com

Feasibility Screening Considerations

- Infiltration bains shall pass infeasible screening criteria to be considered for use.
- Underground infiltration galleries pose a potential risk of groundwater contamination; pretreatment should be used.

Opportunity Criteria

- Soils are adequate for infiltration or can be amended to provide an adequate infiltration rate.
- Appropriate for sites with limited surface space.
- Can be placed beneath roads, parking lots, parks, and athletic fields.
- Potential for groundwater contamination can be mitigated through isolation of pollutant sources, pretreatment of inflow, and/or demonstration of adequate treatment capacity of underlying soils.
- Infiltration is into native soil, or depth of engineered fill is ≤ 5 feet from the bottom of the facility to native material and infiltration into fill is approved by a geotechnical professional.
- Tributary area land uses include mixed-use and commercial, sngle-family and multi-family, roads and parking lots, and parks and open spaces. High pollutant land uses should not be tributary to infiltration BMPs.

OC-Specific Design Criteria and Considerations

☐ Placement of BMPs should observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations, utilities, roadways, etc.)

☐ Minimum separation to mounded seasonally high groundwater of 10 feet shall be observed.

☐ Minimum pretreatment should be provided upstream of the infiltration facility, and water bypassing pretreatment should not be directed to the facility.

☐ Underground infiltration should not be used for drainage areas with high sediment production potential unless preceded by full treatment control with a BMP effective for sediment removal.

☐ Design infiltration rate should be determined as described in **Appendix VII**.

☐ Inspection ports or similar design features shall be provided to verify continued system performance and identify need for major maintenance.

☐ For infiltration facilities beneath roads and parking areas, structural requirements should meet H-20 load requirements.

Computing Underground Infiltration Device Size

Underground infiltration devices vary by design and by proprietary designs. The sizing method selected for use must be based on the BMP type it most strongly resembles.

- For underground infiltration devices with open pore volume (e.g., vaults, crates, pipe sections, etc), sizing will be most similar to infiltration basins.
- For underground infiltration devices with pore space (e.g., aggregate reservoirs), sizing will be most similar to permeable pavement.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 5: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of "biofiltration" that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Street Sweeping and Vacuuming SE-7

Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TR	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

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- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Attachment D

Reference Material

E 6036406.802 N 2260745.312

E 6057907.005 N 2260745.263

12

14

13

13

FULLERTON

ANAHEIM

CITY OF FULLERTON

CITY OF ANAHEIM

PROJECT SITE

GILBERT RETARDING BASIN
BOIB01

BOIB02
CRESCENT
RETARDING BASIN

BOIB03
RAYMOND
RETARDING
BASIN

COUNTY OF ORANGE

ALL LATERALS ARE 18" RCP ON BALLAST LANE AND OUTRIGGER WAY.

E 6036406.959 N 2244945.134

E 6057907.140 N 2244945.106

NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@ocpw.ocgov.com

N

0 200 400 600 800
FEET

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

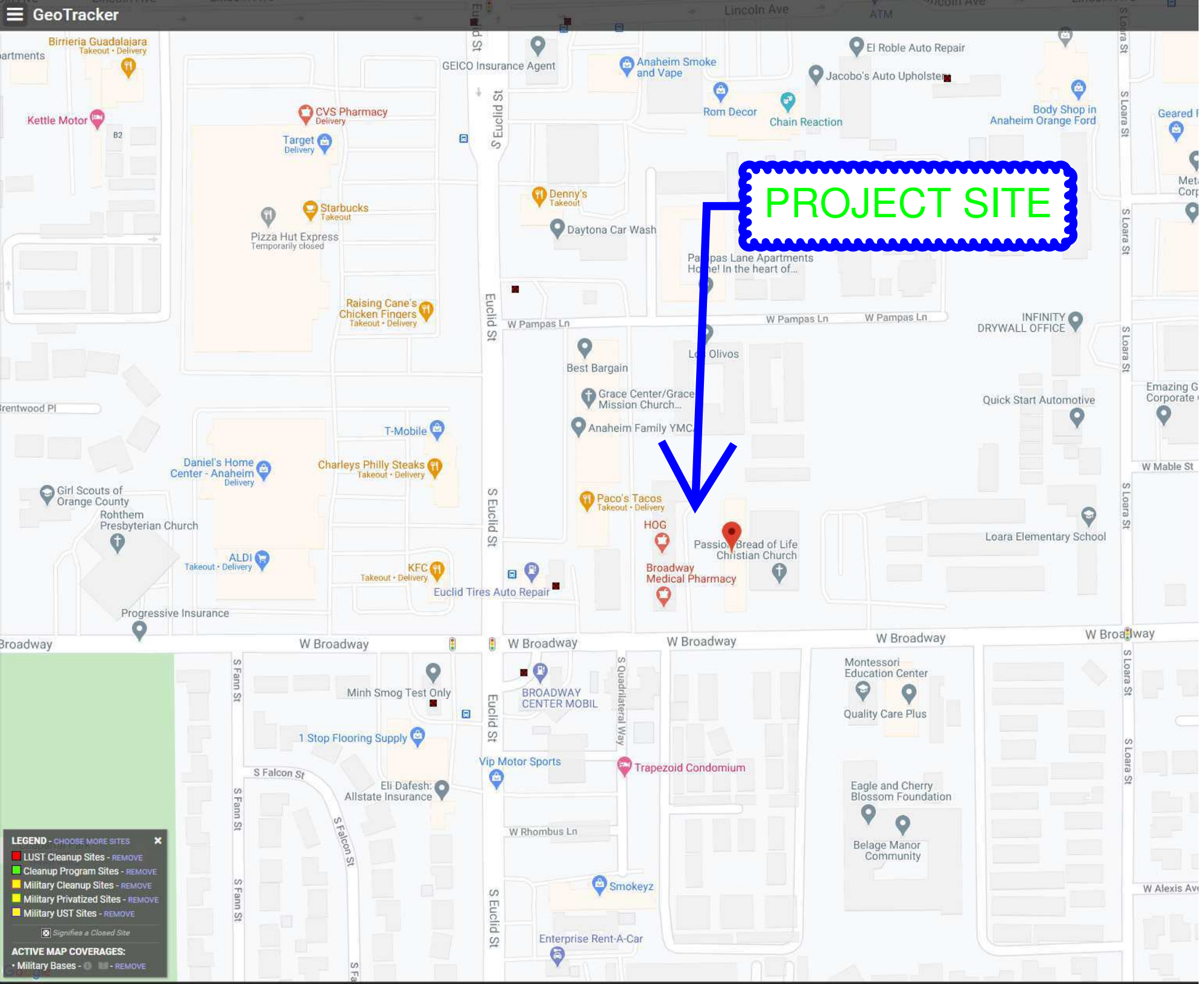
REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	DEC. 20 2010	13	MAPS-113-3

- Channel Drainage Area Boundary
- Major Sub-Area Drainage Boundary
- Minor Sub-Area Drainage Boundary
- Existing O.C.F.C.D. Facility
- Existing Local Facility
- Existing Retarding Basin or Reservoir
- Natural Watercourse
- City Limits
- G G Greenbelt
- P.S. P.S. Pump Station
- Catch Basin (length in feet)
- Drop Inlet or Other Entry
- OCFCD Basins or Reservoirs

Ownership (If other than City or County): Private = P State = S Federal = F

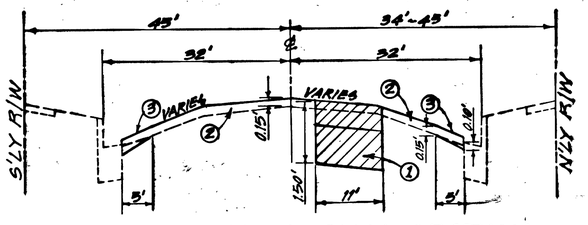
EXISTING FACILITIES

O.C.F.C.D.	LOCAL	
		Earth Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Rectangular Channel (base width by height in feet)
		Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
		Reinforced Concrete Pipe (RCP) (diameter in inches)
		Metal Sheet Channel (MSC) (Base width by pile height in feet./Sheet pile total length)
		Corrugated Metal Pipe (CMP) (diameter in inches)
		Concrete Pipe (diameter in inches)
		Concrete Oval Pipe (width by height in inches)
		Steel Pipe (diameter in inches)
		Reinforced Concrete Arch (base span by height in inches)
		Corrugated Metal Arch (base span by height in inches)

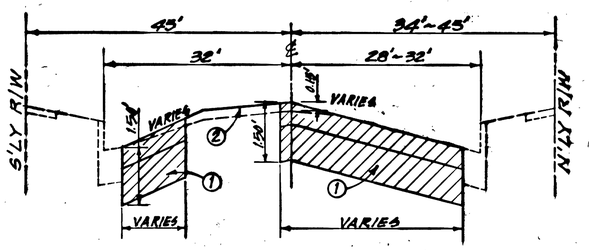

GeoTracker
PROJECT SITE
Birrieria Guadalajara
Takeout • Delivery
Kettle Motor
CVS Pharmacy
Delivery
Target
Delivery
GEICO Insurance Agent
Anaheim Smoke and Vape
El Roble Auto Repair
Jacobo's Auto Upholstery
Rom Decor
Chain Reaction
Body Shop in Anaheim Orange Ford
Denny's
Takeout
Starbucks
Takeout
Pizza Hut Express
Temporarily closed
Daytona Car Wash
Raising Cane's Chicken Fingers
Takeout • Delivery
W Pampas Ln
INFINITY DRYWALL OFFICE
Best Bargain
Grace Center/Grace Mission Church...
Anaheim Family YMCA
Quick Start Automotive
T-Mobile
Daniel's Home Center - Anaheim
Delivery
Charleys Philly Steaks
Takeout • Delivery
Girl Scouts of Orange County
Rohthem Presbyterian Church
Paco's Tacos
Takeout • Delivery
HOG
Broadway Medical Pharmacy
Passion Bread of Life Christian Church
Loara Elementary School
ALDI
Takeout • Delivery
KFC
Takeout • Delivery
Euclid Tires Auto Repair
Progressive Insurance
W Broadway
Minh Smog Test Only
BROADWAY CENTER MOBIL
Montessori Education Center
Quality Care Plus
1 Stop Flooring Supply
Vip Motor Sports
Trapezoid Condomium
S Falcon St
Eli Dafesh: Allstate Insurance
Eagle and Cherry Blossom Foundation
W Rhombus Ln
Belage Manor Community
Smokeyz
Enterprise Rent-A-Car
W Mable St
W Alexis Ave
S Euclid St
S Loara St
S Fann St
S Quadrilateral Way
LEGEND - CHOOSE MORE SITES
LUST Cleanup Sites - REMOVE
Cleanup Program Sites - REMOVE
Military Cleanup Sites - REMOVE
Military Privatized Sites - REMOVE
Military UST Sites - REMOVE
Signifies a Closed Site
ACTIVE MAP COVERAGES:
• Military Bases - REMOVE

QUANTITY ESTIMATE

1	CLEAR AND GRUB	LUMP SUM	
2	SHEETING SHORING AND BRACING	LUMP SUM	
3	EXCAVATION	4155 ~~4075~~	C.Y. ⚠1
4	42" R.C.P. ~ 1500-D	495	L.F.
5	36" R.C.P. ~ 1800-D	662	L.F.
6	24" R.C.P. ~ 2000-D	144	L.F.
7	18" R.C.P. ~ 2000-D	101	L.F.
8	MANHOLE No 4	2	EA.
9	MANHOLE No 2	1	EA.
10	JUNCTION STRUCTURE No 2	4	EA.
11	TRANSITION STRUCTURE	1	EA.
~~12~~	~~A.P.W.A. CATCH BASIN No 1, W = 20'~~	0 ~~1~~	EA. ⚠1
13	CATCH BASIN No 1, W = 20'	4 ~~3~~	EA. ⚠1
14	CATCH BASIN No 1, W = 10'	2	EA.
15	CATCH BASIN No 1, W = 6'	2	EA.
16	P.C.C. COLLAR	4	EA.
17	4" P.C.C. SIDEWALK AND RAMP	1900 ~~1850~~	S.F. ⚠1
18	10" P.C.C. VALLEY CROSS GUTTER	288	S.F.
19	ASPHALT CONCRETE	3796 ~~3515~~	TONS ⚠1
20	BASE MATERIAL	4693 ~~5160~~	TONS ⚠1
21	HEATER REMIX	7730 ~~7760~~	S.Y. ⚠1
22	REJUVENATING AGENT	846 ~~774~~	GAL. ⚠1
23	TRAFFIC LOOPS	33	EA.
24	A.C. PLANING	1585 ~~1683~~	L.F. ⚠1
25	CURB AND GUTTER, TYPE "A"	261 ~~222~~	L.F. ⚠1
26	MOD. SPRINKLER SYSTEM	LUMP SUM	
27	ADJUST MANHOLE TO GRADE	11 ~~12~~	EA. ⚠1
28	ADJUST WATER VALVE BOX TO GRADE	25 ~~20~~	EA. ⚠1
29	8" P.C.C. APRON	644 ~~576~~	S.F. ⚠1
30	P.C.C. CURB TYPE "C"	78 ~~72~~	L.F. ⚠1



BROADWAY ~ TYPICAL SECTION
NOT TO SCALE



CONSTRUCTION NOTES

1. CONST. 0.50' A.C. OVER 1.0' B.M. ~ REMOVE EXIST.
2. CONST. 0.15' A.C. OVERLAY OVER REJUVENATING AGENT OVER HEATER REMIX.
3. PLANE 5' WIDE AT CONCRETE JOINLINE. PLANE 10' WIDE AT A.C. JOINLINE.

CITY OF ANAHEIM

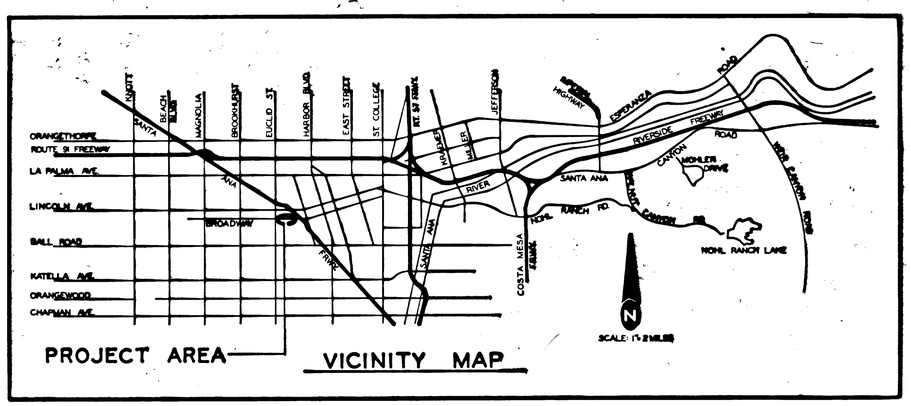
BROADWAY

PLANS FOR THE CONSTRUCTION OF
STREET & STORM DRAIN IMPROVEMENTS
FROM 66' E/o MABLE ST. TO 260' E/o EUCLID ST.

