METROLINK ORANGE COUNTY MAINTENANCE FACILITY PROJECT

APPENDICES

DRAFT INITIAL STUDY/
MITIGATED NEGATIVE DECLARATION

ORANGE COUNTY TRANSPORTATION AUTHORITY

FEBRUARY 2022

Appendix A
Technical Memorandum
Aesthetics

Metrolink Orange County Maintenance Facility

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0	Draft Aesthetics Technical Memorandum	01/15/21
1	Draft Aesthetics Technical Memorandum (Incorporating OCTA's comments)	4/27/2021
2	Draft Aesthetics Technical Memorandum (Incorporating OCTA's comments)	6/17/2021

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The purpose of this memorandum is to describe the potential impacts that the Project would have on the existing baseline visual and aesthetic resources.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)), land use under the General Plan (City of Irvine, 2015). Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval,

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection, and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 0-1). A total of 11 tracks would be built.The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest to the railroad right-of-way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, all six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 0-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)

Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

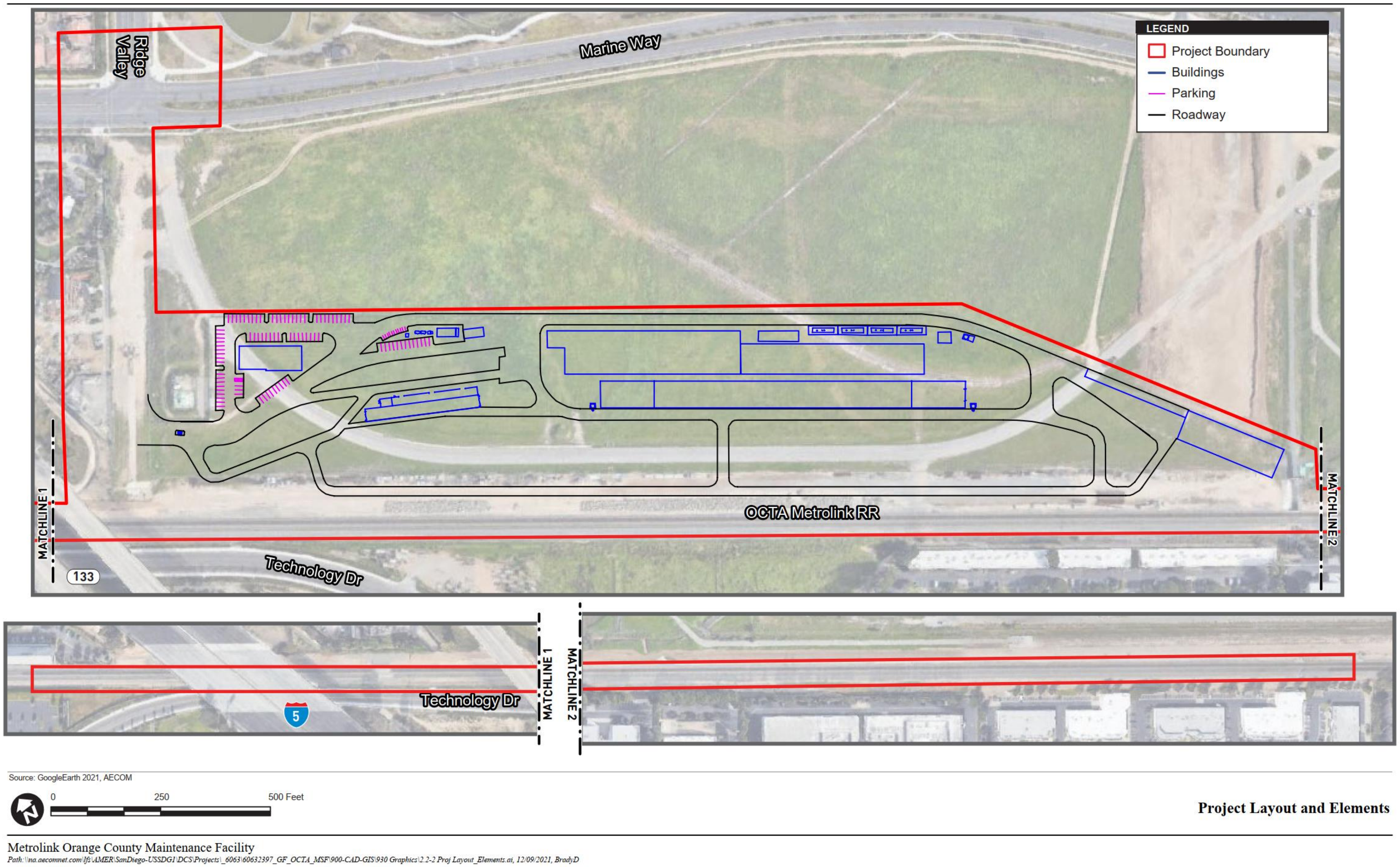
A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette.

Parking would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 0-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink’s “Orange” Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. ENVIRONMENTAL SETTING

3.1 EXISTING CONDITIONS

The Project Site is located in a relatively flat area adjacent to the OCGP, with a multi-sport complex in close proximity to the northeast, office/industrial uses to the southwest, and the I-5 and State Route 133 (SR-133) highways. The existing area in the vicinity of the Project consists of an active railroad corridor, vacant, undeveloped land, active parkland associated with the OCGP, and other urbanized attributes areas containing medium-high rise commercial office buildings (Google Maps, 2018). A complex of two-story single-family homes is located at the northwest corner of Marine Way and Ridge Valley Boulevard. The City of Irvine and their private partner are converting 1,300 acres of the former military base into 472 acres of developed parkway for Great Park with amenities hosting: twenty-five tennis courts, thirteen soccer fields, a golf course, twelve baseball fields, and other community buildings and open space features (City of Irvine, 2020). Future development will consist of museums and other cultural and entertainment components that would require approval from the Irvine City Council. The OCGP would be the fourth largest sports complex in the nation after full build out.

The Santa Ana Mountains can be seen to the east of the Project Site and Bommer and Shady Canyon can be seen southwest of the Project Site. There are no designated Caltrans scenic vistas or scenic resources in the area (Caltrans, 2019).

The vacant parcel between the Project Site and Marine Way is currently being developed into an RV (recreational vehicle) storage area by the County of Orange. The intended use of this parcel is for storage of unoccupied vehicles.

The existing Project Site does not have any light sources. Sources of lighting in the vicinity of the Project Site include the OCGP's tennis courts, sports fields, and parking lot security lighting. The highways additionally have light sources for roadway visibility and headlights from motor vehicle traffic.

3.2 EXISTING VISUAL CHARACTER AND QUALITY

The existing visual character of the Project Site exhibits some natural landforms and vegetation, such as low grasses, due to the Project Site currently being vacant and undeveloped (Figure 3.2-1 and 3.2-2). Other landforms such as a narrow paved road traverses the visual landscape. Minor visual structural features on the Project Site include unused stormwater drains, valves and vents, rail equipment, signal houses, and storage of other rail or electrical related equipment. The form of the Project Site is generally flat, low, and simple, with no vertical elements that dominate the landscape. Lines associated with the Project Site are generally horizontal, curving and continuous, but occasionally irregular, which do not visually dominate the view. Colors that are visible within the landscape include primary hues of brown, with some patches of greens and variable lines including grays. The texture of the Project Site is fine-grained, dense, patchy, with occasional areas of striation. The existing visual quality of the Project Site is considered to have low vividness, intactness, and unity because the Project Site does not exhibit distinctive or memorable visual elements; the integrity of the visual environment is not consistent or patterned; and the visual elements do not combine to form a coherent visual design or organization.

A majority of the areas surrounding the Project Site vary greatly in visual character from the Project Site in terms of form, line, color, and texture due to the presence of more and taller vertical features such as trees, residences, elevated highways, as well as vibrant large areas of green spaces. The visual quality of the surrounding area varies, but generally exhibits a slightly higher degree of vividness, intactness, and unity.

Figure 3.2-1 View from within the Project Site, Looking West

Source: Google Maps (2018)

Figure 3.2-2 View from within the Project Site, Looking Northeast

Source: Google Maps (2018)

3.3 VIEWER CHARACTERISTICS AND SENSITIVITY

Viewer sensitivity or concern is based on the visibility of resources in the landscape, the proximity of viewers to the aesthetic resource, the relative elevation of the viewers compared to the aesthetic resource, the frequency and duration of views, the number of viewers, and the types of individuals. In considering aesthetic impacts of the Project, key views and visually prominent features have been assessed to determine how they would most influence impact perception.

The viewer population is a mix of viewer groups, including residents, park patrons, office building and industrial workers, transit patrons, commuters and bicyclists. Commuters, including bicyclists and motorists on streets and freeways, are anticipated to have low sensitivity to visual change than other viewer groups because they are focused on driving in traffic. Similarly, transit patrons are anticipated to have low sensitivity to visual change because they are taking transit (e.g., Metrolink) typically for the specific purpose of traveling to and from their place of employment. Workers in the nearby office buildings and industrial buildings are anticipated to have low sensitivity to visual change because they are present in this area primarily to work, and not for leisure activities. The residents and park patrons would have high sensitivity to visual change in the area either because their activities are elective or because they spend a great deal of time in the area surrounding the Project Site.

Light sensitive receptors or land uses may include, but are not limited to, all types of residences; commercial or institutional uses that require minimal nighttime illumination for proper function, physical comfort, or commerce; and natural areas. In the vicinity of the Project Site, the sensitive receptors include the senior residential community to the northwest. OCGP, as a park, would be considered a light sensitive receptor; however, it already contains several sources of nighttime illumination for its sports fields. Therefore, the OCGP is not considered a light sensitive receptor for the purposes of this Project.

3.4 REGULATORY FRAMEWORK

City of Irvine General Plan Land Use Policy Objective A-1 Policy (a)- Objective A-1 of City of Irvine's Land Use Policy is to strengthen Irvine's identity. One policy mechanism to achieve this objective is through the conservation of visual resources along the scenic corridors that define the City of Irvine.

4. METHODOLOGY

Visual or aesthetic resources are the natural and built features of the landscape that can be seen. The combination of landform, water, and vegetation patterns represents the natural landscape features that define an area's visual character. Built features, such as buildings, roads, utility structures, and ornamental plantings, reflect human modifications to the landscape. These natural and built landscape features, or visual resources, contribute to the public's experience and appreciation of the environment.

The process used in this visual impact assessment generally follows the guidelines outlined in the publication *Guidelines for the Visual Impact Assessment of Highway Projects* published by the Federal Highway Administration (FHWA) in January 2015, which is an updated version of publication *Visual Impact Assessment for Highway Projects* also published by FHWA in March 1981. Although this guidance was developed for highway projects, it is adaptable to many types of projects. The major components of the visual impact assessment include establishing the visual setting and assessing impacts of the project on visual resources, such as nearby natural or constructed features.

The degree of aesthetic or visual impact was determined by assessing the visible changes that would be introduced by the Project. The assessment focuses on areas where changes in the visual environment would be greatest, such as areas with higher viewer sensitivity and/or where sensitive views would be affected. The assessment of potential aesthetic impacts addresses the following:

- Conflicts or complements to the existing visual character;
- Changes in visual quality;
- Likely impact on viewers with consideration of viewer sensitivity;
- Visual intrusion and blockage of sensitive views with an emphasis placed on any views that are identified by local jurisdictions as requiring protection; and
- Increases in light and glare.

The viewer population is a mix of major viewer groups that includes residents, park patrons, office building and industrial workers, transit patrons, commuters and bicyclists. Scenic views are defined as long-range views toward preserved natural areas or recognized visual and/or historic landmarks. A visual change would be considered significant if it introduces obstructive elements substantially out of character with existing land uses or substantially obscures a scenic view or vista available to major viewer groups near project features. The degree of visual impact is determined by assessing visible changes that would be introduced by the Project during construction and operation, as well as viewers' exposure and sensitivity to these changes.

4.1 CALIFORNIA ENVIRONMENTAL QUALITY ACT THRESHOLDS

CEQA considers an impact significant if the Project would:

1. Have a substantial adverse effect on a scenic vista.
2. Substantially degrade scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.
3. In nonurbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings. (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, if the project would conflict with applicable zoning and other regulations governing scenic quality.
4. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

5. IMPACTS ANALYSIS

5.1 SCENIC VISTAS

A scenic vista generally provides focal views of objects, settings, or features of visual interest; or panoramic views of large geographic areas of scenic quality, primarily from a given vantage point. A significant impact would occur if a project introduced incompatible visual elements within a field of view containing a scenic vista or substantially altered a view of a scenic vista.

Scenic views or vistas are panoramic public views of various natural features, including the ocean, striking or unusual natural terrain, or unique urban or historic features. Public access to these views may be available from nearby parklands, private and public-owned sites, and public ROW.

The City of Irvine General Plan does not delineate or designate any specific views as protected scenic vistas in the Project Site. There are no designated Caltrans scenic vistas or scenic resources in the area. The closest designated scenic highway is Highway 91 and is located approximately 13 miles away from the Project. The Project Site is within an urban setting within the eastern portion of Irvine, directly adjacent to the Metrolink ROW and an elevated freeway. The Project Site is relatively flat, and implementation of the Project would not result in a significant alteration of its topography. The Project would include a new maintenance facility located along the Metrolink ROW and would involve the construction and operation of up to 30-foot-tall buildings, and approximately 30-foot-tall metal structures that would serve as bridges for utility lines. The construction and operations of the Project would include visible features; however, the Project would not alter the views of a designated scenic vista. The Project would not result in the disruption of any designated scenic vistas from the perspective of residences to the northwest of the Project Site or patrons at the surrounding OCGP complex. Therefore, construction and operational impacts related to effects on a scenic vista would be less than significant.

5.2 SCENIC RESOURCES

A significant impact would occur where scenic resources within a state scenic highway were damaged or removed as a result of the Project. The Project is not located along or near an officially designated California Scenic Highway or locally designated scenic highway. The closest designated scenic highway is Highway 91 and is located approximately 13 miles away from the Project. Old Town Irvine is a registered California historical landmark, located approximately ½ mile away from the Project Site; however, it is occluded by the SR-133 and I-5 highways (State of California Office of Historic Preservation, 2020; National Park Services, 2020).

The Project would not impact any groves of trees, street trees, rock outcroppings, historic buildings, or any other potential scenic resources during construction or operations as no existing scenic resources are located on the Project Site. Therefore, no construction or operational impacts would occur related to scenic resources including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.

5.3 VISUAL CHARACTER

Construction Impacts

Project construction would include two phases and would be temporary in nature. Phase 1 would consist of the primary build-out of the facility and would last up to 30 months in duration. Phase 2 is a secondary build-out of up to 24 months in duration.

Visually, the Project Site consists of a vacant area with a minor accessory structure and access roads. The Project Site does not contain any buildings, trees, or landscaping and the existing landscape is not memorable. This is a contrast from the green open space area to the north which includes the OCGP. During the construction phase, construction equipment, staging areas, construction trucks and vehicles, and temporary fencing would be visible to several viewer groups and would result in a contrast and change in visual character from the existing vacant area. However, construction is currently ongoing for the County of Orange’s RV park and, thus, construction activities such as grading would not be different than what is encountered now.

Transit patrons, commuters, and bicyclists would primarily experience views of construction activities while riding the adjacent Metrolink, driving along Marine Way adjacent to the Project Site, and while traveling in the bike path that also exists along Marine Way. The latter two groups would have some blockage of views of the construction site by the proposed RV storage area between Marine Way and the Project Site. In addition, commuters may have prolonged views while idling on the congested freeways. The change in the visual character of the Project Site during the construction phase would be noticed by these viewer groups. However, transit patrons, commuters, and bicyclists are considered to have a low sensitivity to any visual changes on the Project Site as they are likely passing through the vicinity of the Project Site to reach their destinations and their duration of exposure and awareness of landscape changes would be low.

The employees of office buildings and industrial land uses in the vicinity of the Project Site would primarily experience views of the construction activities on the Project Site as they approach and leave their place of work. Therefore, their views of the construction activities would primarily take place while en route to and from these locations in the Project Site. The change in the visual character of the Project Site during the construction phase would be noticed by these viewer groups. However, patrons and employees of office buildings and industrial land uses are considered to have a low sensitivity to any visual changes on the Project Site as they are likely passing through the vicinity to reach their place of work or business and their duration of exposure and awareness of landscape changes would be low.

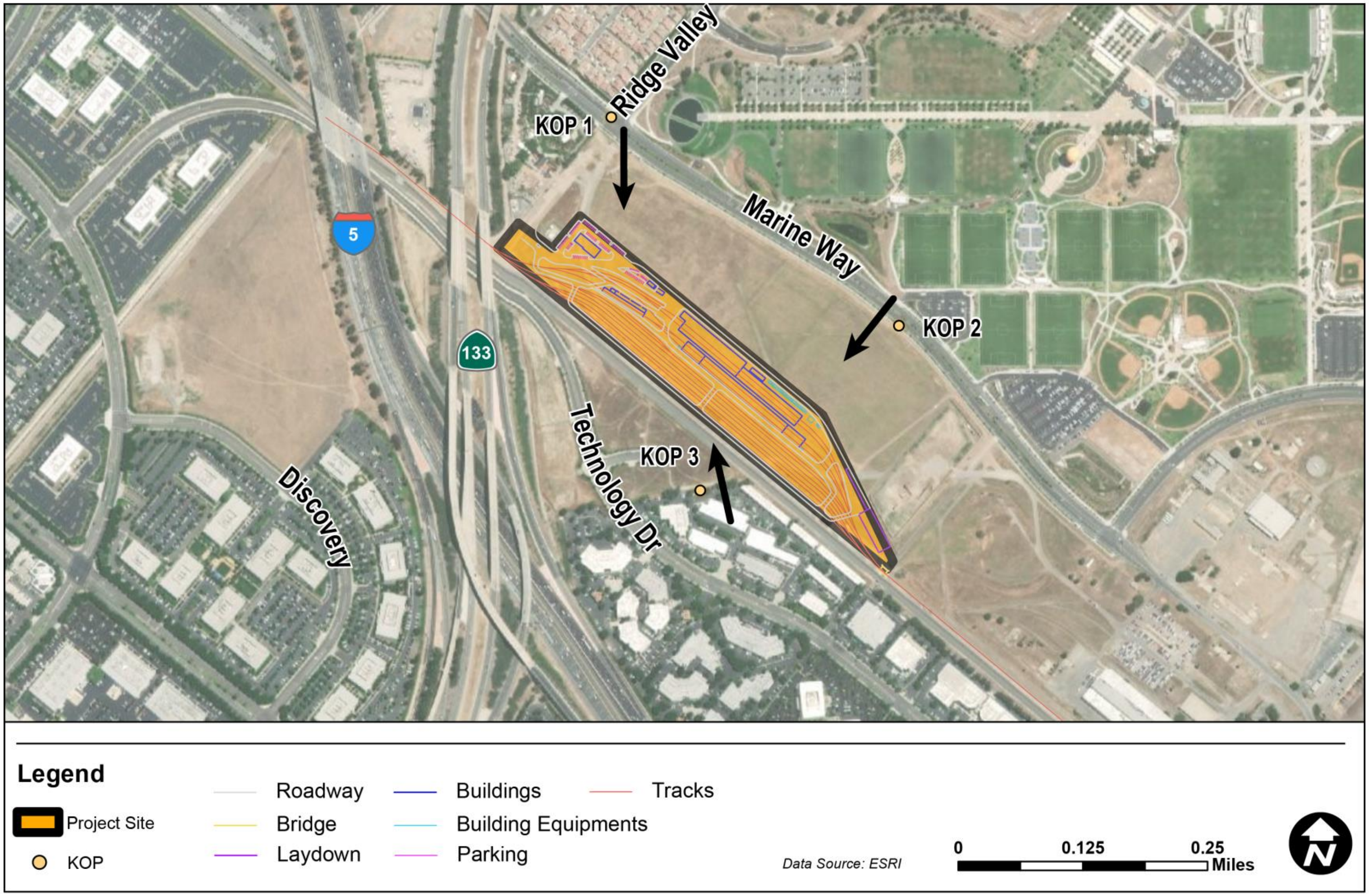
Residents and OCGP patrons would primarily experience views of construction activities while driving to and from their homes and while recreating in the OCGP. Views from the residences located northwest of the Project Site would be blocked by existing mature trees on their properties, as well as the concrete wall which surrounds the residential complex. It would also be blocked by fencing that would surround the Project Site. In addition, park patrons would have prolonged views while spending time in the OCGP located directly north of the Project Site, although their view would be obstructed by the proposed RV storage area between Marine Way and the Project Site, as well as the fencing around the Project Site during construction and operations.

Overall, the construction phase would represent a temporary change in the visual quality and character of the Project Site. However, the construction site would be visibly similar to other construction projects in the City and urban areas. During construction, the Project Site would be surrounded by fencing that would also block the majority of the construction activities. Therefore, construction impacts related to visual character would be less than significant.

<u>Operational Impacts</u>

The Project would include a new maintenance facility located adjacent to the Metrolink ROW and would involve the construction and operation of up to 30-foot-tall buildings, and approximately 30-foot-tall metal structures that would serve as bridges for utility lines. The new structures would be set back on the Project Site over 500 feet from Marine Way to the north. The Project would be within an urban environment and would be consistent with the City's General Plan goals of conservation of visual resources along the scenic corridors in the City. To assess the potential visual changes that would result from the operation of the Project, three Key Observation Points (KOPs) were selected specifically for the Project, as shown below. KOPs represent key locations where the visual character is representative and can be used for visual simulations to evaluate potential visual impacts. Visual simulations from these KOPs were prepared to provide a before and after comparison of the visual effects that would result from the Project. The locations of the three KOPs are shown on Figure 5.3-1. The KOP existing views and simulations are shown on Figures 5.3-2 through 5.3-4.

Figure 5.3-1 Location of Key Observation Points



Source: ESRI (2021), OCTA (2021)

The KOPs are representative of direct views within the Project Site and its surrounding area; simulations from the same locations show how these views would change as a result of the implementation of the Project. The simulated views represent conceptual design and are not intended to represent the Project's final design.

KOP 1 shows the Project Site looking southeast from along Marine Way and the intersection with Ridge Way (see Figure 5.3-2). The Marine Way street ROW, including traffic signals and a streetlight pole, dominate the foreground of the view. Public parkway landscaping and fencing is visible directly adjacent to the roadway. The flat and somewhat vegetated Project Site is visible in the middle ground of the view with no existing structures present. The background of the view includes a segment of elevated freeway on the right, as well as trees and tall office buildings on the center and left. In the distance, the tops of hills can be seen above the elevated freeway.

As shown on Figure 5.3-2, the Project is visible in the middle ground of the view. The new buildings interrupt some of the background views of the distant office buildings, trees, and the elevated freeway. The tops of the hills can still be seen. The Project includes a solid wall that is visible throughout the center of the view from right to left. The simulated view from KOP 1 represents a visual change compared to existing conditions as the development would occur on a site with no existing structures. However, due to the urban and visual environment of the area surrounding the Project Site, including various types of uses and structures, this visual change would be consistent with other developments in the vicinity of the Project Site. The Project would include new large aboveground structures; however, the height and massing of the buildings would not substantially alter visual character for residential viewers since the residential buildings are surrounded by a tall concrete wall and large trees. Additionally, the Project would not substantially alter visual character from this viewpoint primarily due to the distance of the Project buildings from the residential viewers. No aesthetically significant view or landmark would be altered or blocked. Therefore, operational impacts related to visual character would be less than significant for KOP 1.

KOP 2 shows the Project Site looking southwest from along Marine Way, approximately 1,800 feet southeast of Ridge Valley (see Figure 5.3-3). The OCGP is located approximately 94 feet behind the view perspective. This view represents the perspective of vehicle drivers, pedestrians, cyclists, and OCGP patrons. Visible in the foreground is the public sidewalk, landscaping, small bushes, a small tree, and a small concrete slab housing a manhole cover and small, green aboveground utility box. Visible in the middle ground is a narrow dirt road, and a large area of green and brown ground vegetation within the Project Site. The elevated freeway is visible in the background on the right and center of the view. Mature trees, commercial and office buildings, other development, and distant hills are visible in the background in the center and partially in the right side of the view.

Figure 5.3-2 KOP 1 – Before and After Simulation View, Looking Southeast from Residential Uses at Marine Way/Ridge Valley Intersection

Source: Trimble (2021), OCTA (2021)

Figure 5.3-3 KOP 2 – Before and After Simulation View, Looking Southwest from Marine Way and the OCGP

Source: Trimble (2021), OCTA (2021)

As shown in the simulated view of Figure 5.3-3, the Project would be visible in the middle ground of the view, with the tallest buildings being on the right. The new buildings would block the background views of the elevated freeway on the right and would only partially block views of the mature trees, commercial and office buildings, other development, and distant hills. The Project would include a solid wall that would be visible throughout the center of the view from right to left. The simulated view from KOP 2 represents a visual change compared to existing conditions as the development would occur on a site with no existing structures. However, due to the urban and visual environment of the area surrounding the Project Site, including various types of uses and structures, this visual change would be consistent with other developments in the vicinity of the Project Site. The Project would include new large aboveground structures; however, the height

and massing of the buildings would not substantially alter visual character for vehicle drivers, pedestrians, cyclists, and OCGP patrons from this viewpoint primarily due to the distance of the Project from the viewers. Also, no aesthetically significant view or landmark is being altered or blocked. Therefore, operational impacts related to visual character would be less than significant for KOP 2.

KOP 3 shows the Project Site looking north from the parking lot adjacent to a commercial/office building located approximately 335 feet south of the Project Site (see Figure 5.3-4). This view represents the perspective of commercial and industrial building users. Visible in the foreground is a portion of the paved and striped surface parking lot, a mature and smaller tree, as well as small bushes and a chain-linked fence that spans the view from right to left. Visible in the middle ground of the view is a vacant site that is not a part of the Project Site, as well as the Project Site itself. The ground vegetation on the vacant site and Project Site render the sites indistinguishable in this view. The Metrolink ROW divides these two sites, but this is indistinguishable in this view due to the vegetation. The background includes distant views of residential buildings on the center/left, as well as mature trees, OCGP, and hills on the right and center.

As shown in the simulated view in Figure 5.3-4, the Project would be visible in the middle ground of the view. The proposed maintenance building blocks the distant background views of mature trees, OCGP, and hills that would be visible on the right and center of the view. The simulated view from KOP 3 represents a visual change compared to existing conditions as the development would occur on a site with no existing structures. However, due to the urban and visual environment of the area surrounding the Project Site, including various types of uses and structures, this visual change would be consistent with other developments in the vicinity of the Project Site. The Project would include new large aboveground structures. Although the height and massing of the buildings would substantially alter views for commercial, office, and industrial building users, these are considered viewers with low sensitivity. Additionally, no aesthetically significant view or landmark is being altered or blocked. Therefore, no operational impacts related to visual character would occur for KOP 3.

Figure 5.3-4 KOP 3 – Before and After Simulation View, Looking North from Commercial and Industrial Uses

Source: Trimble (2021), OCTA (2021)

Overall, the operation of the Project would represent a change in visual character as compared to the existing Project Site as the development would occur on a site with no existing structures. However, the Project is in an urban area that currently has a mix of open space, industrial and office buildings, residential homes, and adjacent elevated freeway segments. Commercial businesses and offices would have a low to moderate sensitivity to this visual change. Viewers including residents and park patrons would likely have high sensitivity to the visual change; however, views from the residences would be interrupted by mature trees, existing and proposed walls, as well as the RV storage area between Marine Way and the Project Site. As a result, the Project would not conflict with any other regulations governing scenic quality because the Project would not substantially change views in the area or along any scenic corridor. Therefore, operational impacts related to visual character would be less than significant.

5.4 LIGHTING AND GLARE

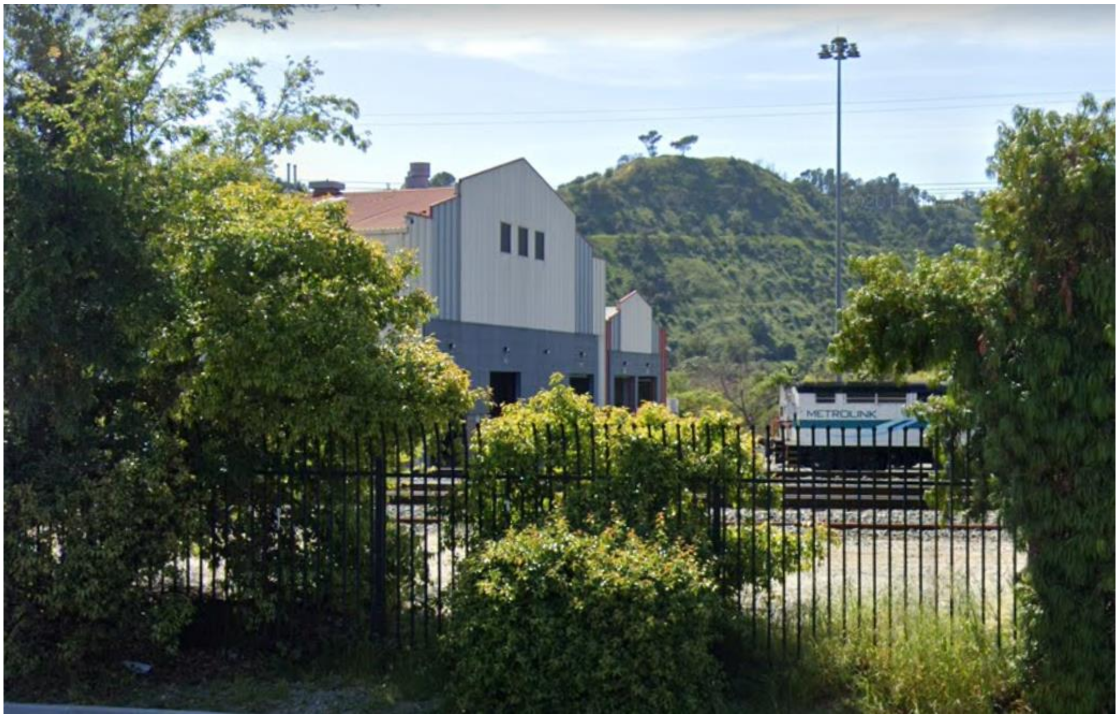
Construction Impacts

The Project Site does not currently have any sources of lighting. A high level of existing ambient lighting currently exists surrounding the Project Site, including a substantial amount of high-poled sports field lighting located in the OCGP complex to the north. Construction of the Project would not include nighttime construction activities (primarily due to construction noise restrictions on work hours), which would require nighttime construction lighting. However, the Project Site would include standard safety lighting during construction. Nevertheless, sensitive receptors (the OCGP and residences) would be too far from the Project Site to experience spillover lighting due to security lighting. Therefore, construction impacts related to lighting would be less than significant. Regarding glare, construction equipment is not likely to be a significant source of glare. Therefore, no impacts related to glare would occur.

Operational Impacts

The Project would include installation of new standard exterior and interior security lighting around and within the maintenance facility, including buildings, which would operate continuously. Although, the sensitive receptors for lighting are located too far from the Project Site to be impacted by spillover lighting, per best management practices, nighttime lighting fixtures would be installed to direct the majority of the light to within and directly adjacent to the facility, and away from sensitive areas, to the maximum extent feasible. In addition, the materials used in the exterior of buildings and structures visible above the proposed six-foot-tall wall between the Project Site and Marine Way would need to comply with applicable City regulations under their Municipal Code (Division 9) and Zoning Ordinance (Section 3.16) to ensure no substantial source of glare. Figure 5.4-1 and Figure 5.4-2 illustrate that the existing Central Maintenance Facility and Eastern Maintenance Facility, which the Project would be similar to, include typical exterior building materials, such as concrete, and do not exhibit reflective properties that could result in glare. Therefore, operational impacts related to the creation of a substantial source of light or glare would be less than significant.

Figure 5.4-1 Existing Central Maintenance Facility, Exterior Building Materials



Source: Google Maps (2021)

Figure 5.4-2 Existing Eastern Maintenance Facility, Exterior Building Materials

Source: Google Maps (2021)

6. MITIGATION MEASURES

No mitigation measures are required.

7. IMPACTS AFTER MITIGATION

Construction and operation of the Project would be less than significant.

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Appendix B
Technical Memorandum
Air Quality & Greenhouse Gases

Metrolink Orange County Maintenance Facility

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Air Quality and Greenhouse Gases Technical Memorandum	03/03/21
1	Draft Air Quality and Greenhouse Gases Technical Memorandum (Incorporating OCTA's comments and results of Health Risk Analysis and Dispersion Modeling)	05/17/21
2	Draft Air Quality and Greenhouse Gases Technical Memorandum (Incorporating OCTA's comments, which includes clarifying receptor spacing for HRA model runs, maps illustrating maximum cancer risk impacts and contour maps of cancer risk, and rationale behind assessing the recreational exposure scenario).	08/04/21
3	Draft Air Quality and Greenhouse Gases Technical Memorandum (Revised calculations based on internal QA)	12/08/21

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1 INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The purpose of this memorandum is to present the results of the air quality and greenhouse gas (GHG) analyses and to describe the potential impacts associated with the Project.

2 PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs.

The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. The City has indicated that a Conditional Use Permit (CUP) would need to be obtained for the Project and application thereof filed with the City. The use of the site as a rail maintenance facility, although deemed consistent with the purpose and intent of the zoning district, has characteristics that the City has indicated would require Zoning Administrator review in order to avoid conflicts with surrounding land uses. Therefore, OCTA would be filing a CUP application for the Project.

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (**Error! Reference source not found.**). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 2.2-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)

Note: sq. ft. = square feet; ft = feet

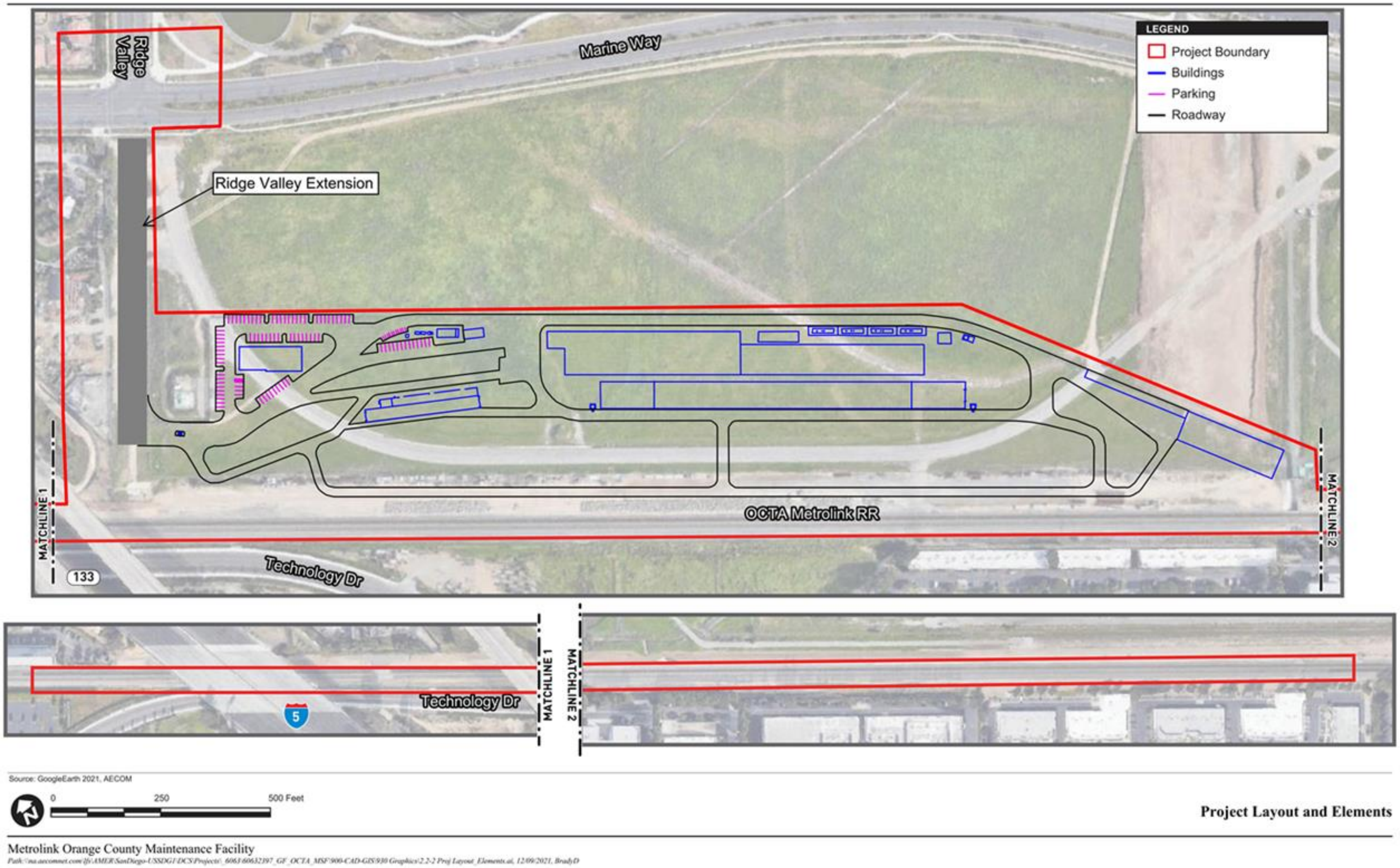
A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette. Approximately 120 automobile parking spaces would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (**Error! Reference source not found.**). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink's "Orange" Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3 AIR QUALITY ENVIRONMENTAL SETTING

3.1 EXISTING CONDITIONS

Air quality is defined by the concentration of pollutants in relation to their impact on human health. Concentrations of air pollutants are determined by the rate and location of pollutant emissions released by pollution sources, and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, and sunlight. Therefore, ambient air quality conditions within the local air basin are influenced by such natural factors as topography, meteorology, and climate, in addition to the amount of air pollutant emissions released by existing air pollutant sources.

Climate, topography, and meteorology influence regional and local ambient air quality. Southern California is characterized as a semiarid climate, although it contains three distinct zones of rainfall that coincide with the coast, mountain, and desert. The Project is located within the City of Irvine, which is within the South Coast Air Basin (SCAB). The SCAB is bounded by the Pacific Ocean to the west, the San Gabriel mountains, San Bernardino mountains, and San Jacinto mountains to the north and east, and the San Diego County line to the south.

The topography and climate of Southern California combine to make the SCAB an area of high air pollution potential. A warm air mass frequently descends over the cool, moist marine layer produced by the interaction between the ocean's surface and the lowest layer of the atmosphere. The warm upper layer forms a cap over the cooler surface layer, which traps the pollutants near the ground. Light winds can further limit ventilation. Additionally, abundant sunlight triggers the photochemical reactions that produce ozone and the majority of particulate matter (SCAQMD, 2017a).

The normal annual precipitation in Orange County, which occurs primarily from October through April, is approximately 13 inches (WRCC, 2003). Normal January temperatures range from an average minimum of 40 degrees Fahrenheit (°F) to an average maximum of 67°F, and August temperatures range from an average minimum of 60°F to an average maximum of 85°F (WRCC, 2003).

3.1.1 Criteria Pollutants

Individual air pollutants at certain concentrations may adversely affect human or animal health, reduce visibility, damage property, and reduce the productivity or vigor of crops and natural vegetation. Six air pollutants have been identified by the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) as being of concern on both nationwide and statewide levels: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead, and particulate matter (PM). PM is subdivided into two classes based on particle size: PM equal to or less than 10 micrometers in diameter (PM_{10}) and PM equal to or less than 2.5 micrometers in diameter ($PM_{2.5}$). Because the air quality standards for these air pollutants are regulated using human health and environmentally based criteria, they are commonly referred to as "criteria air pollutants."

Ozone. Ozone is the principal component of smog and is formed in the atmosphere through a series of reactions involving reactive organic gases (ROGs) or volatile organic compounds (VOC), and nitrogen oxides

(NO_X) in the presence of sunlight. ROG/VOC and NO_X are called precursors of ozone. NO_X includes various combinations of nitrogen and oxygen, including nitric oxide (NO), NO_2, and others. Significant ozone concentrations are usually produced only in the summer, when atmospheric inversions are greatest, and temperatures are high. ROG/VOC and NO_X emissions are both considered critical in ozone formation.

Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered the most susceptible sub-groups for ozone effects. Short-term exposure (lasting for a few hours) to ozone can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. In recent years, a correlation between elevated ambient ozone levels and increases in daily hospital admission rates, as well as mortality, has also been reported. An increased risk for asthma has been found in children who participate in sports and live in communities with high ozone levels.

Carbon Monoxide. CO is a colorless and odorless gas that, in the urban environment, is associated primarily with the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations are typically found near crowded intersections and along heavily used roadways carrying slow-moving traffic. Even under most severe meteorological and traffic conditions, high concentrations of CO are limited to locations within a relatively short distance (300 to 600 feet) of heavily traveled roadways. Vehicle traffic emissions can cause localized CO impacts, and severe vehicle congestion at major signalized intersections can generate elevated CO levels, called “hot spots,” which can be hazardous to human receptors adjacent to the intersections. Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise, and electrocardiograph changes indicative of decreased oxygen supply to the heart. Inhaled CO has no direct toxic effect on the lungs but exerts its effect on tissues by interfering with oxygen transport. Hence, conditions with an increased demand for oxygen supply can be adversely affected by exposure to CO. Individuals most at risk include fetuses, patients with diseases involving heart and blood vessels, and patients with chronic hypoxemia (oxygen deficiency) as seen at high altitudes.

Nitrogen Dioxide. NO_2 is a product of combustion and is generated in vehicles and in stationary sources, such as power plants and boilers. It is also formed when ozone reacts with NO in the atmosphere. As noted above, NO_2 is part of the NO_X family and is a principal contributor to ozone and smog generation. Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children, is associated with long-term exposure to NO_2 at levels found in homes with gas stoves, which are higher than ambient levels found in Southern California. Airway contraction and increased resistance to air flow are observed after short-term exposure to NO_2 in healthy subjects. Larger decreases in lung functions are observed in individuals with asthma or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater susceptibility of these sub-groups.

Sulfur Dioxide. SO_2 is a combustion product, with the primary source being power plants and heavy industries that use coal or oil as fuel. SO_2 is also a product of diesel engine combustion. SO_2 in the atmosphere contributes to the formation of acid rain. SO_2 can irritate lung tissue and increase the risk of acute and chronic respiratory disease. In asthmatics, increased resistance to air flow and a reduction in breathing capacity leading to severe breathing difficulties are observed after acute exposure to SO_2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2. Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO_2 levels. In these studies, efforts to separate the effects of SO_2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically, or one pollutant alone is the predominant factor.

Lead. Lead is a highly toxic metal that may cause a range of human health effects. Previously, the lead used in gasoline anti-knock additives represented a major source of lead emissions to the atmosphere from mobile and industrial sources. EPA began working to reduce lead emissions soon after its inception, issuing the first reduction standards in 1973. In 1975, unleaded gasoline was introduced for motor vehicles equipped with catalytic converters. EPA banned the use of leaded gasoline in highway vehicles in December 1995. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector and levels of lead in the air decreased dramatically. Fetuses, infants, and children are more sensitive than others to the adverse effects of lead exposure. Exposure to low levels of lead can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotient. In adults, increased lead levels are associated with increased blood pressure. Lead poisoning can cause anemia, lethargy, seizures, and death, although it appears that there are no direct effects of lead on the respiratory system.

Particulate Matter. PM is a complex mixture of extremely small particles that consists of dry solid fragments, solid cores with liquid coatings, and small liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soot, and soil or dust particles. Natural sources of PM include windblown dust and ocean spray. The size of PM is directly linked to the potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller, because these particles generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Health studies have shown a significant association between exposure to PM and premature death. Other important effects include aggravation of respiratory and cardiovascular disease, lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and irregular heartbeat (EPA, 2016). Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children. A consistent correlation between elevated PM levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks, and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, some studies have reported an association between long-term exposure to air pollution dominated by fine particles and increased mortality, reduction in lifespan, and an increased mortality from lung cancer. EPA groups PM into two categories, which are described below.

PM_{10}. PM_{10} includes both fine and coarse dust particles; the fine particles are $PM_{2.5}$. Coarse particles, such as those found near roadways and dust-producing industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Sources of coarse particles include crushing or grinding operations and dust from paved or unpaved roads. Control of PM_{10} is primarily achieved through the control of dust at

construction and industrial sites, the cleaning of paved roads, and the wetting or paving of frequently used unpaved roads.

$PM_{2.5}$. Fine particles, such as those found in smoke and haze, are $PM_{2.5}$. Sources of fine particles include all types of combustion activities (motor vehicles, power plants, wood burning, etc.) and certain industrial processes. $PM_{2.5}$ is also formed through reactions of gases, such as SO_2 and NO_X, in the atmosphere. $PM_{2.5}$ is the major cause of reduced visibility (haze) in California.

3.1.2 Air Quality Standards

Health-based air quality standards have been established for these criteria pollutants by EPA at the national level and by CARB at the state level. These standards were established to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. Table 3.1-1 presents the National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards (CAAQS).

Both EPA and CARB use ambient air quality monitoring data to designate areas according to their attainment status for criteria air pollutants. The purpose of these designations is to identify the areas with air quality problems and initiate planning efforts for improvement. The three basic designation categories are nonattainment, attainment, and unclassified. An "attainment" designation for an area signifies that pollutant concentrations did not exceed the established standard. In most cases, areas designated or re-designated as attainment must develop and implement maintenance plans (i.e., an area that was previously in nonattainment but now attains the standard). These areas are designated as "maintenance" areas and are currently under a maintenance plan to ensure continued compliance with the standard.

In contrast to attainment, a "nonattainment" designation indicates that a pollutant concentration has exceeded the established standard. Nonattainment may differ in severity. To identify the severity of the problem and the extent of planning and actions required to meet the standard, nonattainment areas are assigned a classification that is commensurate with the severity of their air quality problem (e.g., moderate, serious, severe, extreme).

Finally, an unclassified designation indicates that insufficient data exist to determine attainment or nonattainment. In addition, the California designations include a subcategory of nonattainment-transitional, which is given to nonattainment areas that are progressing and nearing attainment. As shown in Table 3.1-1, the SCAB is designated as a maintenance area for CO and PM_{10}, as a nonattainment area for ozone and $PM_{2.5}$, and as an unclassifiable or attainment area for NO_2 and SO_2 under the NAAQS. Additionally, the SCAB is designated as a partial nonattainment area for the Los Angeles County portion of the SCAB for near-source monitors for the lead NAAQS. The SCAB is designated as an attainment area for all criteria air pollutants except ozone, PM_{10}, and $PM_{2.5}$ under the CAAQS. The most current monitoring station data and attainment designations for the area surrounding the Project Site are shown in Table 3.1-2.

Table 3.1-3.1-1 NAAQS and CAAQS Attainment Status - South Coast Air Basin

		CAAQS		NAAQS	
Criteria Pollutant	**Averaging Time**	**Averaging Time**	**Designation**	**Averaging Time**	**Designation**
Ozone (O_3)	1-Hour	0.09 ppm	Nonattainment	—	—
	8-Hour	0.070 ppm		0.070 ppm	Nonattainment (Extreme)
PM_{10}	24-Hour	50 µg/m^3	Nonattainment	150 µg/m^3	Attainment (Maintenance)
	Annual	20 µg/m^3		—	—
$PM_{2.5}$	24-Hour	—	Nonattainment	35 µg/m^3	Nonattainment (Serious)
	Annual	12.0 µg/m^3		12.0 µg/m^3	Attainment
CO	1-Hour	20 ppm	Attainment	35 ppm	Attainment (Maintenance)
	8-Hour	9 ppm		9 ppm	
NO_2	1-Hour	0.18 ppm	Attainment	0.10 ppm	Unclassifiable/Attainment
	Annual	0.030 ppm		0.053 ppm	Attainment
SO_2	1-Hour	0.25 ppm (655 µg/m^3)	Attainment	75 ppb	Designations Pending
	24-Hour	0.04 ppm (105 µg/m^3)		0.14 ppm	Unclassifiable/Attainment
	Annual Arithmetic Mean	—		0.03 ppm	Unclassifiable/Attainment
Lead	30-Day Average	1.5 µg/m^3	Attainment	—	—
	Rolling 3-Month Average 24 Hour	—		1.5 µg/m^3	Nonattainment (Partial)
Sulfates	24-Hour	25 µg/m^3	Attainment	No National Standards	
Hydrogen Sulfides	1-Hour	0.03 ppm (42 µg/m^3)	Attainment		
Vinyl Chloride	24-Hour	0.01 ppm (26 µg/m^3)	Attainment		

Notes: NO_2 = nitrogen dioxide; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; SO_2 = sulfur dioxide; ppm = parts per million; ppb = parts per billion; µg/m^3 = micrograms per cubic meter.
Source: SCAQMD 2016

3.1.3 South Coast Air Basin Existing Air Quality

The South Coast Air Quality Management District (SCAQMD) is responsible for enforcing the rules and regulations protecting air quality in the SCAB. Ambient air pollutant concentrations in the SCAB are measured at air quality monitoring stations operated by CARB and the SCAQMD. The closest SCAQMD air quality monitoring station to the Project is the Mission Viejo monitoring station, located at 26081 Via Pera, Mission Viejo, California, approximately 5 miles southeast of the Project Site. This station monitors ozone, PM_{10}, and $PM_{2.5}$. Air quality monitoring data for CO were obtained from the SCAQMD Historical Data by Year tables for the Saddleback Valley source receptor area. Air quality data for NO_2 was obtained from the Costa Mesa monitoring station, located at 2850 Mesa Verde Drive, Costa Mesa, California, approximately 10 miles west of the Project Site. Table 3.1-2 presents 3 years of the most recent information available, summarizing the exceedances of standards and the highest recorded pollutant. These concentrations represent the existing, or baseline, conditions for the area surrounding the Project Site and are based on the most recent information that is available.

As shown in Table 3.1-2, ambient air concentrations of NO_2 did not exceed the NAAQS or CAAQS in 2017 through 2019. The 1-hour and 8-hour ozone standards were exceeded in 2017 through 2019. PM_{10} and $PM_{2.5}$ concentrations also exceeded the standards between 2017 and 2019.

3.2 TOXIC AIR CONTAMINANTS

In addition to criteria pollutants, both federal and state air quality regulations also focus on toxic air contaminants (TACs). TACs can be separated into carcinogens and noncarcinogens based on the nature of the effects associated with exposure to the pollutant. For regulatory purposes, carcinogens are assumed to have no safe threshold below which health impacts would not occur. Any exposure to a carcinogen poses some risk of contracting cancer. Noncarcinogens differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

TACs may be emitted by stationary, area, or mobile sources. Common stationary sources of TAC emissions include gasoline stations, dry cleaners, and diesel backup generators, which are subject to local air district permit requirements. The other, often more significant, sources of TAC emissions are motor vehicles on freeways, high-volume roadways, or other areas with high numbers of diesel particulate matter-emitting activities, such as distribution centers and railyards. Off-road mobile sources are also major contributors of TAC emissions and include construction equipment, ships, and trains.

3.2.1 Diesel Particulate Matter

Particulate exhaust emissions from diesel-fueled engines (diesel PM) were identified as a TAC by CARB in 1998. Federal and state efforts to reduce diesel PM emissions have focused on the use of improved fuels, adding particulate filters to engines, and requiring the production of new-technology engines that emit fewer exhaust particulates.

Table 3.2-1 Ambient Air Quality Summary

Pollutant Standards	2017	2018	2019
Ozone			
State maximum 1-hour concentration (0.09 ppm)	0.103	0.121	0.106
National maximum 8-hour concentration (0.070 ppm)	0.083	0.088	0.087
State maximum 8-hour concentration (0.070 ppm)	0.084	0.088	0.088
CAAQS Exceeded?	Yes	Yes	Yes
NAAQS Exceeded?	Yes	Yes	Yes
Number of Days Standard Exceeded			
CAAQS 1-hour	3	2	3
CAAQS 8- hour /NAAQS 8-hour	27/25	10/9	11/11
Carbon Monoxide (CO) [a]			
National/State Maximum 8-hour concentration (9 ppm/9.0 ppm)	0.9	0.9	0.8
National/State Maximum 1-hour concentration (35 ppm/20 ppm)	1.4	1.2	1.0
NAAQS/CAAQS Exceeded?	No	No	No
Nitrogen Dioxide (NO_2)			
National/State maximum 1-hour concentration (0.18 ppm/100 ppb)	0.045	*	*
National/State Annual Average (0.053 ppm/0.030 ppm)	*	*	*
NAAQS/CAAQS Exceeded?	*	*	*
Number of Days Standard Exceeded			
NAAQS 1-hour	0	0	0
CAAQS 1-hour	0	0	0
Particulate Matter (PM_{10})			
National maximum 24-hour concentration (150 μg/m^3)	58.2	55.6	45.1
State maximum 24-hour concentration (50 μg/m^3)	58.2	55.6	44.2
State annual average concentration (20 μg/m^3)	18.8	19.1	16.7
CAAQS Exceeded?	Yes	Yes	No
NAAQS Exceeded?	No	No	No
Measured Number of Days Standard Exceeded			
NAAQS 24-hour	0	0	0
CAAQS 24-hour	1	1	0
Particulate Matter ($PM_{2.5}$)			
National maximum 24-hour concentration (35 μg/m^3)	19.5	38.9	20.8
National annual average concentration (12.0 μg/m^3)	*	*	7.1
State annual average concentration (12 μg/m^3)	*	*	*
NAAQS Exceeded?	No	Yes	No
Measured Number of Days Standard Exceeded			
NAAQS 24-hour (>35 μg/m^3)	0	1	0

Notes: μg/m^3 = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standards;
NAAQS = National Ambient Air Quality Standards; ppb = parts per billion; ppm = parts per million
[a] Data obtained from the SCAQMD Historical Data by Year.
*Insufficient data to determine the value.
Source: CARB 2020a; SCAQMD 2020

Diesel engines tend to produce a much higher ratio of fine particulates than other types of internal combustion engines. The fine particles that make up diesel PM tend to penetrate deep into the lungs and the rough surfaces of these particles makes it easy for them to bind with other toxins within the exhaust, thus increasing the hazards of particle inhalation. Long-term exposure to diesel PM is known to lead to chronic, serious health problems, including cardiovascular disease, cardiopulmonary disease, and lung cancer.

In 2015, the SCAQMD published the Multiple Air Toxics Exposure Study IV (MATES IV), a monitoring and evaluation study conducted in the SCAB. The MATES IV consists of a monitoring program, an updated emissions inventory of TACs, and a modeling effort to characterize risk across the SCAB. The study focuses on the carcinogenic risk from exposure to air toxics. The MATES IV estimated population weighted risk in the SCAB is 897 per million, a decrease of about 57 percent compared to the previous study (MATES III). The study also showed that diesel exhaust emissions had declined by about 70 percent, but diesel PM continued to account for about two-thirds of the cancer risk from air toxics (SCAQMD, 2017b). MATES IV also extrapolated excess cancer risk levels throughout the SCAB by modeling specific grids. MATES IV estimates an excess cancer risk of 626 per million for the area surrounding the Project Site (SCAQMD, 2015). SCAQMD has begun the MATES V, which will include an updated emissions inventory of TACs and updated modeling effort to characterize risk across the SCAB.

3.2.2 Asbestos

Asbestos is a term used for several types of naturally occurring fibrous minerals that are a human health hazard when airborne. The most common type of asbestos is chrysotile, but other types such as tremolite and actinolite are also found in California. Asbestos was identified as a hazardous air pollutant by EPA in 1971 and identified as a TAC by CARB in 1986 (EPA, 2019a; Van Gosen, 2011). Subsequently, CARB adopted two Airborne Toxic Control Measures (ATCM) to address some of the health concerns associated with exposure to asbestos: ATCM for Surfacing Applications and ATCM for Construction, Grading, Quarrying, and Surface Mining Operations (discussed in more detail in Section 5.2.3 below).

Asbestos can be released from serpentine and ultramafic rocks when the rock is broken or crushed. At the point of release, the asbestos fibers may become airborne, causing air quality and human health hazards. These rocks have been commonly used for unpaved gravel roads, landscaping, fill projects, and other improvement projects in some localities. Asbestos may be released to the atmosphere due to vehicular traffic on unpaved roads, during grading for development projects, and at quarry operations. All of these activities may have the effect of releasing potentially harmful asbestos into the air. Natural weathering and erosion processes can act on asbestos-bearing rock and make it easier for asbestos fibers to become airborne if such rock is disturbed.

Serpentine may contain chrysotile asbestos, especially near fault zones. Ultramafic rock, a rock closely related to serpentinite, may also contain asbestos minerals. Asbestos can also be associated with other rock types in California, though much less frequently than serpentinite and/or ultramafic rock. Serpentinite and/or ultramafic rock are known to be present in 44 of California's 58 counties. These rocks are particularly abundant in counties of the Sierra Nevada foothills, the Klamath Mountains, and

Coast Ranges. The California Department of Conservation, Division of Mines and Geology has developed a map showing the general location of ultramafic rock in the state. According to the General Location Guide for Ultramafic Rocks in California, Orange County and the Project Site are not identified as areas likely to contain natural occurrences of asbestos (CDMG, 2000; Van Gosen, 2011).

3.3 ODOR

Odors are considered an air quality issue both at the local level (e.g., odor from wastewater treatment) and at the regional level (e.g., smoke from wildfires). Odors are generally regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache).

The ability to detect odors varies considerably among the population and is subjective. Some individuals have the ability to smell minute quantities of specific substances, while others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor; an odor that is offensive to one person (e.g., from a fast-food restaurant or bakery) may be perfectly acceptable to another. Unfamiliar odors may be more easily detected and likely to cause complaints than familiar ones.

Offensive odors can potentially affect human health in several ways. First, odorant compounds can irritate the eyes, nose, and throat, which can reduce respiratory volume. Second, the ROGs that cause odors can stimulate sensory nerves to cause neurochemical changes that might influence health, for instance, by compromising the immune system. Finally, unpleasant odors can trigger memories or attitudes linked to unpleasant odors, causing cognitive and emotional effects, such as stress.

Several examples of common land use types that generate substantial odors include wastewater treatment plants, landfills, composting/green waste facilities, recycling facilities, petroleum refineries, chemical manufacturing plants, painting/coating operations, rendering plants, and food packaging plants. There are no wastewater treatment plants, landfills, composting facilities, refineries, or chemical plants in the vicinity of the Project Site.

3.4 SENSITIVE RECEPTORS

Some members of the population are especially sensitive to air pollutant emissions and should be given special consideration when evaluating air quality impacts from projects. The SCAQMD considers a sensitive receptor to be a receptor such as residence, hospital, or convalescent facility where it is possible that an individual could remain for 24 hours (SCAQMD, 2008a).

Residential areas are considered sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to pollutants present. Recreational land uses are considered moderately sensitive to air pollution. Exercise places a high demand on respiratory functions, which can be impaired by air pollution even though exposure periods during exercise are generally short. In addition, noticeable air pollution can detract from the enjoyment of recreation. Industrial and commercial areas are considered the least sensitive to air pollution because exposure periods are relatively short and intermittent as the majority of the workers tend to stay indoors most of the time.

The Project Site is adjacent to the Great Park which serves outdoor recreational activities for the community. The nearest sensitive receptors to the Project Site are the residences in the senior housing community located approximately 650 feet north of the Project Site on Ridge Valley.

4 GREENHOUSE GAS EMISSIONS ENVIRONMENTAL SETTING

4.1 SCIENTIFIC BASIS OF CLIMATE CHANGE

Certain gases in the earth's atmosphere, classified as greenhouse gases (GHGs), play a critical role in determining the earth's surface temperature. A portion of the solar radiation that enters the earth's atmosphere is absorbed by the earth's surface, and a smaller portion of this radiation is reflected back toward space. This infrared radiation (i.e., thermal heat) is absorbed by GHGs within the earth's atmosphere. As a result, infrared radiation released from the earth that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the "greenhouse effect," is responsible for maintaining a habitable climate on the earth.

GHGs are present in the atmosphere naturally, are released by natural and anthropogenic sources, and are formed from secondary reactions taking place in the atmosphere. Natural sources of GHGs include the respiration of humans, animals, and plants; decomposition of organic matter; and evaporation from the oceans. Anthropogenic sources include the combustion of fossil fuels, waste treatment, and agricultural processes. The following are GHGs that are widely accepted as the principal contributors to human-induced global climate change:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)

The majority of anthropogenic CO_2 emissions are byproducts of fossil fuel combustion. CH_4 is the main component of natural gas and is associated with agricultural practices and landfills. N_2O is a colorless GHG that results from industrial processes, vehicle emissions, and agricultural practices. HFCs are synthetic chemicals used as a substitute for chlorofluorocarbons in automobile air conditioners and refrigerants. PFCs are produced as a byproduct of various industrial processes associated with aluminum production and the manufacturing of semiconductors. SF_6 is an inorganic, odorless, colorless, nontoxic, nonflammable GHG used for insulation in electric power transmission and distribution equipment, and in semiconductor manufacturing. The primary GHGs that would be emitted during construction and operation of the Project are CO_2, CH_4, and N_2O.

Global warming potential (GWP) is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to CO_2. The GWP of a GHG is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and length of time (i.e., lifetime) that the gas remains in the atmosphere ("atmospheric lifetime"). The reference gas for GWP is CO_2; therefore, CO_2 has a GWP of 1. The other main GHGs that have been attributed to human activity include CH_4, which has a GWP of 25, and N_2O, which has a GWP of 298 (EPA, 2017a). For example, 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 25 tons of CO_2. GHGs with lower emissions rates than CO_2 may still contribute to climate change because they are more effective at absorbing outgoing infrared radiation than CO_2 (i.e., high GWP). The concept of CO_2-equivalents (CO_2e) is used to account for the different GWP potentials of GHGs to absorb infrared radiation.

Although the exact lifetime of any particular GHG molecule is dependent on multiple variables, it is understood by scientists who study atmospheric chemistry that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. GHG emissions related to human activities have been determined as "extremely likely" to be responsible (indicating 95 percent certainty) for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (CARB, 2014).

4.2 GHG INVENTORIES

GHG emissions contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, electric utility, residential, commercial, and agricultural categories. Emissions of CO_2 are byproducts of fossil fuel combustion and CH_4 is the primary component in natural gas and is associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management.

4.2.1 National

EPA prepares the official United States Inventory of Greenhouse Gas Emissions and Sinks to comply with existing commitments under the United Nations Framework Convention on Climate Change (UNFCCC). In 2018, the United States generated 6,676 million metric tons (MMT) CO_2e (EPA, 2020). The transportation sector was the single largest source of GHG emissions in 2018, accounting for 29 percent of total GHG emissions. The transportation sector was followed by the electric power and industry sectors, which account for 27 and 22 percent of the total GHG emissions, respectively (EPA, 2020).

4.2.2 California

CARB performs an annual GHG inventory for emissions and sinks of the six major GHGs. California produced 425 MMT CO_2e in 2018 (CARB, 2020b). Combustion of fossil fuel in the transportation category was the single largest source of California's GHG emissions in 2018, accounting for 40 percent of total GHG emissions in the state. The transportation category was followed by the industrial and electric power (including in-state and out-of-state sources) categories, which account for 21 and 15 percent of the state's total GHG emissions, respectively (CARB, 2020b).

5 AIR QUALITY REGULATORY FRAMEWORK

Air quality in the SCAB is regulated by EPA, CARB, and the SCAQMD. Each of these agencies develops rules, regulations, or policies, and/or goals to attain the directives imposed through legislation. Although EPA regulation may not be superseded, both state and local regulations may be more stringent.

5.1 FEDERAL STANDARDS

EPA's air quality mandates are drawn primarily from the federal Clean Air Act (CAA), which was enacted in 1970 and amended in 1977 and 1990. The CAA requires EPA to establish the NAAQS and requires each state with regions that have not attained the NAAQS to prepare a State Implementation Plan (SIP), detailing how these standards are to be met in each local area. The SIP is a legal agreement between each state and the federal government to commit resources to improving air quality. It serves as the template for conducting regional and project-level air quality analysis. The SIP is not a single document, but a compilation of new and previously submitted attainment plans, emissions reduction programs, district rules, state regulations, and federal controls.

The CAA Amendments also require that states and local air quality agencies develop a Title V Operating Permit Program, which requires all "major sources" of pollutants to obtain Title V permits. The program is designed to ensure compliance with all applicable requirements of the CAA and to enhance EPA's ability to enforce the CAA. Air pollution sources subject to the program must obtain an operating permit; states must develop and implement the program; and EPA must issue permit program regulations, review each state's proposed program, and oversee the state's efforts to implement any approved program.

Before 1994, there were no standards to limit the amount of emissions from off-road equipment. In 1994, EPA established emission standards for hydrocarbons, NO_X, CO, and PM to regulate new pieces of off-road equipment. These emission standards came to be known as Tier 1. Since that time, increasingly more stringent Tier 2, Tier 3, and Tier 4 (interim and final) standards were adopted by EPA, as well as by CARB. Tier 1 emission standards became effective in 1996. The more stringent Tier 2 and Tier 3 emission standards became effective between 2001 and 2008, with the effective date dependent on engine horsepower. Tier 4 interim standards became effective between 2008 and 2012, and Tier 4 final standards became effective in 2014 and 2015. Each adopted emission standard was phased in over time. New engines built in and after 2015 across all horsepower sizes must meet Tier 4 final emission standards. In other words, new manufactured engines cannot exceed the emissions established for Tier 4 final emissions standards.

5.1.1 Locomotive Emissions Standards

In March 2008, EPA adopted a three-part emissions standard program to reduce emissions from diesel locomotives over time. The regulation tightens emission standards for existing remanufactured locomotives and sets exhaust emission standards for newly built locomotives of model years 2011-2014 (Tier 3) and 2015 and beyond (Tier 4). The regulation is expected to reduce PM emissions from applicable engines by as much as 90% and NO_X emissions by as much as 80 percent when fully implemented.

5.1.2 Code of Federal Regulations 49 Parts 200-299

Metrolink operations are subject to Federal Regulations that dictate the frequency and nature of mechanical inspections. The following rules describe the federal requirements:

- 229.21 Daily Inspections - Requires locomotives to be inspected and tested daily.
- 238.303 Exterior Inspections - Exterior mechanical inspection of passenger equipment each calendar day.
- 238.305 Interior Inspections - Interior mechanical inspection of passenger equipment each calendar day.
- 232.205 Class 1 Brake Test Initial Terminal Inspection – Functional air brake test at location where train is assembled.
- 238.313 Class 1 Air Brake Test – Functional air brake test required each calendar day.

5.2 STATE STANDARDS

CARB is the lead agency responsible for developing the SIP in California. Local air districts and other agencies prepare air quality attainment plans or air quality management plans, and submit them to CARB for review, approval, and incorporation into the applicable SIP.

5.2.1 California Clean Air Act

CARB is also responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA). The CCAA was adopted in 1988 and requires CARB to establish CAAQS. In most cases, CAAQS are more stringent than NAAQS. Other CARB responsibilities include, but are not limited to, overseeing local air district compliance with state and federal laws; approving local air quality plans; submitting SIPs to EPA; monitoring air quality; determining and updating area designations and maps; and setting emission standards for new mobile sources, consumer products, small utility engines, off-road vehicles, and fuels. CARB maintains air quality monitoring stations throughout the state in conjunction with local air districts. Data collected at these stations are used by CARB to classify air basins as being in attainment or nonattainment with respect to each pollutant and to monitor progress in attaining air quality standards.

The CCAA requires that each area exceeding the CAAQS for ozone, CO, SO_2, and NO_2 develop a plan aimed at achieving those standards. California Health and Safety Code Section 40914 requires air districts to design a plan that achieves an annual reduction in district-wide emissions of 5 percent or more, averaged every consecutive 3-year period. To satisfy this requirement, the local air districts have to develop and implement air pollution reduction measures, which are described in their air quality attainment plans, and outline strategies for achieving the CAAQS for any criteria pollutants for which the region is classified as nonattainment.

CARB has established emission standards for vehicles sold in California and for various types of equipment. California gasoline specifications are governed by both state and federal agencies. During the past decade, federal and state agencies have imposed numerous requirements on the production and sale of gasoline in California. CARB has also adopted control measures for diesel PM and more stringent emissions standards for various on-road mobile sources of emissions, including transit buses and off-road diesel equipment (e.g., tractors, generators).

5.2.2 Tanner Toxics Act

TACs in California are regulated primarily through the Tanner Air Toxics Act (Chapter 1047, Statutes of 1983) and the Air Toxics Hot Spots Information and Assessment Act (Chapter 1252, Statutes of 1987). Assembly Bill (AB) 1807 sets forth a formal procedure for CARB to designate substances as TACs. Research, public participation, and scientific peer review must occur before CARB can designate a substance as a TAC. The Air Toxics Hot Spots Information and Assessment Act requires that TAC emissions from stationary sources be quantified and compiled into an inventory according to criteria and guidelines developed by CARB, and if directed to do so by the local air district, a health risk assessment (HRA) must be prepared to determine the potential health impacts of such emissions.

The CARB adopted a Diesel Risk Reduction Plan, which recommends control measures to achieve a diesel PM reduction of 85 percent by 2020 from year 2000 levels. Recent regulations and programs include the low-sulfur diesel fuel requirement and more stringent emission standards for heavy-duty diesel trucks and off-road in-use diesel equipment. As emissions are reduced, it is expected that the risks associated with exposure to the emissions will also be reduced.

The CARB has also developed the *Air Quality and Land Use Handbook: A Community Health Perspective* to provide guidance on land use compatibility with sources of TACs (CARB, 2005). These sources include freeways and high-traffic roads, commercial distribution centers, rail yards, refineries, dry cleaners, gasoline stations, and industrial facilities. The handbook is not a law or adopted policy but offers advisory recommendations for the siting of sensitive receptors near uses associated with TACs. The handbook indicates that land use agencies have to balance other considerations, including housing and transportation needs, economic development priorities, and other quality of life issues. The recommendations relevant to the Project include to avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard. In response to new research demonstrating benefits of compact, infill development along transportation corridors, CARB released a technical supplement, *Technical Advisory: Strategies to Reduce Air Pollution Exposure Near High-Volume Roadways* (Technical Advisory; CARB 2017a), to the 2005 Air Quality and Land Use Handbook. This Technical Advisory was developed to identify strategies that can be implemented to reduce exposure at specific developments or as recommendations for policy and planning documents. It is important to note that it is not intended as guidance for a specific project and does not discuss the feasibility of mitigation measures for the purposes of compliance with the California Environmental Quality Act (CEQA). Some of the strategies identified in the Technical Advisory include implementation design that promotes air flow and pollutant dispersion along street corridors, solid barriers, vegetation for pollutant dispersion, and indoor high efficiency filtration (CARB, 2017a).

5.2.3 Airborne Toxic Control Measures Related to Address Asbestos Exposure

The EPA requires specific work practices to control the release of asbestos fibers relating to a renovation and/or demolition activity. The EPA delegates enforcement authority to state and local agencies for renovation and/or demolition activities that involve the handling of asbestos. After identifying asbestos as a TAC in 1986, CARB adopted two ATCMs to address some of the health concerns associated with exposure to asbestos: ATCM for Surfacing Applications (adopted in 1990) and ATCM for Construction, Grading, Quarrying, and Surface Mining Operations (adopted in 2001). The two asbestos regulations address minimizing the placement of asbestos-containing materials on unpaved surfaces and requiring work practices to minimize asbestos emissions from such activities where naturally-occurring asbestos is found or is likely to be found. The ATCMs were intended to minimize the release of asbestos fibers during activities involving the handling of asbestos.

5.3 REGIONAL AND LOCAL STANDARDS

In Orange County, the SCAQMD is the agency responsible for protecting public health and welfare through the administration of federal and state air quality laws and policies. Included in the SCAQMD's tasks are monitoring of air pollution, preparation of air quality plans, and promulgation of rules and regulations.

The SCAQMD monitors air quality within the Project Site and the SCAB, which includes Orange County and portions of Los Angeles, Riverside, and San Bernardino Counties. The SCAB is bounded by the Pacific Ocean to the west; the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east; and the San Diego County line to the south.

Under the CCAA, the SCAQMD is required to develop an air quality attainment plan for nonattainment criteria pollutants within the air district. The most recent air quality plan developed by the SCAQMD is the 2016 Air Quality Management Plan (AQMP). The 2016 AQMP is the legally enforceable blueprint for how the region will meet and maintain the NAAQS and CAAQS. The 2016 AQMP identifies strategies and control measures needed to achieve attainment of the 8-hour ozone standard and federal annual and 24-hour standard for PM2.5 in the SCAB (SCAQMD, 2017a). The future emission forecasts are primarily based on demographic and economic growth projections provided by Southern California Association of Governments (SCAG).

SCAQMD rules relevant to the Project include, but are not limited to:

- Regulation IV: Prohibitions; Rule 401: Visible Emissions. Prohibits the generation of particulate matter emissions that exceed the visible emissions threshold.
- Regulation IV: Prohibitions; Rule 402: Nuisance. Prohibits the discharge, from any source, of such quantities of air contaminants or other materials that cause or have a tendency to cause injury, detriment, nuisance, annoyance to people and/or the public, or damage to any business or property.
- Regulation IV: Prohibitions; Rule 403: Fugitive Dust. Regulates fugitive dust emissions from any commercial construction or demolition activity capable of generating fugitive dust emissions, including active operations, open storage piles, and inactive disturbed areas, as well as track-out and carry-out onto paved roads beyond a project site.
- Regulation XI: Source Specific Standards; Rule 1113: Architectural Coatings. Requires manufacturers, distributors, and end users of architectural and industrial maintenance coatings to reduce VOC emissions from the use of these coatings, primarily by placing limits on the VOC content of various coating categories.
- Regulation XIV: Toxics and Other Non-Criteria Pollutants; Rule 1403: Requires notification and work practice standards to limit asbestos emissions from building demolition and renovation activities, including the removal and associated disturbance of asbestos-containing materials.
- Regulation XIV: Toxics and Other Non-Criteria Pollutants; Rule 1470: Requires all internal combustion engines (ICEs) greater than 50 brake horsepower to obtain a permit to construct from the SCAQMD prior to installation of the engines at a site.

The Project is required to comply with these rules, and conformance would be incorporated into Project specifications and procedures.

6 GREENHOUSE GAS REGULATORY FRAMEWORK

6.1 FEDERAL STANDARDS

EPA is the federal agency responsible for implementing the federal CAA. The Supreme Court of the United States ruled on April 2, 2007, that CO_2 is an air pollutant as defined under the CAA, and that EPA has the authority to regulate emissions of GHGs.

6.1.1 Greenhouse Gas Findings Under the Federal Clean Air Act

On December 7, 2009, EPA signed two distinct findings regarding GHGs under Section 202(a) of the CAA:

- Endangerment Finding: The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations.
- Cause or Contribute Finding: The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

Although these findings did not themselves impose any requirements on industries or other entities, this action was a prerequisite to finalizing EPA's *Proposed Rulemaking to Establish Light Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards* (EPA, 2009). On May 7, 2010, the final *Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards* were published in the Federal Register (EPA, 2010). Phase 1 of the emissions standards required model year 2012 through 2016 vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile, which is equivalent to 35.5 miles per gallon if the automobile industry were to meet this CO_2 level solely through fuel economy improvements.

On August 28, 2012, the U.S. Department of Transportation (USDOT) and EPA issued a joint Final Rulemaking requiring additional federal GHG and fuel economy standards for Phase 2 of the emissions standards for model year 2017 through 2025 passenger cars and light-duty trucks. The standards would require these vehicles to meet an estimated combined average emissions level of 163 grams of CO_2 per mile in model year 2025, which is equivalent to 54.5 miles per gallon if the improvements were made solely through fuel efficiency. However, on April 2, 2018, EPA issued a Mid-term Evaluation Final Determination, which finds that the model year 2022 through 2025 emissions standards are not appropriate and should be revised. This Mid-term Evaluation is not a final agency action; rather, this determination led to the rule making of the Safer Affordable Fuel Efficient (SAFE) Vehicles Rule (EPA, 2018).

In addition to the standards for light-duty vehicles, USDOT and EPA adopted complementary standards to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses on September 15, 2011. The Phase 1 standards together form a comprehensive heavy-duty national program for all on-road vehicles rated at a gross vehicle weight at or above 8,500 pounds for model years 2014 through 2018. The standards were phased in with increasing stringency in each model year from 2014 through 2018. The EPA standards adopted for 2018 represent an average per-vehicle reduction in GHG emissions of 17 percent for diesel vehicles and 12 percent for gasoline vehicles (EPA, 2011). Building on the success of the Phase 1 standards, EPA and the National Highway Traffic Safety Administration finalized Phase 2 standards for medium- and heavy-duty vehicles through model year 2027. The Phase 2 standards are expected to lower CO_2 emissions by approximately 1.1 billion MT. On November 16, 2017, EPA released a proposed rule to repeal the emission standards for heavy-duty glider vehicles, glider engines, and glider kits (EPA, 2017b).

6.1.2 Safer Affordable Fuel Efficient Vehicles Rule

In September 2019, the National Highway Traffic Safety Agency (NHTSA) and the EPA published the SAFE Vehicles Rule Part One: One National Program. The SAFE Part One Rule revokes California's authority and vehicle waiver to set its own emissions standards and set zero emission vehicle mandates in California for passenger cars and light trucks and establish new standards, covering model years 2021 through 2026. In April 2020, the EPA and NHTSA issued the second part of the proposed SAFE Vehicles Rule. This final rule became effective on June 29, 2020. The Final SAFE Rule relaxed the federal GHG emissions and fuel economy standards to increase in stringency at only about 1.5 percent per year from model year 2020 levels over model years 2021–2026. The previously established emission standards and related "augural" fuel economy standards would have achieved about 4 percent per year improvements through MY 2025 (CARB, 2020c). During the period the federal action is in effect, the CARB will administer the affected portions of its program on a voluntary basis. On January 20, 2021, President Joseph Biden signed an Executive Order directing consideration of labor unions, States, and industry views to propose suspension, revision, or rescindment of the SAFE Vehicles Rule (The White House, 2021).

6.1.3 Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA published the Final Mandatory Greenhouse Gas Reporting Rule (Reporting Rule) in the Federal Register. The Reporting Rule requires reporting of GHG data and other relevant information from fossil fuel and industrial GHG suppliers, vehicle and engine manufacturers, and all facilities that would emit 25,000 MT or more of CO_2e per year. Facility owners are required to submit an annual report with detailed calculations of facility GHG emissions on March 31 for emissions from the previous calendar year. The Reporting Rule also mandates recordkeeping and administrative requirements to enable EPA to verify the annual GHG emissions reports.

6.2 STATE STANDARDS

CARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the CCAA.

6.2.1 Assembly Bill 1493

AB 1493, signed in July 2002, requires CARB to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter emissions standards were designed to apply to automobiles and light trucks beginning with model year 2009. In June 2009, the EPA Administrator granted a CAA waiver of preemption to California. This waiver allowed California to implement its own GHG emissions standards for motor vehicles beginning with model year 2009. California agencies worked with federal agencies to conduct joint rulemaking to reduce GHG emissions for passenger car model years 2017 through 2025. However, this waiver was revoked and the GHG emission standards were relaxed with the passage of the SAFE Rule, as discussed above.

6.2.2 Executive Order S-3-05

Executive Order (EO) S-3-05, signed in June 2005, proclaimed that California is vulnerable to the impacts of climate change. EO S-3-05 declared that increased temperatures could reduce the Sierra Nevada's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the executive order established total GHG emissions targets. Specifically, emissions were to be reduced to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below the 1990 levels by 2050. The statewide GHG emissions in 2000 were approximately 466 MMT CO_2e (CARB, 2012). In 2010, overall statewide GHG emissions were approximately 453 MMT CO_2e, exceeding the 2010 goal established by Executive Order S-3-05 (CARB, 2012).

6.2.3 Assembly Bill 32

In 2006, California passed the California Global Warming Solutions Act of 2006 (AB 32; California Health and Safety Code Division 25.5, Sections 38500, et seq.). AB 32 further details and puts into law the mid-term GHG reduction target established in Executive Order S-3-05: reduce GHG emissions to 1990 levels by 2020. AB 32 also identifies CARB as the state agency responsible for the design and implementation of emissions limits, regulations, and other measures to meet the target. AB 32 also established several programs to achieve GHG emission reductions, including the Low Carbon Fuel Standard and the Cap-and-Trade program. As of 2017, the state has reduced emissions below the revised AB 32 limit of 427 MMT CO_2e.[1]

6.2.4 Senate Bill 32

In 2016, the California State Legislature adopted Senate Bill (SB) 32 and its companion bill AB 197, and both were signed by Governor Edmund Brown (California Legislative Information). SB 32 establishes a new climate pollution reduction target of 40 percent below 1990 levels by 2030 (California Legislative Information, 2015-2016).

6.2.5 CARB Climate Change Scoping Plans

In December 2008, CARB adopted its *Climate Change Scoping Plan. A Framework for Change* (Scoping Plan), which contains the main strategies California will implement to achieve the required GHG reductions required by AB 32 (CARB, 2008). The Scoping Plan also includes CARB-recommended GHG reductions for each emissions sector of California's GHG inventory. CARB further acknowledges that decisions about how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emissions sectors.

CARB is required to update the Scoping Plan at least once every 5 years to evaluate progress and develop future inventories that may guide this process. CARB approved *First Update to the Climate Change Scoping Plan: Building on the Framework* in June 2014 (CARB, 2014). The Scoping Plan update

[1] For more detail, please see https://ww2.arb.ca.gov/ghg-2020-limit and https://ww2.arb.ca.gov/ghg-inventory-graphs.

includes a status of the 2008 Scoping Plan measures and other federal, state, and local efforts to reduce GHG emissions in California, and potential actions to further reduce GHG emissions by 2020.

In November 2017, CARB released the 2017 Climate Change Scoping Plan, which establishes a framework of action for California to reduce statewide emissions by 40 percent by 2030, compared to 1990 levels (CARB, 2017b). The 2017 Scoping Plan builds upon the framework established by the 2008 Scoping Plan and the 2014 Scoping Plan Update, while also identifying new, technologically feasible and cost-effective strategies to ensure that California meets its GHG reduction targets.

6.2.6 Executive Order S-1-07

EO S-1-07, which was signed by then California governor Arnold Schwarzenegger in 2007, proclaims that the transportation sector is the main source of GHG emissions in California, at more than 40 percent of statewide emissions. EO S-1-07 establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10 percent by 2020. CARB adopted the low carbon fuel standard (LCFS) on April 23, 2009. In November 2015, the Office of Administrative Law approved re-adoption of the LCFS.

6.2.7 Executive Order B-30-15

In April 2015, Governor Edmund Brown issued an EO establishing a statewide GHG reduction goal of 40 percent below 1990 levels by 2030. The emission reduction target acts as an interim goal between the AB 32 goal (i.e., achieve 1990 emission levels by 2020) and Governor Brown's EO S-03-05 goal of reducing statewide emissions 80 percent below 1990 levels by 2050. In addition, the EO aligns California's 2030 GHG reduction goal with the European Union's reduction target (i.e., 40 percent below 1990 levels by 2030) that was adopted in October 2014.

6.2.8 Senate Bill 350

California's Renewables Portfolio Standard (RPS) was established in 2002 under SB 1078 and accelerated in 2006 under SB 107, by requiring that 20 percent of electricity retail sales be served by renewable energy sources by 2010. Subsequent recommendations in California energy policy reports advocated a goal of 33 percent by 2020, and on November 17, 2008, then governor Arnold Schwarzenegger signed EO S-14-08 requiring retail sellers of electricity to serve 33 percent of their load with renewable energy by 2020. In April 2011, SB X1-2 codified EO S-14-08, setting the new RPS targets at 20 percent by the end of 2013, 25 percent by the end of 2016, and 33 percent by the end of 2020 for all electricity retailers. In October 2015, Governor Edmund Brown signed SB 350, which extended the RPS target by requiring retail sellers to procure 50 percent of their electricity from renewable energy resources by 2030. This was followed by SB 100 in 2018, which further increased the RPS target to 60 percent by 2030 along with the requirement that all of the state's electricity come from carbon-free resources by 2045.

6.3 REGIONAL AND LOCAL STANDARDS

CARB acknowledges that local governments have broad influence and, in some cases, exclusive jurisdiction over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations.

6.3.1 Southern California Association of Governments

On September 23, 2020, the SCAG adopted Connect SoCal, the 2020-2045 Regional Transportation Plan/Sustainable Communities Strategies. As a plan with the goal of accelerating the region's progress toward transportation and GHG reduction targets, programs within the Regional Transportation Plan/Sustainable Communities Strategy(RTP/SCS) focus on shifting travel to active transportation modes, expanding the transit network, and efficient movement of goods (SCAG, 2020a).

6.3.2 City of Irvine

On July 9, 2020, City Council voted to develop a City Climate Action Plan. The Climate Action Plan has not been prepared at the time of this analysis.

7 EMISSION ESTIMATES METHODOLOGY

Construction-related and operational activities associated with the Project will include emissions-generating sources. These emissions were estimated in accordance with SCAQMD and CARB guidelines, and as detailed below for construction and operations. Maximum potential emissions for construction and operations were each compared to the SCAQMD's thresholds of significance. The regional thresholds of significance were designed to identify those projects that would result in significant levels of air pollution and to assist the region in attaining the applicable state and federal ambient air quality standards, which were established using health-based criteria to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. Because regional air quality standards have been established for these criteria pollutants to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution, these thresholds of significance can also be used to assess the Project's emissions and inform the Project's impacts to regional air quality and health risks under CEQA. The SCAQMD's thresholds of significance are shown in Table 9.1-1 in this memo. In addition, the SCAQMD has established localized thresholds of significance.

Project-related criteria air pollutant emissions may have the potential to exceed the CAAQS and NAAQS in the area surrounding the Project Site, even though these pollutant emissions may not be significant enough to create a regional impact to the SCAB. In order to assess local air quality impacts, the SCAQMD has developed Localized Significance Thresholds (LSTs) and supporting LST Methodology to assess the Project-related emissions in the project vicinity (SCAQMD, 2008a). The LST Methodology found that the primary emissions of concern are NO_2, CO, PM_{10}, and $PM_{2.5}$.

The LSTs represent the maximum emissions from a project that will not cause or contribute to an exceedance of the most stringent applicable federal or state ambient air quality standards and are developed based on the ambient concentrations of that pollutant for each source receptor area. Since the LSTs consider the ambient air quality, LSTs can also be used to identify those projects that would result in significant levels of air pollution and impact sensitive receptors.

The LST Methodology provides Look-Up Tables with different thresholds based on the location and size of the project site and distance to the nearest sensitive receptors. The Look-Up Tables provide thresholds for 1, 2, and 5-acre projects sites. Since the Project Site is approximately 21.3 acres, the 5-acre project site threshold was utilized in order to provide a conservative analysis for CO and PM_{10} emissions. Since the region is in nonattainment for ozone and $PM_{2.5}$ and the Project Site is larger than 5 acres, consistent with SCAQMD guidance, project-specific localized dispersion modeling was performed for NO_2 (an ozone precursor) and $PM_{2.5}$. The Project Site is located within Source Receptor Area 19, Saddleback Valley.

As described previously, the nearest sensitive receptors are the residences in the senior housing community located approximately 650 feet (200 meters) north of the Project Site. As such, the applicable LST for PM_{10} was determined assuming a receptor distance of 200 meters. In addition, since it is reasonable to assume that offsite workers located at the nursery to the west of the Project Site and buildings along Technology Drive could be present for periods of one to eight hours, the LST analysis was also performed for these worker receptors for pollutants with shorter averaging times, such as CO. The LST for CO was based on a 5-acre Project Site and 25-meter receptor distance. Since Project-specific localized dispersion modeling was performed for NO_2 and $PM_{2.5}$, the LSTs were based on the SCAQMD ambient air quality thresholds for these criteria pollutants. The applicable LSTs are summarized in Table 9.1-2in this memo.

7.1 CONSTRUCTION

Construction-related activities are temporary, short-term sources of emissions. Sources of construction-related criteria air pollutant and GHG emissions include construction equipment exhaust; construction-related trips by workers, delivery and hauling truck trips; fugitive dust from site preparation activities; and off-gassing from traffic coating and paving activities.

Construction of Phase 1 was assumed to begin in 2023 and last approximately 30 months. Construction of Phase 2 is anticipated to begin in 2025 and last approximately 23 months. Emissions generated by construction activities were modeled using emission factors from the CARB's OFFROAD 2017[2] and

[2] OFFROAD2017 is CARB's emissions inventory database for off-road diesel engines, used to quantify the amount of pollutants from thousands of engines in equipment used in industrial applications, agriculture, construction, mining, oil drilling, power generation, and many other industries. OFFROAD2017 was used to generate emission factors for the different types of equipment anticipated to be used by the project. To develop the emission factors associated with each piece of off-road construction equipment that would be needed for the project, OFFROAD2017 was first used to generate an emissions inventory for Orange County. Equipment was aggregated to include all model years. This approach allows for the identification of typical characteristics for off-road vehicle equipment in Orange County (since the specific fleet that would be used for the project is unknown). The emissions inventory provided the total pollutant emissions (in tons per day) and equipment activity in Orange

EMFAC 2017[3] inventory models. Construction emissions from the operation of diesel-fueled off-road equipment were estimated by multiplying construction equipment usage information by the equipment-specific emissions factors, based on aggregate model years and horsepower provided in OFFROAD. Construction equipment usage was provided by the Project engineers and include a range of equipment including, but not limited to, backhoes, concrete saws, dump trucks, excavators, generators, graders, rubber tired dozers, and electric/pneumatic equipment such as nail guns and power wrenches. Additional details on equipment types, counts, and estimated usage per day by construction phase are available in Appendix A.

Emissions from on-site and off-site on-road motor vehicles were estimated using vehicle trips, vehicle miles travelled (VMT), and EMFAC 2017 mobile source emission factors. The emission factors represent the fleet-wide average emission factors in Orange County. On-road emissions estimates also considered PM from break wear, tire wear, and re-entrained roadway dust. On-road motor vehicle usage was based on construction crew size and estimated number of haul truck trips provided by the Project engineers. The construction crew size ranged from approximately 10 to 57 workers per day depending on the individual construction subphases. It was assumed each construction worker would travel to and from the site each day (two one-way trips) and each trip length was assumed to be 14.7 miles based on the California Emissions Estimator Model (CalEEMod) default trip length for workers in Orange County. The analysis also assumed approximately 120,000 cubic yards (CY) of material import would be required, resulting in 7,500 loaded truck trips, during the earthwork subphase during construction of Phase 1. Material import truck trip lengths were assumed to be 20 miles based on the CalEEMod default for haul trucks. In addition, the analysis accounted for concrete truck deliveries based on the anticipated concrete needs as identified by the Project engineers and an assumed concrete truck capacity of 9 CY. The analysis assumed 163 and 204 concrete trucks trips would be required during construction of Phase 1 and Phase 2, respectively. Concrete truck trip lengths were assumed to be 6.9 miles based on the CalEEMod default trip length for vendor trips. Additionally, the analysis assumed three delivery options for track material (i.e., rail, turnouts, ballast, and other track materials) deliveries. One option for delivery of these materials is delivery by haul trucks. It is estimated that approximately 1,224 and 333 truckloads of material would be required during construction of Phase 1 and Phase 2, respectively. The other option includes the use of two welded rail trains. Based on information provided by the Project engineers, the analysis assumed the flash butt welding machine is electric-powered and available in truck-design which was assumed to have a 599-horsepower diesel engine and require two full days of operation. The third material delivery option includes delivery by rail car. The analysis assumed one hour of train travel within the SCAB to deliver materials to the Project Site and an additional hour of idling to

County (in annual horsepower-hours (hp-hrs). Total daily pollutant emissions were then multiplied by 365 (to convert to tons per year), converted to grams, and then divided by total hp-hrs to derive an emissions rate in terms of grams per horsepower hour (g/hp-hr) for each vehicle classification and horsepower bin (e.g., 100 hp to 175 hp). To estimate the total daily mass of criteria air pollutant emissions from a piece of off-road construction equipment, the equipment's emissions factor (g/hp-hr) for each pollutant was multiplied by the equipment's horsepower, engine load factor, and maximum daily runtime hours. To estimate total mass emissions over the duration of construction, the daily mass emissions were multiplied by the maximum duration of use (days).

[3] *The EMFAC 2017 factors, as applicable to vehicle categories, were adjusted off-model to account for the impacts of the "Safer Affordable Fuel-Efficient Vehicles Rule Part One: One National Program" adopted by the USEPA and the National Highway Traffic Safety Administration.*

unload materials. It was assumed that the local work train delivering the materials would be a Tier-4 locomotive. Additional details regarding trip counts, trip lengths, and phasing are available in Appendix A.

Fugitive dust emissions were estimated using the U.S. EPA Compilation of Air Pollutant Factors (AP 42) and CalEEMod methodology for activities including material loading into haul trucks, vehicle miles traveled, earthwork quantities and activities including graders, scrapers, and dozers leveling land or moving dirt. Fugitive dust emission estimates of PM_{10} and $PM_{2.5}$ include reductions associated with implementation of fugitive dust control practices per SCAQMD Rule 403 (e.g., watering disturbed surface areas at least twice per day). Additional details are available in Appendix A.

The analysis also estimated VOC emissions associated with architectural coatings of the buildings and painting of stripes, handicap symbols, directional arrows, and car space descriptions in parking lots using CalEEMod version 2016.3.2 methodology and the anticipated building and parking lot square footages. The analysis also estimated off-gassing emissions associated with asphalt paving of the parking lot and paved access road using CalEEMod methodology. Additional details are available in Appendix A.

7.2 OPERATIONS

After construction of the Project, operations would generate long-term emissions of criteria air pollutants and GHGs from a variety of sources. Emissions generated by operational activities were modeled for locomotive operations, heavy-duty equipment used on-site (such as cranes and forklifts), emergency generator operations, sand silo refilling and use, fuel tank emissions, natural gas consumption, and on-road vehicle travel for worker, delivery, and haul trips to and from the Project Site. Indirect emissions were also modeled for indirect sources associated with electricity use, water demand, and waste generation. Operation of Phase 1 was assumed to begin in 2026 and emission factors used were based on anticipated equipment and vehicle fleets for this earliest possible operational year.

Locomotive emissions were estimated for on-site activity, which would include idling during service and inspection activities as well travel through the wash bay. Diesel locomotive engine power is controlled by “notched” throttles. Idling, braking, and moving the locomotive is conducted by placing the throttle in one of several available “notch” settings. A locomotive’s duty cycle is a description of how much, on average, the locomotive spends in each notch setting while operating. Emission factors for calculations were based on EPA’s 2009 Emission Factors for Locomotives Technical Highlights (EPA-240-F-09-025) and the conversion factors for CH_4 and N_2O from EPA’s 2018 Emission Factors for Greenhouse Gas Inventories guide. Emission standards are defined per unit of activity (in grams per horsepower-hour) for both Tier 2 and Tier 4 engines that would be serviced by the Project. Based on information provided by OCTA, the current fleet mix includes approximately 27 percent Tier 2 engines and approximately 73 percent Tier 4 engines. Per information provided by OCTA, it is anticipated that all locomotives would be Tier 4 by 2028. Since the first operational year of Phase 1 is anticipated to be 2026, the analysis assumed the fleet mix would be 8 percent Tier 2 and 92 percent Tier 4 locomotives by 2026 (using a linear conversion schedule based on the existing fleet mix and future 100 percent Tier 4 fleet). Emissions were estimated using the estimated on-site idling and operational time per train per day during service at the Project Site. To estimate annual GHG emissions, daily emissions were annualized assuming 365 operating days per year. Additional details are available in Appendix A.

Train fueling and sanding would also occur on the Project Site. Fuel would be stored in four aboveground storage tanks with 30,000-gallon capacity and one aboveground storage tank with a 10,000-gallon capacity. Fugitive emissions associated with fueling were estimated using TankESP modeling software, based on the projected fuel daily throughput of approximately 13,000 gallons per day. Fugitive dust emissions associated with the sand silos were also estimated. The sand silos are used to store and distribute sand to locomotives as needed. Sand is used to provide traction and prevent wheel slip when moving locomotives. Sand throughput for the Project was estimated based on the throughput for a reference project (Los Angeles Commerce Railyard Maintenance Facility) and scaled based on facility operations. Emissions were estimated using EPA AP 42 Table 11.12-2 methodology. Additional details are available in Appendix A.

Emissions from the operation of diesel-fueled off-road yard equipment were estimated using emission factors from CARB's OFFROAD 2017 emissions database. Emissions were estimated by multiplying estimated daily equipment usage information (the number of each equipment type and hours of daily use) by the equipment-specific emissions factors, based on aggregate model years and horsepower provided in OFFROAD 2017. It was assumed the yard equipment would include four cranes and four forklifts. Emissions associated with limited testing and use of the on-site backup generator were also estimated and accounted for using emission factors and load factor from CalEEMod, and assuming up to 50 hours of use per year. On-road vehicle emissions were modeled using emission factors from the CARB EMFAC 2017[4] emissions inventory database. Emissions from on-road motor vehicles were estimated using vehicle trips per day, estimated trip distances, and EMFAC 2017 mobile source emission factors specific to the range of vehicle categories serving the Project for worker trips, delivery trips (including sand and fuel deliveries), and haul trips. The emission factors represent the fleet-wide average emission factors in Orange County for each vehicle category. On-road emissions estimates also considered particulate matter from break wear, tire wear, and re-entrained roadway dust. Re-entrained roadway dust emissions were estimated using the AP 42 Section 13.2.1 methodology for paved roads. Based on information provided by OCTA, the analysis assumed 40 workers would travel to and from the site each day and that 10 delivery haul trucks and 2 fuel trucks would travel to and from the site to represent a maximum daily emissions scenario. Additional details are available in Appendix A.

The Project would not result in an increase in commuter rail service or additional locomotive train travel in the region. Therefore, regional emissions associated with in-transit locomotive operations were assumed to remain like existing conditions. However, as described in more detail in Section 8.0 below, for the purposes of localized emissions and health risk assessment, emissions associated with on-site idling and train travel within one mile of the proposed Project Site were estimated. As described in Section 2, a maintenance facility located along the Metrolink route through Orange County, such as the

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[4] The EMFAC 2017 factors, as applicable to vehicle categories, were adjusted off-model to account for the impacts of the "Safer Affordable Fuel-Efficient Vehicles Rule Part One: One National Program" adopted by the USEPA and the National Highway Traffic Safety Administration.

Project, would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The Project would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. The storage and maintenance activities that would occur operationally at this facility would be a shift in these operations from the existing storage and maintenance facilities to the proposed Project Site. As such, due to the optimal location of the proposed Project Site, the Project is also anticipated to result in reduced locomotive travel in the region and a reduction in the emissions associated with locomotive and rail car travel in the region. It is also anticipated that total regional emissions associated with train idling would decrease at the existing maintenance facilities due to more efficient operations and logistics.

Natural gas would be consumed by on-site building operations. Monthly forecasted natural gas use for the facility was based upon default CalEEMod data for a general office building, and adjusted for the size of the proposed facility; this land use was selected as the most conservative assumption for units of natural gas consumption per 1,000 square feet of land use.

Indirect emissions associated with electricity generation, water use and waste disposal were calculated to estimate GHG emissions. Emission factors for electricity use were based on the utility-specific data for Southern California Edison (the electricity provider) and EPA eGrid data. Although GHG emissions associated with electricity production are anticipated to decline over time due to state regulations and the Renewables Portfolio Standards, emissions were estimated using the most current (2018) emissions factors which is estimated to be approximately 474 pounds per megawatt-hour. Monthly forecasted electricity use for the facility was based upon default CalEEMod data for a general office building and adjusted for the size of the proposed facility; this land use was selected as the most conservative assumption for units of electricity consumption per 1,000 square feet of land use. Estimated waste generation and emission factors for waste disposal were based upon default emissions factors available from the CalEEMod emissions estimating tool for Climate Zone 8. Water demand associated with train washes was estimated for the Project, and typical operational water demand for building operations was added to this using water demand estimates from CalEEMod for a general office building; this land use was selected as the most conservative assumption for units of water demand per 1,000 square feet of land use. Electricity demand associated with water supply, treatment and disposal were based on CalEEMod default data inputs. Using the same emission factors as previously described for Southern California Edison electricity, the indirect emissions associated with water demand were estimated using the Project specific water usage estimates and CalEEMod estimates of electricity consumption per gallon of water use. Additional details are available in Appendix A.

Consistent with CalEEMod methodology, emissions associated with periodic architectural coatings were also accounted for in the operational emissions estimates. The analysis assumed up to 10 percent of building and parking surface areas are repainted annually.

8 HEALTH RISK ASSESSMENT METHODOLOGY

8.1 DISPERSION MODELING

The American Meteorological Society/U.S. EPA Regulatory Model (AERMOD) dispersion model (Version 19191) (EPA, 2019b) was used to estimate pollutant concentrations at specific distances from Project emission sources, in conjunction with representative meteorological data from nearby John Wayne International Airport. AERMOD was applied with the regulatory default options and the urban modeling option (dispersion coefficients) with a population of 3,010,323 (Orange County), consistent with SCAQMD modeling guidance (SCAQMD, 2021a). Information regarding other model inputs are provided in the following sections.

8.1.1 Meteorological Data

AERMOD requires a sequential hourly record of dispersion meteorology representative of the region within which the Project would be located. AERMOD was supplied with 5 years (2012 to 2016) of hourly meteorological data consisting of surface observations from the John Wayne International Airport meteorological station in Santa Ana, the nearest station to the Project Site. Upper air data for this 5-year period was from San Diego, California. SCAQMD provides AERMOD-ready meteorological files on their website (SCAQMD, 2021b) to use for HRAs. This meteorological dataset was processed with the regulatory-approved low wind option (adjusted u-star). A wind rose of the 5 years of data is shown in Figure 8.1-1. The wind rose indicates that the predominant wind direction is onshore, from the southwest.

John Wayne International Airport is located approximately 6.2 miles west from the Project Site. An inspection of aerial imagery and topographic maps indicates there are no significant elevated terrain features between the two sites. Both sites are located at similar distances from the coastline and have higher terrain to the north and east. Therefore, the John Wayne International Airport data is the most representative meteorological dataset available for dispersion modeling.

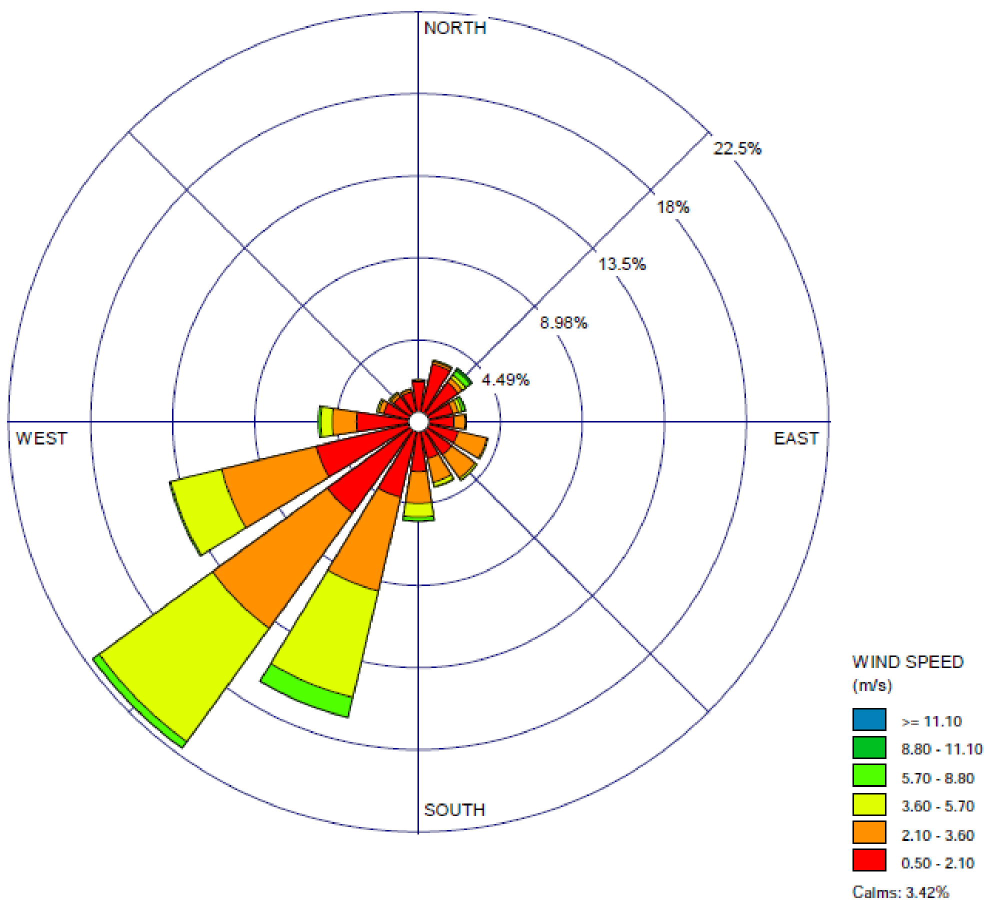
8.1.2 Terrain and Receptor Data Processing

Terrain elevations were obtained from commercially available digital terrain elevations in the National Elevation Dataset (NED) developed by the U.S. Geological Survey (USGS, 2021). The NED data provide terrain elevations with 1-meter vertical resolution and 10-meter (1/3 arc-second) horizontal resolution based on a Universal Transverse Mercator (UTM) coordinate system. The U.S. Geological Survey specifies coordinates in North American Datum 83, UTM Zone 11. EPA's terrain pre-processor, AERMAP (Version 18081), was used to process the NED data and assign elevations to the receptor locations and sources.

As shown in Figure 8.1-2, construction-related pollutant concentrations were estimated for nearby receptors located within 1,000 feet of the Project and 500 feet on either side of roadways to account for Project-related traffic. Receptor spacing within 1,000 feet of the Project and 500 feet of roadways are set at 20-meter intervals. Pollutant concentrations for operations were estimated for nearby receptors located within 1¼ miles of the Project Site. Figure 8.1-3 shows a map of the nested receptor grid used in assessing impacts from operations. The nested receptor grid used the following interval spacing:

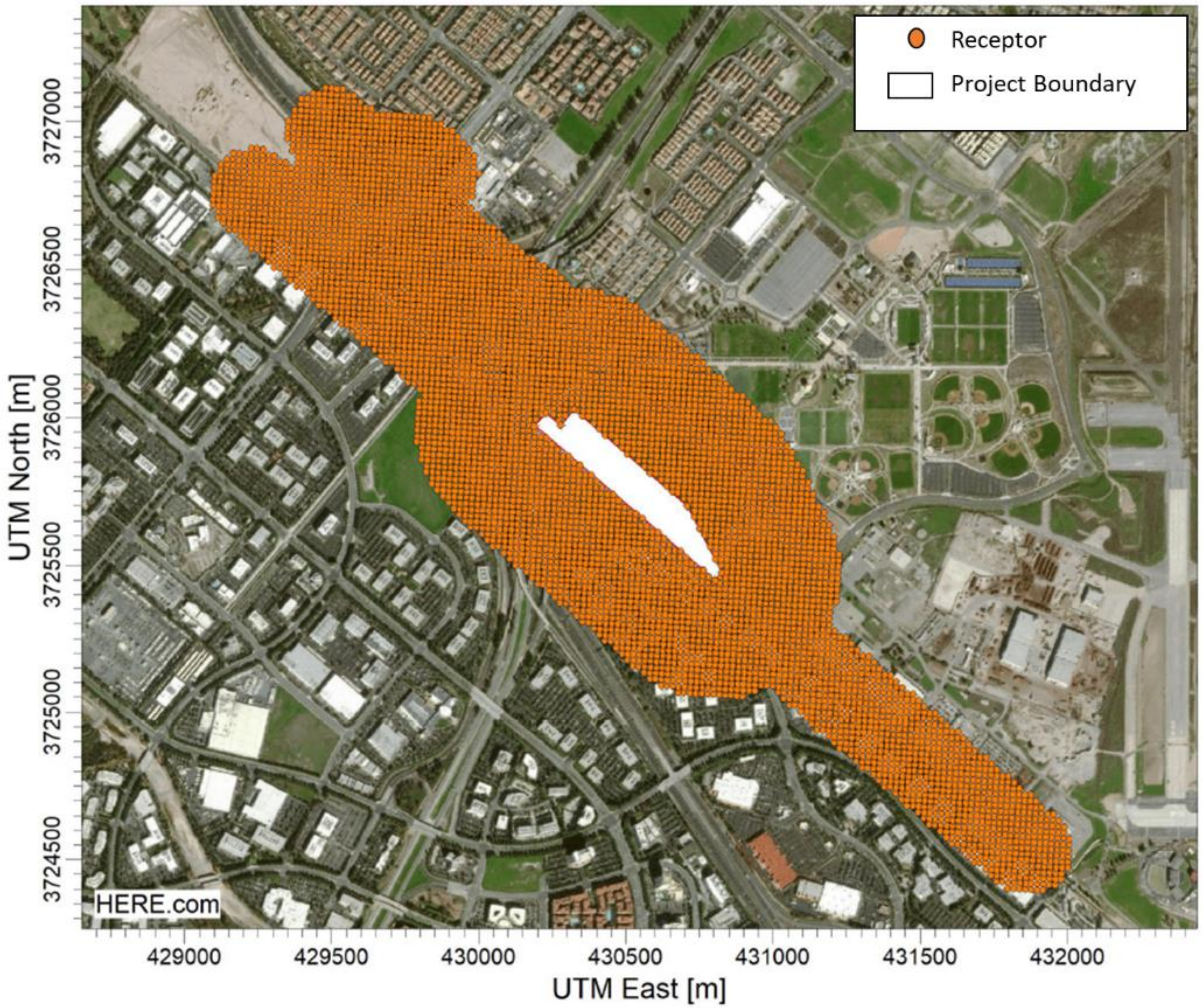
- Receptors within 500 meters of the Project boundary are spaced 20-meters apart,
- Receptors located between 500 meters and 970 meters are at 50-meter intervals, and
- Receptors beyond 970 meters to 1 ¼ mile are spaced 100 meters apart.

Figure 8.1-8.1-1 Wind Rose for John Wayne International Airport 2012-2016



Source: OCTA (2021)

Figure 8.1-8.1-2 HRA Receptor Locations for Construction Impact Analysis



Source: OCTA (2021)

Figure 8.1-8.1-3 HRA Receptor Locations for Operational Impact Analysis

Source: OCTA (2021)

8.1.3 Construction Sources

Off-road construction equipment utilized for on-site Project activities were modeled as multiple adjacent volume sources over the areas of construction-related activity. The locations of the volume sources vary by construction phase (Phase 1 and Phase 2). Phase 1 consists of construction activities in 2023 through first half of 2025. Phase 2 involves construction from July 2025 through June 2027. To account for potential turbulent mixing that can occur with engine exhaust from construction equipment, an initial vertical dimension of 1.4 meters for each volume source was used. Table 8.1-1 lists the volume source parameters used for construction-related activities, consistent with SCAQMD guidance (SCAQMD, 2008a).

Table 8.1-8.1-1 SCAQMD Adjacent Volume Source Parameters

Parameter	Adjacent Volume Sources
Release Height (m)	5.0
Lateral Dimension (m)[1]	20 by 20
Initial Vertical Height (m)	1.4

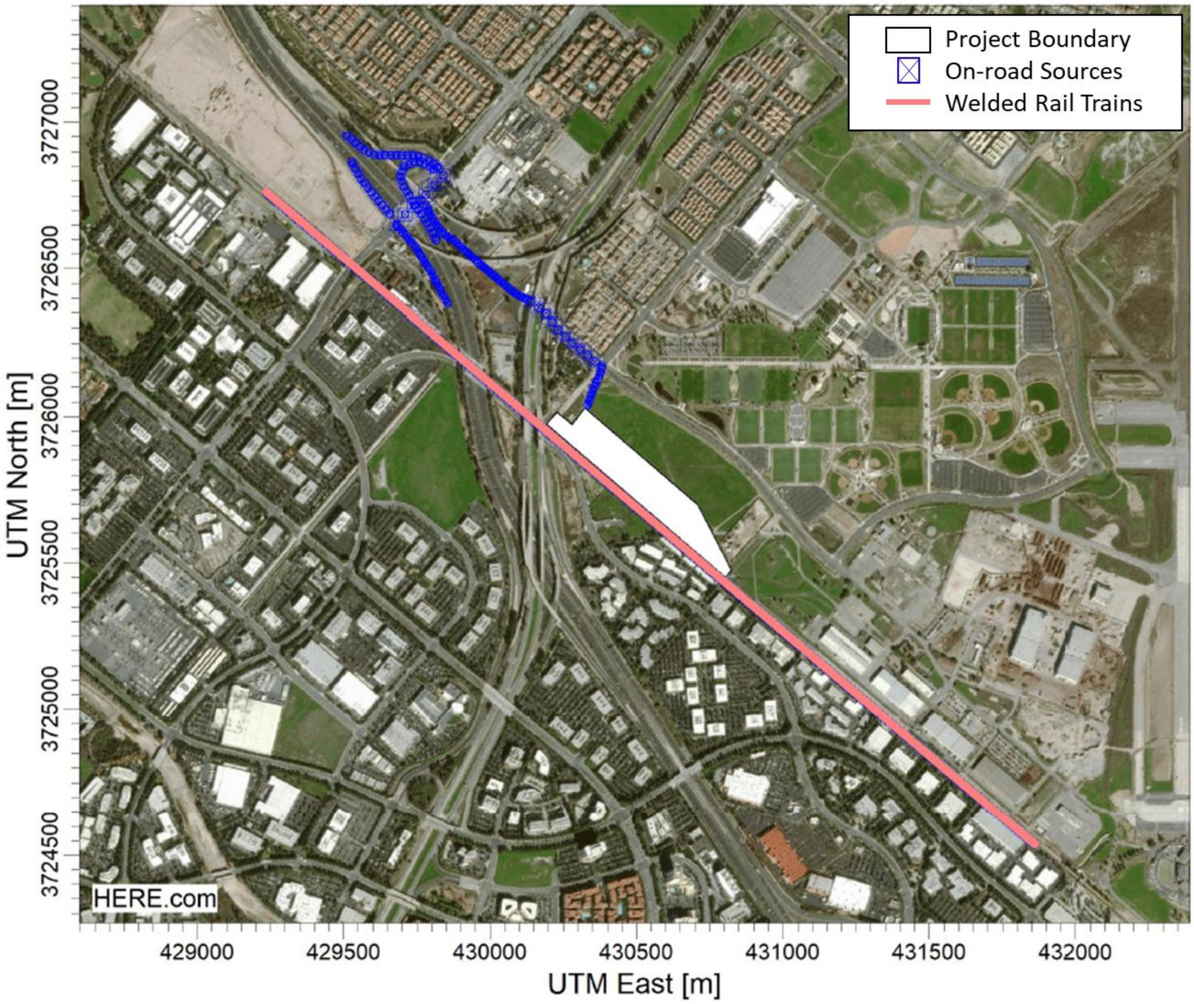
Notes: m = meters.
[1] For projects areas ≥ 5 acres.
Source: SCAQMD 2008a

On-road emissions from construction worker vehicles, haul trucks, material delivery trucks, and Project-related work trucks traveling to and from the Project Site were modeled as adjacent volume sources. The release height of these sources was set to 2 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimensions vary depending on roadway width. All construction-related traffic would access the Project Site from Marine Way. As shown in Figure 8.1-4, traffic was modeled from the intersection of Marine Way and Ridge Valley to the on/off ramps of I-5 (with access from Sand Canyon Avenue). On-road traffic within 4,000 feet of the Project Site was included in the model. Modeling parameters for the area and roadway sources are summarized in Appendix B.

As discussed in Section 7.1, track materials delivered on site may arrive by two welded rail trains. These emission sources were modeled as adjacent volume sources along the existing rail line located adjacent to the southern boundary of the Project Site. The volume sources extended out approximately 4,000 feet in either direction from the Project Site. Figure 8.1-4 illustrates the segments of track included in the model for the welded rail trains. A release height of 5 meters and an initial vertical dimension of 1.40 meters were used, based on similar analyses (SJRRC, 2018) for rail sources.

Construction would occur Monday through Friday from 7 a.m. to 5 p.m. (2,607 hours per year); therefore, those hours were modeled in AERMOD using the EMISFACT HRDOW keywords to account for these Project-specific weekdays and hours.

Figure 8.1-8.1-4 On-Road/Rail Construction Emission Sources



Source: OCTA (2021)

8.1.4 Operational Sources

Operational emission sources evaluated as part of the HRA include locomotive operations, heavy-duty equipment used on-site (such as cranes and forklifts), fuel tank emissions, emergency generator, sand silos, and on-road vehicle travel to and from the site. Operation of Phase 1 was assumed to begin in July 2025 and operation of Phase 2 was assumed to begin in January 2028 (at the completion of construction of Phase 2).

Locomotive operations (including in-transit and idling) were modeled as adjacent volume sources along each section of track to be built on the site. Phase 1 includes 11 segments of track with Phase 2 adding another 5 segments for a total of 16 segments by 2028. For exhaust parameters, a similar methodology was used to that presented in the HRA conducted for the Central Maintenance Facility (Metrolink, 2014). This methodology included using EPA's SCREEN3 (EPA, 2013) screening-level dispersion model to estimate plume rise for the locomotives for daytime and nighttime hours. Table 8.1-2 summarizes the inputs to

SCREEN3. Based on the results from SCREEN3, separate daytime and nighttime model parameters for the locomotives were used, as listed in Table 8.1-3.

Table 8.1-8.1-2 Inputs to SCREEN3 for Locomotive Plume Rise Calculations

Parameter	Locomotives (Daytime)[4]	Locomotives (Nighttime)[4]
Release Height (m)[1]	4.6	4.6
Stack Diameter (m) [1]	0.666	0.666
Exit Velocity (m/s)[2]	7.03	7.03
Exit Temperature (K)[2]	422.38	422.38
Average Wind Speed (m/s)[3]	3.59	2.47
Average Air Temperature (K)[3]	294.89	290.64
Stability Class[1]	D	F

Notes: m = meters, m/s = meters per second, K = Kelvin
[1] Values obtained from Metrolink HRA (2014)
[2] Weighted average of idling, brake test, and in-transit velocity or temperature presented in Metrolink HRA. Assumed 10 minutes of idling and 1 hour of additional on-site engine operations (locomotive movement, maintenance, and testing) per train per day.
[3] Based on 2012-2016 meteorology from John Wayne International Airport.
[4] Included building information to account for downwash. Height (4.57 m), width (3 m), and length (20 m), consistent with Metrolink HRA.

Table 8.1-8.1-3 Adjacent Volume Source Parameters for Locomotives in AERMOD

Parameter	Daytime	Nighttime
Release Height (m)	10.64	23.76
Lateral Dimension (m)[1]	9.1	9.1
Initial Vertical Height (m)	13.79	10.84

Notes: m = meters.
[1] Width of track (3 m) plus wake zone (6 m) for a total width of 9.1 meters

Daytime locomotive emissions were modeled from 9 a.m. to 6 p.m. with nighttime emissions occurring from 6 p.m. until 9 a.m. Eighty percent of daily emissions were allocated to occur at night and the remaining 20 percent were assumed to occur during the day, given the majority of on-site activity that is anticipated to occur overnight.

In addition to open track areas, on-site train movement and idling would occur for short periods of time in the train wash or the maintenance buildings. Emissions from these locations were modeled as volume sources located at the height of the roof for each building. The parameters for these emissions sources are provided in Appendix B.

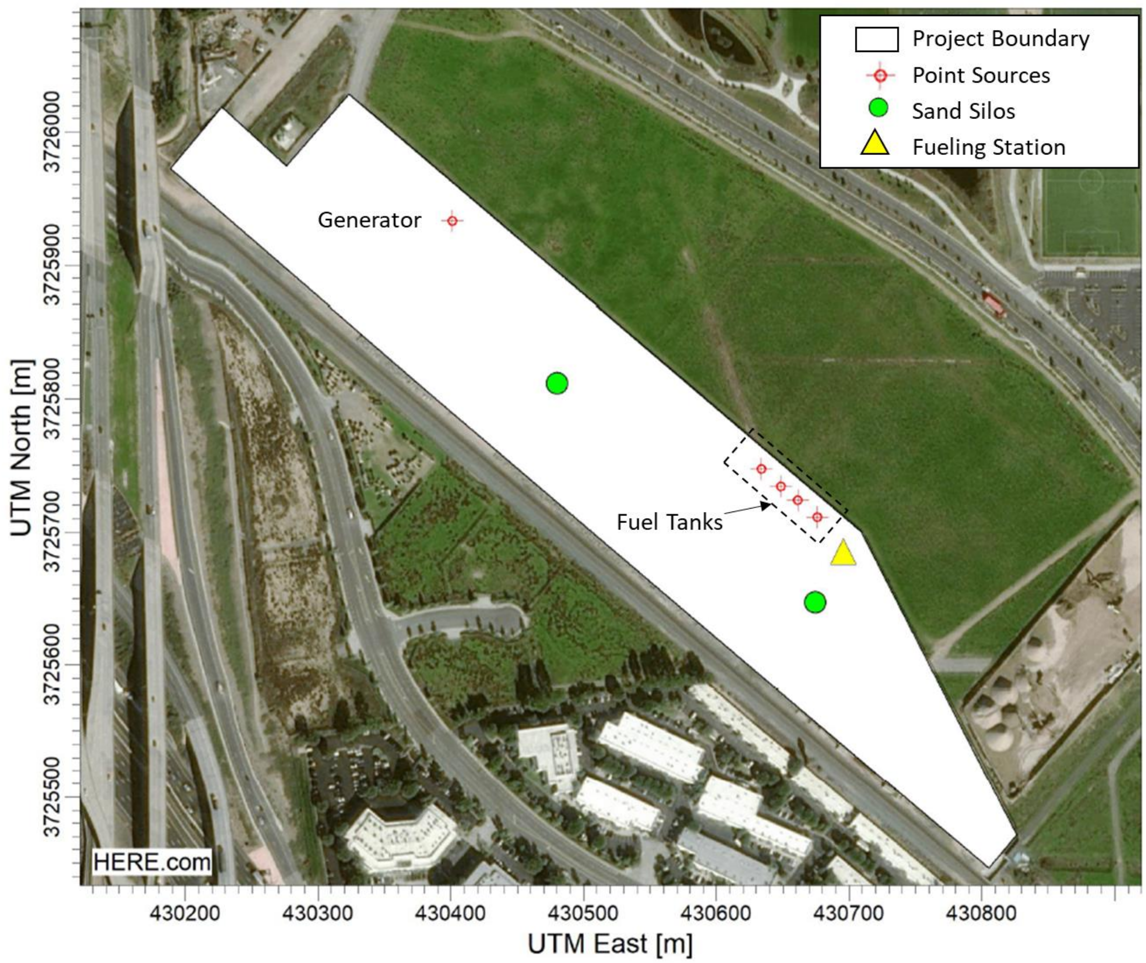
On-road emissions from operational vehicles associated with the Project Site were modeled as adjacent volume sources. The release height of these sources was set to 2 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimensions vary depending on roadway width. Project-generated on-road traffic up to 6,500 feet of the Project Site was modeled. Fuel and sand deliveries were also accounted for in the on-road emissions. The on-site delivery routes are shown in Figure 8.1-5 with the on-road sources located within the Project Site. Figure 8.1-5 also illustrates the on-road vehicle routes modeled for Project operations (located off site), which aligns with traffic turn data from Figure 4.2-1 of the Traffic Technical Memorandum (AECOM, 2021). The source parameters are summarized in Appendix B.

Figure 8.1-8.1-5 On-Road Vehicles Routes for Operations

Source: OCTA (2021)

The on-site generator, sand silos, fuel tanks and dispenser were all modeled as stationary sources as shown in Figure 8.1-6. The generator and fuel tanks were modeled as vertical, uncapped point sources. Tank filling and silos were modeled as individual volume sources. Details on the source parameters for these stationary sources included in the model are provided in Appendix B.

Figure 8.1-8.1-6 Stationary Source Locations for Project Operations



Source: OCTA (2021)
Note: Fuel tanks were modeled both as point sources and as volume sources to account for fueling/spillage.

8.2 HEALTH RISK CHARACTERIZATION AND ESTIMATION

Risk characterization integrates exposure information provided by the dispersion modeling with potential health effects associated with specific TACs. This step provides quantitative estimates of potential health risks associated with TACs to which the potential existing off-site receptors of the Project would be exposed. AERMOD was run using unit emissions. Each source was modeled assuming emissions of 1 gram per second (g/s) for point sources, 1 g/s divided by the number of volume sources in a road segment, or 1 g/s divided by the area source in square meters. The unitized AERMOD results for each source are output in micrograms per cubic meter (µg/m^3) per g/s [(µg/m^3)(g/s)$^{-1}$]. Maximum hourly and period-average plot files generated by AERMOD as described above were input to HARP2 with corresponding TAC emission rates for each phase of construction as well as the Project's operational emissions to calculate the Project's concentration contributions. The HARP2 (Version 21081) (CARB, 2005) model was created by CARB and is used to estimate carcinogenic and noncarcinogenic health risks from proposed projects. The HARP2 model uses the equations and algorithms contained in the Office of Environmental Health Hazard Assessment's

(OEHHA) *Air Toxics Hot Spots Program Risk Assessment Guidelines: Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015 Risk Assessment Guidelines) to calculate health risks based on input parameters such as emissions, "unit" ground-level concentrations, and toxicological data based on the OEHHA 2015 Risk Assessment Guidelines. These concentrations were then used to estimate the long-term effects of TACs on nearby receptors.

The assessment was performed in accordance with the OEHHA 2015 Risk Assessment Guidelines, CAPCOA Guidance Document: Health Risk Assessments for Proposed Land Use Projects (CAPCOA, 2009), and SCAQMD guidance (Table 9.1-3). Based on the guidance above, the maximum cancer risk associated with the Project's on- and off-site sources was assessed for the following exposure scenarios:

- **MEIR** – Maximally-exposed individual resident (MEIR) based on a 30-year lifetime exposure period. The MEIR assumes an exposure of 24 hours per day, and 350 days per year.
- **MEIW** – Maximally-exposed individual worker (MEIW) based on a 25-year lifetime exposure period. The MEIW assumes an exposure of 8 hours per day, and 245 days per year and a starting age of 16 years.
- **Recreational** – Considering the proximity to recreational facilities, a maximally-exposed individual located at a recreational site (outdoor fields, running/walking paths, training facility, park, etc.) based on a 40-year lifetime exposure. An exposure of 2 hours per day for 245 days and an elevated breathing rate of 1,097 liters per kilogram per day (L/kg/day) were assumed.

Table 8.2-1 summarizes the HARP2 options selected for the HRA.

Table 8.2-1 Summary of HARP2 Options

Option	Cancer – Resident	Cancer – Worker	Cancer – Recreation
Exposure Duration	30 years	25 years	40 years
Exposure Frequency (hours/day, days/year)	24, 350	8, 245	2, 245
Start Age	3rd Trimester	16 years	0 years
Method	RMP using Derived Method	OEHHA Derived Method	RMP using Derived Method

In addition to cancer risk, non-cancer chronic (long-term) and acute (short-term) exposure to TACs were assessed. Since only diesel PM was assessed for the construction modeling, only cancer and chronic risk were evaluated for construction emissions.

8.3 CRITERIA AIR POLLUTANTS LOCALIZED DISPERSION MODELING METHODOLOGY

As shown in Section 10.1 below, construction and operational-related activities would result in emissions of criteria air pollutants, but at levels that would not exceed the SCAQMD localized thresholds of significance. However, considering that the region is in nonattainment for ozone and $PM_{2.5}$ and since the Project Site is larger than 5 acres (mass-rate LSTs developed by SCAQMD are for project sites up to 5 acres, as detailed in Section 7 and presented in Table 9.1-2), criteria pollutant modelling specific to the Project was performed to determine localized impacts for NO_2 (an ozone precursor) and $PM_{2.5}$.

NO_2 and $PM_{2.5}$ emissions were provided as inputs to AERMOD for all project-related operational sources. Similar to the TAC analysis, there were two phases of operations: Phase 1 (2025-2027) and Phase 2 (2028). The model output was then compared against the applicable thresholds listed in Table 9.1-2 below.

9 THRESHOLDS OF SIGNIFICANCE

9.1 AIR QUALITY

Table 9.1-9.1-1 SCAQMD Regional Thresholds of Significance

Pollutant	Daily Emissions lbs/day (Construction)	Daily Emissions lbs/day (Operation)
NO_X	100	55
PM_{10}	150	150
$PM_{2.5}$	55	55
CO	550	550
VOC	75	55
SO_X	150	150
Lead[1]	3	3

Notes: NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; VOC = volatile organic compounds; SO_X = sulfur oxides; lbs/day = pounds per day.

[1] This analysis does not directly evaluate lead because little to no quantifiable and foreseeable emissions of these substances would be generated by the Project. Lead emissions have significantly decreased due to the near elimination of leaded fuel use.

Source: SCAQMD 2019

Table 9.1-9.1-2: SCAQMD Localized Thresholds

Threshold [1]	NO_X	CO	PM_{10}	$PM_{2.5}$
Mass-Rate Look Up Tables for LSTs for a 5-Acre Project Site Construction (lbs/day)	197	1,804	74	30
Mass-Rate Look Up Tables for LSTs for a 5-Acre Project Site Operations (lbs/day)	197	1,804	18	8
Operational Ambient Air Quality Standards for Criteria Pollutants	0.18 ppm(338.4 $\mu g/m^3$) 0.03 ppm (56.4 $\mu g/m^3$)	20 ppm	2.5 $\mu g/m^3$	2.5 $\mu g/m^3$

Notes: LST = localized significance threshold; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.

[1] The mass-rate LSTs developed by SCAQMD are for a 5-acre project site. As detailed in Section 8.3 above, due to the region's nonattainment status for ozone and PM2.5 and the Project Site size, criteria pollutant modeling was performed for NO_2 (an ozone precursor) and $PM_{2.5}$.

Source: SCAQMD 2008a, 2019

Table 9.1-9.1-3 SCAQMD Health Risk Assessment Thresholds

TACs	Threshold
Maximum Incremental Cancer Risk	10 in 1 million
Chronic & Acute Hazard Index	1.0

Notes: TAC = toxic air contaminant
Source: SCAQMD 2019

9.2 GREENHOUSE GAS EMISSIONS

The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; however, no single project alone is expected to measurably contribute to a noticeable incremental change in the global average temperature, or to a global, local, or micro climate. Therefore, the geographic scope of consideration for GHG emissions is on a global scale as such emissions contribute, on a cumulative basis, to global climate change. Given the nature of environmental consequences from GHGs and global climate change, CEQA requires that lead agencies evaluate the cumulative impacts of GHGs, even relatively small additions, on a global basis. By their nature, GHG evaluations under CEQA are a cumulative study. (See *Center for Biological Diversity v. California Department of Fish and Wildlife* [2015] 62 Cal.4th 204.)

The CEQA Guidelines encourage but do not require lead agencies to adopt thresholds of significance (CEQA Guidelines, §15064.7). When developing these thresholds, and consistent with the December 2018 CEQA and Climate Change Advisory published by the California Office of Planning and Research (OPR, 2018), the Guidelines allow lead agencies to develop their own significance threshold and/or to consider thresholds of significance adopted or recommended by other public agencies, or recommended by experts, provided that the thresholds are supported by substantial evidence. Individual lead agencies may also undertake a case-by-case approach for the use of significance thresholds for projects consistent with available guidance and current CEQA practice (OPR, 2018).

As the City of Irvine has not established screening thresholds for GHG emissions, the analysis reviewed the applicable significance thresholds developed by the SCAQMD. The SCAQMD has adopted a significance threshold of 10,000 MT of CO_2e per year for industrial (stationary source) projects (SCAQMD, 2008b).

The SCAQMD recommends that construction emissions associated with a project be amortized over the life of the Project (typically assumed to be 30 years). Therefore, this analysis includes a quantification of the total modeled construction-related GHG emissions. Those emissions are then amortized and evaluated over the life of the project (assumed to be 30 years). The Project's type is closest to an industrial project (i.e., doesn't include residential or commercial land uses). The 10,000 MT CO_2e threshold was developed in 2008 and was intended to ensure at least 90 percent of new GHG emissions would be reviewed and assessed for mitigation, thereby contributing to GHG emissions reduction goals of AB 32. However, the Project would begin construction in 2023; thus, construction-related GHG emissions should also be analyzed in the SB 32 statewide framework (which established a 2030 GHG emissions reduction target of 40 percent below 1990 levels). However, the SCAQMD has not adopted a threshold of significance consistent with SB 32 goals. To provide this additional information to put the Project-generated GHG emissions in the appropriate statewide context, this analysis presumes that a 40 percent reduction in the SCAQMD's existing threshold (resulting in 6,000 MT CO_2e) is necessary to achieve the State's 2030 GHG reduction goal (which is a 40 percent reduction below 1990 GHG emissions levels).

It is not the intent of this CEQA document to cause the adoption of these thresholds as mass emissions limits for this or other projects, but rather to provide this additional information to put the Project-generated GHG emissions in the appropriate statewide context.

10 AIR QUALITY IMPACTS

10.1 CRITERIA AIR POLLUTANTS

10.1.1 Construction Emissions

Tables 10.1-1 and 10.1-2 present the maximum daily emissions associated with Project construction of Phase 1 for comparison to the SCAQMD regional and localized thresholds of significance, respectively.

Table 10.1-10.1-1 Phase 1 Construction-Related Maximum Daily Emissions

Description	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Phase 1 Maximum Daily Emissions (lbs/day)[1]	38.06	77.07	75.20	0.25	41.47	22.82
SCAQMD Threshold (lbs/day)	75	550	100	100	150	55
Exceeds Threshold?	No	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.
[1] Phase 1 emissions are based on the overlap of subphases per the anticipated construction schedule. Maximum daily emissions for NOx and SOx occur during the overlap of site utilities/electric, earthwork, foundations, bridge, and roadways/paving construction activities. Maximum daily emissions of VOC and CO occur during the overlap of site utilities/electric, foundations, bridge, roadways/paving, and building construction activities. Maximum daily emissions for PM_{10} and $PM_{2.5}$ occur during the overlap of clear and grub, site utilities/electric, demolition, and earthwork construction activities.

Table 10.1-10.1-2 Phase 1 Localized Construction-Related Maximum Daily Emissions

Description	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily On-Site Emissions (lbs/day)[1]	63.96	69.49	38.63	21.98
SCAQMD Localized Threshold (lbs/day)	197	1,804	74	30
Exceeds Threshold?	No	No	No	No

Notes: NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.
[1] Maximum daily localized emissions account for on-site activities including off-road equipment use, fugitive dust, and on-site on-road vehicle travel. It was assumed that approximately 7% of the total on-road vehicles would occur on site (estimated portion of vehicle emissions occurring on site compared to the CalEEMod average trip length).

As shown in Tables 10.1-1 and 10.1-2, Phase 1 construction activities would not exceed the SCAQMD regional and localized thresholds of significance. Tables 10.1-3 and 10.1-4 summarize the maximum daily emissions associated with Phase 2 construction for comparison to the SCAQMD regional and localized thresholds of significance, respectively.

Table 10.1-10.1-3 Phase 2 Construction-Related Maximum Daily Emissions

Description	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Phase 2 Maximum Daily Emissions (lbs/day)[1]	80.36	57.92	45.32	0.12	14.22	8.02
SCAQMD Threshold (lbs/day)	75	550	100	100	150	55
Exceeds Threshold?	**Yes**	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

[1] Phase 2 emissions are based on the overlap of subphases per the anticipated construction schedule. Maximum daily emissions for all pollutants except PM_{10} and $PM_{2.5}$ occur during the overlap of site utilities/electric, building, trackwork-direct fixation, and major equipment construction activities. Maximum daily emissions for PM_{10} and $PM_{2.5}$ occur during the overlap of site utilities/electric and earthwork construction activities.

Table 10.1-10.1-4 Phase 2 Localized Construction-Related Maximum Daily Emissions

Description	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily On-Site Emissions (lbs/day)[1]	44.91	51.99	13.32	7.76
SCAQMD Localized Threshold (lbs/day)	197	1,804	74	30
Exceeds Threshold?	No	No	No	No

Notes: NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

[1] Maximum daily localized emissions account for on-site activities including off-road equipment use, fugitive dust, and on-site on-road vehicle travel. It was assumed that approximately 7% of the total on-road vehicles would occur on-site (estimated portion of vehicle emissions occurring on-site compared to the CalEEMod average trip length).

As shown in Tables 10.1-3 and 10.1-4, Phase 2 construction activities would not exceed any of the localized thresholds of significance or regional thresholds of significance for any pollutant except VOC. Therefore, this impact would be potentially significant, and mitigation would be required. Project construction of Phase 2 would overlap with Phase 1 operational activities. Therefore, the maximum daily emissions associated with overlapping activities of Phase 1 operations and Phase 2 construction are summarized in Tables 10.1-7 and 10.1-8 below.

10.1.2 Operational Emissions

Tables 10.1-5 and 10.1-6 present the maximum daily emissions associated with Project operations for comparison to the SCAQMD regional and localized thresholds of significance, respectively. As detailed in Section 7.2 of this Technical Memorandum, on-site idling of trains for storage and maintenance purposes would not result in a regional increase in emissions, as these activities (and related emissions) currently occur at the existing storage and maintenance facilities, and would simply shift these emissions sources to the proposed Project Site. However, these emissions are considered for the purposes of localized emissions impacts in Table 10.1-6.

Table 10.1-10.1-5 Operational Maximum Daily Increase in Regional Emissions

Description	VOC (lbs/day)	CO (lbs/day)	NO_X (lbs/day)	SO_X (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
Yard Equipment	0.83	3.48	2.53	0.01	0.11	0.15
Staff and Truck Vehicles	0.06	2.00	1.58	0.02	2.26	0.01
Architectural Coatings	0.13	-	-	-	-	-
Natural Gas Consumption	0.04	0.32	0.39	0.002	0.03	0.03
Train Fueling	0.41	-	-	-	-	-
Sand Silos	-	-	-	-	0.04	0.06
Total Maximum Daily Increase in Regional Emissions	**1.48**	**5.80**	**4.50**	**0.03**	**2.44**	**0.25**
SCAQMD Threshold	55	550	55	100	150	55
Exceeds Threshold?	No	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

Table 10.1-10.1-6 Localized Operational Maximum Daily Emissions

Description	NO_X (lbs/day)	CO (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
On-Site Locomotive Operations (Maintenance and Testing)	98.30	101.85	1.98	1.92
Yard Equipment	2.53	3.48	0.11	0.15
Staff and Truck Vehicles[1]	0.11	0.14	0.16	<0.01
Natural Gas Consumption	0.39	0.32	0.03	0.03
Sand Silos	-	-	0.04	0.06
Total Maximum Daily Localized Emissions (lbs/day)	**101.34**	**105.80**	**2.32**	**2.16**
SCAQMD Localized Threshold	197	1,804	18	8
Exceeds Threshold?	No	No	No	No

Notes: NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

[1] Maximum daily localized emissions account for on-site activities including on-site locomotive operations, on-site off-road equipment use (e.g., forklifts, cranes), and on-road vehicle travel. It was assumed that approximately 7% of the total on-road vehicles would occur on site (estimated portion of vehicle emissions occurring on site compared to the CalEEMod average trip length).

As shown in Tables 10.1-5 and 10.1-6, Project operational emissions would not exceed the SCAQMD regional and localized thresholds of significance. As described previously, since construction of Phase 2 may overlap with operation of Phase 1, the overlapping emissions are summarized in Tables 10.1-7 and 10.1-8. Consistent with SCAQMD guidance, these overlapping emissions are compared to the SCAQMD thresholds of significance applicable to operations. As explained previously, on-site idling of trains for storage and maintenance purposes would not result in a regional increase in emissions, as these activities (and related emissions) currently occur at the existing storage and maintenance facilities, and would simply shift these emissions sources to the proposed Project Site. However, note that these emissions are considered for the purposes of localized emissions impacts in Table 10.1-8.

Table 10.1-10.1-7 Overlapping Construction and Operational Maximum Daily Increase in Regional Emissions

Description	VOC (lbs/day)	CO (lbs/day)	NO_X (lbs/day)	SO_X (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
Phase 2 Construction Emissions	80.36	57.92	45.32	0.12	14.22	8.02
Yard Equipment	0.83	3.48	2.53	0.01	0.11	0.15
Staff and Truck Vehicles	0.06	2.00	1.58	0.02	2.28	0.60
Architectural Coatings	0.13	-	-	-	-	-
Natural Gas Consumption	0.04	0.32	0.39	0.00	0.03	0.03
Train Fueling	0.41	-	-	-	-	-
Sand Silos	-	-	-	-	0.04	0.06
Total Maximum Daily Increase in Regional Emissions (lbs/day)	**81.83**	**63.72**	**49.82**	**0.15**	**16.66**	**8.27**
SCAQMD Threshold	55	550	55	100	150	55
Exceeds Threshold?	**Yes**	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

Table 10.1-10.1-8 Overlapping Construction and Operational Localized Operational Maximum Daily Emissions

Description	NO_X	CO	PM_{10}	$PM_{2.5}$
Phase 2 Localized Construction Emissions	44.91	51.99	13.32	7.76
On-Site Locomotive Operations (Maintenance and Testing)	98.30	101.85	1.98	1.92
Yard Equipment	2.53	3.48	0.11	0.15
Staff and Truck Vehicles[1]	0.11	0.14	0.17	0.04
Natural Gas Consumption	0.39	0.32	0.03	0.03
Sand Silos	-	-	0.04	0.06
Total Maximum Daily Localized Emissions (lbs/day)	**146.25**	**157.79**	**15.64**	**9.92**
SCAQMD Localized Threshold	197	1,804	18	8
Exceeds Threshold?	No	No	No	Yes[2]

Notes: NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day.

[1] Maximum daily localized emissions account for on-site activities including on-site locomotive operations, on-site off-road equipment use (e.g., forklifts, cranes), and on-road vehicle travel. It was assumed that approximately 7% of the total on-road vehicles would occur on site (estimated portion of vehicle emissions occurring on site compared to the CalEEMod average trip length).

[2] As described in Table 9.1-2, the mass-rate LSTs are based on a 5-acre project site and thus, exceedance of this threshold does not represent a significant impact. Project-specific dispersion modeling was performed for $PM_{2.5}$ for comparison to the SCAQMD's ambient air quality thresholds as described below and shown in Table 10.1-9.

As described above, due to the Project size, the exceedance of the mass-rate screening LST for $PM_{2.5}$, and the region's nonattainment status for ozone and $PM_{2.5}$, Project-specific dispersion modeling was performed for NO_2 and $PM_{2.5}$ for comparison to the SCAQMD's ambient air quality thresholds. The results of the criteria pollutant modeling analysis for 1-hour and annual NO_2 and 24-hour $PM_{2.5}$ are summarized in Table 10.1-9 for both phases of operations (2025-2027 and 2028[5]). As shown in Table 10.1-9, the maximum modeled concentration at the point of maximum exposure (PMI) for both pollutants and averaging periods modeled were less than their respective SCAQMD ambient air quality thresholds. Therefore, this impact would be less than significant.

[5] *Phase 2 of construction would be completed at the end of 2027 and result in additional operational emissions sources beyond Phase 1. Furthermore, all trains serviced at the facility are assumed to be Tier 4 by 2028. Based on these changes, the dispersion analysis was conducted for the initial operational period from July 2025 through end of 2027, followed by years of operation from 2028 and later.*

Table 10.1-10.1-9 NO_2 and $PM_{2.5}$ Localized Dispersion Modeling Results

Criteria Pollutant	Averaging Period	Rank	Maximum Modeled Concentration ($\mu g/m^3$)[1]		SCAQMD Threshold ($\mu g/m^3$)	Exceeds Threshold?
			2025-2027[2]	2028+[3]		
NO_2	1-hour	1st	103.1	102.3	338.4	No
	Annual	1st	5.7	3.8	56.4	No
$PM_{2.5}$	24-hour	8th	1.3	1.2	2.5	No

Notes:
NO_2 = nitrogen dioxide; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; $\mu g/m^3$ = micrograms per meter cubed; SCAQMD = South Coast Air Quality Management District.
[1] The point of maximum exposure (unoccupied land near OCTA boundary, to the north).
[2] Period when train fleet mix includes both Tier 2 and Tier 4 locomotive engines.
[3] Period when trains are all Tier 4.

As shown in Table 10.1-7, VOC emissions during construction of Phase 2 would exceed the SCAQMD threshold of significance. Overlapping activities associated with construction and operation of the Project would not exceed the SCAQMD regional thresholds of significance for any of the other pollutants. Therefore, VOC emissions associated with construction of the Project are potentially significant. As shown in Tables 10.1-8 and 10.1-9, localized emissions associated with the overlapping activities would not exceed the SCAQMD localized thresholds of significance and ambient air quality thresholds.

10.2 TOXIC AIR CONTAMINANTS AND HEALTH RISK ASSESSMENT RESULTS

10.2.1 Construction

The greatest potential for TAC emissions during construction would be related to diesel PM emissions associated with heavy-duty equipment operations. According to OEHHA methodology, health effects from carcinogenic TACs are usually described in terms of individual cancer risk, which is based on a 30-year exposure duration (or residency time) to TACs as the basis for public notification and risk reduction audits and plans.

CARB has adopted the In-Use Off-Road Diesel-Fueled Fleets Regulation and ATCMs applicable to off-road diesel equipment and portable diesel engines. The In-Use Off-Road Diesel-Fueled Fleets Regulation require diesel engines to comply with emission limits on a fleet-average basis. The purpose of ATCMs is to reduce emissions of TAC emissions, including diesel PM, from engines subject to the rule. CARB has also adopted an ATCM that limits diesel-fueled commercial motor vehicles idling. The rule restricts vehicles from idling for more than 5 minutes at any location with exceptions for idling that may be necessary in the operation of the vehicle. All off-road diesel equipment, on-road heavy-duty diesel trucks, and portable diesel equipment used for the Project would be subject to CARB's regulations and ATCMs.

A quantified HRA was performed to evaluate the Project's construction-related TAC emissions on existing nearby off-site sensitive receptors. Table 10.2-1 summarizes the results of the construction-related health risks. The maximum incremental cancer risk exposure during the 4.5-year period of construction is less than 0.5 in a million. The chronic hazard index is also well below the SCAQMD threshold of 1.0. Therefore, sensitive receptors would not be exposed to substantial TAC concentrations during construction of the Project and this impact would be less than significant.

Table 10.2-1: Summary of Construction-Related Health Risks

Construction Period	Project Construction Incremental Cancer Risk (in a million)	Chronic Hazard Index
2023	0.20	2.24E-04
2024	0.18	2.21E-04
2025	0.01	8.48E-05
2026	0.01	5.14E-05
2027	0.004	3.07E-05
Total Project Construction (4.5 years)	**0.40**	**0.001**
SCAQMD Threshold	10	1.0
Exceeds Threshold?	No	No

Note: SCAQMD = South Coast Air Quality Management District

As described above in Section 3.2, asbestos is also a listed TAC; however, the Project Site is not located in an area known to contain naturally occurring asbestos. Further, demolition activities associated with Project construction are minimal and limited to an abandoned road, stormwater drains, and underground bunker with a network of pipelines, valves, and associated vents that are currently not in use. Prior to Project Site demolition activities, building materials must be carefully assessed for the presence of asbestos-containing materials (ACM), and removal of this material, where necessary, must comply with state and federal regulations, including SCAQMD Rule 1403. SCAQMD Rule 1403 specifies work practices with the goal of minimizing asbestos emissions during building demolition activities, including the removal and associated disturbance of ACMs. The requirements for demolition and renovation activities include asbestos surveying; notification; ACM removal procedures and time schedules; ACM handling and cleanup procedures; and storage, disposal, and landfill disposal requirements for asbestos-containing waste materials. If ACM are found during construction, the Project would comply with the requirements of SCAQMD Rule 1403. Therefore, exposure to asbestos during construction would be less than significant.

10.2.2 Operation

As discussed previously, following construction of the Project, operations would generate long-term emissions, including TACs, from a variety of sources. Diesel PM would be the dominant TAC generated at the Project Site. Sources of diesel PM at the Project Site include: locomotive usage (used during fueling, servicing, inspection, brake testing, train washing, load testing, yard switching, idling, and train movement throughout the yard), on-site equipment (emergency generator, cranes, and forklifts used for maintenance activities), refueling, and on-road trucks (fuel and vendor delivery trucks). The majority of the diesel PM emissions would be generated along the tracks, maintenance building, fueling/sanding pit, and the service and inspection facility which are located at distances of approximately 1,100 feet from the nearest residential receptors. As discussed in Section 5.2.2, the CARB recommends a 1,000-foot buffer between sensitive receptors and major service and maintenance rail yards based on a study which found that the area of highest impact is within 1,000 feet of the yard (CARB, 2005); the next highest impact was found to be between a half to one mile of the maintenance rail yards. As described previously, the nearest sensitive receptors are the residences in the senior housing community located approximately 650 feet (200 meters) north of the Project Site. The closest recreational fields and walking/running paths to the Project Site are located approximately 700 feet from maintenance buildings. The nearest worker receptors are located at the nursery to the west of the Project Site and buildings along Technology Drive. As such, a quantified HRA was performed to evaluate the Project's operational TAC emissions on existing nearby off-site receptors, including the nearby residences, recreational facilities, and adjacent workers located at the buildings along Technology Drive and at the nearby nursery.