ACCOUNT NO. 12-793-6325-365GO
10-793-6325-365MO
51-483-6993-23351

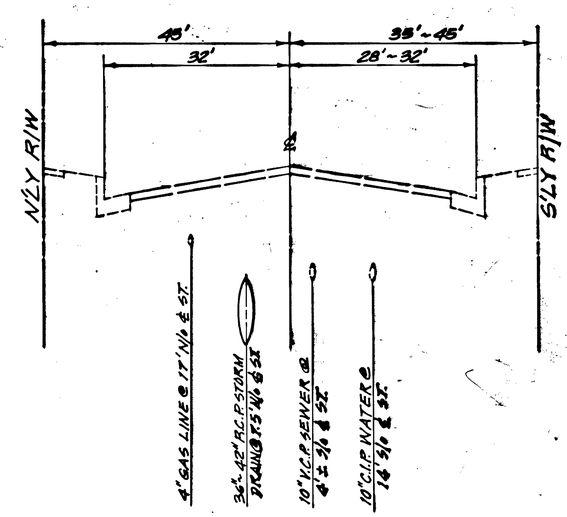
NOTES

1. ⟨1⟩ DENOTES DETAIL NUMBER / ⟨1⟩ DENOTES PLAN NUMBER
2. ALL STATIONING IS ALONG CENTERLINE OF PIPE.
3. EXISTING ELEVATIONS ARE TO BE VERIFIED AT TIME OF CONSTRUCTION AND IF NECESSARY ALL OTHER ELEVATIONS SHALL BE ADJUSTED BY THE FIELD ENGINEER.
4. ALL CURVES ON MAINLINE LATERAL SHALL BE INSTALLED USING BEVELLED PIPE WHERE NECESSARY. NO ADDITIONAL COMPENSATION WILL BE ALLOWED.
5. THE CONTRACTOR SHALL NOTIFY THE FOLLOWING AGENCIES TWO WORKING DAYS PRIOR TO CONSTRUCTION:
   - UNDERGROUND SERVICE ALERT ——— 1-800-422-4133
   - CITY OF ANAHEIM FIELD INSPECTION ——— 714-254-5126
   - SOUTHERN CALIFORNIA GAS COMPANY: ——— 714-634-3258
6. NOTIFY CITY OF ANAHEIM WATER UTILITY, THOM COUGHRAN AT 254-6859, 15 DAYS PRIOR TO CONSTRUCTION FOR RELOCATION AND RECONSTRUCTION OF WATER SERVICES.
7. ALL TREES, SHRUBS, SIGNS, FENCES, WATER METERS, ETC. TO BE PROTECTED UNLESS NOTED OTHERWISE.



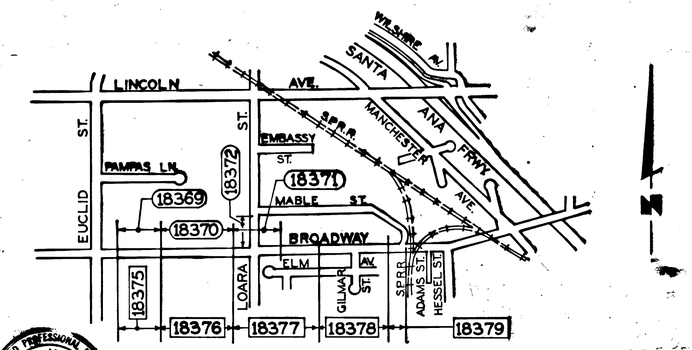
PROJECT AREA — VICINITY MAP

BROADWAY
TYPICAL SECTION
NO SCALE



STORM DRAIN IMPROVEMENT PLAN NUMBERS

STREET IMPROVEMENT PLAN NUMBERS



LOCATION MAP
NO SCALE

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HEPP
C27923
EXP 9-31-94
CIVIL
STATE OF CALIFORNIA

Ralph M. Hepp

AS CONSTRUCTED
A.B.C. DAT 4-12-96

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
⚠1	A.B.C.	REVISED QUANTITY ITEMS PER FINAL PAYMENT.	[illegible]	6/4/96

REFERENCES

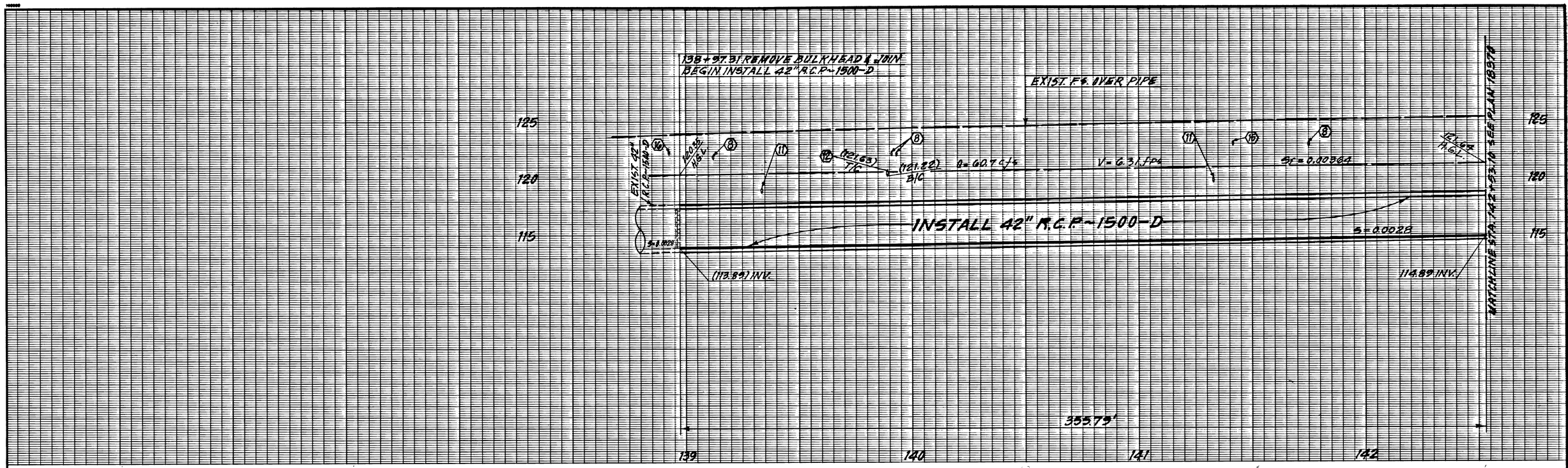
FIELD BOOKS	PAGES	BENCH MARK NO.	ELEVATION	
129 129 A-1	1 THRU 3 7	5A-18-85	122.87	FOR NOTES TO CONTRACTOR SEE PLAN 18368 FOR STANDARD DETAILS SEE 110, 301, 302, 308, 311, 312, 313, 314, 315, 317, 318, 410, 424, 428, 444, 519, A.P.W.A. 307-0 PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

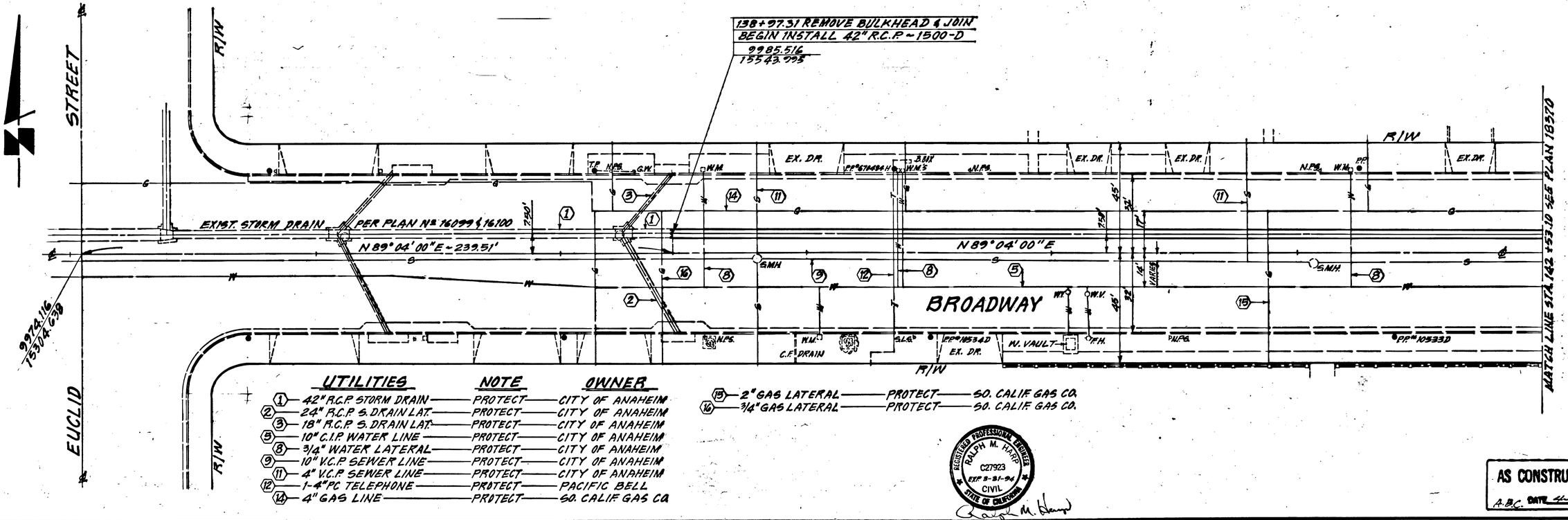
		DATE
DRAWN BY	A.B.C. & K.R.B.	7-19-91
CHECKED BY	S. BHULLAR	9-10-91
APPROVED		
APPROVED	DEPUTY CITY ENGINEER	9-16-91
APPROVED	D.P.W./CITY ENGINEER	9-16-91

STREET & STORM DRAIN IMPROVEMENTS
BROADWAY
FROM 66' E/o MABLE ST. TO 260' E/o EUCLID ST.
CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO. 12-793-6325-365GO 10-793-6325-365MO
SHEET 1 OF 13
PLAN NUMBER 18368

18368





UTILITIES	NOTE	OWNER
(1) 42" R.C.P. STORM DRAIN	PROTECT	CITY OF ANAHEIM
(2) 24" R.C.P. S. DRAIN LAT.	PROTECT	CITY OF ANAHEIM
(3) 18" R.C.P. S. DRAIN LAT.	PROTECT	CITY OF ANAHEIM
(5) 10" C.I.P. WATER LINE	PROTECT	CITY OF ANAHEIM
(8) 3/4" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(9) 10" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(11) 4" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(12) 1-4"PC TELEPHONE	PROTECT	PACIFIC BELL
(14) 4" GAS LINE	PROTECT	SO. CALIF. GAS CO.
(15) 2" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(16) 3/4" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HARP
C27923
EXP 3-31-94
CIVIL
STATE OF CALIFORNIA

AS CONSTRUCTED
A.B.C. DATE 4-18-92

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
1	A.B.C	ADDED W.S. ELEV.	[illegible]	5/21/92

REFERENCES

FIELD BOOKS	PAGES	BENCH MARK NO. 5A-18-83	FOR NOTES TO CONTRACTOR SEE PLAN 18368
129	1	ELEVATION 122.87	FOR STANDARD DETAILS SEE 3/9
			PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

		DATE
SCALE: HORZ. 1" = 20' VERT. 1" = 4'		
DRAWN BY	A.B.C. & K.R.B.	7-19-91
CHECKED BY	S. BHULLAR	9-10-91

FOR APPROVALS OF THIS PROJECT SEE PLAN NO. 18368

STORM DRAIN IMPROVEMENT
BROADWAY
FROM 595' TO 240' E/o EUCLID STREET
CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO.
12-793-6325-365GO
10-793-6325-365MO
SHEET 2 OF 13
PLAN NUMBER 18369

142+61.05 CONST STD. J.S. Nº 2, C=3.23'

143+90.51 END INSTALL 42"R.C.P.-1500-D
143+92.97 CONST. STD. M.H. Nº 4, C=4.37'
143+96.53 BEGIN INSTALL 36"R.C.P.-1800-D

144+98.98 ⚠1
~~143+05.57~~ CONST. STD. J.S. Nº 2, C=3.13'

EXIST. F.S. OVER PIPE

146+58.72 END INSTALL 36"R.C.P.-1800-D
146+61.05 CONST. STD. MANHOLE Nº 2
146+63.38 BEGIN INSTALL 36"R.C.P.-1800-D

MATCHLINE STA. 142+53.10 SEE PLAN 18369

MATCHLINE STA. 148+53.10 SEE PLAN 18371

INSTALL 42"R.C.P.-1500-D

INSTALL 36"R.C.P.-1800-D

INSTALL 36"R.C.P.-1800-D

S=0.0028

S=0.0016

S=0.0020

114.92 INV.

114.89 INV.

115.27 INV.

115.80 INV.

115.97 INV.

~~115.38 INV.~~

116.22 INV.

116.23 INV.

116.61 INV.

5.56

2.46'

2.33'

2.33'

7.95'

131.92'

106.01'
~~122.38~~

162.07'
~~195.14~~

192.05'

600.00'

143 144 145 146 147 148

UTILITIES — NOTE — OWNER

(5)	10" C.I.P. WATER LINE	PROTECT	CITY OF ANAHEIM
(7)	3" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(8)	3/4" WATER LATERAL	PROTECT	CITY OF ANAHEIM
(9)	10" V.C.P. SEWER LINE	PROTECT	CITY OF ANAHEIM
(13)	BURIED CABLE TEL.	PROTECT	PACIFIC BELL
(29)	3" GAS LINE	PROTECT	SO. CALIF. GAS CO.
(15)	2" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(16)	3/4" GAS LATERAL	PROTECT	SO. CALIF. GAS CO.
(17)	15 KV ELECTRICAL	PROTECT	CITY OF ANAHEIM
(27)	ABANDONED BU. CA. TEL.	PROTECT	PACIFIC BELL
(28)	6" V.C.P. SEWER LAT.	PROTECT	CITY OF ANAHEIM

144+05.09

(125.04) 7.90 C.F. | 124.65 10'C.F. | 124.03 10'C.F. | (125.14) 7.60 C.F.

142+79.70

(124.80) 7.44 C.F. | 124.60 10'C.F. | 124.63 10'C.F. | (124.86) 7.44 C.F.

145+29.00

(125.57) 7.80 C.F. | 125.38 10'C.F. | 125.41 10'C.F. | (125.60) 7.80 C.F.

N 29° 04' 00" E

N 89° 04' 00" E

S 60° 56' 00" E

S 60° 56' 00" E

BROADWAY

R/W

EX. DR.

CONST. STD. P.C.C. SIDEWALK (110 S.F.)

C.F. DRAIN

N.P.S.

W.M.

G.M.

W.V.

S.M.H.

T.P.# 735680 H

T.P.# 760113 H

T.P.

P.P.# 1053 D

P.P.# 1051 D

P.P.# 5220

P.P.# 1052 D

F.H.

W.M. VAULT

FL.S.

142+79.70 CONST. STD. C.B. Nº 1
W=10', V=4.5', TYPE "A" L.D.
INSTALL 18"R.C.P.-2000-D (41 L.F.)
9951.751
15926.985
18373

142+61.05 CONST. STD.
J.S. Nº 2, C=3.23'
9991.441
15907.684

144+05.09 CONST. STD. C.B. Nº 1
W=20', V=5', TYPE "A" L.D.
INSTALL 24"R.C.P.-2000-D (21 L.F.)
10014.785
16051.375
2
18373

143+90.51 END INSTALL 42"R.C.P.-1500-D
143+92.97 CONST. STD. M.H. Nº 4 C=4.37'
143+96.53 BEGIN INSTALL 36"R.C.P.-1800-D
9993.590
16039.594

144+98.98 ⚠1
~~143+05.57~~ CONST. STD.
J.S. Nº 2, C=3.13'
9995.~~435~~ 317
16~~52.580~~ 45.582 ⚠1

22.07 ⚠1

145+~~29.00~~ CONST. STD. C.B. Nº 1
W=10', V=4.5', TYPE "A" L.D.
INSTALL 18"R.C.P.-2000-D (49 L.F.)
9955.~~##~~ 619
16~~156.290~~ 69.325 ⚠1
3
18373

146+58.72 END INSTALL 36"R.C.P.-1800-D
146+61.05 CONST. STD. MANHOLE Nº 2
146+63.38 BEGIN INSTALL 36"R.C.P.-1800-D
9997.957
16307.630

REGISTERED PROFESSIONAL ENGINEER
RALPH M. HARP
C27923
EXP. 3-31-94
CIVIL
STATE OF CALIFORNIA

AS CONSTRUCTED
A.B.C. DATE 4-15-92

REVISIONS

NO.	INITIAL	DESCRIPTION	APPROVED BY	DATE
⚠1	A.B.C.	MOVED C.B. DET. Nº 3 & ADDED GAS LAT. PER AS BUILT PLANS. ADDED W.S. ELEV.	[illegible]	4-15-92

REFERENCES

FIELD BOOKS	PAGES	BENCH MARK NO. 5A-18-83	FOR NOTES TO CONTRACTOR SEE PLAN 18368
129	2	ELEVATION 122.87	FOR STANDARD DETAILS SEE 301, 302, 308, 311, 312, 313, 314, 318, 319
			PLANS FOR THESE IMPROVEMENTS 18368 THRU 18380

SCALE: HORZ. 1"=20' VERT. 1"=4'
DRAWN BY A.B.C. & K.K.M. DATE 7-19-91
CHECKED BY S. BAUTISTA DATE 9-10-91

FOR APPROVALS OF THIS PROJECT SEE PLAN NO. 18368

STORM DRAIN IMPROVEMENT
BROADWAY
FROM 1195' E/o TO 595' E/o EUCLID STREET

CITY OF ANAHEIM
PUBLIC WORKS ENGINEERING DEPARTMENT

ACCOUNT NO.
12-793-6325-365GO
10-793-6325-365MO

SHEET 3 OF 13

PLAN NUMBER 18370

18350

Attachment E

Operation and Maintenance Plan

To be provided during final engineering

Attachment F

Geotechnical Report

ALTA CALIFORNIA
GEOTECHNICAL INC.

170 North Maple Street, Suite 108
Corona, CA 92880
www.altageotechnical.com

CITY VENTURES
3121 Michelson Drive
Irvine, California 92612

January 4, 2021
Project No. 1-0357

Attention: Ms. Kim Prijatel

Subject: **GEOTECHNICAL INVESTIGATION**
1661 W. Broadway
City of Anaheim, California

References: See Appendix A

Dear Ms. Prijatel:

Alta California Geotechnical, Inc. (Alta) is pleased to present this geotechnical investigation for the proposed residential development located at 1661 W. Broadway in the City of Anaheim, California. This report is based on a recent subsurface investigation conducted by Alta, laboratory testing and a review of the referenced reports.

Alta's review of the data indicates that the proposed development is feasible, from a geotechnical perspective, provided that the recommendations presented in this report are incorporated into the grading and improvement plans and implemented during site development.

Also included in this report are:

- Discussion of the site geotechnical conditions.
- Recommendations for remedial and site grading, including unsuitable soil removals.
- Geotechnical site construction recommendations.
- Foundation design parameters.

If you have any questions or should you require any additional information, please contact the undersigned at (951) 509-7090. Alta appreciates the opportunity to provide geotechnical consulting services for your project.

Sincerely,
Alta California Geotechnical, Inc.

FERNANDO RUIZ
Civil Engineering Associate

Reviewed By:

SCOTT A. GRAY/RGE 2857
Reg. Exp.: 12-31-22
Registered Geotechnical Engineer
President

THOMAS J. MCCARTHY/CEG 2080
Reg. Exp.: 9-30-22
Certified Engineering Geologist
Vice President

Distribution: (1) Addressee

FR: JCB: SAG: TJM:-1-0357, January 4, 2021 (Geo Investigation, 1661 Broadway, Anaheim)

1.0 INTRODUCTION

The following report presents Alta's findings, conclusions, and geotechnical recommendations for the proposed residential development located at 1661 W. Broadway in the City of Anaheim, California.

1.1 Purpose

The purpose of this report is to examine the existing onsite geotechnical conditions and assess the impacts that the geotechnical conditions may have on the proposed development. The property is depicted on the Plate 1. This report is suitable for use in developing grading plans and engineer's cost estimates.

1.2 Scope of Work

Alta's *Scope of Work* for this geotechnical investigation included the following:

- Reviewing the referenced reports and air photos (Appendix A).
- Site geologic mapping.
- Excavating, logging, and sampling four (4) hollow-stem auger borings to a maximum depth of 31.0-feet below the existing surface (Appendix B).
- Conducting laboratory testing on samples obtained during our investigation (Appendix C).
- Performing an infiltration study on an additional two (2) borings to provide an assessment of the infiltration characteristics of the onsite soil and their impact on storm water disposal.
- Evaluating engineering geologic and geotechnical engineering data, including laboratory data, to develop recommendations for site remedial grading including specialized grading techniques for unsuitable soil removals along the property boundary, import soil, foundations and utilities.
- Preparing this report and accompanying exhibits.

Legend

afu - Artificial Fill-Undocumented

Qyf - Quaternary Alluvial Fan Deposits

B-1 ◉ - Approximate Location of Boring

P-1 ◎ - Approximate Location of Infiltration Test

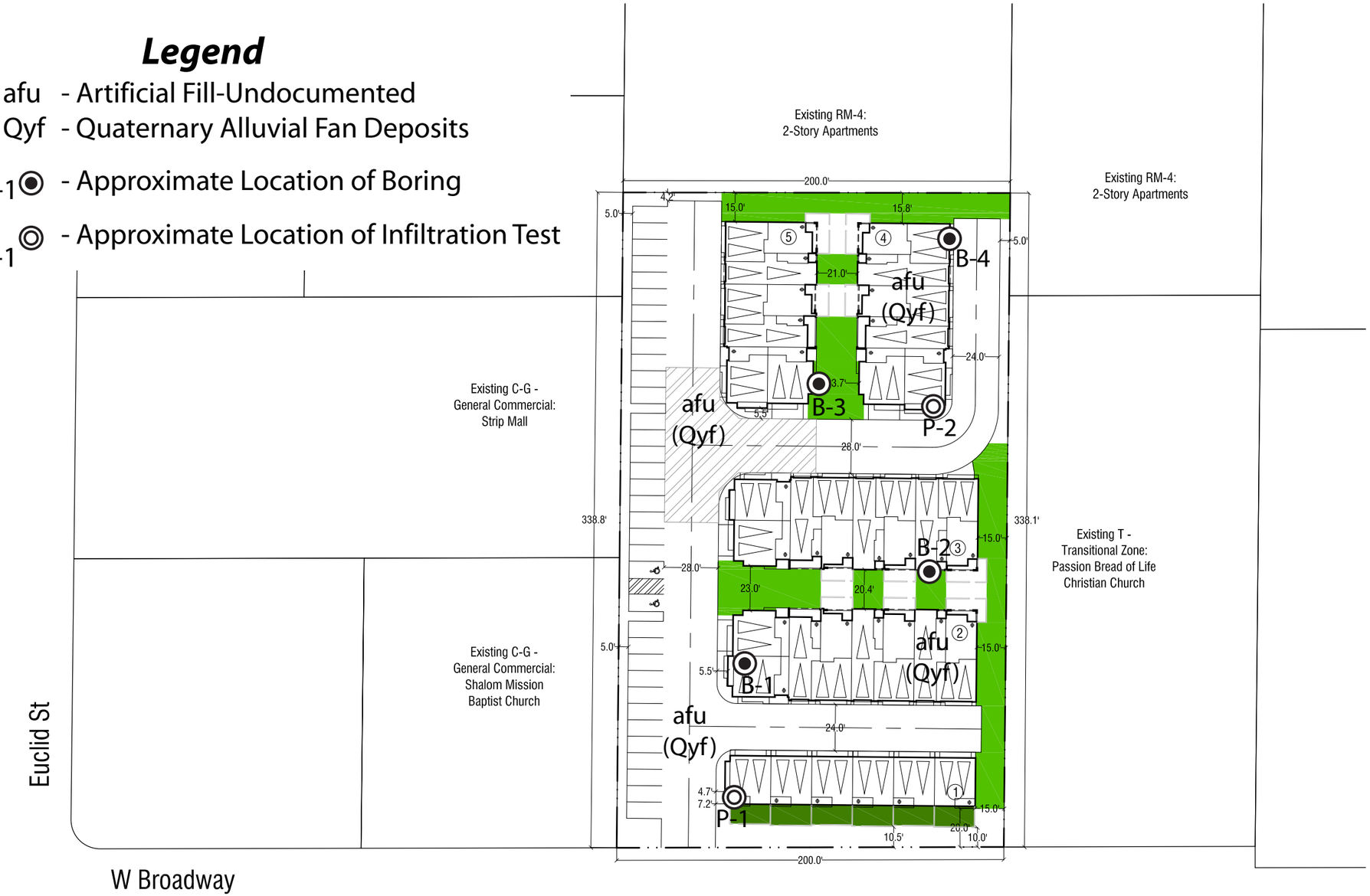


PLATE 1

Project Summary

Total Site Area: ± 1.55 Acres (± 67,693 SF)

Total Units: 34 Homes
- (6) Plan 1: ± 1,100 SF, 2 Bedroom, 2.5 Bath
- (8) Plan 2: ± 1,329 SF, 2 Bedroom, 2.5 Bath, Loft, Opt. Bed 3
- (10) Plan 3: ± 1,417 SF, 3 Bedroom, 3 Bath
- (10) Plan 4: ± 1,671 SF, 3 Bedroom, 3 Bath, Den, Opt. Bed 4

Density: 21.93 Homes per Acre

Parking:

Required: 103 Spaces (3.03 spaces per home)
- (6) 2 Bedroom x 2.25 Spaces = 13.5 Spaces
- (18) 3 Bedroom x 3.0 Spaces = 54 Spaces
- (10) 4 Bedroom x 3.5 Spaces = 35 Spaces

Provided: 103 Spaces (3.03 spaces per home)
- Garage: 68 Spaces
- Head In: 33 Spaces (8.5' x 18')
- ADA: 2 Spaces (9' x 18')

Open Space:

Required: 9,350 SF Total (275 SF per home)
- Common: xx SF (10' min. dim.)
- Private: xx SF (10' min. dim. ground, 7' min. dim deck)

Provided: 10,038 SF Total (± 295 per home)
- Common: 8,094 SF (10' Min. Dimension)
- Private: 1,944 SF
  - Ground: 1,264 SF (10' Min. Dimension)
  - Deck: 680 SF (7' Min. Dimension)

Lot Coverage: 23,830 SF (35.2% of site)

Zoning Summary

Existing General Plan:	Office - Low
Proposed General Plan:	Mid Density
Existing Zoning:	C-G - General Commercial
Proposed Zoning:	RM-3.5 - Multiple-Family Residential
Max. Density:	27 Homes per Acre
Building Setbacks:	Front Yard: 20' Interior Side Yard: 15' Street Side Yard: 15' Rear Yard: 15'
Building Separation:	Varies
Max. Building Height:	40' and 3 Stories
Max. Lot Coverage:	50%

Notes:

1. Site plan is for conceptual purposes only.
2. Site plan must be reviewed by planning, building, and fire departments for code compliance.
3. Base information per civil engineer.
4. Civil engineer to verify all setbacks and grading information
5. Building Footprints might change due to the final design elevation style.
6. Open space area is subject to change due to the balcony design of the elevation.
7. Building setbacks are measured from property lines to building foundation lines.

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 N. MAPLE STREET, STE 108, CORONA, CA 92880
TELEPHONE: (951) 509-7090
PROJECT NUMBER: 1-0357 DATE: 1-04-21

City Ventures

CONCEPTUAL SITE PLAN
1661 BROADWAY SITE
ANAHEIM, CA

0 15 30 60

CONCEPT STUDY

 | 2020291 | 10-12-20

ARCHITECTS . PLANNERS . DESIGNERS
WHA
ORANGE COUNTY . LOS ANGELES . BAY AREA

1.3 Report Limitations

The conclusions and recommendations presented in this report are based on the field and laboratory information generated during this investigation, and a review of the referenced reports. The information contained in this report is intended to be used for development of grading plans and preliminary construction cost estimates.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Existing Conditions

The rectangular shaped site is relatively flat and is currently occupied by commercial structures and asphalt parking lots. The site is bounded to the north by apartments, to the west by commercials structures, to the south by W. Broadway, and to the east primarily by a church.

Online review of vintage air photographs indicates the site was previously used for agriculture purposes in 1953. By 1963 one of the structures onsite had been constructed and by 1972, two other structures were constructed. The site has remained relatively unchanged since then.

2.2 Proposed Development

Alta anticipates that the existing structures and parking lot will be demolished, and the site will be redeveloped to support five multi-family residential structures (34 units) with drive aisles and associated improvements. We anticipate that remedial grading will be required to develop the site to support the proposed structures with shallow foundations and reinforced concrete slabs-on-grade. Significant height slopes are not anticipated for the project.

3.0 SITE INVESTIGATION

3.1 Investigation and Laboratory Testing

Alta conducted a subsurface investigation on December 10, 2020, consisting of the excavation, logging and select sampling of four (4) hollow-stem auger borings up to a maximum depth of 31.0 feet and the installation of two (2) five feet deep wells for infiltration testing. The locations of the exploratory excavations are shown on Plate 1 and the boring logs are presented in Appendix B.

Laboratory testing was performed on bulk and ring samples obtained during the field investigation. A brief description of the laboratory test procedures and the test results are presented in Appendix C.

3.2 Infiltration Testing

It is Alta's understanding that the project may utilize infiltration systems for storm water disposal. Details of the system are not known at this time.

Infiltration testing was undertaken using two (2) five-foot-deep borings (P-1 and P-2). The testing was performed on December 11, 2020 in general accordance with the County of Orange WQMP standards. The two test wells were presoaked at least 24 hours prior to testing. During testing, the water level readings were recorded every 30 minutes until the readings stabilized

The data was then adjusted to provide an infiltration rate utilizing the Porchet Method. The resulting infiltration rates are presented in Table 3-1. The results do not include a factor of safety. Recommendations for infiltration BMP design are presented in Section 6.3.

Table 3-1-Summary of Infiltration Testing (No Factor of Safety)		
Test Designation	P-1	P-2
Approximate Depth of Test	5 ft	5 ft
Time Interval	30 minutes	30 minutes
Radius of Test Hole	4 inches	4 inches
Tested Infiltration Rate	0.61 (in/hr)	0.68 (in/hr)

4.0 GEOLOGIC CONDITIONS

4.1 Geologic and Geomorphic Setting

Regionally, the subject site is located in the Peninsular Ranges geomorphic province, which characterizes the southwest portion of southern California where right lateral major active fault zones predominately trend northwest-southeast. The Peninsular Ranges province is composed of plutonic and metamorphic rock, with lesser amounts of Tertiary volcanic and sedimentary rock, Quaternary drainage in-fills and sedimentary veneers.

4.2 Stratigraphy

Based on our literature review and subsurface investigation, the site is underlain by undocumented artificial fill and alluvium. These geologic units are briefly described below.

4.2.1 Artificial Fill-Undocumented (map symbol afu)

The artificial fill observed at the site consists mainly of light tan brown to brown, silty sand in a dry to moist, medium dense condition. The unit was logged to a depth of 7.0 feet below the ground surface.

4.2.2 Young Alluvial Fan Deposits (map symbol Qyf)

The alluvium observed at the site consists mainly of gray, light brown gray, and light tan gray sand, silty sand, and silty clay in a dry to moist, medium dense to dense and firm condition. The unit was logged to a depth of 31.0 feet below the ground surface.

4.3 Geologic Structure

4.3.1 Tectonic Framework

Jennings and Bryant (1985, 2010) defined eight structural provinces within California that have been classified by predominant regional fault trends and similar fold structure. These provinces are in turn divided into blocks and sub-blocks that are defined by "major Quaternary faults." These blocks and sub-blocks exhibit similar structural features. Within this framework, the subject site is located within Structural Province I, which is controlled by the dominant northwest trend of the San Andreas Fault and is divided into two blocks, the Coast Range Block and the Peninsular Range Block. The Peninsular Range Block, on which this site is located, is characterized by a series of parallel, northwest trending faults that exhibit right lateral dip-slip movement. These faults are terminated by the Transverse Range block to the north and extend southward into the Baja Peninsula. These northwest trending faults divide the Peninsular Range block into eight sub-blocks. The site is located on the northwest portion of the Santa Ana Sub-block, one of the eight sub-blocks, which is bound on the east by the Elsinore fault zone and on the west by the Newport-Inglewood fault zone.