The results of the HRA for operations are summarized in Table 10.2-1. The operational period would begin in July 2025, upon the completion of Phase 1 construction. Phase 2 of construction would be completed at the end of 2027 and result in additional operational emissions sources. Furthermore, all trains serviced at the facility are assumed to be Tier 4 by 2028. Based on these changes, the HRA for operations includes an initial operational period from July 2025 through end of 2027, followed by years of operation from 2028 and later. The total of these two operational periods are compared against the SCAQMD threshold of 10 in a million.

Maximum modeled excess cancer exposure was estimated for residential, worker, and recreation receptors within the modeled domain. The closest residential receptor was at the intersection of Marine Way and Ridge Valley, which is part of a 55 and older housing community. The closest residential receptor that was not part of this community was located at Ridge Valley and Pinehurst. The location of the maximum worker receptor is to the west of the Project at a nursery. The closest recreation area is the OCGP, located to the north of the Project Site on the other side of Marine Way.

As shown in Tables 10.2-2 and Table 10.2-3, the maximum incremental cancer risk, and chronic and acute hazard index, respectively, for the maximally exposed individual resident and maximally exposed individual worker would not exceed the SCAQMD thresholds of significance. Therefore, receptors would not be exposed to substantial pollutant concentrations of TACs during operations and this impact would be less than significant.

Figure 10.2-1 illustrates the locations of the PMI, MEIR, MEIW and MEI Recreation (maximally exposed individual at recreation area) for the maximum incremental cancer risk associated with operations of the Project. Figure 10.2-2 through Figure 10.2-4 provide maps of the cancer risk zones using contour plots.

Table 10.2-2: Summary of Excess Cancer Risks

Receptor	Years of Age	Maximum Modeled Excess Cancer Risk (in a million)			SCAQMD Threshold	Exceeds Threshold?
		2025-2027[1]	2028+[2]	Total		
$MEIR_{<50}$	3rd Trimester – 30 (30 years)	5.85	3.40	9.25	10	No
$MEIR_{\geq 50}$	50 - 80 (30 years)	0.24	1.45	1.68	10	No
MEIW	16 – 41 (25 years)	0.94	4.37	5.31	10	No
MEI Recreation	0 – 39 (40 years)	1.29	2.05	3.33	10	No

Notes: $MEIR_{<50}$ = maximally exposed individual resident in non-55+ age restricted communities; $MEIR_{\geq 50}$ = maximally exposed individual resident in 55+ age restricted communities; MEIW = maximally exposed individual worker; MEI Recreation = maximally exposed individual at recreation area; SCAQMD = South Coast Air Quality Management District.
[1] Period when train fleet mix includes both Tier 2 and Tier 4 locomotive engines.
[2] Period when trains are all Tier 4.

Table 10.2-3: Summary of Chronic and Acute Risks

Risk	Years of Age	Maximum Modeled Risk			SCAQMD Threshold	Exceeds Threshold?
		2025-2027[1]	2028+[2]	Total		
Chronic	PMI	0.05	0.01	0.06	1.0	No
Acute		0.0006	0.0004	0.001	1.0	No

Notes: PMI = point of maximum exposure (unoccupied land near OCTA boundary, to the north); SCAQMD = South Coast Air Quality Management District.
[1] Period when train fleet mix includes both Tier 2 and Tier 4 locomotive engines.
[2] Period when trains are all Tier 4.

Figure 10.2-1: Location of PMI, MEIR, MEIW and MEI Recreation for Cancer Risk

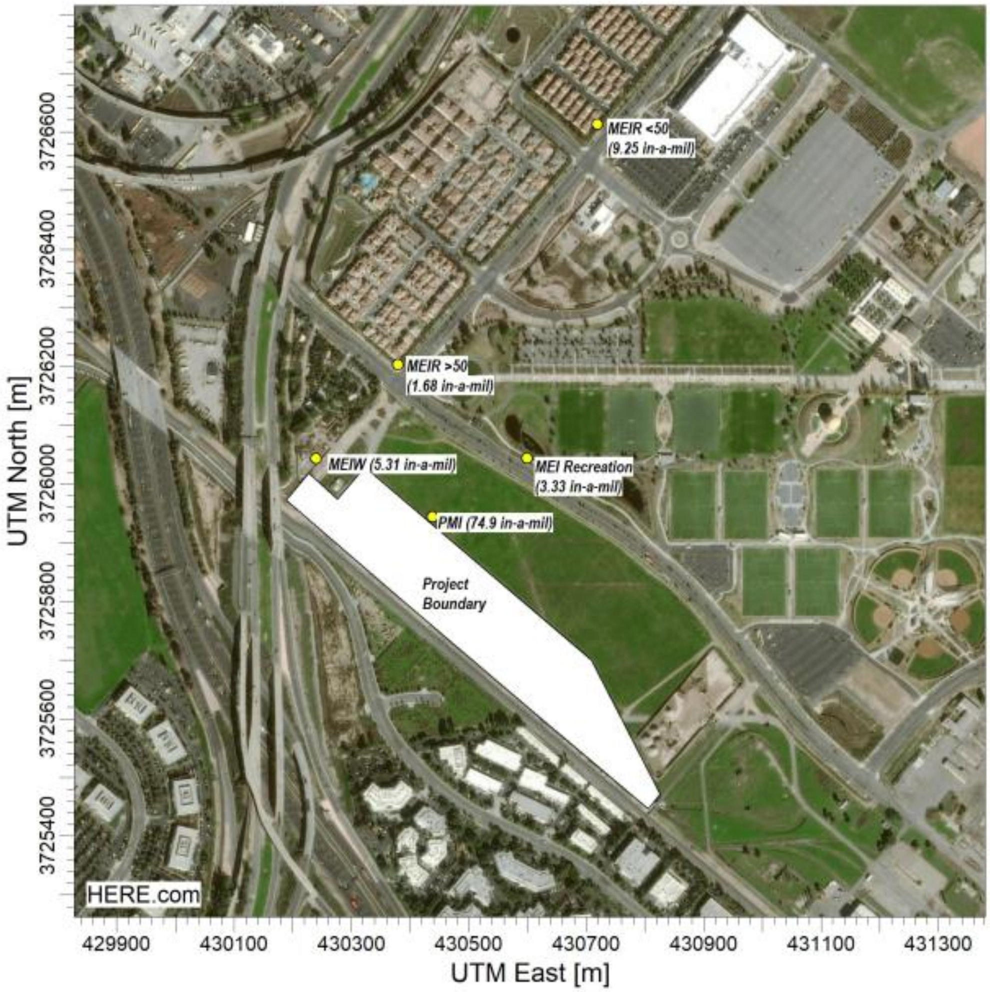
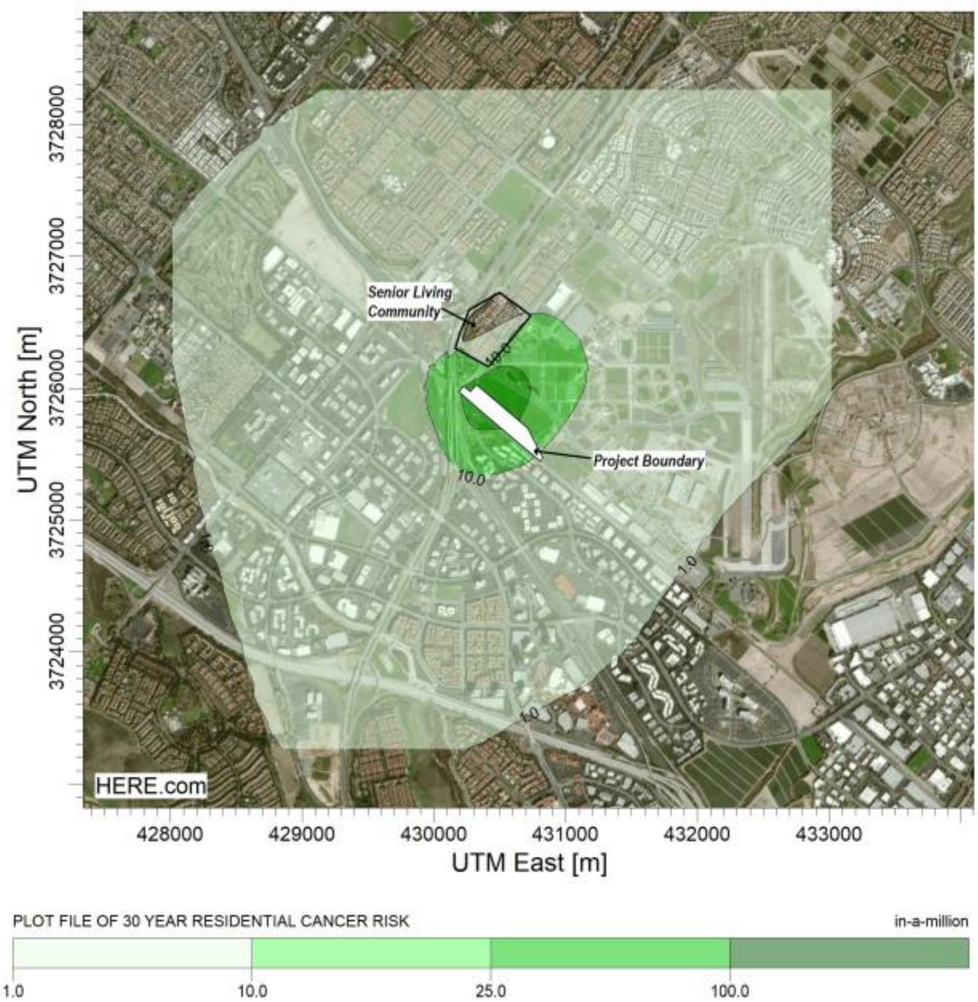


Figure 10.2-2: Contour Map of 30-Year Residential Cancer Risk



Notes: Receptors within Senior Living Community use starting age of 50-years old. All other receptors use starting age of 3rd trimester.

Figure 10.2-3: Contour Map of 25-Year Worker Cancer Risk

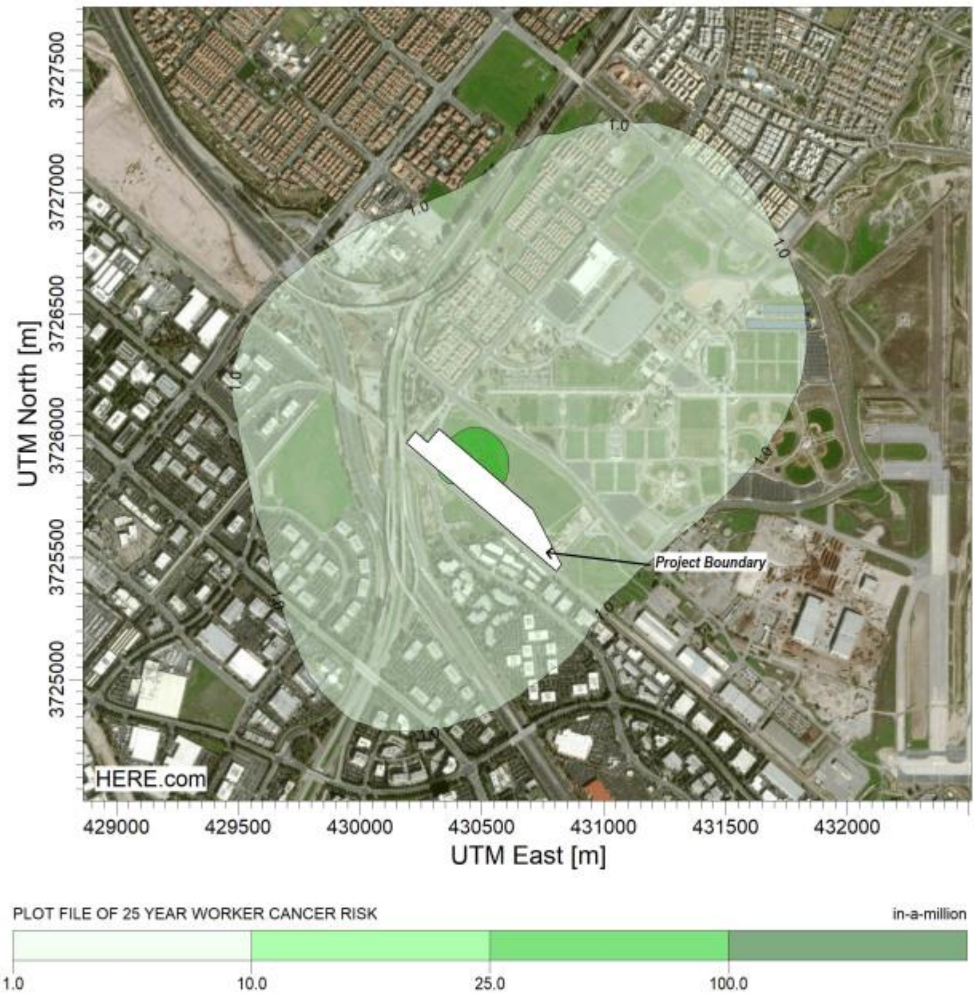
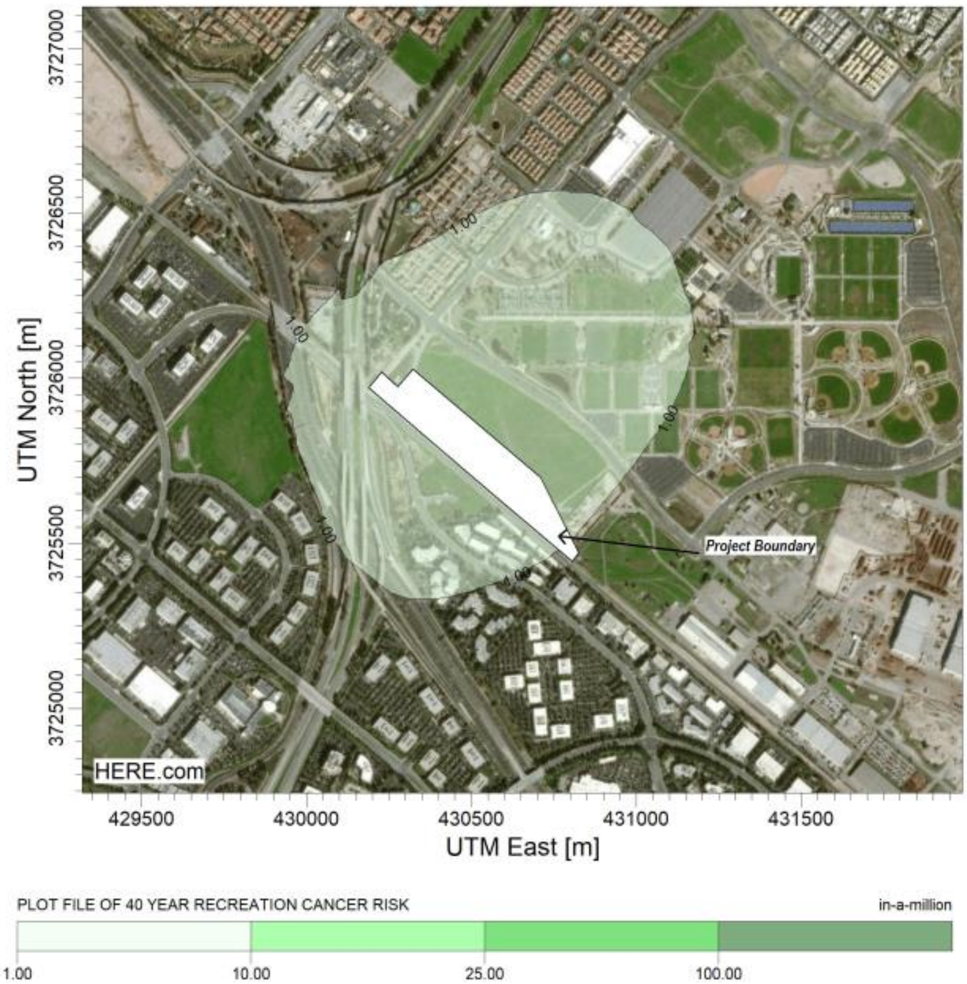


Figure 10.2-4: Contour Map of 40-Year Recreational Cancer Risk



10.3 CUMULATIVE EFFECTS

By its very nature, air pollution is largely a cumulative impact. The nonattainment status of regional pollutants is a result of past and present development within the SCAB, and this regional impact is cumulative rather than being attributable to any one source. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. The thresholds identified in Table 9.1-1 are designed to identify those projects that would result in significant levels of air pollution and to assist the region in attaining the applicable state and federal ambient air quality standards. Projects that would not exceed the thresholds of significance would not contribute a considerable amount of criteria air pollutant emissions to the region's emissions profile and would not impede attainment and maintenance of ambient air quality standards.

As shown in Table 10.1-1, the maximum daily emissions associated with construction of Phase 1 would not exceed the SCAQMD regional thresholds of significance. However, since construction of Phase 2 would result in a potentially significant impact due to the exceedance of the VOC threshold, Project construction may result in a cumulative impact. The SCAB is classified as a nonattainment area for ozone, and VOC is a precursor pollutant to ozone. As such, the Project may contribute to a considerable amount of criteria air pollutant emissions to the region's emissions profile.

As shown in Table 10.1-5, operational emissions are not anticipated to result in any exceedances of the SCAQMD thresholds of significance. However, as shown in Table 10.1-7, the overlapping activities of Phase 2 construction and operation may result in a potentially cumulative impact for VOC emissions. Therefore, mitigation would be required.

10.4 ODORS

The occurrence and severity of other emissions, such as those leading to odor impacts, depend on numerous factors, including the nature, frequency, and intensity of the source; wind speed and direction; and the presence of sensitive receptors. While offensive odors rarely cause any physical harm, they still can be very unpleasant, leading to considerable distress and often generating citizen complaints to local governments and regulatory agencies. Projects with the potential to frequently expose individuals to objectionable odors are deemed to have a significant impact. Typical facilities that generate odors include wastewater treatment facilities, sanitary landfills, composting facilities, petroleum refineries, chemical manufacturing plants, and food processing facilities.

Construction activities associated with the Project could result in short-term odor emissions from diesel exhaust associated with construction equipment. The Project would utilize typical construction techniques, and the odors would be typical of most construction sites and temporary in nature.

Project operations would not include any land uses identified by the CARB as being associated with the generation of objectionable odors. However, the locomotive rail operations on the tracks that access the maintenance facility and locomotive idling and refueling activities may increase the potential for generation of odors from locomotive diesel fuel combustion. However, these odors would be intermittent and of short duration. Any odors resulting from diesel fuel combustion along rail alignment would be intermittent and short-term and not considered a significant odor-generating source (CARB, 2005).

11 GREENHOUSE GAS EMISSIONS IMPACTS

GHG emissions generated during construction and operation of the Project are summarized in Table 11-1. As detailed in Section 7.2 of this Technical Memorandum, on-site idling of trains for storage and maintenance purposes would not result in a regional increase in emissions, as these activities (and related emissions) currently occur at the existing storage and maintenance facilities, and would simply shift these emissions sources to the proposed Project Site. Thus, these emissions are not included in Table 11-1.

Table 10.4-1: Annual GHG Emissions

Source	GHG Emissions (MT CO_2e/year)
Total Construction	2,185
Amortized Construction [1]	73
Yard Equipment	98
Staff and Truck Vehicles	0.13
Natural Gas Consumption	85
Electricity Consumption	329
Water and Wastewater Consumption	24
Solid Waste Generation	279
Operations Subtotal [2]	815
Total (Construction and Operations)	**888**
SCAQMD Threshold	10,000
SCAQMD Threshold (Adjusted for SB 32)	6,000
Exceeds Threshold?	**No**

Notes: MT CO_2e = metric tons carbon dioxide equivalent. GHG = greenhouse gas; SCAQMD = South Coast Air Quality Management District.
[1] Assumed amortization period is 30 years, based on the typically assumed project lifetime (SCAQMD 2008b), which recommends amortizing GHG emissions from construction activities over a project's operational lifetime.

As shown in Table 11-1, GHG emissions would not exceed SCAQMD's adopted significance threshold of 10,000 MT CO_2e per year nor the adjusted SB 32 threshold of 6,000 MT CO_2e per year. Therefore, this impact would be less than cumulatively considerable.

12 MITIGATION MEASURES

12.1 AIR QUALITY MITIGATION MEASURES

As described in Section 10.1.2, Phase 2 construction activities exceed the SCAQMD threshold of significance for VOC emissions. The exceedance of the VOC threshold is primarily related to architectural coating activities of the maintenance building. As such, implementation of Mitigation Measure AQ-1 would be required to reduce VOC emissions below the threshold of significance.

MM-AQ-1. Utilize low VOC paint for architectural coating activities during Phase 2 construction. To reduce VOC emissions during construction, the Project contractor shall utilize water-based or low VOC interior and exterior paints. The VOC content of the architectural coatings shall comply with the VOC content limits in SCAQMD Rule 1113 or not exceed 100 grams per liter, whichever is lower. To ensure that low VOC paint will be used during Project construction, this requirement will be included in applicable bid documents, purchase orders, and contracts. Successful contractor(s) must demonstrate the ability to supply the compliant architectural coatings for use prior to any coating activities. A copy of each proposed architectural coating Material Safety Data Sheet and VOC content shall be available upon request. Alternatively, the contractor may utilize tilt-up concrete buildings that do not require the use of architectural coatings.

Section 13 below summarizes the Project's impacts after implementation of Mitigation Measure AQ-1.

12.2 GREENHOUSE GAS MITIGATION MEASURES

Impacts related to GHG emissions are less than cumulatively considerable. As such, Mitigation Measures are not proposed.

13 IMPACTS AFTER MITIGATION MEASURES

13.1 AIR QUALITY IMPACTS AFTER MITIGATION

Table 13.1-1 demonstrates the maximum daily emissions associated with construction of Phase 2 with implementation of Mitigation Measure AQ-1.

Table 13.1-13.1-1: Phase 2 Mitigated Construction-Related Maximum Daily Emissions

Description	VOC	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Phase 2 Maximum Daily Emissions (lbs/day)[1]	35.78	57.92	45.32	0.12	14.22	8.02
SCAQMD Threshold (lbs/day)	75	550	100	100	150	55
Exceeds Threshold?	No	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day; SCAQMD = South Coast Air Quality Management District.

[1] Phase 2 emissions are based on the overlap of subphases per the anticipated construction schedule. Maximum daily emissions for all pollutants occur during the overlap of site utilities/electric, building, trackwork-direct fixation, and major equipment construction activities.

As shown in Table 13.1-1, with implementation of Mitigation Measure AQ-1, emissions of VOC would no longer exceed the SCAQMD threshold of significance. Since construction of Phase 2 of the Project would overlap with operational activities of Phase 1, overlapping emissions were also identified to be potentially significant.

Table 13.1-13.1-2: Overlapping Mitigated Construction and Operational Maximum Daily Increase in Regional Emissions

Description	VOC (lbs/day)	CO (lbs/day)	NO_X (lbs/day)	SO_X (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
Mitigated Phase 2 Construction Emissions	35.78	57.92	45.32	0.12	14.22	8.02
Yard Equipment	0.83	3.48	2.53	0.01	0.11	0.15
Staff and Truck Vehicles	0.06	2.00	1.58	0.02	2.26	0.01
Architectural Coatings	0.13	-	-	-	-	-
Natural Gas Consumption	0.04	0.32	0.39	0.00	0.03	0.03
Train Fueling	0.41	-	-	-	-	-
Sand Silos	-	-	-	-	0.04	0.06
Total Maximum Daily Increase in Regional Emissions (lbs/day)	**37.25**	**63.72**	**49.82**	**0.15**	**16.66**	**8.27**
SCAQMD Threshold	55	550	55	100	150	55
Exceeds Threshold?	**No**	No	No	No	No	No

Notes: VOC = volatile organic compounds; SO_X = sulfur oxides; NO_X = nitrogen oxides; PM_{10} = suspended particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in diameter; CO = carbon monoxide; lbs/day = pounds per day; SCAQMD = South Coast Air Quality Management District.

As shown in Table 13.1-2, with implementation of Mitigation Measure AQ-1, the maximum daily emissions associated with overlapping activities of Phase 1 operations and Phase 2 construction would also not exceed the SCAQMD threshold of significance. Therefore, this impact would be less than significant with mitigation.

In addition, with implementation of Mitigation Measure AQ-1, the Project is also not anticipated to result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment. Further, one of the Project objectives is to provide equipment to inspect, clean, and maintain existing cars and locomotives on a regular and efficient basis. The storage and maintenance activities that would occur operationally at this facility would be a shift in these operations from the existing storage and maintenance facilities to the proposed Project Site. As such, due to the optimal location of the proposed Project Site, the Project is also anticipated to result in reduced locomotive travel in the region and a reduction in the emissions associated with locomotive and rail car travel in the region.

13.2 GREENHOUSE GAS EMISSIONS IMPACTS AFTER MITIGATION

Impacts related to GHG emissions are less than cumulatively considerable. As such, mitigation measures are not proposed.

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Appendix B Attachments
Air Quality and Greenhouse Gases
Technical Memorandum

Metrolink Orange County
Maintenance Facility

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February 2022

Attachment A

Construction and Operational Emission Estimates

Orange County Maintenance Facility - Construction Emissions Summary

Phase 1 - Daily Maximum Off-Road Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	1.54	12.00	13.12	0.03	0.54	0.49
Clear and Grub, Site Util/Electric, Demo, Earthwork	6.53	69.20	53.72	0.13	2.17	1.99
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	7.30	61.31	63.08	0.15	2.52	2.32
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	7.84	68.90	63.63	0.16	2.55	2.34
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	6.55	59.15	52.32	0.14	2.05	1.89
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	5.97	52.56	46.05	0.11	1.87	1.72

Trackwork-Ballasted Phase includes emissions associated with the maximum emissions of either the welded rail train or rail delivery options

Phase 1 - Daily Maximum On-Road Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	0.02	0.72	0.05	0.00	0.23	0.06
Clear and Grub, Site Util/Electric, Demo, Earthwork	0.18	3.82	11.75	0.09	3.05	0.90
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	0.27	6.87	12.12	0.10	4.04	1.17
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	0.26	8.17	0.72	0.03	2.61	0.72
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	0.24	7.53	0.87	0.03	2.45	0.67
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.20	6.40	0.44	0.02	2.03	0.56

Phase 1 - Maximum Daily Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	1.56	12.71	13.17	0.03	6.79	3.88
Clear and Grub, Site Util/Electric, Demo, Earthwork	6.70	73.02	65.47	0.22	41.47	22.82
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	7.95	68.17	75.20	0.25	39.79	21.76
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	38.06	77.07	64.35	0.18	14.19	8.04
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	36.37	66.68	53.19	0.16	10.52	5.88
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	35.75	58.96	46.49	0.13	9.93	5.60
Maximum Daily Emissions	38.06	77.07	75.20	0.25	41.47	22.82
SCAQMD Threshold	75	550	100	150	150	55

Phase 1 - Maximum Daily On-Site Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	1.54	12.05	13.12	0.03	6.58	3.82
Clear and Grub, Site Util/Electric, Demo, Earthwork	6.54	69.48	54.58	0.13	38.63	21.98
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	7.70	61.80	63.96	0.16	36.05	20.68
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	37.82	69.49	63.68	0.16	11.77	2.39
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	36.15	59.69	52.38	0.16	8.25	5.26
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	35.56	53.03	46.09	0.13	8.04	7.79
Maximum Daily Emissions	37.82	69.49	63.96	0.16	38.63	21.98

Percent on-road emisions on/around project site: 7%

Daily Fugitive Dust Emissions (lbs/day)		
Phase	PM_{10}	$PM_{2.5}$
Clear and Grub	6.022	3.319
Site Utilities	6.022	3.319
Earthwork	24.196	13.290
Roadway Paving	3.011	1.659

Daily VOC Emissions (lbs/day) - Phase 1	
Phase	VOC
Buildings (Interior and Exterior)	29.51
Paved Areas (Painting)	0.07
Paved Areas (Asphalt Paving Off-Gassing)	0.382

GHG Emissions - Phase 1	
Project Component	MT CO2e
Off-Road Emissions	761
On-Road Emissions	943
Total GHG Emissions	1,704

Phase 2 - Daily Maximum Off-Road Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey	0.07	0.47	0.51	0.00	0.02	0.02
Site Util/Electric, Demo	3.55	46.70	25.71	0.07	1.04	0.95
Site Util/Electric, Earthwork	3.20	28.58	27.51	0.06	1.20	1.10
Earthwork, Foundations	1.82	16.84	17.25	0.04	0.78	0.71
Foundations, Roadway/Paving	2.11	18.22	18.26	0.05	0.73	0.67
Buildings, Trackwork-Ballasted, Major Equip	3.98	39.92	34.48	0.09	1.29	1.19
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	5.85	51.53	44.88	0.10	1.84	1.69
Major Equip, Commissioning	0.76	6.13	6.05	0.01	0.29	0.26

Phase 2 - Daily Maximum On-Road Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey	0.01	0.17	0.01	0.00	0.05	0.01
Site Util/Electric, Demo	0.04	1.43	0.10	0.00	0.46	0.13
Site Util/Electric, Earthwork	0.07	1.95	2.34	0.02	0.97	0.28
Earthwork, Foundations	0.09	2.41	2.77	0.02	1.16	0.33
Foundations, Roadway/Paving	0.07	2.18	0.55	0.01	0.73	0.20
Buildings, Trackwork-Ballasted, Major Equip	0.21	6.63	0.58	0.02	2.13	0.58
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.20	6.40	0.44	0.02	2.03	0.56
Major Equip, Commissioning	0.06	1.99	0.14	0.01	0.63	0.17

Phase 2 - Maximum Daily Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey	0.08	0.64	0.53	0.00	0.07	0.03
Site Util/Electric, Demo	3.59	48.13	25.81	0.07	7.52	4.40
Site Util/Electric, Earthwork	3.28	30.52	29.85	0.08	14.22	8.02
Earthwork, Foundations	1.91	19.25	20.01	0.06	7.96	4.36
Foundations, Roadway/Paving	2.18	20.40	18.81	0.06	4.47	2.53
Buildings, Trackwork-Ballasted, Major Equip	78.50	46.55	35.05	0.11	3.41	1.78
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	80.36	57.92	45.32	0.12	9.89	5.57
Major Equip, Commissioning	0.82	8.11	6.18	0.02	0.92	0.44
Maximum Daily Emissions	80.36	57.92	45.32	0.12	14.22	8.02
SCAQMD Threshold	75	550	100	150	150	55

Phase 2 - Maximum Daily On-Site Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey	0.07	0.48	0.51	0.00	0.02	0.02
Site Util/Electric, Demo	3.55	46.80	25.72	0.07	7.10	4.28
Site Util/Electric, Earthwork	3.21	28.72	27.68	0.06	13.32	7.76
Earthwork, Foundations	1.83	17.01	17.45	0.04	6.88	4.06
Foundations, Roadway/Paving	2.12	18.38	18.30	0.05	3.79	2.35
Buildings, Trackwork-Ballasted, Major Equip	78.31	40.40	34.52	0.09	1.44	1.23
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	80.18	51.99	44.91	0.10	8.01	5.05
Major Equip, Commissioning	0.76	6.27	6.06	0.01	0.33	0.27
Maximum Daily Emissions	80.18	51.99	44.91	0.10	13.32	7.76

Percent on-road emisions on/around project site: 7%

Daily Fugitive Dust Emissions (lbs/day)		
Phase	PM_{10}	$PM_{2.5}$
Site Utilities	6.0221	3.3185
Earthwork	6.0221	3.3185
Roadway Paving	3.0110	1.6593

Unmitigated Daily VOC Emissions (lbs/day) - Phase 2	
Phase	VOC
Buildings (Interior and Exterior)	74.31
Paved Areas (Painting)	-
Paved Areas (Asphalt Paving Off-Gassing)	-

GHG Emissions - Phase 2	
Project Component	MT CO2e
Off-Road Emissions	207
On-Road Emissions	274
Total GHG Emissions	481

Phase 2 - MItigated Maximum Daily Emissions (lbs/day)						
Phases	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Survey	0.08	0.64	0.53	0.00	0.07	0.03
Site Util/Electric, Demo	3.59	48.13	25.81	0.07	7.52	4.40
Site Util/Electric, Earthwork	3.28	30.52	29.85	0.08	14.22	8.02
Earthwork, Foundations	1.91	19.25	20.01	0.06	7.96	4.36
Foundations, Roadway/Paving	2.18	20.40	18.81	0.06	4.47	2.53
Buildings, Trackwork-Ballasted, Major Equip	33.91	46.55	35.05	0.11	3.41	1.78
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	35.78	57.92	45.32	0.12	9.89	5.57
Major Equip, Commissioning	0.82	8.11	6.18	0.02	0.92	0.44
Maximum Daily Emissions	35.78	57.92	45.32	0.12	14.22	8.02

Mitigated Daily VOC Emissions (lbs/day) - Phase 2	
Phase	VOC
Buildings (Interior and Exterior)	29.73

ORANGE COUNTY MAINTENANCE FACILITY - Phase 1 Construction Schedule
Phase 1

	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Survey	x	x																												
Clear and grub		x	x	x																										
Site Util/Electric			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Demo			x	x	x																									
Earthwork				x	x	x	x	x	x																					
Foundations								x	x	x	x																			
Roadways/Paving									x	x	x	x																		
Buildings										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Bridge						x	x	x	x	x	x																			
Trackwork-Ballasted															x	x	x	x	x	x	x	x	x	x						
Trackwork -DF																									x	x	x			
Major equip																							x	x	x	x	x	x		
Commisioning																													x	x

ORANGE COUNTY MAINTENANCE FACILITY - PHASE 2 Construction Schedule
Phase 2

	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27	Apr-27	May-27	Jun-27	Jul-27	Aug-27	Sep-27	Oct-27	Nov-27
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Survey	x																												
Site Util/Electric		x	x																	x	x								
Demo		x																											
Earthwork			x	x																									
Foundations				x	x																								
Roadways/Paving					x	x																							
Buildings							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
Trackwork-Ballasted															x	x	x	x											
Trackwork -DF																			x	x	x								
Major equip																		x	x	x	x	x	x						
Commisioning																						x	x						

Off-Road Construction Emissions - Phase 1

Construction Year[1]

2023									Emissions Factors (g/bhp-hr)							Emission Factor (g/gal)				Emissions (lbs/day)						metric tons/phase			
Project Phase/Equipment	Notes		Number	Hours per Day	Total Days[1]	Horsepower	Total Runtime Hours	Load Factor [2]	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	gal/hp-hr	Total Gallons	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Survey					42															0.19	1.25	1.37	0.01	0.05	0.05	10.41	0.00	0.00	10.42
Impact hammer	electric/hand-held	Other Construction Equipment	1	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power drill	electric/hand-held	Other Construction Equipment	1	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tool truck		Off-Highway Trucks	1	8	42	402	336	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.000345	47	0.19	1.25	1.37	0.01	0.05	0.05	10.41	0.00	0.00	10.42
Clear and Grub					63															1.35	10.74	11.75	0.02	0.49	0.45	7.10	0.00	0.00	7.23
Brush cutter /Brush hog	assumes skid steer attachment (ht	Skid Steer Loaders	1	8	6	65	50	0.37	0.06	1.20	0.75	0.00	0.03	0.02	194.50	0.57	0.26	0.00	4	0.02	0.51	0.32	0.00	0.01	0.01	0.23	0.00	0.00	0.24
Chain saw	assumes diesel	Concrete/Industrial Saws	1	8	3	81	25	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	697	0.38	3.33	2.90	0.01	0.10	0.09	0.62	0.00	0.00	0.68
D5 Dozer		Rubber Tired Dozers	1	8	13	247	101	0.40	0.18	1.04	1.95	0.00	0.09	0.08	209.04	0.57	0.26	0.03	626	0.31	1.81	3.40	0.00	0.15	0.14	2.08	0.00	0.00	2.14
Excavator-Track hoe		Excavators	1	4	3	158	13	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	2	0.04	0.63	0.30	0.00	0.01	0.01	0.15	0.00	0.00	0.15
Front end loader (rubber)		Rubber Tired Loaders	1	4	32	203	126	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	10	0.05	0.28	0.47	0.00	0.02	0.01	1.76	0.00	0.00	1.76
Prentice / Log Loader	http://s7d2.scene7.com/is/conter	Tractors/Loaders/Backhoes	1	2	3	160	6	0.37	0.07	1.14	0.56	0.00	0.03	0.03	193.81	0.57	0.26	0.00	1	0.02	0.30	0.15	0.00	0.01	0.01	0.07	0.00	0.00	0.07
Stump Grinder	http://www.banditchippers.com/t	Other Construction Equipment	1	4	3	74	13	0.42	0.30	1.74	2.93	0.00	0.21	0.19	215.79	0.57	0.26	0.07	64	0.08	0.47	0.80	0.00	0.06	0.05	0.08	0.00	0.00	0.09
Tractor trailer		Off-Highway Trucks	1	8	6	402	50	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	7	0.19	1.25	1.37	0.01	0.05	0.05	1.56	0.00	0.00	1.56
Tree shear	assumes attachment to skid steer	Skid Steer Loaders	1	8	1	65	5	0.37	0.06	1.20	0.75	0.00	0.03	0.02	194.50	0.57	0.26	0.00	0	0.02	0.51	0.32	0.00	0.01	0.01	0.02	0.00	0.00	0.02
Tri-axle Dump Trucks		Off-Highway Trucks	2	4	3	402	10	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	1	0.19	1.25	1.37	0.01	0.05	0.05	0.31	0.00	0.00	0.31
Wood chipper	https://www.stumpcutters.com/w	Other Construction Equipment	1	3	6	116	19	0.42	0.11	1.31	1.13	0.00	0.06	0.05	218.42	0.57	0.26	0.01	19	0.04	0.42	0.36	0.00	0.02	0.02	0.20	0.00	0.00	0.20
Site Utilities	.				504															2.27	19.53	18.19	0.05	0.73	0.68	366.28	0.01	0.01	368.26
Abrasive/demo saw	assumes diesel	Concrete/Industrial Saws	1	2	50	81	101	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	2787	0.10	0.83	0.73	0.00	0.03	0.02	2.47	0.00	0.00	2.73
Backhoe		Tractors/Loaders/Backhoes	1	8	403	97	3226	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	62	0.05	0.81	0.54	0.00	0.03	0.02	22.60	0.00	0.00	22.60
Bucket Truck		Off-Highway Trucks	1	8	126	402	1008	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	140	0.19	1.25	1.37	0.01	0.05	0.05	31.24	0.00	0.00	31.25
Compressor		Air Compressors	1	8	252	78	2016	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	1192	0.20	1.55	1.25	0.00	0.05	0.05	20.59	0.00	0.00	20.70
Concrete mixer		Cement and Mortar Mixers	1	4	50	9	202	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	184	0.01	0.08	0.10	0.00	0.00	0.00	0.32	0.00	0.00	0.34
Concrete pump		Pumps	1	5	202	84	1008	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	853	0.02	0.69	0.36	0.00	0.02	0.02	10.01	0.00	0.00	10.08
Concrete saw		Concrete/Industrial Saws	1	8	50	81	403	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	11147	0.38	3.33	2.90	0.01	0.10	0.09	9.88	0.01	0.00	10.90
Concrete truck		Off-Highway Trucks	1	5	202	402	1008	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	140	0.12	0.78	0.86	0.00	0.03	0.03	31.24	0.00	0.00	31.25
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	5	202	5.5	1008	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	297	0.01	0.05	0.07	0.00	0.00	0.00	0.81	0.00	0.00	0.84
Excavator-Track hoe		Excavators	1	8	252	158	2016	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	332	0.07	1.25	0.60	0.00	0.03	0.03	24.53	0.00	0.00	24.56
Front end loader (rubber)		Tractors/Loaders/Backhoes	1	8	252	97	2016	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	39	0.05	0.81	0.54	0.00	0.03	0.02	14.12	0.00	0.00	14.13
Generator		Generator Sets	1	8	302	84	2419	0.74	0.06	1.17	0.48	0.00	0.04	0.04	420.53	0.57	0.26	0.01	1317	0.06	1.29	0.53	0.00	0.04	0.04	63.24	0.00	0.00	63.36
Gradall		Graders	1	8	126	187	1008	0.41	0.12	0.53	1.32	0.00	0.04	0.04	215.93	0.57	0.26	0.00	179	0.16	0.71	1.78	0.00	0.06	0.05	16.63	0.00	0.00	16.65
Grinder	https://www.essexequipment.con	Other Construction Equipment	1	2	252	11	504	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	297	0.01	0.04	0.05	0.00	0.00	0.00	0.81	0.00	0.00	0.84
Horizontal Boring /Jacking machine		Bore/Drill Rigs	1	8	25	221	202	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	821	0.12	1.04	1.17	0.00	0.04	0.03	5.89	0.00	0.00	5.97
Roller-vibratory		Rollers	1	2	101	80	202	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	51	0.01	0.17	0.14	0.00	0.01	0.01	1.20	0.00	0.00	1.20
Tractor trailer		Off-Highway Trucks	1	2	403	402	806	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	112	0.05	0.31	0.34	0.00	0.01	0.01	24.99	0.00	0.00	25.00
Trenching machine (Ditch witch)		Trenchers	1	4	151	78	605	0.50	0.24	1.86	2.26	0.00	0.16	0.14	265.84	0.57	0.26	0.03	1204	0.08	0.64	0.78	0.00	0.05	0.05	6.30	0.00	0.00	6.41
Tri-axle Dump Trucks		Off-Highway Trucks	2	8	252	402	2016	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	280	0.38	2.50	2.74	0.01	0.10	0.09	62.48	0.00	0.00	62.50
Vacuum excavator truck		Off-Highway Trucks	1	4	50	402	202	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	28	0.10	0.63	0.69	0.00	0.02	0.02	6.25	0.00	0.00	6.25
Welder		Welders	1	8	252	46	2016	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	134	0.09	0.75	0.64	0.00	0.02	0.02	10.67	0.00	0.00	10.68
Demolition					63															1.40	28.21	8.70	0.02	0.35	0.31	26.21	0.01	0.00	27.28
Abrasive/demo saw		Concrete/Industrial Saws	1	4	13	81	50	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1393	0.19	1.66	1.45	0.00	0.05	0.05	1.23	0.00	0.00	1.36
Asphalt/Concrete crusher		Crushing/Proc. Equipment	1	6	21	85	125	0.78	0.53	21.52	1.66	0.01	0.05	0.03	655.82	0.57	0.26	0.94	9927	0.46	18.88	1.46	0.01	0.04	0.03	5.42	0.01	0.00	6.33
Backhoe		Tractors/Loaders/Backhoes	1	8	21	97	166	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	3	0.05	0.81	0.54	0.00	0.03	0.02	1.17	0.00	0.00	1.17
Compressor		Air Compressors	1	8	32	78	252	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	149	0.20	1.55	1.25	0.00	0.05	0.05	2.57	0.00	0.00	2.59
Excavator-Track hoe		Excavators	1	8	32	158	252	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	42	0.07	1.25	0.60	0.00	0.03	0.03	3.07	0.00	0.00	3.07
Front end loader (rubber)		Rubber Tired Loaders	1	4	50	203	202	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	16	0.05	0.28	0.47	0.00	0.02	0.01	2.82	0.00	0.00	2.82
Generator		Generator Sets	1	8	32	84	252	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	37	0.06	1.29	0.53	0.00	0.04	0.04	2.50	0.00	0.00	2.50
Grinder	https://www.essexequipment.con	Other Construction Equipment	1	2	13	11	25	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	15	0.01	0.04	0.05	0.00	0.00	0.00	0.04	0.00	0.00	0.04
Hoe Ram	attachment to tractor, backhoe	Tractors/Loaders/Backhoes	1	8	9	97	76	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	1	0.05	0.81	0.54	0.00	0.03	0.02	0.53	0.00	0.00	0.53
Jack hammers	https://www.edisons.com.au/bau	Other Construction Equipment	2	5	9	3.5	47	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	9	0.01	0.06	0.08	0.00	0.00	0.00	0.02	0.00	0.00	0.03
Tractor trailer		Off-Highway Trucks	1	2	47	402	95	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	13	0.05	0.31	0.34	0.00	0.01	0.01	2.93	0.00	0.00	2.93
Tri-axle Dump Trucks		Off-Highway Trucks	2	4	32	402	126	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	17	0.19	1.25	1.37	0.01	0.05	0.05	3.90	0.00	0.00	3.91
Earthwork					126															1.51	10.72	15.10	0.03	0.60	0.55	48.43	0.00	0.00	48.74
D5 Dozer		Rubber Tired Dozers	1	8	63	247	504	0.40	0.18	1.04	1.95	0.00	0.09	0.08	209.04	0.57	0.26	0.03	3131	0.31	1.81	3.40	0.00	0.15	0.14	10.41	0.00	0.00	10.70
Excavator-Track hoe		Excavators	1	8	13	158	101	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	17	0.07	1.25	0.60	0.00	0.03	0.03	1.23	0.00	0.00	1.23
Front end loader (rubber)		Rubber Tired Loaders	1	5	101	203	504	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	40	0.06	0.35	0.59	0.00	0.02	0.02	7.05	0.00	0.00	7.05
Gradall		Graders	1	8	42	187	333	0.41	0.12	0.53	1.32	0.00	0.04	0.04	215.93	0.57	0.26	0.00	59	0.16	0.71	1.78	0.00	0.06	0.05	5.49	0.00	0.00	5.49
Pan		Scrapers	1	8	6	367	50	0.48	0.11	0.85	1.19	0.00	0.05	0.04	255.22	0.57	0.26	0.00	7	0.36	2.65	3.73	0.01	0.14	0.13	2.28	0.00	0.00	2.28
Road Grader		Graders	1	8	6	187	50	0.41	0.12	0.53	1.32	0.00	0.04	0.04	215.93	0.57	0.26	0.00	9	0.16	0.71	1.78	0.00	0.06	0.05	0.83	0.00	0.00	0.83
Roller-sheepsfoot		Rollers	1	8	25	80	202	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	51	0.05	0.68	0.58	0.00	0.03	0.03	1.20	0.00	0.00	1.20
Roller-vibratory		Rollers	1	8	25	80	202	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	51	0.05	0.68	0.58	0.00	0.03	0.03	1.20	0.00	0.00	1.20
Tri-axle Dump Trucks		Off-Highway Trucks	2	6	101	402	605	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	84	0.29	1.88	2.06	0.01	0.07	0.07	18.74	0.00	0.00	18.75
Foundations					84															0.77	6.75	6.75	0.02	0.27	0.25	28.19	0.01	0.00	29.32
Backhoe		Tractors/Loaders/Backhoes	1	8	67	97	538	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	10	0.05	0.81	0.54	0.00	0.03	0.02	3.77	0.00	0.00	3.77
Concrete mixer		Cement and Mortar Mixers	1	8	8	9	67	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	61	0.03	0.16	0.21	0.00	0.01	0.01	0.11	0.00	0.00	0.11
Concrete pump		Pumps	1	4	42	84	168	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	142	0.02	0.55	0.29	0.00	0.02	0.02	1.67	0.00	0.00	1.68
Concrete truck		Off-Highway Trucks	1	4	42	402	168	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	23	0.10	0.63	0.69	0.00	0.02	0.02	5.21	0.00	0.00	5.21
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	4	42	5.5	168	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	49	0.01	0.04	0.05	0.00	0.00	0.00	0.14	0.00	0.00	0.14
Crane		Cranes	1	8	8	231	67	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	27	0.11	0.61	1.17	0.00	0.05	0.05	0.68	0.00	0.00	0.68
Excavator-Track hoe		Excavators	1	8	21	158	168	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	28	0.07	1.25	0.60	0.00	0.03	0.03	2.04	0.00	0.00	2.05
Front end loader (rubber)		Rubber Tired Loaders	1	8	67	203	538	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	43	0.10	0.56	0.95	0.00	0.03	0.03	7.52	0.00	0.00	7.53
Pile driver		Bore/Drill Rigs	1	6	8	221	50	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	205	0.09	0.78	0.88	0.00	0.03	0.03	1.47	0.00	0.00	1.49
Roller-vibratory-walk behind	https://www.doosanportablepow	Rollers	1	2	25	6	50	0.38	1.51	4.14	2.87	0.00	0.39	0.36	220.05	0.57	0.26	38.63	11681	0.01	0.04	0.03	0.00	0.00	0.00	0.02	0.01	0.00	1.10
Tractor Trailer		Off-Highway Trucks	1	2	42	402	84	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	12	0.05	0.31	0.34	0.00	0.01	0.01	2.60	0.00	0.00	2.60
Tri-axle Dump Trucks		Off-Highway Trucks	2	2	42	402	84	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	12	0.10	0.63	0.69	0.00	0.02	0.02	2.60	0.00	0.00	2.60
Welder		Welders	1	4	17	46	67	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	4	0.05	0.38	0.32	0.00	0.01	0.01	0.36	0.00	0.00	0.36
Roadway Paving					84															1.34	11.47	11.51	0.03	0.46	0.42	17.62	0.00	0.00	17.70
Asphalt Pavers		Pavers	2	6	13	130	81	0.42	0.08	1.25	0.83	0.00	0.04	0.04	219.72	0.57	0.26	0.01	98	0.12	1.78	1.18	0.00	0.06	0.05	0.96	0.00	0.00	0.97
Backhoe		Tractors/Loaders/Backhoes	1	8	42	97	336	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	6	0.05	0.81	0.54	0.00	0.03	0.02	2.35	0.00	0.00	2.35
Concrete trucks		Off-Highway Trucks	2	4	17	402	67	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	9	0.19	1.25	1.37	0.01	0.05	0.05	2.08	0.00	0.00	2.08
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	4	17	5.5	67	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	20	0.01	0.04	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.06
Core drill machine (testing)		Bore/Drill Rigs	1	4	2	221	7	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	27	0.06	0.52	0.59	0.00	0.02	0.02	0.20	0.00	0.00	0.20
Demo/Concrete saws		Concrete/Industrial Saws	2	4	4	81	17	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	464	0.38	3.33	2.90	0.01	0.10	0.09	0.41	0.00	0.00	0.45
Dozer		Rubber Tired Dozers	1	4	8	247	34	0.40	0.18	1.04	1.95	0.00	0.09	0.08	209.04	0.57	0.26	0.03	209	0.16	0.90	1.70	0.00	0.08	0.07	0.69	0.00	0.00	0.71
Front end loader (rubber)		Rubber Tired Loaders	1	8	25	203	202	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	16	0.10	0.56	0.95	0.00	0.03	0.03	2.82	0.00	0.00	2.82
Roller-smooth drum		Rollers	1	8	25	80	202	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	51	0.05	0.68	0.58	0.00	0.03	0.03	1.20	0.00	0.00	1.20
Rollers-vibratory		Rollers	1	4	25	80	101	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	25	0.03	0.34	0.29	0.00	0.02	0.01	0.60	0.00	0.00	0.60
Tri-axle Dump Trucks		Off-Highway Trucks	2	4	50	402	202	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	28	0.19	1.25	1.37	0.01	0.05	0.05	6.25	0.00	0.00	6.25
Building					399															2.06	18.31	15.65	0.03	0.62	0.57	88.45	0.01	0.01	90.39
Abrasive/demo saw		Concrete/Industrial Saws	1	2	20	81	40	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1103	0.10	0.83	0.73	0.00	0.03	0.02	0.98	0.00	0.00	1.08
Backhoe		Tractors/Loaders/Backhoes	1	8	200	97	1596	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	31	0.05	0.81	0.54	0.00	0.03	0.02	11.18	0.00	0.00	11.18
Circular saws		Concrete/Industrial Saws	2	4	120	81	479	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	13237	0.38	3.33	2.90	0.01	0.10	0.09	11.73	0.01	0.00	12.95
Compressor		Air Compressors	1	8	200	78	1596	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	944	0.20	1.55	1.25	0.00	0.05	0.05	16.30	0.00	0.00	16.39
Concrete finisher		Paving Equipment	1	4	80	132	319	0.36	0.08	1.10	0.75	0.00	0.04	0.04	187.02	0.57	0.26	0.02	676	0.03	0.46	0.31	0.00	0.02	0.01	2.80	0.00	0.00	2.86
Concrete pump		Pumps	1	4	20	84	80	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	68	0.02	0.55	0.29	0.00	0.02	0.02	0.79	0.00	0.00	0.80
Concrete saw		Concrete/Industrial Saws	1	8	8	81	64	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1765	0.38	3.33	2.90	0.01	0.10	0.09	1.56	0.00	0.00	1.73
Concrete truck		Off-Highway Trucks	1	4	20	402	80	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	11	0.10	0.63	0.69	0.00	0.02	0.02	2.47	0.00	0.00	2.47
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	4	20	5.5	80	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	23	0.01	0.04	0.05	0.00	0.00	0.00	0.06	0.00	0.00	0.07
Crane		Cranes	1	6	8	231	48	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	20	0.08	0.46	0.88	0.00	0.04	0.03	0.48	0.00	0.00	0.49
Front end loader (rubber)		Rubber Tired Loaders	1	4	200	203	798	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	63	0.05	0.28	0.47	0.00	0.02	0.01	11.16	0.00	0.00	11.17
Generator		Generator Sets	1	8	200	84	1596	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	235	0.06	1.29	0.53	0.00	0.04	0.04	15.84	0.00	0.00	15.86
Grinder	https://www.essexequipment.con	Other Construction Equipment	1	4	80	11	319	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	188	0.01	0.08	0.10	0.00	0.00	0.00	0.51	0.00	0.00	0.53
Jack hammers	https://www.edisons.com.au/bau	Other Construction Equipment	2	4	8	3.5	32	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	6	0.01	0.05	0.07	0.00	0.00	0.00	0.02	0.00	0.00	0.02
Lull		Forklifts	1	4	120	89	479	0.20	0.06	0.73	0.60	0.00	0.04	0.03	105.95	0.57	0.26	0.00	4	0.01	0.12	0.09	0.00	0.01	0.01	0.91	0.00	0.00	0.91
Mortar mixer		Cement and Mortar Mixers	1	4	120	9	479	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	438	0.01	0.08	0.10	0.00	0.00	0.00	0.77	0.00	0.00	0.81
Nail guns	electric/hand-held	Other Construction Equipment	2	4	80	0	319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paint sprayers	assumes powered by air compress	Air Compressors	2	8	8	78	64	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	38	0.39	3.10	2.51	0.00	0.10	0.09	0.65	0.00	0.00	0.66
Table saw		Concrete/Industrial Saws	1	2	40	81	80	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	2206	0.10	0.83	0.73	0.00	0.03	0.02	1.96	0.00	0.00	2.16
Tractor trailer		Off-Highway Trucks	1	2	120	402	239	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	33	0.05	0.31	0.34	0.00	0.01	0.01	7.42	0.00	0.00	7.42
Welder		Welders	1	2	80	46	160	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	11	0.02	0.19	0.16	0.00	0.01	0.01	0.84	0.00	0.00	0.85
Bridge(assume precast)					126															1.40	12.84	11.54	0.03	0.46	0.42	37.88	0.00	0.00	38.22
Abrasive/demo saw		Concrete/Industrial Saws	1	4	6	81	25	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	697	0.19	1.66	1.45	0.00	0.05	0.05	0.62	0.00	0.00	0.68
Backhoe		Tractors/Loaders/Backhoes	1	8	63	97	504	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	10	0.05	0.81	0.54	0.00	0.03	0.02	3.53	0.00	0.00	3.53
Circular saws		Concrete/Industrial Saws	2	2	25	81	50	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1393	0.19	1.66	1.45	0.00	0.05	0.05	1.23	0.00	0.00	1.36
Compressor		Air Compressors	1	6	63	78	378	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	224	0.15	1.16	0.94	0.00	0.04	0.03	3.86	0.00	0.00	3.88
Concrete drill	assumes powered by air compress	Air Compressors	1	4	6	78	25	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	15	0.10	0.78	0.63	0.00	0.02	0.02	0.26	0.00	0.00	0.26
Concrete finisher		Paving Equipment	1	4	13	132	50	0.36	0.08	1.10	0.75	0.00	0.04	0.04	187.02	0.57	0.26	0.02	107	0.03	0.46	0.31	0.00	0.02	0.01	0.44	0.00	0.00	0.45
Concrete mixer		Cement and Mortar Mixers	1	4	13	9	50	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	46	0.01	0.08	0.10	0.00	0.00	0.00	0.08	0.00	0.00	0.09
Concrete pump		Pumps	1	4	25	84	101	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	85	0.02	0.55	0.29	0.00	0.02	0.02	1.00	0.00	0.00	1.01
Concrete saw		Concrete/Industrial Saws	1	0	0	81	0	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete truck		Off-Highway Trucks	1	4	25	402	101	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	14	0.10	0.63	0.69	0.00	0.02	0.02	3.12	0.00	0.00	3.13
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	4	25	5.5	101	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	30	0.01	0.04	0.05	0.00	0.00	0.00	0.08	0.00	0.00	0.08
Crane		Cranes	1	8	25	231	202	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	82	0.11	0.61	1.17	0.00	0.05	0.05	2.04	0.00	0.00	2.05
Excavator		Excavators	1	8	25	158	202	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	33	0.07	1.25	0.60	0.00	0.03	0.03	2.45	0.00	0.00	2.46
Front end loader (rubber)		Rubber Tired Loaders	1	8	50	203	403	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	32	0.10	0.56	0.95	0.00	0.03	0.03	5.64	0.00	0.00	5.64
Generator		Generator Sets	1	4	101	84	403	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	59	0.03	0.64	0.27	0.00	0.02	0.02	4.00	0.00	0.00	4.01
Grinder	https://www.essexequipment.con	Other Construction Equipment	1	8	25	11	202	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	119	0.03	0.16	0.21	0.00	0.01	0.01	0.32	0.00	0.00	0.34
Jack hammers	https://www.edisons.com.au/bau	Other Construction Equipment	2	2	6	3.5	13	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	2	0.00	0.03	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Nail guns	electric/hand-held	Other Construction Equipment	2	4	25	0	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pile Driver		Bore/Drill Rigs	1	8	19	221	151	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	616	0.12	1.04	1.17	0.00	0.04	0.03	4.42	0.00	0.00	4.47
Tractor trailer		Off-Highway Trucks	1	2	63	402	126	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	17	0.05	0.31	0.34	0.00	0.01	0.01	3.90	0.00	0.00	3.91
Vibratory Plate tamper		Plate Compactors	1	2	38	8	76	0.43	0.24	1.49	1.78	0.00	0.07	0.06	244.37	0.57	0.26	0.09	53	0.00	0.02	0.03	0.00	0.00	0.00	0.06	0.00	0.00	0.07
Welder		Welders	1	4	38	46	151	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	10	0.05	0.38	0.32	0.00	0.01	0.01	0.80	0.00	0.00	0.80
Trackwork- Ballasted- (top of sub ballast up)					210															1.10	9.19	8.71	0.02	0.37	0.34	81.18	0.00	0.00	81.78
Air Compressor		Air Compressors	1	8	168	78	1344	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	795	0.20	1.55	1.25	0.00	0.05	0.05	13.73	0.00	0.00	13.80
Backhoe		Tractors/Loaders/Backhoes	1	8	168	97	1344	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	26	0.05	0.81	0.54	0.00	0.03	0.02	9.42	0.00	0.00	9.42
Ballast cars (dump)	assumes no separate engine	Other Material Handling Equipment	2	6	42	0	252	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ballast Compactor		Plate Compactors	1	4	42	8	168	0.43	0.24	1.49	1.78	0.00	0.07	0.06	244.37	0.57	0.26	0.09	117	0.01	0.05	0.05	0.00	0.00	0.00	0.14	0.00	0.00	0.15
Ballast Regulator	https://www.progressrail.com/en	Other General Industrial Equipment	1	4	42	250	168	0.34	0.07	0.40	0.67	0.00	0.02	0.02	180.73	0.57	0.26	0.00	187	0.05	0.30	0.51	0.00	0.02	0.01	2.59	0.00	0.00	2.61
Front end loader (rubber)		Rubber Tired Loaders	1	4	168	203	672	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	53	0.05	0.28	0.47	0.00	0.02	0.01	9.40	0.00	0.00	9.41
Generator		Generator Sets	1	4	52.5	84	210	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	31	0.03	0.64	0.27	0.00	0.02	0.02	2.08	0.00	0.00	2.09
Power wrench	assumes powered by air compress	Air Compressors	1	4	21	78	84	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	50	0.10	0.78	0.63	0.00	0.02	0.02	0.86	0.00	0.00	0.86
Prentice Loader (hi rail log loader)	http://s7d2.scene7.com/is/conter	Tractors/Loaders/Backhoes	1	4	63	160	252	0.37	0.07	1.14	0.56	0.00	0.03	0.03	193.81	0.57	0.26	0.00	45	0.04	0.59	0.29	0.00	0.01	0.01	2.89	0.00	0.00	2.90
Rail drill	assumes powered by air compress	Other Construction Equipment	1	2	42	78	84	0.42	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	50	0.04	0.34	0.27	0.00	0.01	0.01	0.74	0.00	0.00	0.75
Rail Profile Grinder	https://www.pandrol.com/us/pro	Other Construction Equipment	1	4	21	6.4	84	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	29	0.01	0.05	0.06	0.00	0.00	0.00	0.08	0.00	0.00	0.08
Rail saw		Concrete/Industrial Saws	1	1	157.5	81	158	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	4354	0.05	0.42	0.36	0.00	0.01	0.01	3.86	0.00	0.00	4.26
Rail Train **	modeled in deliveries tab	Other General Industrial Equipment	1	8	10.5	0	84	0.34											0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ral heater/vibrator	assumes to be powered by air con	Air Compressors	1	2	126	78	252	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	149	0.05	0.39	0.31	0.00	0.01	0.01	2.57	0.00	0.00	2.59
Speedswing (360 on track crane)		Cranes	1	8	168	231	1344	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	549	0.11	0.61	1.17	0.00	0.05	0.05	13.59	0.00	0.00	13.64
Spiking gun*	assumes to not be used per notes	Other Construction Equipment	0	0	126	171	0	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tamper/Liner	assumes max 100 hp	Other Construction Equipment	1	6	42	100	252	0.42	0.16	1.49	1.47	0.00	0.10	0.09	219.44	0.57	0.26	0.01	130	0.09	0.82	0.81	0.00	0.05	0.05	2.30	0.00	0.00	2.31
Tie Drill	electric/hand-held	Other Construction Equipment	1	6	126	0	756	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractor Trailer		Off-Highway Trucks	1	2	21	402	42	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	6	0.05	0.31	0.34	0.00	0.01	0.01	1.30	0.00	0.00	1.30
Tri Axle dump trucks		Off-Highway Trucks	2	4	126	402	504	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	70	0.19	1.25	1.37	0.01	0.05	0.05	15.62	0.00	0.00	15.63
Trackwork- Direct Fixation					63															1.09	9.92	8.17	0.02	0.34	0.32	15.63	0.00	0.00	15.91
Air Compressor		Air Compressors	1	8	32	78	252	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	149	0.20	1.55	1.25	0.00	0.05	0.05	2.57	0.00	0.00	2.59
Backhoe		Tractors/Loaders/Backhoes	1	8	13	97	101	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	2	0.05	0.81	0.54	0.00	0.03	0.02	0.71	0.00	0.00	0.71
Circular / Table saw		Concrete/Industrial Saws	1	2	6	81	13	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	348	0.10	0.83	0.73	0.00	0.03	0.02	0.31	0.00	0.00	0.34
Concrete drill	assumes powered by air compress	Air Compressors	1	4	32	78	126	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	75	0.10	0.78	0.63	0.00	0.02	0.02	1.29	0.00	0.00	1.29
Concrete grinder	https://hupshenghardware.com/p	Other Construction Equipment	1	2	32	6	63	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	20	0.00	0.02	0.03	0.00	0.00	0.00	0.06	0.00	0.00	0.06
Concrete mixer		Cement and Mortar Mixers	1	4	32	9	126	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	115	0.01	0.08	0.10	0.00	0.00	0.00	0.20	0.00	0.00	0.21
Concrete pump		Pumps	1	2	6	84	13	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	11	0.01	0.28	0.15	0.00	0.01	0.01	0.13	0.00	0.00	0.13
Concrete truck		Off-Highway Trucks	1	2	6	402	13	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	2	0.05	0.31	0.34	0.00	0.01	0.01	0.39	0.00	0.00	0.39
Concrete vibrator	https://www.indiamart.com/prod	Other Construction Equipment	1	2	6	5.5	13	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	4	0.00	0.02	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Front end loader (rubber)		Rubber Tired Loaders	1	4	32	203	126	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	10	0.05	0.28	0.47	0.00	0.02	0.01	1.76	0.00	0.00	1.76
Generator		Generator Sets	1	8	32	84	252	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	37	0.06	1.29	0.53	0.00	0.04	0.04	2.50	0.00	0.00	2.50
Nail guns (air)	assumes powered by air compress	Air Compressors	1	2	6	78	13	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	7	0.05	0.39	0.31	0.00	0.01	0.01	0.13	0.00	0.00	0.13
Power wrench	assumes powered by air compress	Air Compressors	1	2	3	78	6	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	4	0.05	0.39	0.31	0.00	0.01	0.01	0.06	0.00	0.00	0.06
Prentice Loader (hi rail log loader)	http://s7d2.scene7.com/is/conter	Tractors/Loaders/Backhoes	1	2	32	160	63	0.37	0.07	1.14	0.56	0.00	0.03	0.03	193.81	0.57	0.26	0.00	11	0.02	0.30	0.15	0.00	0.01	0.01	0.72	0.00	0.00	0.72
Pressure washer	http://www.ultimatewasher.com/	Other Construction Equipment	1	1	32	10	32	0.42	0.16	0.97	1.31	0.00	0.06	0.05	170.09	0.57	0.26	0.22	70	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.03
Rail drill	assumes powered by air compress	Other Construction Equipment	1	2	38	78	76	0.42	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.00	0	0.04	0.34	0.27	0.00	0.01	0.01	0.67	0.00	0.00	0.67
Rail Profile Grinder	https://www.pandrol.com/us/pro	Other Construction Equipment	1	2	38	6.4	76	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	26	0.00	0.02	0.03	0.00	0.00	0.00	0.07	0.00	0.00	0.07
Rail saw		Concrete/Industrial Saws	1	2	38	81	76	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	2090	0.10	0.83	0.73	0.00	0.03	0.02	1.85	0.00	0.00	2.04
Ral heater/vibrator	assumes to be powered by air con	Air Compressors	1	4	13	78	50	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	30	0.10	0.78	0.63	0.00	0.02	0.02	0.51	0.00	0.00	0.52
Speedswing (360 on track crane)		Cranes	1	4	32	231	126	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	52	0.05	0.30	0.59	0.00	0.02	0.02	1.27	0.00	0.00	1.28
Tractor Trailer		Off-Highway Trucks	1	2	6	402	13	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	2	0.05	0.31	0.34	0.00	0.01	0.01	0.39	0.00	0.00	0.39
Major Equipment					126															0.55	4.81	4.06	0.01	0.17	0.16	7.51	0.00	0.00	7.52
Concrete drill	assumes powered by air compress	Air Compressors	1	3	13	78	38	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	22	0.07	0.58	0.47	0.00	0.02	0.02	0.39	0.00	0.00	0.39
Concrete grinder	https://hupshenghardware.com/p	Other Construction Equipment	1	3	13	6	38	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	12	0.01	0.03	0.04	0.00	0.00	0.00	0.03	0.00	0.00	0.03
Crane		Cranes	1	4	13	231	50	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	21	0.05	0.30	0.59	0.00	0.02	0.02	0.51	0.00	0.00	0.51
Fork lift		Forklifts	1	4	63	89	252	0.20	0.06	0.73	0.60	0.00	0.04	0.03	105.95	0.57	0.26	0.00	2	0.01	0.12	0.09	0.00	0.01	0.01	0.48	0.00	0.00	0.48
Front end loader		Tractors/Loaders/Backhoes	1	4	63	97	252	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	5	0.03	0.41	0.27	0.00	0.01	0.01	1.77	0.00	0.00	1.77
Generator		Generator Sets	1	4	76	84	302	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	45	0.03	0.64	0.27	0.00	0.02	0.02	3.00	0.00	0.00	3.01
Impact guns	assumes powered by air compress	Air Compressors	2	4	6	78	25	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	15	0.20	1.55	1.25	0.00	0.05	0.05	0.26	0.00	0.00	0.26
Steel drill	assumes to be powered by air con	Air Compressors	1	4	6	78	25	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	15	0.10	0.78	0.63	0.00	0.02	0.02	0.26	0.00	0.00	0.26
Steel grinder	https://www.essexequipment.con	Other Construction Equipment	1	4	6	11	25	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	15	0.01	0.08	0.10	0.00	0.00	0.00	0.04	0.00	0.00	0.04
Tractor Trailer		Off-Highway Trucks	1	2	13	402	25	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	3	0.05	0.31	0.34	0.00	0.01	0.01	0.78	0.00	0.00	0.78
Commissioning					42															0.21	1.32	1.99	0.00	0.11	0.10	5.23	0.00	0.00	5.27
Car Wash	Assumes no diesel engine	Air Compressors	0	8	42	78	336	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drop Table	Assumes no diesel engine	Forklifts	0	8	42	89	336	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Overhead Crane		Cranes	1	8	42	231	336	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	137	0.11	0.61	1.17	0.00	0.05	0.05	3.40	0.00	0.00	3.41
Wheel Truing Machine		Other General Industrial Equipment	1	8	42	88	336	0.34	0.19	1.34	1.55	0.00	0.12	0.11	181.11	0.57	0.26	0.01	365	0.10	0.71	0.82	0.00	0.06	0.06	1.83	0.00	0.00	1.86

	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Maximum Daily Scenarios - Off-Road Equipment Emissions			lbs/day			
Survey, Clear and Grub	1.54	12.00	13.12	0.03	0.54	0.49
Clear and Grub, Site Util/Electric, Demo, Earthwork	6.53	69.20	53.72	0.13	2.17	1.99
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	7.30	61.31	63.08	0.15	2.52	2.32
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	7.84	68.90	63.63	0.16	2.55	2.34
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	5.98	51.83	46.60	0.11	1.90	1.75
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	5.97	52.56	46.05	0.11	1.87	1.72

On-Road Construction Emissions - Phase 1

Project Component/On-Road Vehicles	Days	Daily Trips	Trip Distance (One-way)	Total VMT
Survey				
Concrete Trucks	42	-	6.9	-
Haul Trucks	42	-	20.0	-
Workers	42	6	14.7	88
Clear and Grub				
Concrete Trucks	63	-	6.9	-
Haul Trucks	63	-	20.0	-
Workers	63	20	14.7	294
Site Utilities				
Concrete Trucks	504	-	6.9	-
Haul Trucks	504	-	20.0	-
Workers	504	32	14.7	470
Demolition				
Concrete Trucks	63	-	6.9	-
Haul Trucks	63	-	20.0	-
Workers	63	20	14.7	294
Earthwork				
Concrete Trucks	126	-	6.9	-
Haul Trucks	126	119	20.0	2,381
Haul Trucks - Ballast Delivery (Occurs over 80 days months 4 through 6 and 9)	80	27	20.0	540
Workers	126	32	14.7	470
Foundations				
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	84	4	6.9	27
Haul Trucks	84	-	20.0	-
Workers	84	48	14.7	706
Roadway Paving				
Concrete Trucks	84	-	6.9	-
Haul Trucks	84	-	20.0	-
Workers	84	30	14.7	441
Building				
Concrete Trucks	399		6.9	-
Haul Trucks	399		20.0	-
Workers	399	114	14.7	1,676
Bridge(assume precast)				
Concrete Trucks	126	-	6.9	-
Haul Trucks	126	-	20.0	-
Workers	126	72	14.7	1,058
Trackwork- Ballasted- (top of sub ballast up)				
Concrete Trucks	210	-	6.9	-
Haul Trucks	63	5	20.0	91
Workers	210	60	14.7	882
Trackwork- Direct Fixation				
Concrete Trucks	63	-	6.9	-
Haul Trucks	63	-	20.0	-
Workers	63	20	14.7	294
Major Equipment				
Concrete Trucks	126	-	6.9	-
Haul Trucks	126	-	20.0	-
Workers	126	66	14.7	970
Commissioning				
Concrete Trucks	42	-	6.9	-
Haul Trucks	42	-	20.0	-
Workers	42	6	14.7	88

Emissions Factors (g/mi for RunEx, BW, TW and g/trip for StartEx)

Project Component/On-Road Vehicles	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW	CO_2 RunEx	CO_2 StartEx	CH_4 RunEx	CH_4 StartEx	N_2O RunEx	N_2O StartEx
Survey																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Clear and Grub																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Site Utilities																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Demolition																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Earthwork																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Haul Trucks - Ballast Delivery (Occurs over 80 days months 4 through 6 and 9)	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Foundations																				
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Roadway Paving																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Building																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Bridge(assume precast)																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Trackwork- Ballasted- (top of sub ballast up)																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Trackwork- Direct Fixation																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Major Equipment																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Commissioning																				
Concrete Trucks	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261

Emissions (lbs/day); Emissions (MT/phase); MT

Project Component/On-Road Vehicles	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW	CO_2 RunEx	CO_2 StartEx	CH_4 RunEx	CH_4 StartEx	N_2O RunEx	N_2O StartEx	CO_2 (MT/phase)	CH_4 (MT/phase)	N_2O (MT/phase)	CO_2e (MT)
Survey	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003	1.0711	0.0000	0.0000	1.0792
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003	1.07	0.00	0.00	1.079223
Clear and Grub	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.3554	0.0001	0.0001	5.3961
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.36	0.00	0.00	5.396116
Site Utilities	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0018	68.5496	0.0015	0.0016	69.0703
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0018	68.55	0.00	0.00	69.07029
Demolition	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.3554	0.0001	0.0001	5.3961
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.36	0.00	0.00	5.396116
Earthwork	0.0989	0.0166	1.6805	0.1576	10.4418	1.1710	0.0835	0.0000	0.0742	0.0001	2.3495	0.0710	0.0001	0.6576	8823.7771	4.2106	0.0069	0.0037	1.3458	0.0018	471.6464	0.0006	0.0718	493.0719
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0715	0.0000	0.7789	0.0000	8.4739	0.9429	0.0657	0.0000	0.0592	0.0000	1.6881	0.0566	0.0000	0.4745	6951.5279	0.0000	0.0033	0.0000	1.0927	0.0000	397.30	0.00	0.06	415.9129
Haul Trucks - Ballast Delivery (Occurs over 80 days months 4 through 6 and 9)	0.0162	0.0000	0.1766	0.0000	1.9219	0.2139	0.0149	0.0000	0.0134	0.0000	0.3829	0.0128	0.0000	0.1076	1576.6065	0.0000	0.0008	0.0000	0.2478	0.0000	57.21	0.00	0.01	59.89145
Workers	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0018	17.14	0.00	0.00	17.26757
Foundations	0.0178	0.0248	1.0973	0.2364	0.1916	0.0593	0.0051	0.0001	0.0033	0.0002	0.4368	0.0030	0.0002	0.1184	522.5593	6.3160	0.0043	0.0055	0.0203	0.0028	20.1511	0.0004	0.0009	20.4225
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	0.0011	0.0000	0.0099	0.0000	0.1225	0.0379	0.0007	0.0000	0.0008	0.0000	0.0190	0.0008	0.0000	0.0053	79.0954	0.0000	0.0001	0.0000	0.0124	0.0000	3.01	0.00	0.00	3.154887
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0167	0.0248	1.0874	0.2364	0.0691	0.0214	0.0044	0.0001	0.0024	0.0002	0.4178	0.0022	0.0002	0.1131	443.4639	6.3160	0.0043	0.0055	0.0079	0.0028	17.14	0.00	0.00	17.26757
Roadway Paving	0.0104	0.0155	0.6797	0.1478	0.0432	0.0134	0.0027	0.0000	0.0015	0.0001	0.2611	0.0014	0.0001	0.0707	277.1650	3.9475	0.0027	0.0034	0.0049	0.0017	10.7109	0.0002	0.0003	10.7922
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0104	0.0155	0.6797	0.1478	0.0432	0.0134	0.0027	0.0000	0.0015	0.0001	0.2611	0.0014	0.0001	0.0707	277.1650	3.9475	0.0027	0.0034	0.0049	0.0017	10.71	0.00	0.00	10.79223
Building	0.0397	0.0590	2.5827	0.5615	0.1642	0.0509	0.0104	0.0001	0.0057	0.0004	0.9923	0.0053	0.0004	0.2686	1053.2268	15.0004	0.0102	0.0131	0.0187	0.0066	193.3313	0.0042	0.0046	194.7998
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0397	0.0590	2.5827	0.5615	0.1642	0.0509	0.0104	0.0001	0.0057	0.0004	0.9923	0.0053	0.0004	0.2686	1053.2268	15.0004	0.0102	0.0131	0.0187	0.0066	193.33	0.00	0.00	194.7998
Bridge(assume precast)	0.0251	0.0372	1.6312	0.3547	0.1037	0.0322	0.0066	0.0001	0.0036	0.0003	0.6267	0.0033	0.0003	0.1696	665.1959	9.4739	0.0064	0.0083	0.0118	0.0041	38.5592	0.0008	0.0009	38.8520
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0251	0.0372	1.6312	0.3547	0.1037	0.0322	0.0066	0.0001	0.0036	0.0003	0.6267	0.0033	0.0003	0.1696	665.1959	9.4739	0.0064	0.0083	0.0118	0.0041	38.56	0.00	0.00	38.85204
Trackwork- Ballasted- (top of sub ballast up)	0.0236	0.0310	1.3892	0.2955	0.4118	0.0630	0.0080	0.0001	0.0053	0.0002	0.5871	0.0050	0.0002	0.1596	821.2686	7.8949	0.0055	0.0069	0.0518	0.0035	61.1825	0.0012	0.0025	61.9467
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0027	0.0000	0.0299	0.0000	0.3254	0.0362	0.0025	0.0000	0.0023	0.0000	0.0648	0.0022	0.0000	0.0182	266.9387	0.0000	0.0001	0.0000	0.0420	0.0000	7.63	0.00	0.00	7.985527
Workers	0.0209	0.0310	1.3593	0.2955	0.0864	0.0268	0.0055	0.0001	0.0030	0.0002	0.5223	0.0028	0.0002	0.1414	554.3299	7.8949	0.0054	0.0069	0.0098	0.0035	53.55	0.00	0.00	53.96116
Trackwork- Direct Fixation	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.3554	0.0001	0.0001	5.3961
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012	5.36	0.00	0.00	5.396116
Major Equipment	0.0230	0.0341	1.4952	0.3251	0.0950	0.0295	0.0060	0.0001	0.0033	0.0003	0.5745	0.0031	0.0002	0.1555	609.7629	8.6844	0.0059	0.0076	0.0108	0.0038	35.3459	0.0008	0.0008	35.6144
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0230	0.0341	1.4952	0.3251	0.0950	0.0295	0.0060	0.0001	0.0033	0.0003	0.5745	0.0031	0.0002	0.1555	609.7629	8.6844	0.0059	0.0076	0.0108	0.0038	35.35	0.00	0.00	35.61437
Commissioning	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003	1.0711	0.0000	0.0000	1.0792
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.00	0.00	0
Workers	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003	1.07	0.00	0.00	1.079223
																								942.92

Maximum Daily Scenarios - On-Road Equipment Emissions
Survey, Clear and Grub
Clear and Grub, Site Util/Electric, Demo, Earthwork
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip
Site Util/Electric, Buildings, Trackwork-DF, Major Equip

Maximum Daily Scenarios - On-Road Equipment Emissions
Survey, Clear and Grub
Clear and Grub, Site Util/Electric, Demo, Earthwork
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip
Site Util/Electric, Buildings, Trackwork-DF, Major Equip

Maximum Daily Scenarios - On-Road and Off-Road Equipment Emissions
Survey, Clear and Grub
Clear and Grub, Site Util/Electric, Demo, Earthwork
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip
Site Util/Electric, Buildings, Trackwork-DF, Major Equip

Maximum Daily Scenarios - On-Road Equipment Emissions	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW
Survey, Clear and Grub	0.0091	0.0134	0.5890	0.1281	0.0374	0.0116	0.0024	0.0000	0.0013	0.0001	0.2263	0.0012	0.0001	0.0613
Clear and Grub, Site Util/Electric, Demo, Earthwork	0.1240	0.0538	3.3117	0.5123	10.5455	1.2032	0.0901	0.0001	0.0779	0.0004	2.9762	0.0743	0.0004	0.8272
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	0.1634	0.1107	5.8136	1.0541	10.8264	1.2902	0.1009	0.0003	0.0843	0.0008	3.9527	0.0802	0.0008	1.0917
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	0.1042	0.1531	6.7158	1.4580	0.5487	0.1700	0.0278	0.0004	0.0158	0.0012	2.5956	0.0145	0.0011	0.7027
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	0.0974	0.1407	6.1921	1.3398	0.7171	0.1577	0.0274	0.0003	0.0160	0.0011	2.4325	0.0148	0.0010	0.6590
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.0808	0.1200	5.2560	1.1428	0.3341	0.1036	0.0212	0.0003	0.0117	0.0009	2.0195	0.0108	0.0008	0.5466

Maximum Daily Scenarios - On-Road Equipment Emissions	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	0.0225	0.7171	0.0490	0.0024	0.2277	0.0626
Clear and Grub, Site Util/Electric, Demo, Earthwork	0.1777	3.8239	11.7487	0.0902	3.0545	0.9019
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	0.2741	6.8677	12.1166	0.1011	4.0378	1.1727
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	0.2573	8.1738	0.7187	0.0282	2.6125	0.7183
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	0.2381	7.5319	0.8747	0.0277	2.4496	0.6748
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.2008	6.3988	0.4377	0.0215	2.0321	0.5582

Maximum Daily Scenarios - On-Road and Off-Road Equipment Emissions	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Survey, Clear and Grub	1.5624	12.7128	13.1662	0.0318	0.7655	0.5573
Clear and Grub, Site Util/Electric, Demo, Earthwork	6.7043	73.0223	65.4729	0.2163	5.2252	2.8923
Site Util/Electric, Earthwork, Foundations, Bridge, Roadways/Paving	7.5704	68.1739	75.1981	0.2531	6.5621	3.4950
Site Util/Electric, Foundations, Bridge, Roadways/Paving, Buildings	8.0948	77.0711	64.3515	0.1836	5.1590	3.0611
Site Util/Electric, Buildings, Trackwork-Ballasted, Major Equip	6.2162	59.3638	47.4754	0.1369	4.3545	2.4273
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	6.1661	58.9623	46.4912	0.1284	3.9070	2.2830
Maximum Daily Emissions	8.0948	77.0711	75.1981	0.2531	6.5621	3.4950

Constants		
lb		grams
1		453.59237
ton		lbs
1		2000
metric ton		grams
1		1000000
GWP CO2e		CH4
25		1
GWP CO2e		N2O
298		1
ton		lbs
1		2000
metric ton		lbs
1		2204.623
metric ton		ton
0.907185		1

Trip Length Assumptions - CalEEMod		miles	Source	
				0.5
Workers		14.7	CalEEMod default for Orange County	3%
Vendor		6.9	CalEEMod default for Orange County	7%
Haul Trucks		20	CalEEMod default	3%

Sources:
1 Start year assumed to be 2023 based on completion year of 2028 and 4.5-year total construction period for Phases 1 and 2
2 Equipment types, quantities, usage from Orange County Maintenance Facility- Activities and equipment--Phase 1-with hours=06JAN21 Workbook
3 HP and Load factors from CalEEMod default tables (Appendix D), unless indicated otherwise.