4.3.2 Regionally Mapped Active Faults

Several large, active fault systems including the Elsinore-Whittier, Newport-Inglewood, and the San Andreas occur in the region surrounding the site. These fault systems have been studied extensively and in a large part control the geologic structure of southern California.

4.3.3 Geologic Structure

Based upon our site investigation and literature review, the sediments are of Quaternary age, and are not folded or faulted.

4.4 Groundwater

Groundwater was not encountered to a depth of 31.0 feet below the ground surface during our subsurface investigation. The most recent well data recorded in October of 2020 from Well No. 338229N1179374W002 located within 0.75 miles of the site indicates that current groundwater levels in the area are approximately 87.0 feet below the ground surface. Based on state-provided information, the historic-high groundwater is greater than 50 feet below the ground surface (CDMG, 1997).

4.5 Earthquake Hazards

The subject site is located in southern California, which is a tectonically active area. The type and magnitude of seismic hazards affecting a site are dependent on the distance to the causative fault and the intensity and magnitude of the seismic event. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction and/or ground lurching.

4.5.1 Local and Regional Faulting

The nearest known active faults (movement occurring ≤ 11,700 years ago) are, the Puente Hills fault, the Newport-Inglewood fault, the Elsinore fault, the San Joaquin Hills fault, the San Jose fault, and the Palos Verdes fault, located approximately 3.2, 7.0, 8.0, 9.1, 12.2, and 16.1 miles from the site (USGS, 2008). The site is not within an Alquist-Priolo Fault Hazard Zone (CGS, 2018).

4.5.2 Surface Rupture

Active faults are not known to exist within the project and a review of Special Publication 42 indicates the site is not within a California State designated earthquake fault zone. Accordingly, the potential for fault surface rupture on the subject site is very low.

4.5.3 Seismicity

Ground shaking hazards caused by earthquakes along other active regional faults do exist. The 2019 California Building Code requires use-modified spectral accelerations and velocities for most structural designs. Seismic design parameters using soil profile types identified in the 2019 California Building Code are presented in Section 7.3.

4.5.4 Liquefaction

Seismic agitation of relatively loose saturated sands, silty sands, and some silts can result in a buildup of pore pressure. If the pore pressure exceeds the overburden stresses, a temporary quick condition known as liquefaction can occur. Liquefaction effects can manifest in several ways including: 1) loss of bearing; 2) lateral spread; 3) dynamic settlement; and 4) flow failure. Lateral spreading has typically been the most damaging mode of failure.

In general, the more recent that a sediment has been deposited, the more likely it will be susceptible to liquefaction. Other factors that must be considered are: groundwater, confining stresses, relative density, and the intensity and duration of seismically-induced ground shaking.

Groundwater was not encountered during our subsurface investigation to a depth of 31.0 feet below the ground surface. The seismic hazard zone report for the area (CDMG, 1997) indicates that historic high groundwater elevation is greater than 50 feet below the existing ground surface. The site is not located in a liquefaction zone per the seismic hazard map (CGS, 1998).

Based on the depth to groundwater it is our opinion that the potential for liquefaction to occur onsite is considered minimal.

4.5.5 Dry Sand Settlement

Dry sand settlement is the process of non-uniform settlement of the ground surface during a seismic event. Based on our subsurface investigation and our removal/recompaction recommendations, the potential for dry sand settlement is anticipated to be low and within foundation design tolerances. Design dynamic settlement parameters are presented in Table 7-1.

5.0 ENGINEERING PROPERTIES AND ANALYSIS

5.1 Materials Properties

Presented herein is a general discussion of the engineering properties of the onsite materials that will be encountered during construction of the proposed project. Descriptions of the soil (Unified Soil Classification System) are presented on the boring logs in Appendix B.

5.1.1 Excavation Characteristics

Based on the data provided from the subsurface investigation, it is our opinion that the majority of the onsite materials possess favorable excavation characteristics such that conventional earth moving equipment can be utilized.

5.1.2 Compressibility

The undocumented artificial fill upper portions of young alluvial fan deposits onsite are considered compressible and unsuitable to support the proposed improvements. Recommended removal depths are presented in Section 6.1.2.

5.1.3 Hydro-Consolidation

Hydro-consolidation is the effect of introducing water into soil that is prone to collapse. Upon loading and initial wetting, the soil structure and apparent strength are altered resulting in almost immediate settlement. That settlement can have adverse impacts on engineered structures, particularly in areas where it is manifested differentially. Differential settlements are typically associated with differential wetting, irregularities in the subsurface soil conditions, or irregular loading patterns.

Based on our laboratory testing (Appendix C), the potential for hydro-collapse onsite is minimal and should be within foundation tolerances upon the completion of the recommended unsuitable soil removals.

5.1.4 Expansion Potential

Expansion index testing was performed on samples taken during our subsurface investigation. Based on the results, it is anticipated that the majority of materials onsite are “very low” to “low” in expansion potential (0≤EI≤50, Appendix C) when tested per ASTM D: 4829.

5.1.5 Earthwork Adjustments

The values presented in Table 5-1 are deemed appropriate for estimating purposes and may be used in an effort to balance earthwork quantities. As is the case with every project, contingencies should be made to adjust the earthwork balance when grading is in-progress and actual conditions are better defined.

TABLE 5-1
Earthwork Adjustment Factors

Geologic Unit	Adjustment Factor Range	Average
Undocumented Artificial Fill/Young Alluvial Fan Deposits	Shrink 6% to 10%	8%

5.1.6 Chemical Analyses

Chemical testing was performed on samples of material underlying the proposed site. Soluble sulfate test results indicate that the soluble sulfate concentrations of the soils tested are classified as negligible (Class S0) per ACI 318-14.

Negligible chloride levels were detected in the onsite soils. Resistivity testing conducted as part of this investigation, indicates that the soils are "moderately corrosive" to buried metals (per Romanoff, 1989). Additional discussions on corrosion are presented in Section 7.9. Corrosion tests results are presented in Appendix C.

5.2 Engineering Analysis

Presented below is a general discussion of the engineering analysis methods that were utilized to develop the conclusions and recommendations presented in this report.

5.2.1 Bearing Capacity and Lateral Earth Pressures

Ultimate bearing capacity values were obtained using the graphs and formula presented in NAVFAC DM-7.1. Allowable bearing was determined by applying a factor of safety of at least 3 to the ultimate bearing capacity. Static lateral earth pressures were calculated using Rankine methods for active and passive cases. If it is desired to use Coulomb forces, a separate analysis specific to the application can be conducted.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on Alta's findings during our subsurface investigation, the laboratory test results, our staff's previous experience in the area, it is Alta's opinion that the development of the site is feasible from a geotechnical perspective. Presented below are Alta's recommendations that should be incorporated into site development and construction plans.

6.1 General Earthwork Recommendations

All grading shall be accomplished under the observation and testing of the project geotechnical consultant in accordance with the recommendations contained herein and the City of Anaheim criteria.

6.1.1 Site Preparation

Vegetation, construction debris, and other deleterious materials are unsuitable as structural fill material and should be disposed of off-site prior to commencing grading/construction. Any septic tanks, seepage pits or wells should be abandoned as per the County of Orange Department of Health Services.

Existing concrete should be removed prior to the placement of engineered fill. The demolished concrete may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. Prior to placement as engineered fill any protruding steel rebar should be cut from the concrete pieces and disposed of offsite.

Existing asphaltic concrete should be removed prior to the placement of engineered fill. From a geotechnical perspective, this material may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. The crushed asphalt should not be placed under residential structures, but rather, it can be placed in approved non-

residential areas, such as streets, parking areas or open space. These recommendations should be verified by the environmental consultant.

6.1.2 Unsuitable Soil Removals

The artificial fill and the upper portions of the young alluvial fan deposits near the surface are compressible and as such, are not suitable to support the proposed structures. As such, it is anticipated that the upper (4) to eight (8) feet of existing soils will require removal and recompaction, depending on the depth of the existing fill, extending a minimum of five (5) feet horizontally outside the structures. This recommended removal combined with the foundation recommendations presented in Section 7.1 should provide suitable support for the proposed structures.

The Project Geotechnical Consultant should observe the removal bottom prior to placing fill. If unsuitable soils such as undocumented artificial fill are exposed upon the completion of the removals recommended above, additional removals may be required.

For streets, in general, a minimum removal and recompaction of the upper two (2) feet of native soils is recommended, although deeper removals may be required if unsuitable soils are exposed at that depth. Removal bottoms in street areas should be tested to determine that the exposed soils have a minimum relative compaction of 85% of the laboratory maximum density (per ASTM test method D-1557).

Material removed as part of the unsuitable soil removals can be used as artificial fill, provided it is free of deleterious materials.

6.1.3 Over-excavation of Building Pads

Footings for structures should be underlain by a minimum of two (2) feet of compacted fill. As such, for building pads where unsuitable soil removals do not provide the minimum depth of compacted fill, or where design grades and/or remedial grading activities create cut/fill transitions, the cut and shallow fill portions of the building pads should be over-excavated during grading and replaced with compacted fill.

6.2 General Earthwork Recommendations

6.2.1 Compaction Standards

All fill and processed natural ground shall be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557. Fill material should be moisture conditioned to optimum moisture or above, and as generally discussed in Alta's Earthwork Specification Section presented in Appendix E. Compaction shall be achieved with the use of sheepsfoot rollers or similar kneading type equipment.

6.2.2 Groundwater/Seepage

It is anticipated that groundwater will not be encountered during construction. It is possible that perched water conditions could be encountered depending on the time of year construction occurs.

6.2.3 Documentation of Removals

All removal/over-excavation bottoms should be observed and approved by the project Geotechnical Consultant prior to fill placement. Consideration should be given to surveying the removal bottoms and undercuts after approval by the geotechnical consultant and prior to the placement of fill. Staking should be provided in order to verify undercut locations and depths.

6.2.4 Treatment of Removal Bottoms

At the completion of removals/over-excavation, the exposed removal bottom should be ripped to a minimum depth of eight (8) inches, moisture-conditioned to above optimum moisture content and compacted in-place to the project standards.

6.2.5 Fill Placement

After removals, scarification, and compaction of in-place materials are completed, additional fill may be placed. Fill should be placed in eight-inch bulk maximum lifts, moisture conditioned to optimum moisture content or above, compacted and tested as grading/construction progresses until final grades are attained.

6.2.6 Moisture Content

The moisture content of the upper in-situ soils varies, as shown on the boring logs in Appendix B. Moisture conditioning will be required during grading to achieve optimum or above conditions. Most soils will require the addition of water and mixing prior to placement as compacted fill.

6.2.7 Mixing

Mixing of materials may be necessary to prevent layering of different soil types and/or different moisture contents. The mixing should be accomplished prior to and as part of compaction of each fill lift.

6.2.8 Import Soils

Import soils, if necessary, should consist of clean, structural quality, low expansive, compactable materials similar to the on-site soils and should be free of trash, debris or other objectionable materials. The project Geotechnical Consultant should be notified not less than 72 hours in advance of the locations of any soils proposed for import. Import sources should be sampled, tested, and approved by the project Geotechnical

Consultant at the source prior to the importation of the soils to the site. The project Civil Engineer should include these requirements on plans and specifications for the project.

6.2.9 Utility Trenches

6.2.9.1 Excavation

Utility trenches should be supported, either by laying back excavations or shoring, in accordance with applicable OSHA standards. In general, existing site soils are classified as Soil Types "B" and “C” per OSHA standards. Upon completion of the recommended removals and re-compaction, the artificial fill will be classified as Soil Type "B". The Project Geotechnical Consulting should be consulted if geologic conditions vary from what is presented in this report.

6.2.9.2 Backfill

Trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D-1557. Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks, or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

Under-slab trenches should also be compacted to project specifications. If select granular backfill (SE > 30) is used, compaction by flooding will be acceptable.

6.2.10 Backcut Stability

Temporary backcuts, if required during unsuitable soil removals, should be made no steeper than 1:1 without review and approval of the geotechnical consultant. Flatter backcuts may be necessary where geologic conditions dictate and where minimum width dimensions are to be maintained.

Care should be taken during remedial grading operations in order to minimize risk of failure. Should failure occur, complete removal of the disturbed material will be required.

In consideration of the inherent instability created by temporary construction backcuts for removals, it is imperative that grading schedules are coordinated to minimize the unsupported exposure time of these excavations. Once started, these excavations and subsequent fill operations should be maintained to completion without intervening delays imposed by avoidable circumstances. In cases where five-day workweeks comprise a normal schedule, grading should be planned to avoid exposing at-grade or near-grade excavations through a non-work weekend. Where improvements may be affected by temporary instability, either on or offsite, further restrictions such as slot cutting, extending work days, implementing weekend schedules, and/or other requirements considered critical to serving specific circumstances may be imposed.

6.3 Storm Water Infiltration Systems

From a geotechnical perspective, allowing storm water to infiltrate the onsite soil in concentrated areas increases the potential for settlement, liquefaction, and water-related damage to structures/improvements, such as wet slabs or pumping subgrade, and should be avoided where possible. If infiltration systems are required on this site, care should be taken in designing systems that control the storm water as much as possible.

Preliminary infiltration testing was conducted at the site as part of this investigation, and the methodology is discussed in 3.2. The resulting infiltration rates for P-1 and P-2 was calculated to be 0.61-inches per hour and 0.68-inches per hour, respectively. The results do not include a factor of safety. Tests P-1 and P-2 were conducted in sand lenses of the young alluvial fan deposits onsite approximately 5 feet below the ground surface.

Groundwater was not encountered during our investigation to a maximum depth of 31.0 feet below the ground surface. Data from nearby wells indicates that recent groundwater is greater than 50 feet below the ground surface (CDWR, 2020).

Based on the infiltration rate of the underlying soil, infiltration-type WQMP's are likely feasible for project within the depths tested. The Project Geotechnical Consultant should review the final WQMP design prior to construction.

6.4 Boundary Conditions

The site is bounded to the north by apartments, to the west by commercials structures, to the south by W. Broadway, and to the east primarily by a church. Construction of retaining/screen walls along these boundaries may require additional geotechnical recommendations concerning unsuitable soil removals and foundation design parameters. Boundary conditions for the project should be reviewed by the Project Geotechnical Consultant as the design progresses.

7.0 DESIGN CONSIDERATIONS

7.1 Structural Design

It is anticipated that multi-story wood-framed residential structures with slab on-grade and shallow foundations will be constructed. Upon the completion of rough grading, finish grade samples should be collected and tested in order to provide specific recommendations as they relate to the individual building pads. These test results and corresponding design recommendations should be presented in a final rough grading report. Final slab and foundation design recommendations should be made based upon specific structure sitings, loading conditions, and as-graded soil conditions.

It is anticipated that the majority of onsite soils will possess “very low” to “low” expansion potential when tested in general accordance with ASTM Test Method D: 4829. For budgeting purposes, the following foundation design requirements for a range of potential expansion characteristics are presented.

7.1.1 Foundation Design

Foundations may be preliminary designed based on the values presented in Table 7-1 below.

Table 7-1
Foundation Design Parameters*

Allowable Bearing	2000 lbs/ft^2 (assuming a minimum embedment depth and width of 12 inches)
Lateral Bearing	250 lbs/ft^2 at a depth of 12 inches plus 250 lbs/ft^2 for each additional 12 inches of embedment to a maximum of 2000 lbs/ft^2.
Sliding Coefficient	0.30
Settlement	Static Settlement – 0.5 inch in 40 feet Dynamic Settlement – 0.5 inches in 40 feet

*These values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern depth and reinforcement requirements and should be evaluated.