Work Days Per Month		21

Off-Road Construction Emissions - Phase 2

Construction Year[1]

2026

									Emissions Factors (g/bhp-hr)							Emission Factor (g/gal)				Emissions (lbs/day)						metric tons/phase			
Project Phase/Equipment	Notes		Number	Hours per Day	Total Days[1]	Horsepower	Total Runtime Hours	Load Factor [2]	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	gal/hp-hr	Total Gallons	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Survey					21															0.07	0.47	0.51	0.00	0.02	0.02	1.95	0.00	0.00	1.95
Impact hammer	electric/hand-held	Other Construction Equipment	1	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power drill	electric/hand-held	Other Construction Equipment	1	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tool truck		Off-Highway Trucks	1	3	21	402	63	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	9	0.07	0.47	0.51	0.00	0.02	0.02	1.95	0.00	0.00	1.95
Site Utilities/Electric		.			84															2.15	18.49	17.02	0.04	0.70	0.64	27.25	0.00	0.00	27.44
Abrasive/demo saw	assumes diesel	Concrete/Industrial Saws	1	2	8	81	17	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	464	0.10	0.83	0.73	0.00	0.03	0.02	0.41	0.00	0.00	0.45
Backhoe		Tractors/Loaders/Backhoes	1	8	17	97	134	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	3	0.05	0.81	0.54	0.00	0.03	0.02	0.94	0.00	0.00	0.94
Bucket Truck		Off-Highway Trucks	1	8	21	402	168	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	23	0.19	1.25	1.37	0.01	0.05	0.05	5.21	0.00	0.00	5.21
Compressor		Air Compressors	1	8	42	78	336	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	199	0.20	1.55	1.25	0.00	0.05	0.05	3.43	0.00	0.00	3.45
Concrete mixer		Cement and Mortar Mixers	1	4	8	9	34	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	31	0.01	0.08	0.10	0.00	0.00	0.00	0.05	0.00	0.00	0.06
Concrete pump		Pumps	1	5	17	84	84	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	71	0.02	0.69	0.36	0.00	0.02	0.02	0.83	0.00	0.00	0.84
Concrete saw		Concrete/Industrial Saws	1	8	4	81	34	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	929	0.38	3.33	2.90	0.01	0.10	0.09	0.82	0.00	0.00	0.91
Concrete truck		Off-Highway Trucks	1	5	17	402	84	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	12	0.12	0.78	0.86	0.00	0.03	0.03	2.60	0.00	0.00	2.60
Concrete vibrator	https://www.indiamart	Other Construction Equipment	1	5	17	5.5	84	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	25	0.01	0.05	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.07
Excavator-Track hoe		Excavators	1	8	8	158	67	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	11	0.07	1.25	0.60	0.00	0.03	0.03	0.82	0.00	0.00	0.82
Front end loader (rubber)		Tractors/Loaders/Backhoes	1	8	8	97	67	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	1	0.05	0.81	0.54	0.00	0.03	0.02	0.47	0.00	0.00	0.47
Generator		Generator Sets	1	8	17	84	134	0.74	0.06	1.17	0.48	0.00	0.04	0.04	420.53	0.57	0.26	0.01	73	0.06	1.29	0.53	0.00	0.04	0.04	3.51	0.00	0.00	3.52
Gradall		Graders	1	8	4	187	34	0.41	0.12	0.53	1.32	0.00	0.04	0.04	215.93	0.57	0.26	0.00	6	0.16	0.71	1.78	0.00	0.06	0.05	0.55	0.00	0.00	0.56
Grinder	https://www.essexequi	Other Construction Equipment	1	2	42	11	84	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	49	0.01	0.04	0.05	0.00	0.00	0.00	0.14	0.00	0.00	0.14
Horizontal Boring /Jacking machine		Bore/Drill Rigs	1	0	0	221	0	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roller-vibratory		Rollers	1	2	17	80	34	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	8	0.01	0.17	0.14	0.00	0.01	0.01	0.20	0.00	0.00	0.20
Tractor trailer		Off-Highway Trucks	1	2	17	402	34	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	5	0.05	0.31	0.34	0.00	0.01	0.01	1.04	0.00	0.00	1.04
Trenching machine (Ditch witch)		Trenchers	1	4	17	78	67	0.50	0.24	1.86	2.26	0.00	0.16	0.14	265.84	0.57	0.26	0.03	134	0.08	0.64	0.78	0.00	0.05	0.05	0.70	0.00	0.00	0.71
Tri-axle Dump Trucks		Off-Highway Trucks	2	8	17	402	134	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	19	0.38	2.50	2.74	0.01	0.10	0.09	4.17	0.00	0.00	4.17
Vacuum excavator truck		Off-Highway Trucks	1	4	2	402	7	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	1	0.10	0.63	0.69	0.00	0.02	0.02	0.21	0.00	0.00	0.21
Welder		Welders	1	8	25	46	202	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	13	0.09	0.75	0.64	0.00	0.02	0.02	1.07	0.00	0.00	1.07
Demolition					21															1.40	28.21	8.70	0.02	0.35	0.31	8.74	0.00	0.00	9.09
Abrasive/demo saw		Concrete/Industrial Saws	1	4	4	81	17	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	464	0.19	1.66	1.45	0.00	0.05	0.05	0.41	0.00	0.00	0.45
Asphalt/Concrete crusher		Crushing/Proc. Equipment	1	6	7	85	42	0.78	0.53	21.52	1.66	0.01	0.05	0.03	655.82	0.57	0.26	0.94	3309	0.46	18.88	1.46	0.01	0.04	0.03	1.81	0.00	0.00	2.11
Backhoe		Tractors/Loaders/Backhoes	1	8	7	97	55	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	1	0.05	0.81	0.54	0.00	0.03	0.02	0.39	0.00	0.00	0.39
Compressor		Air Compressors	1	8	11	78	84	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	50	0.20	1.55	1.25	0.00	0.05	0.05	0.86	0.00	0.00	0.86
Excavator-Track hoe		Excavators	1	8	11	158	84	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	14	0.07	1.25	0.60	0.00	0.03	0.03	1.02	0.00	0.00	1.02
Front end loader (rubber)		Rubber Tired Loaders	1	4	17	203	67	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	5	0.05	0.28	0.47	0.00	0.02	0.01	0.94	0.00	0.00	0.94
Generator		Generator Sets	1	8	11	84	84	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	12	0.06	1.29	0.53	0.00	0.04	0.04	0.83	0.00	0.00	0.83
Grinder	https://www.essexequi	Other Construction Equipment	1	2	4	11	8	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	5	0.01	0.04	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Hoe Ram	attachment to tractor, l	Tractors/Loaders/Backhoes	1	8	3	97	25	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	0	0.05	0.81	0.54	0.00	0.03	0.02	0.18	0.00	0.00	0.18
Jack hammers	https://www.edisons.c	Other Construction Equipment	2	5	3	3.5	16	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	3	0.01	0.06	0.08	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Tractor trailer		Off-Highway Trucks	1	2	16	402	32	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	4	0.05	0.31	0.34	0.00	0.01	0.01	0.98	0.00	0.00	0.98
Tri-axle Dump Trucks		Off-Highway Trucks	2	4	11	402	42	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	6	0.19	1.25	1.37	0.01	0.05	0.05	1.30	0.00	0.00	1.30
Earthwork					42															1.05	10.09	10.49	0.02	0.50	0.46	10.77	0.00	0.00	10.88
D5 Dozer		Rubber Tired Dozers	1	8	21	247	168	0.40	0.18	1.04	1.95	0.00	0.09	0.08	209.04	0.57	0.26	0.03	1044	0.31	1.81	3.40	0.00	0.15	0.14	3.47	0.00	0.00	3.57
Excavator-Track hoe		Excavators	1	8	4	158	34	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	6	0.07	1.25	0.60	0.00	0.03	0.03	0.41	0.00	0.00	0.41
Front end loader (rubber)		Rubber Tired Loaders	1	5	34	203	168	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	13	0.06	0.35	0.59	0.00	0.02	0.02	2.35	0.00	0.00	2.35
Roller-sheepsfoot		Graders	1	8	8	187	67	0.41	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	40	0.14	1.73	1.47	0.00	0.08	0.07	1.02	0.00	0.00	1.02
Roller-vibratory		Scrapers	1	8	8	367	67	0.48	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	78	0.32	4.01	3.41	0.01	0.19	0.17	2.36	0.00	0.00	2.36
Tri-axle Dump Trucks		Graders	2	6	13	187	76	0.41	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	5	0.14	0.93	1.02	0.00	0.04	0.03	1.17	0.00	0.00	1.17
Foundations					42															0.77	6.75	6.75	0.02	0.27	0.25	14.09	0.00	0.00	14.66
Backhoe		Tractors/Loaders/Backhoes	1	8	34	97	269	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	5	0.05	0.81	0.54	0.00	0.03	0.02	1.88	0.00	0.00	1.88
Concrete mixer		Cement and Mortar Mixers	1	8	4	9	34	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	31	0.03	0.16	0.21	0.00	0.01	0.01	0.05	0.00	0.00	0.06
Concrete pump		Pumps	1	4	21	84	84	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	71	0.02	0.55	0.29	0.00	0.02	0.02	0.83	0.00	0.00	0.84
Concrete truck		Off-Highway Trucks	1	4	21	402	84	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	12	0.10	0.63	0.69	0.00	0.02	0.02	2.60	0.00	0.00	2.60
Concrete vibrator	https://www.indiamart	Other Construction Equipment	1	4	21	5.5	84	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	25	0.01	0.04	0.05	0.00	0.00	0.00	0.07	0.00	0.00	0.07
Crane		Cranes	1	8	4	231	34	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	14	0.11	0.61	1.17	0.00	0.05	0.05	0.34	0.00	0.00	0.34
Excavator-Track hoe		Excavators	1	8	11	158	84	0.38	0.07	1.18	0.56	0.00	0.03	0.03	201.69	0.57	0.26	0.00	14	0.07	1.25	0.60	0.00	0.03	0.03	1.02	0.00	0.00	1.02
Front end loader (rubber)		Rubber Tired Loaders	1	8	34	203	269	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	21	0.10	0.56	0.95	0.00	0.03	0.03	3.76	0.00	0.00	3.76
Pile driver		Bore/Drill Rigs	1	6	4	221	25	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	103	0.09	0.78	0.88	0.00	0.03	0.03	0.74	0.00	0.00	0.75
Roller-vibratory-walk behind	https://www.doosanpo	Rollers	1	2	13	6	25	0.38	1.51	4.14	2.87	0.00	0.39	0.36	220.05	0.57	0.26	38.63	5841	0.01	0.04	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.55
Tractor Trailer		Off-Highway Trucks	1	2	21	402	42	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	6	0.05	0.31	0.34	0.00	0.01	0.01	1.30	0.00	0.00	1.30
Tri-axle Dump Trucks		Off-Highway Trucks	2	2	21	402	42	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	6	0.10	0.63	0.69	0.00	0.02	0.02	1.30	0.00	0.00	1.30
Welder		Welders	1	4	8	46	34	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	2	0.05	0.38	0.32	0.00	0.01	0.01	0.18	0.00	0.00	0.18
Roadway Paving					42															1.34	11.47	11.51	0.03	0.46	0.42	8.81	0.00	0.00	8.85
Asphalt Pavers		Pavers	2	6	7	130	40	0.42	0.08	1.25	0.83	0.00	0.04	0.04	219.72	0.57	0.26	0.01	49	0.12	1.78	1.18	0.00	0.06	0.05	0.48	0.00	0.00	0.48
Backhoe		Tractors/Loaders/Backhoes	1	8	21	97	168	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	3	0.05	0.81	0.54	0.00	0.03	0.02	1.18	0.00	0.00	1.18
Concrete trucks		Off-Highway Trucks	2	4	8	402	34	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	5	0.19	1.25	1.37	0.01	0.05	0.05	1.04	0.00	0.00	1.04
Concrete vibrator	https://www.indiamart	Other Construction Equipment	1	4	8	5.5	34	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	10	0.01	0.04	0.05	0.00	0.00	0.00	0.03	0.00	0.00	0.03
Core drill machine (testing)		Bore/Drill Rigs	1	4	1	221	3	0.50	0.06	0.53	0.60	0.00	0.02	0.02	263.10	0.57	0.26	0.02	14	0.06	0.52	0.59	0.00	0.02	0.02	0.10	0.00	0.00	0.10
Demo/Concrete saws		Concrete/Industrial Saws	2	4	2	81	8	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	232	0.38	3.33	2.90	0.01	0.10	0.09	0.21	0.00	0.00	0.23
Dozer		Rubber Tired Dozers	1	4	4	247	17	0.40	0.18	1.04	1.95	0.00	0.09	0.08	209.04	0.57	0.26	0.03	104	0.16	0.90	1.70	0.00	0.08	0.07	0.35	0.00	0.00	0.36
Front end loader (rubber)		Rubber Tired Loaders	1	8	13	203	101	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	8	0.10	0.56	0.95	0.00	0.03	0.03	1.41	0.00	0.00	1.41
Roller-smooth drum		Rollers	1	8	13	80	101	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	25	0.05	0.68	0.58	0.00	0.03	0.03	0.60	0.00	0.00	0.60
Rollers-vibratory		Rollers	1	4	13	80	50	0.38	0.10	1.28	1.09	0.00	0.06	0.05	198.12	0.57	0.26	0.00	13	0.03	0.34	0.29	0.00	0.02	0.01	0.30	0.00	0.00	0.30
Tri-axle Dump Trucks		Off-Highway Trucks	2	4	25	402	101	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	14	0.19	1.25	1.37	0.01	0.05	0.05	3.12	0.00	0.00	3.13
Building					315															2.06	18.31	15.65	0.03	0.62	0.57	69.83	0.01	0.00	71.36
Abrasive/demo saw		Concrete/Industrial Saws	1	2	16	81	32	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	871	0.10	0.83	0.73	0.00	0.03	0.02	0.77	0.00	0.00	0.85
Backhoe		Tractors/Loaders/Backhoes	1	8	158	97	1260	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	24	0.05	0.81	0.54	0.00	0.03	0.02	8.83	0.00	0.00	8.83
Circular saws		Concrete/Industrial Saws	2	4	95	81	378	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	10450	0.38	3.33	2.90	0.01	0.10	0.09	9.26	0.01	0.00	10.22
Compressor		Air Compressors	1	8	158	78	1260	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	745	0.20	1.55	1.25	0.00	0.05	0.05	12.87	0.00	0.00	12.94
Concrete finisher		Paving Equipment	1	4	63	132	252	0.36	0.08	1.10	0.75	0.00	0.04	0.04	187.02	0.57	0.26	0.02	533	0.03	0.46	0.31	0.00	0.02	0.01	2.21	0.00	0.00	2.26
Concrete pump		Pumps	1	4	16	84	63	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	53	0.02	0.55	0.29	0.00	0.02	0.02	0.63	0.00	0.00	0.63
Concrete saw		Concrete/Industrial Saws	1	8	6	81	50	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1393	0.38	3.33	2.90	0.01	0.10	0.09	1.23	0.00	0.00	1.36
Concrete truck		Off-Highway Trucks	1	4	16	402	63	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	9	0.10	0.63	0.69	0.00	0.02	0.02	1.95	0.00	0.00	1.95
Concrete vibrator	https://www.indiamart	Other Construction Equipment	1	4	16	5.5	63	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	19	0.01	0.04	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Crane		Cranes	1	6	6	231	38	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	15	0.08	0.46	0.88	0.00	0.04	0.03	0.38	0.00	0.00	0.38
Front end loader (rubber)		Rubber Tired Loaders	1	4	158	203	630	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	50	0.05	0.28	0.47	0.00	0.02	0.01	8.81	0.00	0.00	8.82
Generator		Generator Sets	1	8	158	84	1260	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	186	0.06	1.29	0.53	0.00	0.04	0.04	12.51	0.00	0.00	12.52
Grinder	https://www.essexequi	Other Construction Equipment	1	4	63	11	252	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	148	0.01	0.08	0.10	0.00	0.00	0.00	0.41	0.00	0.00	0.42
Jack hammers	https://www.edisons.c	Other Construction Equipment	2	4	6	3.5	25	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	5	0.01	0.05	0.07	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Lull		Forklifts	1	4	95	89	378	0.20	0.06	0.73	0.60	0.00	0.04	0.03	105.95	0.57	0.26	0.00	3	0.01	0.12	0.09	0.00	0.01	0.01	0.72	0.00	0.00	0.72
Mortar mixer		Cement and Mortar Mixers	1	4	95	9	378	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	346	0.01	0.08	0.10	0.00	0.00	0.00	0.61	0.00	0.00	0.64
Nail guns	electric/hand-held	Other Construction Equipment	2	4	63	0	252	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paint sprayers	assumes powered by ai	Air Compressors	2	8	6	78	50	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	30	0.39	3.10	2.51	0.00	0.10	0.09	0.51	0.00	0.00	0.52
Table saw		Concrete/Industrial Saws	1	2	32	81	63	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1742	0.10	0.83	0.73	0.00	0.03	0.02	1.54	0.00	0.00	1.70
Tractor trailer		Off-Highway Trucks	1	2	95	402	189	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	26	0.05	0.31	0.34	0.00	0.01	0.01	5.86	0.00	0.00	5.86
Welder		Welders	1	2	63	46	126	0.45	0.26	2.06	1.74	0.00	0.07	0.06	255.73	0.57	0.26	0.00	8	0.02	0.19	0.16	0.00	0.01	0.01	0.67	0.00	0.00	0.67
Trackwork- Ballasted- (top of sub ballast up)					84															1.13	9.49	9.06	0.02	0.40	0.37	33.00	0.00	0.00	33.25
Air Compressor		Air Compressors	1	8	67	78	538	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	318	0.20	1.55	1.25	0.00	0.05	0.05	5.49	0.00	0.00	5.52
Backhoe		Tractors/Loaders/Backhoes	1	8	67	97	538	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	10	0.05	0.81	0.54	0.00	0.03	0.02	3.77	0.00	0.00	3.77
Ballast cars (dump)	assumes no separate er	Other Material Handling Equipment	2	6	17	0	101	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ballast Compactor		Plate Compactors	1	4	17	8	67	0.43	0.24	1.49	1.78	0.00	0.07	0.06	244.37	0.57	0.26	0.09	47	0.01	0.05	0.05	0.00	0.00	0.00	0.06	0.00	0.00	0.06
Ballast Regulator	https://www.progressr	Other General Industrial Equipment	1	4	17	250	67	0.34	0.07	0.40	0.67	0.00	0.02	0.02	180.73	0.57	0.26	0.00	75	0.05	0.30	0.51	0.00	0.02	0.01	1.04	0.00	0.00	1.04
Front end loader (rubber)		Rubber Tired Loaders	1	4	67	203	269	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	21	0.05	0.28	0.47	0.00	0.02	0.01	3.76	0.00	0.00	3.76
Generator		Generator Sets	1	4	21	84	84	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	12	0.03	0.64	0.27	0.00	0.02	0.02	0.83	0.00	0.00	0.83
Power wrench	assumes powered by ai	Aerial Lifts	1	4	8	78	34	0.31	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	20	0.06	0.50	0.40	0.00	0.02	0.01	0.22	0.00	0.00	0.22
Prentice Loader (hi rail log loader)	http://s7d2.scene7.com	Tractors/Loaders/Backhoes	1	4	25	160	101	0.37	0.07	1.14	0.56	0.00	0.03	0.03	193.81	0.57	0.26	0.00	18	0.04	0.59	0.29	0.00	0.01	0.01	1.16	0.00	0.00	1.16
Rail drill	assumes powered by ai	Other Construction Equipment	1	2	17	78	34	0.42	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	20	0.04	0.34	0.27	0.00	0.01	0.01	0.30	0.00	0.00	0.30
Rail Profile Grinder	https://www.pandrol.c	Other Construction Equipment	1	4	8	6.4	34	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	12	0.01	0.05	0.06	0.00	0.00	0.00	0.03	0.00	0.00	0.03
Rail saw		Concrete/Industrial Saws	1	1	63	81	63	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	1742	0.05	0.42	0.36	0.00	0.01	0.01	1.54	0.00	0.00	1.70
Rail Train**	modeled in deliveries ta	Other General Industrial Equipment	1	8	4	0	34	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ral heater/vibrator	assumes to be powered	Air Compressors	1	2	50	78	101	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	60	0.05	0.39	0.31	0.00	0.01	0.01	1.03	0.00	0.00	1.03
Speedswing (360 on track crane)		Cranes	1	8	67	231	538	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	220	0.11	0.61	1.17	0.00	0.05	0.05	5.44	0.00	0.00	5.46
Spiking gun *	assumes to not be used	Other Construction Equipment	0	6	50	171	302	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tamper/Liner	assumes max 100 hp	Other Construction Equipment	1	6	17	171	101	0.42	0.16	1.49	1.47	0.00	0.10	0.09	219.44	0.57	0.26	0.01	89	0.15	1.40	1.38	0.00	0.09	0.09	1.57	0.00	0.00	1.58
Tie Drill	electric/hand-held	Other Construction Equipment	1	6	50	0	302	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractor Trailer		Off-Highway Trucks	1	2	8	402	17	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	2	0.05	0.31	0.34	0.00	0.01	0.01	0.52	0.00	0.00	0.52
Tri Axle dump trucks		Off-Highway Trucks	2	4	50	402	202	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	28	0.19	1.25	1.37	0.01	0.05	0.05	6.25	0.00	0.00	6.25
Trackwork- Direct Fixation					63															1.09	9.92	8.17	0.02	0.34	0.32	15.63	0.00	0.00	15.91
Air Compressor		Air Compressors	1	8	32	78	252	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	149	0.20	1.55	1.25	0.00	0.05	0.05	2.57	0.00	0.00	2.59
Backhoe		Tractors/Loaders/Backhoes	1	8	13	97	101	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	2	0.05	0.81	0.54	0.00	0.03	0.02	0.71	0.00	0.00	0.71
Circular / Table saw		Concrete/Industrial Saws	1	2	6	81	13	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	348	0.10	0.83	0.73	0.00	0.03	0.02	0.31	0.00	0.00	0.34
Concrete drill	assumes powered by ai	Air Compressors	1	4	32	78	126	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	75	0.10	0.78	0.63	0.00	0.02	0.02	1.29	0.00	0.00	1.29
Concrete grinder	https://hupshenghardv	Other Construction Equipment	1	2	32	6	63	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	20	0.00	0.02	0.03	0.00	0.00	0.00	0.06	0.00	0.00	0.06
Concrete mixer		Cement and Mortar Mixers	1	4	32	9	126	0.56	0.31	1.82	2.35	0.00	0.09	0.08	318.42	0.57	0.26	0.10	115	0.01	0.08	0.10	0.00	0.00	0.00	0.20	0.00	0.00	0.21
Concrete pump		Pumps	1	2	6	84	13	0.74	0.03	1.01	0.53	0.00	0.03	0.03	159.70	0.57	0.26	0.01	11	0.01	0.28	0.15	0.00	0.01	0.01	0.13	0.00	0.00	0.13
Concrete truck		Off-Highway Trucks	1	2	6	402	13	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	2	0.05	0.31	0.34	0.00	0.01	0.01	0.39	0.00	0.00	0.39
Concrete vibrator	https://www.indiamart	Other Construction Equipment	1	2	6	5.5	13	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	4	0.00	0.02	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Front end loader (rubber)		Rubber Tired Loaders	1	4	32	203	126	0.36	0.08	0.43	0.73	0.00	0.02	0.02	190.49	0.57	0.26	0.00	10	0.05	0.28	0.47	0.00	0.02	0.01	1.76	0.00	0.00	1.76
Generator		Generator Sets	1	8	32	84	252	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	37	0.06	1.29	0.53	0.00	0.04	0.04	2.50	0.00	0.00	2.50
Nail guns (air)	electric/hand-held	Air Compressors	1	2	6	78	13	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	7	0.05	0.39	0.31	0.00	0.01	0.01	0.13	0.00	0.00	0.13
Power wrench	electric/hand-held	Air Compressors	1	2	3	78	6	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	4	0.05	0.39	0.31	0.00	0.01	0.01	0.06	0.00	0.00	0.06
Prentice Loader (hi rail log loader)	http://s7d2.scene7.com	Tractors/Loaders/Backhoes	1	2	32	160	63	0.37	0.07	1.14	0.56	0.00	0.03	0.03	193.81	0.57	0.26	0.00	11	0.02	0.30	0.15	0.00	0.01	0.01	0.72	0.00	0.00	0.72
Pressure washer	http://www.ultimatewa	Other Construction Equipment	1	1	32	10	32	0.42	0.16	0.97	1.31	0.00	0.06	0.05	170.09	0.57	0.26	0.22	70	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.03
Rail drill	electric/hand-held	Other Construction Equipment	1	2	38	78	76	0.42	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.00	0	0.04	0.34	0.27	0.00	0.01	0.01	0.67	0.00	0.00	0.67
Rail Profile Grinder	https://www.pandrol.c	Other Construction Equipment	1	2	38	6.4	76	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	26	0.00	0.02	0.03	0.00	0.00	0.00	0.07	0.00	0.00	0.07
Rail saw		Concrete/Industrial Saws	1	2	38	81	76	0.73	0.37	3.19	2.78	0.01	0.10	0.09	414.36	0.57	0.26	0.34	2090	0.10	0.83	0.73	0.00	0.03	0.02	1.85	0.00	0.00	2.04
Ral heater/vibrator	assumes to be powered	Air Compressors	1	4	13	78	50	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	30	0.10	0.78	0.63	0.00	0.02	0.02	0.51	0.00	0.00	0.52
Speedswing (360 on track crane)		Cranes	1	4	32	231	126	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	52	0.05	0.30	0.59	0.00	0.02	0.02	1.27	0.00	0.00	1.28
Tractor Trailer		Off-Highway Trucks	1	2	6	402	13	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	2	0.05	0.31	0.34	0.00	0.01	0.01	0.39	0.00	0.00	0.39
Major Equipment					126															0.55	4.81	4.06	0.01	0.17	0.16	7.51	0.00	0.00	7.52
Concrete drill	assumes powered by ai	Air Compressors	1	3	13	78	38	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	22	0.07	0.58	0.47	0.00	0.02	0.02	0.39	0.00	0.00	0.39
Concrete grinder	https://hupshenghardv	Other Construction Equipment	1	3	13	6	38	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	12	0.01	0.03	0.04	0.00	0.00	0.00	0.03	0.00	0.00	0.03
Crane		Cranes	1	4	13	231	50	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	21	0.05	0.30	0.59	0.00	0.02	0.02	0.51	0.00	0.00	0.51
Fork lift		Forklifts	1	4	63	89	252	0.20	0.06	0.73	0.60	0.00	0.04	0.03	105.95	0.57	0.26	0.00	2	0.01	0.12	0.09	0.00	0.01	0.01	0.48	0.00	0.00	0.48
Front end loader		Tractors/Loaders/Backhoes	1	4	63	97	252	0.37	0.08	1.29	0.85	0.00	0.04	0.04	195.21	0.57	0.26	0.00	5	0.03	0.41	0.27	0.00	0.01	0.01	1.77	0.00	0.00	1.77
Generator		Generator Sets	1	4	76	84	302	0.74	0.06	1.17	0.48	0.00	0.04	0.04	159.70	0.57	0.26	0.00	45	0.03	0.64	0.27	0.00	0.02	0.02	3.00	0.00	0.00	3.01
Impact guns	assumes powered by ai	Air Compressors	2	4	6	78	25	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	15	0.20	1.55	1.25	0.00	0.05	0.05	0.26	0.00	0.00	0.26
Steel drill	assumes to be powered	Air Compressors	1	4	6	78	25	0.48	0.30	2.35	1.90	0.00	0.07	0.07	272.77	0.57	0.26	0.01	15	0.10	0.78	0.63	0.00	0.02	0.02	0.26	0.00	0.00	0.26
Steel grinder	https://www.essexequi	Other Construction Equipment	1	4	6	11	25	0.42	0.34	2.02	2.59	0.01	0.10	0.09	352.40	0.57	0.26	0.05	15	0.01	0.08	0.10	0.00	0.00	0.00	0.04	0.00	0.00	0.04
Tractor Trailer		Off-Highway Trucks	1	2	13	402	25	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26	0.00	3	0.05	0.31	0.34	0.00	0.01	0.01	0.78	0.00	0.00	0.78
Commissioning					42															0.21	1.32	1.99	0.00	0.11	0.10	5.23	0.00	0.00	5.27
Car Wash	Assumes no diesel engi	Air Compressors	0	8	42	78	336	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drop Table	Assumes no diesel engi	Forklifts	1	8	42	89	336	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Overhead Crane		Cranes	1	8	42	231	336	0.29	0.09	0.52	1.00	0.00	0.04	0.04	151.96	0.57	0.26	0.00	137	0.11	0.61	1.17	0.00	0.05	0.05	3.40	0.00	0.00	3.41
Wheel Truing Machine		Other General Industrial Equipment	1	8	42	88	336	0.34	0.19	1.34	1.55	0.00	0.12	0.11	181.11	0.57	0.26	0.01	365	0.10	0.71	0.82	0.00	0.06	0.06	1.83	0.00	0.00	1.86

	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Maximum Daily Scenarios - Off-Road Equipment Emissions	lbs/day					
Survey	0.07	0.47	0.51	0.00	0.02	0.02
Site Util/Electric, Demo	3.55	46.70	25.71	0.07	1.04	0.95
Site Util/Electric, Earthwork	3.20	28.58	27.51	0.06	1.20	1.10
Earthwork, Foundations	1.82	16.84	17.25	0.04	0.78	0.71
Foundations, Roadway/Paving	2.11	18.22	18.26	0.05	0.73	0.67
Buildings, Trackwork-Ballasted, Major Equip	3.74	32.61	28.76	0.06	1.20	1.10
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	5.85	51.53	44.88	0.10	1.84	1.69
Major Equip, Commissioning	0.76	6.13	6.05	0.01	0.29	0.26

On-Road Construction Emissions - Phase 2

Emissions Factors (g/mi for RunEx, BW, TW and g/trip for StartEx)

Project Component/On-Road Vehicles	Days	Daily Trips	Trip Distance (One-way)	Total VMT	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW	CO_2 RunEx	CO_2 StartEx	CH_4 RunEx	CH_4 StartEx	N_2O RunEx	N_2O StartEx
Survey																								
Concrete Trucks	21	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	21	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	21	6	14.7	88	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Site Utilities/Electric																								
Concrete Trucks	84	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	84	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	84	32	14.7	470	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Demolition																								
Concrete Trucks	21	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	21	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	21	20	14.7	294	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Earthwork																								
Concrete Trucks	42	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	42	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Haul Trucks - Ballast Delivery (Occurs over over 21 days months 2 through 3 and 4)	21	28	20.0	560	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0261
Workers	42	32	14.7	470	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0000
Foundations																								
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	42	10	6.9	67	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	42	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	42	48	14.7	706	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Roadway Paving																								
Concrete Trucks	42	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	42	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	42	30	14.7	441	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Building																								
Concrete Trucks	315		6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	315		20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	315	114	14.7	1,676	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Trackwork- Ballasted- (top of sub ballast up)																								
Concrete Trucks	84	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks (occurs during first two months of track construction	42	2	20.0	31	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	84	60	14.7	882	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Trackwork- Direct Fixation																								
Concrete Trucks	63	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	63	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	63	20	14.7	294	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Major Equipment																								
Concrete Trucks	126	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	126	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	126	66	14.7	970	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261
Commissioning																								
Concrete Trucks	42	-	6.9	-	0.0191	0.0000	0.1675	0.0000	2.0777	4.4297	0.0127	0.0000	0.0144	0.0000	0.3216	0.0137	0.0000	0.0904	1341.5330	0.0000	0.0009	0.0000	0.2109	0.0000
Haul Trucks	42	-	20.0	-	0.0136	0.0000	0.1484	0.0000	1.6143	3.5926	0.0125	0.0000	0.0113	0.0000	0.3216	0.0108	0.0000	0.0904	1324.3272	0.0000	0.0006	0.0000	0.2082	0.0000
Workers	42	6	14.7	88	0.0107	0.2346	0.6991	2.2343	0.0444	0.2026	0.0028	0.0006	0.0016	0.0018	0.2686	0.0014	0.0016	0.0727	285.0792	59.6848	0.0028	0.0520	0.0051	0.0261

Emissions (lbs/day)

Project Component/On-Road Vehicles	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW	CO_2 RunEx	CO_2 StartEx	CH_4 RunEx	CH_4 StartEx	N_2O RunEx	N_2O StartEx
Survey	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003
Site Utilities/Electric	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0018
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0018
Demolition	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012
Earthwork	0.0280	0.0166	0.9082	0.1576	2.0391	0.2361	0.0184	0.0000	0.0155	0.0001	0.6756	0.0148	0.0001	0.1870	1930.6420	4.2106	0.0036	0.0037	0.2623	0.0016
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks - Ballast Delivery (Occurs over over 21 days months 2 through 3 and 4)	0.0168	0.0000	0.1832	0.0000	1.9931	0.2218	0.0154	0.0000	0.0139	0.0000	0.3970	0.0133	0.0000	0.1116	1634.9994	0.0000	0.0008	0.0000	0.2570	0.0016
Workers	0.0111	0.0166	0.7250	0.1576	0.0461	0.0143	0.0029	0.0000	0.0016	0.0001	0.2786	0.0015	0.0001	0.0754	295.6426	4.2106	0.0029	0.0037	0.0053	0.0000
Foundations	0.0195	0.0248	1.1123	0.2364	0.3769	0.1165	0.0063	0.0001	0.0045	0.0002	0.4655	0.0043	0.0002	0.1265	642.1791	6.3160	0.0044	0.0055	0.0391	0.0028
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	0.0028	0.0000	0.0248	0.0000	0.3078	0.0951	0.0019	0.0000	0.0021	0.0000	0.0476	0.0020	0.0000	0.0134	198.7151	0.0000	0.0001	0.0000	0.0312	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0167	0.0248	1.0874	0.2364	0.0691	0.0214	0.0044	0.0001	0.0024	0.0002	0.4178	0.0022	0.0002	0.1131	443.4639	6.3160	0.0043	0.0055	0.0079	0.0028
Roadway Paving	0.0104	0.0155	0.6797	0.1478	0.0432	0.0134	0.0027	0.0000	0.0015	0.0001	0.2611	0.0014	0.0001	0.0707	277.1650	3.9475	0.0027	0.0034	0.0049	0.0017
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0104	0.0155	0.6797	0.1478	0.0432	0.0134	0.0027	0.0000	0.0015	0.0001	0.2611	0.0014	0.0001	0.0707	277.1650	3.9475	0.0027	0.0034	0.0049	0.0017
Building	0.0397	0.0590	2.5827	0.5615	0.1642	0.0509	0.0104	0.0001	0.0057	0.0004	0.9923	0.0053	0.0004	0.2686	1053.2268	15.0004	0.0102	0.0131	0.0187	0.0066
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0397	0.0590	2.5827	0.5615	0.1642	0.0509	0.0104	0.0001	0.0057	0.0004	0.9923	0.0053	0.0004	0.2686	1053.2268	15.0004	0.0102	0.0131	0.0187	0.0066
Trackwork- Ballasted- (top of sub ballast up)	0.0218	0.0310	1.3695	0.2955	0.1977	0.0392	0.0063	0.0001	0.0038	0.0002	0.5445	0.0035	0.0002	0.1476	645.6267	7.8949	0.0054	0.0069	0.0242	0.0035
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks (occurs during first two months of track construction	0.0009	0.0000	0.0102	0.0000	0.1113	0.0124	0.0009	0.0000	0.0008	0.0000	0.0222	0.0007	0.0000	0.0062	91.2967	0.0000	0.0000	0.0000	0.0144	0.0000
Workers	0.0209	0.0310	1.3593	0.2955	0.0864	0.0268	0.0055	0.0001	0.0030	0.0002	0.5223	0.0028	0.0002	0.1414	554.3299	7.8949	0.0054	0.0069	0.0098	0.0035
Trackwork- Direct Fixation	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0070	0.0103	0.4531	0.0985	0.0288	0.0089	0.0018	0.0000	0.0010	0.0001	0.1741	0.0009	0.0001	0.0471	184.7766	2.6316	0.0018	0.0023	0.0033	0.0012
Major Equipment	0.0230	0.0341	1.4952	0.3251	0.0950	0.0295	0.0060	0.0001	0.0033	0.0003	0.5745	0.0031	0.0002	0.1555	609.7629	8.6844	0.0059	0.0076	0.0108	0.0038
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0230	0.0341	1.4952	0.3251	0.0950	0.0295	0.0060	0.0001	0.0033	0.0003	0.5745	0.0031	0.0002	0.1555	609.7629	8.6844	0.0059	0.0076	0.0108	0.0038
Commissioning	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003
Concrete Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Haul Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Workers	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141	55.4330	0.7895	0.0005	0.0007	0.0010	0.0003

Project Component/On-Road Vehicles	Emissions (MT/phase) CO_2	CH_4	N_2O	MT CO_2e
Survey	0.5355	0.0000	0.0000	0.5396
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	0.54	0.00	0.00	0.539612
Site Utilities/Electric	11.4249	0.0002	0.0003	11.5117
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	11.42	0.00	0.00	11.51171
Demolition	1.7851	0.0000	0.0000	1.7987
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	1.79	0.00	0.00	1.798705
Earthwork	21.6044	0.0001	0.0026	22.3866
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Haul Trucks - Ballast Delivery (Occurs over over 21 days months 2 through 3 and 4)	15.89	0.00	0.00	16.64119
Workers	5.71	0.00	0.00	5.745393
Foundations	12.3544	0.0002	0.0008	12.5969
Concrete Trucks (conservatively included during foundations phase [shorter than building phase])	3.79	0.00	0.00	3.963088
Haul Trucks	0.00	0.00	0.00	0
Workers	8.57	0.00	0.00	8.633786
Roadway Paving	5.3554	0.0001	0.0001	5.3961
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	5.36	0.00	0.00	5.396116
Building	152.6300	0.0033	0.0036	153.7893
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	152.63	0.00	0.00	153.7893
Trackwork- Ballasted- (top of sub ballast up)	23.1610	0.0005	0.0008	23.4052
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks (occurs during first two months of track construction	1.74	0.00	0.00	1.820774
Workers	21.42	0.00	0.00	21.58447
Trackwork- Direct Fixation	5.3554	0.0001	0.0001	5.3961
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	5.36	0.00	0.00	5.396116
Major Equipment	35.3459	0.0008	0.0008	35.6144
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	35.35	0.00	0.00	35.61437
Commissioning	1.0711	0.0000	0.0000	1.0792
Concrete Trucks	0.00	0.00	0.00	0
Haul Trucks	0.00	0.00	0.00	0
Workers	1.07	0.00	0.00	1.079223
				273.51

Maximum Daily Scenarios - On-Road Equipment Emissions	ROG RunEx	ROG StartEx	CO RunEx	CO StartEX	NOx RunEx	NOx StartEx	SOx RunEx	SOx StartEx	PM_{10} RunEx	PM_{10} StartEx	PM_{10} BW, TW	$PM_{2.5}$ RunEx	$PM_{2.5}$ StartEx	$PM_{2.5}$ BW, TW
Survey	0.0021	0.0031	0.1359	0.0296	0.0086	0.0027	0.0005	0.0000	0.0003	0.0000	0.0522	0.0003	0.0000	0.0141
Site Util/Electric, Demo	0.0181	0.0269	1.1781	0.2561	0.0749	0.0232	0.0048	0.0001	0.0026	0.0002	0.4527	0.0024	0.0002	0.1225
Site Util/Electric, Earthwork	0.0391	0.0331	1.6331	0.3152	2.0852	0.2504	0.0213	0.0001	0.0171	0.0003	0.9541	0.0163	0.0002	0.2624
Earthwork, Foundations	0.0475	0.0414	2.0204	0.3941	2.4160	0.3526	0.0246	0.0001	0.0201	0.0003	1.1411	0.0191	0.0003	0.3135
Foundations, Roadway/Paving	0.0300	0.0403	1.7919	0.3842	0.4201	0.1299	0.0090	0.0001	0.0061	0.0003	0.7266	0.0057	0.0003	0.1972
Buildings, Trackwork-Ballasted, Major Equip	0.0845	0.1241	5.4475	1.1822	0.4569	0.1196	0.0228	0.0003	0.0129	0.0009	2.1113	0.0119	0.0009	0.5716
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.0808	0.1200	5.2560	1.1428	0.3341	0.1036	0.0212	0.0003	0.0117	0.0009	2.0195	0.0108	0.0008	0.5466
Major Equip, Commissioning	0.0251	0.0372	1.6312	0.3547	0.1037	0.0322	0.0066	0.0001	0.0036	0.0003	0.6267	0.0033	0.0003	0.1696

Maximum Daily Scenarios - On-Road Equipment Emissions	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Survey	0.0052	0.1655	0.0113	0.0006	0.0526	0.0144
Site Util/Electric, Demo	0.0450	1.4342	0.0981	0.0048	0.4555	0.1251
Site Util/Electric, Earthwork	0.0722	1.9484	2.3356	0.0214	0.9715	0.2789
Earthwork, Foundations	0.0889	2.4145	2.7686	0.0247	1.1614	0.3328
Foundations, Roadway/Paving	0.0703	2.1761	0.5500	0.0091	0.7330	0.2031
Buildings, Trackwork-Ballasted, Major Equip	0.2086	6.6296	0.5764	0.0231	2.1251	0.5844
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	0.2008	6.3988	0.4377	0.0215	2.0321	0.5582
Major Equip, Commissioning	0.0623	1.9858	0.1358	0.0067	0.6307	0.1732

Maximum Daily Scenarios - On-Road and Off-Road Equipment Emissions	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Survey	0.0774	0.6350	0.5252	0.0024	0.0711	0.0315
Site Util/Electric, Demo	3.5939	48.1311	25.8100	0.0728	1.5002	1.0796
Site Util/Electric, Earthwork	3.2761	30.5238	29.8461	0.0838	2.1720	1.3833
Earthwork, Foundations	1.9114	19.2530	20.0136	0.0623	1.9365	1.0459
Foundations, Roadway/Paving	2.1820	20.3969	18.8137	0.0556	1.4631	0.8748
Buildings, Trackwork-Ballasted, Major Equip	3.9444	39.2387	29.3401	0.0841	3.3262	1.6893
Site Util/Electric, Buildings, Trackwork-DF, Major Equip	6.0502	57.9246	45.3209	0.1237	3.8695	2.2486
Major Equip, Commissioning	0.8218	8.1117	6.1846	0.0175	0.9158	0.4355
Maximum Daily Emissions	6.0502	57.9246	45.3209	0.1237	3.8695	2.2486

Constants		
lb		grams
1		453.59237
ton		lbs
1		2000
metric ton		grams
1		1000000
GWP CO2e		CH4
25		1
GWP CO2e		N2O
298		1
ton		lbs
1		2000
metric ton		lbs
1		2204.623
metric ton		ton
0.907185		1

Trip Length Assumptions - CalEEMod		miles	Source	
				0.5
Workers		14.7	CalEEMod default for Orange County	3%
Vendor		6.9	CalEEMod default for Orange County	7%
Haul Trucks		20	CalEEMod default	3%

Sources:

1 Start year assumed to be 2026 based on completion year of 2028 and 4.5-year total construction period for Phases 1 and 2
2 Equipment types, quantities, usage from Orange County Maintenance Facility- Activities and equipment--Phase 2-with hours=06JAN21 Workbook
3 HP and Load factors from CalEEMod default tables (Appendix D), unless indicated otherwise.

Work Days Per Month		21

Phase 1 Deliveries

Rail, OTM and Turnouts-Ballasted Track — Assume 144 truckloads delivered evenly spread over first three months of track construction

Ballast — Assume 1080 loads ballast delivered (14/day) evenly over 80 days months 4 through 6 and month 9

Options

	Car Loads @ 100 tn/car		
Rail deliver by railcar (100 tons/ car) **	8	Assume 4 round trips trips with 2 cars each.	(Yard type locomotive (4000 HP +/-, Type EMD SD40-2) in and out four two times each)

*** Quantity could be delivred on a welded rail train with one delivery if sufficient storage available. Assume 2 road engines (5000 HP) in at start of day, running all day while unloading and out at end of day for two days*

	Rail Delivery Options	Days	Quantity	Horsepower	Hrs Per Day	Load Factor	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
							g/bhp-hr								
1	Onsite Idling During Rail Delivery	4	1	4000	1	0.4	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125
1	In Transit Rail Delivery	4	1	4000	1	0.248	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125

Rail Delivery Options	ROG	CO	NOX	SO2	PM10	PM2.5	ROG	CO	NOX	SO2	PM10	PM2.5
	lb/day						total lbs					
Onsite Idling During Rail Delivery	0.148574	4.515067	3.527396	0.01628	0.052911	0.051324	0.594296	18.06027	14.10958	0.065121	0.211644	0.205294
In Transit Rail Delivery	0.092116	2.799342	2.186986	0.010094	0.032805	0.031821	0.368463	11.19737	8.747943	0.040375	0.131219	0.127283
Total	0.24069	7.314409	5.714382	0.026374	0.085716	0.083144	0.962759	29.25763	22.85753	0.105496	0.342863	0.332577

In transit rail delivery includes emissions associated with delivery within the basin.
Assumes 4 days of deliveries.

		Days	Quantity	Horsepower	Hrs Per Day	Load Factor	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
							g/bhp-hr							g/gal	
2	Welded Rail Train(Off-Highway Truck)	2	2	599	8	0.38	0.07	0.46	0.51	0.00	0.02	0.02	201.86	0.57	0.26

	ROG	CO	NOX	SO2	PM10	PM2.5	ROG	CO	NOX	SO2	PM10	PM2.5
	lbs/day						total lbs					
Welded Rail Train(Off-Highway Truck)	0.57359	3.731253	4.08353	0.015045	0.147056	0.135292	1.147179	7.462507	8.16706	0.030091	0.294112	0.270583

Assumptions:
Off-highway truck (gal/hp-hr) 0.000345475 6.622065852 Total Gallons
Assumes truck engine horsepower is 599 HP per http://www.plasseramerican.com/en/machines-systems/mobile-rail-rectification-apt-1500-rl.html (flash-butt welding in truck design)
Welding machinery assumptions determined to be electric per 17Feb21 email from Jason N. (https://kzeso.com/en/k920-1/). Flash butt welding machines on road-rail vehicles.

Locomotives	Emission Factors (g/bhp-hr)*				Emission Factors (g/bhp-hr)									
	PM10	HC	NOx	CO	HC	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
Tier 4	0.015	0.04	1	1.28	0.04	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125

Assumes Tier 4 work train is performing the local delivery.

Constants		
lb		grams
1		453.59237
ton		lbs
1		2000
metric ton		grams
1		1000000
GWP CO2e		CH4
25		1
GWP CO2e		N2O
298		1
ton		lbs
1		2000
metric ton		lbs
1		2204.623
metric ton		ton
0.907185		1

Phase 2 Deliveries

Rail, OTM and Turnouts-Ballasted Track — Assume 33 truckloads delivered evenly spread over first two months of track construction

Ballast — Assume 300 loads ballast delivered (14/day) evenly over 21 days months 2 through 3 and 4

Options

	Car Loads @ 100 tn/car		
Rail deliver by railcar (100 tons/ car) **	2	Assume 1 round trips trips with 2 cars each.	(Yard type locomotive (4000 HP +/-, Type EMD SD40-2) in and out one time)

*** Rail delivery would be more economical if purchased with Phase 1 material.*

Rail Delivery Options	Days	Quantity	Horsepower	Hrs Per Da	Load Facto	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
						g/bhp-hr								
1 Onsite Idling During Rail Delivery	1	1	4000	1	0.4	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125
1 In Transit Rail Delivery	1	1	4000	1	0.248	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125

Rail Delivery Options	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O	CO2e
	lb/day						Total Metric Tons			MT
1 Onsite Idling During Rail Delivery	0.148574	4.515067	3.527396	0.01628	0.052911	0.051324	0.785077	6.15385E-05	2E-05	0.792575
1 In Transit Rail Delivery	0.092116	2.799342	2.186986	0.010094	0.032805	0.031821	0.486748	3.81538E-05	1.24E-05	0.491397
Total	0.24069	7.314409	5.714382	0.026374	0.085716	0.083144	1.271824	9.96923E-05	3.24E-05	1.283972

Locomotives	Emission Factors (g/bhp-hr)*				Emission Factors (g/bhp-hr)									
	PM10	HC	NOx	CO	HC	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
Tier 4	0.015	0.04	1	1.28	0.04	0.04212	1.28	1	0.004615	0.015	0.01455	490.6731	0.038462	0.0125

*Source: EPA Emission Factors for Locomotives - Technical Highlights (EPA-420-F-09-025)

Constants		
lb		grams
1		453.59237
ton		lbs
1		2000
metric ton		grams
1		1000000
GWP CO2e		CH4
25		1
GWP CO2e		N2O
298		1
ton		lbs
1		2000
metric ton		lbs
1		2204.623
metric ton		ton
0.907185		1

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: ORANGE
Calendar Year: 2023
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN. Note 'day' in the unit is operation day.

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	VMT	%VMT	Trips	%Trips	ROG_RUNEX	ROG_STREX	CO_RUNEX	CO_STREX	NOx_RUNEX	NOx_STREX	SOx_RUNEX	SOx_STREX	PM10_RUNEX	PM10_STREX	PM10_PMTW	PM10_PMBW	PM2.5_RUNEX	PM2.5_STREX	PM2.5_PMTW	PM2.5_PMBW	CO2_RUNEX	CO2_STREX	CH4_RUNEX	CH4_STREX	N2O_RUNEX	N2O_STREX
ORANGE	2023	LDA	Aggregated	Aggregated	GAS	1317264	49965793.64	58.22%	6248383.008	58%	0.007743836	0.197501239	0.606543885	2.06671228	0.030489814	0.169590934	0.002540209	0.000523211	0.00149995	0.001817693	0.008000002	0.036750011	0.001379154	0.001671339	0.002000001	0.015750005	256.6954233	53.53810958	0.002122662	0.045450547	0.003904294	0.024384848
ORANGE	2023	LDA	Aggregated	Aggregated	DSL	13431.01	521944.8541	0.61%	63854.3682	1%	0.013569946	0	0.227182921	0	0.048567852	0	0.001882379	0	0.005609463	0	0.008000002	0.036750011	0.0053668	0	0.002000001	0.015750005	199.117743	0	0.000630298	0	0.031298536	0
ORANGE	2023	LDA	Aggregated	Aggregated	ELEC	33012.03	1363745.619	1.59%	164035.8627	2%	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011	0	0	0.002000001	0.015750005	0	0	0	0	0	0
ORANGE	2023	LDT1	Aggregated	Aggregated	GAS	145926	5324604.48	6.20%	676933.8582	6%	0.020442622	0.299527348	1.037043845	2.191511003	0.077597393	0.228974772	0.002962779	0.000615855	0.001978943	0.00233687	0.008000002	0.036750011	0.001819608	0.002148737	0.002000001	0.015750005	299.3973221	63.01801694	0.004787653	0.06188013	0.006505475	0.027172949
ORANGE	2023	LDT1	Aggregated	Aggregated	DSL	46.29888	970.2407912	0.00%	157.1623518	0%	0.173929598	0	0.970366346	0	0.850017124	0	0.003757056	0	0.136007381	0	0.008000002	0.036750011	0.130123762	0	0.002000001	0.015750005	397.420837	0	0.008078697	0	0.062469021	0
ORANGE	2023	LDT1	Aggregated	Aggregated	ELEC	1366.204	58816.77113	0.07%	6870.769993	0%	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011	0	0	0.002000001	0.015750005	0	0	0	0	0	0
ORANGE	2023	LDT2	Aggregated	Aggregated	GAS	459128.1	16860833.77	19.65%	2151241.261	20%	0.013032857	0.276732518	0.803616066	2.574979445	0.057855547	0.24813429	0.003178729	0.000671197	0.001502955	0.001736807	0.008000002	0.036750011	0.001381922	0.001596948	0.002000001	0.015750005	321.2197143	68.6810073	0.003349111	0.061292995	0.005421704	0.03012684
ORANGE	2023	LDT2	Aggregated	Aggregated	DSL	3171.576	131714.3685	0.15%	15530.20474	0%	0.017675285	0	0.157636726	0	0.038163309	0	0.002584973	0	0.004938616	0	0.008000002	0.036750011	0.004724973	0	0.002000001	0.015750005	273.4380282	0	0.000820983	0	0.04298065	0
ORANGE	2023	LDT2	Aggregated	Aggregated	ELEC	5547.578	177681.564	0.21%	27961.08308	0%	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011	0	0	0.002000001	0.015750005	0	0	0	0	0	0
ORANGE	2023	MDV	Aggregated	Aggregated	GAS	313407.7	11014472.81	12.84%	1450734.231	13%	0.017533478	0.353870453	0.929801761	2.934181699	0.077587328	0.309678232	0.003936807	0.000829199	0.001558009	0.00186252	0.008000002	0.036750011	0.001432615	0.001712642	0.002000001	0.015750005	397.8255985	84.84868518	0.004357919	0.073940782	0.006786742	0.033157254
ORANGE	2023	MDV	Aggregated	Aggregated	DSL	7459.366	293854.6559	0.34%	36276.35582	0%	0.012459134	0	0.235878169	0	0.041879477	0	0.003405794	0	0.004379732	0	0.008000002	0.036750011	0.004190267	0	0.002000001	0.015750005	360.2643448	0	0.000578703	0	0.056628538	0
ORANGE	2023	MDV	Aggregated	Aggregated	ELEC	3044.279	101132.5162	0.12%	15528.53705	0%	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011	0	0	0.002000001	0.015750005	0	0	0	0	0	0
							85,815,565.29		10,857,506.70																							
Worker Vehicle Weighted Average Emission Factors (accounts for SAFE Rule)											0.010743	0.234611	0.699061	2.234266	0.044431	0.202557	0.002820	0.000583	0.001555	0.001790	0.008000	0.036750	0.001432	0.001646	0.002000	0.015750	285.079162	59.684785	0.002758	0.052038	0.005064	0.026127

EMFAC2017 Off-Model Adjustment Factors for Gasoline Light Duty Vehicle Emissions

Year	NOx Exhaust	TOG Exhaust	PM Exhaust	CO Exhaust	CO2 Exhaust
2023	1.0007	1.0007	1.0032	1.0027	1.0126

Applied to gas powered LDA, LDT1, and LDT2 vehicles
Source: Table 2 in ARB 2019 EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One
https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf
https://ww3.arb.ca.gov/msei/emfac_off_model_co2_adjustment_factors_06262020-final.pdf

Haul Truck Emission Factor

ORANGE	2023	T7 Single	Aggregated	Aggregated	DSL	2446.304	171547.3811	100%	28230.00459		0.01362657	0	0.148382097	0	1.614349314	3.592637291	0.012511587	0	0.011277582	0	0.03600001	0.061740018	0.010789719	0	0.009000003	0.026460008	1324.327211	0	0.000632919	0	0.208165795	0

Concrete Truck Emission Factor

ORANGE	2023	T7 single construction	Aggregated	Aggregated	DSL	722.5048	50137.89549	100%	3266.415907		0.019116717	0	0.167473405	0	2.077703851	4.429731006	0.012674139	0	0.014351546	0	0.03600001	0.061740018	0.013730705	0	0.009000003	0.026460008	1341.533024	0	0.000887922	0	0.210870309	0

Assumed to be T7 single construction vehicle category (based on CARB 2019 Presentation, slide 51 https://ww2.arb.ca.gov/sites/default/files/2019-10/oct19emfac202x.pdf)

Fugitive Dust Emissions

Truck Loading and Stockpiling
Material Import/Excavation Quantities

Assumptions	Excavation (CY)	Excavation (tons)	Import (CY)	Import (tons)
Material Import during Phase 1		-	120,000	151,700

	Earthwork		Earthwork	
Total Emissions from Stockpiling and Truck Loading Soils	PM10 (lbs/day)	PM2.5 (lbs/day)	PM10 (total lbs)	PM2.5 (total lbs)
Import	0.11	0.02	13.55	2.05

Fugitive Dust Emission Factors

Storage Pile and Truck Loading Fugitive Dust Emission Factors
$EF_D = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units	Notes
EF (PM_{10}) for soil	0.000089	lb/ton	
EF ($PM_{2.5}$) for soil	0.000014	lb/ton	
k (PM_{10})	0.35	factor	
k ($PM_{2.5}$)	0.053	factor	
U (mean wind speed)	4.92	miles/hr	Based on CalEEMod Default Data for Orange County 2.2 m/s
M (moisture content) of saturated soil	12.00	percent	Based on default moisture content in CalEEMod User's Guide (Appendix A)
Soil density (CalEEMod default)	1.26	tons/cy	
M (moisture content) of demolition debris	2.00	percent	Based on CalEEMod default using MRI report (Appendix A)

E (lbs) = EF (lb/ton) x TP (tons)

						Unmitigated Emissions (lbs/day)		Controlled Emissions (lbs/day)		Unmitigated Emissions (total lbs)	
Phase 1 - Subphase	Equipment	Number of Earthworking Equipment	Daily Activity Level	Total Activity Level	Days	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Clear and Grub	D5 Dozer	1	8	8	13	6.02209	3.31852	2.70994	1.49334	75.87828	18.81603
Site Utilities	Gradall	1	8	8	126	6.02209	3.31852	2.70994	1.49334	758.78285	188.16030
Earthwork	D5 Dozer	1	8	8	63	6.02209	3.31852	2.70994	1.49334	379.39142	94.08015
	Gradall	1	8	8	42	6.02209	3.31852	2.70994	1.49334	250.39834	62.09290
	Pan	1	8	8	6	6.02209	3.31852	2.70994	1.49334	37.93914	9.40801
	Road Grader	1	8	8	6	6.02209	3.31852	2.70994	1.49334	37.93914	9.40801
Roadway Paving	Dozer	1	4	4	8	3.01104	1.65926	1.35497	0.74667	25.29276	6.27201
Daily and Total Fugitive Dust Emissions from Bulldozing, Scraping, and Grading						39.14356	21.57040	17.61460	9.70668	1565.62194	388.23741

Phase 2 - Subphase	Equipment	Number of Earthworking Equipment	Daily Activity Level	Total Activity Level	Days	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Site Utilities/Electric	Gradall	1	8	8	4	6.02209	3.31852	2.70994	1.49334	25.2927615	13.9377997
Earthwork	D5 Dozer	1	8	8	21	6.02209	3.31852	2.70994	1.49334	126.4638076	69.6889983
Roadway Paving	Dozer	1	4	4	4	3.01104	1.65926	1.35497	0.74667	12.6463808	6.9688998
Daily and Total Fugitive Dust Emissions from Bulldozing, Scraping, and Grading						15.05522	8.29631	6.77485	3.73334	164.40295	90.59570

Bulldozing, Scraping and Grading Emission Factors

PM10 Emission Factor [lb/hr] = 0.75 x (silt content [%])$^{1.5}$ / (moisture)$^{1.4}$
PM2.5 Emission Factor [lb/hr] = 0.60 x (silt content [%])$^{1.2}$ / (moisture)$^{1.3}$
Reference: AP-42, Table 11.9-1, July 1998

Parameter	Value	Basis
Silt Content	6.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive Emission
Moisture	7.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive Emission

PM10 Emission Factor 0.75 lb/hr
PM2.5 Emission Factor 0.41 lb/hr

Emissions [pounds per day] = Controlled emission factor [pounds per hour] x Bulldozing, scraping or grading time [hours/day]

Paved Roads Fugitive Dust Emissions

Paved Roads	100%

Paved Road Dust

$EF_{DUST} = [(k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N))$

Source: AP-42 Section 13.2.1 (Paved Roads) - http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0201.pdf

Variable	Value	Description
k (PM10)	0.0022	particle size multiplier for particle size range and units of interest (lb/VMT)
k (PM2.5)	0.00054	particle size multiplier for particle size range and units of interest (lb/VMT)
sL	0.032	road surface silt loading (g/m^2) based on EPA 2011 default for collector streets (https://ww
W	5.20	average weight of all vehicles based on weighted average of trip types
W	5.20	haul truck tons
P	64	number of "wet" days with at least 0.254 mm of precipitation during the averaging period
N	365	number of days in averaging period

All Vehicle Trip Types

EF (PM10)	0.000494	lb/VMT
EF (PM2.5)	0.000121	lb/VMT

Conversion Units	
lbs	tons
2000	1

Vehicle Type	Total Trips	Percent	Weight (tons)
Worker	526	77.3%	2.4
Trucks	154	22.7%	14.75
Total	680	Average Weight	5.20

Architectural Coatings

Phase 1 Total Arch Coating and Parking Related VOC Emissions (lbs)	239.62
Phase 2 Total Arch Coating and Parking Related VOC Emissions (lbs)	187.27
Phase 1 Max Daily Arch Coating and Parking Related VOC Emissions (lbs)	29.58
Phase 2 Max Daily Arch Coating and Parking Related VOC Emissions (lbs)	74.31

Mitigated Emissions

Phase 2 Max Daily Arch Coating and Parking Related VOC Emissions (lbs)	29.73

Phase 1	Total Sq. Ft.	Source/Note
Train Wash	11,110	1
S&I (Pump House)	750	
Utility Building	961	
Transportation Building	7,495	
Total	20,316	

Phase 2	Total Sq. Ft.	Source/Note
Maintenance Building	40,392	1

		Architectural Coatings	
		Total VOC Emissions (lbs)	VOC Emissions (lbs/day)
Phase 1 Buildings - Exterior Surface Area (A)		58.87	7.38
Phase 1 Buildings - Interior Surface Area (A)		176.61	22.13
Phase 2 Buildings - Exterior Surface Area (A)		117.04	18.58
Phase 2 Buildings - Interior Surface Area (A)		351.13	55.74
MITIGATED 2 Buildings - Exterior Surface Area (A)		46.82	7.43
MITIGATED Phase 2 Buildings - Interior Surface Area (A)		140.45	22.29

Assumptions: Default value based on SCAQMD methods used in coating rules are 25% for exterior shell and 75% for interior surfaces.
Assumes architectural coating occurs for 2% of the Building Phase duration (consistent with paint sprayers estimated duration)

CalEEMod Default Assumptions	Unmitigated	Mitigated	Unit	Sources/Notes:
NonResidential Interior	250	100	g/L	CalEEMod Appendix D
NonResidential Exterior	250	100	g/L	CalEEMod Appendix D

	Unmitigated	Mitigated
Interior EF_{AC} (lb/sq.ft)	0.011590844	0.004636337
Exterior EF_{AC} (lb/sq.ft)	0.011590844	0.004636337

Painting of Stripes, Handicap Symbols, Directional Arrows, etc.