7.1.2 Conventional Foundation Systems

Based on the onsite soils conditions and information supplied by the CBC 2019, conventional foundation systems may be designed in accordance with Tables 7-1 and 7-2.

TABLE 7-2 CONVENTIONAL FOUNDATION DESIGN PARAMETERS	
Expansion Potential	***Very Low to Low***
Soil Category	I
Design Plasticity Index	12
Minimum Footing Embedment	12 inches*
*The minimum footing embedments presented herein are based on expansion indexes. The structural engineer should determine minimum embedments based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code.	
Minimum Footing Width	12-inches-The structural engineer should determine the minimum footing width based on loading and the latest California Building Code.
Minimum Footing Reinforcement	No. 4 rebar, one (1) on top, one (1) on bottom
Minimum Slab Thickness	4 inches (actual)
Minimum Slab Reinforcement	No. 3 rebar spaced 18 inches on center, each way
Under-Slab Requirement	See Section 7.2
Slab Subgrade Moisture	Minimum of 110 percent of optimum moisture to a depth of 12 inches prior to placing concrete.
Footing Embedment Adjacent to Swales and Slopes	If exterior footings adjacent to drainage swales are to exist within five (5) feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that at least five- (5) feet is provided horizontally from edge of the footing to the face of the slope.
Garages	A grade beam reinforced continuously with the garage footings shall be constructed across the garage entrance, tying together the ends of the perimeter footings and between individual spread footings. This grade beam should be embedded at the same depth as the adjacent perimeter footings. A thickened slab, separated by a cold joint from the garage beam, should be provided at the garage entrance. Minimum dimensions of the thickened edge shall be six (6) inches deep. Footing depth, width and reinforcement should be the same as the structure. Slab thickness, reinforcement and under-slab treatment should be the same as the structure.

7.1.3 Post-Tensioned Slabs/Foundation Design Recommendations

Post-tensioned slabs for the project may be designed utilizing the parameters presented in Tables 7-1 and 7-3. The parameters presented herein are based on methodology provided in the Design of Post-Tensioned Slabs-On-Ground, Third Edition, by the Post-Tensioning Institute, in accordance with the 2019 CBC.

TABLE 7-3
POST-TENSION SLAB DESIGN PARAMETERS

Category	Expansion Potential	Minimum Embedment*	Edge Lift		Center Lift	
			Em (ft)	Ym (inch)	Em (ft)	Ym (inch)
I	Very Low to Low	12 inches	5.7	0.61	9.0	0.26
Slab Subgrade Moisture						
Category I	Minimum 110% of optimum moisture to a depth of 12 inches prior to pouring concrete					
Embedment* The minimum footing embedments presented herein are based on expansion indexes. The structural engineer should determine minimum embedments based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code. If mat slabs are utilized, alternate embedment depths can be provided.						
Moisture Barrier A moisture barrier should be provided in accordance with the recommendations presented in Section 7.2						
The parameters presented herein are based on procedures presented in the Design of Post-Tensioned Slabs-On-Ground, Third Edition. No corrections for vertical barriers at the edge of the slab, or for adjacent vegetation have been assumed. The design parameters are based on a Constant Suction Value of 3.9 pF.						

7.2 Moisture Barrier

A moisture and vapor retarding system should be placed below the slabs-on-grade in portions of the structure considered to be moisture sensitive and should be capable of effectively preventing the migration of water and reducing the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as Visqueen, placed between two to four inches of clean sand, has been used for this purpose. The use of this system or other systems can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

7.3 Seismic Design

In accordance with the requirements in Section 11.4.8 of ASCE 7-16 for sites with Site Class D and S1 values greater than 0.2, Alta has performed a site-specific ground motion analysis for the subject project. The analysis was performed in accordance with Chapter 21 of ASCE 7-16, the 2019 CBC, and the 2014 USGS Ground Acceleration Maps. The USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/index.php) and the USGS National Seismic Hazard Map source model was utilized to perform the analysis.

The site class was determined based on the referenced reports and published geologic maps in the area in general conformance with Chapter 20 of ASCE 7-16. Based on density of the underlying soil, a Site Class of D was selected (shear wave velocity of 259 m/s).

Probabilistic (MCER) ground motions were determined in accordance with Method 2 of Section 21.2.1 of ACE 7-16. The site specific MCER was taken as the lesser of the probabilistic and deterministic ground motions.

The design response spectrum was determined per Section 21.3 of ASCE 7-16. Design acceleration parameters were determined per Section 21.4 of ASCE 7-16 and the results are presented in Table 7-4. These parameters should be verified by the structural engineer. Additional parameters should be determined by the structural engineer based on the Occupancy Category of the proposed structures.

TABLE 7-4 Seismic Ground Motion Values 2019 CBC and ASCE 7-16	
Parameter	*Value*
Site Class	D
Site Latitude	33.8293
Site Longitude	-117.9398
Spectral Response Acceleration Parameter, S_S	1.471
Spectral Response Acceleration Parameter, S_1	0.519
Site Coefficient, F_a	1.0
Site Coefficient, F_v (Per Table 11.4-2 of ASCE 7-16. Site Specific Parameters Govern)	1.8
Site Specific Parameters Per Chapter 21 of ASCE 7-16	
MCE Spectral Response Acceleration Parameter, S_{MS}	1.515
MCE Spectral Response Acceleration Parameter, S_{M1}	1.155
Design Spectral Response Acceleration Parameter, S_{DS}	1.010
Design Spectral Response Acceleration Parameter, S_{D1}	0.770
Peak Ground Acceleration, PGA_M	0.70

7.4 Fence and Garden Walls

Block walls, if used, should be embedded a minimum of 2 feet below the lowest adjacent grade. Construction joints (not more than 20 feet apart) should be included in the block wall construction. Side yard walls should be structurally separated from the rear yard wall.

7.5 Footing Excavations

Soils from the footing excavations should not be placed in slab-on-grade areas unless properly compacted and tested. The excavations should be cleaned of all loose/sloughed materials and be neatly trimmed at the time of concrete placement. The Project Geotechnical Consultant should observe the footing excavations prior to the placement of concrete to determine that the excavations are founded in suitably compacted material.

7.6 Retaining Walls

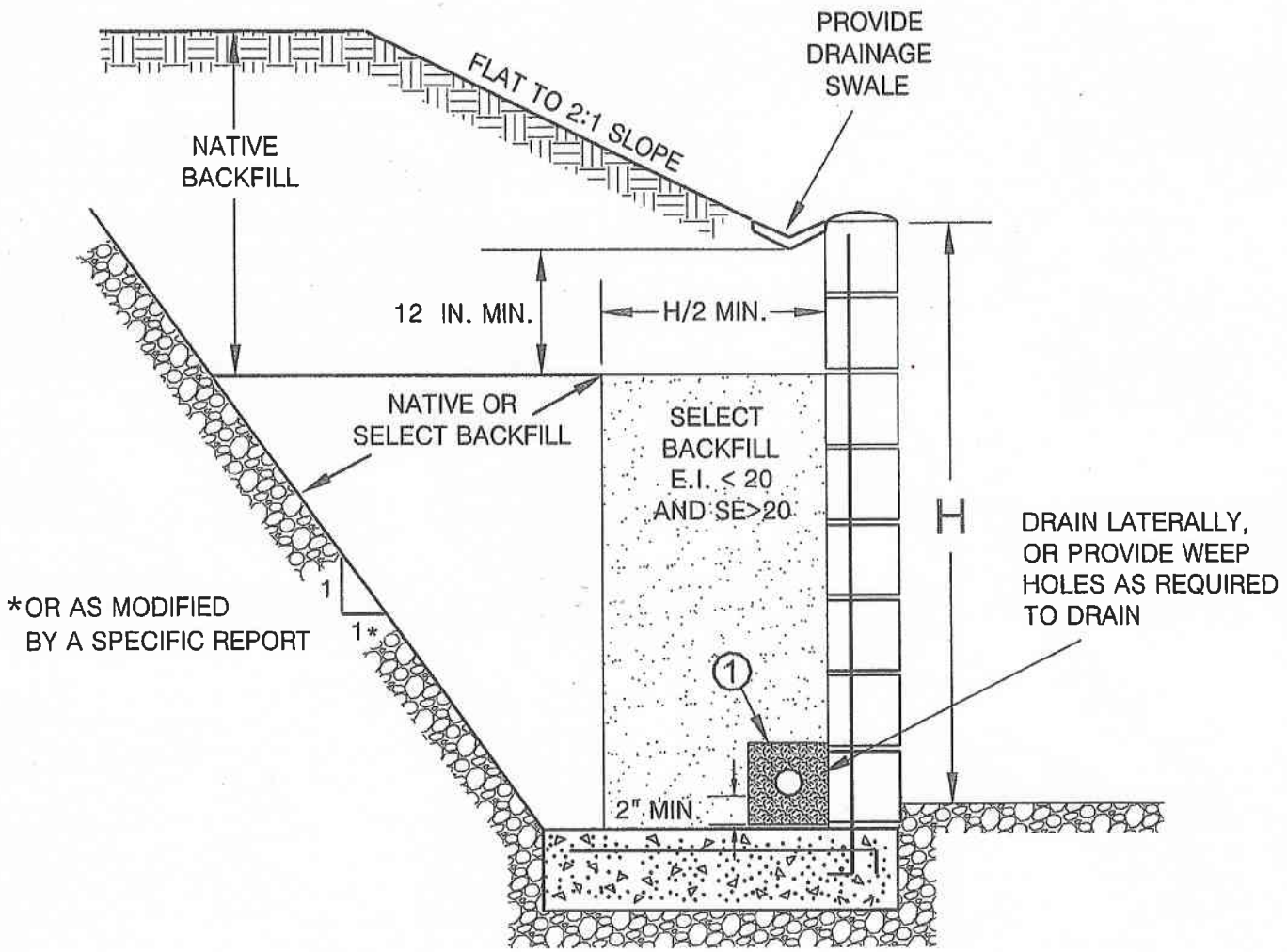
Retaining walls should be founded on engineered fill and should be backfilled with granular soils that allow for drainage behind the wall. Based on the fine-grained nature of the soils onsite, it is anticipated suitable free-draining backfill material will need to be imported to the site. Foundations may be designed in accordance with the recommendations presented in Table 7-1, above. Unrestrained walls, free to horizontally move 0.0005H (for dense cohesionless backfill), may be designed to resist lateral pressures imposed by a fluid with a unit weight determined in accordance with the Table 7-5 below. The table also presents design parameters for restrained (at-rest) retaining walls. These parameters may be used to design retaining walls that may be considered as restrained due to the method of construction or location (corner sections of unrestrained retaining walls).

TABLE 7-5 Equivalent Fluid Pressures for 90% Compacted Fill (Select Material)		
Backfill	**Active Pressure (psf/ft)**	**At-Rest Pressure (psf/ft)**
Level	35	55

Per the requirements of the 2019 CBC, the seismic force acting on the retaining walls with backfill exceeding 6-feet in height may be resolved utilizing the formula $14H^2$ lb/lineal ft (H=height of the wall). This force acts at approximately 0.6H above the base of the wall (inverted triangle). The seismic value can be converted as required by the retaining wall engineer. Retaining walls should be designed in general accordance with Section 1807A.2 of the 2019 CBC.

- Restrained retaining walls should be designed for "at-rest" conditions.
- The design loads presented in the above table are to be applied on the retaining wall in a horizontal fashion and as such friction between wall and retained soils should not be allowed in the retaining wall analyses.
- Additional allowances should be made in the retaining wall design to account for the influence of construction loads, temporary loads, and possible nearby structural footing loads.
- Select backfill should be granular, structural quality backfill with a Sand Equivalent of 20 or better and an ASCE Expansion Index of 20 or less. The backfill must encompass the full active wedge area. The upper one foot of backfill should be comprised of native on-site soils (see Plate A).
- The wall design should include waterproofing (where appropriate) and backdrains or weep holes for relieving possible hydrostatic pressures. The backdrain should be comprised of a 4-inch perforated PVC pipe in a 1 ft. by 1 ft., ¾-inch gravel matrix, wrapped with a geofabric. The backdrain should be installed with a minimum gradient of 2 percent and should be outletted to an appropriate location. For subterranean walls this may include drainage by sump pumps.
- No backfill should be placed against concrete until minimum design strengths are achieved.

RETAINING WALL BACKFILL DETAIL



(1)

PIPE: 4-INCH PERFORATED PVC, SCHEDULE 40, SDR35 OR APPROVED ALTERNATE MINIMUM 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FT. IN BOTTOM HALF OF PIPE

ROCK: MINIMUM VOLUME OF 1 CU. FT. OF 3/4-IN. MAX. ROCK PER. LINEAL FOOT OF PIPE, OR APPROVED ALTERNATE

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

It should be noted that the allowable bearing and lateral bearing values presented in Table 7-1 are based on level conditions at the toe. Modified design parameters can be presented for retaining walls with sloping condition at the toe. Other conditions should be evaluated on a case by case basis.

7.7 Exterior Slabs and Walkways

Exterior concrete slabs and walkways should be designed and constructed in consideration of the following recommendations.

7.7.1 Subgrade Compaction

The subgrade below exterior concrete slabs should be compacted to a minimum of 90 percent relative compaction as determined by ASTM Test Method: D 1557.

7.7.2 Subgrade Moisture

The subgrade below concrete slabs should be moisture conditioned to a minimum of 110 percent of optimum moisture prior to concrete placement.

7.7.3 Concrete Slab Thickness

Concrete flatwork and driveways should be designed utilizing four-inch minimum thickness.

7.7.4 Concrete Slab Reinforcement

Utilization of reinforcement for flatwork and driveways is subject to a cost/benefit analysis. Reinforcement will decrease the amount of cracking that may occur in flatwork, however, planning for occasional repairs may be more cost effective. Utilizing closely spaced control joints is likely more cost-effective than utilizing reinforcement. The majority of the soils onsite are classified as very low in expansion potential. Consideration should be given to reinforcing flatwork with irregular (non-square/rectangular) shapes.

7.7.5 Control Joints

Weakened plane joints should be installed on walkways at intervals of approximately eight feet (maximum) or less. Exterior slabs should be designed to withstand shrinkage of the concrete.

7.8 Concrete Design

As stated in Section 5.1.6, negligible concentrations of sulfates were detected in the onsite soils (Class S0). Therefore, the use of sulfate resistant concrete is not required per ACI 318-14 at this time. Post-grading conditions should be evaluated, and final recommendations made at that time.

7.9 Corrosion

Based on preliminary testing, the onsite soils are moderately corrosive to buried metal objects. Buried ferrous metals should be protected against the effects of corrosive soils in accordance with the manufacturer's recommendations. Typical measures may include using non-corrosive backfill, protective coatings, wrapping, plastic pipes, or a combination of these methods. A corrosion engineer should be consulted if specific design recommendations are required by the improvement designer.

Per ACI 318-14, an exposure class of C1 would be applicable to metals encased in concrete (rebar in footings) due to being exposed to moisture from surrounding soils. Per Table 19.3.2.1 of ACI 318-14, the requirements for concrete with an exposure class of C1 are a minimum compressive strength of 2500 psi and a maximum water-soluble chloride ion content in concrete of 0.30 (percent by weight of cement).

7.10 Pavement Design

Pavement sections for the proposed streets shall be designed based on laboratory testing conducted on samples taken from the soil subgrade. Preliminarily, based on an assumed R-Value of 30, the pavement may be designed utilizing the sections presented in Table 7-6. These sections should be verified upon the completion of grading, based on R-Value testing. The ultimate pavement section design for public streets is under the City of Anaheim's purview.

Table 7-6
Preliminary Pavement Sections

Traffic Index	Pavement Section Options OR	
5.0	3-inch AC on 6-inch AB	4-inch AC on 4-inch AB
5.5	3-inch AC on 7-inch AB	4-inch AC on 5-inch AB
6.0	3.5-inch AC on 7.5-inch AB	4-inch AC on 6.5-inch AB
AC-Asphalt Concrete AB-Caltrans Class II Base		

Construction of the streets should be accomplished in accordance with the current criteria of the City of Anaheim. Prior to the placement of base material, the subgrade should be suitably moisture conditioned, processed and compacted to a minimum 95 percent of the laboratory maximum density (ASTM: D 1557) to at least twelve (12) inches below subgrade. After subgrade compaction, the exposed grade should then be "proof"-rolled with heavy equipment to ensure the grade does not "pump" and is verified as non-yielding. Aggregate base material should be placed on the compacted subgrade and compacted in-place to a minimum 95 percent of the laboratory standard obtained per ASTM: D 1557.

8.0 LOT MAINTENANCE

Ongoing maintenance of the improvements is essential to the long-term performance of structures. As such, the owners must implement certain maintenance procedures. The attached " Maintenance and Improvement Considerations" presented in the Appendix E may be included as part of the sales packet to educate the owners in issues related to drainage, maintenance, improvements, etc. The following recommendations should also be implemented.

8.1 Lot Drainage

Roof, pad, and lot drainage should be collected and directed away from structures and slopes and toward approved disposal areas. Design fine grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures and slopes. Residents should be made aware that they are responsible for maintenance and cleaning of all drainage terraces, down drains, and other devices that have been installed to promote structure and slope stability.

8.2 Burrowing Animals

Owners should undertake a program for the elimination of burrowing animals.

9.0 FUTURE PLAN REVIEWS

This report represents a geotechnical review of the site. As the project design for the project progresses, site specific geologic and geotechnical issues should be considered in the design and construction of the project. Consequently, future plan reviews may be necessary. These reviews may include reviews of:

- Grading Plans
- Foundation Plans
- Utility Plans

These plans should be forwarded to the project Geotechnical Consultant for review.

10.0 CLOSURE

10.1 Geotechnical Review

For the purposes of this report, multiple working hypotheses were established for the project, utilizing the available data and the most probable model is used for the analysis. Future information collected during the proposed grading operations is intended to evaluate the hypothesis and as such, some of the assumptions summarized in this report may need to be changed. Some modifications of the grading recommendations may become necessary, should the conditions encountered in the field differ from the conditions hypothesized in this report.

Plans and sections of the project specifications should be reviewed by Alta to evaluate conformance with the intent of the recommendations contained in this report. If the project description or final design varies from that described in herein, Alta must be consulted regarding the applicability of the recommendations contained herein and whether any changes are required. Alta accepts no liability for any use of its recommendations if the project description or final design varies and Alta is not consulted regarding the alterations.

10.2 Limitations

This report is based on the following: 1) the project as presented on the attached plan; 2) the information obtained from Alta's laboratory testing included herein; and 3) from the information presented in the referenced reports. The findings and recommendations are based on the results of the subsurface investigation, laboratory testing, and office analysis combined with an interpolation and extrapolation of conditions between and beyond the subsurface excavation locations. However, the materials adjacent to or beneath those observed may have different characteristics than those observed, and no precise representations are made as to the quality or extent of the materials not

observed. The results reflect an interpretation of the direct evidence obtained. Work performed by Alta has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by a geotechnical consultant who is familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report.

The conclusions and recommendations included in this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Alta.

Alta has no responsibility for construction means, methods, techniques, sequences, procedures, safety precautions, programs in connection with the construction, acts or omissions of the CONTRACTOR or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

APPENDIX A

References

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APPENDIX B

Subsurface Investigation

APPENDIX B

Subsurface Investigation

Alta's subsurface investigation consisted of excavating, logging, and sampling four (4) hollow-stem auger borings. Details of the subsurface investigation are presented in Table B. The approximate location of the exploratory excavation is shown on the accompanying Plate 1 and the Geotechnical Logs are attached.

TABLE B
SURFACE INVESTIGATION DETAILS

Equipment	Range of Depths	Sampling Methods	Sample Locations
Hollow-stem auger	Up to 31 feet	1. Bulk 2. Ring Samples	1. Bulk-Select Depth 2. Every 2.5 to 5-feet

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravel and Gravelly Soils: More than 50% of coarse fraction retained on No. 4 sieve		GW	Well-graded gravels or gravel sand mixtures, little or no fines
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines
			GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils: More than 50% of coarse fraction passes on No. 4 sieve		SW	Well-graded sands or gravelly sands, little or no fines
			SP	Poorly-graded sands or gravelly sands, little or no fines
			SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, and-clay mixtures

Major Divisions		grf	ltr	
Fine Grained Soils: More than 50% passes on No. 200 sieve	Silts And Clays LL,<50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silt-clays of low plasticity
	Silts And Clays LL,<50		MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts
			VH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat and other highly organic soils

BOUNDARY CLASSIFICATION: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"	
Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

RELATIVE DENSITY

Sands and Gravels	Blows/Foot (SPT)
Very Loose	<4
Loose	4-10
Medium Dense	11-30
Dense	31-50
Very Dense	>50

CONSISTENCY CLASSIFICATION

Silts and Clays	Criteria
Very Soft	Thumb penetrates soil >1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Very Stiff	Thumbnail will not indent soil

HARDNESS

Bedrock
Soft
Moderately Hard
Hard
Very Hard

LABORATORY TESTS

Symbol	Test
DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Consolidation
SA	Sieve Analysis
MAX	Maximum Density
RV	Resistance (R) Value
EI	Expansion Index
SE	Sand Equivalent
AL	Atterberg Limits
CHEM	Chemical Analysis
HY	Hydrometer Analysis

SOIL MOISTURE

Increasing Visual Moisture Content

Dry - Dry to touch

Moist - Damp, but no visible free water

wet - Visible free water

SIZE PROPORTIONS

Trace - <5%

Few - 5 to 10%

Some - 15 to 25%

KEY TO EXPLORATORY BORING LOGS

ALTA CALIFORNIA GEOTECHNICAL INC.

PLATE B

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	118	BORING DESIG.	B-1
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	@0.0 ASPHALTIC CONCRETE 3.5", No Base.				
						ARTIFICIAL FILL-UNDOCUMENTED(afu): SILTY SAND, very fine to fine grained, brown, slightly moist, medium dense.				
	115	R	18			@2.5ft. moist.	9.4	106	44	
5		R	15		SP	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SAND, fine grained, brown, moist, medium dense, trace silt.	11.9	115	73	
	110									
10		R	22			@10.0ft. medium to coarse grained, light grayish tan, dry.	2.8	99	11	
	105									
15		R	16			@15.0ft. grayish tan, slightly moist.	6.6	107	32	
	100									
20		R	30			@20.0ft. medium grained, gray, dry, dense.	3.6	93	12	
	95									
25		R	23			@25.0ft. medium to coarse grained, brownish gray, medium dense, trace clay.	4.6	98	18	
						TOTAL DEPTH 26.0 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-1

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	118	BORING DESIG.	B-2
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					ML	@0.0 ASPHALTIC CONCRETE 4" over 2" of 1/2" Base **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, brown, moist, stiff, very fine grained sand.				
	115	R	17				13.7	109	70	
		B								
5		R	17		SC	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): CLAYEY SAND, very fine to fine grained, brown, moist, medium dense, some silt.	10.5	103	46	MAX, EI, HY, CHEM CON, HY
	110									
10		R	24			@10.0ft. fine to coarse grained, light gray, dry.	2.5	98	10	
	105									
15		R	29			@15.0ft. light tan gray, trace fine gravel <3/4".	3.3	101	14	
	100									
20		R	35			@20.0ft. gray, dense.	3.9	100	16	
	95									
25		R	27			@25.0ft. medium to coarse grained, brownish gray, slightly moist, medium dense, trace clay, few fine gravel <3/4".	7.1	100	29	
	90									
30		R	34			@30.0ft. fine to medium grained, gray, dry, dense.	3.3	110	17	
						TOTAL DEPTH 31.0 FEET NO GROUND WATER ENCOUNTERED SLIGHT CAVING BELOW 5.0 FEET.				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-2

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	119	BORING DESIG.	B-3
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	@0.0 ASPHALTIC CONCRETE 4" over 2" of 1/2" Base **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILTY SAND, very fine grained, brown, slightly moist, medium dense.				
		R	14				7.4	104	33	
	115									
5		R	11			@5.0ft. moist.	18.5	102	79	
					SP	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SAND, fine to coarse grained, gray, slightly moist, medium dense, some silt.				
	110	B								
10		R	17			@10.0ft. dry.	3.6	100	15	CON, HY
	105									
15		R	20		CL SP	@15.0ft. SILTY CLAY, brown, moist, stiff, trace fine sand. @15.5ft. SAND, fine to coarse grained, gray, dry, medium dense.	11.9	104	53	
	100									
20		R	33			@20.0ft. dense.	4.5	95	16	
	95									
25		R	14			@25.0. NO RECOVERY, medium dense.				
						TOTAL DEPTH 26.0 FEET NO GROUNDWATER ENCOUNTERED SLIGHT CAVING OBSERVED BELOW 10.0 feet				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-3

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	119	BORING DESIG.	B-4
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	@0.0 ASPHALTIC CONCRETE 4" over 2" of 1/2" Base **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILTY SAND, very fine to fine grained, brown, slightly moist, medium dense.				
		R	19		SP	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SAND, very fine to fine grained, light tan gray, dry, medium dense, trace silt.	4.7	102	20	
	115									
5		R	38		SM	@5.0ft. SILTY SAND, very fine grained, light tan brown, slightly moist, dense, trace pores, trace calcium carbonates.	8.5	106	41	
					SP	@8.0ft. SAND, very fine to fine grained, dry, medium dense.				
	110									
10		R	13				1.5			
	105									
15		R	27			@15.0ft. coarse grained, grayish tan, dry, medium dense, some fine gravel <3/4".	3.0	100	12	
	100									
20		R	26			@20.0ft. medium to coarse grained, trace fine gravel <3/4".	2.0			
	95									
25		R	24		SP	@25.0ft. SILTY SAND, very fine to fine grained, brown, moist, medium dense, trace clay.	9.9	116	62	
	90									
30		R	27		CL SP	@30.0ft. SILTY CLAY, brown, slightly moist, firm. @30.5ft. SAND, very fine to fine grained, gray, dry, medium dense.	6.4	115	39	

TOTAL DEPTH 31.0 FEET
NO GROUNDWATER ENCOUNTERED
SLIGHT CAVING OBSERVED BELOW 10.0 FEET

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-4

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	118	BORING DESIG.	P-1
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	115				SM	**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILTY SAND, very fine to fine grained, brown, dry, medium dense, with roots. @0.8ft. light tan brown, slightly moist.				
5					SP	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SAND, very fine to medium grained, light tan brown, slightly moist, medium dense, trace silt. TOTAL DEPTH 5.0 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-5

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	12/10/20	GROUND ELEV.	119	BORING DESIG.	P-2
DATE FINISHED	12/10/20	GW DEPTH (FT)		LOGGED BY	JC
DRILLER	2R Drilling Inc.	DRIVE WT.	140lbs	NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP	30 in.		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILTY SAND, very fine to fine grained, gray brown, dry, medium dense. @0.5ft. concrete debris. @1.0ft. dark brown, moist, medium dense.				
	115				SP	**YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SAND, very fine to fine grained, light tan brown, dry, medium dense, some silt.				
5						TOTAL DEPTH 5.0 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-6

APPENDIX C

Laboratory Testing

LABORATORY TESTING

The following laboratory tests were performed on a representative sample in accordance with the applicable latest standards or methods from the ASTM, California Building Code (CBC) and California Department of Transportation.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

Particle Size Analysis

Modified hydrometer testing was conducted to aid in classification of the soil. The results of the particle size analysis are presented in Table C.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of one representative bulk sample was evaluated in accordance with ASTM D-1557. The results are summarized in Table C.

Expansion Index Tests

One (1) expansion index test was performed to evaluate the expansion potential of typical on-site soil. Testing was carried out in general conformance with ASTM Test Method D-4829. The results are presented in Table C.

Consolidation Tests

Consolidation testing was performed on two (2) relatively "undisturbed" soil samples at their natural moisture content in accordance with procedures outlined in ASTM D-2435. The sample was placed in a consolidometer and loads were applied incrementally in geometric progression. The sample (2.42-inches in diameter and 1-inch in height) was permitted to consolidate under each load increment until the slope of the characteristic linear secondary compression portion of the thickness versus log of time plot was apparent. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The consolidation test results are shown on Plates C-1 and C-2.

Chemical Analyses

Chemical testing was performed on two select samples by Alta. The results of these tests (sulfate content, resistivity, chloride content and pH) are presented on Table C.

TABLE C
SUMMARY OF LABORATORY TEST DATA
P.N. 1-0357

Boring/Pit No.	Depth (Feet)	Soil Description	Group Symbol - Unified Soil Classification System	Maximum Dry Density		Direct Shear	Grain Size Analysis				Expansion Index	Sulfate Content (%)	Consolidation	Other Tests Remarks
				Maximum Density (pcf)	Optimum Moisture (%)		Gravel (% + No. 4 Screen)	% Sand	%Silt (0.074 to 0.005mm)	% Clay (-0.005 mm)				
B-2	4	Sandy Silt (afu)	ML	121.7	11.1	-	5	42	38	15	16	ND	-	Min. Resistivity: 5,100 OHM-CM Chloride: 15ppm PH: 7.77
B-2	5	Clayey Sand (Qyf)	SC	-	-	-	0	71	12	17	-	-	See Plate C-1	-
B-3	10	Sand (Qyf)	SP	-	-	-	0	93	5	2	-	-	See Plate C-2	-