Total	14869	square feet	Qty	Sq. Ft. per qty.	Sources/Notes
ADA Parking Spaces	418	square feet	2	209	1
Parking Spaces	13851	square feet	81	171	1
Golf Cart Spaces	600	square feet	12	50	1

		Parking-Related Paint	
	square feet	VOC Emissions (lbs)	VOC Emissions (lbs/day)
A_{Paint}	892	4.14	0.07

Assumes paint sprayers during building construction also paint the paved areas.
CalEEMod Default Assumptions
Parking Lot Paint 100 g/L

Parking EF AC (lb/sq.ft) 0.004636337

Conversion Factors	
tons	pounds
1	2000
sq. ft.	acre
43560	1
grams	lb
453.592	1
L	gal
3.78541	1
L	oz
1	33.814

Asphalt Paving Off-Gassing Emissions

	lbs VOC	lbs/day
Asphalt Paving Off-Gassing	5.128668	0.381597

Assumes asphalt paving occurs for 16% of the roadway paving phase (consistent with estimated usage of pavers)

Project Information

				Source/Notes
Paved Area Total	85269	sq. ft.	1.958	1

Note: Includes parking lot paved area and Ridge Valley Road paving, assuming 1,600 feet by 44 feet wide

CalEEMod Assumption (lb VOC/acre) 2.62

Source: CalEEMod User's Guide Appendix A

Conversion Factors	
tons	pounds
1	2000
sq. ft.	acre
43560	1

CalEEMod
Equipment HP and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	221	0.50
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	231	0.29
Crawler Tractors	212	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	158	0.38
Forklifts	89	0.201
Generator Sets	84	0.74
Graders	187	0.41
Off-Highway Tractors	124	0.44
Off-Highway Trucks	402	0.38
Other Construction Equipment	171	0.42
Other General Industrial Equipmen	88	0.34
Other Material Handling Equipmen	168	0.40
Pavers	130	0.42
Paving Equipment	132	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.3
Pumps	84	0.74
Rollers	80	0.38
Rough Terrain Forklifts	100	0.40
Rubber Tired Dozers	247	0.4
Rubber Tired Loaders	203	0.36
Scrapers	367	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	263	0.30
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	97	0.37
Trenchers	78	0.50
Welders	46	0.45

Operational Emissions Summary

Project Operational Emissions:

	Daily Emissions (lb/day)						Total Emissions (metric tons)
	ROG	CO	NOX	SO2	PM10	PM2.5	CO2e
On-Site Equipment + Backup Generator	0.83	3.48	2.53	0.01	0.11	0.15	98
On-site Fueling	0.41	-	-	-	-	-	-
On-site Sand Silo	-	-	-	-	0.04	0.064	-
On-Road Vehicles	0.06	2.00	1.58	0.02	2.26	0.01	0.13
Architectural Coatings	0.13	-	-	-	-	-	-
Facility Natural Gas	0.04	0.32	0.39	0.002	0.03	0.03	85
Facility Electricity	-	-	-	-	-	-	329
Facility Water	-	-	-	-	-	-	24
Facility Waste	-	-	-	-	-	-	279
Total	**1.48**	**5.80**	**4.50**	**0.03**	**2.44**	**0.25**	**815**
Air District Threshold	55.00	550.00	55.00	150.00	150.00	55.00	10,000
Exceed Threshold?	No	No	No	No	No	No	No

On-Site Emissions Sources	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**
Locomotive Operations (On-site)	4.45	101.85	98.30	0.37	1.98	1.92
On-Site Equipment + Backup Generator	0.83	3.48	2.53	0.01	0.11	0.15
On-Road Vehicles	0.004	0.14	0.11	0.00	0.16	0.00
Architectural Coatings	0.13	-	-	-	-	-
On-site Fueling	0.41	-	-	-	-	-
Facility Natural Gas	0.04	0.32	0.39	0.00	0.03	0.03
On-site Sand Silo	-	-	-	-	0.04	0.06
Total	**5.88**	**105.80**	**101.34**	**0.38**	**2.32**	**2.16**

Locomotive Operational Emissions

Daily Locomotive Operational Emissions	Daily In-Transit Emissions (lbs/day)										MT/Year
Operational Activity	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	**N2O**	**CO2e**	**CO2e**
On-site	4.45	101.85	98.30	0.37	1.98	1.92	38943.59	3.06	0.99	39316.50	6509.29

Maintenance Facility On-Site Emissions				Daily Idling Emissions (lbs/day)									
	Daily Idling Hours	*HP*	*Load Factor*	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	**N2O**	**CO2e**
Arrival and Departure Idling Emissions per Tier 2 train per day	0.166666667	3000	0.40	0.1207	0.5644	2.1826	0.0020	0.0794	0.0770	215.7986	0.0170	0.0055	218
Arrival and Departure Idling Emissions per Tier 4 train per day	0.166666667	4000	0.40	0.0248	0.7525	0.5879	0.0027	0.0088	0.0086	287.7315	0.0226	0.0073	290
Other on-site engines operations per Tier 2 train per day	1	3000	0.70	1.2679	5.9277	22.9236	0.0214	0.8336	0.8086	2266.5331	0.1781	0.0579	2288
Other on-site engines operations per Tier 4 train per day	1	4000	0.70	0.2601	7.9036	6.1747	0.0285	0.0926	0.0898	3022.0441	0.2375	0.0772	3051

*Daily idling time estimated as up to 5 minutes upon arrival and departure (10 minutes total) per train per day.
Additional on-site engine operations for movement, maintenance, testing bsaed upon project engineer input.

Emission Factors

	Emission Factors (g/bhp-hr)*				Emission Factors (g/bhp-hr)									
Locomotives	**PM10**	**HC**	**NOx**	**CO**	**HC**	**ROG**	**CO**	**NO_X**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	**N2O**
Tier 2	**0.18**	**0.26**	**4.95**	**1.28**	0.26	0.27378	1.28	4.95	0.004615385	0.18	0.1746	489.4230769	0.038461538	0.0125
Tier 4	0.015	0.04	1	1.28	0.04	0.04212	1.28	1	0.004615385	0.015	0.01455	489.4230769	0.038461538	0.0125

*Source: EPA Emission Factors for Locomotives - Technical Highlights (EPA-420-F-09-025)

Notes:
Assumes Line-Haul Locomotives with Tier 4 Engines

Emission Factors Calculations:	Conversion Factor		
ROG is estimated as 1.053 times the EF for HC	1.053		
PM10 = PM			
PM2.5 as a 97% of PM10	97%		
SO2 Emission Factor (g/gal) = (fuel density) * (64 g SO2 / 32 g S) * (S content of fuel)			
Fuel density	3200		
2281)	15		
SO2 EF (g/gal)	0.096		
CO2 is defined by U.S. EPA as 10,180 g CO2/gal diesel fuel (https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references#:~:text=of%20diesel%20consumed-,In%20the%20preamble%20to%20the%20joint%20EPA%2FDepartment%20of%20Transportation,emissions%20per%20gallon%20of%20diesel)	10180	CO2 (g/gal) = (fuel density) * (44 g CO2/12 g C) * (C content of fuel)	
CH4 and N2O Emission Factors per EPA: Table 5 in https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf		Carbon content of renewable diesel =	
CH4 g/gal	0.8	density of fuel	3200 g/gal
N2O g/gal	0.26	39.33 gCO2e/MJ	
Conversion for g/gal to g/hp-hr (divide by) per EPA 2009 Technical Highlights			
Line Haul and Passenger	20.8		
Switch	15.2		

Operational Variables	
Operational Days per Year	*365*
Number of Trains Serviced at Facility Daily	12
Engine Tier	2
Engine HP	3000
Engine Tier	4
Engine HP	4000

**Per Metrolink Ops excel table, average operational hours are about 15 hours per train.*
***Per project-specific data inputs, 15 existing engines are Tier 2 and 40 engines are Tier 4*

Locomotive Engine Mix

	2026	2021	2028
Percent Tier 2	8%	27%	0.00%
Percent Tier 4	92%	73%	100%

Horsepower and Load Factor Calculations

Notch	*Percent Operating Time at Each Notch Power Level[1]*	Reweighted time (split idle and moving time)	Notch Power Level as a Percent of Rated Power[2]
Normal Idle	*47.40%*	100.00%	0.40%
Dynamic Break	*6.20%*	11.79%	2.10%
Notch 1	*7.00%*	13.31%	4.50%
Notch 2	*5.10%*	9.70%	11.50%
Notch 3	*5.70%*	10.84%	23.50%
Notch 4	*4.70%*	8.94%	35.00%
Notch 5	*4.00%*	7.60%	48.50%
Notch 6	*2.90%*	5.51%	64.00%
Notch 7	*1.40%*	2.66%	85.00%
Notch 8	*15.60%*	29.66%	100.00%

1. Per EPA 1998 Locomotive Emission Standards Regulatory Support Document , Table 4-5 https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF
2. Per EPA 1998 Locomotive Emission Standards Regulatory Support Document , Table 5-2 https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF

Time-weighted engine Load Factor

Idle	0.40%
In-transit	46.8%
Idling and In-Transit	24.8%
Idling and In-Transit	70.0%

Conversion Factors (per EPA 2009 Emission Factors for Locomotives Technical Highlights - Table 3)

Locomotive Application	**Conversion Factor (bhp-hr/gal)**
Large Line-Haul and Passenger	20.8
Small Line-Haul	18.2
Switching	15.2

Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

On-Site Equipment Exhaust Emissions

Project-Specific Equipment (CalEEMod equivalent) [1]	# / Day	Operational hours / day	Horsepower [2]	Load Factor	Emission Factors (g/hp-hr) [3]							Emission Factors (g/gal)		gal/hp-hr
					ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O	
Crane	4	6	231	0.29	0.035984	0.23724301	0.1553145	0.0009742	0.002854	0.0026	105	0.57	0.26	7.22227E-05
Forklift	4	6	89	0.2	0.0475337	1.014356664	0.1487462	0.0015081	0.00548	0.005	163	0.57	0.26	0.002415779
Total														

Project-Specific Equipment (CalEEMod equivalent) [1]	Daily Emissions (lb/day)									Annual Emissions (metric tons/year)
	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e
Crane	0.13	0.84	0.55	0.00	0.01	0.01	374	0.0001	0.0001	61.90
Forklift	0.04	0.96	0.14	0.00	0.01	0.00	154	0.0013	0.0006	25.49
Total	**0.17**	**1.80**	**0.69**	**0.00**	**0.02**	**0.01**	**528**	**0.00**	**0.00**	**87.39**

1. Equipment types is based on project-specific list of anticipated equipment requirements provided by project engineers.
2. Used CalEEMod default horsepower and loadfactors of off-road equipment.
3. Emission factors based on CARB OFFROAD2017 emissions database for year 2028.

Conversion Factors

grams per pound	453.59237
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

Average Operational Days per Year:	365

On-Site Emergency Generator Exhaust Emissions

						Emissions (lbs/day)								
Equipment Type	Horsepower	Load Factor	Hours of Operation per Day	Number of Units	Days per Year	ROG	CO	NO_X	SO2	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	CO_2	CH_4	N_2O
300KV Backup Generator	402	0.73	1	1	50	0.660285	1.682118242	1.843860381	0.003196025	0.09704528	0.13293874	462.3	0.06469686	0

	Emissions (tons/year)									
Equipment Type	ROG	CO	NO_X	SO2	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	CO_2	CH_4	N_2O	CO_2e (MT/year)
300KV Backup Generator	0.02	0.04	0.05	0.00	0.00	0.00	11.56	0.00	0.00	10.52

Emission factors and load power based upon CalEEMod modeling factors.

Conversion Factors	
lb	grams
1	453.59237
metric ton	grams
1	1000000
ton	lbs
1	2000
metric ton	lbs
1	2204.623
metric ton	ton
0.907185	1
CO2 grams	gallons diesel
10180	1
CO2 grams	gallons diesel
8890	1
GWP CO2e	CH4
25	1
GWP CO2e	N2O
298	1

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

CalEEMod Emission Factors	Diesel Emergency Generator Emission Factors								
Horsepower Bin	TOG (lb/hp-hr)	ROG (lb/hp-hr)	CO (g/hp-hr)	NOX (g/hp-hr)	SO2 (g/hp-hr)	PM10 (g/hp-hr)	PM2.5 (g/hp-hr)	CO2 (lb/hp-hr)	CH4 (g/hp-hr)
175-300	0.00247	0.00225	2.6	2.85	0.00494	0.15	0.15	1.15	0.073
300-600	0.00247	0.00225	2.6	2.85	0.00494	0.15	0.15	1.15	0.073

Offsite On-Road Vehicle Emissions (Exhaust)

Vehilcle Type	Trips / Day[1]	Miles / Day[2]	Daily Emissions[3] (lb/day)													Daily Emissions (metric tons/day)	Annual Emissions (metric tons)
			ROG	CO	NOX	SO2	PM10 Fugitive Dust[4]	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust[4]	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	CO2e	CO2e
Fuel Trucks	2	33.2	0.001	0.011	0.134	0.001	0.117	0.001	0.117	0.029	0.001	0.030	91.236	0.000	0.014	0.041	0.007
Delivery Haul Trucks	20	332	0.010	0.112	1.341	0.009	1.165	0.009	1.175	0.294	0.007	0.301	912.362	0.000	0.143	0.414	0.069
Worker Trips	80	1328	0.044	1.877	0.105	0.007	0.978	0.0	0.986	0.260	0.003	0.267	718.540	0.011	0.015	0.326	0.054
Total On-Road Emissions			0.056	2.001	1.580	0.017	2.260	0.014	2.278	0.584	0.011	0.598	1722	0.012	0.173	0.781	0.129

1.Trips per day reflects estiamted maximum daily workers, delivery trucks, and fuel trucks. Trips are one-way trips.
2. Miles per day based on trip length data from CalEEMod for Orange County for commercial-worker (C-W) and commericial-nonworker (C-NW) trips.
3. Emission factors based on EMFAC2017 aggregate fleet for year 2028 (anticipated construction completion / operational year), and gasoline light duty vehicle (LDA, LDT1, LDT2 and MDV) emission factors were adjusted using the CARB Off-Model Adjustment Factors for the same year.
4. Includes emission factor for fugitive re-entrained road dust emissions for paved roads (AP-42,Section 13.2.1)

Assumptions	
Fuel Truck Trip length (miles) (CalEEMod default C-NW for Orange County Urban)	6.9
Delivery Truck Trip length (miles) (CalEEMod default C-NW for Orange County Urban)	6.9
Worker Trip length (miles) (CalEEMod default C-W for Orange County Urban)	16.6
Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.	

Operational Days per Year: 365

Vehilcle Type	Emission Factors (g/mile)[3]																					
	ROG_ RUNEX	ROG_ STREX	CO_ RUNEX	CO_ STREX	NOX_ RUNEX	NOX_ STREX	SO2_ RUNEX	SO2_ STREX	PM10 Fugitive Dust[4]	PM10_ RUNEX	PM10_ STREX	PM10 Total	PM2.5 Fugitive Dust[4]	PM2.5_ RUNEX	PM2.5_ STREX	PM2.5 Total	CO2_ RUNEX	CO2_ STREX	CH4_ RUNEX	CH4_ STREX	N2O_ RUNEX	N2O_ STREX
Fuel Trucks	0.014	0.000	0.154	0.000	1.614	3.606	0.012	0.000	1.592	0.013	0.000	1.605	0.402	0.009	0.000	0.411	1246.507	0.000	0.001	0.000	0.196	0.000
Delivery Haul Trucks	0.014	0.000	0.154	0.000	1.614	3.606	0.012	0.000	1.592	0.013	0.000	1.605	0.402	0.009	0.000	0.411	1246.507	0.000	0.001	0.000	0.196	0.000
Worker Trips	0.006	0.153	0.530	1.853	0.027	0.146	0.002	0.000	0.334	0.001	0.001	0.337	0.089	0.001	0.001	0.091	242.415	49.957	0.002	0.036	0.004	0.021

Architectural Coatings

Max Daily Arch Coating and Parking Related VOC Emissions (lbs)	0.13

Phase 1	Total Sq. Ft.	Source/Note
Train Wash	11,110	1
S&I (Pump House)	750	
Utility Building	961	
Transportation Building	7,495	
Total (assumes 10% of total area per year)	2,032	

		Architectural Coatings	
		Total VOC Emissions (lbs)	VOC Emissions (lbs/day)
Buildings Exterior Surface Area (A)		5.89	0.03
Buildings - Interior Surface Area (A)		17.66	0.10

Assumptions: Surface for painting is 2 times the nonresidential square footage. Default value based on SCAQMD methods used in coating rules are 25% for exterior shell and 75% for interior surfaces.

Assumes architectural coating occurs for 2% of the Building Phase duration (consistent with paint sprayers estimated duration)

CalEEMod Default Assumptions		Unit	Sources/Notes:
NonResidential Interior	250	g/L	CalEEMod Appendix D
NonResidential Exterior	250	g/L	CalEEMod Appendix D

Interior EF_{AC} (lb/sq.ft) 0.011590844

Exterior EF_{AC} (lb/sq.ft) 0.011590844

Painting of Stripes, Handicap Symbols, Directional Arrows, etc.

			Qty	Sq. Ft. per qty.	Sources/Notes
Total (assumes 10% of total area per year)	1486.9	square feet			
ADA Parking Spaces	418	square feet	2	209	1
Parking Spaces	13851	square feet	81	171	1
Golf Cart Spaces	600	square feet	12	50	1

		Parking-Related Paint	
	square feet	VOC Emissions (lbs)	VOC Emissions (lbs/day)
A_{Paint}	89	0.41	0.002

Assumes paint sprayers during building construction also paint the paved areas.

CalEEMod Default Assumptions

Parking Lot Paint 100 g/L

Parking EF AC (lb/sq.ft) 0.004636337

Conversion Factors	
tons	pounds
1	2000
sq. ft.	acre
43560	1
grams	lb
453.592	1
L	gal
3.78541	1
L	oz
1	33.814

Sources/Notes

1 Square footages from AQ Request - GF Responses

The emission factor (EF) is based on the VOC content of the surface coatings and is calculated estimated using the equation below:

$$EF_{AC} = C_{VOC} / 454(g/lb) \times 3.785(L/Gal)/180(sqft)$$

Where:

EF = emission factor (lb/sq. ft.)

C = VOC content (g/L). This varies by location and year.

$$E_{AC} = EF_{AC} \times F \cdot A_{paint}$$

Where:

E = emissions (lb VOC)

EF = emission factor (lb/sq. ft.)

A = building surface area (sq. ft.).

CalEEMod also calculates the VOC emissions from the painting of stripes, handicap symbols, directional arrows and car space descriptions in parking lots. Please refer to Appendix E for the studies conducted to determine a default percent of parking lot square footage that is painted. The equation for striping emission is the same as that for E_{AC} above, but A_{paint} is:

$$A_{paint} = A_{PL} \times P\%$$

Where:

A_{PL} = Parking lot area (sq. ft.)

P% = Default percent of parking lot area that is painted (6%)

The VOC content limit for parking lot area is either provided by local air districts or based on the exterior coating VOC limit of the region where the project is located. If the user has more specific VOC content limit on the coating being applied the default can be overridden but the user is expected to explain and justify the change in the “Remarks” box at the bottom of the screen.

Fuel Tank Emissions

	Total Losses (tpy)	Hexane (-n) tpy	Benzene (tpy)	Toluene (tpy)	Ethylbenzene (tpy)	Xylene (-m) (tpy)	1,2,4-Trimethylbenzene (tpy)
Tank 1-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 2-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 3-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 4-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 5-10,000	1.44E-02	0.00E+00	0.00E+00	3.14E-04	3.37E-05	8.54E-04	6.92E-04

Speciated TACs from SCAQMD storage tank guidance document for diesel.
http://www.aqmd.gov/docs/default-source/planning/annual-emission-reporting/supplemental-instructions-for-liquid-organic-storage-tanks.pdf

APPENDIX 3: Default TAC Profile for Select Petroleum Products

Crude Oil

Chemical Name	CAS Number	Liquid Weight (%)	Molecular Weight
Hexane (-n)	110543	0.40	86.17
Benzene	71432	0.60	78.11
Isooctane	26635643	0.10	114.22
Toluene	108883	1.00	92.13
Ethylbenzene	100414	0.40	106.17
Xylene (-m)	1330207	1.40	106.17
Isopropyl benzene	98828	0.10	120.20
1,2,4-Trimethylbenzene	95636	0.33	120.19
Cyclohexane	110827	0.70	84.16

Distillate Fuel Oil #2 (Diesel)

Chemical Name	CAS Number	Liquid Weight (%)	Molecular Weight
Hexane (-n)	110543	0.00	86.17
Benzene	71432	0.00	78.11
Toluene	108883	0.03	92.13
Ethylbenzene	100414	0.01	106.17
Xylene (-m)	1330207	0.29	106.17
1,2,4-Trimethylbenzene	95636	1.00	120.19

Sand Silo Fugitive Dust

*Note that exhaust emissions assoiated with truck delivery is captured under "On-Road Vehicle Emissions"

Estimated Sand Throughput (tons per year)	Pneumatic Transfer Emission Factor (pounds PM10 per ton)	Gravity Transfer Emission Factor (pounds PM10 per ton)	Pneumatic Transfer Emissions (pounds PM10 per year)	Gravity Transfer Emissions (pounds PM10 per year)	Total PM10 (pounds)
1243	0.00034	0.00099	0.42254	1.23033	1.65287

Notes:
1. Sand throughput based on estimated throughput of reference Los Angeles Commerce Railyard Maintenance Facility sand throughput. Throughput is scaled based on facility operations.
2. Emission factors based on AP-42, Table 11.12-2.

Facility Natural Gas Emissions (Direct)

	Emissions (lbs/day)									Emissions (tons/year)									
kBTU/yr	ROG	CO	NO_X	SO2	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	CO_2	CH_4	N_2O	ROG	CO	NO_X	SO2	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	CO_2	CH_4	N_2O	CO_2e (MT/year)
327	0.042	0.324	0.385	0.002	0.029	0.029	462.111	0.009	0.008	0.008	0.059	0.070	0.000	0.005	0.005	84.335	0.002	0.002	84.86

*Natural gas consumption and daily emissions estimate using CalEEMod General Office Building of the same square footage as the proposed project.

Conversion Factors	
kWh to MWh	0.001
pounds per ton	2000
pounds per metric ton	2204.62262
average days per month	30.5
days per year	365
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth assessment	

Operational Days per Year: 365

Facility Electricity Emissions (Indirect)

		Emissions (lb/day)				Emissions (metric tons per year)			
kWh/month	**Electricity Provider**	**CO2**	**CH4**	**N2O**	**CO2e**	**CO2**	**CH4**	**N2O**	**CO2e**
128,011	SCE	1961.63	0.14	0.08	1989.52	324.77	0.02	0.01	329.39

*Electricity estimate based upon CalEEMod General Office Building of the same square footage as the proposed project (this is a conservative estimate resulting in higher electricity consumption compared to industrial uses).

Emission Factors

	CO2 (MT/MWh)	CH4 (MT/MWh)	N2O (MT/MWh)	CO2 (lb/MWh)	CH4 (lb/MWh)	N2O (lb/MWh)
SCE	0.21	-	8.82179E-06	467.38	0.034	0.019

Notes:
Southern California Edison emission factors for CO2 and N2O based upon EEI Metrics produced by Edison International for Southern California Edison (https://www.edison.com/content/dam/eix/documents/sustainability/eix-esg-pilot-quantitative-section-sce.xlsx). Emission factor for CH4 based upon U.S. EPA eGrid for CAMX subregion (https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf)

Conversion Factors	
kWh to MWh	0.001
pounds per ton	2000
pounds per metric ton	2204.62262
average days per month	30.5
days per year	365
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.	

Operational Days per Year: 365

Facility Waste Emissions (Indirect)

		Emissions (metric tons per year)			
Average Annual Waste Tonnage (tons/1000 sq ft/year)	**Average Annual Waste Tonnage (tons/year)**	**CO2**	**CH4**	**N2O**	**CO2e**
3.82	599.2052	124.43	6.17	0.00	278.69

*Anticipated waste based on CalEEMod data for Automobile Care Center (note this is more conservative than data for Heavy Industrial) in Climate Zone 8.

Emission Factors

CO2 (tons/ton waste)	CH4 (tons/ton waste)	N2O (tons/ton waste)
0.23	0.011350894	0

Source: CalEEMod

Conversion Factors	
metric tons per ton	0.907185
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

Facility Water Emissions (Indirect)

Single Wash Fresh Water Demand (gallons)	Single Wash Reclaim Water Demand (gallons)	Trains Washed per Day	Building General Operational Water Demand (per 1,000 sq ft)	Annual Fresh Water Demand (mgd)	Daily Reclaim Water Demand (mgd)	Emissions (metric tons per year) CO2	CH4	N2O	CO2e
1,101.00	1,220.00	10.00	177,734	31.90	4.45	23.77	0	0.00	24.07

*Anticipated water use provided by project engineering team for train washes; also added typical building water demand for staff and general operations based on CalEEMod default data for a General Office Building.

Energy Demand	kWhr/million gallons	MWh/million gallons
Fresh Water	3500	3.5
Reclaimed Water	111	0.111

Source: CalEEMod energy demand for water supply, treat, and distribute.

Conversion Factors	
pounds per ton	2000
pounds per metric ton	2204.62262
average days per month	30.5
days per year	365
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

	CO2 (MT/MWh)	CH4 (MT/MWh)	N2O (MT/MWh)
SCE	0.21	0	8.82179E-06

Notes:
Southern California Edison emission factors for CO2 and N2O based upon EEI Metrics produced by Edison International for Southern California Edison (https://www.edison.com/content/dam/eix/documents/sustainability/eix-esg-pilot-quantitative-section-sce.xlsx). Emission factor for CH4 based upon U.S. EPA eGrid for CAMX subregion (https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf)

EIC Code:

SCC/EIC	YEAR	PM PROFILE NUMBER	PM2.5/TPM	PM10/TPM	OG PROFILE	ROG/TOG	VOC/TOG
43042270780000	0	371	0.075	0.5	600	0.6986	0.6986

https://www.arb.ca.gov/app/emsinv/2017/emseic_query.php?F_YR=2020&F_DIV=-4&F_SEASON=A&SP=SIP105ADJ&SPN=SIP105ADJ&F_AREA=CA&F_EICSUM=430

PM10 (lb/yr)	1.652870894
PM10 (lb/hr)	0.000754736
PM10/PM2.5 (g/s)	

PM PROFILE NUMBER	SAROAD	WEIGHT FRACTION OF PM2.5	WEIGHT FRACTION OF PM10	WEIGHT FRACTION OF TPM	CAS	TAC	lb/yr	lb/hr
371	12114	0.0005	0.0005	0.0005	7440508	Copper	8.26E-04	3.77E-07
371	12126	0.0055	0.0055	0.0055	N/A	Iron	9.09E-03	4.15E-06
371	12136	0.0005	0.0005	0.0005	7440020	Nickel	8.26E-04	3.77E-07
371	12165	0.4	0.4	0.4	1175	Silica, crystln	6.61E-01	3.02E-04
371	12403	0.0055	0.0055	0.0055	9960	Sulfates	9.09E-03	4.15E-06
371	12999	0.588	0.588	0.588	N/A	Other	9.72E-01	4.44E-04

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: ORANGE
Calendar Year: 2028
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN. Note 'day' in the unit is operation day.

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	VMT	%VMT	Trips	%Trips
ORANGE	2028	LDA	Aggregated	Aggregated	GAS	1411674.912	50878519.1	57.71%	6683308.947	57%
ORANGE	2028	LDA	Aggregated	Aggregated	DSL	15920.07914	592226.2677	0.67%	76102.48189	1%
ORANGE	2028	LDA	Aggregated	Aggregated	ELEC	59785.95341	2456904.286	2.79%	294218.8335	3%
ORANGE	2028	LDT1	Aggregated	Aggregated	GAS	163763.9552	5651024.535	6.41%	758748.0988	6%
ORANGE	2028	LDT1	Aggregated	Aggregated	DSL	24.64592637	736.2971993	0.00%	102.2031952	0%
ORANGE	2028	LDT1	Aggregated	Aggregated	ELEC	3304.208074	139600.8795	0.16%	16405.6098	0%
ORANGE	2028	LDT2	Aggregated	Aggregated	GAS	479336.0185	16749817.97	19.00%	2240043.251	19%
ORANGE	2028	LDT2	Aggregated	Aggregated	DSL	4143.230594	155300.4458	0.18%	19940.42034	0%
ORANGE	2028	LDT2	Aggregated	Aggregated	ELEC	12010.15439	349262.4991	0.40%	59524.73884	1%
ORANGE	2028	MDV	Aggregated	Aggregated	GAS	315682.2972	10621237.82	12.05%	1460180.383	12%
ORANGE	2028	MDV	Aggregated	Aggregated	DSL	9344.610081	338224.9396	0.38%	44718.51684	0%
ORANGE	2028	MDV	Aggregated	Aggregated	ELEC	7944.433907	236534.5432	0.27%	39689.56194	0%
							88,169,389.59	1.00	11,692,983.05	1.00
Worker Vehicle Weighted Average Emission Factors (accounts for SAFE Rule)										
Haul and Fuel Truck Emission Factor										
ORANGE	2028	T7 Single	Aggregated	Aggregated	DSL	2663.768192	194675.0856	100%	30739.51562	

Vehicle Category	Fuel	ROG_RUNEX	ROG_STREX	CO_RUNEX	CO_STREX	NOx_RUNEX	NOx_STREX	SOx_RUNEX	SOx_STREX	PM10_RUNEX	PM10_STREX	PM10_PMTW	PM10_PMBW
LDA	GAS	0.004238235	0.131529841	0.480052086	1.728090108	0.020666771	0.131325118	0.002223683	0.000456419	0.001173899	0.001471991	0.008000002	0.036750011
LDA	DSL	0.008498971	0	0.196887456	0	0.020888547	0	0.001665124	0	0.002468205	0	0.008000002	0.036750011
LDA	ELEC	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
LDT1	GAS	0.010563564	0.188108592	0.695023659	1.832733697	0.044289341	0.168287266	0.002626948	0.00054344	0.001422127	0.001743226	0.008000002	0.036750011
LDT1	DSL	0.063453782	0	0.45651042	0	0.247160389	0	0.00319413	0	0.035351113	0	0.008000002	0.036750011
LDT1	ELEC	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
LDT2	GAS	0.007966005	0.193658875	0.626007517	2.224931153	0.035888226	0.176904177	0.002708463	0.000572968	0.001227962	0.001496399	0.008000002	0.036750011
LDT2	DSL	0.017172368	0	0.167659441	0	0.03267798	0	0.002275403	0	0.004338879	0	0.008000002	0.036750011
LDT2	ELEC	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
MDV	GAS	0.009532677	0.227426582	0.666664182	2.38485248	0.042464551	0.204157737	0.003360921	0.000708409	0.001247783	0.001523548	0.008000002	0.036750011
MDV	DSL	0.009487418	0	0.220270272	0	0.023826779	0	0.002989891	0	0.002773437	0	0.008000002	0.036750011
MDV	ELEC	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
Worker Vehicle Weighted Average		0.005925	0.153312	0.529542	1.852656	0.027081	0.145860	0.002398	0.000494	0.001201	0.001448	0.008000	0.036750
T7 Single	DSL	0.01427489	0	0.153637872	0	1.614349314	3.605728287	0.011776379	0	0.012817379	0	0.03600001	0.061740018

Vehicle Category	Fuel	PM2.5_RUNEX	PM2.5_STREX	PM2.5_PMTW	PM2.5_PMBW	CO2_RUNEX	CO2_STREX	CH4_RUNEX	CH4_STREX	N2O_RUNEX	N2O_STREX
LDA	GAS	0.001079357	0.001353441	0.002000001	0.015750005	224.7095449	46.12240883	0.001275336	0.031948574	0.003139936	0.020365464
LDA	DSL	0.002361431	0	0.002000001	0.015750005	176.1365845	0	0.000394761	0	0.027686218	0
LDA	ELEC	0	0	0.002000001	0.015750005	0	0	0	0	0	0
LDT1	GAS	0.001307593	0.001602832	0.002000001	0.015750005	265.4606621	54.91615101	0.002623105	0.041562866	0.004502539	0.022649618
LDT1	DSL	0.033821839	0	0.002000001	0.015750005	337.8745965	0	0.002947307	0	0.053109181	0
LDT1	ELEC	0	0	0.002000001	0.015750005	0	0	0	0	0	0
LDT2	GAS	0.001129066	0.001375884	0.002000001	0.015750005	273.6979072	57.90009413	0.002162847	0.044818303	0.00397438	0.024082926
LDT2	DSL	0.004151181	0	0.002000001	0.015750005	240.6918359	0	0.000797624	0	0.037833405	0
LDT2	ELEC	0	0	0.002000001	0.015750005	0	0	0	0	0	0
MDV	GAS	0.00114729	0.001400846	0.002000001	0.015750005	339.6307051	71.58677008	0.002532832	0.050478075	0.004486793	0.025584364
MDV	DSL	0.00265346	0	0.002000001	0.015750005	316.270206	0	0.000440672	0	0.049713272	0
MDV	ELEC	0	0	0.002000001	0.015750005	0	0	0	0	0	0
Worker Vehicle Weighted Average		0.001106	0.001331	0.002000	0.015750	242.415353	49.956982	0.001626	0.035847	0.003840	0.020918
T7 Single	DSL	0.008901201	0	0.009000003	0.026460008	1246.506913	0	0.000663032	0	0.195933528	0

EMFAC2017 Off-Model Adjustment Factors for Gasoline Light Duty Vehicle Emissions

Year	NOx Exhaust	TOG Exhaust	PM Exhaust	CO Exhaust
2028	1.0034	1.0028	1.0117	1.012

Applied to gas powered LDA, LDT1, and LDT2 vehicles
Source: Table 2 in ARB 2019 EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One
https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

Fugitive Dust Emission Factors

Paved Road Dust	$EF_{DUST} = [(k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N))$	
Source: AP-42 Section 13.2.1 (Paved Roads) - http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0201.pdf		
Variable	Value	Description
k (PM10)	0.0022	particle size multiplier for particle size rangeand units of interest (lb/VMT)
k (PM2.5)	0.00054	particle size multiplier for particle size rangeand units of interest (lb/VMT)
sL	0.1	road surface silt loading (g/m^2)
W	2.4	average weight (tons) of vehicles (2.4 tons)
W	12	haul truck tons
P	51	number of "wet" days with at least 0.254 mm (0.1 inches) of precipitation during the averaging period
N	365	number of days in averaging period
Pickup and Worker		
EF (PM10)	0.000637964	lb/VMT
EF (PM2.5)	0.000156591	lb/VMT
Haul Truck		
EF (PM10)	0.003294168	lb/VMT
EF (PM2.5)	0.000808568	lb/VMT

OFFROAD Tons Per Year and Gallons Per Horsepower-Hour Calculation

Constants	
lbs	grams
1	453.5924
ton	lbs
1	2000

CH4 Emissions Factor (g/gallon diesel): 0.57
N2O Emissions Factor (g/gallon diesel): 0.26

Region	CalYr	VehClass	MdlYr	HP_Bin	Fuel	HC_g_hp-hr	ROG_g_hp-hr	TOG_g_hp-hr	CO_g_hp-hr	NOx_g_hp-hr	CO2_g_hp-hr	PM10_g_hp-hr	PM2_5_g_hp-hr	PM_g_hp-hr	SOx_g_hp-hr	NH3_g_hp-hr	gal/hp-hr
South Coast AQMD	2028	CHE - Rail RTG Crane	Aggregate(	Aggregate(	Diesel	0.0297389	0.035984038	0.04282398	0.237243	0.155314526	105.470878	0.002854091	0.002625764	0.00285409	0.00097424	0.00086084	7.22227E-05
South Coast AQMD	2028	CHE - Rail Forklift	Aggregate(	Aggregate(	Diesel	0.0392841	0.047533723	0.05656906	1.0143567	0.148746164	163.249337	0.005479709	0.005041333	0.00547971	0.00150814	0.00133242	0.002415779
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregate(	Aggregate(	Gasoline	0.6523443	0.600026265	0.71786508	33.779709	0.754440462	335.070377	0.231449201	0.17487273	0.25716578	0.00393045	0.00517929	0.001767678
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregate(	Aggregate(	Diesel	0.2165427	0.257703711	0.31182149	1.2458643	1.965178752	261.426991	0.074904968	0.06891257	0.07490497	0.0035618	0.00218849	0.004997523
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregate(	Aggregate(	Nat Gas	0	0	0.19748075	52.726227	1.4509006	310.335024	0	0	0.15939052	0	0	0.012648857
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregate(	Aggregate(	Gasoline	0.2431377	0.223638068	0.26755822	24.625827	1.018190829	232.291908	0.016210581	0.012247994	0.01801176	0.00232723	0.00360408	2.81879E-05
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregate(	Aggregate(	Nat Gas	0	0	0.01887453	8.2085885	0.886377026	202.398041	0	0	0.01800889	0	0	1.35055E-05
South Coast AQMD	2028	OFF - Industrial - Other General Industrial E(	Aggregate(	Aggregate(	Gasoline	0.9981045	0.918056541	1.09835314	69.488677	1.513604764	360.713457	0.055085962	0.041620504	0.06120662	0.00515933	0.00628188	0.00441549
South Coast AQMD	2028	OFF - Industrial - Other General Industrial E(	Aggregate(	Aggregate(	Diesel	0.2347298	0.279347844	0.33801089	1.3300849	2.18657337	289.833446	0.082558925	0.075954211	0.08255892	0.00387491	0.00242538	0.00485907
South Coast AQMD	2028	OFF - Industrial - Other Material Handling E(	Aggregate(	Aggregate(	Gasoline	0.2823722	0.259725989	0.31073343	18.776703	1.448620842	410.757795	0.028633529	0.021634222	0.03181503	0.00398599	0.00584591	0.019803423
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregate(	Aggregate(	Gasoline	0.621852	0.571979475	0.6843102	45.428046	1.655059377	532.488381	0.046635848	0.035235974	0.05181761	0.00603441	0.00803572	0.00239064
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregate(	Aggregate(	Diesel	0.3064518	0.364702928	0.44129054	1.8813037	2.896232509	386.31212	0.110040831	0.101237564	0.11004083	0.00532149	0.00323403	0.042474795

OFFROAD Tons Per Year and Gallons Per Horsepower-Hour Calculation

Constants	
year	days
1	365

Region	CalYr	VehClass	MdlYr	HP_Bin	Fuel	HC_tpy	ROG_tpy	TOG_tpy	CO_tpy	NOx_tpy	CO2_tpy	PM10_tpy	PM2_5_tpy	PM_tpy	SOx_tpy	NH3_tpy	gal/hp-hr
South Coast AQMD	2028	CHE - Rail RTG Crane	Aggregated	Aggregated	Diesel	4.255279	5.1488876	6.1276017	33.946651	22.22366	15091.627	0.4083865	0.3757156	0.4083865	0.1394019	0.1231758	0.0103342
South Coast AQMD	2028	CHE - Rail Forklift	Aggregated	Aggregated	Diesel	0.2601088	0.3147316	0.3745567	6.7162873	0.9848823	1080.9112	0.0362824	0.0333798	0.0362824	0.0099858	0.0088223	0.0159954
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Gasoline	16.477303	15.155824	18.132267	853.22817	19.05611	8463.4087	5.8460829	4.4170404	6.4956476	0.0992776	0.1308217	0.0446491
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Diesel	1.1383845	1.3547716	1.6392736	6.5496204	10.331121	1374.3452	0.3937822	0.3622796	0.3937822	0.0187247	0.0115051	0.0262724
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Nat Gas	0	0	0.9779558	261.10859	7.1850886	1536.828	0	0	0.789327	0	0	0.0626391
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregated	Aggregated	Gasoline	267.99528	246.50206	294.91245	27143.487	1122.2872	256040.63	17.867895	13.500187	19.853216	2.565162	3.9725529	0.0310697
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregated	Aggregated	Nat Gas	0	0	47.204143	20529.222	2216.7795	506186.21	0	0	45.039241	0	0	0.0337765
South Coast AQMD	2028	OFF - Industrial - Other General Industrial Eq	Aggregated	Aggregated	Gasoline	12.241324	11.25957	13.470831	852.24885	18.563714	4423.996	0.6756057	0.5104577	0.750673	0.0632769	0.0770445	0.0541541
South Coast AQMD	2028	OFF - Industrial - Other General Industrial Eq	Aggregated	Aggregated	Diesel	1.4065327	1.6738901	2.025407	7.9700489	13.102244	1736.7213	0.4947043	0.4551279	0.4947043	0.023219	0.0145332	0.0291162
South Coast AQMD	2028	OFF - Industrial - Other Material Handling Eq	Aggregated	Aggregated	Gasoline	0.7185806	0.6609505	0.7907542	47.782938	3.6864491	1045.2961	0.0728666	0.0550547	0.0809629	0.0101435	0.0148767	0.0503957
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregated	Aggregated	Gasoline	18.01937	16.574217	19.829218	1316.3659	47.958561	15429.886	1.3513643	1.0210308	1.5015159	0.1748587	0.2328506	0.0692734
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregated	Aggregated	Diesel	0.2801105	0.3333546	0.4033591	1.7195947	2.6472845	353.10635	0.1005822	0.0925356	0.1005822	0.0048641	0.002956	0.0388238

OFFROAD2017 (v1.0.1) Emissions Inventory
Region Type: County
Region: Orange
Calendar Year: 2028
Scenario: All Adopted Rules - Exhaust
Vehicle Classification: OFFROAD2017 Equipment Types
Units: Emissions: tons/day, Fuel Consumption: gallons/year, Activity: hours/year, HP-Hours: HP-hours/year

Region	CalYr	VehClass	MdlYr	HP_Bin	Fuel	HC_tpd	ROG_tpd	TOG_tpd	CO_tpd	NOx_tpd	CO2_tpd	PM10_tpd	PM2_5_tpd	PM_tpd	SOx_tpd	NH3_tpd	Fuel_gpy	Total_Activity_hpy	Total_Popula	Horsepower_Hours_hhpy
South Coast AQMD	2028	CHE - Rail RTG Crane	Aggregated	Aggregated	Diesel	0.011658	0.014107	0.016788	0.093005	0.060887	41.34692	0.001118867	0.001029358	0.001118867	0.000381923	0.000337468	1341455.424	456416.8269	94.71014	1.3E+08
South Coast AQMD	2028	CHE - Rail Forklift	Aggregated	Aggregated	Diesel	0.000713	0.000862	0.001026	0.018401	0.002698	2.9614	9.94039E-05	9.14516E-05	9.94039E-05	2.73582E-05	2.41706E-05	96079.37611	45140.98014	17.40261	6006678
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Gasoline	0.045143	0.041523	0.049677	2.337611	0.052209	23.18742	0.016016665	0.01210148	0.017796295	0.000271993	0.000358416	1023098.65	564939.7	1545.94	22914218
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Diesel	0.003119	0.003712	0.004491	0.017944	0.028304	3.765329	0.001078855	0.000992547	0.001078855	5.13005E-05	3.15208E-05	125297.2	272826.55	683.06	4769152
South Coast AQMD	2028	OFF - Industrial - Aerial Lifts	Aggregated	Aggregated	Nat Gas	0	0	0.002679	0.715366	0.019685	4.210488	0	0	0.00216254	0	0	281407.7	238162.5	634.51	4492522
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregated	Aggregated	Gasoline	0.734234	0.675348	0.807979	74.36572	3.074759	701.4812	0.048953136	0.036986814	0.054392373	0.007027841	0.010883707	31067580.9	15191471.55	8437.66	1E+09
South Coast AQMD	2028	OFF - Industrial - Forklifts	Aggregated	Aggregated	Nat Gas	0	0	0.129326	56.24444	6.073368	1386.812	0	0	0.123395181	0	0	76632764.7	34458241.1	19128.77	2.27E+09
South Coast AQMD	2028	OFF - Industrial - Other General Industrial Equip	Aggregated	Aggregated	Gasoline	0.033538	0.030848	0.036906	2.334928	0.050859	12.12054	0.001850975	0.001398514	0.002056638	0.000173361	0.000211081	602531.05	499422.2	1088.43	11126233
South Coast AQMD	2028	OFF - Industrial - Other General Industrial Equip	Aggregated	Aggregated	Diesel	0.003854	0.004586	0.005549	0.021836	0.035897	4.75814	0.001355354	0.001246926	0.001355354	6.36137E-05	3.9817E-05	158274.95	301705.35	211.49	5435974
South Coast AQMD	2028	OFF - Industrial - Other Material Handling Equip	Aggregated	Aggregated	Gasoline	0.001969	0.001811	0.002166	0.130912	0.0101	2.863825	0.000199634	0.000150835	0.000221816	2.77905E-05	4.0758E-05	116343.75	42975.1	111.29	2308603
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregated	Aggregated	Gasoline	0.049368	0.045409	0.054327	3.606482	0.131393	42.27366	0.003702368	0.002797345	0.004113742	0.000479065	0.000637947	1821021.5	643301.55	1531.09	26287442
South Coast AQMD	2028	OFF - Industrial - Sweepers/Scrubbers	Aggregated	Aggregated	Diesel	0.000767	0.000913	0.001105	0.004711	0.007253	0.967415	0.000275568	0.000253522	0.000275568	1.33262E-05	8.09875E-06	32193	44822	68.86	829207

Tank ESP Inputs Key

Fixed roof tank type

Column-supported (cone)	A
Horizontal Tank	D
No fixed roof (open top)	C
Self-supporting (dome)	B

Shell/roof finish

aluminum-colored paint (diffuse)	B
aluminum-colored paint (specular)	A
beige/cream-colored paint	C
black	G
brown paint	D
light gray paint	E
medium gray paint	F
mill finish aluminum (unpainted)	L
red primer or dark green paint	H
rust (unpainted iron oxide)	I
tan paint	J
white paint	K

Shell/roof condition

Aged (Ag)	Ag
Average (Av)	Av
New (N)	N

Tank insulation

Fully insulated (shell and roof insulated)	F
Not insulated	N
Partially insulated (Shell only)	P

Inside shell condition

dense rust	D
gunite lined	G
light rust	L

Shell construction

riveted	R
welded	W

Stock data

Name	Abbrv.
Out of Service	OUT
Crude Oil RVP_X	CRUDE_X
Gasoline RVP_X	GAS_X
Jet kerosene	JET
Kerosene	KERO
Diesel	DIESEL
No. 2 Oil	2OIL
No. 6 Oil	6OIL
Vacuum Residual Oil	STR_RESID
Propylene glycol	PROPGLY
Methanol	METHANOL
Triethylene glycol	TRIGLY

Tank ESP Tank Info

Required entry
Not required - can leave blank if N/A
Defaults will be used if unknown

Closest Met Station	USER ID	Start Date	DIAMETER	HEIGHT (Vert tanks) or LENGTH (Horz tanks)	Fixed Roof Type	Shell Finish	Shell Condition	Roof Finish	Roof Condition	Operating Pressure	Min Vent Relieving Pressure PSIG	Max vent relieving pressure PSIG	HEIGHT Max L (ft)	HEIGHT Min L (ft)	Cone Roof SLOPE (in/ft)	Slope of Cone Bottom	Dome Roof_HEIGHT	Dome Roof_Radius
Santa Ana, CA	Tank 1-30,000	1/1/2023	10	48	D	K	Av	K	Av	0	-0.03	0.03						
Santa Ana, CA	Tank 2-30,000	1/1/2023	10	48	D	K	Av	K	Av	0	-0.03	0.03						
Santa Ana, CA	Tank 3-30,000	1/1/2023	10	48	D	K	Av	K	Av	0	-0.03	0.03						
Santa Ana, CA	Tank 4-30,000	1/1/2023	10	48	D	K	Av	K	Av	0	-0.03	0.03						
Santa Ana, CA	Tank 5-10,000	1/1/2023	10	18	B	K	Av	K	Av									

		Insulation Condition	Vapor Control Efficiency	Max Pump Rate (gal/hr)	Combo PV Vents	P Vents	V Vents	Open Vents	Inside Shell Condition	Shell Construction	Build Date	Assoc. Source Category	Sump Diameter (ft)	Sump Height (ft)	Tank ID 2 (FIN)	Emission Point No. (EPN)	Is Closed?	Control ID No, (CIN)	Location (coordinates)
Santa Ana, CA	Tank 1-30,000	N							L	W							N		
Santa Ana, CA	Tank 2-30,000	N							L	W							N		
Santa Ana, CA	Tank 3-30,000	N							L	W							N		
Santa Ana, CA	Tank 4-30,000	N							L	W							N		
Santa Ana, CA	Tank 5-10,000	N																	

Tank ESP Tank Service

Tank ID	Start Date	Throughtput	Throughput Unit	Stock	Stock RVP	Bulk Storage Temp (degF)	Comments	Min Heated Temp (F)	Max Heated Temp (F)	Heating Cycle Length (days)	Flash Gas
Tank 1-30,000	1/1/2023	1,186,250	gallons	DIESEL							
Tank 2-30,000	1/1/2023	1,186,250	gallons	DIESEL							
Tank 3-30,000	1/1/2023	1,186,250	gallons	DIESEL							
Tank 4-30,000	1/1/2023	1,186,250	gallons	DIESEL							
Tank 5-10,000	1/1/2023	4,745,000	gallons	DIESEL							

TankSummaries for Every month between Jan and Dec 2023

Site: OCTA,

Equations for this site: After 2019 AP-42 revisions H/D ratio: Default 0.5

Tank ID	Row label	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Tank 1-30,000													
	Diameter (ft)	10	10	10	10	10	10	10	10	10	10	10	10
	Fixed Roof Type	D	D	D	D	D	D	D	D	D	D	D	D
	Inside Shell Condition	L	L	L	L	L	L	L	L	L	L	L	L
	Shell Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Shell Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Roof Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Roof Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Product	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Throughput (gal)	100749.999	91000.0014	100749.999	97500.0012	100749.999	97500.0012	100749.999	100749.999	97500.0012	100749.999	97500.0012	100749.999
	Bulk Liquid Temperature (degF)	57.96184	58.622082	60.736128	63.113753	66.438912	69.363065	72.94733	74.241485	72.714272	68.300468	62.584563	57.439062
	Avg. Liquid Surface Temp. (degF)	58.825504	59.682387	62.206889	64.986839	68.375535	71.412614	75.014948	76.219366	74.347351	69.523393	63.565675	58.235875
	Avg. TVP (psia)	0.006235178	0.00641443	0.006969278	0.007628905	0.008507021	0.009368503	0.010489212	0.010889372	0.010273029	0.008824036	0.007285117	0.006114418
	Estimated standing losses (lbs)	0.2566938	0.2334849	0.30469824	0.35631705	0.37805837	0.40107392	0.47727438	0.50535619	0.43417246	0.35460892	0.30237473	0.2480649
	Estimated working losses (lbs)	1.6610115	1.5403807	1.8428117	1.9406263	2.2216069	2.353754	2.7048025	2.8020802	2.5684975	2.301937	1.8607732	1.6308652
	Total estimated emissions (lbs)	1.9177053	1.7738656	2.1475099	2.2969434	2.5996653	2.7548279	3.1820769	3.3074364	3.0026699	2.6565459	2.1631479	1.8789301
	Benzene	0	0	0	0	0	0	0	0	0	0	0	0
	Benzo(g,h,i)perylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Biphenyl	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cumene {isopropylbenzene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cyclohexane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Ethylbenzene	0.004428053	0.004102685	0.004990159	0.005363312	0.006103533	0.006497218	0.007541971	0.007851198	0.007110506	0.006248035	0.005038611	0.004333516
	Hexane (n-)	0	0	0	0	0	0	0	0	0	0	0	0
	Iso-octane {2,2,4 trimethylpentane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Total loss components in the "Cho	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	PACs {Chrysene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Phenanthrene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Toluene	0.042588038	0.039329299	0.047381077	0.050399213	0.056649331	0.059651286	0.068374507	0.070882616	0.064612509	0.057751305	0.047598342	0.041773586
	Trimethylbenzene (1,2,4)	0.086695928	0.080685409	0.099427399	0.108385786	0.125455255	0.135557802	0.160119039	0.16764468	0.150476398	0.129156483	0.101092537	0.084583452
	Xylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Xylene (m-)	0.111806969	0.103616533	0.126120261	0.13565817	0.154530188	0.164640472	0.191312307	0.199225282	0.180333023	0.158240565	0.127393865	0.109401809
Tank 2-30,000													
	Diameter (ft)	10	10	10	10	10	10	10	10	10	10	10	10
	Fixed Roof Type	D	D	D	D	D	D	D	D	D	D	D	D
	Inside Shell Condition	L	L	L	L	L	L	L	L	L	L	L	L
	Shell Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Shell Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Roof Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Roof Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Product	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Throughput (gal)	100749.999	91000.0014	100749.999	97500.0012	100749.999	97500.0012	100749.999	100749.999	97500.0012	100749.999	97500.0012	100749.999
	Bulk Liquid Temperature (degF)	57.96184	58.622082	60.736128	63.113753	66.438912	69.363065	72.94733	74.241485	72.714272	68.300468	62.584563	57.439062
	Avg. Liquid Surface Temp. (degF)	58.825504	59.682387	62.206889	64.986839	68.375535	71.412614	75.014948	76.219366	74.347351	69.523393	63.565675	58.235875
	Avg. TVP (psia)	0.006235178	0.00641443	0.006969278	0.007628905	0.008507021	0.009368503	0.010489212	0.010889372	0.010273029	0.008824036	0.007285117	0.006114418
	Estimated standing losses (lbs)	0.2566938	0.2334849	0.30469824	0.35631705	0.37805837	0.40107392	0.47727438	0.50535619	0.43417246	0.35460892	0.30237473	0.2480649
	Estimated working losses (lbs)	1.6610115	1.5403807	1.8428117	1.9406263	2.2216069	2.353754	2.7048025	2.8020802	2.5684975	2.301937	1.8607732	1.6308652
	Total estimated emissions (lbs)	1.9177053	1.7738656	2.1475099	2.2969434	2.5996653	2.7548279	3.1820769	3.3074364	3.0026699	2.6565459	2.1631479	1.8789301
	Benzene	0	0	0	0	0	0	0	0	0	0	0	0
	Benzo(g,h,i)perylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Biphenyl	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cumene {isopropylbenzene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cyclohexane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Ethylbenzene	0.004428053	0.004102685	0.004990159	0.005363312	0.006103533	0.006497218	0.007541971	0.007851198	0.007110506	0.006248035	0.005038611	0.004333516
	Hexane (n-)	0	0	0	0	0	0	0	0	0	0	0	0
	Iso-octane {2,2,4 trimethylpentane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Total loss components in the "Cho	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	PACs {Chrysene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Phenanthrene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Toluene	0.042588038	0.039329299	0.047381077	0.050399213	0.056649331	0.059651286	0.068374507	0.070882616	0.064612509	0.057751305	0.047598342	0.041773586
	Trimethylbenzene (1,2,4)	0.086695928	0.080685409	0.099427399	0.108385786	0.125455255	0.135557802	0.160119039	0.16764468	0.150476398	0.129156483	0.101092537	0.084583452
	Xylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Xylene (m-)	0.111806969	0.103616533	0.126120261	0.13565817	0.154530188	0.164640472	0.191312307	0.199225282	0.180333023	0.158240565	0.127393865	0.109401809
Tank 3-30,000													
	Diameter (ft)	10	10	10	10	10	10	10	10	10	10	10	10
	Fixed Roof Type	D	D	D	D	D	D	D	D	D	D	D	D
	Inside Shell Condition	L	L	L	L	L	L	L	L	L	L	L	L
	Shell Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Shell Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Roof Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Roof Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Product	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Throughput (gal)	100749.999	91000.0014	100749.999	97500.0012	100749.999	97500.0012	100749.999	100749.999	97500.0012	100749.999	97500.0012	100749.999
	Bulk Liquid Temperature (degF)	57.96184	58.622082	60.736128	63.113753	66.438912	69.363065	72.94733	74.241485	72.714272	68.300468	62.584563	57.439062
	Avg. Liquid Surface Temp. (degF)	58.825504	59.682387	62.206889	64.986839	68.375535	71.412614	75.014948	76.219366	74.347351	69.523393	63.565675	58.235875
	Avg. TVP (psia)	0.006235178	0.00641443	0.006969278	0.007628905	0.008507021	0.009368503	0.010489212	0.010889372	0.010273029	0.008824036	0.007285117	0.006114418
	Estimated standing losses (lbs)	0.2566938	0.2334849	0.30469824	0.35631705	0.37805837	0.40107392	0.47727438	0.50535619	0.43417246	0.35460892	0.30237473	0.2480649
	Estimated working losses (lbs)	1.6610115	1.5403807	1.8428117	1.9406263	2.2216069	2.353754	2.7048025	2.8020802	2.5684975	2.301937	1.8607732	1.6308652
	Total estimated emissions (lbs)	1.9177053	1.7738656	2.1475099	2.2969434	2.5996653	2.7548279	3.1820769	3.3074364	3.0026699	2.6565459	2.1631479	1.8789301
	Benzene	0	0	0	0	0	0	0	0	0	0	0	0
	Benzo(g,h,i)perylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Biphenyl	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cumene {isopropylbenzene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cyclohexane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Ethylbenzene	0.004428053	0.004102685	0.004990159	0.005363312	0.006103533	0.006497218	0.007541971	0.007851198	0.007110506	0.006248035	0.005038611	0.004333516
	Hexane (n-)	0	0	0	0	0	0	0	0	0	0	0	0
	Iso-octane {2,2,4 trimethylpentane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Total loss components in the "Cho	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	PACs {Chrysene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Phenanthrene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Toluene	0.042588038	0.039329299	0.047381077	0.050399213	0.056649331	0.059651286	0.068374507	0.070882616	0.064612509	0.057751305	0.047598342	0.041773586
	Trimethylbenzene (1,2,4)	0.086695928	0.080685409	0.099427399	0.108385786	0.125455255	0.135557802	0.160119039	0.16764468	0.150476398	0.129156483	0.101092537	0.084583452
	Xylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Xylene (m-)	0.111806969	0.103616533	0.126120261	0.13565817	0.154530188	0.164640472	0.191312307	0.199225282	0.180333023	0.158240565	0.127393865	0.109401809

TankSummaries for Every month between Jan and Dec 2023

Site: OCTA,

Equations for this site: After 2019 AP-42 revisions H/D ratio: Default 0.5

Tank ID	Row label	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Tank 4-30,000													
	Diameter (ft)	10	10	10	10	10	10	10	10	10	10	10	10
	Fixed Roof Type	D	D	D	D	D	D	D	D	D	D	D	D
	Inside Shell Condition	L	L	L	L	L	L	L	L	L	L	L	L
	Shell Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Shell Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Roof Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Roof Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Product	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Throughput (gal)	100749.999	91000.0014	100749.999	97500.0012	100749.999	97500.0012	100749.999	100749.999	97500.0012	100749.999	97500.0012	100749.999
	Bulk Liquid Temperature (degF)	57.96184	58.622082	60.736128	63.113753	66.438912	69.363065	72.94733	74.241485	72.714272	68.300468	62.584563	57.439062
	Avg. Liquid Surface Temp. (degF)	58.825504	59.682387	62.206889	64.986839	68.375535	71.412614	75.014948	76.219366	74.347351	69.523393	63.565675	58.235875
	Avg. TVP (psia)	0.006235178	0.00641443	0.006969278	0.007628905	0.008507021	0.009368503	0.010489212	0.010889372	0.010273029	0.008824036	0.007285117	0.006114418
	Estimated standing losses (lbs)	0.2566938	0.2334849	0.30469824	0.35631705	0.37805837	0.40107392	0.47727438	0.50535619	0.43417246	0.35460892	0.30237473	0.2480649
	Estimated working losses (lbs)	1.6610115	1.5403807	1.8428117	1.9406263	2.2216069	2.353754	2.7048025	2.8020802	2.5684975	2.301937	1.8607732	1.6308652
	Total estimated emissions (lbs)	1.9177053	1.7738656	2.1475099	2.2969434	2.5996653	2.7548279	3.1820769	3.3074364	3.0026699	2.6565459	2.1631479	1.8789301
	Benzene	0	0	0	0	0	0	0	0	0	0	0	0
	Benzo(g,h,i)perylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Biphenyl	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cumene {isopropylbenzene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cyclohexane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Ethylbenzene	0.004428053	0.004102685	0.004990159	0.005363312	0.006103533	0.006497218	0.007541971	0.007851198	0.007110506	0.006248035	0.005038611	0.004333516
	Hexane (n-)	0	0	0	0	0	0	0	0	0	0	0	0
	Iso-octane {2,2,4 trimethylpentane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Total loss components in the "Cho	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	PACs {Chrysene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Phenanthrene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Toluene	0.042588038	0.039329299	0.047381077	0.050399213	0.056649331	0.059651286	0.068374507	0.070882616	0.064612509	0.057751305	0.047598342	0.041773586
	Trimethylbenzene (1,2,4)	0.086695928	0.080685409	0.099427399	0.108385786	0.125455255	0.135557802	0.160119039	0.16764468	0.150476398	0.129156483	0.101092537	0.084583452
	Xylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Xylene (m-)	0.111806969	0.103616533	0.126120261	0.13565817	0.154530188	0.164640472	0.191312307	0.199225282	0.180333023	0.158240565	0.127393865	0.109401809
Tank 5-10,000													
	Diameter (ft)	10	10	10	10	10	10	10	10	10	10	10	10
	Fixed Roof Type	B	B	B	B	B	B	B	B	B	B	B	B
	Inside Shell Condition	L	L	L	L	L	L	L	L	L	L	L	L
	Shell Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Shell Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Roof Condition (post-19)	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av	Av
	Roof Finish	K	K	K	K	K	K	K	K	K	K	K	K
	Product	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Throughput (gal)	403000.0002	364000.0014	403000.0002	390000.0006	403000.0002	390000.0006	403000.0002	403000.0002	390000.0006	403000.0002	390000.0006	403000.0002
	Bulk Liquid Temperature (degF)	57.96184	58.622082	60.736128	63.113753	66.438912	69.363065	72.94733	74.241485	72.714272	68.300468	62.584563	57.439062
	Avg. Liquid Surface Temp. (degF)	58.825504	59.682387	62.206889	64.986839	68.375535	71.412614	75.014948	76.219366	74.347351	69.523393	63.565675	58.235875
	Avg. TVP (psia)	0.006235178	0.00641443	0.006969278	0.007628905	0.008507021	0.009368503	0.010489212	0.010889372	0.010273029	0.008824036	0.007285117	0.006114418
	Estimated standing losses (lbs)	0.098946289	0.089995337	0.1174249	0.13729116	0.14563061	0.15445724	0.18374224	0.19453039	0.16715937	0.13658499	0.11651864	0.095623557
	Estimated working losses (lbs)	1.7719724	1.6432831	1.9659174	2.0702663	2.3700173	2.5109923	2.8854919	2.9892681	2.7400813	2.4557137	1.9850787	1.7398122
	Total estimated emissions (lbs)	1.8709186	1.7332784	2.0833423	2.2075575	2.5156479	2.6654495	3.0692342	3.1837985	2.9072407	2.5922987	2.1015974	1.8354357
	Benzene	0	0	0	0	0	0	0	0	0	0	0	0
	Benzo(g,h,i)perylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Biphenyl	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cumene {isopropylbenzene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cyclohexane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Ethylbenzene	0.004320021	0.004008813	0.004841053	0.005154598	0.005906276	0.006286421	0.007274518	0.007557706	0.006884524	0.006096929	0.004895242	0.004233202
	Hexane (n-)	0	0	0	0	0	0	0	0	0	0	0	0
	Iso-octane {2,2,4 trimethylpentane	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Total loss components in the "Cho	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	PACs {Chrysene}	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Phenanthrene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Toluene	0.041549009	0.038429419	0.04596533	0.048437921	0.054818508	0.057715943	0.065949813	0.068232897	0.062559028	0.056354619	0.046243973	0.040806591
	Trimethylbenzene (1,2,4)	0.08458079	0.078839274	0.096456506	0.104167939	0.121400727	0.131159727	0.154440903	0.161377822	0.145694037	0.1260329	0.098216036	0.082625475
	Xylene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Xylene (m-)	0.109079192	0.101245719	0.122351785	0.130379015	0.149536001	0.159298831	0.184527996	0.191777884	0.174601775	0.154413599	0.123768983	0.106869326

Attachment B

Construction and Operational Emission Estimates

Table B-1: Modeling Parameters for On-Road Construction Sources

Road	Road Width (ft)	Road Width (m)	Base Elevation	SourceID	Line Volume Src Type	Release Height from	Initial Lateral Dimensio	Initial Vertical Dimensio	# Volume Sources	Total Length (m)	g/s per vol (1 g/s)
Marine Way (West of Perimeter Rd and East of Rt-133)	89.47	27.27	varies - AERMAP	MARINE1	Adjacent	2.00	varies - based on	2.30	10	395	**1.0000E-01**
Marine Way (West of Rt-133 and East of Sand Canyon Ave)	26.90	8.20	varies - AERMAP	MARINE2	Adjacent	2.00	varies - based on	2.30	34	236.7	**2.9412E-02**
Perimeter Road (Project Site to Marine Way)	24.67	7.52	varies - AERMAP	PERIM1	Adjacent	2.00	varies - based on	2.30	12	155.7	**8.3333E-02**
Sand Canyon Ave (North of Marine Way and South of I-5 on ramp Westbound)	126.64	38.60	varies - AERMAP	SAN1	Adjacent	2.00	varies - based on	2.30	3	173	**3.3333E-01**
Sand Canyon Ave (South of Marine Way and North of I-5 on ramp Eastbound)	126.64	38.60	varies - AERMAP	SAN2	Adjacent	2.00	varies - based on	2.30	3	90.8	**3.3333E-01**
I-5 on ramp Westbound	42.65	13.00	varies - AERMAP	I5ON1	Adjacent	2.00	varies - based on	2.30	19	370.4	**5.2632E-02**
I-5 on ramp Eastbound	24.93	7.60	varies - AERMAP	I5ON2	Adjacent	2.00	varies - based on	2.30	24	596	**4.1667E-02**
I-5 off ramp from Westbound	43.64	13.30	varies - AERMAP	I5OFF1	Adjacent	2.00	varies - based on	2.30	12	172.7	**8.3333E-02**
I-5 off ramp from Eastbound	41.67	12.70	varies - AERMAP	I5OFF2	Adjacent	2.00	varies - based on	2.30	22	408.3	**4.5455E-02**
Entrance Road to Site South of Marine Way	76.35	23.27	varies - AERMAP	ENT1	Adjacent	2.00	varies - based on	2.30	7	208.7	**1.4286E-01**
Entrance Road Turning East	76.35	23.27	varies - AERMAP	ENT2	Adjacent	2.00	varies - based on	2.30	7	122	**1.4286E-01**

	2023-2025		2026-2027	
Route Length	**meters**	**miles**	**meters**	**miles**
Outbound West	1330.8	0.826921	1505.8	0.935661
Outbound East	1474.2	0.916025	1649.2	1.024765
Inbound West	1330.5	0.826734	1505.5	0.935474
Inbound East	1791.7	1.113311	1966.7	1.222051
Route 1 (out west, in east)	3122.5	1.940232	3472.5	2.157711
Route 2 (out east, in west)	2804.7	1.74276	3154.7	1.96024

Table B-2: Modeling Parameters On-Site Sources

Model ID	Description	Source Type	Ht. (ft)	Ht. (m)	Init. Lateral (m)	Init. Vert (m)[2]	No. of Volumes	Exit Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
FUEL_D1-4	Fuel Dispensing	Volume	3.38[1]	1.03	3.4571[1,3]	1.4295	1	---	---	---
DISPEN	Fuel Delivery	Volume	3.38[1]	1.03	3.4571[1,3]	2.5518	1	---	---	---
DEFTNK	Def Tank	Volume	18	5.49	3.4571[1,3]	2.5518	1	---	---	---
SAND1-2	Sand Silos (2)	Volume	30	9.14	2.7907[1]	1.4295	1	---	---	---
SKID	Pump Skid Def Tank	Volume	3.38	1.03	1.8605[1]	0.4792	1	---	---	---
WASH	Train Wash	Volume	55	16.76	5.58[2]	7.80	6	---	---	---
MAINT	Maintenance	Volume	75	22.86	13.02[2]	10.63	4	---	---	---
CRANE	Crane/Forklift	Volume	75	22.86	13.02[2]	10.63	4	---	---	---
GEN1	Emergency Generator[1]	Point	12	3.66	---	---	---	739.8	45.3	0.183
TNKVENT1-4	Fuel Tank Vent (4)	Point	12	3.66	---	---	---	ambient	0.001	0.0762

[1] Based on SF 2020 Citywide HRA (Table 7).

[2] Based on building height/2.15 (EPA 2017).

[3] Assumes 1 dispenser.

Table B-3: Building Inputs

Building ID	Description	Height (ft)	Height (m)
TRANS	Transportation Building	75	22.86
MAINT1	Maintenance Building	75	22.86
UTILITY	Utility Building	55	16.76
TRN_WASH	Train Wash Building	55	16.76
PUMP	Pump House	18	5.49
WATER	Water Treatment Room	30	9.14
MATERIAL	Materials Storage Building	30	9.14
DEF_TNK	Def Fuel Tank	18	5.49
TANK1-4	Fuel Tanks	10.08	3.07
SILO1-2	Sand Silos	30	9.14

Table B-4: Modeling Parameters for On-Road Operation Sources

Road	Road Width (m)	Base Elevation	SourceID	Line Volume Src Type	Release Height from CRRP-HRA (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m) from CRRP-HRA	# Volume Sources	Total Length (m)	g/s per vol (1 g/s)
Marine Way (West of Perimeter Rd and East of Rt-133)	27.27	varies - AERMAP	MARINE1	Adjacent	2.00	varies - based on plume width	2.30	10	395	**1.0000E-01**
Marine Way (West of Rt-133 and East of Sand Canyon Ave)	8.20	varies - AERMAP	MARINE2	Adjacent	2.00	varies - based on plume width	2.30	34	236.7	**2.9412E-02**
Sand Canyon Ave (North of Marine Way and South of Great Park Blvd)	38.60	varies - AERMAP	SAN4	Adjacent	2.00	varies - based on plume width	2.30	29	1271.2	**3.4483E-02**
Sand Canyon Ave (South of Marine Way and North of I-5 on ramp Eastbound)	38.60	varies - AERMAP	SAN2	Adjacent	2.00	varies - based on plume width	2.30	3	90.8	**3.3333E-01**
I-5 on ramp Westbound	13.00	varies - AERMAP	I5ON1	Adjacent	2.00	varies - based on plume width	2.30	20	428.2	**5.0000E-02**
I-5 on ramp Eastbound	7.60	varies - AERMAP	I5ON2	Adjacent	2.00	varies - based on plume width	2.30	24	596	**4.1667E-02**
I-5 off ramp from Westbound	13.30	varies - AERMAP	I5OFF1	Adjacent	2.00	varies - based on plume width	2.30	12	172.7	**8.3333E-02**
I-5 off ramp from Eastbound	12.70	varies - AERMAP	I5OFF2	Adjacent	2.00	varies - based on plume width	2.30	22	408.3	**4.5455E-02**
Entrance Road to Site South of Marine Way	23.27	varies - AERMAP	ENT1	Adjacent	2.00	varies - based on plume width	2.30	7	208.7	**1.4286E-01**
Entrance Road Turning East	23.27	varies - AERMAP	ENT2	Adjacent	2.00	varies - based on plume width	2.30	7	122	**1.4286E-01**
Sand Canyon Ave (South of I-5 on ramp Eastbound and North of Irvine Center Dr)	38.60	varies - AERMAP	SAN3	Adjacent	2.00	varies - based on plume width	2.30	23	1010.3	**4.3478E-02**
Marine Way (East of Perimeter Rd and West of Skyhawk)	27.27	varies - AERMAP	MARINE3	Adjacent	2.00	varies - based on plume width	2.30	31	1033.6	**3.2258E-02**
Ridge Valley (North of Marine Way and South of Great Park Blvd)	27.27	varies - AERMAP	RVAL	Adjacent	2.00	varies - based on plume width	2.30	39	1281.6	**2.5641E-02**
I-5 (South of Sand Canyon Ave)	64.40	varies - AERMAP	EASTI5	Adjacent	2.00	varies - based on plume width	2.30	15	1075.6	**6.6667E-02**
I-5 (North of Sand Canyon Ave)	64.40	varies - AERMAP	WESTI5	Adjacent	2.00	varies - based on plume width	2.30	17	1216.9	**5.8824E-02**
Entrance Onsite	7.62	varies - AERMAP	ENT3	Adjacent	2.00	varies - based on plume width	2.30	10	138.8	**1.0000E-01**
Fuel/Sand Loop	7.62	varies - AERMAP	LOOPA1	Adjacent	2.00	varies - based on plume width	2.30	59	801.3	**1.6949E-02**
Delivery Loop	7.62	varies - AERMAP	LOOPB1	Adjacent	2.00	varies - based on plume width	2.30	13	183.6	**7.6923E-02**

Table B-5: HARP2 Emissions for Construction Years

				2023		2024		2025		2026		2027	
				lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr
CONST	1	9901	DieselExhPM	1.23E+02	0.00E+00	1.25E+02	0.00E+00	3.33E+01	0.00E+00	4.38E+01	0.00E+00	2.64E+01	0.00E+00
MARINE1	2	9901	DieselExhPM	1.48E-01	0.00E+00	5.04E-02	0.00E+00	3.40E-02	0.00E+00	2.94E-02	0.00E+00	1.40E-02	0.00E+00
MARINE2	3	9901	DieselExhPM	8.87E-02	0.00E+00	3.02E-02	0.00E+00	2.04E-02	0.00E+00	1.76E-02	0.00E+00	8.41E-03	0.00E+00
PERIM1	4	9901	DieselExhPM	5.83E-02	0.00E+00	1.99E-02	0.00E+00	1.34E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SAN1	5	9901	DieselExhPM	6.48E-02	0.00E+00	2.21E-02	0.00E+00	1.49E-02	0.00E+00	1.29E-02	0.00E+00	6.14E-03	0.00E+00
SAN2	6	9901	DieselExhPM	3.40E-02	0.00E+00	1.16E-02	0.00E+00	7.83E-03	0.00E+00	6.77E-03	0.00E+00	3.22E-03	0.00E+00
I5ON1	7	9901	DieselExhPM	3.12E-02	0.00E+00	1.06E-02	0.00E+00	7.17E-03	0.00E+00	6.27E-03	0.00E+00	2.99E-03	0.00E+00
I5ON2	8	9901	DieselExhPM	5.58E-02	0.00E+00	1.90E-02	0.00E+00	1.28E-02	0.00E+00	1.11E-02	0.00E+00	5.29E-03	0.00E+00
I5OFF1	9	9901	DieselExhPM	1.62E-02	0.00E+00	5.51E-03	0.00E+00	3.72E-03	0.00E+00	3.22E-03	0.00E+00	1.53E-03	0.00E+00
I5OFF2	10	9901	DieselExhPM	3.44E-02	0.00E+00	1.17E-02	0.00E+00	7.90E-03	0.00E+00	6.91E-03	0.00E+00	3.29E-03	0.00E+00
ENT1	11	9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-02	0.00E+00	7.41E-03	0.00E+00
ENT2	12	9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.09E-03	0.00E+00	4.33E-03	0.00E+00
RAIL_WEL	13	9901	DieselExhPM	2.71E-01	0.00E+00	2.71E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RAIL_DEL	13	9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E-02	0.00E+00	3.18E-02	0.00E+00	3.18E-02	0.00E+00
RAIL_IDL	14	9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E-02	0.00E+00	5.13E-02	0.00E+00	5.13E-02	0.00E+00
CONSTP2	15	9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Notes: In 2025, source CONST represents final 6 months of Phase 1 construction (Jan. through Jun.). CONSTP2 represents initial 6 months (Jul. through Dec.) of Phase 2 construction. DPM lb/hr emissions are listed as zero since it does not have an acute risk threshold.

Table B-6: Fuel Tank Emissions

Tank	Total Losses (tpy)	Hexane (-n) tpy	Benzene (tpy)	Toluene (tpy)	Ethylbenzene (tpy)	Xylene (-m) (tpy)	1,2,4-Trimethylbenzene (tpy)
Tank 1-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 2-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 3-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 4-30,000	1.48E-02	0.00E+00	0.00E+00	3.23E-04	3.48E-05	8.81E-04	7.15E-04
Tank 5-10,000	1.44E-02	0.00E+00	0.00E+00	3.14E-04	3.37E-05	8.54E-04	6.92E-04
Speciated TACs from SCAQMD storage tank guidance document for diesel.							
http://www.aqmd.gov/docs/default-source/planning/annual-emission-reporting/supplemental-instructions-for-liquid-organic-storage-tanks.pdf							

Table B-7: Sand Silo Emission Estimates

SCC/EIC	YEAR	PM PROFILE NUMBER	PM2.5/TPM	PM10/TPM	OG PROFILE NUMBER	ROG/TOG	VOC/TOG
43042270780000	0	371	0.075	0.5	600	0.6986	0.6986

https://www.arb.ca.gov/app/emsinv/2017/emseic_query.php?F_YR=2020&F_DIV=-4&F_SEASON=A&SP=SIP105ADJ&SPN=SIP105ADJ&F_AREA=CA&F_EICSUM=430

PM10 (lb/yr)	1.652870894	
PM10 (lb/hr)	0.000754736	Assumes 6 hours/day
PM10/PM2.5 (g/s)	9.50951E-05	per silo

PM PROFILE NUMBER	SAROAD	WEIGHT FRACTION OF PM2.5	WEIGHT FRACTION OF PM10	WEIGHT FRACTION OF TPM	CAS	TAC	lb/yr	lb/hr
371	12114	0.0005	0.0005	0.0005	7440508	Copper	8.26E-04	3.77E-07
371	12136	0.0005	0.0005	0.0005	7440020	Nickel	8.26E-04	3.77E-07
371	12165	0.4	0.4	0.4	1175	Silica, crystln	6.61E-01	3.02E-04
371	12403	0.0055	0.0055	0.0055	9960	Sulfates	9.09E-03	4.15E-06

Table B-8: Onsite Locomotive Emission Estimates for HRA

Daily Locomotive Operational Emissions	Daily In-Transit Emissions (lbs/day)		
Operational Activity	**NOx**	**PM10**	**PM2.5**
On-site (2025-2027)	98.30	1.98	1.92
On-site (2028+)	81.15	1.22	1.18

Day/Night Percentage	%
Day	20%
Night	80%

Phase 1 (2025 – 2027)																
Source	% Allocated	Hours / Day	Daily In-Transit Emissions (lbs/hr)			Daily In-Transit Emissions (lbs/yr)						# of Vol	Daily In-Transit Emissions per source (g/s)			
			NOx	PM10	PM2.5	NOx (Day)	NOx (Night)	PM10 (Day)	PM10 (Night)	PM2.5 (Day)	PM2.5 (Night)		NOx (Day)	NOx (Night)	PM2.5 (Day)	PM2.5 (Night)
Tracks (Idling & In-Transit)	55%	24	2.253	0.05	0.04	3.95E+03	1.58E+04	7.93E+01	3.17E+02	7.70E+01	3.08E+02	682	8.32396E-05	3.32959E-04	1.62307E-06	6.49229E-06
Maintenance Shop	0%	24	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
Wash Station	45%	24	1.84	0.04	0.04	3.23E+03	1.29E+04	6.49E+01	2.60E+02	6.30E+01	2.52E+02	6	7.74129E-03	3.09651E-02	1.50946E-04	6.03783E-04

Phase 2 (2028+)																
Source	% Allocated	Hours / Day	Daily In-Transit Emissions (lbs/hr)			Daily In-Transit Emissions (lbs/yr)						# of Vol	Daily In-Transit Emissions per source (g/s)			
			NOx	PM10	PM2.5	NOx (Day)	NOx (Night)	PM10 (Day)	PM10 (Night)	PM2.5 (Day)	PM2.5 (Night)		NOx (Day)	NOx (Night)	PM2.5 (Day)	PM2.5 (Night)
Tracks (Idling & In-Transit)	40%	24	1.35	0.02	0.02	2.37E+03	9.48E+03	3.55E+01	1.42E+02	3.45E+01	1.38E+02	781	4.36402E-05	1.74561E-04	6.34964E-07	2.53986E-06
Maintenance Shop	30%	24	1.01	0.02	0.01	1.78E+03	7.11E+03	2.67E+01	1.07E+02	2.59E+01	1.03E+02	4	6.39056E-03	2.55622E-02	9.29826E-05	3.71930E-04
Wash Station	30%	24	1.01	0.02	0.01	1.78E+03	7.11E+03	2.67E+01	1.07E+02	2.59E+01	1.03E+02	6	4.26037E-03	1.70415E-02	6.19884E-05	2.47954E-04

Table B-9: Onsite Point Sources

Equipment Type	Emissions (lbs/year)			Annual Emissions (g/s)			Short-term Emissions (g/s)		
	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
300KV Backup Generator	9.22E+01	4.85E+00	6.65E+00	1.32604E-03	6.97916E-05	9.56049E-05	2.32323E-01	1.22275E-02	1.67500E-02
Crane	2.01E+02	3.69E+00	3.40E+00						
Forklift	5.11E+01	1.88E+00	1.73E+00						
Crane + Forklift (Model ID: CRANE)	2.52E+02	5.58E+00	5.13E+00	9.06402E-04	2.0051E-05	1.84469E-05	0.01450	0.00032	0.00030

Table B-10: HARP2 Emissions for Operations – Phase 1 (2025 – 2027) & Phase 2 (2028+)

				2025-2027		2028+	
				lb/yr	lb/hr	lb/yr	lb/hr
GEN	1	9901	DieselExhPM	6.65E+00	0.00E+00	6.65E+00	0.00E+00
RAIL_D	2	9901	DieselExhPM	7.70E+01	0.00E+00	3.45E+01	0.00E+00
RAIL_N	3	9901	DieselExhPM	3.08E+02	0.00E+00	1.38E+02	0.00E+00
WASH_D	4	9901	DieselExhPM	6.30E+01	0.00E+00	2.59E+01	0.00E+00
WASH_N	5	9901	DieselExhPM	2.52E+02	0.00E+00	1.03E+02	0.00E+00
MARINE1	6	9901	DieselExhPM	5.77E-02	0.00E+00	5.77E-02	0.00E+00
MARINE2	7	9901	DieselExhPM	3.46E-02	0.00E+00	3.46E-02	0.00E+00
MARINE3	8	9901	DieselExhPM	8.89E-03	0.00E+00	8.89E-03	0.00E+00
ENT1	9	9901	DieselExhPM	3.59E-02	0.00E+00	3.59E-02	0.00E+00
ENT2	10	9901	DieselExhPM	2.10E-02	0.00E+00	2.10E-02	0.00E+00
SAN2	11	9901	DieselExhPM	1.56E-03	0.00E+00	1.56E-03	0.00E+00
SAN3	12	9901	DieselExhPM	1.74E-02	0.00E+00	1.74E-02	0.00E+00
SAN4	13	9901	DieselExhPM	1.09E-02	0.00E+00	1.09E-02	0.00E+00
I5ON1	14	9901	DieselExhPM	1.84E-02	0.00E+00	1.84E-02	0.00E+00
I5ON2	15	9901	DieselExhPM	2.56E-02	0.00E+00	2.56E-02	0.00E+00
I5OFF1	16	9901	DieselExhPM	7.43E-03	0.00E+00	7.43E-03	0.00E+00
I5OFF2	17	9901	DieselExhPM	1.76E-02	0.00E+00	1.76E-02	0.00E+00
RVAL	18	9901	DieselExhPM	2.20E-02	0.00E+00	2.20E-02	0.00E+00
EASTI5	19	9901	DieselExhPM	4.63E-02	0.00E+00	4.63E-02	0.00E+00
WESTI5	20	9901	DieselExhPM	9.42E-02	0.00E+00	9.42E-02	0.00E+00
ENT3	21	9901	DieselExhPM	2.39E-02	0.00E+00	2.39E-02	0.00E+00
LOOPA1	22	9901	DieselExhPM	3.03E-02	0.00E+00	3.03E-02	0.00E+00
LOOPB1	23	9901	DieselExhPM	2.46E-02	0.00E+00	2.46E-02	0.00E+00
TNKVENT1	24	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
TNKVENT1	24	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
TNKVENT1	24	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
TNKVENT1	24	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
TNKVENT2	25	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
TNKVENT2	25	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
TNKVENT2	25	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
TNKVENT2	25	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
TNKVENT3	26	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
TNKVENT3	26	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
TNKVENT3	26	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
TNKVENT3	26	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
TNKVENT4	27	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
TNKVENT4	27	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
TNKVENT4	27	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
TNKVENT4	27	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
DEFTNK	28	108883	Toluene	6.27E-01	7.16E-05	6.27E-01	7.16E-05
DEFTNK	28	100414	Ethyl benzene	6.75E-02	7.70E-06	6.75E-02	7.70E-06

DEFTNK	28	108383	m-Xylene	1.71E+00	1.95E-04	1.71E+00	1.95E-04
DEFTNK	28	95636	1,2,4TriMeBenze	1.38E+00	1.58E-04	1.38E+00	1.58E-04
FUEL_D1	29	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
FUEL_D1	29	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
FUEL_D1	29	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
FUEL_D1	29	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
FUEL_D2	30	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
FUEL_D2	30	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
FUEL_D2	30	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
FUEL_D2	30	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
FUEL_D3	31	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
FUEL_D3	31	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
FUEL_D3	31	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
FUEL_D3	31	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
FUEL_D4	32	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
FUEL_D4	32	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
FUEL_D4	32	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
FUEL_D4	32	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
SKID	33	108883	Toluene	6.27E-01	7.16E-05	6.27E-01	7.16E-05
SKID	33	100414	Ethyl benzene	6.75E-02	7.70E-06	6.75E-02	7.70E-06
SKID	33	108383	m-Xylene	1.71E+00	1.95E-04	1.71E+00	1.95E-04
SKID	33	95636	1,2,4TriMeBenze	1.38E+00	1.58E-04	1.38E+00	1.58E-04
DISPEN	34	108883	Toluene	6.47E-01	7.39E-05	6.47E-01	7.39E-05
DISPEN	34	100414	Ethyl benzene	6.96E-02	7.95E-06	6.96E-02	7.95E-06
DISPEN	34	108383	m-Xylene	1.76E+00	2.01E-04	1.76E+00	2.01E-04
DISPEN	34	95636	1,2,4TriMeBenze	1.43E+00	1.63E-04	1.43E+00	1.63E-04
SAND1	35	7440508	Copper	8.26E-04	3.77E-07	8.26E-04	3.77E-07
SAND1	35	7440020	Nickel	8.26E-04	3.77E-07	8.26E-04	3.77E-07
SAND1	35	1175	Silica, crystln	6.61E-01	3.02E-04	6.61E-01	3.02E-04
SAND1	35	9960	Sulfates	9.09E-03	4.15E-06	9.09E-03	4.15E-06
SAND2	36	7440508	Copper	8.26E-04	3.77E-07	8.26E-04	3.77E-07
SAND2	36	7440020	Nickel	8.26E-04	3.77E-07	8.26E-04	3.77E-07
SAND2	36	1175	Silica, crystln	6.61E-01	3.02E-04	6.61E-01	3.02E-04
SAND2	36	9960	Sulfates	9.09E-03	4.15E-06	9.09E-03	4.15E-06
MAINT_D	37	9901	DieselExhPM	N/A	0.00E+00	2.59E+01	0.00E+00
MAINT_N	38	9901	DieselExhPM	N/A	0.00E+00	1.03E+02	0.00E+00
CRANE	39	9901	DieselExhPM	N/A	0.00E+00	5.13E+00	0.00E+00

Notes: Grey-shaded sources only exist in the Phase 2 (2028+) scenario.

DPM lb/hr emissions are listed as zero since it does not have an acute risk threshold.

Appendix C
Technical Memorandum
Biological Resources

Metrolink Orange County Maintenance Facility

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0	Draft Biological Resources Technical Memorandum	01/06/21
1	Draft Biological Resources Technical Memorandum Rev 1 (Incorporating OCTA's comments)	02/25/21
2	Draft Biological Resources Technical Memorandum Rev 2 (Incorporating OCTA's comments)	06/17/21
3	Draft Biological Resources Technical Memorandum Rev 3 (Incorporating OCTA's comments)	08/04/21

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as “OCMF” or “the Project”). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency’s goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink’s member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The Biological Resource Technical Memorandum was prepared for the Project in support of CEQA review process. This memorandum summarizes the results of biological resource database reviews and a site survey conducted for the Project to document existing biological conditions at the site (Project Site), a discussion of potential impacts to biological resources, and mitigation measures identified to minimize and avoid potential impacts to biological resources.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval.

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 0-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 0-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)

Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

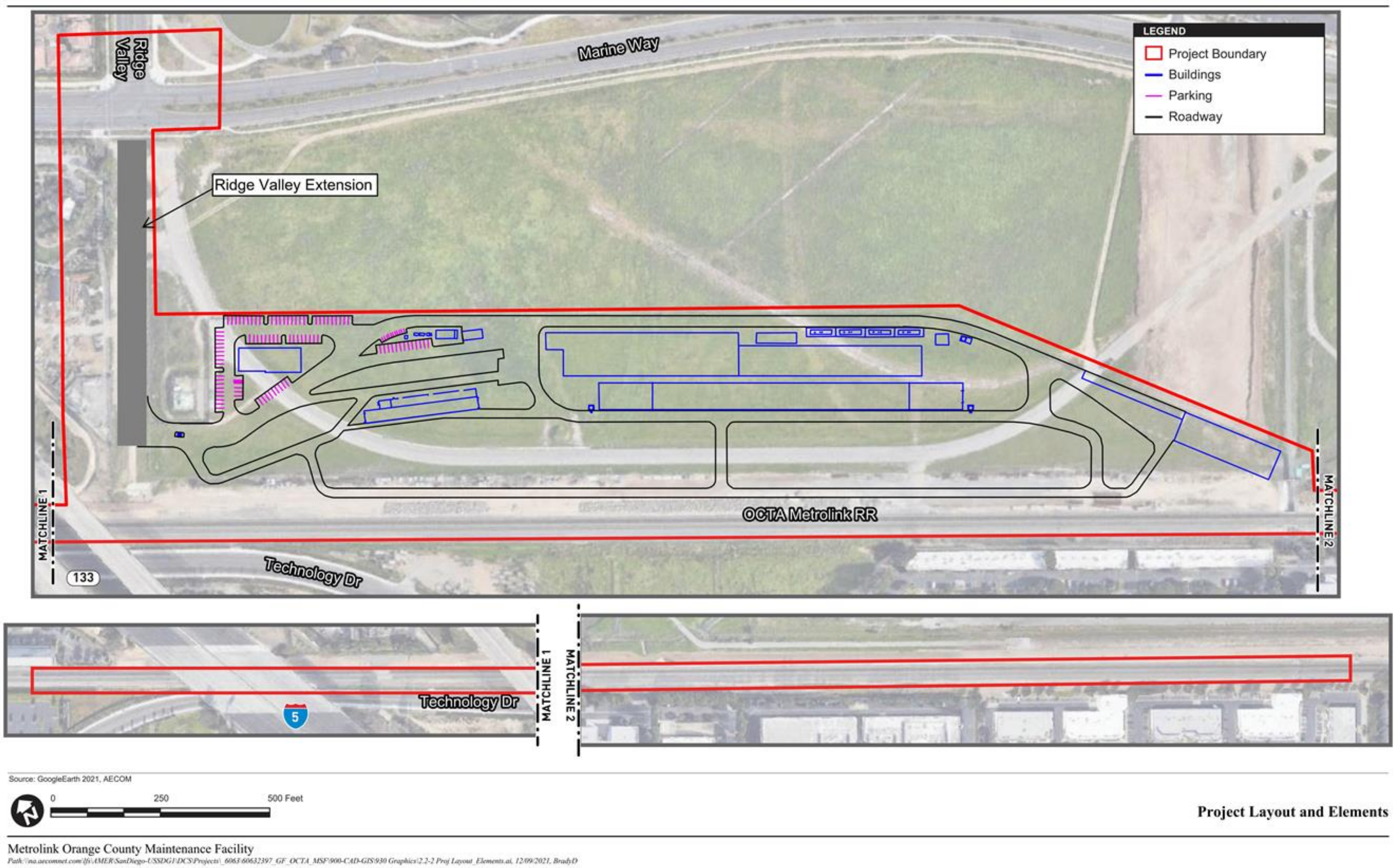
A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette. Approximately 120 automobile parking spaces would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 0-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.

Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink's "Orange" Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. METHODS FOR ASSESSING BIOLOGICAL RESOURCES

A search of relevant regional databases for special-status biological resources in the vicinity of the project area was conducted prior to conducting a field survey. The Project Site is located in the City of Irvine, with most of the Project Site located in the southwest corner of the U.S. Geological Survey's El Toro, California quadrangle and a smaller portion located in the southeast corner of the Tustin, California quadrangle. A search of the El Toro and surrounding eight quadrangles including Tustin, Orange, Black Star Canyon, Corona South, Santiago Peak, Laguna Beach, San Juan Capistrano, and Canada Gobernadora were made of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) (CDFW 2020a), California Native Plant Society's (CNPS) on-line Inventory of Rare and Endangered Plants of California (CNPS 2020), and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) California Species List Tool (NMFS 2016). Additionally, the U.S. Fish and Wildlife Service's (USFWS) online Information for Planning and Consultation (IPaC) (USFWS 2020) environmental review process was queried. These desktop reviews provided a list of special-status species, sensitive natural communities, and protected areas known from the project vicinity and are referenced and discussed further in this memorandum.

The area evaluated for biological resources includes the Project Site and a 500-foot survey buffer, known as the Biological Survey Areas (BSA). A buffer around the Project Site was evaluated in order to capture potential indirect effects to biological resources from implementation of the Project. Indirect effects could include elevated noise and dust levels and increased human activity within the BSA. A 500-foot survey buffer is appropriate for capturing potential indirect impacts from a project on biological resources. It is anticipated that indirect impacts beyond 500 feet for this Project are generally diffuse and would not significantly impact biological resources.

Prior to conducting a field survey, aerial imagery of the BSA was reviewed for the presence of areas that could potentially support special-status biological resources. Since most of the BSA is developed by hardscape features (i.e. buildings and a paved lot), the desktop review focused on identifying any significant green or otherwise open spaces in the vicinity of the Project. On July 30, 2020, a field survey of the Project Site and survey buffer was conducted by AECOM biologist Chris Hargreaves to document existing biological resources that occur or have the potential to occur within and adjacent to the BSA, and to evaluate the potential for special-status plant and wildlife species to occur within the BSA. Binoculars were utilized to scan for evidence of wildlife activity in the BSA. Seasonal, species-specific botanical or wildlife surveys were not conducted as part of this evaluation; however, based on the survey conducted and an assessment of conditions in the BSA, it is apparent that special-status plant and wildlife species are not anticipated within the urbanized environment of the BSA.

4. ENVIRONMENTAL SETTING

4.1 EXISTING CONDITIONS

The Project occurs on a 21.3-acre OCTA-owned parcel in the City of Irvine, Orange County. The entire BSA is urbanized or has otherwise been previously disturbed and includes roadways, rail tracks, commercial development, and undeveloped areas covered by weeds and grass. Athletic fields in the Great Park lie to the east and north and commercial development lies to the west and south. Vegetation within the Project Site consists primarily of non-native herbaceous mustard and grass species. The surrounding BSA includes similar ruderal vegetation and ornamental trees and shrubs associated with surrounding commercial and recreational uses. The Project Site is moderately sloped in a southeast to northwest direction, with an elevation of approximately 240 feet above mean sea level (amsl) in the far southern portion of the BSA, to 220 amsl in the northern portion. Bee Canyon Wash flows within an underground concrete box channel northeast to southwest at the southern perimeter of the Project Site. A short, isolated reach of the channel at the southern edge of the Project Site is open. Photographs of the Project Site are included in Attachment A.

4.2 VEGETATION COMMUNITIES AND PLANTS

Vegetation communities are assemblages of plant species that commonly coexist. The classification of vegetation communities is based on the life form of the dominant species within that community and the associated species. No natural vegetation communities exist within the BSA. The nearest areas of natural communities occur approximately four miles to both the northeast in foothills of the Santa Ana Mountains, and to the southwest in the San Joaquin Hills.

Project Site

Onsite habitat can be characterized as upland mustards and other ruderal forbs, as described in A Manual of California Vegetation (MCV) (Sawyer et al. 2009). Plant species within the proposed Project Site consist primarily of non-native herbaceous species, including: wild mustard (*Hirschfeldia incana*), black mustard (*Brassica nigra*), yellow starthistle (*Centaurea solsticialis*), red brome (*Bromus madritensis* spp. *rubens*), and wild oat (*Avena* sp.), with one native herb, doveweed (*Croton setigera*). (Photos 1-4, Attachment A). Some areas of the Project Site containing only patchy vegetative growth composed primarily of black mustard (Photo 5), and areas of bare ground where railroad equipment is currently being stored (Photo 6). It appears that most of the Project Site is regularly mowed to control vegetative growth. Areas at the eastern and western extent of the Project Site, at the bends in Marine Way, appear to be mowed less frequently and contain additional non-native herbaceous plant species (Photo 7). No trees or shrubs exist within the Project Site. A list of the plant species identified during the field survey of the site are provided in Table 4.2-1.

Table 4.2-1 Plant Species Observed Within the Project Site

Common Name	Scientific Name	Native/Non-Native Species
Ragweed	*Ambrosia psilostachya*	Native
Wild oat	*Avena sp.*	Non-Native
Black mustard	*Brassica nigra*	Non-Native
Red brome	*Bromus madritensis spp. rubens*	Non-Native
Yellow starthistle	*Centaurea solsticialis*	Non-Native
Doveweed	*Croton setigera*	Native
Bermuda grass	*Cynodon dactylon*	Non-Native
Jimsonweed	*Datura wrightii*	Native
Canada horseweed	*Erigeron canadensis*	Native
Spotted spurge	*Euphorbia maculata*	Non-Native
Prickly lettuce	*Lactuca seriola*	Non-Native
Telegraph weed	*Heterotheca grandiflora*	Native
White sweetclover	*Melilotus albus*	Non-Native
Fountain grass	*Pennisetum setaceum*	Non-native
Castor bean	*Ricinus communis*	Non-native

A short, open reach of Bee Canyon Wash occurs at the southern edge of the Project Site, where a bridge carrying rail tracks is proposed over the channel. At this location, the channel is a concrete box, with some rip-rap above the channel on the banks (Photo 8). The channel is underground north (upstream) of this reach. There is no vegetative growth in the channel.

Stormwater runoff drains from the Project Site via an open concrete channel that occurs in the northwest corner of the site (Photo 9). From this point, stormwater is further conveyed downstream to the Marshburn Channel, which occurs outside the BSA to the northwest.

Surrounding BSA

The 500-foot survey buffer around the Project Site includes roadways, rail tracks, commercial development to the southwest and athletic fields in Great Park to the northeast. Vegetation within the BSA consists of ornamental pine (*Pinus* sp.), fig (*Ficus* sp.), and sweet gum (*Liquidambar styraciflua*) trees within landscaped areas in the commercial development. These trees are visible in the background of Photos 5-8. Vacant land covered by herbaceous habitat similar to that on the Project Site occurs in the BSA to the east around Voyager Drive and to the south of the Project Site.

A soft-bottom, vegetated stormwater channel drains into the open portion of Bee Canyon channel from the southeast in the BSA. Some growth of native riparian species including willow (*Salix* sp.) and mulefat (*Baccharis salicifolia*) are present in this channel; however, it occurs just outside the Project Site and would not be impacted by the Project.

4.3 WILDLIFE

With most vegetation being less than a foot in height, the Project is generally unsuitable for wildlife nesting and cover. Wildlife activity was minimal during the field survey. Species observed include western fence lizard (*Sceloporus occidentalis*), and observations of mourning dove (*Zenaida macroura*), American crow (*Corvus brachyrhynchos*), and common raven (*Corvus corax*) flying across the Project Site. No active or old bird nests were observed within the Project Site; however, killdeer (*Charadrius vociferous*), a common ground-nester could potentially nest on site.

4.4 WILDLIFE CORRIDORS

In an urban context, a wildlife migration corridor can be defined as a linear landscape feature of sufficient width and buffer to allow animal movement between two comparatively undisturbed habitat fragments, or between a habitat fragment and some vital resource that encourages population growth and diversity. Habitat fragments are isolated patches of habitat separated by otherwise foreign or inhospitable areas, such as urban tracts or highways. Two types of wildlife migration corridors seen in urban settings are regional corridors, defined as those linking two or more large areas of natural open space, and local corridors, defined as those allowing resident wildlife to access critical resources (food, cover, and water) in a smaller area that might otherwise be isolated by urban development.

The BSA occurs within an urbanized area and does not occur within or intersect a recognized or established regional wildlife corridor. Vegetative growth within the Project Site and ornamental trees and shrubs within landscaped areas within the surrounding BSA provide some opportunities for cover, resting, foraging, and nesting to localized bird populations; however, they do not provide functions as a significant wildlife movement corridor.

5. SPECIAL-STATUS SPECIES

5.1 SPECIAL-STATUS PLANT SPECIES

Special-status plant species include those listed as Endangered, Threatened, Rare or those species proposed for listing by the USFWS under the federal Endangered Species Act (FESA), those listed by CDFW under the California Endangered Species Act (CESA), and the CNPS.[1,2,3] The CNPS inventory is sanctioned by the CDFW and essentially serves as the list of candidate plant species for state listing. CNPS's California Rare Plant Ranks (CRPR) 1B and 2 species are considered eligible for state listing as endangered or threatened.

A total of 76 special-status plant species were identified from the El Toro and surrounding eight quadrangles in the CNDDB and CNPS, and from a search of IPaC for the vicinity of the Project Site, including 10 federal and/or state-listed species:

- Munz's onion (*Allium munzii*), federal-listed endangered and state-listed threatened
- Braunton's milk-vetch (*Astragalus brauntonii*), federal-listed endangered
- Thread-leaved brodiaea (*Brodiaea filifolia*), federal-listed threatened and state-listed endangered
- San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*), federal candidate for listing and state-listed endangered
- Slender-horned spineflower (*Dodecahema leptoceras*), federal and state-listed endangered
- Santa Monica dudleya (*Dudleya cymosa* ssp. *ovatifolia*), federal-listed threatened
- Laguna Beach dudleya (*Dudleya stolonifera*), federal and state-listed threatened
- Santa Ana River woollystar (*Eriastrum densifolium* ssp. *sanctorum*), federal and state-listed endangered
- Gambel's water cress (*Nasturtium gambellii*), federal-listed endangered and state-listed threatened
- Big-leaved crownbeard (*Verbesina dissita*), federal and state-listed threatened

The 76 special-status plant species identified during the database reviews, their status, and habitat requirements are provided in Attachment B, Table A.

No special-status plant species were observed during the field survey and no records of special-status plant species were found during the database reviews to coincide with the BSA. Due to the developed nature of the BSA and lack of natural habitats that are potentially suitable to support special-status plants, none are

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1 Species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (Title 50 Code of Federal Regulations [CFR] 17.12 [listed plants], Title 50 CFR 17.11 [listed animals] and includes notices in the Federal Register for proposed species).

2 Species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (Title 14 California Code of Regulations 670.5).

3 Plants listed as rare under the California Native Plant Protection Act (California Fish and Game Code Section 1900 *et seq*.).

expected to occur in the BSA. The nearest special-status plant species identified during database reviews are primarily recorded from native habitats two plus miles southwest of the BSA, in the vicinity of Sand Canyon Reservoir.

5.2 SPECIAL-STATUS WILDLIFE SPECIES

Special-status wildlife species include those listed by USFWS under FESA and by CDFW under CESA. USFWS and CDFW officially list species as either threatened, endangered, or as candidates for listing. Additional species receive federal protection under the Bald Eagle Protection Act (e.g., bald eagle, golden eagle), the Migratory Bird Treaty Act (MBTA), and state protection under CEQA Section 15380(d).

All birds, except European starlings, English house sparrows, rock doves (pigeons), and non-migratory game birds such as quail, pheasant, and grouse are protected under the MBTA. However, the nests and eggs of non-migratory game birds are protected under California Fish and Game Code (CFGC) Section 3503. Many other species are considered by CDFW to be California Species of Special Concern (SSC) and others are on a CDFW Watch List (WL). The CNDDB tracks species within California for which there is conservation concern, including many that are not formally listed, and assigns them a CNDDB Rank (CDFW 2020b). Although CDFW SSC and WL species and species that are tracked by the CNDDB but not formally listed are afforded no official legal status, they may receive special consideration during the environmental review process. CDFW further classifies some species as "Fully Protected" (FP), indicating that the species may not be taken or possessed except for scientific purposes, under special permit from CDFW. Additionally, CFGC Sections 3503, 3505, and 3800 prohibit the take, destruction, or possession of any bird, nest, or egg of any bird except English house sparrows and European starlings unless authorization is obtained from CDFW.

A total of 66 special-status wildlife species were identified during a search of the El Toro and surrounding eight quadrangles in the CNDDB and NMFS databases, and from a search of IPaC for the vicinity of the Project, including 20 federal and/or State-listed wildlife species:

- Tricolored blackbird (*Agelaius tricolor*), state-listed threatened
- Arroyo toad (*Anaxyrus californicus*), federal-listed endangered
- Crotch bumble bee (*Bombus crotchii*), state candidate-endangered
- San Diego fairy shrimp (*Branchinecta sandiegonensis*), federal-listed endangered
- Santa Ana sucker (*Catostomus santaanae*), federal-listed threatened
- Western snowy plover (*Charadrius alexandrinus nivosus*), federal-listed threatened
- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), federal-listed threatened and state-listed endangered
- Stephens' kangaroo rat (*Dipodomys stephensi*), federal-listed endangered and state-listed threatened
- Southwestern willow flycatcher (*Empidonax traillii extimus*), federal and state-listed endangered
- Tidewater goby (*Eucyclogobius newberryi*), federal-listed endangered
- Quino checkerspot butterfly (*Euphydryas editha quino*), federal-listed endangered
- Bald eagle (*Haliaeetus leucocephalus*), state-listed endangered
- California black rail (*Laterallus jamaicensis coturniculus*), state-listed threatened
- Steelhead – southern California DPS (*Oncorhynchus mykiss pop. 10*), federal-listed endangered
- Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), state-listed endangered
- Pacific pocket mouse (*Perognathus longimembris pacificus*), federal-listed endangered
- Coastal California gnatcatcher (*Polioptila californica californica*), federal-listed threatened
- Light-footed Ridgway's rail (*Rallus obsoletus levipes*), federal and state-listed endangered
- California least tern (*Sternula antilarum browni*), federal and state-listed endangered
- Least Bell's vireo (*Vireo bellii pusillis*), federal and state-listed endangered

The 66 special-status wildlife species identified during the database reviews, their status, and habitat requirements are provided in Attachment B, Table B.

No special-status wildlife species were detected during the field survey and no historical records of special-status wildlife were identified to coincide with the BSA during database reviews. Records of burrowing owl (*Athena cunicularia*), a CDFW SSC, are known from 1-2 miles east of the BSA from 2010, within the former El Toro Air Station, where adults were found overwintering. It was determined at the time that these individuals were not nesting and burrows were collapsed to prohibit reuse (CDFW 2020a). No records of burrowing owl have been made in the vicinity of the Project Site since 2010 and no individuals of this species or burrows suitable for this species were observed onsite during the field survey. Although this species prefers open grassland habitat with low plant growth similar to that within the Project Site, a lack of recent records and absence of any indication of the species occurrence in the Project Site indicate the species is likely no longer present in the vicinity. CNDDB records from 1999 of tricolored blackbird are known from 1-2 miles west and southwest of the BSA, on the other (west) side of I-5 from the Project Site. Subsequent surveys for this species in 2014 noted it was no longer present and the area had been developed (CDFW 2020a). Due to the developed nature of the BSA, native habitats suitable to support these and other special-status wildlife species are generally absent from the BSA. No special-status invertebrates, reptiles, amphibians, fish, or mammals are expected to occur within the BSA.

Two CDFW WL species, Cooper's hawk (*Accipiter cooperii*) and California horned lark (*Eremphila alpestris actia*) have some potential to occur within the BSA; California horned lark as a potential ground-nester within the Project Site and Cooper's hawk as a transient migrant or forager across the BSA (refer to Attachment B, Table B).

6. SENSITIVE NATURAL COMMUNITIES

Sensitive natural communities are those that are designated as rare in the region by CDFW in the CNDDB, support special-status plant or wildlife species, or are aquatic communities such as wetlands, rivers, streams, and riparian areas that fall under regulatory jurisdiction of the U.S. Army Corps of Engineers (USACE), CDFW, and/or the Regional Water Quality Control Board (RWQCB). Tidal waters around the peninsula are considered sensitive natural communities, falling under the jurisdiction of NMFS. Regulations applicable to sensitive natural communities are discussed further in Section 7 of this memorandum.

Fourteen sensitive vegetative communities were identified during a search of the CNDDB for the El Toro and surrounding eight quadrangles, including the following:

- California Walnut Woodland
- Canyon Live Oak Ravine Forest
- Riversidian Alluvial Fan Sage Scrub
- Southern California Arroyo Chub/Santa Ana Sucker Stream
- Southern Coast Live Oak Riparian Forest
- Southern Coastal Salt Marsh
- Southern Cottonwood Willow Riparian Forest
- Southern Interior Cypress Forest
- Southern Mixed Riparian Forest
- Southern Riparian Forest
- Southern Riparian Scrub
- Southern Sycamore Alder Riparian Woodland
- Southern Willow Scrub
- Valley Needlegrass Grassland

These communities are absent from the BSA and are known from inland mountain ranges and coastal canyons generally occurring within 3-4 miles northeast and southwest of the BSA. No USFWS-designated critical habitats for federally-listed species or any other sensitive, protected, or managed communities or habitats were identified during a review of IPaC to coincide with the Project Site.

As identified in Section 4.1, Bee Canyon Wash (Lower San Diego Creek; Hydrologic Unit Code [HUC] 12 = 180702040102) occurs as a mostly underground channel along the southeastern perimeter of the Project Site, with a short, isolated open portion of the channel at the southern edge of the Project Site. Bee Canyon Wash originates as a headwater channel in the Santa Ana Mountains five to six miles northeast of the BSA in the vicinity of the Frank R. Bowerman Landfill. Round Canyon Wash, a tributary of Bee Canyon Wash, originates to the southeast of Bee Canyon in Limestone Canyon Regional Park. From their source, these streams flow southwest (under the 241 Toll Road) and confluence just south of the Portola Springs area of the City of Irvine. Bee Canyon Wash then flows under the former El Toro Marine Air Station and daylights along the southeast perimeter of the Project Site, before flowing into an underground storm drain system which eventually enters San Diego Creek, approximately one mile southwest of the BSA.

The San Diego Creek watershed drains roughly 112 square miles, most of which is located in the City of Irvine. From its confluence with Bee Canyon Wash, San Diego Creek continues through urbanized portions of the City for approximately eight miles before flowing into Newport Bay, where it contributes nearly all of the freshwater inflow to Newport Bay.

7. BIOLOGICAL RESOURCES REGULATORY FRAMEWORK

Several regulations and standards have been established by federal, state, and local agencies to protect and conserve biological resources. The Project's compliance with the regulations and standards listed below were assessed.

Federal

Federal Endangered Species Act

Enacted in 1973, the FESA provides for the conservation of threatened and endangered species and their ecosystems (United States Code [U.S.C.] Title 16, Chapter 35, Sections 1531–1544). The ESA prohibits the "take" of threatened and endangered species except under certain circumstances and only with authorization from USFWS through a permit under Section 4(d), 7 or 10(a) of the ESA. "Take" under the FESA is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Formal consultation under the FESA would be required if the Project had the potential to affect a federally-listed species that has been detected within or adjacent to the BSA. No federally-listed species were detected during the field survey and suitable habitats for such species do not occur in the BSA. Therefore, formal consultation is not expected for the Project.

Migratory Bird Treaty Act (MBTA)

Under the MBTA, it is unlawful at any time, by any means or manner, to pursue, hunt, take, capture, or kill migratory birds. The law applies to the removal of nests occupied by migratory birds during the breeding season. The MBTA (16 U.S.C. 703-71 1), 50 CPR Part 10, protects migratory birds, their occupied nests, and their eggs from disturbance or destruction.

Although unlikely due to the absence of trees and shrubs on site, native migratory bird species protected under the MBTA may nest on site. No permit is issued under the MBTA; therefore, the Project would need to employ measures that would avoid take of protected migratory birds, their occupied nests and their eggs.

Bald and Golden Eagle Protection Act (Eagle Act)

The Eagle Act was originally implemented for the protection of bald eagles. In 1962, Congress amended the Eagle Act to also cover golden eagles, a move that was partially an attempt to strengthen protection of bald eagles, since the latter were often killed by people mistaking them for golden eagles. This act makes it illegal to import, export, take (which includes molest or disturb), sell, purchase, or barter any bald eagle or golden eagle or part thereof.

Although known from the region, bald and golden eagles are not known from the vicinity of the Project, and habitat in the BSA is not suitable for these species. As a result, the Project is not expected to take a bald or golden eagle.

Clean Water Act (CWA)

Under Section 404 of the CWA, the USACE regulates the discharge of dredged or fill material into jurisdictional waters of the U.S., which include those waters listed in 33 CFR 328.3 (Definitions) (U.S.C. Title 33, Chapter 26, Sections 101–607). In June of 2020, the Navigable Waters Protection Rule became effective. The Final Rule modified the definition of Waters of the U.S. 33 CFR 328 3(b)(3) indicates that ephemeral features are not regulated by the CWA. The definitions of intermittent and perennial require surface water flowing continuously for weeks or months during certain times of the year and more than in direct response to precipitation (e.g., ephemeral drainages). The final rule preamble Section III.A.2 does clarify that features with effluent-derived intermittent or perennial flows may be considered jurisdictional as well.

As described in Section 6, Bee Canyon Wash occurs along the southeastern perimeter of the Project Site. Although Bee Canyon Wash's hydrologic regime is not currently known, the analysis assumes that the wash is jurisdictional due to the size of the watershed and urban influence located upstream. This feature constitutes a potential jurisdictional water of the U.S. per USACE regulations. Potential permitting requirements pursuant to Section 404 and 401 of the CWA are discussed in Section 8.

Section 401 of the CWA requires a Water Quality Certification from the state for all permits issued by the USACE under Section 404 of the CWA. The RWQCB is the state agency in charge of issuing a CWA Section 401 Water Quality Certification or waiver.

Magnuson-Stevens Fisher Conservation and Management Act (Magnuson-Stevens Act)

Under the purview of NMFS, amendments in 1996 to the Magnuson-Stevens Act set forth a number of mandates for NMFS, Regional Fishery Management Councils, and federal action agencies to identify and protect important marine and anadromous fish habitat. The Councils, with assistance from NMFS, are required to delineate Essential Fish Habitat (EFH) in fishery management plans for all managed species. As defined by this act, EFH is necessary for fish to spawn, breed, feed, or grow to maturity, and includes subsets of habitats known as Habitat Areas of Particular Concern (HAPC), which are high-priority areas for conservation, management, and research and are necessary for healthy ecosystems and sustainable fisheries. HAPC include estuaries, kelp canopies, rocky reefs, and beds of seagrass, habitats that are rare, stressed by development, provide important ecological functions for federally managed species, and/or are especially vulnerable to anthropogenic (or human impact) degradation. They can cover a specific location (a bank or ledge, spawning location) or a habitat that is found over a wider area, such as coral, nearshore nursery areas, or pupping grounds. The HAPC designation does not provide additional protection or restrictions on an area but helps prioritize conservation efforts (NMFS 2020a).

As described in Section 6, Bee Canyon Wash occurs within the BSA and flows into San Diego Creek and further into Newport Bay. Waters in Newport Bay are identified by NMFS as EFH and a review of HAPC occurring along and off the coast of Newport Bay indicates the presence of estuary habitat in the Bay (NMFS 2020b). However, due to the distance from the BSA to Newport Bay, coordination with NMFS regarding potential impacts to EFH and HAPC are not anticipated for the Project.

State

California Environmental Quality Act (CEQA)

CEQA requires that biological resources be considered when assessing the environmental impacts resulting from proposed actions. CEQA does not specifically define what constitutes an "adverse effect" on a biological resource. Instead, lead agencies are charged with determining what specifically should be considered an impact. This memorandum has been prepared in support of a review of biological resource pursuant to CEQA.

California Fish and Game Code (CFGC)

CFGC regulates the taking or possession of birds, mammals, fish, amphibians, and reptiles, as well as impacts to natural resources such as wetlands and waters of the state. It includes CESA (Sections 2050–2115) and Lake and Streambed Alteration Agreement (LSAA) regulations (Section 1600 et seq.).

Wildlife "take" is defined by CDFW as "to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Protection extends to the animals, dead or alive, and all their body parts. Section 2081 of CESA allows CDFW to issue an incidental take permit for state-listed threatened or endangered species, should the Project have the potential to "take" a state-listed species that has been detected within or adjacent to the Project Site. Certain criteria are required under CESA prior to the issuance of such a permit, including the requirement that impacts of the take are minimized and fully mitigated.

Additionally, CFGC Sections 3503, 3505, and 3800 mirror the MBTA, but also prohibit the take, destruction, or possession of any bird, nest, or egg of <u>any</u> bird species except English house sparrows and European starlings unless authorization is obtained from CDFW.

No state-listed species are anticipated to be affected by the Project as habitat potentially suitable for such species does not occur within the BSA, or the species' known distribution does not coincide with the BSA. As a result, a permit under Section 2081 is not anticipated for the Project.

Bee Canyon Wash may constitute a regulated streambed under the jurisdiction of CDFW. As a result, an LSAA will be required for the Project.

Porter-Cologne Water Quality Control Act

Under Section 13000 et seq., of the Porter-Cologne Water Quality Act (Porter-Cologne), the RWQCB is the agency that regulates discharges of waste and fill material within any region that could affect a water of the state (CWC 13260[a]) (including wetlands and isolated waters) as defined by CWC Section 13050(e).

Waste Discharge Requirements (WDR) pursuant to Porter-Cologne may be required if water quality certification pursuant to Section 401 of the CWA is not required. General Waste Discharge Order 2004-2004-DWQ may apply if Bee Canyon Wash would be subject to discharge of fill and is not regulated under CWA.

Local

Orange County Central and Coastal Subregion Natural Community Conservation Plan and Habitat Conservation Plan (NCCP/HCP)

The NCCP/HCP (County of Orange 1996a) was prepared by the County of Orange in cooperation with California Department of Fish and Game (CDFG, now CDFW) and USFWS. The document was prepared in accordance with the provisions of the state Natural Community Conservation Planning Act of 1991 (NCCP Act), Sections 1600 *et seq.* of the CFGC and FESA. The 208,00-acre Central and Coastal Subregion is part of a five-county NCCP Study Area established by the state as part of the Southern California Coastal Sage Scrub NCCP Program. The Project falls within the Central Subregion of the NCCP/HCP.

In addition, a Joint Programmatic Environmental Impact Report and Environmental Impact Statement (Joint EIR/EIS) (County of Orange 1996b) that addresses the effects related to the NCCP/HCP was prepared in accordance with the CEQA, and National Environmental Policy Act (NEPA). The County is the lead agency responsible for preparation of the NCCP/HCP and the EIR. The USFWS is the lead agency responsible for preparation of the HCP and EIS.

The NCCP/HCP focuses on creating a multiple-species, multiple-habitat subregional Reserve System and implementing a long-term "adaptive management" program that will protect coastal sage scrub and other habitats and species located within the coastal sage scrub habitat mosaic, while providing for economic uses that will meet the social and economic needs of the people of the subregion. The primary goal is to protect and manage habitat supporting a broad range of plant and animal populations that are found within the Central and Coastal subregions of Orange County. To accomplish this goal, the NCCP/HCP creates a subregional habitat Reserve System for coastal sage scrub and related habitats and implements a program that manages biological resources within the habitat reserve. The Reserve System would be established by incorporating existing parklands and open space and additional dedications that would occur over 25 years or more.

Two categories of landowners are identified by the NCCP/HCP including, *participating landowners* and *non-participating landowners*. Each of these landowner categories is offered different endangered species habitat mitigation opportunities under the NCCP/HCP. Non-participating landowners, such as OCTA, are those public and private landowners that are not contributing significant land and/or funding toward implementation of the Reserve System and adaptive management program. For non-participating landowners, development activities are required under current law to assure that impacts to listed species resulting from activities on their lands are fully mitigated consistent with the FESA and CESA. Consistency with the FESA and CESA is achieved by 1) onsite avoidance of impacts to listed species; 2) satisfying applicable FESA and CESA provisions under the consultation and permit provisions of these acts; or 3) payment of a Mitigation Fee to the non-profit management corporation as provided for in the NCCP/HCP.

As presented in Section 8 below, significant impacts to federally and/or State-listed species and non-listed special-status-species and sensitive community will be avoided. Listed species are not expected onsite, sensitive communities are absent from the site, and avoidance and minimization measures would be implemented to reduce potential impacts to nesting birds protected under the MBTA and CFGC. As a result, the Project is not anticipated to conflict with the NCCP/HCP and payment of a Mitigation Fee per the NCCP/HCP is not expected.

8. IMPACTS ON BIOLOGICAL RESOURCES

Biological resources may be either directly or indirectly impacted by a project. Direct and indirect impacts may be either permanent or temporary in nature. These impact categories are defined below.

- **Direct**: Any alteration, physical disturbance, or destruction of biological resources that would result from project-related activities is considered a direct impact. Examples include clearing vegetation, encroaching into wetlands or a stream, and the loss of individual species and/or their habitats.
- **Indirect**: As a result of project-related activities, biological resources may also be affected in a manner that is ancillary to physical impacts. Examples include elevated noise and dust levels, increased human activity, decreased water quality, and the introduction of invasive wildlife (domestic cats and dogs) and plants.
- **Permanent**: All impacts that result in the long-term or irreversible removal of biological resources are considered permanent. Examples include constructing a building or permanent road on an area containing biological resources.
- **Temporary**: Any impacts considered to have reversible effects on biological resources can be viewed as temporary. Examples include the generation of fugitive dust during construction; or removing vegetation for the preparation of stream bank stabilization activities, and either allowing the natural vegetation to recolonize or actively revegetating the impact area. Surface disturbance that removes vegetation and disturbs the soil is considered a long-term temporary impact because of slow natural recovery in arid ecosystems.

8.1 CONSTRUCTION

The anticipated impacts of Project construction on biological resources are described below.

Vegetation

Herbaceous vegetation composed primarily of non-native mustard and grass species occur within the Project Site; no trees or shrubs occur on site. The removal of such vegetation during implantation of the Project does not constitute a significant direct impact.

Indirect impacts to vegetation during the Project’s construction could include the accumulation of fugitive dust and further colonization of non-native, invasive plant species. Other indirect impacts could include the potential for surface runoff, increased erosion, and sediment deposition beyond the footprint of disturbance as a result of the use of heavy construction equipment and general construction-related activities. However, standard construction practices related to fugitive dust and erosion control would be implemented. As a result, no significant indirect impacts to vegetation are anticipated.

Special-Status Plant Species

No federal- or state-listed plant species were identified during the field survey and special-status plants are not expected to occur in the BSA due to a lack of potentially suitable habitat. As a result, direct impacts to special-status plant species would not occur.

Likewise, suitable habitat for special-status plants is not present in the urbanized environment surrounding the Project Site. As a result, significant indirect impacts to special-status plant species are not anticipated.

Wildlife

No federal- or state-listed wildlife species were identified during the field survey or are expected to occur in the BSA due to a lack of potentially suitable habitat. As a result, direct impacts to federal- or state-listed wildlife species would not occur.

Although no trees or shrubs occur within the Project Site, the low and sometimes sparse vegetative growth present is potentially suitable for ground-nesting bird species such as California horned lark, a CDFW WL, and killdeer (*Charadrius vociferus*). Additionally, trees in ornamental landscapes within the surrounding BSA at the athletic fields to the northeast and in commercial development to the southwest provide potentially suitable nesting opportunities for birds protected under CFGC. By implementing avoidance and minimization measures outlined in Mitigation Measure BIO-1 in Section 9, direct impacts to any birds protected under the MBTA and by CFGC that may occur in the BSA would be less than significant.

Indirect impacts to nesting birds within the BSA could occur during construction as a result of noise, dust, increased human presence, and vibrations resulting from construction activities. Such disturbances could result in increased nestling mortality due to nest abandonment or decreased feeding frequency; mortalities resulting from such indirect effects would be considered significant. However, implementing and adhering to avoidance and minimization measures outlined in Mitigation Measure BIO-1 in Section 9 would reduce potential indirect impacts to nesting birds protected under the MBTA and by CFGC to a level that is less than significant.

Special-Status Wildlife Species

No federal- or state-listed wildlife species have been identified in the BSA, and potentially suitable habitat for such species is absent from the BSA. However, as presented in Section 5.2, two non-listed special-status bird species identified as CDFW WL species, Cooper's hawk and California horned lark, have some potential to occur within the BSA. As a result, direct and indirect impacts to special-status wildlife could occur. However, by implementing and adhering to avoidance and minimization measures outlined in Mitigation Measure BIO-1 in Section 9, potential impacts to nesting individuals of these special-status birds and any other bird species that could occur on site, would be reduced to a level that is less than significant.

Wildlife Movement Corridor

The BSA does not serve as a regional wildlife corridor and as a result, impacts to a regional wildlife movement corridor would not occur.

Sensitive Natural Communities

No sensitive natural vegetation communities occur within the BSA; however, Bee Canyon Wash, an aquatic feature under regulatory jurisdiction of the USACE, CDFW, and RWQCB, occurs within the BSA. Under the current design, construction of the bridge over Bee Canyon Wash would require a discharge of fill (e.g. soil, concrete) as the channel must be modified (e.g. widened, deepened, realigned, storm drain outlets added or modified) to accommodate the new bridge structure. Such impacts would require permits from USACE, CDFW and RWQCB. The Project occurs within the San Diego Creek (SDC) Watershed Special Area Management Plan (SAMP) area and is located outside of any pre-defined Aquatic Resource Integrity Area. Additionally, this segment of Bee Canyon Wash is not located within the “major streams” category. Construction of the Project would meet the terms and conditions of a Letter of Permission (LOP), and operation and maintenance would potentially meet the criteria for authorization under Regional General Permit (RGP) No. 74.

Construction of a bridge to carry rail tracks over an isolated, open portion of Bee Canyon Wash may be eligible to obtain an LOP from the USACE as a “Road Crossing,” which includes construction and/or maintenance of new and existing bridges and culverts. The LOP application process would require:

- Pre-application coordination meeting with USACE to address:
    - CWA Section 404(b)(1) Guidelines alternatives analysis;
    - How avoidance and minimization of discharges to jurisdictional waters were achieved for the Project;
    - Compensatory mitigation plan consistent with the SAMP mitigation framework to address any unavoidable impacts to jurisdictional waters and the program goal of no net loss of wetlands.
- Coordination with RWQCB regarding a Section 401 Water Quality Certification that demonstrates the Project’s compliance with water quality standards.

Alternatively, it may be determined during coordination with USACE that the proposed bridge over Bee Canyon Wash would qualify for RGP No. 74 to fulfill CWA Section 404 requirements. A RGP 74 would be issued by the USACE, Los Angeles District. This RGP authorizes discharges of dredged or fill material resulting in temporary impacts up to 0.5 acre of jurisdictional waters of the U.S. in eligible areas, no more than 0.1 acre of which may be vegetated with native riparian and/or wetland vegetation. No permanent impacts to waters of the U.S., including impacts from fills, flooding, excavation beyond a Corps Regulatory Division-approved maintenance baseline, or drainage are permitted under this RGP.

Construction of the proposed bridge over Bee Canyon Wash would require the Project applicant to obtain a permit pursuant to Sections 404 and 401 of the CWA and to Section 1600 et seq of CFGC. The Project would comply with the regulatory framework set forth by the USACE, RWQCB, and CDFW. Following the permitting process and SAMP requirements described below would further reduce the impacts of bridge installation over Bee Canyon Wash at a level less than significant. For CEQA purposes, potentially significant impacts would include those impacts that require mitigation.

Permitting Process:

- If discharge of fill to Bee Canyon Wash cannot be avoided and it is determined to meet the definition of a Water of the U.S., then prior to the start of the Project's construction, the Project Applicant shall coordinate with the USACE to obtain authorization pursuant to Section 404 of the CWA (i.e. LOP or RGP 74 per SAMP permit procedures) and the RWQCB to obtain a Water Quality Certification pursuant to Section 401 of the CWA.
- If discharge of fill to Bee Canyon Wash cannot be avoided and it is determined to NOT meet the definition of a Water of the U.S., then prior to the start of the Project's construction, the Project Applicant shall submit a Notice of Intent to be enrolled under and to comply with General Water Quality Order No. 2004-2004-DWQ.
- If the Project results in substantial modification of the bed or banks of Bee Canyon Wash, then, the Project Applicant shall coordinate with CDFW to determine the need to obtain a LSAA pursuant to Section 1600 et seq. of CFGC.

SAMP Requirements:

- The applicant shall comply with the SAMP Mitigation Framework (see Section 9 below) applicable to the LOP or RGP 74 permit procedures.
- If a permanent loss of regulated waters or streambed occurs because of the Project, compensatory mitigation (purchase of credit at an in-lieu fee or mitigation bank approved by the resource agencies), or applicant proposed enhancement or establishment of waters or streambed) shall be provided at a minimum ratio of 1:1. Temporary impacts shall be restored to pre-Project conditions to the extent practicable.

Local Plans

Although the Project Site falls within the boundary of the Orange County Central/Coastal NCCP/HCP, OCTA is not a participating landowner and as a result, the Project is not eligible for coverage under the NCCP/HCP for impacts to federally and/or state listed species. However, since no federally and/or State-listed species are expected to be impacted, no sensitive communities occur on site, and avoidance and minimization measures will be implemented to reduce impacts to nesting birds protected under the MBTA and CFGC, the Project does not conflict with the NCCP/HCP and will not require payment of a Mitigation Fee per the NCCP/HCP for such impacts.

8.2 OPERATION

Impacts to biological resources during operation and maintenance of the Project are not anticipated as such activities would be conducted within previously disturbed and developed surfaces containing non-native vegetation and would generally not change biological conditions from those present prior to and after the Project's construction. Special-status plant species are not expected to occur due to a lack of suitable habitat within the Project Site and surrounding BSA, and impacts to common wildlife, special-status wildlife species, and wildlife movement are not anticipated. Maintenance activities would be conducted at the Project Site and therefore Impacts would be less than significant.

9. AVOIDANCE AND MINIMIZATION MEASURES

With the potential for ground-nesting birds protected under the MBTA and CFGC to occur within the Project Site and other bird species to occur in the surrounding BSA, implementation of Mitigation Measure BIO-1 presented below would mitigate potential impacts to nesting birds should construction overlap the bird breeding season (February 15 through September 1).

MM-BIO-1 Ground-disturbing activities during construction shall occur outside of the nesting bird season (generally February 15 through September 1). If avoiding the nesting season is not practicable, the following additional measures shall be employed:

- A pre-construction nesting survey shall be conducted by a qualified biologist within three days prior to the start of construction activities to determine whether active nests are present within or directly adjacent to the construction zone. All nests found shall be recorded.
- If construction activities must occur within 300 feet of an active nest of any passerine bird or within 500 feet of an active nest of any raptor, with the exception of an emergency, a qualified biologist shall monitor the nest on a weekly basis, and the activity shall be postponed until the biologist determines that the nest is no longer active.
- If the recommended nest avoidance zone is not feasible, the qualified biologist shall determine whether an exception is possible and obtain concurrence from the resource agencies before construction work can resume within the avoidance buffer zone. All work shall cease within the avoidance buffer zone until either agency concurrence is obtained or the biologist determines that the adults and young are no longer reliant on the nest site.

Additionally, construction of the proposed bridge over Bee Canyon Wash would require the project applicant to obtain a permit pursuant to Sections 404 and 401 of the CWA and to Section 1600 et seq of CFGC. The Project Applicant shall coordinate with the USACE to obtain authorization pursuant to Section 404 of the CWA (i.e. LOP or RGP 74 per SAMP permit procedures) and the RWQCB to obtain a Water Quality Certification pursuant to Section 401 of the CWA. Additionally, If the Project results in any modification of the bed or banks of Bee Canyon Wash, then, the Project Applicant shall coordinate with CDFW to determine the need to obtain a LSAA pursuant to Section 1600 et seq. of CFGC.

Mitigation Measure Bio-2 presented below would mitigate potential impacts of the proposed bridge to Bee Canyon Wash, reducing impacts to this jurisdictional feature to less than significant.

- **MM-BIO-2** Pursuant to SAMP requirements, if a permanent loss of regulated waters or streambed occurs because of the Project, compensatory mitigation (purchase of credit at an in-lieu fee or mitigation bank approved by the resource agencies), or applicant proposed enhancement or establishment of waters or streambed) shall be provided at a minimum ratio of 1:1. Temporary impacts shall be restored to pre-Project conditions to the extent practicable.

10.CONCLUSIONS

No direct impacts to special-status plant species are anticipated, as none were observed during the field survey and the BSA lacks habitat suitable for such species. As a result, the Project would not result in a significant impact on any federally listed or state-listed threatened, endangered, or candidate plant species, or any non-listed special-status plant species occurring or potentially occurring within the Project.

No special-status wildlife species were observed during the field survey; however, as presented in Section 5.2, two CDFW WL bird species have some potential to occur within the BSA. In addition, bird species protected by the MBTA and CFGC have the potential to occur and nest in the BSA. Potential direct impacts to these species or their nests could occur during construction or during the use or transport of the Project’s equipment or materials, on which common bird species may nest. Potential indirect impacts are associated with noise, dust, vibration, and increased human activity, which could cause adults to change their behavior, move out of the area, and abandon the nest or conduct less feedings, resulting in nestling mortality. Implementation of the avoidance and minimization measures in Section 9 would avoid disturbance of these species, resulting in less than significant impacts to special-status wildlife species and nesting birds.

Construction and operation of the Project would not affect a wildlife movement corridor. The Project Site itself does not serve as a wildlife movement corridor and vegetation removed during construction does not provide the functions and values to support wildlife movement compared to native vegetation communities. No impacts to a wildlife movement corridor would occur.

The Project would have no impact on any sensitive native vegetation community, USFWS-designated critical habitat, NMFS-managed habitat, or any other managed or protected habitat or community. However, construction of the Project includes a bridge over Bee Canyon Wash, which could result in impacts to a potential jurisdictional aquatic feature under the jurisdiction of USACE, RWQCB, and CDFW. However, by adhering to the avoidance and minimization measures in Section 9 related to coordination with regulatory agencies pursuant to CWA Section 404 and 401 and CFGC Section 1600, impacts to potential jurisdictional features would be less than significant.

11.REFERENCES

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Appendix C Attachments
Technical Memorandum
Biological Resources

Metrolink Orange County Maintenance Facility

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February 2022

Attachment A

Project Site Photos

Photo 1. Southeast-facing view from the northwest corner across Project Site.
Marine Way is visible at left, with miscellaneous rail equipment and materials stored onsite and rail tracks at right.

Photo 2. Southwest-facing view across the Project Site. Marine Way is visible at right.

Photo 3. Northwest-facing view across the Project Site, with Marine Way at left.

Photo 4. North-facing view from the southwest corner of the Project Site. Vehicles in background are parked on Marine Way. Miscellaneous rail equipment and materials stored onsite are visible at left.

Photo 5. South-facing view across patchy vegetative cover in the southern portion of the Project Site.

Photo 6. South-facing view of railroad equipment and materials stored onsite.

Photo 7. South-facing view of unmowed vegetation along Marine Way at the north end of the Project Site.

Photo 8. Southwest-facing view of portion of Bee Canyon Wash at southern edge of the Project Site.

Photo 9 A bridge carrying rail tracks into the site from rail tracks visible in the background would cross over this portion of the Bee Canyon channel.

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Attachment B

Regional Special-Status Plant Species and Sensitive Natural Communities
Regional Special-Status Wildlife Species

Table A
Special-Status Plant Species and Natural Vegetation Communities[1]

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA
PLANTS			
chaparral sand-verbena *Abronia villosa* var. *aurita*	Federal: None State: None CRPR: 1B.1	Prefers sandy soils in chaparral, coastal scrub, and desert dune habitats. Occurs between 75-1,500 meters (250-5,250 feet). Blooms (January) March-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Munz's onion *Allium munzii*	Federal: FE State: ST CRPR: 1B.1	Prefers mesic or clay soils in chaparral, cismontane woodland, coastal scrub, pinyon and juniper woodland, and valley and foothill grassland habitats. Occurs between 295-1,070 meters (965-3,510 feet). Blooms March-May.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
aphanisma *Aphanisma blitoides*	Federal: None State: None CRPR: 1B.2	Prefers sandy or gravelly soils in coastal bluff scrub, coastal dunes, and coastal scrub habitats. Occurs between 0-305 meters (0-1,000 feet). Blooms February-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western spleenwort *Asplenium vespertinum*	Federal: None State: None CRPR: 4.2	Found in rocky habitats, including chaparral, cismontane woodland, and coastal scrub. Occurs between 180-1,000 meters (590-3,280 feet). Blooms February-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Braunton's milk-vetch *Astragalus brauntonii*	Federal: FE State: None CRPR 1B.1	Prefers recent burns or disturbed areas, in stiff gravelly clay soils overlying granite or limestone. Found in closed-cone coniferous forest, chaparral, coastal scrub, and valley and foothill grassland habitats. Occurs between 5-640 meters (10-2,100 feet). Blooms January-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Coulter's saltbush *Atriplex coulteri*	Federal: None State: None CRPR 1B.2	Prefers alkaline areas or clay soils in coastal bluff scrub, coastal dune, coastal scrub, and valley and foothill grassland habitats. Occurs between 0-460 meters (10-1,510 feet). Blooms March-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**
south coast saltscale *Atriplex pacifica*	Federal: None State: None CRPR 1B.2	Found in alkali sink, coastal sage scrub, wetland-riparian playas and coastal habitats. Occurs between 0-140 meters (0-460 feet). Blooms March-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Parish's brittlescale *Atriplex parishii*	Federal: None State: None CRPR 1B.1	Found in alkaline chenopod scrub, playa, and vernal pool habitats. Occurs between 25-1,900 meters (80-6,230 feet). Blooms June-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Davidon's saltscale *Atriplex serenana* var. *davidsonii*	Federal: None State: None CRPR 1B.2	Found in areas with alkaline soils in coastal bluff scrub and coastal scrub habitats. Occurs between 10-200 meters (30-660 feet). Blooms April-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Malibu baccharis *Baccharis malibuensis*	Federal: None State: None CRPR 1B.1	Found in chaparral, cismontane woodland, coastal scrub, and riparian woodland habitats. Occurs between 150–305 meters (500-1,000 feet). Blooms in August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
thread-leaved brodiaea *Brodiaea filifolia*	Federal: FT State: SE CRPR: 1B.1	Prefers clay soils in chaparral (openings), cismontane woodland, coastal scrub, playa, valley and foothill grassland, and vernal pool habitats. Occurs between 25-1,120 meters (85-3,675 feet). Blooms March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Brewer's calandrinia *Calandrinia breweri*	Federal: None State: None CRPR: 4.2	Prefers sandy or loamy soils, disturbed sites, and burns in chaparral and coastal scrub habitats. Occurs between 10-1,220 meters (35-4,000 feet). Blooms (Jan) March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Catalina mariposa lily *Calochortus catalinae*	Federal: None State: None CRPR: 4.2, NCCP	Found in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland habitats. Occurs between 15-700 meters (50-2,300 feet). Blooms February-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
Plummer's mariposa-lily *Calochortus plummerae*	Federal: None State: None CRPR 4.2	Prefers rocky or sandy soils in coastal scrub, chaparral, valley and foothill grassland, cismontane woodland, lower montane coniferous forest habitats. Occurs between 100–1,700 meters (330-5,580 feet). Blooms May-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
intermediate mariposa lily *Calochortus weedii* var. *intermedius*	Federal: None State: None CRPR: 1B.2, NCCP	Found in chaparral, chenopod scrub, cismontane woodland, coastal scrub, lower montane coniferous forest and valley and foothill grassland. Occurs between 30-1,500 meters (100-4,920 feet). Blooms April-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Lewis' evening-primrose *Camissoniopsis lewisii*	Federal: None State: None CRPR: 3	Prefers sandy or clay soils in coastal bluff-scrub, cismontane woodland, coastal dune, coastal scrub, and valley and foothill grassland habitats. Occurs between 0-300 meters (0-985 feet). Blooms March-May (June).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Payson's jewelflower *Caulanthus simulans*	Federal: None State: None Other: 4.2	Prefers sandy or granitic soils in chaparral and coastal scrub habitats. Occurs between 90-2,200 meters (295-7,215 feet). Blooms (February) March-May (June).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
southern tarplant *Centromadia parryi* ssp. *australis*	Federal: None State: None CRPR: 1B.1	Found in margins of marshes and swamps, valley and foothill grassland, and vernal pool habitats. Occurs between 0-480 meters (0-1,570 feet). Blooms May-November.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
smooth tarplant *Centromadia pungens* ssp. *laevis*	Federal: None State: None CRPR: 1B.1	Prefers alkaline soils in chenopod scrub, meadows and seeps, playas, riparian woodland, and valley and foothill grassland habitats. Occurs between 0-640 meters (0-2,100 feet). Blooms April-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Orcutt's pincushion *Chaenactis glabriuscula* var. *orcuttiana*	Federal: None State: None CRPR: 1B.1	Found in sandy coastal bluff scrub and coastal dune habitats. Occurs between 0-100 meters (0-330 feet). Blooms January-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**
Peninsular spineflower *Chorizanthe leptotheca*	Federal: None State: None CRPR: 4.2	Prefers alluvial fan or granitic areas in chaparral, coastal scrub, and lower montane coniferous forest habitats. Occurs 300-1,900 (980-6,230 feet). Blooms May-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
San Fernando Valley spineflower *Chorizanthe parryi* var. *fernandina*	Federal: FC State: SE CRPR 1B.1	Found in sandy coastal scrub and valley and foothill grassland habitats. Occurs 150-1,220 meters (490-4,000 feet). Blooms April – July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
long-spined spineflower *Chorizanthe polygonoides* var. *longispina*	Federal: None State: None CRPR: 1B.2	Prefers clay soils in chaparral, coastal scrub, meadows and seeps, valley and foothill grassland, and vernal pool habitats. Occurs between 30-1,530 meters (100-5,020 feet). Blooms between April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
white-bracted spineflower *Chorizanthe xanti* var. *leucotheca*	Federal: None State: None CRPR: 1B.2	Prefers sandy or gravelly soils in coastal scrub (alluvial fans), Mojavean desert scrub, and pinyon and juniper woodland habitats. Occurs between 300-1,200 meters (980-3,940 feet). Blooms April-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
seaside cisanthe *Cistanthe maritima*	Federal: None State: None CRPR: 4.2	Prefers sandy habitats in coastal bluff scrub, coastal scrub, and valley and foothill grassland habitats. Occurs between 5-300 meters (15-985 feet). Blooms February-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
San Miguel savory *Clinopodium chandleri*	Federal: None State: None CRPR: 1B.2	Prefers rocky, gabbroic, or metavolcanic soils in chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland habitats. Occurs between 120-1,075 meters (390-3,525 feet). Blooms March-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
summer holly *Comarostaphylis diversifolia* ssp. *diversifolia*	Federal: None State: None Other: 1B.2	Found in chaparral and cismontane woodland habitats. Occurs between 30-790 meters (95-2,595 feet). Blooms April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**
small-flowered morning glory *Convolvulus simulans*	Federal: None State: None CRPR: 4.2	Prefers clay soils and serpentine seeps in chaparral, coastal scrub, and valley and foothill grassland habitats. Occurs between 30-700 meters (100-2,300 feet). Blooms March-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
paniculate tarplant *Deinandra paniculata*	Federal: None State: None CRPR: 4.2	Usually prefers vernally mesic, sometimes sandy coastal scrub, valley foothill grassland, and vernal pool habitats. Occurs between 25-940 meters (80-3,085 feet). Blooms (March) April-November.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western dichondra *Dichondra occidentalis*	Federal: None State: None CRPR: 4.2, NCCP	Found in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland habitats. Occurs between 50-500 meters (160-1,640 feet). Blooms (January) March-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Cleveland's bush monkeyflower *Diplacus clevelandii*	Federal: None State: None CRPR: 4.2	Found in gabbroic or rocky soils, disturbed areas, and openings in chaparral, cismontane woodland, and lower montane coniferous forest habitats. Occurs between 450-2,000 meters (1,475-6,565 feet). Blooms April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
slender-horned spineflower *Dodecahema leptoceras*	Federal: FE State: SE CRPR 1B.1	Found in sandy chaparral, cismontane woodland, and alluvial fan coastal scrub habitats. Occurs between 200-760 meters (890-2,510 feet). Blooms April-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Santa Monica dudleya *cymosa* ssp. *ovatifolia*	Federal: FT State: None CRPR 1B.1, NCCP	Prefers volcanic or sedimentary rocky soils in chaparral and coastal scrub habitats. Occurs between 150-1675 meters (495-5,525 feet). Blooms March–June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
many-stemmed dudleya *Dudleya multicaulis*	Federal: None State: None CRPR 1B.2	Prefers clay soils in chaparral, coastal scrub, and valley and foothill grassland habitats. Occurs between 15-790 meters (50-2,520 feet). Blooms April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA
Laguna Beach dudleya *Dudleya stolonifera*	Federal: FT State: ST CRPR:1B.1, NCCP	Prefers rocky areas in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland habitats. Occurs between 10-260 meters (30-855 feet). Blooms May-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
sticky dudleya *Dudleya viscida*	Federal: None State: None CRPR: 1B.2	Prefers rocky areas in coastal bluff scrub, chaparral, cismontane woodland, and coastal scrub habitats. Occurs between 10-550 meters (30-1,805 feet). Blooms May-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Santa Ana River woollystar *Eriastrum densifolium* ssp. *sanctorum*	Federal: FE State: SE CRPR:1B.1	Prefers sandy or gravelly soils in chaparral and coastal scrub (alluvial fan) habitats. Occurs between 90-610 meters (300-2,000 feet). Blooms April-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Palomar monkeyflower *Erythranthe diffusa*	Federal: None State: None CRPR: 4.3	Prefers sandy or gravelly soils in chaparral and lower montane coniferous forest habitats. Occurs between 1,220-1,830 meters (4,000-6,000 feet). Blooms April-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
cliff spurge *Euphorbia misera*	Federal: None State: None CRPR: 2B.2	Prefers rocky areas in coastal bluff scrub, coastal scrub, and Mojavean desert scrub habitats. Occurs between 10-550 meters (30-1,810 feet). Blooms December-August (October).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Palmer's grapplinghook *Harpagonella palmeri*	Federal: None State: None CRPR 4.2, NCCP	Prefers clay soils in open grassy areas within chaparral, coastal scrub, and valley and foothill grassland habitats. Occurs between 20-955 meters (65-3,130 feet). Blooms March-May.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Los Angeles sunflower *Helianthus nuttallii* ssp. *parishii*	Federal: None State: None CRPR: 1A	Found in coastal salt and freshwater marshes and swamps. Occurs between 10-1,525 meters (30-5,005 feet). Blooms August-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
Tecate cypress *Hesperocyparis forbesii*	Federal: None State: None CRPR: 1B.1, NCCP	Prefers clay, gabbroic or metavolcanic soils in closed-cone coniferous forest and chaparral habitats. Occurs between 80-1,500 meters (260-4,920 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
vernal barley *Hordeum intercedens*	Federal: None State: None CRPR: 3.2	Found in coastal dune, coastal scrub, valley and foothill grassland (saline flats and depressions), and vernal pool habitats. Occurs between 5-1,000 meters (15-3,280 feet). Blooms March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
mesa horkelia *Horkelia cuneata* var. *puberula*	Federal: None State: None CRPR 1B.1	Prefers sandy or gravelly soils in chaparral, cismontane woodland, and coastal scrub habitats. Occurs between 70-810 meters (230-2,660 feet). Blooms February-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
California satintail *Imperata brevifolia*	Federal: None State: None CRPR: 2B.1	Prefers mesic areas in chaparral, coastal scrub, Mojavean desert scrub, alkali meadows and seeps, and riparian scrub habitats. Occurs between 0-1,215 meters (0-3,990 feet). Blooms September-May.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
decumbent goldenbush *Isocoma menziesii* var. *decumbens*	Federal: None State: None CRPR 1B.2	Prefers sandy soils or disturbed areas in chaparral and coastal scrub habitats. Occurs between 10-135 meters (30-450 feet). Blooms April-November.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Coulter's goldfields *Lasthenia glabrata* ssp. *coulteri*	Federal: None State: None CRPR 1B.1	Found in coastal salt marsh, playa, and vernal pool habitats. Occurs between 0-1,220 meters (0-4,000 feet). Blooms February-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
heart-leaved pitcher sage *Lepechinia cardiophylla*	Federal: None State: None CRPR: 1B.2, NCCP	Found in closed-cone coniferous forest, chaparral, and cismontane woodland habitats. Occurs between 520-1370 meters (1,705-4,495 feet). Blooms April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
Robinson's pepper-grass *Lepidium virginicum* var. *robinsonii*	Federal: None State: None CRPR: 4.3	Found in chaparral and coastal scrub habitats. Occurs between 0-885 meters (5-2,905 feet). Blooms January-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
ocellated Humboldt lily *Lilium humboldtii* ssp. *ocellatum*	Federal: None State: None CRPR: 4.2	Prefers openings in chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, and riparian woodland habitats. Occurs between 30-1,800 meters (100-6,000 feet). Blooms March-July (August).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
California box-thorn *Lycium californicum*	Federal: None State: None CRPR: 4.2	Found in coastal bluff scrub and coastal scrub habitats. Occurs between 5-150 meters (15-495 feet). Blooms December-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
cliff malacothrix *Malacothrix saxatilis* var. *saxatilis*	Federal: None State: None CRPR: 4.2	Found in coastal bluff scrub and coastal scrub habitats. Occurs between 0-200 meters (0-660 feet). Blooms March-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
intermediate monardella *Monardella hypoleuca* ssp. *lanata*	Federal: None State: None CRPR: 1B.3	Prefers chaparral, cismontane woodland, and sometimes lower montane coniferous forest habitats. Occurs between 400-1,250 meters (1,310-4,100 feet). Blooms April-September.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
felt-leaved monardella *Monardella hypoleuca* ssp. *lanata*	Federal: None State: None CRPR: 1B.2	Found in chaparral and cismontane woodland habitats. Occurs between 300-1,575 meters (980-5,170 feet). Blooms June-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Hall's monardella *Monardella macrantha* ssp. *hallii*	Federal: None State: None CRPR: 1B.3	Found in broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, and valley and foothill grassland habitats. Occurs between 730-2,195 meters (2,395-7,200 feet). Blooms June-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
mud nama *Nama stenocarpa*	Federal: None State: None CRPR: 2B.2	Prefers marches and swamps along lake margins and riverbanks. Occurs between 5-500 meters (15-1,640 feet). Blooms January-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
Gambel's water cress *Nasturtium gambellii*	Federal: FE State: ST CRPR: 1B.1	Found in freshwater or brackish marshes and swamps. Occurs between 5-330 meters (15-1,085 feet). Blooms April-October.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
prostrate vernal pool navarretia *Navarretia prostrata*	Federal: None State: None CRPR: 1B.1	Found in mesic areas in coastal scrub, meadows and seeps, valley and foothill grassland, and vernal pool habitats. Occurs between 0-1,210 meters (5-3,970 feet). Blooms April- July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
chaparral nolina *cismontana*	Federal: None State: None CRPR 1B.2	Prefers sandstone or gabbro soils in chaparral and coastal scrub habitats. Occurs between 140-1,275 meters (460-4,180 feet). Blooms (March) May-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
California beardtongue *Penstemon californicus*	Federal: None State: None CRPR: 1B.2	Prefers sandy areas in chaparral, lower montane coniferous forest, or pinyon and juniper woodland habitats. Occurs between 1,170-2,300 meters (3,840-7,545 feet). Blooms May-June (August).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Allen's pentachaeta *Pentachaeta aurea* ssp. *allenii*	Federal: None State: None CRPR: 1B.1	Prefers openings in coastal scrub and valley and foothill grassland habitats. Occurs between 75-520 meters (245-1,706 feet). Blooms March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Santiago Peak phacelia *Phacelia keckii*	Federal: None State: None CRPR: 1B.3	Found in closed-cone coniferous forest and chaparral habitats. Occurs between 545-1,600 meters (1,785-5,250 feet). Blooms May-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
south coast branching phacelia *Phacelia ramosissima* var. *austrolitoralis*	Federal: None State: None CRPR: 3.2	Prefers sandy or rocky areas in chaparral, coastal dune, coastal scrub, and coastal salt marsh and swamp habitats. Occurs between 5-300 meters (15-985 feet). Blooms March-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
woolly chaparral-pea *Pickeringia montana* var. *tomentosa*	Federal: None State: None CRPR: 4.3	Prefers gabbroic, granitic, and clay soils in chaparral habitats. Occurs 0-1,700 meters (0-5,575 feet). Blooms May-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
chaparral rein orchid *Piperia cooperi*	Federal: None State: None CRPR: 4.2	Found in chaparral, cismontane woodland, and valley and foothill grassland habitats. Occurs 15-1,585 meters (50-5,200 feet). Blooms March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
narrow-petaled rein orchid *Piperia leptopetala*	Federal: None State: None CRPR: 4.3	Found in cismontane woodland, lower montane coniferous forest, and upper montane coniferous forest habitats. Occurs 380-2,225 meters (1,245-7,300 feet). Blooms May-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
Fish's milkwort *Polygala cornuta* var. *fishiae*	Federal: None State: None CRPR: 4.3	Found in chaparral, cismontane woodland, and riparian woodland habitats. Occurs between 100-1,000 meters (330-3,280 feet). Blooms May-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
white rabbit-tobacco *Pseudognaphalium leucocephalum*	Federal: None State: None CRPR: 2B.2	Prefers sandy, gravelly areas in chaparral, cismontane woodland, coastal scrub, or riparian woodland habitats. Occurs between 0-2,100 meters (0-6,890 feet). Blooms (July) August-November (December).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Nuttall's scrub oak *Quercus dumosa*	Federal: None State: None CRPR 1B.1, NCCP	Prefers sandy or clay loam soils in closed-cone coniferous forest, chaparral, and coastal scrub habitats. Occurs between 15-400 meters (50-1,310 feet). Blooms February-August.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Coulter's matilija poppy *Romneya coulteri*	Federal: None State: None CRPR: 4.2, NCCP	Found in chaparral or coastal scrub habitats. Occurs between 20-1,200 meters (65-3,940 feet). Blooms March-July (August).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
chaparral ragwort *Senecio aphanactis*	Federal: None State: None CRPR: 2B.2	Prefers alkaline sites in chaparral, cismontane woodland, and coastal scrub habitats. Occurs 15-800	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA**
		meters (50-2,625 feet). Blooms January-April (May).	
salt spring checkerbloom *Sidalcea neomexicana*	Federal: None State: None CRPR: 2B.2	Prefers alkaline or mesic sites in chaparral, coastal scrub, lower montane coniferous forest, Mojavean desert scrub, and playas. Occurs between 15-1,530 meters (50-5,020 feet). Blooms March-June.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
estuary seablite *Suaeda esteroa*	Federal: None State: None CRPR: 1B.2	Found in coastal salt marshes and swamps. Occurs between 0-5 meters (0-20 feet). Blooms May-January.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
San Bernardino aster *Symphyotrichum defoliatum*	Federal: None State: None CRPR: 1B.2	Prefers sites near ditches, streams, and springs in coastal scrub, meadows and seeps, cismontane woodland, lower montane coniferous forest, and valley and foothill grassland habitats. Occurs between 0-2,040 meters (0-6,690 feet). Blooms July-November.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Parry's tetracoccus *Tetracoccus dioicus*	Federal: None State: None CRPR: 1B.2	Found in chaparral and coastal scrub habitats. Occurs between 165-1,000 meters (540-3,280 feet). Blooms April-May.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the project falls outside the elevation range known for this species.
big-leaved crownbeard *Verbesina dissita*	Federal: FT State: ST CRPR: 1B.1	Found in maritime chaparral and coastal scrub habitats. Occurs between 45-205 meters (145-675 feet). Blooms (March) April-July.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Sensitive Natural Communities			
California Walnut Woodland			**Absent**
Canyon Live Oak Ravine Forest			**Absent**
Riversidian Alluvial Fan Sage Scrub			**Absent**
Southern California Arroyo Chub/Santa Ana Sucker Stream			**Absent**
Southern Coast Live Oak Riparian Forest			**Absent**
Southern Coastal Salt Marsh			**Absent**
Southern Cottonwood Willow Riparian Forest			**Absent**
Southern Interior Cypress Forest			**Absent**
Southern Mixed Riparian Forest			**Absent**

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**
Southern Riparian Forest			**Absent**
Southern Riparian Scrub			**Absent**
Southern Sycamore Alder Riparian Woodland			**Absent**
Southern Willow Scrub			**Absent**
Valley Needlegrass Grassland			**Absent**

[1] Special-status plant species and sensitive natural communities known from the CNDDB and CNPS to occur on the El Toro, Tustin, Orange, Black Star Canyon, Corona South, Santiago Peak, Laguna Beach, San Juan Capistrano, and Canada Gobernadora quadrangles, and from a search of the IPaC for the project vicinity.