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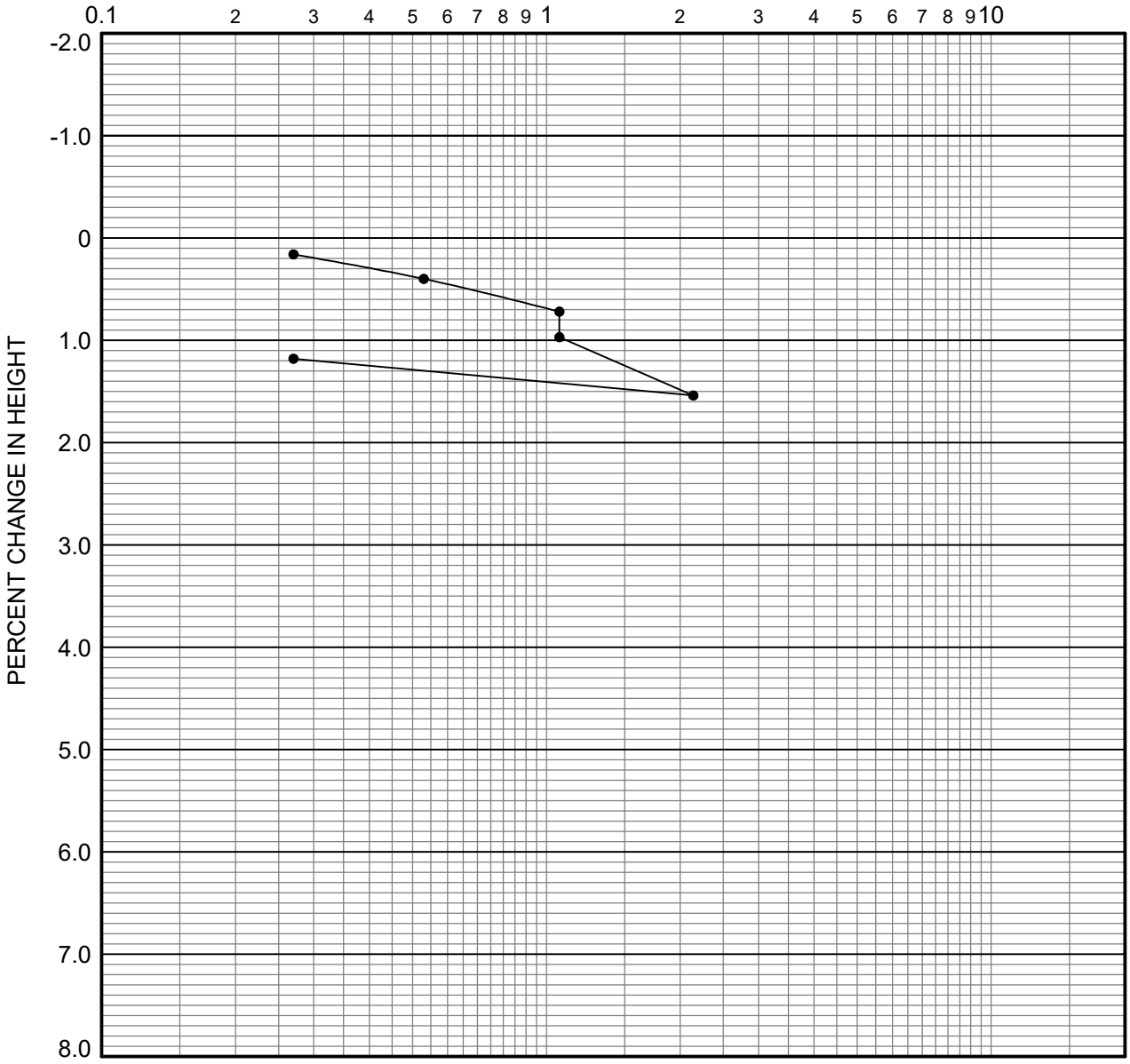
COMPRESSIVE STRESS IN TSF



boring	depth (ft.)	dry density (pcf)	in situ moist. (%)	in situ satur. (%)	-200 sieve (%)	group symbol	typical names
B-2	5.0	103	10.5	46	29	SC	Clayey Sand (Qyf)

REMARKS: WATER ADDED AT 1.07 TSF

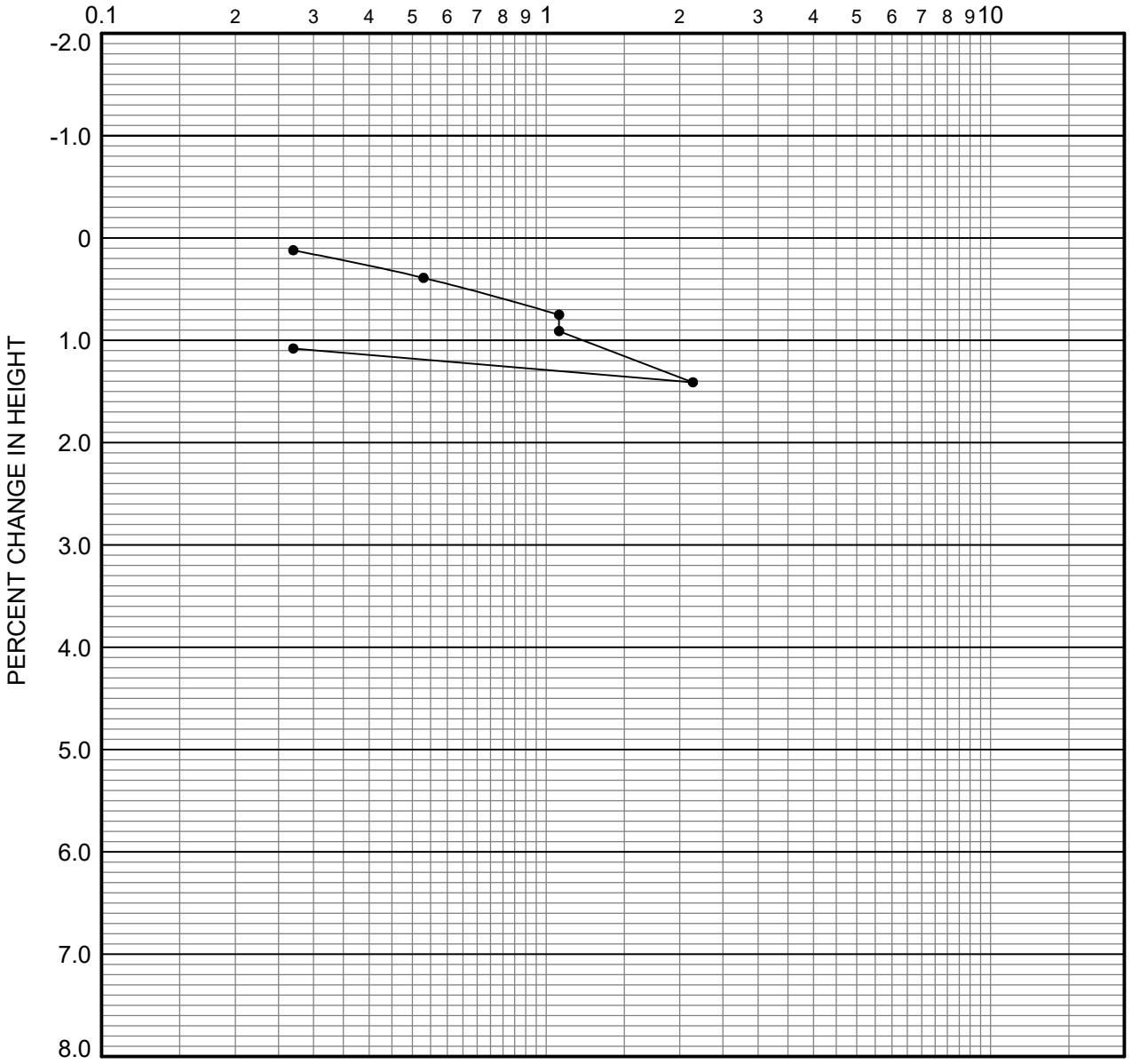
CONSOLIDATION CURVE

Alta California Geotechnical, Inc.

P.N. 1-0357

PLATE C-1

COMPRESSIVE STRESS IN TSF



boring	depth (ft.)	dry density (pcf)	in situ moist. (%)	in situ satur. (%)	-200 sieve (%)	group symbol	typical names
B-3	10.0	100	3.6	15	7	SP	Sand (Qyf)

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

Alta California Geotechnical, Inc.

P.N. 1-0357

PLATE C-2

APPENDIX D

Maintenance and Improvement Considerations

MAINTENANCE AND IMPROVEMENT CONSIDERATIONS

General

Owners purchasing property must assume a certain degree of responsibility for improvements and for maintaining conditions around their home. Of primary importance from a geotechnical standpoint are maintaining drainage patterns and minimizing the soil moisture variation below all improvements. Such design, construction and owner maintenance provisions may include:

- Employing contractors for improvements who design and build in recognition of local building codes and specific site soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other improvements.
- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Watering should be done in a uniform manner, as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts that are designed to carry roof runoff directly into area drains or discharged well away from the foundation areas.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively uniform moisture conditions.

Sulfates

Owners should be cautioned against the import and use of certain inorganic fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils and increase the sulfate concentrations to potentially detrimental levels.

Site Drainage

- The owners should be made aware of the potential problems that may develop when drainage is altered through construction of hardscape improvements. Ponded water, drainage over the slope face, leaking irrigation systems, overwatering, or other conditions which could lead to ground saturation must be avoided.
- No water should be allowed to flow over the slopes. No alteration of pad gradients should be allowed that would prevent pad and roof runoff from being directed to approved disposal areas.
- Drainage patterns have been established at the time of the fine grading should be maintained throughout the life of the structure. No alterations to these drainage patterns should be made unless designed by qualified professionals in compliance with local code requirements and site-specific soils conditions.

Slope Drainage

- Residents should be made aware of the importance of maintaining and cleaning all interceptor ditches, drainage terraces, down drains, and any other drainage devices, which have been installed to promote slope stability.
- Subsurface drainage pipe outlets may protrude through slope surfaces and/or wall faces. These pipes, in conjunction with the graded features, are essential to slope and wall stability and must be protected in-place. They should not be altered or damaged in any way.

Planting and Irrigation of Slopes

- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It is the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately.
- Sprinklers should be adjusted to provide maximum uniform coverage with a minimum of water usage and overlap. Overwatering with consequent wasteful runoff and serious ground saturation must be avoided.
- If automatic sprinkler systems are installed, their use must be adjusted to account for seasonal and natural rainfall conditions.

Burrowing Animals

- Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability.

Owner Improvement

Owner improvements (pools, spas, patio slabs, retaining walls, planters, etc.) should be designed to account for the terrain of the project, as well as expansive soil conditions and chemical characteristics. Design considerations on any given lot may need to include provisions for differential bearing materials, ascending/descending slope conditions, bedrock structure, perched (irrigation) water, special geologic surcharge loading conditions, expansive soil stresses, and long-term creep/settlement.

All owner improvements should be designed and constructed by qualified professionals utilizing appropriate design methodologies, which account for the on-site soils and geologic conditions. Each lot and proposed improvement should be evaluated on an individual basis.

Setback Zones

Manufactured slopes maybe subject to long-term settlement and creep that can manifest itself in the form of both horizontal and vertical movement. These movements typically are produced as a result of weathering, erosion, gravity forces, and other natural phenomenon. A setback adjacent to slopes is required by most building codes, including the California Building Code. This zone is intended to locate and support the residential structures away from these slopes and onto soils that are not subject to the potential adverse effects of these natural phenomena.

The owner may wish to construct patios, walls, walkways, planters, swimming pools, spas, etc. within this zone. Such facilities may be sensitive to settlement and creep and should not be constructed within the setback zone unless properly engineered. It is suggested that plans for such improvements be designed by a professional engineer who is familiar with grading ordinances and design and construction requirements. In addition, we recommend that the designer and contractor familiarize themselves with the site specific geologic and geotechnical conditions on the specific lot.

APPENDIX E

Earthwork Specifications

ALTA CALIFORNIA GEOTECHNICAL, INC.
EARTHWORK SPECIFICATIONS

These specifications present the generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superseded in preliminary geology and soils reports, grading plan review reports or by the prevailing grading codes or ordinances of the controlling agency.

A. GENERAL

1. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

2. The project Geotechnical Engineer and Engineering Geologist, or their representatives, shall provide observation and testing services, and Geotechnical consultation for the duration of the project.

3. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Geotechnical Engineer/Engineering Geologist.

4. It is the Contractor's responsibility to prepare the ground surface to receive fill to the satisfaction of the Geotechnical Engineer and to place, spread, mix, moisture condition, and compact the fill in accordance with the job specifications and as required by the Geotechnical Engineer. The Contractor shall also remove all material considered by the Geotechnical Engineer to be unsuitable for use in the construction of engineered fills.

5. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit the proper preparation of fills.

B. PREPARATION OF FILL AREAS

1. Excessive vegetation and all deleterious material should be disposed of offsite as required by the Geotechnical Engineer.

   Existing fill, soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and hauled from the site. Where applicable, the Contractor may obtain the

approval of the Soils Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removal of the deleterious materials have been accomplished, earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Geotechnical Engineer/Engineering Geologist.

2. Upon achieving a suitable bottom for fill placement, the exposed removal bottom shall be disced or bladed by the Contractor to the satisfaction of the Geotechnical Engineer. The prepared ground surfaces shall then be brought to the specified moisture content mixed as required, and compacted and tested as specified. In localities where it is necessary to obtain the approval of the controlling agency prior to placing fill, it will be the Contractor's responsibility to contact the proper authorities to visit the site.

3. Any underground structure such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or other structures not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer and/or the controlling agency for the project.

C. ENGINEERED FILLS

1. Any material imported or excavated on the property may be utilized as fill, provided the material has been determined to be suitable by the Geotechnical Engineer. Deleterious materials shall be removed from the fill as directed by the Geotechnical Engineer.

2. Rock or rock fragments less than twelve inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Geotechnical Engineer.

3. Rocks greater than twelve inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal.

4. All materials to be used as fill, shall be tested in the laboratory by the Geotechnical Engineer. Proposed import materials shall be approved by the Geotechnical Engineer 48 hours prior to importation.

5. The fill materials shall be placed by the Contractor in lifts, that when compacted, shall not exceed six inches. Each lift shall be spread evenly and shall be

thoroughly mixed to achieve a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at or above the optimum moisture content, as determined by the applicable laboratory standard. The Contractor will be notified if the fill materials are too wet or too dry to achieve the required compaction standard.

6. When the moisture content of the fill material is below the limit specified by the Geotechnical Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. When the moisture content of the fill material is above the limits specified by the Geotechnical Engineer, the fill materials shall be aerated by discing, blading, mixed with dryer fill materials, or other satisfactory methods until the moisture content is within the specified limits.

7. Each fill lift shall be compacted to the minimum project standards, in compliance with the testing methods specified by the controlling governmental agency, and in accordance with recommendations of the Geotechnical Engineer.

   In the absence of specific recommendations by the Geotechnical Engineer to the contrary, the compaction standard shall be the most recent version of ASTM:D 1557.

8. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable materials into sound bedrock or firm material, in accordance with the recommendations and approval of the Geotechnical Engineer.

9. Side hill fills shall have a minimum key width of 15 feet into bedrock or firm materials, unless otherwise specified in the soil report and approved by the Geotechnical Engineer in the field.

10. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Geotechnical Engineer and Engineering Geologist.

11. The Contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as directed by the Geotechnical Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting

back to the compacted core; by direct compaction of the slope face with suitable equipment; or by any other procedure which produces the required result.

12. The fill portion of fill-over-cut slopes shall be properly keyed into rock or firm material; and the fill area shall be stripped of all soil or unsuitable materials prior to placing fill.

    The design cut portion of the slope should be made first and evaluated for suitability by the Engineering Geologist prior to placement of fill in the keyway above the cut slope.

13. Pad areas in cut or natural ground shall be approved by the Geotechnical Engineer. Finished surfaces of these pads may require scarification and recompaction, or over excavation as determined by the Geotechnical Engineer.

D. CUT SLOPES

1. The Engineering Geologist shall observe all cut slopes and shall be notified by the Contractor when cut slopes are to be started.

2. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soil Engineer shall investigate, analyze and make recommendations to remediate these problems.

3. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the superjacent, prevailing drainage.

4. Unless otherwise specified in specific geotechnical reports, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

5. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Geotechnical Engineer or Engineering Geologist.

E. GRADING CONTROL

1. Fill placement shall be observed and tested by the Geotechnical Engineer and/or his representative during grading.

   Field density tests shall be made by the Geotechnical Engineer and/or his representative to evaluate the compaction and moisture compliance of each fill lift. Density tests shall be conducted at intervals not to exceed two feet of fill

height. Where sheepsfoot rollers are used, the fill may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Geotechnical Engineer or his representative.

2. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture content is in evidence, that particular layer or portion thereof shall be reworked until the required density and/or moisture content has been attained. Additional fills shall not be placed over an area until the previous lift of fill has been tested and found to meet the density and moisture requirements for the project and the previous lift is approved by the Geotechnical Engineer.

3. When grading activities are interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Geotechnical Engineer indicate the moisture content and density of the fill are within the specified limits.

4. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent the ponding of water. The Contractor shall take remedial action to control surface water and to prevent erosion of graded areas until such time as a permanent drainage and erosion devices have been installed.

5. Observation and testing by the Geotechnical Engineer and/or his representative shall be conducted during filling and compacting operations in order that he will be able to state in his opinion that all cut and filled areas are graded in accordance with the approved specifications.