[2] Sensitivity Status Codes

Federal
- **FT** - Federally Threatened under the Federal Endangered Species Act
- **FE** - Federally Endangered under the Federal Endangered Species Act
- **FC** – A Federal Candidate for listing under the Federal Endangered Species Act

State
- **ST** - State Threatened under the California Endangered Species Act
- **SE** - State Endangered under the California Endangered Species Act

CRPR
- CNPS California Rare Plant Rank (CRPR)
- **1A:** Plants presumed extinct in California
- **1B**: Plants rare, threatened, or endangered in California and elsewhere
- **2**: Plants rare, threatened, or endangered in California, but more common elsewhere
- **3**: Plants more information is needed for
- **4**: Plants of limited distribution – a watch list
  - **0.1**: Seriously threatened in California
  - **0.2**: Fairly endangered in California
  - **0.3**: Not very endangered in California

[3] General Habitat Descriptions from CNPS.

Table B
Special-Status Wildlife Species[1]

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA[4]
Invertebrates			
Crotch bumble bee *Bombus crotchii*	Federal: None State: CE Other: CNDDB	Occurs at relatively warm and dry sites, including the inner Coast Range of California and the margins of the Mojave Desert.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
San Diego fairy shrimp *Branchinecta sandiegonensis*	Federal: FE State: None Other: NCCP	Occurs in vernal pools from 5-30 centimeters deep at temperatures between 10-20°C (50-68°F). Occasionally found in ditches and road ruts that support suitable conditions.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Riverside fairy shrimp *Streptocephalus wootoni*	Federal: FE State: None Other: NCCP	Occurs in vernal pools at least 30 centimeters in depth. Found in Riverside and San Diego counties, as well as northern Baja California.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
monarch butterfly-California overwintering population *Danaus plexippus pop. 1*	Federal: None State: None Other: CNDDB	Winter roosts occur along California coast from Mendocino County, south to Baja California, Mexico. Roosts in wind-protected tree groves (eucalyptus, Monterey pine, cypress) with nectar and water sources nearby.	**Not Expected.** Potentially suitable tree groves are absent from the BSA and there are no suitable water sources nearby.
quino checkerspot butterfly *Euphydryas editha quino*	Federal: FE State: None Other: NCCP	Occurs in coastal sage scrub habitats in southern California and northern Baja California. Larvae rely on host plants *Plantago erecta* or *Castilleja exserta* found in meadows and upland sage scrub/chaparral.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and the host plant for this species was not detected within the BSA.
San Gabriel chestnut *Glyptostoma gabrielense*	Federal: None State: None Other: CNDDB	Found in humid areas in rocky hills and mountains at low elevations.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
mimic tryonia (=California brackishwater snail) *Tryonia imitator*	Federal: None State: None Other: CNDDB	Prefers coarse brackish sediments at the mouths of creeks, streams and rivers of southern California.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Fish			
Santa Ana sucker *Catostomus santaanae*	Federal: FT State: None	Inhabits permanent streams and rivers, with depths from a few centimeters to over a meter. Water must be cool with variable flows. Substrates of gravel, rubble and boulders are preferred for foraging and required for breeding.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA[4]
tidewater goby *Eucyclogobius newberryi*	Federal: FE State: None Other: SSC	Occurs in small coastal lagoons, lower reaches of streams, and uppermost portions of large bays. Most abundant in the upper ends of lagoons created by small coastal streams. In lower sections of coastal streams, occurs in fresh to brackish water (preferably less than 10 ppt).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
arroyo chub *Gila orcuttii*	Federal: None State: None Other: SSC	Found in headwaters, creeks, and small to medium rivers, often intermittent streams; permanent, small to moderate-sized, moderate to high gradient streams with more than 50% of the habitat as runs and pools < 10 cm deep and reaches of permanent water more than 2 km long; requires some flow.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
steelhead – southern California DPS *Oncorhynchus mykiss irideus pop.10*	Federal: FE State: None	Found in Pacific Ocean tributaries from Aleutian Islands in Alaska south to Southern California. Anadromous forms are known as steelhead, freshwater forms as rainbow trout.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Santa Ana speckled dace *Rhinichthys osculus ssp. 3*	Federal: None State: None Other: SSC	Inhabits a variety of habitats, including perennial streams, riffles dominated by gravel and cobble, and pools in low-gradient streams. Mainly found in areas that maintain summer water temperatures below 68 °F (20 °C).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Reptiles			
southern California legless lizard *Anniella stebbinsi*	Federal: None State: None Other: SSC	Found in a broader range of habitats than any of the other species in the genus. Often locally abundant, specimens are found in coastal sand dunes and a variety of interior habitats, including sandy washes and alluvial fans.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
California glossy snake *Arizona elegans occidentalis*	Federal: None State: None Other: SSC	Most common is desert habitats but also occur in chaparral, sagebrush, valley-foothill hardwood, pine-juniper, and annual grass.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
orange-throated whiptail *Aspidoscelis hyperythra*	Federal: None State: None Other: WL, NCCP	Inhabits washes, streams, terraces, and other sandy areas often where there are rocks and patches of brush and rocky hillsides. Frequent coastal chaparral, thorn scrub and streamside growth.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA[4]
coastal whiptail *Aspidoscelis tigris stejnegeri*	Federal: None State: None Other: SCC, NCCP	Found in deserts and semiarid areas with sparse vegetation and open areas. Also occurs in woodland and riparian areas. Substrate may be firm, sandy, or rocky soils.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
red-diamond rattlesnake *Crotalus ruber*	Federal: None State: None Other: SSC, NCCP	Occurs in coastal sage scrub, chamise chaparral, redshank, desert slope scrub, desert washes, grassy fields, orchards, cactus patches, and rocky areas.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western pond turtle *Emys marmorata*	Federal: None State: None Other: SSC	Inhabits permanent or nearly permanent bodies of water in many habitat types, below 1,830 meters (6,000 feet). Requires basking sites such as partially submerged logs, vegetation mats, or open mud banks. Also needs suitable nesting sites.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
coast horned lizard *Phrynosoma blainvillii*	Federal: None State: None Other: SSC, NCCP	Inhabits coastal sage scrub and chaparral in arid and semiarid climates. Prefers friable, rocky, or shallow sandy soils.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
coast patch-nosed snake *Salvadora hexalepis virgultea*	Federal: None State: None Other: SSC	Inhabits brushy chaparral habitats dominated by chamise and redshank, as well as riparian areas.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
two-striped garter snake *Thamnophis hammondii*	Federal: None State: None Other: SSC	Highly aquatic, found in or near permanent freshwater, often along streams with rocky beds and riparian growth. Known from coastal California from the vicinity of Salinas to northwest Baja California, from sea level to about 2,135 meters (7,000 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Amphibians			
arroyo toad *Anaxyrus californicus*	Federal: FE State: None Other: SSC, NCCP	Requires shallow, slow moving stream and riparian habitat, with extensive braided channels and sediment deposits of sand, gravel, or pebbles, occasionally reworked by flooding. Tadpoles may require 2-4 years to complete their aquatic development.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western spadefoot *Spea hammondii*	Federal: None State: None Other: SSC, NCCP	Grasslands with shallow temporary pools are optimal habitats for the western spadefoot. Elevations of occurrence extend from near sea level to 1,360 meters (4,460 feet). This species occurs primarily in	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**[4]
		grasslands, but occasional populations also occur in valley-foothill hardwood woodlands.	
Coast Range newt *Taricha torosa*	Federal: None State: None Other: SSC	Endemic to California. Found in wet forests, oak forests, chaparral, and rolling grasslands. In southern California, drier chaparral, oak woodland, and grasslands are used.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Birds			
Cooper's hawk *Accipiter cooperii*	Federal: None State: None Other: WL	Inhabits dense stands of live oak, riparian deciduous, or other forest habitats near water. Nests in deciduous riparian areas, usually near streams. Species has become a fairly common urban/suburban bird in southern California.	**Low:** This species is common in urbanized areas across southern California and a CNDDB record of this species from 2016 occurs approximately one mile southwest of the BSA along San Diego Creek. This species may fly over or occur within the BSA as a transient migrant or forager. Mature trees in the BSA may provide suitable nesting habitat; however, this species prefers nesting in riparian habitats and is not expected to nest in the BSA.
tricolored blackbird *Agelaius tricolor*	Federal: None State: ST Other: SSC	Inhabits annual grasslands, wet and dry vernal pools, seasonal wetlands. Frequently found in and around agricultural areas.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
southern California rufous-crowned sparrow *Aimophila ruficeps*	Federal: None State: None Other: WL, NCCP	Resident of southern California coastal sage scrub and sparse mixed chaparral. Frequents relatively steep, often rocky hillsides with grass and forb patches.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
grasshopper sparrow *Ammodramus savannarum*	Federal: None State: None Other: SSC	Prefers moderately open grasslands with scattered shrubs such as California buckwheat and California sagebrush.	**Not Expected.** The BSA lacks scattered native scrubs preferred by this species and the nearest record is from 2003 and is approximately 4-5 miles south of the BSA. As a result, this species is not expected to occur within the BSA. Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**[4]
golden eagle *Aquila chrysaetos*	Federal: None State: None Other: BGE, FP, NCCP	Prefers rolling foothills and mountain terrain, wide arid plateaus deeply cut by streams and canyons, open mountain slopes, and cliffs and rock outcrops. Uncommon permanent resident and migrant throughout California, except center of Central Valley. Ranges from 0-3,830 meters (0-11,500 feet). Habitat typically includes rolling foothills, mountain areas, sage-juniper flats, and desert.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
great blue heron *Ardea herodias*	Federal: None State: None Other: CNDDB	Prefers shallow estuaries and fresh and saline emergent wetlands.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
long-eared owl *Asio otus*	Federal: None State: None Other: SSC	Prefers dense foliage, such as willow thickets and evergreen trees. Nests in conifer groves adjacent to open fields and wetlands.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
burrowing owl *Athene cunicularia*	Federal: None State: None Other: SSC	Inhabits open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, California ground squirrel.	**Not Expected.** Although two 2010 records of this species occur within 2 miles of the BSA and conditions onsite are marginally suitable, no indications of this species presence onsite (i.e. suitable burrows, owl pellets, white-wash) were observed during the field survey. As a result, this species is not expected to occur within the BSA.
ferruginous hawk *Buteo regalis*	Federal: None State: None Other: WL	Inhabits arid grasslands and adjacent farmlands. Nests in isolated trees or on rock outcrops.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
coastal cactus wren *Campylorhynchus brunneicapillus sandiegensis*	Federal: None State: None Other: SSC, NCCP	Inhabits cactus scrub complexes that can include *Rhus* sp. Presence of cholla cactus is preferred, as well as large dense stands of cactus.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western snowy plover *Charadrius nivosus*	Federal: FT State: None Other: SSC	Inhabits coastal beaches, coastal dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries. Less common habitat includes dredged material disposal sites, salt pond levees, dry salt ponds, and river bars.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA[4]
northern harrier *Circus hudsonius*	Federal: None State: None Other: SSC, NCCP	Found in meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands, and occasionally in wooded areas. Occurs from 0-3,000 meters (0-10,000 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Federal: FT State: SE	Found in valley foothill and desert riparian habitats across California. Breeding pairs are known to reside in the Sacramento and Owens valleys and along the Kern, Santa Ana, Amargosa, and San Luis Rey rivers.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
yellow rail *Coturnicops noveboracensis*	Federal: None State: None Other: SSC	Inhabits sedge marshes and meadows with moist soil or shallow standing water.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
white-tailed kite *Elanus leucurus*	Federal: None State: None Other: FP	Inhabits herbaceous and open stages of most habitats, primarily in cismontane California. Prefers undisturbed, open grasslands, meadows, farmlands, and emergent wetlands for foraging.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
southwestern willow flycatcher *Empidonax traillii extimus*	Federal: FE State: SE Other: NCCP	Found in riparian woodlands in Southern California.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
California horned lark *Eremophila alpestris actia*	Federal: None State: None Other: WL	Prefers expansive open areas, with barren or sparsely vegetated ground, such as beaches, plowed fields and occasionally parking lots or runways.	**Low.** Although site conditions may be suitable for this ground-nesting species, the nearest record of this species is from 2003 and occurs approximately 4 miles south of the BSA.
American peregrine falcon *Falco peregrinus anatum*	Federal: Delisted State: Delisted Other: FP, NCCP	Frequents bodies of water in open areas with cliffs and canyons nearby for cover and nesting. Also know to nest on tall buildings or bridges within urban environments.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
bald eagle *Haliaeetus leucocephalus*	Federal: Delisted State: SE Other: BGE, FP	Occurs as a local winter migrant of inland waters in southern California, including at Big Bear Lake, Cachuma Lake, Lake Mathews, Nacimiento Reservoir, San Antonio Reservoir, and along the Colorado River.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
yellow-breasted chat *Icteria virens*	Federal: None State: None Other: SSC	Occurs in dense tangled brushy patches, hedgerows and wood edges, in open sunny areas and along riparian woodland ecotones.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status[2]**	**General Habitat Description[3]**	**Potential for Occurrence in the BSA[4]**
California black rail *Laterallus jamaicensis coturniculus*	Federal: None State: ST Other: FP	Inhabits saline, brackish, and fresh emergent wetlands.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Belding's savannah sparrow *Passerculus sandwichensis beldingi*	Federal: None State: SE	Inhabits southern coastal wetlands.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
coastal California gnatcatcher *Polioptila californica*	Federal: FT State: None Other: SSC, NCCP	Obligate, permanent resident of coastal sage scrub below 2.500 feet (760 meters) in southern California. Inhabits low, coastal sage scrub in arid washes, on mesas and slopes.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
light-footed Ridgway's rail *Rallus obsoletus levipes*	Federal: FE State: SE Other: FP	Resident of coastal wetlands in southern California.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
yellow warbler *Setophaga petechia*	Federal: None State: None Other: SSC	Occupy riparian vegetation in close proximity to water along streams and in wet meadows. Associated with willows and cottonwoods.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
California least tern *Sternula antillarum browni*	Federal: FE State: SE Other: FP	Found along coastal beaches, bays, large rivers, and salt flats. Known to feed in shallow coastal waters and occasionally inland.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
least Bell's vireo *Vireo bellii pusillus*	Federal: FE State: SE Other: NCCP	Summer resident of southern California in low riparian habitat in vicinity of water or in dry river bottoms, below 620 meters (2,000 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Mammals			
pallid bat *Antrozous palidus*	Federal: None State: None Other: SCC, WBWG-H	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rock areas for roosting. Roosts must protect bats from high temperatures; very sensitive to disturbance of roosting sites.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
northwestern San Diego pocket mouse *Chaetodipus fallax*	Federal: None State: None Other: SSC	Found in coastal scrub, chamise-redshank chaparral, mixed chaparral, sagebrush, desert wash, desert scrub, desert succulent scrub, pinyon-juniper, and annual grassland habitats. Prefers sandy herbaceous areas with rocks or course gravel. Occurs in Riverside, San Bernardino, and San Diego counties from 0-1,350 meters (0-4,500 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name *Scientific Name*	Status[2]	General Habitat Description[3]	Potential for Occurrence in the BSA[4]
Mexican long-tongued bat *Choeronycteris mexicana*	Federal: None State: None Other: SSC, WBWG-H	In California, mostly known from urban habitats in San Diego county. In New Mexico and Arizona, found in desert and montane riparian, desert succulent shrub, desert scrub, and pinyon-juniper habitats from 0-2,400 meters (0-6,000 feet).	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Stephens' kangaroo rat *Dipodomys stephensi*	Federal: FE State: ST	Found from San Jacinto Valley in Riverside County to the vicinity of Vista in San Diego County. Prefers grassland habitats, but also found in open coastal scrub or sagebrush and disturbed areas.	**Not Expected.** Although onsite habitat is potentially suitable for this species, it is not known to occur in Orange County.
western mastiff bat *Eumops perotis californicus*	Federal: None State: None Other: SCC, WBWG-H	Known from open semiarid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grassland, and chaparral. Roosts in crevices in cliff faces, high buildings, trees, and tunnels. Roost locations are generally high above the ground providing a 3-meter minimum clearance below the entrance for flight. Requires large open-water drinking sites.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western red bat *Lasiurus blossevillii*	Federal: None State: None Other: SCC, WBWG-H	Prefers edges or habitat mosaics that have trees for roosting and open areas for foraging. Roosting habitat includes forests and woodlands from sea level up through mixed conifer forests. Feeds over a wide variety of habitats including grasslands, shrublands, open woodlands and forests, and croplands. Not found in desert areas	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
western yellow bat *Lasiurus xanthinus*	Federal: None State: None Other: SSC, WBWG-H	Occurs below 600 meters (2,000 feet) in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. Roosts in trees and palms.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Yuma myotis *Myotis yumanensis*	Federal: None State: None Other: WBWG-LM	Distribution is closely tied to bodies of water, which it uses as foraging sites and sources of drinking water. Found in a wide variety of habitats ranging from sea level to 3,300 meters (11,000 feet), but it is uncommon to rare above 2,560 meters (8,000 feet). Optimal habitats are open forests and woodlands with sources of water over which to feed.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.

Common Name ***Scientific Name***	**Status**[2]	**General Habitat Description**[3]	**Potential for Occurrence in the BSA**[4]
San Diego desert woodrat *Neotoma lepida intermedia*	Federal: None State: None Other: SCC, NCCP	Found in coastal scrub of southern California from San Diego County to San Luis Obispo County. Moderate to dense canopies preferred. They are particularly abundant in rock outcrops and rocky cliffs and slopes.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
pocketed free-tailed bat *Nyctinomops femorosaccus*	Federal: None State: None Other: SSC, WBWG-M	Occurs in pinyon-juniper woodlands, desert scrub, desert succulent scrub, desert riparian, desert wash, alkali desert scrub, Joshua tree, and palm oasis habitats. Roost in rock crevices, caverns, or buildings.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
big free-tailed bat *Nyctinomops macrotis*	Federal: None State: None Other: SSC, WBWG-MH	Often found in urban areas. Roost in buildings, caves, hollow trees, high cliffs, and rocky outcrops.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
southern grasshopper mouse *Onychomys torridus ramona*	Federal: None State: None Other: SSC	Prefers alkali desert scrub and other desert scrub habitats. Also occurs in succulent shrub, wash, riparian, coastal scrub, mixed chaparral, sagebrush, low sage, and bitterbrush habitats.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
Pacific pocket mouse *Perognathus longimembris pacificus*	Federal: FE State: None Other: SSC, NCCP	Inhabits areas with fine-grained sandy substrates in coastal dunes, river alluvium, and coastal sage scrub habitats within 3 miles of the ocean.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
southern California saltmarsh shrew *Sorex ornatus salicornicus*	Federal: None State: None Other: SSC	Occurs in coastal salt marshes, preferring those dominated by pickleweed and saltgrass.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA.
American badger *Taxidea taxus*	Federal: None State: None Other: SCC	Uncommon, permanent resident found throughout most of the state, except in the northern North Coast area. Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils.	**Not Expected.** Potentially suitable habitat for this species is absent from the BSA and burrows suitable for the species were not observed during the field survey.

[1] Special-status wildlife species known from the CNDDB and NMFS databases to occur in the El Toro, Tustin, Orange, Black Star Canyon, Corona South, Santiago Peak, Laguna Beach, San Juan Capistrano, and Canada Gobernadora quadrangles, and from a search of IPaC for the project vicinity.

[2] Sensitivity Status Codes

Federal	**FT** – Federally Threatened under Federal Endangered Species Act (FESA)
	FE – Federally Endangered under FESA
State	**ST** – State Threatened under California Endangered Species Act (CESA)
	SE – State Endangered under CESA
	SC – State Candidate for listing under CESA
Other	**BGE** – Bald and Golden Eagle Protection Act
	SSC – Designated as a Species of Special Concern by CDFW

WL – Designated as a Watch List species by CDFW
CNDDB – Tracked by CDFW in the CNDDB or considered locally sensitive
WBWG-H – Designated by the Western Bat Working Group (WBWG) as High Priority - species that are imperiled or are at high risk of imperilment
WBWG-M – Designated by the WBWG as Medium Priority – a level of concern that should warrant closer evaluation, more research, and conservation actions of both species and possible threats
WBWG-L – Designated by the WBWG as Low Priority – an indication that existing data supports stable populations of the species and that the potential for major changes in status in the future is considered unlikely

[3] General Habitat Descriptions from CDFW and NMFS.

[4] References to historical species occurrences taken from the CNDDB (CDFW 2020a).

Appendix D
Technical Memorandum
Cultural Resources

Metrolink Orange County Maintenance Facility

Prepared for:

Orange County Transportation Authority

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And

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Cultural Resources Technical Memorandum	01/08/21
1	Draft Cultural Resources Technical Memorandum (Incorporating OCTA's comments)	03/17/21
2	Draft Cultural Resources Technical Memorandum (Incorporating Independent Reviewer's comments)	08/24/21
3	Draft Cultural Resources Technical Memorandum (Incorporating Independent Reviewer's comments and results of Native American AB 52 consultation)	10/04/21
4	Draft Cultural Resources Technical Memorandum (Incorporating comments from OCTA)	11/18/2021
5	Draft Cultural Resources Technical Memorandum (Incorporating comments from OCTA)	12/13/2021

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The purpose of this memorandum is to present the results of a cultural resources investigation and to describe the potential impacts to historic properties as defined by Section 106 of the National Historic Preservation Act (NHPA), or cultural resources as defined by CEQA, that may be associated with the Project.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

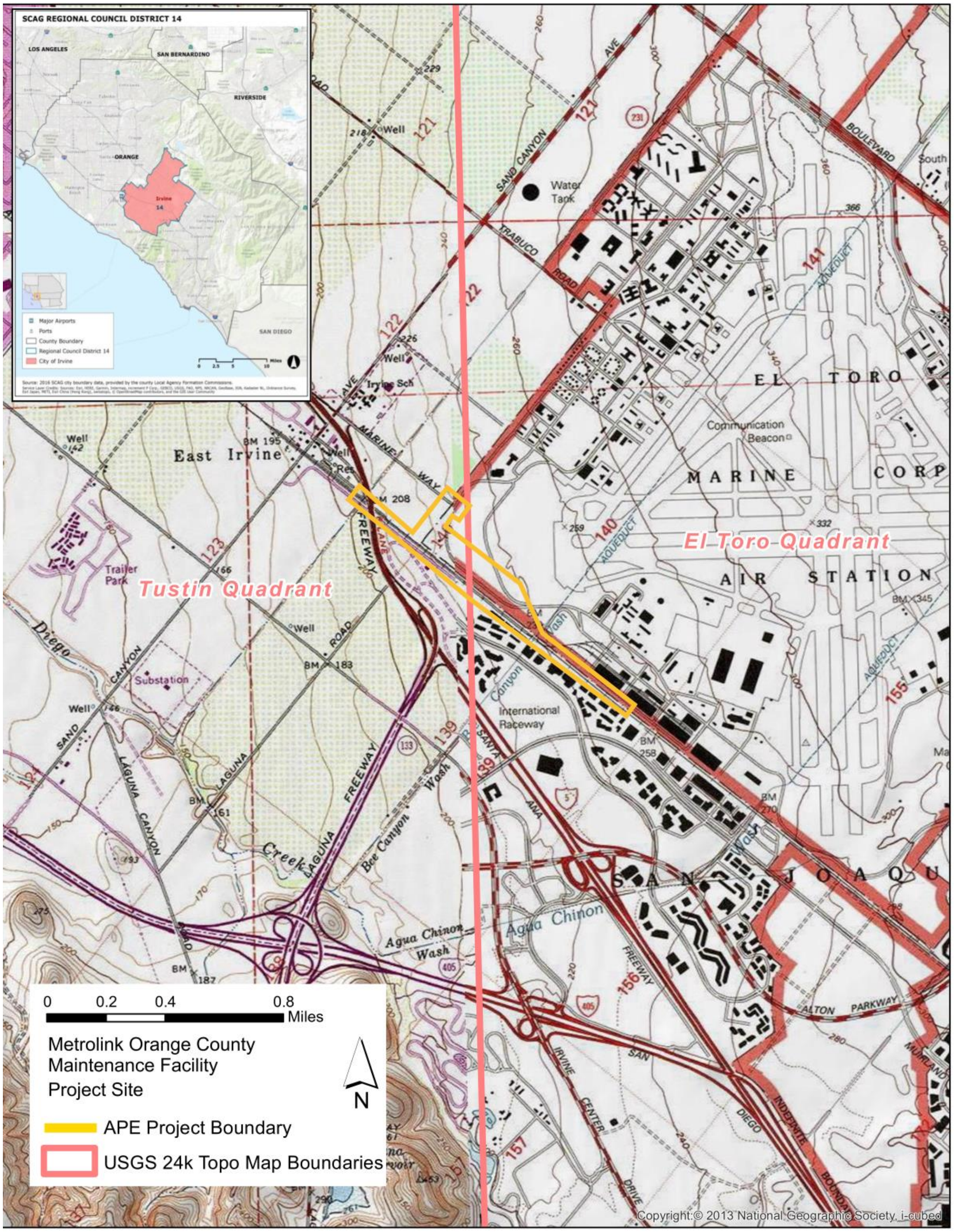
The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

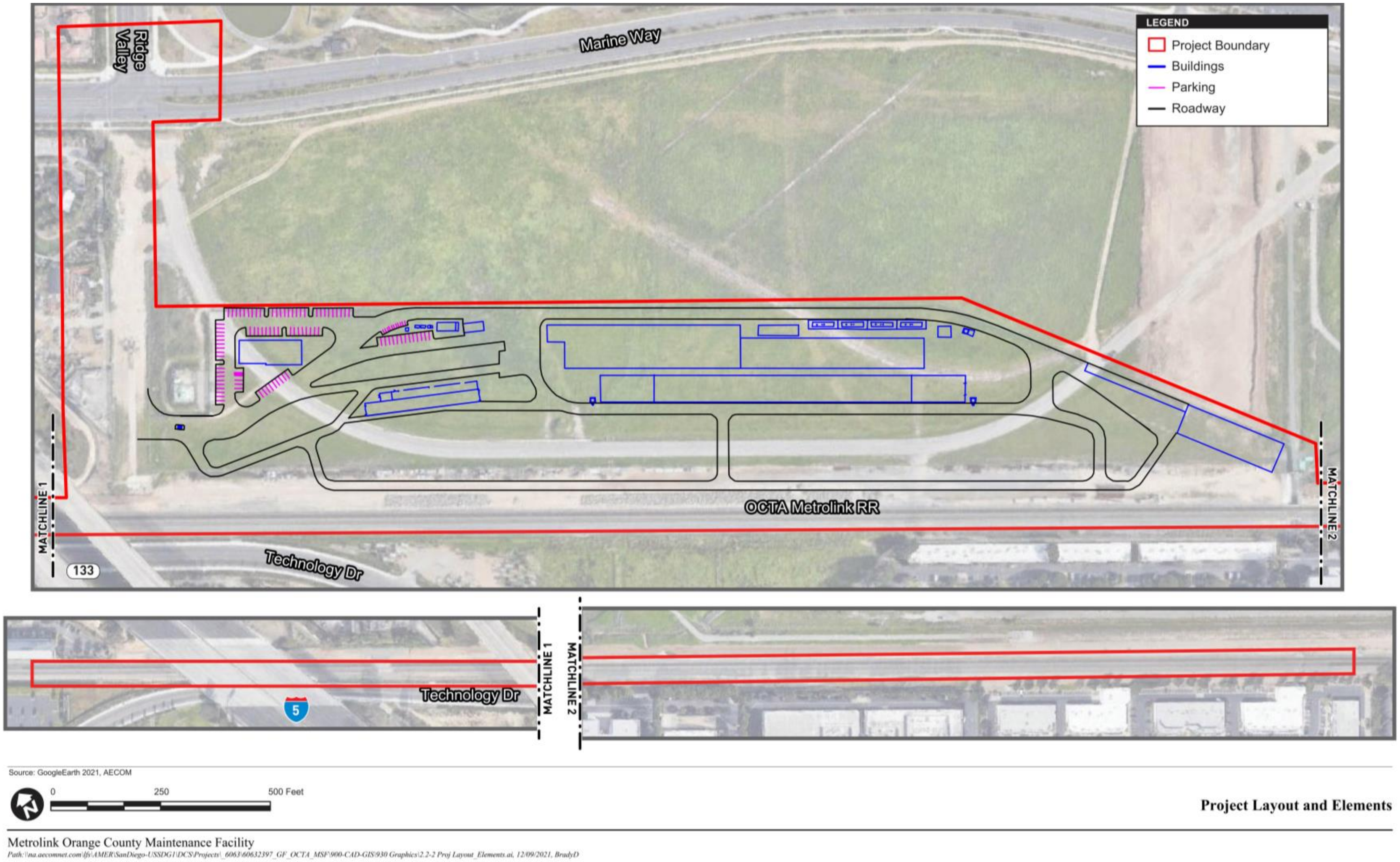
The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1 and Figure 2.2-2). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval.

Figure 2.2-1 Project Location



Source: ESRI (2021), OCTA (2021)

Figure 2.2-2 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 0-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 0-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)
Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette.

Parking would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 0-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.

Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink's "Orange" Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

3. ENVIRONMENTAL SETTING

3.1 REGULATORY FRAMEWORK

3.1.1 National Environmental Policy Act and National Historic Preservation Act

Federal agencies must consider the effects of proposed projects on historic properties and natural resources. Lead agencies evaluate potential impacts under the National Environmental Policy Act (Public Law 91-190; NEPA) and potential effects under the NHPA (16 USC 470) to "historic properties," which are defined as resources that are listed in or eligible for listing in the National Register of Historic Places (NRHP), in an effort to avoid potential significant impacts and adverse effects. Resources that may be eligible for listing in the NRHP include districts, sites, buildings, structures, and objects that are at least 50 years old and are significant in American history, prehistory, architecture, archaeology, engineering, and/or culture. To be eligible for listing, the resource must meet one of the NRHP Criteria for Evaluation (A–D) (36 Code of Federal Regulations [CFR] 60.4), as follows:

A. A property is associated with events that have made a significant contribution to the broad patterns of our history; or

B. A property is associated with the lives of a person or persons significant in our past; or

C. A property embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possesses high artistic values, or that represents a significant and distinguishable entity whose components may lack individual distinction; or

D. A property has yielded, or may be likely to yield, information important in prehistory or history.

In addition, historic properties must possess integrity of location, design, setting, material, workmanship, feeling, and association.

Resources younger than 50 years may be eligible if they have exceptional importance and meet Criteria Consideration G, as described in Bulletin No. 22 from the National Park Service (NPS), *How to Evaluate and Nominate Potential National Register Properties that have Achieved Significance Within the Last 50 Years* (Sherfy and Luce 1998). Other types of resources that are typically not eligible for the NRHP, including religious properties, moved properties, birthplaces or graves, cemeteries, reconstructed properties, and commemorative properties, may be eligible under other specific NRHP criteria considerations.

NEPA requires that environmental impacts to historic properties be evaluated and addressed during the environmental review process in coordination with procedures established by Section 106 of the NHPA to address effects on historic properties. A significant impact and/or an adverse effect would occur if a project would directly or indirectly diminish any of the characteristics that qualify a historic property for NRHP eligibility or listing. Under NEPA, a significant impact may be resolved with mitigation measures to avoid the impact or to reduce the impact to a level of less than significant. Under Section 106 of the NHPA, adverse effects must be resolved through a consultation process between the federal lead agency, the State Historic Preservation Office, interested parties, and the Advisory Council on Historic Preservation (ACHP). If an adverse effect cannot be avoided, mitigation may be agreed upon and documented in a signed Memorandum of Agreement to resolve the adverse effect. If mitigation is not agreed upon through the Section 106 process, consultation is terminated and the ACHP may make comments on the procedure.

3.1.2 California Environmental Quality Act

CEQA (Public Resources Code [PRC] Sections 21000–21177) is intended to prevent significant avoidable impacts to the environment by requiring feasible alternatives or mitigation measures. If cultural resources are identified within the Project Site, the sponsoring agency must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the cultural resource.

A cultural resource is considered to be a "historical resource" under CEQA if the resource meets the criteria for listing in the California Register of Historical Resources (CRHR) (PRC Section 5024.1, Title 14 California Code of Regulations [CCR], Section 4852). The CRHR was designed to be used by state and local agencies, private groups and citizens to identify existing historical resources within the state and to indicate which of those resources should be protected, to the extent prudent and feasible, from substantial adverse change. The criteria for the CRHR (PRC Section 5024.1, Title 14 CCR, Section 4852) are consistent with the criteria for the NRHP, but generally focus on resources of statewide, rather than national, significance. To be eligible for listing in the CRHR, a property generally must be at least 50 years of age and possess significance at the local, state, or national level, under one or more of the following four criteria:

1. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States;
2. It is associated with the lives of persons important to local, California, or national history;
3. It embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values; and/or
4. It has yielded, or has the potential to yield, information important in the prehistory or history of the local area, California, or the nation.

Potential historical resources eligible for listing in the CRHR may include buildings, sites, structures, objects and historic districts. A resource less than 50 years of age may be eligible if it can be demonstrated that sufficient time has passed to understand its historic importance. While the criteria for the CRHR is less rigorous than the NRHP with regard to the issue of integrity, there is the expectation that properties reflect their appearance during their period of significance (Title 14 CCR, Section 4852).

Archaeological resources identified as "unique archaeological resources" are similarly protected by Division 13, Chapter 2.6, of the Public Resources Code. A "unique archaeological resource" is defined as an archaeological resource that:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
2. Has a special and particular quality such as being the oldest of its type or the best available example of its type.
3. Is directly associated with a scientifically recognized important prehistoric or historic event or person. (PRC Division 13, Chapter 2.6, 21083.2[g])

An archaeological resource that is considered nonunique need be given no additional consideration other than its existence being recorded, unless it is determined to be a tribal cultural resource.

3.1.3 Public Resources Code Section 5097.5

PRC Section 5097.5 states that no person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological, or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. “Public lands” refers to land owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

3.1.4 Public Resources Code Section 5097.9-5097.991

PRC Section 5097.9 protects the free expression of Native American religion. Section 5097.91 creates the Native American Heritage Commission (NAHC) to coordinate with state agencies. Section 5097.94 empowers the NAHC to identify and catalog Native American sacred sites, including graves, thereby creating the Sacred Lands File. The NAHC is also empowered to make recommendations to public agencies to ensure their access and protection. Section 5097.98 mandates County Coroners to notify the NAHC when human remains of Native American origin are identified and provides for the identification of a Most Likely Descendant to advise the respectful treatment of such remains. Section 5097.99 makes it illegal to obtain Native American artifacts or human remains from a burial or cairn except by following the legal process outlined in Section 5097.98, and Section 5097.991 indicates that it is the policy of the State that Native American human remains and grave artifacts be repatriated.

3.1.5 Public Resources Code Section 21074

PRC Section 21074 was added as one of the amendments to CEQA enacted in Assembly Bill (AB) 52. This section creates a new category of resources called tribal cultural resources, which are defined as either of the following:

1. Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
    a. Included or determined to be eligible for inclusion in the CRHR.
    b. Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1.

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

3.1.6 Public Resources Code Section 21080.3.1

PRC Section 21080.3.1 was also added to the Public Resources Code by AB 52. Section 21080.3.1 recognizes that California Native American tribes which are traditionally and culturally affiliated with a geographic area may have expertise regarding potential tribal cultural resources that may be impacted by proposed projects. Section 21080.3.1 also mandates that a lead agency consult with geographically and culturally affiliated Native American tribes prior to the release of a negative declaration, mitigated negative declaration, or environmental impact report for a project in order to identify potential impacts to tribal cultural resources and, if necessary, craft mitigation measures to reduce impacts to tribal cultural resources.

3.1.7 Local Regulations - City of Irvine General Plan

The City of Irvine General Plan includes Element E on Cultural Resources. It recognizes the importance of historical, archaeological and paleontological resources in the City and establishes a process for their early identification, consideration, and where appropriate, preservation. It requires assessment of potential resources on projects and utilizes planning policies, ordinances, approval conditions and mitigation measures to protect the resources.

Cultural resources are the physical remains of the City's historic and prehistoric heritage (City of Irvine, 2015). Historical resources include sites established after 1542 A.D., the date when European contact with California began, which may be significant to history, architecture, or culture. Archaeological resources include any location containing evidence of human activities which took place prior to 1750 A.D. Historical sites established prior to 1750 A.D. are also archaeological sites. Paleontological resources include any location containing a trace of plants or animals from past ages.

3.2 AREA OF POTENTIAL EFFECTS

The Area of Potential Effects (APE or “Project APE”) is defined in 36 CFR 800.16(d) as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.”

The APE consists of the area where the proposed undertaking has the potential to cause effects on historic properties, and has been delineated to reflect the nature, scale, and location of the Project. The proposed APE includes built resources and historic and cultural landscapes and all areas that could be directly (caused by an action and occurring at the same time and place) or indirectly (caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable) affected by the proposed project, as defined in 40 CFR § 1508.8(a)-(b). The APE has been delineated to include the Project Site and a portion of railroad and right-of-way (which includes access roads, new roads and intersections, new track leads along the rail alignment, and construction staging areas), in which impacts on both archaeological and built environment resources are possible, and adjacent areas to consider the Project’s potential visual, atmospheric, and audible effects on built environment resources near the Project Site. The vertical extent of the APE encompasses the maximum depth of excavation and grading, which may extend up to 10 feet beneath the existing ground surface for the building foundations, and the maximum height of construction, which will extend no more than 30 feet above the existing ground surface for the proposed administration building. The APE, showing historic built resources, is shown in Figure 3.2-1. The APE showing all resources, including previously documented archaeological resources, is depicted in the map in Attachment A.

3.3 EXISTING CONDITIONS

3.3.1 Prehistoric Overview

Geologic maps indicate that the entire Project APE is covered with surficial deposits of Qyf (Morton and Miller 2006). These deposits consist of young Quaternary alluvial fan deposits. They consist of slightly consolidated to cemented deposits of unsorted boulders, cobbles, gravels, and sands deposited by fluvial processes. Shallow Qyf deposits date to the Holocene (approximately 11,650 calibrated radiocarbon years before present to today). These younger Quaternary deposits can be tens of feet thick and overlie older Quaternary alluvium at varying depths.

The earliest occupation of Southern California may be associated with the peoples who first colonized North America in the terminal Pleistocene and earliest Holocene (Arnold et al., 2004). A key indicator of these early cultures are fluted points, which have been reported at a number of locations in Southern California (Rondeau, 2008). Closest to the Project APE, the Farpoint Site (CA-LAN-451) in Malibu, Los Angeles County, has yielded a fluted point, and its excavator argues the site should be associated with the Clovis culture (Stickel, 2008). Clovis is the earliest universally recognized material culture in North America, and dates to approximately 11,500 radiocarbon years before present (B.P.).

However, scholarly consensus holds that the earliest unambiguous evidence of human occupation in the Los Angeles area dates to at least 9000 B.P. and is associated with a period known as the Millingstone Cultural Horizon (Wallace 1955; Warren 1968). Millingstone populations established permanent settlements that were located primarily on the coast and in the vicinity of estuaries, lagoons, lakes, streams, and marshes where a variety of resources, including seeds, fish, shellfish, small mammals, and birds, were exploited. Early Millingstone occupations are typically identified by the presence of handstones (manos) and millingstones (metates), while those Millingstone occupations dating later than 5000 B.P. contain a mortar and pestle complex as well, signifying the exploitation of acorns in the region.

Figure 3.2-1 Area of Potential Effects Map

Source: ESRI, AECOM

0 842 1,684 Feet

1 inch = 842 feet 1:10,100

Metrolink Orange County Maintenance Facility

Although many aspects of Millingstone culture persisted, by 3500 B.P., a number of socioeconomic changes occurred (Erlandson 1994; Wallace 1955; Warren 1968). These changes are associated with the period known as the Intermediate Horizon (Wallace 1955). Increasing population size necessitated the intensification of existing terrestrial and marine resources (Erlandson 1994). This was accomplished in part through use of new technological innovations such as the circular shell fishhook on the coast and, in inland areas, use of the mortar and pestle to process an important new vegetal food staple (acorns); and the dart and atlatl, which resulted in a more diverse hunting capability. Evidence for shifts in settlement patterns has been noted as well at a variety of locations at this time and is seen by many researchers as reflecting increasingly territorial and sedentary populations. The Intermediate Horizon marks a period in which specialization in labor emerged, trading networks became an increasingly important means by which both utilitarian and nonutilitarian materials were acquired, and travel routes were extended.

The Late Prehistoric period, spanning from approximately 1500 years B.P. to the Spanish mission era, is the period associated with the florescence of contemporary Native American groups. The group occupying the southern Channel Islands and adjacent mainland areas of Los Angeles and Orange Counties came to be known as the Gabrielino, after Mission San Gabriel. They are reported to have been second only to their Chumash neighbors in terms of population size, regional influence, and degree of sedentism (Bean and Smith 1978). The boundary between these two groups is commonly believed to be in the area by Topanga Canyon, with the Chumash living along the beaches of Malibu up to the area of Paso Robles and the Gabrielino residing along the coast to southern Orange County. The Gabrielino are estimated to have numbered around 5,000 in the pre-contact period (Kroeber 1925). Maps produced by early explorers indicate the existence of at least 40 Gabrielino villages, but as many as 100 may have existed prior to contact with Europeans (Bean and Smith 1978; McCawley 1996; Reid 1939 [1852]).

Subsistence during the Late Prehistoric period consisted of hunting, fishing, and gathering. Small terrestrial game was hunted with deadfalls and rabbit drives, and by burning undergrowth, while larger game such as deer were hunted using bows and arrows. Fish were taken by hook and line, nets, traps, spears, and poison (Bean and Smith 1978; Reid 1939 [1852]). The primary plant resources were acorns gathered in the fall and processed with mortars and pestles, and various seeds that were harvested in late spring and summer and ground with manos and metates. The seeds included chia and other sages, various grasses, and Islay or holly-leafed cherry (Reid 1939 [1852]).

3.3.2 Historic Overview

Spanish explorers made brief visits to Gabrielino territory in 1542 and 1602, and on both occasions the two groups exchanged trade items (McCawley 1996). Sustained contact with Europeans did not commence until the onset of the Spanish period, which began in 1769 when Gaspar de Portola and a small Spanish contingent began their exploratory journey along the California coast from present-day San Diego to Monterey. The Portola expedition crossed today's Orange County and forded the Santa Ana River on July 28, 1769. On the banks of the river they encountered "a populous village of Indians, who received us with great friendliness" (quoted in McCawley 1996:60).

Several Native American villages are known to have existed on the Santa Ana River plain at about the time of contact. The village encountered by the Portola expedition was probably *Hotuukngа*, which was located near the former location of the Bernardo Yorba adobe, in today's Yorba Linda (McCawley 1996:60). A village named *Pasbengna* was located on the Santa Ana River in the vicinity of today's Santa Ana (McCawley 1996:60). A place called *Moyo* or *Moyoonga*, which may have been a village, was located on what became the Rancho San Joaquin near Newport Bay (McCawley 1996:72). Other villages, some of the names of which were recorded by missionaries or early anthropologists, are known to have existed throughout today's Orange County, but no village centers are known to have existed within the APE.

In the years following the Portola expedition, missions were established across California. Mission San Gabriel Arcàngel was established in 1771 in what is now Whittier Narrows in Los Angeles County. Another location considered for the mission was near the Santa Ana River (McCawley 1996:189). The natives that occupied the northern areas of present-day Orange County became known as the *Gabrieleño* (later anglicized to Gabrielino) because of the mission. Mission San Juan Capistrano was established in 1776 in present-day San Juan Capistrano, and the Native American group in the vicinity became known as the *Juaneño* (Koerper et al. 2002: 64). Missionization brought with it significant and detrimental changes in *Gabrieleño* and *Juaneño* health and cultural integrity.

Alta California became a state when Mexico won its independence from Spain in 1821, and Los Angeles selected its first city council the following year. The authority of the California missions gradually declined, culminating with their secularization in 1834. Although the Mexican government directed that each mission's lands, livestock, and equipment be divided among its converts, the majority of these holdings quickly fell into non-Indigenous hands. Mission buildings were abandoned and quickly fell into decay.

The first party of U.S. immigrants arrived in Los Angeles in 1841, although surreptitious commerce had previously been conducted between Mexican California and residents of the United States and its territories. As the possibility of a takeover of California by the United States loomed large, the Mexican government increased the number of land grants in an effort to keep the land in the hands of upper-class *Californios* such as the Avila, Domínguez, Lugo, and Sepúlveda families (Wilkman and Wilkman 2006:14–17). Governor Pío Pico and his predecessors made more than 600 rancho grants between 1833 and 1846, putting most of the state's lands into private ownership for the first time (Gumprecht 1999).

The project APE lay in the southern portion of the sphere of influence of Mission San Gabriel from its establishment in 1771. In 1842, Governor Juan Bautista Alvarado granted lands that included the project APE to José Sepúlveda as part of Rancho San Joaquin. Throughout the Spanish and Mexican periods the local Native American populations continued to use the land. They also served as the labor on the mission lands and ranchos (Phillips 2010). Writing about a rancho in the San Fernando Valley, one mission father observed in 1795, "These Indians are the cowherds, cattlemen, irrigators, bird-catchers, foremen, horsemen, etc." (Englehardt 1927:5). As time went by the Native Americans were taught additional specialists' skills such as masonry, blacksmithing, carpentry, painting, and Mexican-style ceramics (Frierman 1992; Schuetz-Miller 1994). The same was true of today's Orange County, where Native Americans labored, often with the skills and knowledge of specialists, building wealth for the missions and the rancheros.

The United States took control of California after the Mexican–American War of 1846, and seized Monterey, San Francisco, San Diego, and Los Angeles (then the state capital) with little resistance. Hostilities officially ended with the signing of the Treaty of Guadalupe Hidalgo in 1848, in which the United States agreed to pay Mexico $15 million for the conquered territory, which included California, Nevada, and Utah, and parts of Colorado, Arizona, New Mexico, and Wyoming. The conquered territory represented nearly one-half of Mexico's pre-1846 holdings. California joined the United States in 1850 as the 31st state (Wilkman and Wilkman 2006:15).

The discovery of gold at Sutter's Mill in 1849 led to an enormous influx of people from other parts of the United States in the 1850s and 1860s; these "forty-niners" rapidly displaced the old rancho families. Southern California's prosperity in the 1850s was largely a result of the increased demand for cattle for meat and hides, which was created by the gold rush, and the local ranching community profited handsomely (Bell 1881:26).

James Irvine emigrated from Ireland to California in 1846. Between 1864 and 1876, Irvine created the Irvine Ranch (the predecessor to The Irvine Company) by purchasing three, large, Spanish-Mexican land grants: San Joaquin, Santiago de Santa Ana, and Lomas de Santiago. The Irvine Ranch was initially used for agriculture; farming fruits and vegetables, such as lima beans and oranges, and raising cattle. Irvine also developed water infrastructure by drilling wells and developing the Irvine Ranch water system.

During the 1880s, railroad development in the region put the Irvine Ranch landholdings at the focus of debate. The Southern Pacific Railroad (SPRR) wanted to build a line south to connect to San Diego before its rival the Atchison, Topeka, and Santa Fe Railroad (AT&SF). However, James Irvine despised one of the SPRR's primary investors, Collis Huntington, and refused to allow the railroad a convenient right-of-way across his property. The California Southern Railroad, a subsidiary of the AT&SF, laid a line from San Diego to Oceanside which routed northeast to Temecula, thereby avoiding the Irvine Ranch. However, this line was washed out shortly after its opening in 1882. The more ideal corridor passed through the Irvine Ranch. In 1887, the California Southern Railroad attempted to sue the ranch to obtain a right-of-way. Ultimately, the Irvine family agreed to grant the AT&SF passage, as long as the railroad would build a depot to serve the property. The railroad segment that passes through the ranch was laid in 1887 (Amtrak 2019; Cleland 1952; Liebeck 1988). The AT&SF railroad ceased operating passenger trains in 1971 with the establishment of the National Railroad Passenger Corporation (Amtrak). In 1995, the AT&SF ceased operations and the entire company's holdings were acquired by the Burlington Northern Santa Fe (BNSF). Within the APE, the Orange County Transportation Authority is the current owner of the SCRRA Orange Subdivision railroad tracks.

In 1942, a military pilot's fleet operational training facility was established on 2,340 acres of the Irvine Ranch Corporation. In the following year, the facility was commissioned as MCAS El Toro. During World War II, MCAS El Toro was a major debarkation location and served as a training base for pilots, aircrews, and ground personnel (City of Irvine 2003).

During the 1950s, the Irvine Company donated land to the University of California system, and the campus became the new focus of development in the periphery. The Irvine Company hired architect and planner William Pereira to develop a master plan. The master-planned community was defined by architectural themes among neighborhoods, roadway connections to shopping centers, and open spaces. The I-5 bridge crossing Bee Canyon Channel, located south of the APE, was constructed in 1958, and later reconstructed in 1969 (NBI 2020). The Irvine Ranch Water District (IRWD) was formed in 1961. The IRWD tiered off much of the existing water infrastructure developed during the 1930s and 1940s including Irvine Lake (formerly Santiago Reservoir) which was constructed in 1931.

MCAS El Toro was decommissioned in 1999. The roadways to the northwest and south of the APE were further developed in the 1990s. The I-5 bridge crossing the AT&SF was constructed in 1992, the State Route 133 (SR-133) bridge crossing Marine Way was constructed in 1997, and the SR-133 bridge over the former AT&SF was constructed in 1998 (NBI 2020). In 2001, Measure W was passed which authorized the former air station's use as a park and multi-use development, now known as the Great Park area.

Based on review of historical topographic maps and aerial photographs, the APE itself has undergone some development in the past 100 years. The earliest topographic map from 1901 shows the railroad alignment, but no buildings are depicted. A 1938 aerial photograph shows the area as agricultural fields bound to the southwest by the former AT&SF alignment (NETR 2020). From 1942 to 1950, a rail siding was added bisecting the APE. In 1952, the water transfer vault located at the northwestern end of the APE is present. The current footprint of the perimeter road is present by 1963, and trees were planted alongside the perimeter road by 1994 (NETR 2020). Additional fencing and water transfer equipment structures were constructed at the northwestern end of the APE during the mid-2000s. The former AT&SF alignment southwest of the APE boundaries has been altered over time for modern use, with modifications accommodating technological developments and commercial demands (e.g., larger trains, second track, automated switches), and other ongoing maintenance.

3.3.3 Archival Research

On April 30, 2020, AECOM requested a California Historical Resources Information System records search from the South Central Coastal Information Center (SCCIC) housed at California State University, Fullerton. The research focused on the identification of previously recorded cultural resources within the APE and a 0.5-mile radius around the Project site. The SCCIC responded via email on August 19, 2020.

The records search revealed that 37 cultural resources investigations were previously conducted within a 0.5-mile radius of the Project site (Table 3.3.3-1). Four of these investigations overlap the APE in whole or in part. The entirety of the APE has been subject to previous archaeological study.

Table 3.3.3-1 Previous Surveys Conducted within 0.5-Mile of the Project Site

Author	Report # (OR-)	Description	Date
Schroth, Adella	00305	The History of Archaeological Research on Irvine Ranch Property: The Evolution of a Company Tradition	1979
Douglas, Ronald D.	00586	Assessment of Cultural/Scientific Resources, Village 12, SCE HVtl Relocation, Irvine, California	1980
Padon, Beth	00754	Cultural Resource Assessment, Irvine Center Project, Orange County, California	1984
Padon, Beth	00787	Archaeological and Paleontological Monitoring for the Irvine Center Project	1985
Anonymous	00808	Final Environmental Impact Report Regional Domestic Water Storage and Transmission Facilities from Diemer/SAC and Wellfield Systems to Existing Distribution Network	1979
Romani, John F.	00814	Archaeological Survey Report for the Route I-5 Santa Ana Transportation Corridor, Route 405 in Orange County to Route 65 in Los Angeles County, PM 21.30/44.38; 0.00/6.85	1982
Padon, Beth	00847	Archaeological Resource Inventory, City of Irvine and Its Sphere of Influence	1985
Padon, Beth and Pat Jertberg	00906	Cultural Resources Report for the San Diego Creek Drainage Basin Project Level Facilities Orange County	1988
Jertberg, Patricia R.	00972	Archaeological and Paleontological Monitoring at Spectrum I Parcel #87-212	1989
Padon, Beth	01098	Cultural/Scientific Resources Assessment for Planning Area 13	1991
Cooley, Theodore G.	01099*	Archaeological Resources Assessment Conducted for Proposed Irvine Ranch Water District Pipeline Right-of-Ways	1979
Brock, James P.	01402*	Cultural Resources Assessment for the Irvine Desalter Project, Irvine California	1994
Webb, Lois M.	01844	Request for Finding of Effect for the Proposed Eastern Transportation Corridor	1991
Anonymous	01902	Historic Property Survey 07ORA-133	1985
Padon, Beth	01941	Archaeological and Paleontological Monitoring of Preliminary Grading for Jack-in-the-Box Restaurant 3278, Permit No. 34126 CCG, Irvine, California	1999
Anonymous	01944	Draft Environmental Impact Report, East Irvine Historical Site, Irvine, California	1991
Strozier, Hardy	02225	The Irvine Company Planning Process and California Archaeology—A Review and Critique	1978
Hunt, Kevin P.	02267	An Archaeological and Paleontological Survey of the Irvine Spectrum GPA Project	2000
Demcak, Carol, and Milos Vlechovsky	02337	Final Report on Archaeological and Paleontological Monitoring Program Conducted at Spectrum 6, City of Irvine, Orange County, California	2000
Anonymous	02534	Annual Report to the Irvine Company from Archaeological Research, Inc.	1976
Brown, Joan C.	02636	A Cultural Resources Literature Study and Field Reconnaissance for the Natural Treatment System Master Plan Facilities, Orange County, California	2003

Table 3.3.3-1 Previous Surveys Conducted within 0.5-Mile of the Project Site

Author	Report # (OR-)	Description	Date
Allen, Rebecca	02649*	Archaeological Survey Report Marine Corps Air Station, El Toro	1997
Mason, Roger D.	03293	Historic Property Survey Report for the Sand Canyon Grade Separation Project in the City of Irvine, Orange County, California	2003
Bonner, Michael A.	03347	Supplemental Environmental Impact Statement for the Eastern Transportation Corridor TCA EIS 2-1	1992
Marvin, Judith	03355	Historical Resources Evaluation Report for the Interstate 5/S and Canyon Avenue Interchange Improvement Project, City of Irvine, Orange County, California	2005
Padon, Beth	03380	Cultural Resource Assessment for Traveland Project, Irvine, Orange County	2007
Strudwick, Ivan H.	03392*	Cultural Resource Survey for the Proposed Irvine Desalter Project, City of Irvine, Orange County, California	2004
Bonner, Wayne H.	03357	Cultural Resources Records Search and Site Visit for Royal Street Communications, California LLC Candidate LA2516B—La Quinta	2008
Drover, Christopher	03825	A Cultural Resources Inventory of Planning Area 9B and 9C, Irvine, California	2000
McKenna, Jeanette A.	03917	Historic Resource Evaluation Report: Hangar 244 of the Former El Toro Marine Corps Air Station (MCAS) and Now Located Within the Great Park, Orange County, California (Project No. B-09-SP-CA-0359)	2010
Fitzgerald, Maggie	03933	Great Park, Cultural Resources Monitoring Report	2010
Fulton, Terri, and Deborah McLean	04084	Cultural Resource Assessment of 22 Natural Treatment System Facility Sites Within the San Diego Creek Watershed – Natural Treatment System Project, Irvine Ranch Water District, Orange County, California	2005
Flynn, Chris	04223	Notification of Finding of No Adverse Effect with Standard Conditions for the Bridge Deck Maintenance and Sealing at 30 Locations Throughout Orange County, California	2011
Strudwick, Ivan	04403	Cultural Resource Monitoring Report for the Sand Canyon Avenue Undercrossing Project, City of Irvine, County of Orange, California	2014
Strudwick, Ivan	04478	Cultural Resource Analysis for the Technology Drive Extension Project in the City of Irvine, Orange County, California	2013

In addition to the reports reviewed at the SCCIC, the 1998 *Architectural Survey of Marine Corps Air Station, El Toro* (JRP 1998) and the 2000 *California Historic Military Buildings and Structures Inventory* (USACE 2000) were reviewed. The 1998 study included an inventory and evaluation of the buildings and structures at MCAS El Toro and determined that there are no NRHP eligible buildings, structures, or districts within the former base (JRP 1998).

The SCCIC records search identified 14 previously recorded cultural resources within a 0.5-mile radius of the Project Site (Table 3.3.3-2). These resources include one isolated lithic flake and one isolated shell that, although unmodified, was transported to the APE by human activity, possibly during the prehistoric period. The remaining 12 resources include nine historic buildings dating from the 1890s to the 1950s, one historic district encompassing some of those buildings, and two historic railroad alignments. The majority of the historic buildings are associated with Old Town Irvine Historic District, which is located approximately 0.40-mile northeast of the APE.

Two of the resources overlap the APE in whole or in part and are detailed below in Table 3.3.3-2.

Table 3.3.3-2 Previously Recorded Resources within 0.5 Mile of the Project APE

Primary Number (P-30-)	Permanent Trinomial (CA-ORA-)	Description/Historic Name	Period of Significance	NRHP/CRHR Eligibility
100124	None	Isolated metavolcanic flake	Prehistoric	Not eligible for CRHR or NRHP
100372*	None	Isolated Venus clam shell	Prehistoric	Not eligible for CRHR or NRHP
157788	None	Irvine Blacksmith Shop	1915-1916	Listed on CRHR and NRHP
161870	None	Worker's Cottage	1904	Appears ineligible for NRHP; not evaluated for CRHR
161871	None	Irvine Hotel	1913	Appears ineligible for NRHP; not evaluated for CRHR
161872	None	Agricultural Storage Shed	1930	Appears ineligible for NRHP; not evaluated for CRHR
161875	None	Irvine Garage	1923	Appears ineligible for NRHP; not evaluated for CRHR
161889	None	Irvine Bean Growers Association Building	1895-1947	Listed in NRHP and CRHR
161894	None	Old Town Irvine Historic District	1887-1947	Listed in CRHR
176663*	None	Former AT&SF	1885-1888	Appears ineligible for NRHP, CRHR, or local designation
176838	None	Irvine Community Church	1952	Appears ineligible for NRHP, CRHR, or local designation
176945	None	Irvine General Store	1911	Appears ineligible for NRHP
177038	None	El Toro MCAS Hanger 244	1943-1945	Found ineligible for NRHP by consensus through the Section 106 process
179855*	None	Former AT&SF Railroad	1885-1888	Appears ineligible for NRHP

*Intersects with Project APE.

Resource P-30-100372

This resource is an isolated Venus clam shell. The shell was observed next to a gopher hole with no other shell or artifacts in the vicinity (Garcia and Vader 2006). A shovel test pit was excavated next to the shell to a depth of 30 centimeters with negative results. Because of the distance from the coast, it was assumed that the shell was transported to this location by human activity. However, it is impossible to determine when or how the shell was transported, or whether the shell's transportation to this location was intentional or accidental. By their nature, isolated resources are in general not eligible for inclusion in the CRHR or NRHP.

Resource P-30-176663

This resource is an approximately 14.7-mile-long segment of the SCRRA Orange Subdivision railroad tracks (originally part of the AT&SF Railway and subsequently BNSF Railway) and is within Orange and Los Angeles Counties. While originally constructed between 1885 and 1888, the railroad has been continuously used, resulting in replacement of all or most of its historic fabric. Because of its lack of integrity, this resource has been repeatedly recommended ineligible for listing in the NRHP (see Attachment A, Records Search Results Map). The eligibility of this segment has not been formally determined via State Historic Preservation Officer (SHPO) consensus.

3.3.4 Sacred Lands File Search and Native American Consultation

On July 8, 2020, AECOM contacted the NAHC and requested the Sacred Lands File be searched for documented sacred sites within the APE or its vicinity. The NAHC responded in a letter dated July 9, 2020. According to the NAHC letter, "The results were positive [meaning that there are known sacred lands or resources in the vicinity of the APE]. Please contact the Juaneno Band of Mission Indians and the Juaneno Band of Mission Indians Acjachemen Nation - Belardes on the attached list for more information." The response also included a list of 11 Native American representatives of nine State-recognized tribal governments who may have interest in and knowledge of resources that may be impacted by the Project. Two of these tribal governments are also Federally-recognized.

OCTA is conducting consultation under AB 52.

Assembly Bill 52 Consultation

OCTA contacted each of the tribal contacts by mail on June 2, 2021, to invite them to consult under AB 52. One of these letters was returned by the U.S. Postal Service as undeliverable. Follow-up emails were sent on June 30, 2021, to each tribal contact who did not respond to the mailing.

To date, one tribal representative has responded to the request for AB 52 consultation. Chairperson Andrew Salas of the Gabrieleno Band of Mission Indians-Kizh Nation requested a meeting with OCTA to discuss his tribe's concerns regarding the project. On September 9, 2021, a meeting was held between OCTA representatives and Chairperson Salas and Tribal Archaeologist John Torres representing the Kizh Nation. At the meeting, Chairperson Salas expressed that the Project APE is sensitive for buried tribal cultural resources. He pointed out that his tribe, and his family in particular, have ties to the region. He noted that railroads often followed traditional Native American trails, and also observed that military bases often encompassed ancient village sites. Moreover, he informed OCTA that his monitors are currently involved in projects elsewhere in the Irvine area where buried human remains were identified by his tribal monitors. Chairperson Salas recommended tribal monitoring during ground-disturbing activities in order to identify and protect any tribal cultural resources that may exist within the APE. Chairperson Salas provided

OCTA with more historical information regarding the general project region, the project APE, as well sample language to help guide mitigation measures to be developed for this project. Consultation is ongoing (see Confidential Attachment B for files associated with consultation).

3.3.5 Field Survey

An archaeological and built environment survey was conducted on July 30, 2020, by AECOM personnel Marc Beherec, Ph.D., RPA, and Frank Humphries, M.S., RPA, who both meet the Secretary of the Interior's Professional Qualifications Standards in Archaeology (36 CFR Part 61). The two surveyors walked over the entire APE, with the exception of the active railroad right-of-way and a segment of Ridge Valley Road that is paved or covered in imported gravel (see Figure 3.2-1), in a series of transects spaced 15 meters apart. Part of the APE is obscured by a paved access road. Ground visibility in the rest of the APE ranged from approximately 10 to 50 percent. Non-native grasses obscured much of the ground surface, but the area was mowed at the time of visit.

Evidence of superficial disturbances included abundant gopher holes and evidence of an irrigation system in the form of 3/4-inch polyvinyl chloride (PVC) pipes and sprinkler heads. The ground also appeared recently disced or plowed and has been historically plowed based on historic aerial photographs.

Archaeological Resources

No archaeological resources were observed within the APE. The previously recorded isolated clam shell (P-30-100372) was not located during the survey. The resource was documented in 2006 (Garcia and Vader 2006); however, the single clam shell may have been misplotted, or it may have been removed or reburied by human or animal activity in the 14 years since it was recorded.

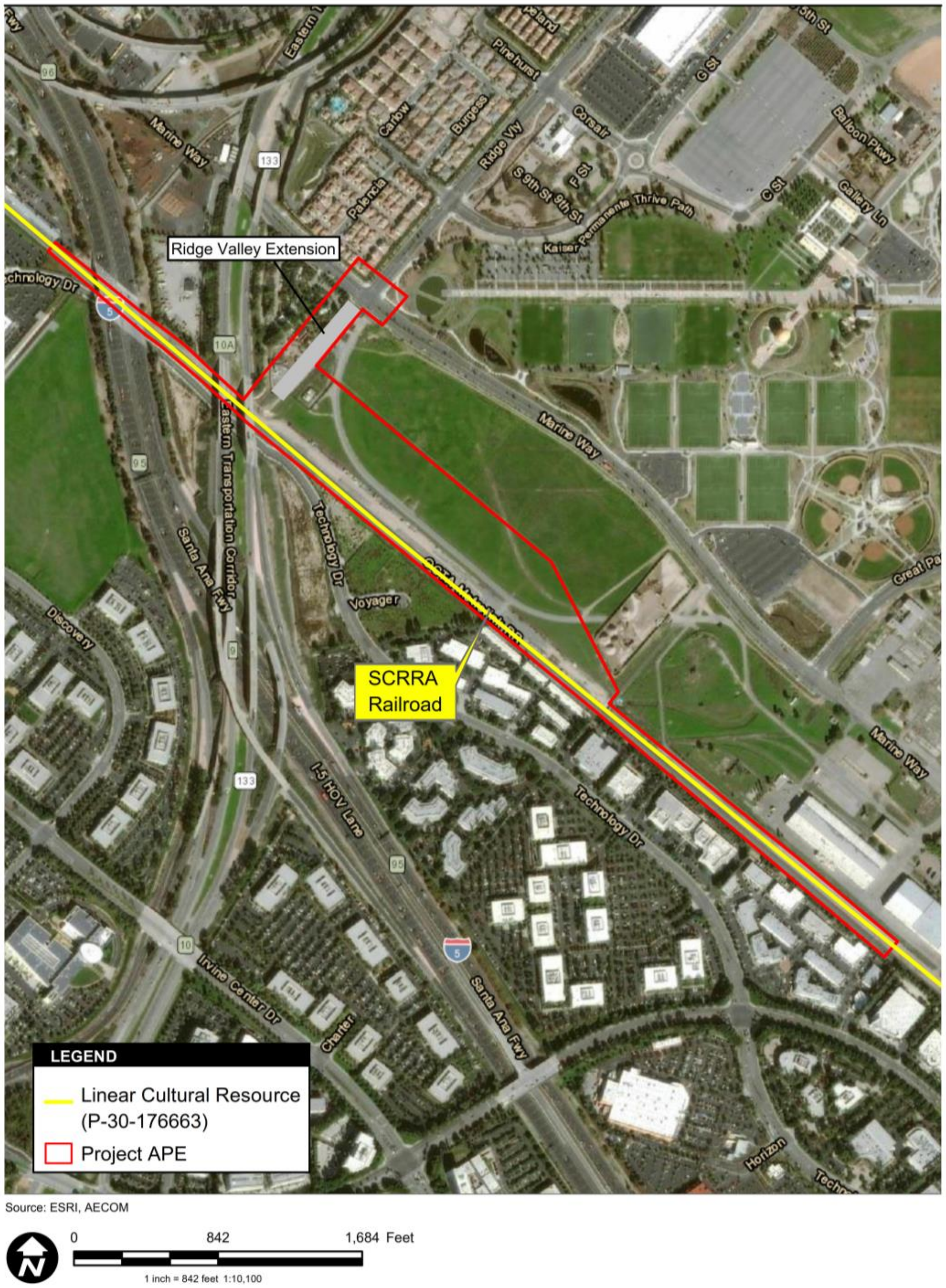
Built Environment Resources

The archival research and survey identified two built resources that are greater than 50 years of age within the APE. Resource information is included on California Department of Parks and Recreation (DPR) 523 forms included in Attachment C.

P-30-176663 Former AT&SF Segment

The portion of resource P-30-176663, the former AT&SF railroad within the APE, is a double track which runs northwest to southeast (Figure 3.3.5-1). The profile approaches one percent grade, rising from the north (west) end of the site as the tracks pass under the SR-133 overhead structure, to the south (east) end of the site where the mainline tracks cross over the Bee Canyon Channel on a double track bridge. This portion of the former AT&SF is a standard gauge railroad which sits on a bed of large-medium ballasts. The rails sit on wooden ties and are fastened via metal railroad spikes. This segment has been altered over time for modern use, with modifications accommodating technological developments and commercial demands (e.g., larger trains, second track, automated switches), and other ongoing maintenance. The original elements of the rail line have been repaired and replaced.