6. Upon the completion of grading activities and after the Geotechnical Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or fill placement shall be undertaken without prior notification of the Geotechnical Engineer and/or Engineering Geologist.

F. FINISHED SLOPES

All finished cut and fill slopes shall be planted and irrigated and/or protected from erosion in accordance with the project specifications, governing agencies, and/or as recommended by a landscape architect.

ALTA CALIFORNIA
GEOTECHNICAL INC.

170 North Maple Street, Suite 108
Corona, CA 92880
www.altageotechnical.com

CITY VENTURES
3121 Michelson Drive
Irvine, California 92612

February 3, 2021
Project No. 1-0357

Attention: Ms. Kim Prijatel

Subject: **SUMMARY OF ADDITIONAL INFILTRATION TESTING**
1661 W Broadway
City of Anaheim, California

Reference: Alta California Geotechnical, Inc., 2021, Geotechnical Investigation, 1661 W. Broadway, City of Anaheim, California, dated January 4, 2021 (Project No. 1-0357).

Dear Ms. Prijatel:

Presented herein is Alta California Geotechnical, Inc.'s (Alta) summary of additional infiltration testing for the proposed residential development, located at 1661 West Broadway, in the City of Anaheim, California. Alta previously conducted infiltration testing onsite in December 2020 (Alta, 2021). Additional infiltration testing was performed onsite at the request of C&V Consulting.

Presented below is a summary of our infiltration testing, and conclusions and recommendations based on the additional testing.

Infiltration Testing

Two additional infiltration tests were conducted on February 2, 2021 at the locations shown on Plate 1, identified as P-3 and P-4. P-1 and P-2 were presented in the referenced report. The locations of the additional infiltration testing where determined by C&V Consulting. The infiltration tests were conducted in sand lenses of the young alluvial fan deposits, and boring

logs are presented in Appendix A. Infiltration testing utilized deep percolation test methods in general conformance with the County of Orange Technical Guidance Document standards.

A summary of the test results is presented in Table A. The results do not include a factor of safety.

Table A-Summary of Infiltration Testing (No Factor of Safety)

Test Designation	P-3	P-4
Approximate Depth of Test	10 ft	15 ft
Time Interval	30 minutes	30 minutes
Radius of Test Hole	4 inches	4 inches
Tested Infiltration Rate	0.8 (in/hr)	3.7 (in/hr)

Conclusions and Recommendations

Based on our testing, use of infiltration WQMP systems at the depths tested are feasible at the subject site. The WQMP designer should review the test results and determine if the proposed WQMP system is appropriate for the site. A factor of safety should be applied to the results that is in accordance with County of Orange requirements.

From a geotechnical perspective, allowing storm water to infiltrate the onsite soil in concentrated areas increases the potential for settlement, liquefaction, and water-related damage to structures/improvements, such as wet slabs or pumping subgrade. Care should be taken in designing systems that control the storm water as much as possible. A methodology for dealing with overflow should be infiltration system become clogged or full should be developed and maintained.

It is recommended that the Project Geotechnical Consultant review the WQMP plans and observe the WQMP excavations during construction to verify that the infiltration rates presented herein are appropriate. If it is determined that rates may be variable, additional infiltration testing should be undertaken.

Limitations

The conclusions and recommendations presented in this report are based on our infiltration test results and experience with similar soil conditions on similar projects. Materials adjacent to or beneath those observed may have different characteristics than those observed, and no precise representations are made as to the quality or extent of the materials not observed.

Alta appreciates the opportunity to provide geotechnical consulting services for your project.

Respectfully submitted,

Alta California Geotechnical, Inc.

FERNANDO RUIZ
Civil Engineering Associate

Reviewed By:

SCOTT A. GRAY/RGE 2857
Reg. Exp.: 12-31-22
Registered Geotechnical Engineer
President

Distribution: (1) Addressee

SAG: 1-0357, February 3, 2021 (Summary of Additional Infiltration Testing, 1661 W Broadway Ave)

APPENDIX A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravel and Gravelly Soils: More than 50% of coarse fraction retained on No. 4 sieve		GW	Well-graded gravels or gravel sand mixtures, little or no fines
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines
			GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils: More than 50% of coarse fraction passes on No. 4 sieve		SW	Well-graded sands or gravelly sands, little or no fines
			SP	Poorly-graded sands or gravelly sands, little or no fines
			SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, and-clay mixtures

Major Divisions		grf	ltr	
Fine Grained Soils: More than 50% passes on No. 200 sieve	Silts And Clays LL,<50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silt-clays of low plasticity
	Silts And Clays LL,<50		MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts
			VH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat and other highly organic soils

BOUNDARY CLASSIFICATION: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"	
Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

RELATIVE DENSITY

Sands and Gravels	Blows/Foot (SPT)
Very Loose	<4
Loose	4-10
Medium Dense	11-30
Dense	31-50
Very Dense	>50

CONSISTENCY CLASSIFICATION

Silts and Clays	Criteria
Very Soft	Thumb penetrates soil >1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Very Stiff	Thumbnail will not indent soil

HARDNESS

Bedrock
Soft
Moderately Hard
Hard
Very Hard

LABORATORY TESTS

Symbol	Test
DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Consolidation
SA	Sieve Analysis
MAX	Maximum Density
RV	Resistance (R) Value
EI	Expansion Index
SE	Sand Equivalent
AL	Atterberg Limits
CHEM	Chemical Analysis
HY	Hydrometer Analysis

SOIL MOISTURE

Increasing Visual Moisture Content

Dry - Dry to touch

Moist - Damp, but no visible free water

wet - Visible free water

SIZE PROPORTIONS

Trace - <5%

Few - 5 to 10%

Some - 15 to 25%

KEY TO EXPLORATORY BORING LOGS

ALTA CALIFORNIA GEOTECHNICAL INC.

PLATE B

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	2/1/21	GROUND ELEV.		BORING DESIG.	P-3
DATE FINISHED	2/1/21	GW DEPTH (FT)		LOGGED BY	FR
DRILLER	2R Drilling Inc.	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	ASPHALTIC CONCRETE 3", No Base. **ARTIFICIAL FILL-UNDOCUMENTED** (afu): SILTY SAND, fine to medium grained, brown, moist, medium dense				
5					SM	**YOUNG ALLUVIAL FAN DEPOSITS** SILTY SAND, fine to medium grained, light brown, moist, medium dense				
					SP	@ 7.0ft. SAND, fine to medium grained, light tan brown, slightly moist, medium dense, few silt				
10						TOTAL DEPTH 10.0 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-1

GEOTECHNICAL BORING LOG

PROJECT NO.	1-0357	PROJECT NAME	1661 W. Broadway		
DATE STARTED	2/1/21	GROUND ELEV.		BORING DESIG.	P-4
DATE FINISHED	2/1/21	GW DEPTH (FT)		LOGGED BY	FR
DRILLER	2R Drilling Inc.	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	8" Hollow Stem Auger	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	ASPHALTIC CONCRETE 3", No Base.				
						ARTIFICIAL FILL-UNDOCUMENTED (afu): SILTY SAND, fine to medium grained, dark brown to brown, moist, medium dense				
5					SM	**YOUNG ALLUVIAL FAN DEPOSITS** (Qyf): SILTY SAND, fine to medium grained, brown, moist, medium dense, trace clay				
					SP	@ 8.0ft. SAND, fine to medium grained, brown, slightly moist, medium dense, few silt				
10						@ 10.0ft. medium to coarse grained, tan, more sand				
15						@ 15.0ft. medium grained, trace gravel up to 1/2" in diameter				
						TOTAL DEPTH 15.0 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

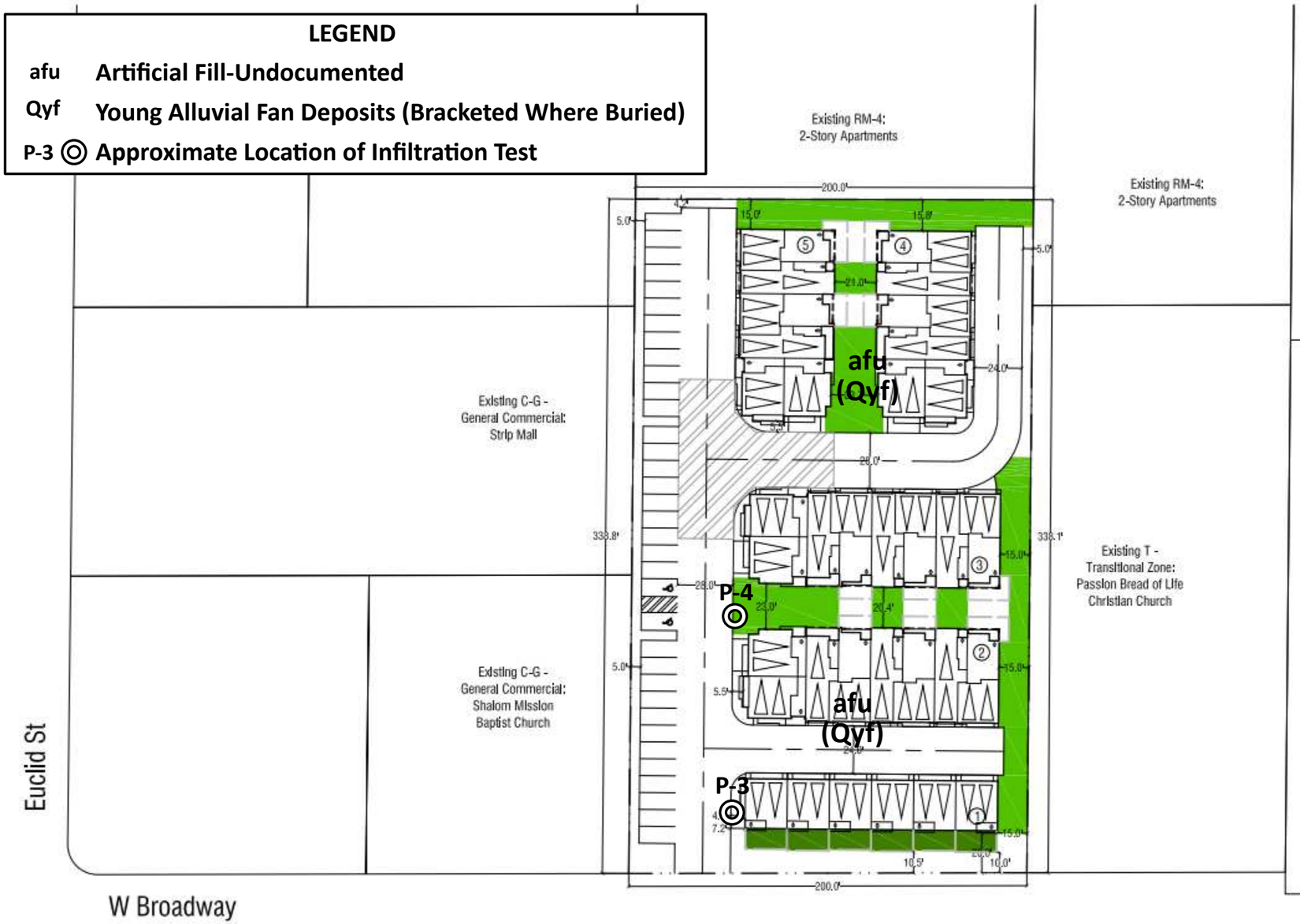
GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0357 PLATE B-2

LEGEND

afu	Artificial Fill-Undocumented
Qyf	Young Alluvial Fan Deposits (Bracketed Where Buried)
P-3 ◎	Approximate Location of Infiltration Test



Project Summary

Total Site Area: ± 1.55 Acres (± 67,693 SF)

Total Units: 34 Homes
- (6) Plan 1: ± 1,100 SF, 2 Bedroom, 2.5 Bath
- (8) Plan 2: ± 1,329 SF, 2 Bedroom, 2.5 Bath, Loft, Opt. Bed 3
- (10) Plan 3: ± 1,417 SF, 3 Bedroom, 3 Bath
- (10) Plan 4: ± 1,671 SF, 3 Bedroom, 3 Bath, Den, Opt. Bed 4

Density: 21.93 Homes per Acre

Parking:

Required: 103 Spaces (3.03 spaces per home)
- (6) 2 Bedroom x 2.25 Spaces = 13.5 Spaces
- (18) 3 Bedroom x 3.0 Spaces = 54 Spaces
- (10) 4 Bedroom x 3.5 Spaces = 35 Spaces

Provided: 103 Spaces (3.03 spaces per home)
- Garage: 68 Spaces
- Head In: 33 Spaces (8.5' x 18')
- ADA: 2 Spaces (9' x 18')

Open Space:

Required: 9,350 SF Total (275 SF per home)
- Common: xx SF (10' min. dim.)
- Private: xx SF (10' min. dim. ground, 7' min. dim deck)

Provided: 10,038 SF Total (± 295 per home)
- Common: 8,094 SF (10' Min. Dimension)
- Private: 1,944 SF
  - Ground: 1,264 SF (10' Min. Dimension)
  - Deck: 680 SF (7' Min. Dimension)

Lot Coverage: 23,830 SF (35.2% of site)

Zoning Summary

Existing General Plan:	Office - Low
Proposed General Plan:	Mid Density
Existing Zoning:	C-G - General Commercial
Proposed Zoning:	RM-3.5 - Multiple-Family Residential
Max. Density:	27 Homes per Acre
Building Setbacks:	Front Yard: 20' Interior Side Yard: 15' Street Side Yard: 15' Rear Yard: 15'
Building Separation:	Varies
Max. Building Height:	40' and 3 Stories
Max. Lot Coverage:	50%

Notes:

1. Site plan is for conceptual purposes only.
2. Site plan must be reviewed by planning, building, and fire departments for code compliance.
3. Base information per civil engineer.
4. Civil engineer to verify all setbacks and grading information
5. Building Footprints might change due to the final design elevation style.
6. Open space area is subject to change due to the balcony design of the elevation.
7. Building setbacks are measured from property lines to building foundation lines.

PLATE 1

City Ventures

CONCEPTUAL SITE PLAN
1661 BROADWAY SITE
ANAHEIM, CA

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 N. MAPLE STREET, STE 108, CORONA, CA 92880
TELEPHONE: (951) 509-7090

PROJECT NUMBER: 1-0357 DATE: 2-3-21

0 15 30 60

CONCEPT STUDY | 2020291 | 10-12-20

ARCHITECTS . PLANNERS . DESIGNERS
WHA.
ORANGE COUNTY . LOS ANGELES . BAY AREA

Attachment G

Notice of Transfer of Responsibility

Water Quality Management Plan
Notice of Transfer of Responsibility

Submission of this Notice of Transfer of Responsibility constitutes notice to the City of Anaheim that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/ her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsibility Party Information

Company/ Individual Name		Contact Person	
Street Address		Title	
City	State	Zip	Phone

II. Information about Site Transferred

Name of Project	
Title of WQMP Applicable to Site:	
Street Address of Site	
Tract Number(s) for Site	Lot Numbers
Date WQMP Prepared (or Revised)	

III. New Owner/ New Responsible Party Information

Company/ Individual Name		Contact Person	
Street Address		Title	
City	State	Zip	Phone

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any)
Lot/ Tract Number(s) of Site Transferred to New Owner	
Remaining Lot/ Tract Number(s) to WQMP still held by Owner (if any)	
Date of Ownership Transfer	

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/ parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of the project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by the Previous Owner. Those portions retained by the Previous Owner shall be labeled "Previous Owner," and those portions previously transferred by the Previous Owner shall be labeled as "Previously Transferred."

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Owner is now the Responsible Party of record for the WQMP for this portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the New Owner.

Print Name of Previous Owner Representative	Title
Signature of Previous Owner Representative	Date

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Print Name of New Owner Representative	Title
Signature of New Owner Representative	Date

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