Figure 3.3.5-1 Cultural Resources within APE



Metrolink Orange County Maintenance Facility

Figure 3.3.5-2 Overview of P-30-176663, Former AT&SF Railroad from Project APE, View to West

Source: AECOM (2020)

NRHP and CRHR Evaluation

Resource P-30-176663 was originally recorded in 2002, and updated in 2007 (Ballester and Tang, 2002; McCormick, 2007; Smith and Harper, 2007). The resource was found to have been upgraded and substantially altered since its original construction and did not retain sufficient historical integrity to reflect its original historical association (Figure 3.3.5-2). Therefore, the railroad was recommended as not eligible for listing on the NRHP or CRHR due to its lack of integrity of materials, workmanship, and setting. The records do not note whether Section 106 consultation with the SHPO was performed for these undertakings. It does not appear that a formal determination of eligibility with SHPO concurrence has been completed for this resource. After review of the previous recordation and current field check and research, AECOM concurs with the previous eligibility assessments.

Water Transfer Vault

Within the APE and approximately 350 feet northeast of the SR-133 bridge over the former AT&SF railroad is a rectangular water transfer vault constructed circa 1950 and abandoned in 2006 (Figure 3.3.5-3). The resource is a concrete domestic water intake structure originally used for MCAS El Toro. The vault located on the western periphery of the former MCAS El Toro property does not have any distinct associations with the United States Marine Corps' mission operations during the 1950s and is a minor and vernacular water infrastructure element. The entrance to the subterranean structure is by way of stairs covered by a metal grate. The vault measures approximately 46 feet long and 27 feet wide; the interior is approximately 10 feet tall. The vault's footprint appears unchanged since construction; however, a low concrete interior partition appears to have been removed in order to install new piping. Additional fencing and water transfer equipment structures were constructed adjacent to the vault during the mid-2000s.

Figure 3.3.5-3 Overview of Water Transfer Vault from surface, View to West

Source: AECOM (2020)

NRHP and CRHR Evaluation

Under NRHP Criterion A and CRHR Criterion 1, the water transfer vault has no significant association with the broad patterns of local, state, or national history. This structure was constructed during the 1950s and is associated with MCAS El Toro's expansion and development but does not convey an important association with the base. The water transfer vault's components, which include concrete construction and piping, are representative of utilitarian work. Since the water transfer vault has no association with the broad patterns of local, state, or national history, it is not eligible for the NRHP under Criterion A or CRHR under Criterion 1.

Under NRHP Criterion B and CRHR Criterion 2, this structure is not significant for any associations with the lives of persons important to history. Research did not identify any important associations between the water transfer vault and any notable persons or their work. Therefore, this property is not eligible under NRHP under Criterion B or CRHR Criterion 2.

Under NRHP Criterion C and CRHR Criterion 3, the water transfer vault is not an important example of a type, period, or method of construction. The vault's design and construction is typical of utilitarian construction and does not appear to possess any unique characteristics; therefore, it is not eligible for the NRHP under Criterion B or CRHR under Criterion 3.

Under NRHP Criterion D and CRHR Criterion 4, the water transfer vault is not significant as a source (or likely source) of important information regarding history. It does not appear to have any likelihood of yielding important information about historic construction materials or technologies. It is not eligible for the NRHP under Criterion D or CRHR under Criterion 4.

The water transfer vault does not appear to meet the criteria for listing in the NRHP or CRHR, either as an individual resource or as a contributor to a larger resource such as the former MCAS El Toro. In addition, a 1998 inventory and evaluation of the buildings and structures at MCAS El Toro determined that there are no NRHP eligible buildings, structures, or districts within the former base (JRP 1998).

4. EXTENDED PHASE I

An Extended Phase I (XPI) cultural resources identification was completed within the APE in 2021 by HDR (HDR 2021). The XPI was conducted because the APE was determined to have a moderate sensitivity to encounter buried cultural resources. The purpose of the XPI was to determine the presence or absence of buried historic or prehistoric cultural resources and to further assess the overall archaeological sensitivity in portions of the OCMF project area where deep Project-related excavations are proposed. XPI investigations consisted of 40 subsurface shovel and hand auger test probe excavations to confirm the presence or absence of buried cultural materials. All tests were negative for the presence of prehistoric cultural material. No historic properties, historic resources, unique archaeological resources, or tribal cultural resources were identified during the XPI. Based on the results of the XPI, it is not anticipated that the Project will impact buried cultural resources. A copy of the XPI is included in Attachment E.

5. METHODOLOGY

Archival research, Native American consultation, and survey activities were conducted to identify archaeological or historic built resources within the Project APE that may be considered historical resources for the purposes of CEQA or historic properties for the purposes of Section 106 of the NHPA. In addition, this study sought to evaluate the potential to encounter unknown buried archaeological resources within the APE that may meet the criteria to be considered historical resources and/or historic properties. Because of the Project APE’s sensitivity, an XPI study was also conducted to probe the APE for subsurface archaeological deposits. The section above contains the environmental setting, cultural history, previous archaeological studies, results of archival research and records search, survey results, and the results of the XPI for the Project APE.

Archival research was conducted to determine the nature and substance of existing documentation or archaeological resources within the APE. The research was conducted at the South Central Coastal Information Center, located at California State University, Fullerton. In addition, published and unpublished archival material was consulted as appropriate. The NAHC was contacted to provide their input regarding known tribal resources and contacts, and every tribal contact identified by the NAHC was invited to consult upon the Project. However, no significant resources were identified within the Project APE as a result of the archival research, surface survey, or XPI. Mitigation measures are proposed for the treatment of potential buried resources that may be located within the APE.

6. IMPACTS ANALYSIS

Under Section 106 of the NHPA, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property as defined by 36 CFR 60.4 that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration must be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include any reasonably foreseeable effects caused by the undertaking, including not only immediate effects, but also effects that may occur later in time, be farther removed in distance, or be cumulative.

As detailed in Appendix G of the CEQA Guidelines, a project would have an adverse impact to a historical resource if it would:

a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5;

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5; or

c) Disturb any human remains, including those interred outside of formal cemeteries.

The archival research and survey identified two built environment resources that are greater than 50 years of age within the Project APE. P-30-176663 is a segment of the former AT&SF that was previously recorded and evaluated as not eligible for the NRHP or CRHR; however, the records do not note whether a formal determination of eligibility was made. In addition, the survey identified a previously unrecorded historic-period resource, a water transfer vault. The water transfer vault is evaluated in Section 3.3.5 of this document and is recommended not eligible for inclusion in the CRHR or NRHP. Both resources do not appear to be historic properties as defined by 36 CFR 60.4 historical resource in accordance with Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code.

The archival research identified one isolated archaeological resource within the Project APE. Resource P-30-100372 is a Venus clam shell that was documented within the boundaries of the APE in 2006 but could not be relocated during the recent survey. By its nature, this isolated shell is not eligible for inclusion in the NRHP or CRHR. No archaeological resources were identified within the Project APE that meet the criteria to be considered historic properties as defined by 36 CFR 60.4. No archaeological resources were identified within the Project APE that can be considered a historical resource in accordance with Section

15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code, or a unique archaeological resource in accordance with Section 15064.5(c) of the CEQA Guidelines, using the criteria outlined in Section 21083.2 of the California Public Resources Code.

However, based on the results of the archival research, field survey, Native American consultation, and past documented land use of the APE, the Project has a moderate to high sensitivity to encounter buried cultural resources. The single isolated Venus clam shell, while not itself significant and possibly not prehistoric, indicates an elevated sensitivity for resources within the APE. The APE is located near to water sources that both would have been attractive as natural resource procurement areas and could have contributed to burying archaeological resources beneath fluvial sediments. Native American authorities have pointed out their tribes; close ties to the project APE, the possibility that the existing railroad right-of-way was placed on an Native American trade route, and the fact that the project lay within the territory of nearby villages. Although the entire Project APE has been subject to surficial ground disturbance including farming and the construction of Marine Corps Station El Toro and despite the negative findings of the XPI, the likelihood of encountering native sedimentary deposits that may preserve significant archaeological remains increases with depth.

7. RECOMMENDATIONS

Based on the results of the archival research, field survey, and Native American consultation, the Project has a moderate to high sensitivity to encounter significant intact buried cultural resources. While the XP1 that was conducted was negative for the presence of subsurface cultural deposits, there is still the potential to encounter resources during construction as the Project will impact native soils. The possibility exists for the Project to encounter unknown archaeological resources in the course of ground-disturbing construction in native soils. The following mitigation measures are recommended to reduce any impacts to unknown archaeological resources encountered during excavations to a less than significant level.

MM-CUL-1 Prior to construction, OCTA shall retain a qualified archaeologist who meets the Secretary of the Interior’s Guidelines for Archaeology (36 CFR Part 61). The qualified archaeologist shall prepare a Cultural and Tribal Cultural Resources Awareness Training as part of the Project Worker Environmental Awareness Program (WEAP). The training will instruct workers as to the laws protecting cultural and tribal cultural resources and also give examples of the kinds of resources that can be reasonably expected to be found in the Area of Potential Effect (APE). An environmental compliance contact responsible for enforcing mitigation measures and who is to be notified in the event of a find will be identified in the training. Training will be delivered to all staff involved in ground-disturbing activities prior to their working on the project.

MM-CUL-2 Prior to construction, a project-specific cultural resources monitoring, and discovery plan (CRMDP) will be developed by a qualified archaeologist who meets the Secretary of the Interior's Guidelines for Archaeology (36 CFR Part 61). The monitoring plan should identify what construction activities that occur in native soils would require archaeological and tribal monitoring, describe monitoring procedures, and outline the protocol to be followed in the event of a find. Criteria will be defined, and triggers identified as to when further consultation is required for the treatment of finds. Plans of treatment of typical finds will be detailed, as will a plan of treatment for any human remains that are inadvertently encountered. If a potentially significant discovery is made and cannot feasibly be avoided, then additional work, potentially including data recovery excavations, may be required. Key staff will be identified, and the process of notification and consultation will be specified within the CRMDP. A curation plan will also be outlined within the CRMDP. All work should be conducted under the direction of a qualified archaeological Principal Investigator who meets the Secretary of the Interior's standards for archaeology. Consulting tribes under AB52 for the Project shall have the opportunity to review and comment on the draft CRMDP.

MM-TCR-1 Prior to construction, OCTA shall retain a qualified Native American monitor, with preference given to the consulting Native American tribes. The CRMDP described in MM-CUL-2 will define the scope of Native American monitoring and will be prepared with the input of the consulting Native American tribe(s). The monitoring plan will define pre-construction coordination, archaeological and tribal construction monitoring for the excavations based on activities, and depth of disturbance planned for each Project component. The CRMDP will define the role and responsibilities of the Native American monitor and identify thresholds where additional consultation with Native American tribe(s) is required.

MM-TCR-2 If prehistoric or ethnohistoric cultural resources are encountered during the course of construction, the consulting Native American tribe(s) will be consulted as to the significance and treatment of these resources. OCTA will determine whether the resources constitute tribal cultural resources in consultation with the Native American tribe(s) and if necessary, a mitigation plan will be prepared.

8. IMPACTS AFTER MITIGATION MEASURES

There are no known historic properties, cultural resources, or tribal cultural resources that would be impacted by the Project. In the event that any unknown resources that may meet the criteria to be considered historic properties, cultural resources, or tribal cultural resources are found during construction, implementation of Mitigation Measures MM-CUL-1 and MM-CUL-2 and MM-TCR-1 and MM-TCR-2 would reduce any potential impacts to less than significant.

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Appendix D Attachments
Cultural Resources
Technical Memorandum

Metrolink Orange County Maintenance Facility

Prepared for:

Orange County Transportation Authority

550 S. Main St.
Orange, CA 92868

And

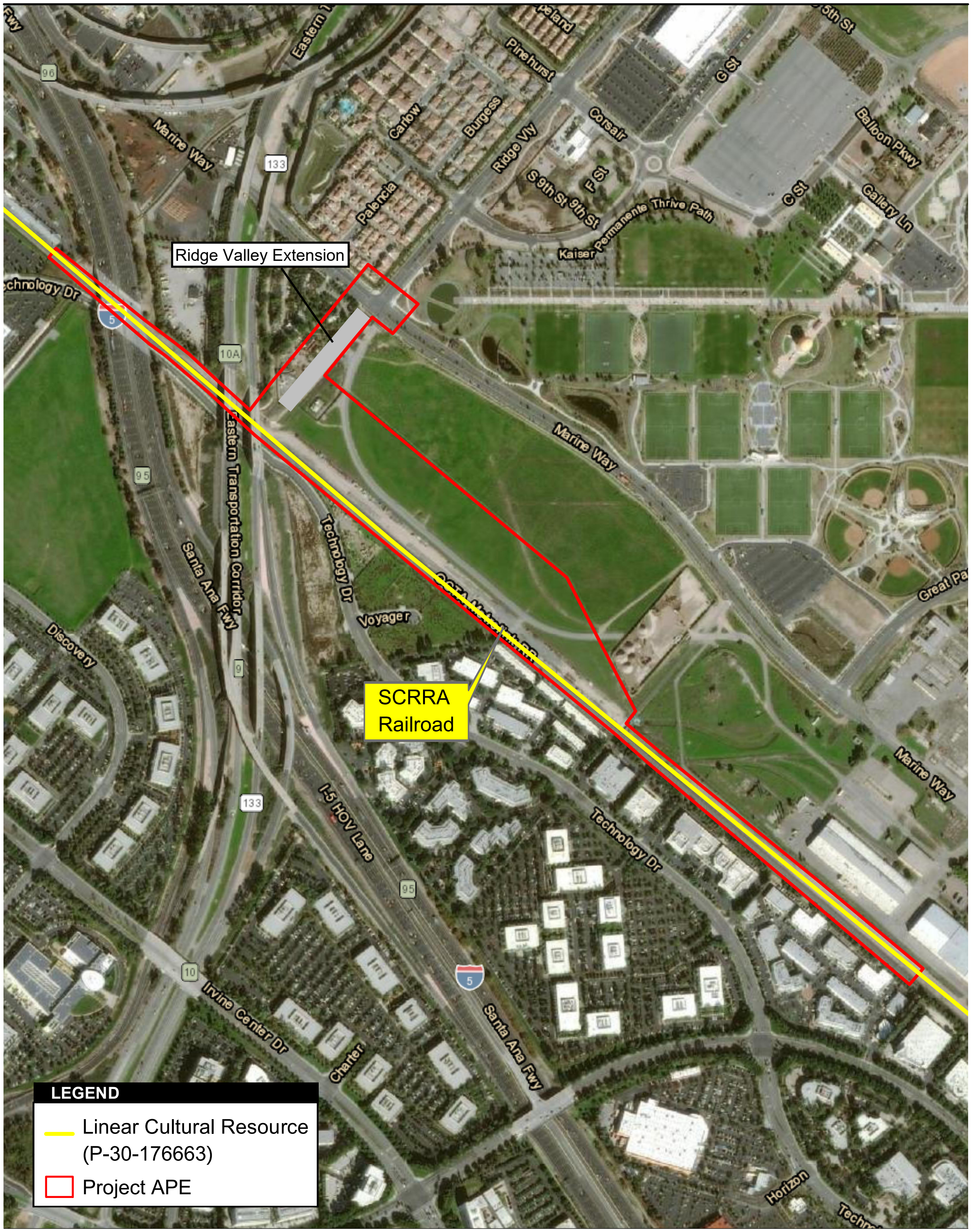
Gannett Fleming
20 Pacifica, Suite 430
Irvine, CA 92618

AECOM
Kaiser Center
300 S.Grand Ave
Los Angeles, CA 90071

February 2022

Attachment A

Area of Potential Effects Map



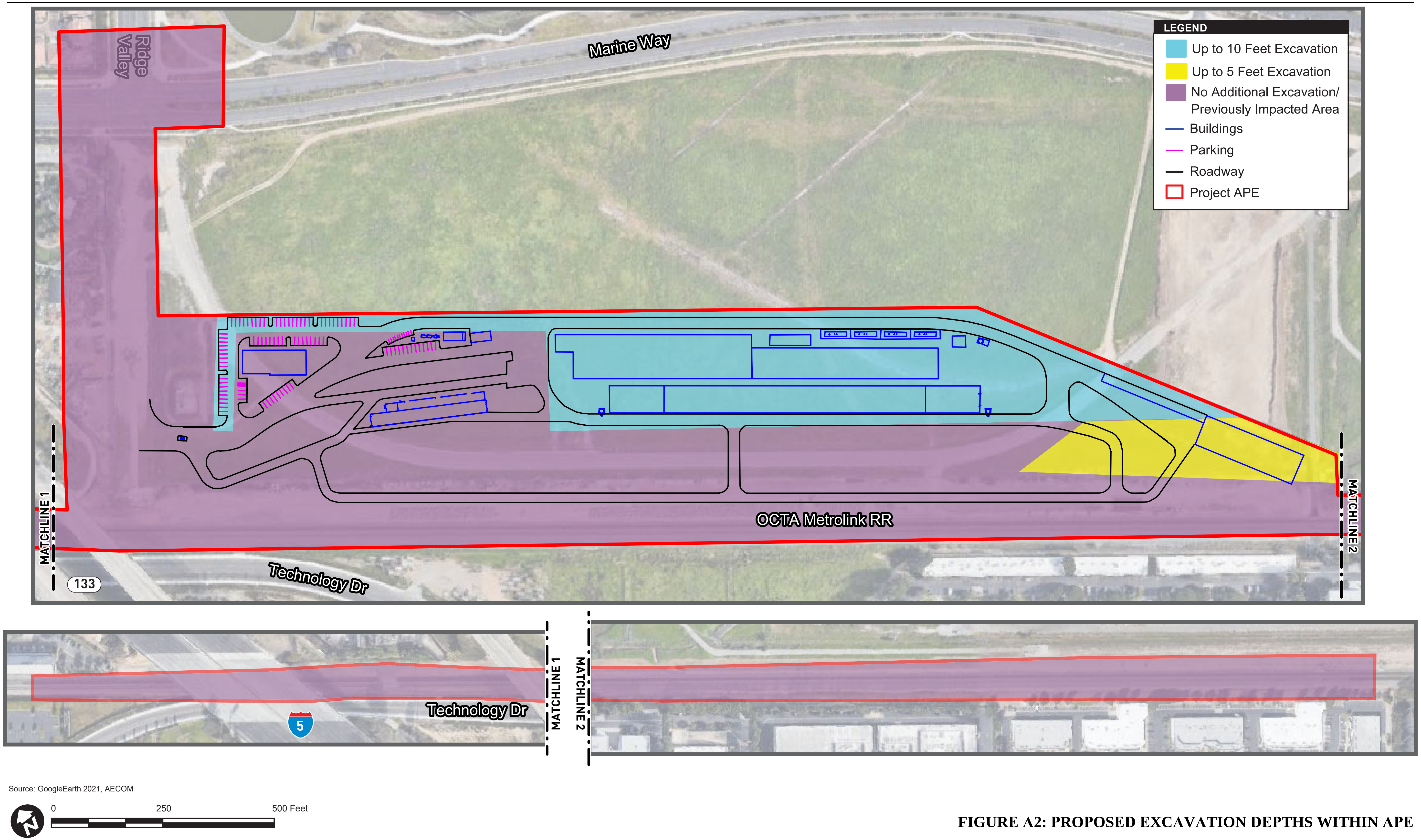
Source: ESRI, AECOM

0 842 1,684 Feet

1 inch = 842 feet 1:10,100

FIGURE A1: RECORDS SEARCH RESULTS WITHIN APE

Path: \\na.aecomnet.com\lfs\AMER\SanDiego-USSDG1\DCS\Projects_6063\60632397_GF_OCTA_MSF\900-CAD-GIS\920 GIS\map_docs\mxd\OCTA MFF_Figure2_APE.mxd, 10/1/2021, Jessica.Koon



Source: GoogleEarth 2021, AECOM

FIGURE A2: PROPOSED EXCAVATION DEPTHS WITHIN APE

Metrolink Orange County Maintenance Facility

Path:\\na.aecomnet.com\lfs\AMER\SanDiego-USSDG1\DCS\Projects_6063\60632397_GF_OCTA_MSF\900-CAD-GIS\920GIS\map_docs\mxd\OCTAMFF_APE.ai, 11/02/2021, BradyD

Attachment B

Records Search Results
Confidential

The information contained in this attachment is confidential per State and Federal regulations intended to protect these resources. Only qualified cultural resources practitioners may have access to this data.

Attachment C

AB 52 Consultation
Confidential

The information contained in this attachment is confidential per State and Federal regulations intended to protect these resources. Only qualified cultural resources practitioners may have access to this data.

Attachment D

DPR 523 Forms
Confidential

The information contained in this attachment is confidential per State and Federal regulations intended to protect these resources. Only qualified cultural resources practitioners may have access to this data.

Attachment E

Extended Phase I

Technical Memorandum

To: Lora Cross, Project Manager, Orange County Transportation Authority

From: Daniel Leard, Archaeologist, HDR

Date: November 29, 2021

Subject: **OCTA OCMF Extended Phase I Cultural Resource Survey**

1. Introduction

HDR completed Extended Phase I (XPI) cultural resources identification work in support of Orange County Transit Authority's (OCTA) Orange County Maintenance Facility (OCMF) Project (Project). In compliance with the requirements of the California Environmental Quality Act and Section 106 of the National Historic Preservation Act, AECOM cultural resources specialists completed a Phase I cultural resources investigation of the designated Area of Potential Effects (APE) as defined in 36 CFR 800.16(d), that included archival research at the California Historical Resources Information System records search from the South Central Coastal Information Center, a search of the Sacred Lands File, Native American Consultation, and completion of archaeological and built environment field surveys. The results of the cultural resources investigations were presented in a technical memorandum prepared for OCTA by AECOM in 2021. Archaeological field survey was limited to pedestrian surface inspection of the APE. Based on the results of the survey, no historic properties, historical resources, or unique archaeological resources were identified within the APE. However, the Project area was determined to have a moderate sensitivity to encounter buried cultural resources.

The purpose of the XPI was to determine the presence or absence of buried historic or prehistoric cultural resources and to further assess the overall archaeological sensitivity in portions of the OCMF project area where deep Project-related excavations are proposed. Cultural resource presence-and-absence testing was conducted by HDR from October 25 to November 4, 2021. This technical memorandum documents the results of the XPI to append to the archaeological survey report previously prepared by AECOM.

2. Study Area

The proposed OCMF is planned to be located on a 21.3-acre parcel owned by OCTA in the City of Irvine. The site is adjacent to the Metrolink Orange subdivision between mileposts 183.50 and 184.00 and the future Ridge Valley Road extension, and approximately 400 feet south of Marine Way (**Figure 1**). The APE includes the Project Site (which includes access roads and construction staging areas) and adjacent areas. The vertical extent of the APE encompasses the maximum depth of excavation and grading, which may extend up to 10 feet beneath the existing ground surface. Scoping for the XPI effort was based an aerial exhibit showing anticipated areas of

Project cut (deeper than 2 feet) produced by OCTA consultant Gannett Fleming and transmitted to the Project Delivery Team on October 14, 2021. The XPI area includes approximately 8.4 acres where ground excavation was expected, primarily along the northeast side of the 21.3-acre Project APE (**Figure 1** and **Figure 2**).

3. Methods

Professional services were performed by individuals who meet the Secretary of the Interior's Professional Qualification Standards for Archaeology (48 Federal Register 44716). Field efforts were led by Daniel Leonard, PhD, and Daniel Leard, both of whom are Registered Professional Archaeologists. Katherine Lemberg provided geographical information system and global positioning system support.

XPI investigations consisted of excavation of subsurface shovel test probes (STPs) to confirm the presence or absence of buried cultural materials. STPs were placed at 30-meter (100-foot) intervals across the 8.4-acre XPI area and numbered sequentially (**Figure 1**). Initially, 41 STPs were planned within the 30 m grid. Each STP measured approximately 50 centimeters (cm) in diameter and was excavated with hand tools (e.g., picks, shovels, trowels, augers) to a maximum depth of 2 meters (6.5 feet) below surface level or upon reaching culturally sterile sediments. Shovels were primarily used to excavate to a maximum workable depth of approximately 80 cm. Hand augers, using either a 4-inch diameter (sand auger) or 6-inch diameter (clay auger) bucket depending on the soil texture, were used for deeper testing. All soils recovered were dry-sifted through 1/8-inch wire mesh screens. All cultural material discovered during testing was recorded and reburied. Data from the testing—including location, depth of excavation, soil type and consistency, stratigraphy, and descriptions of any cultural materials recovered—was recorded on standardized forms. Photographs were taken of each STP prior to backfilling with the excavated soils. The location of each STP was recorded using a hand-held global positioning system unit with sub-meter accuracy capabilities.

4. Results

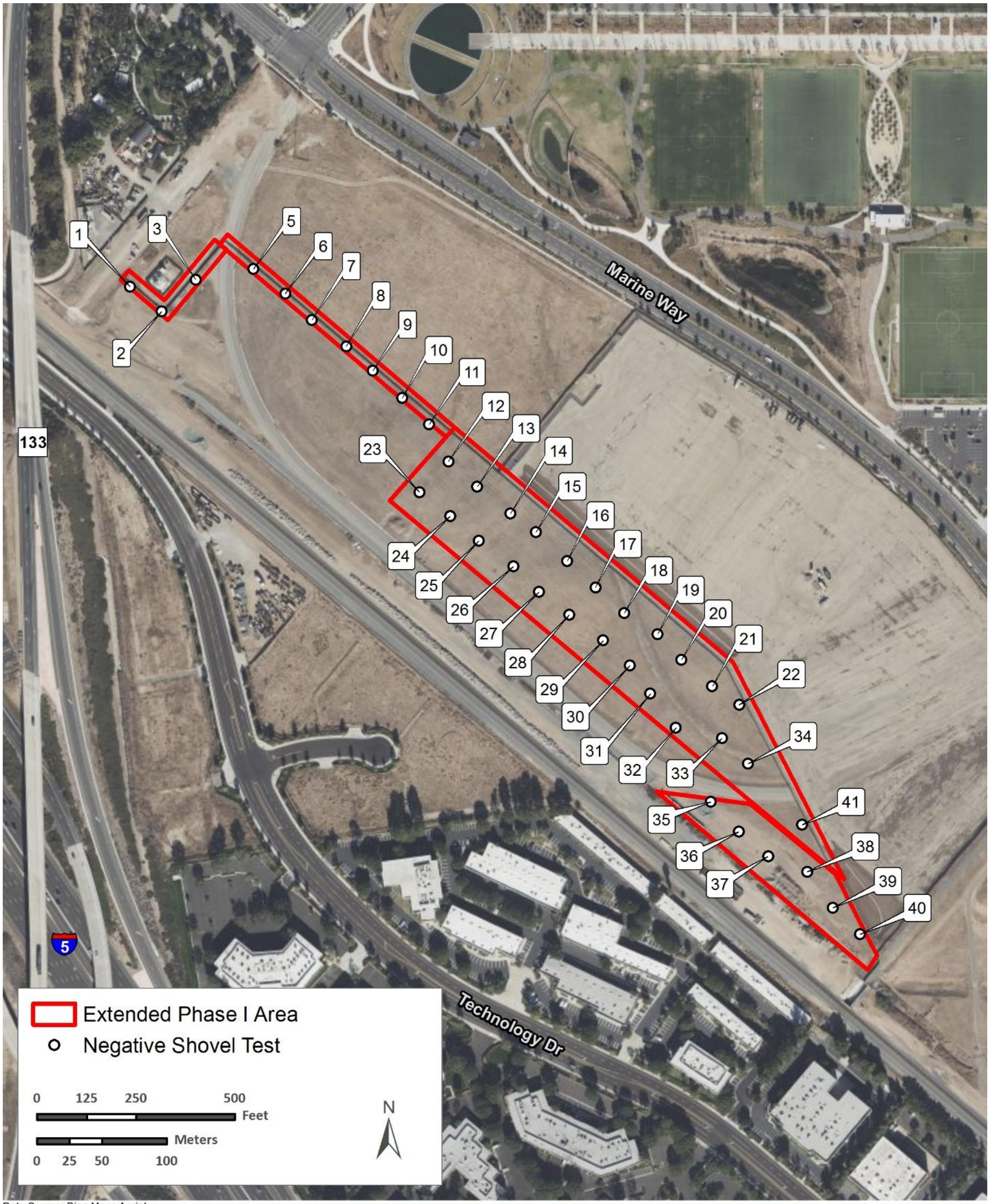
As a result of the survey, HDR archaeologists completed 40 STPs within the 8.4-acre XPI area. STP 4 was planned between STP 3 and STP 5 but not excavated because of the existing roadway at this location. Full descriptions of each test are presented in Error! Reference source not found.. Soil types varied from silty or sandy loams to dense clays or silty clay loam with varying trace gravels. Layers of fine loamy silt or sand and loose gravelly sands were found at depths below approximately 150 cm. As expected, moderate to significant soil disturbance was observed across the testing area, likely resulting from the development of Marine Corps Air Station El Toro between 1942 and 1999 or previous historic plowing. Depth of visible disturbance varied from 20 cm to as much as 80 cm below surface level depending on location. Areas with the most significant disturbance were found at the southeastern and northwestern ends of the XPI area at STPs 1-5, 10 11, 18, 19, and 33-41. These tests exhibited top layers of highly compacted artificial fill consisting of mixed sandy sediments with concrete slurry and imported gravel with chunks of asphalt and concrete/mortar, or, in some cases loose sand and gravel road base (**Figure 3** and

Figure 4). In the remaining tests, disturbance was less obvious; however, possible grading or historic plowing and compaction of the soil was still evident to depths varying between 15 cm and 40 cm below surface level. Natural disturbance from rodent burrowing was also visible across the site. Soil disturbance at STPs 16 (**Figure 5**), 17 and 20-30 appeared relatively minimal.

All tests were negative for the presence of prehistoric cultural material. A small amount of likely modern debris was identified in eighteen of the tests (STPs 2, 5, 7, 8, 12, 13, 14, 19, 23, 24, 25, 32, 36, 37, 38, 39, 40, and 41). This included small bottle glass fragments, window glass fragments, several plastic fragments, green PVC pipe pieces, several wire nails, an aluminum can tab, one piece of wire, and one possible piece of asbestos, all found at shallow depths and within disturbed soils. All material was analyzed in the field and reburied upon completion of the test. None of the material recovered could be identified as older than 50 years in age.

5. Recommendations

No historic properties, historic resources, or unique archaeological resources were identified during the XPI. Based on the results of the XPI, it is not anticipated that the Project will impact buried cultural resources. Implementation of mitigation measures MM-CUL-1 through MM-CUL-3 recommended in the *Technical Memorandum Cultural Resources* for the Metrolink Orange County Maintenance Facility completed by AECOM in 2021 would reduce any impacts to unknown archaeological resources encountered during excavations to a less than significant level.



Data Source: Bing Maps Aerial

Figure 1. Extended Phase I Study Area and Subsurface Test Locations

Figure 2. Overview of XPI area from location of STP 34, viewing northwest

Figure 3. Soil profile at STP 36 showing layer of compacted fill beneath loose overburden

Figure 4. Soil profile at STP 3 showing deep layer of road base

Figure 5. Soil profile at STP 16

Table 1. Excavation notes for STPs 1 through 41

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
1	0-22	10YR5/3 brown	Sandy loam, high compaction, with 40-50% poorly sorted gravels	None	Possible artificial fill or reworked and compacted topsoil	None noted
	22-55	10YR4/2 dark grayish brown	Clayey silt loam, very compact	None	None noted	None noted
	55-120	10YR4/3 brown	Silty loam, moderate compaction	None	None noted	Gradual soil transition; sand auger after 80 cm
	120-160	10YR3.5/2 very dark grayish brown	Silty clay loam	None	None noted	None noted
	160-200	10YR4/3 brown	Clayey silt loam, less compact	None	None noted	None noted
2	0-9	10YR4/3 brown	Sandy loam, moderate compaction with 15% gravel	None	None noted	None noted
	9-45	10YR5/3 brown	Sandy loam, rock hard fill with slurry mix, 20-25% gravel	Bits of asphalt; colorless glass fragments; 1 wire nail	None noted	None noted
	45-80	10YR3/2 very dark grayish brown	Sandy Clay, high compaction	None	None noted	None noted
3	0-60		Coarse sand and gravel road base	None	Artificial fill	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	60-75	10YR3/2 very dark grayish brown	Loamy clay	None	None noted	None noted
	75-80	10YR4/3 brown	Gravelly coarse sand with clay	None	None noted	Too much large gravel to auger through
4	Not excavated because of the existing roadway at this location					
5	0-7	10YR4/2 dark grayish brown	Loamy loose sediments	None	Recently spread dirt	None noted
	7-45	10YR5/3 brown	Sandy clay loam, rock hard, dry, with 30-50% gravel content	Several small pieces of asphalt	Appears to be artificial fill with slurry/gravel mix	None noted
	45-80	10YR3/3 dark brown	Sandy loam, compact, with varying amounts of gravel	Small bits of asphalt and several pieces of green PVC plastic from 45-60cm	Likely disturbed to 60 cm depth	No clear soil transition
	80-180	10YR3/3 dark brown	Silty clay loam getting sandier after 150 cm; medium compaction	None	None noted	Sand auger after 80 cm
	180-200	10YR4/4 dark yellowish brown	Silty loam to very fine sandy loam	None	None noted	None noted
6	0-30	10YR4/3 brown	Sandy loam, high compaction	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	30-60	10YR3/3 dark brown	Silty clay loam, medium compaction	None	None noted	None noted
	60-80	10YR4/3 brown	Loam, medium compaction	None	None noted	Subtle soil transition
7	0-20		Mix of wood chip debris and loose sediments	None	Not natural	None noted
	20-35	10YR3/2 very dark grayish brown	Very compact sandy clay loam with small gravels	1 possible asbestos tile	Likely artificial fill or plowed and recompacted	None noted
	35-100	10YR3/2 very dark grayish brown	Clay loam or loamy clay, speckled with light sand or carbonates	None	None noted	None noted
	100-160	10YR5/3 brown	Clayey loam to silty clay loam, getting gradually lighter in color and less compact	None	None noted	None noted
	160-200	10YR6/3 pale brown	Sandy silt, loosely compacted	None	None noted	None noted
8	0-25	10YR4/3 brown	Clayey loam with imported shale gravel, compact	Plastic	Likely previously plowed or graded and recompacted	None noted
	25-80	10YR4/3 brown	Loam, medium compaction	None	None noted	Appears to be natural horizon
	80-130	10YR3/3 dark brown	Loamy clay with carbonate stringers	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
9	0-30	10YR4/3 brown	Clayey loam with imported shale gravel, compact	None	Likely previously plowed or graded and recompacted	None noted
	30-90	10YR3/3 dark brown	Clayey loam, medium compaction	None	None noted	Appears to be natural horizon
	90-130	10YR3/2 very dark grayish brown	Loamy clay with speckles of light sand or carbonates	None	None noted	None noted
	130-150	10YR3/3- 4/3 dark brown	Mottled loamy clay with carbonate stringers	None	None noted	None noted
	150-190	10YR5/3 brown	Clayey silt loam	None	None noted	None noted
	190-200	10YR6/3 pale brown	Silt, very soft	None	None noted	Possible E horizon
10	0-37	10YR7/3 very pale brown	60-70% imported gravel with compact sand and silt	None	Looks like slurry fill	None noted
	37-75	10YR4/3 brown	Clayey silt loam, very compact	None	None noted	<10% gravel
	75-120	10YR4/3 brown	Silty loam, moderate compaction	None	None noted	Sand auger after 80 cm
11	0-30		Crushed shale base (no soil)	None	Artificial fill	None noted
	30-80	10YR4/3 brown	Clayey sandy loam, compact	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	80-100	10YR5/3 brown	Fine sandy silt, loosely compacted	None	None noted	Sand auger after 80 cm
	100-150	10YR4/3 brown	Clayey loam, compact	None	None noted	Too difficult to auger past 150 cm
12	0-5	10YR4/2 dark grayish brown	Loose loamy sediments	1 piece of window glass; lumber pieces	Loose dirt spread over surface	None noted
	5-25	10YR5/3 brown	Silty clay loam, compact, with 25% large gravels	None	Likely artificial fill or plowed and recompacted	None noted
	25-150	10YR4/3 - 3/2 dark brown	Clayey silt loam, medium compaction	None	None noted	Sand auger after 80 cm
	150-200	10YR4/4 - 5/4 yellowish brown	Fine sandy silt, loosely compacted; changing to 5/4 after 180 cm	None	None noted	Gradual soil transition
13	0-10	10YR5/3 brown	Loose mixed sediments	10-15 pieces of tinted flat glass; 1 piece of colorless glass; 2 pieces of white plastic	Loose dirt spread over surface	None noted
	10-25	10YR4/3 brown	Compacted mixed sand and silt with some clay	Several pieces of plastic	Reworked and compacted soil	None noted
	25-70	10YR3/4 dark yellowish brown	Silty loam, medium compaction	None	None noted	Appears to be natural horizon
	70-120	10YR3/2 very dark grayish brown	Loamy clay or clay loam, compact	None	None noted	Sand auger after 80 cm

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	120-150	10YR5/4 yellowish brown	Sandy silt loam, loosely compacted	None	None noted	Gradual soil transitions
	150-200	7.5YR5/4 brown	Loose, dry silty sand	None	None noted	None noted
14	0-20	10YR5/3-4/3 brown	Mixed sediments, very compact but lacks structure	Plastic PVC pipe fragment	Reworked and compacted soil	None noted
	20-75	10YR4/3 brown	Sandy clay loam, medium compaction	None	None noted	Appears to be natural horizon
	75-170	10YR5/3 brown	Silty sand loam, medium compaction. A greenish mudstone surface is present at around 110 cm with pockets of clay beneath.	None	None noted	None noted
	170-200	10YR5/4 yellowish brown	Silty sand, loosely compacted	None	None noted	None noted
15	0-25	10YR5/3 brown	Mixed sediments, very compact but lacks structure	None	Reworked and compacted soil	None noted
	25-70	10YR4/3 brown	Silty loam, compact	None	None noted	Appears to be natural horizon
	70-90	10YR4.5/3 brown	Sandy silt loam, medium compaction	None	None noted	Sand auger after 80 cm

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	90-200	10YR5/4 yellowish brown	Fine silty sand, loosely compacted, transitioning to lighter color and sandier with depth	None	None noted	None noted
16	0-25	10YR5/3 brown	Silty loam, very compact	None	Likely plowed or graded and recompacted	None noted
	25-80	10YR4/3 brown	Sandy silt loam, medium compaction	None	None noted	Appears to be natural horizon
	80-180	10YR4/4 dark yellowish brown	Clayey sand, loosely compacted	None	None noted	Sand auger after 80 cm
	180-200	10YR5/4 yellowish brown	Gravelly fine sand	None	None noted	None noted
17	0-65	10YR4/3 brown	Silty sand loam, dry and compact from 0-20 cm; slightly less compact 20-65 cm	None	Appears minimal but likely historically plowed (0-20 cm)	None noted
	65-100	10YR4/4 dark yellowish brown	Loamy sand, low compaction	None	None noted	Sand auger after 80 cm
	100-130	7.5YR5/3 brown	Clayey silt, compact, with carbonate stringers after 120 cm	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
18	0-15		Loose sand and large gravel overburden	None	Road berm buildup	None noted
	15-40		75% gravel cemented with yellow sand/slurry mix	None	Road base	None noted
	40-60		75% gravel with compact sand and clay	None	Road base	Impenetrable with hand tools
19	0-10	10YR5/3 brown	Gravelly loose loam	None	Rodent burrowing	None noted
	10-40	10YR5/3 brown	Silty loam, very compact	1 colorless glass fragment	Likely plowed or graded and recompacted	None noted
	40-75	10YR4/3 brown	Silty loam, compact	None	None noted	Appears to be natural horizon
	75-160	10YR4/4 dark yellowish brown	Clayey silt, getting lighter in color with depth	None	None noted	None noted
	160-200	10YR5/4 yellowish brown	Fine sand, loosely compacted	None	None noted	None noted
20	0-50	10YR5/3 brown	Silty loam, very compact, dry	None	Likely plowed/recompacted	None noted
	50-75	10YR4/3 brown	Silty loam, compact	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	75-130	10YR4/3 brown	Sandy loam, medium compaction	None	None noted	None noted
	130-200	10YR5/4 yellowish brown	Fine sand, loosely compacted	None	None noted	None noted
21	0-40	7.5YR3/2 dark brown	Silty loam, damp and soft	None	Rodent burrowing	Appears relatively undisturbed
	40-100	7.5YR3/3 dark brown	Silty loam, damp and soft	None	None noted	Sand auger after 90 cm
	100-120	7.5YR4/4 brown	Clayey sand loam, moist and loosely compacted	None	None noted	None noted
	120-160	7.5YR5/4 brown	Loamy sand, low compaction	None	None noted	None noted
	160-200	10YR5/4 yellowish brown	Fine sandy silt, loosely compacted	None	None noted	None noted
22	0-90	10YR4/3 brown	Silty loam, compact	None	None noted	Sand auger after 80 cm
	90-180	10YR5/4 yellowish brown	Sandy silt	None	None noted	None noted
	180-200	10YR6/4 light yellowish brown	Loamy silt, loose compaction	None	None noted	15% angular shale gravel

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
23	0-15	10YR4/3 brown	Gravelly sand and silt, very compact, lacks soil structure	Modern plastic and glass fragments	Graded and recompacted dirt	None noted
	15-40	7.5YR3/2 dark brown	Clayey loam, compact	None	None noted	None noted
	40-70	10YR5/3 brown	Loamy silt, medium compaction	None	None noted	None noted
	70-120	10YR3/2 very dark grayish brown	Clay loam to loamy clay with carbonate stringers below 90 cm, compact	None	None noted	Hand auger after 80 cm
	120-200	7.5YR5/4 brown	Loamy silt, compact	None	None noted	None noted
24	0-20	10YR4/3 brown	Gravelly sand and silt, very compact, lacks soil structure	None	Graded and recompacted dirt	None noted
	20-150	7.5YR3/2 dark brown	Silty clay loam to clayey silt, compact	1 piece of plastic that may have fallen from above	None noted	Hand auger after 80 cm
	150-120	10YR5/4 yellowish brown	Fine sandy silt, loosely compacted	None	None noted	None noted
25	0-28	10YR5/3 brown	Sandy loam to sandy clay loam, dry with moderate compaction	Piece of plastic	None noted	<10% gravel
	28-50	10YR4/3 brown	Silty clay loam, moderate compaction	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	50-70	10YR3/2 - 5/3	Compact silty loam mottled with 20% soft silt	None	None noted	None noted
	70-80	10YR4/2 dark grayish brown	Silty clay loam, moderate compaction	None	None noted	None noted
	80-180	10YR4/3 brown	Fine sandy loam, low compaction	None	None noted	Sand auger after 80 cm
	180-200	10YR4/4 dark yellowish brown	Fine sandy loam with increasing gravel content, loose	None	None noted	None noted
26	0-30	10YR4/3 brown	Silty loam, dry and compact	None	Likely plowed or graded and recompacted	None noted
	30-80	7.5YR4/2 brown	Clayey loam, compact	None	None noted	None noted
	80-150	10YR5/4 yellowish brown	Clayey sand, loosely compacted	None	None noted	None noted
	150-200	10YR6/3 pale brown	Gravelly sand, loosely compacted	None	None noted	None noted
27	0-80	10YR4/3 brown	Clayey silt loam, compact	None	Bioturbation from 0-30 cm	None noted
	80-140	7.5YR6/3 pale brown	Loamy silt, compact	None	None noted	Hand auger after 80 cm

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
28	0-5	10YR4/2 dark grayish brown	Loose loamy sediments	None	None noted	None noted
	5-30	10YR4/3 brown	Silty clay loam, medium compaction	None	None noted	None noted
	30-70	10YR4/2 dark grayish brown	Silty loam, medium compaction	None	None noted	None noted
	70-150	10YR5/4 yellowish brown	Silty loam, medium compaction	None	None noted	Sand auger after 80 cm
	150-180	10YR4/3 brown	Silty loam, transitioning to 10YR5/3 -6/3 with depth	None	None noted	None noted
	180-200	10YR5/4 yellowish brown	Fine sand, loosely compacted	None	None noted	None noted
29	0-30	10YR4/3 brown	Gravelly silty loam, very compact	None	Likely graded and recompacted soil	None noted
	30-80	10YR3/2 very dark grayish brown	Silty clay loam, compact	None	None noted	Unable to auger through clay
30	0-100	10YR4/3 brown	Sandy Clay Loam or clayey loam; very compact but softens after 60 cm	pieces of asphalt and concrete and 1 large cobble between 0 and 40 cm	Likely plowed and possible reworked and compacted dirt from 0-40 cm	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	100-150	10YR5/4 yellowish brown	Silty clay loam, low compaction, with calcium carbonates	None	None noted	Sand auger after 80 cm
	150-200	10YR5/4 yellowish brown	Loam transitioning to gravelly loamy sand after 170 cm	None	None noted	30% gravel at 190 cm
31	0-40	10YR5/3 brown	Gravelly silty loam, very compact	None	Heavy bioturbation.	None noted
	40-110	10YR4/3 brown	Clayey silt loam, compact	None	None noted	None noted
	110-180	10YR5/3 - 5/4 yellowish brown	Loamy silt, dry and compact	None	None noted	None noted
	180-200	10YR6/3 pale brown	Silt, loosely compacted	None	None noted	None noted
32	0-40	10YR5/3 brown	Sandy loam, dry, very compact with 40% mixed gravel	Small concrete chunks and some plastic	Likely graded and recompacted soil	None noted
	40-120	10YR4/3 - 5/3 brown	sandy silty loam, transitioning to loamy silt, medium compaction	None	None noted	Sand auger after 80 cm
	120-160	10YR6/3 pale brown	Fine silty sand with approx. 25% gravel	None	None noted	Terminated at gravelly layer

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
33	0-10	10YR4/3 brown	Loose sand and silt	None	Artificial fill	None noted
	10-30		Gravel and sand road base	None	Artificial fill	None noted
	30-60	10YR4/3 to 3/2 brown	Sandy loam or clayey sand loam, very compact	None	Mottled and lacks structure. Likely reworked or plowed soil and recompacted	Not uniform
	60-120	10YR4/3 brown	Silty clay loam, moderate compaction	None	Looks like natural A horizon	Sand auger after 80 cm
	120-200	10YR5/3 - 6/3 pale brown	Silty loam, low compaction, getting lighter with depth	None	None noted	None noted
34	0-15	10YR4/3 brown	Gravelly sand, loose compaction, 25% poorly sorted gravels	None	Looks like road base	None noted
	15-27	10YR5/3 brown	Gravelly sand continuation, but high compaction	None	Road base	None noted
	27-37	10YR5/4 yellowish brown	Sand and gravel, rock hard, with 60-70% poorly sorted gravel	None	Road base	None noted
	37-100	10YR3/2 very dark grayish brown	clay loam, high to moderate compaction	None	Tiny bits of asphalt down to 80 cm	Sand auger after 80 cm

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	100-185	10YR4/4 dark yellowish brown	Silty clay loam, low compaction	None	None noted	None noted
	185-200	10YR4/4 dark yellowish brown	Fine powdery sandy loam	None	None noted	None noted
35	0-25	10YR5/3 brown	Highly compacted sandy loam	Several small pieces of asphalt and concrete	Reworked and compacted soil	None noted
	25-70	10YR4/3 brown	sandy clay loam to sandy loam, very compact	Several small asphalt bits down to approx. 40 cm	Does not appear to be natural soil stratum. Lacks soil structure	Mottled soil color between 10YR4/2 and 3/2. Very compact but breaks up easy.
	70-170	10YR3/3 dark brown	Sandy loam, moderate compaction; transitions to 10YR4/4 after 120 cm	None	None noted	Sand auger after 80 cm
	170-200	10YR5/4 yellowish brown	Loamy sand, low compaction	None	None noted	None noted
36	0-25	10YR6/3 pale brown	Sandy loam, very compact, with 40% large gravels/ballast	1 metal wire piece; 1 large asphalt chunk	Appears to be artificial fill with slurry/gravel mix	None noted
	25-55	10YR5/3 brown	Loamy sand, dry and compact	None	None noted	None noted
	55-100	10YR4/2 dark grayish brown	Clayey sand loam to silty loam, medium compaction	None	None noted	Clay auger after 60 cm

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	100-150	10YR4/3 brown	Silty loam, medium compaction	None	None noted	None noted
	150-200	10YR6/4 light yellowish brown	Fine sandy silt	None	None noted	Sand auger
37	0-65	10YR4/2 dark grayish brown	Fine sandy loam, medium compaction, 60% large gravel from 0-10 cm decreasing to 20% gravel below 10cm	1 wire nail; 1 colorless glass fragment; 1 piece of asphalt	Gravel consists of ballast from nearby stockpile to the south. Likely all artificial fill	None noted
	65-80	10YR4/3 brown	Loamy sand, medium compaction, with 10% small gravels	Aluminum pull tab and a few small, rusted metal fragments	None noted	None noted
38	0-40	10YR5/3 brown	Loamy sand, very compact, with poorly sorted gravel	Small pieces of asphalt and 1 Styrofoam chunk	Probable overburden with possible slurry mix	None noted
	40-80	10YR4/3 brown	Loamy coarse sand, moderate compaction, with 40-50% mixed gravel	2 rusted iron pieces and 1 piece of cement/mortar	Continuation of above disturbed layer, less dry	None noted
	80-200	10YR4/3 brown	Fine sand, loosely compacted	None	None noted	Hand auger after 80 cm
39	0-50	10YR5/3 brown	Sandy with clay, very compact, with 40-50% gravel	Several small glass and asphalt fragments	Appears to be artificial fill with slurry/imported gravel mix	None noted
	50-75	10YR4/3 brown	Sandy loam, very compact, minimal gravel	None	None noted	None noted

STP#	Depth (cm)	Munsell Soil Color	Soil Description	Cultural Material	Disturbance	Comments
	75-90	10YR4/3 brown	Gravelly loamy sand with 20% poorly sorted gravel	None	None noted	Sand auger after 75 cm. Unable to excavate past 90 cm
40	0-50	10YR5/3 brown	Sandy with clay, compact, with 50-60% gravel	Several green glass fragments and chunks of asphalt and concrete	Appears to be artificial fill with slurry/gravel mix	None noted
	50-80	10YR4/3 brown	Sandy loam, very compact, 5% gravel	None	None noted	None noted
	80-110	10YR4/3 brown	Loamy sand with 20% gravel	None	None noted	Sand auger after 80 cm. Terminated at large rock obstruction
41	0-5	10YR4/3 brown	Loose sand and silt	None	Loose overburden	None noted
	5-30	10YR6/3 pale brown	Sandy silt loam with 40-50% gravel	1 piece of colorless glass; several chunks of asphalt	Compacted artificial fill	None noted
	30-70	10YR5/3 brown	Silty loam, dry, very compact	None	Possibly compacted	None noted
	70-180	10YR5/3 - 4/3 brown	Silty loam to fine sandy silt, gradually less compact	None	None noted	Sand auger after 70 cm
	180-200	10YR6/4 light yellowish brown	Fine loamy sand, dry and loose	None	None noted	None noted

Appendix E
Technical Memorandum
Hazards and Hazardous Materials

Metrolink Orange County Maintenance Facility

Prepared for:

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Hazards & Hazardous Materials Technical Memorandum	01/06/21
1	Draft Hazards & Hazardous Materials Technical Memorandum (Incorporating OCTA's comments)	02/25/21

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The purpose of this memorandum is to present the results of a Hazardous Materials investigation and to describe the potential impacts to the proposed OCMF project.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval.

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 2.2-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 2.2-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)

Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

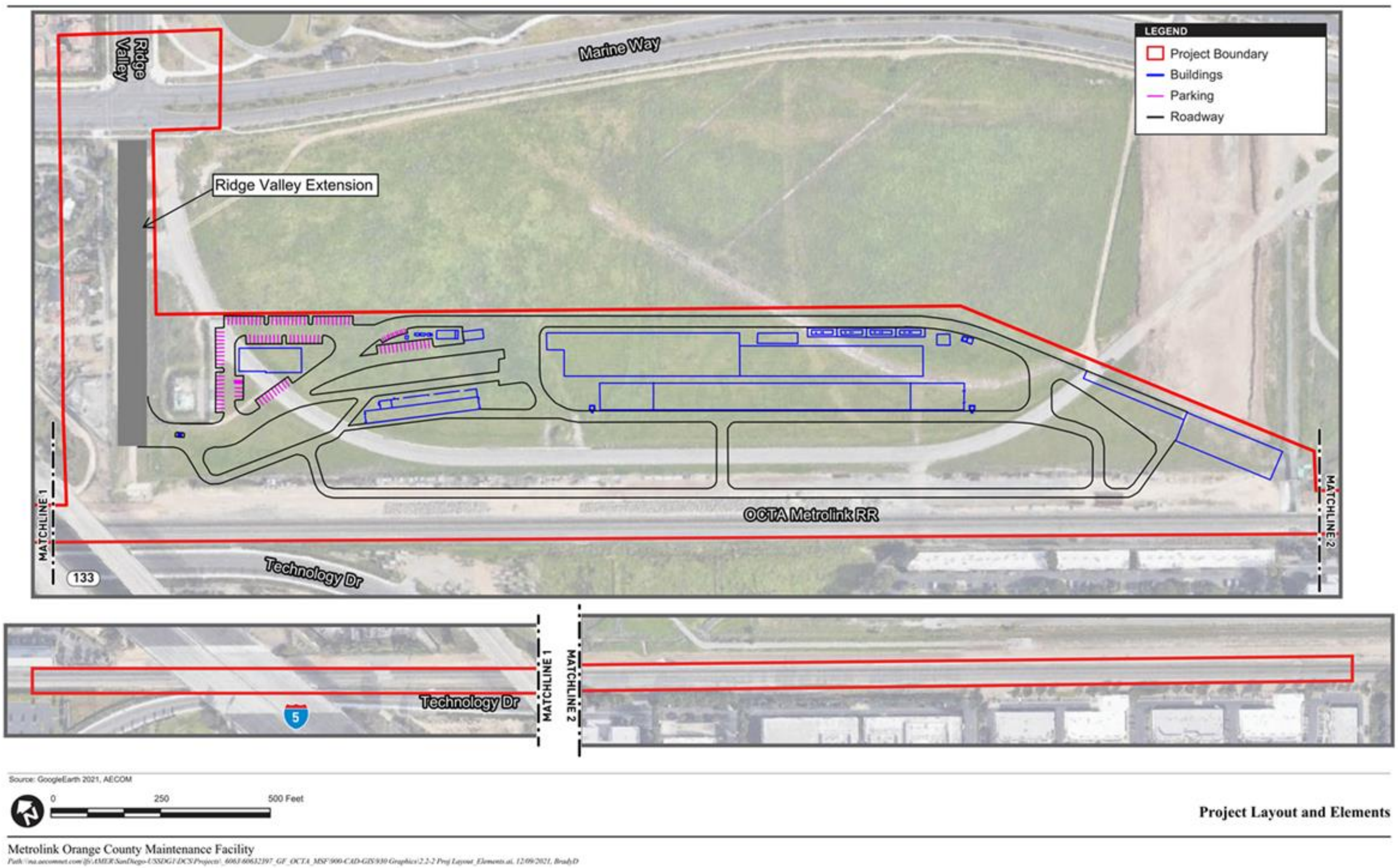
A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette. Approximately 120 automobile parking spaces would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 2.2-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.

Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink’s “Orange” Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. ENVIRONMENTAL SETTING

3.1 EXISTING CONDITIONS

The Project Site is located within a portion of the former MCAS El Toro, which was decommissioned in 1999, which is a Superfund site [(U.S. Environmental Protection Agency (EPA), 2020]. Hazardous materials, including chemicals and jet fuels, were stored and used on various portions of the former MCAS, including the OCMF site. These chemicals resulted in contamination of the soils, for which the DON was required to perform environmental remediation. From records provided by the DON, it appears only two groundwater monitoring wells were installed within the Project Site after the closure of MCAS El Toro. One of the wells is located in the middle of the proposed storage yard (between storage tracks) and would require relocation. The other well is located near the south entrance of the site and appears out of conflict with any major proposed improvements. The site will be developed to provide for periodical access to the wells by the DON. Previous analysis related to hazardous materials have been prepared to address contamination on the Project Site. Figure 3.2-1 shows the location of the known hazardous materials sites in the vicinity of the Project Site. A Phase I Site Assessment completed in 2014 did not find any recognized environmental condition (REC) sites (Kleinfelder 2014). There is an updated Phase I Environmental Site Assessment that is currently being finalized, which has been used to supplement this information.

As mentioned in the Wildfire portion of Chapter 5 of the Baseline Analysis, the Project Site is not located within or in proximity to an area designated as “High Fire Severity Rating & Open Space with Fire Potential” according to the City of Irvine General Plan’s Safety Element.

Moreover, the Project Site is not located within two miles of a public airport or public use airport. The closest airport to the Project Site is John Wayne Airport, which is located in Santa Ana adjacent to the City of Irvine boundary. This airport is approximately seven miles to the west of the Project Site and, thus, the Project Site is located outside of the John Wayne Airport Clear Zones according to the City of Irvine General Plan’s Safety Element. No private airstrip exists in the vicinity of the Project, either.

In addition, there are no existing schools or educational institutions within one-quarter mile of the Project Site (refer to Table 3.15-1 Public Service Facility Summary, in Chapter 3.15 Public Services).

3.2 REGULATORY FRAMEWORK

3.2.1 Federal

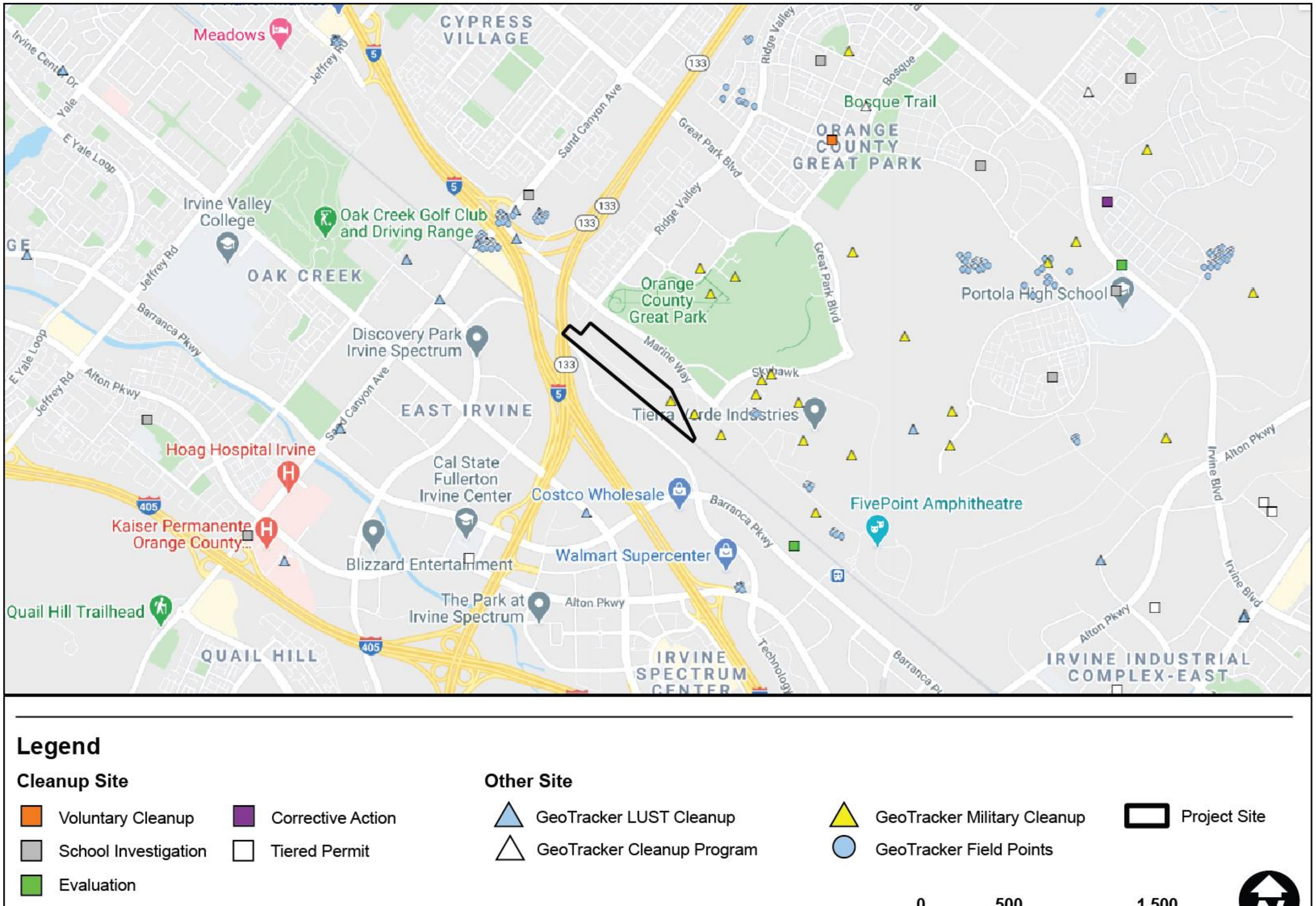
Hazardous Materials Resources

The USEPA is the lead federal agency responsible for enforcing federal regulations regarding hazardous materials. The primary legislation governing hazardous materials includes the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Superfund Amendments and Reauthorization Act (SARA), and the Toxic Substances Control Act (TSCA).

Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA, also known as Superfund, created a tax on the chemical and petroleum industries to provide for response and cleanup of hazardous substances that may endanger public health or the environment. CERCLA established requirements for abandoned hazardous waste sites and provided for liability of persons responsible for releases of hazardous waste at these sites.

Figure 3.2-1 Known Hazardous Material Sites



Data Source: California Department of Toxic Substances Control

Superfund Amendments and Reauthorization Act

SARA amended CERCLA to increase state involvement and required Superfund actions to consider state environmental laws and regulations. SARA also established a regulatory program for underground storage tanks (USTs) and the Emergency Planning and Community Right-to-Know Act (EPCRA).

3.2.2 State

In case of any chemical release of hazardous materials, the project will comply with the Hazardous Materials Release Notification, including the following:

- Health and Safety Codes Sections 25270.7, 25270.8, and 25507
- Vehicle Code Section 23112.5
- Public Utilities Code Section 7673 (PUC General Orders #22-B, 161)
- Government Code Sections 51018, 8670.25.5 (a)
- Water Codes Sections 13271, 13272
- Labor Code Section 6409.1(b)10

If hazardous materials or extremely hazardous materials are to be handled at the project site more than a specified amount (“reporting quantity”), the project will need to develop and submit a Hazardous Materials Business Plan (HMBP) as mandated both by the federal government (Code of Federal Regulations) and the State of California (Health and Safety Code) to the Orange County Health Care Agency (OCHCA).

3.2.3 Local

The project will need to comply with the Irvine Municipal Code, especially Division 9 (Emergency Services) and Division 17 (Hazardous Materials) of Title 4 (Public Safety), as well as the Irvine Zoning Ordinance, Chapter 2-13 (Hazardous Waste Facility Procedure).

The project will also need to comply with the Hazardous Materials Disclosure Program and the Accidental Release Prevention Program. The Unified Program is implemented at the local government level by the OCHCA. The Hazardous Materials Division of OCHCA is designated by the State Secretary for Environmental Protection as the CUPA for Orange County. Inspections and business plans are managed by the Orange County Fire Authority (OCFA) on behalf of OCHCA.

Assembly Bill (AB) 1130 authorized CUPAs to administer and implement programs related to the Aboveground Petroleum Storage Act (APSA) for any business with a total aboveground storage capacity of 1,320-gallons of petroleum products in tanks or containers larger than 55 gallons. APSA defines “Petroleum” as crude oil, or any fraction thereof, which is liquid at 60 degrees Fahrenheit temperature and 14.7 pounds per square inch absolute pressure. Tank facilities that are regulated under APSA are also regulated by the U.S. EPA Region 9 Oil Program Clean Water Act Compliance Office. Since the Project will consider building underground storage tanks or aboveground storage tanks (ASTs) for petroleum products/fuels, the plan will need to comply with the California Code of Regulations for underground and aboveground tanks, respectively, as oversight by OCHCA. APSA would require the following of the Project if storage of petroleum tanks meets or exceeds the 1,320-gallon aboveground petroleum products/fuels storage threshold:

- Complete and submit to OCHCA an initial Aboveground Petroleum Storage Tank Facility Statement Form.
- Prepare and implement an Spill Prevention Control and Countermeasures (SPCC) Plan in accordance with U.S. Code of Federal Regulations, Title 40, Part 112 (40 CFR 112).
- Conduct periodic inspections of ASTs to ensure compliance with the 40 CFR 112.
- Allow OCHCA to conduct periodic inspections.
- Immediately notify the California Emergency Management Agency (EMA) and OCHCA upon discovery of a spill or release of 42 gallons or more of petroleum.

Facilities regulated under APSA or the Federal SPCC Rule must prepare and implement a Spill Prevention Control and Countermeasures Plan (SPCC Plan) or Spill Prevention and Counter Measure Plan. Regulated facilities fall into three categories:

- Aboveground storage capacity more than 10,000 gallons who must prepare a full plan that has been certified by a Professional Engineer and be approved by the facility or corporation management.
- Aboveground storage capacity more than 1,320-gallons and less than 10,000-gallons, and with no history of release, can prepare and self-certify an abbreviated plan. These businesses are known as "Qualified Facilities". There are in turn two types of Qualified Facilities, Tier I and Tier II Qualified Facilities:
  - Tier I Qualified Facility: has between 1,320 and 10,000 gallons with no single container greater than 5,000-gallons and have no single discharge to navigable waters or adjacent shorelines exceeding 1,000 gallons and no two discharges, each exceeding 42 gallons within any twelve-month period in the past three years.
  - Tier II Qualified Facility: has between 1,320 and 10,000 gallons with a single container greater than 5,000 gallons and have no single discharge to navigable waters or adjacent shorelines exceeding 1,000 gallons and no two discharges, each exceeding 42 gallons within any twelve-month period in the past three years.

The Project will need to notify the appropriate State and local agencies (e.g., OCHCA, DTSC, or the Regional Water Quality Board) since soil and groundwater contamination is present due to the MCAS site. Notification to these State and local regulatory oversight agencies will simultaneously satisfy coverage under the applicable Federal agencies under Superfund (refer back to Section 3.2.1 above). If requested as follow-up by the State and/or local regulatory oversight agency(ies), then an environmental site assessment or a risk assessment (e.g., human health risk assessment) shall be prepared to ensure that future site activities and/or uses pose no risks to human health and/or the environment.

In accordance with the State Water Board's requirements for construction sites greater than one acre, a stormwater pollution prevention plan (SWPPP) must be prepared and implemented during construction for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. Similarly, construction sites subject to the Construction General Permit are required to implement SWPPP in the City of Irvine. While Santa Ana Regional Water Quality Board issues the Construction General Permit, Water Quality Ordinance (No. 10-06) gives the City of Irvine adequate legal authority as may be necessary to carry out the requirements of the NPDES Permit and accomplish the requirements of the Clean Water Act.

4. METHODOLOGY

A Draft Phase I Environmental Site Assessment (ESA) was prepared for the Project Site by Diaz, Yourman & Associates, on behalf of OCTA, dated November 12, 2020. The assessment was performed in general conformance with the scope and limitations of American Society for Testing and Materials (ASTM) Standard E1527-13. During the assessment, the Project Site was observed currently vacant, with the exception of a segment of an abandoned road, stormwater drains, an underground bunker with a network of pipelines, valves and associated vents, and including miscellaneous rail equipment observed stored on site. The following hazardous materials were identified in the assessment to be potentially encountered at the Project Site from historical and/or current uses:

1) Hydrocarbons, volatile organic compounds (VOCs) including chlorinated solvents such as trichloroethylene (TCE), and metals to soil, soil vapor and/or groundwater from historical former MCAS El Toro operations, adjacent oil and gas pipelines, and soil and other debris stockpiles observed on site;
2) Pesticides/herbicides to soil from historical agricultural crop land use;
3) Polychlorinated biphenyls (PCBs)-containing equipment remaining on site, if any including potential impacts to soils due to leaks;
4) Asbestos-containing material (ACM) and lead-based paint from existing structures;
5) Treated wood waste (TWW) from materials remaining on site (e.g., railroad ties); LBP/chromium from yellow thermoplastic striping from road materials remaining on site; and, aerially deposited lead in soil due to adjacent and onsite roadways.

5. IMPACTS ANALYSIS

Based on the above-described proposed project information, the following hazards and hazardous materials impacts analysis is provided for the Project Site:

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

   Determination: **Less Than Significant Impact**

   Construction and operation of the Project Site would require the routine handling and storage of petroleum products and hazardous materials. Wastes including used oils and hazardous wastes generated from the Project Site would be properly managed, transported and disposed resulting in less than significant hazard to the public or environment. The Project shall comply to regulatory standards specified under the California Code of Regulations (CCR), Title 22, Division 4.5 during the transport, use, or disposal of hazardous materials to make this a less than significant impact. Criteria for identifying characteristics of hazardous waste are also designated in CCR Title 22 Division 4.5.

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

   Determination: **Less Than Significant Impact**

   Construction Impacts

   Due to the routine handling and use of petroleum products and hazardous materials to be used during the construction of the proposed project, the potential for environmental impacts from hazardous material incidents is less than significant. The most likely incidents involving these materials are associated with minor drips, leaks or spills. Impacts from such incidents would be avoided by thoroughly cleaning up minor drips, leaks or spills as soon as they occur. A site-specific SWPPP would be developed and implemented to ensure quick response to minor drips, leaks or spills.

   Operational Impacts

   The Project Site would conduct routine handling and use of petroleum products and hazardous materials that could leak or spill if equipment such as tanks are damaged from a seismic event, fire or other unforeseen incident. To minimize potential impacts, the design of the proposed project would provide containment and/or diversionary structures or equipment to prevent illicit discharge of an oil or hazardous materials spill. Furthermore, the facility would develop and implement a HMBP and SPCC Plan before reportable quantities of hazardous materials/wastes or tanks/oil-filled equipment are handled or stored on site. The HMBP includes an Emergency Response Plan element.

If the Project has aboveground petroleum products/fuel tanks larger than 55-gallons with the storage capacity of 1,320-gallons or more, the SPCC Plan would be required to comply with the regulatory framework set forth by the Aboveground Storage Tank Act. Tank facilities that are regulated under APSA are also regulated by the U.S. EPA Region 9 Oil Program Clean Water Act Compliance Office. The Project would be required to prepare and implement an SPCC Plan in accordance with U.S. Code of Federal Regulations, Title 40, Part 112 (40 CFR 112). In addition, SCRRA would be required to immediately notify the California Emergency Management Agency (EMA) and OCHCA upon discovery of a spill or release of 42 gallons or more of petroleum.

These programs and plans would be developed to be consistent with other Metrolink maintenance facilities.

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

Determination: **No Impact**

There are no existing schools or educational institutions within one-quarter mile of the Project Site.

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

Determination: **Less Than Significant Impact**

The Project Site is located within a portion of the MCAS El Toro Superfund site, situated within a portion of Operating Unit (OU) 2A - IRP Site 24 - water transfer facility. According to the Phase I ESA, one groundwater monitoring well (18BGMW101A) and one groundwater extraction well (24EX11) in connection with IRP Site 24 are located within the Project Site boundaries. According to additional information provided in site documents available in the online California Department of Toxic Substances Control’s (DTSC’s) Envirostor database and on the EPA’s Superfund Site El Toro MCAS web page, buried water transfer conveyance lines associated with these wells are also located within the Project Site boundaries. An Institutional Control (IC) is in effect in connection with IRP Site 24, which includes the following land use restrictions and/or requirements:

- Activities prohibited which disturb the remediation and monitoring systems without approval;
- Annual inspection and/or report;
- No drilling for drinking water, oil or gas without approval;
- Notify damages to remedy and monitoring systems no later than 10 days upon discovery;
- Notify no later than 30 days after change of property owner; and
- Only extraction of groundwater for site remediation and/or construction dewatering permitted.

Prior to construction of the project and also following construction of the project, proper notifications to the required parties will be made in accordance with the IRP Site 24 IC in order to maintain compliance with the site management requirements/IC in connection with the ongoing military clean-up site operations.

5) For a project located within an airport land use plan or, where such as plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?

Determination: **No Impact**

The Project Site is not located within two miles of a public airport or public use airport. The closest airport to the Project Site is John Wayne Airport, which is located in Santa Ana adjacent to the City of Irvine boundary. This airport is approximately seven miles to the west of the Project Site and, thus, the Project Site is located outside of the John Wayne Airport Clear Zones according to the City of Irvine General Plan's Safety Element. No private airstrip exists in the vicinity of the Project, either.

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

Determination: **No Impact**

Construction Impacts

In places where the components of the Proposed Project span a road or require a lane closure, construction activities would be coordinated with the local jurisdiction so as not to cause closure of any emergency access route. Flaggers may briefly hold traffic back while conductor is pulled across a roadway, but emergency vehicles would be provided access even in the event of temporary road closures. Therefore, emergency access would not be directly impacted by construction of the proposed project because all streets would remain open to emergency vehicles at all times during construction activities.

Operational Impacts

The Project Site design will be constructed in a configuration that complies with required emergency response plan or emergency evacuation plan elements in accordance with project design and permitting requirements.

7) Would the project expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?

Determination: **No Impact**

The Project Site is not located within or in proximity to an area designated as "High Fire Severity Rating & Open Space with Fire Potential" according to the City of Irvine General Plan's Safety Element. Additionally, the Project Site would be grubbed of vegetation and graded prior to the staging of equipment, further minimizing the potential for wildland fires.

6. MITIGATION MEASURES

Mitigation measures were described in Section 5 above where a less than significant impact to the Project Site was identified. The mitigation measures for the Project Site are summarized as follows:

MM-HAZ-1 The Project applicant shall notify the appropriate agencies (e.g., OCHCA, DTSC, USEPA, or the Regional Water Quality Board) regarding soil, soil gas and/or groundwater contamination in connection with the ongoing military clean-up site associated with the former El Toro MACS Superfund site.

MM-HAZ-2 Where the Project Site construction and operational activities coincide with the current groundwater monitoring systems (e.g., wells, water transfer conveyance lines) the requirements of the IC in connection with IRP Site 24 for the ongoing military clean-up site associated with the former El Toro MACS Superfund site shall be adhered to in order to protect human health and the environment from potential hazardous materials exposures.

MM-HAZ-3 Prior to construction activities at the Project, if required by the State or local regulatory oversight agencies, then further assessment including soil, soil vapor and/or groundwater investigations shall be conducted to reveal the presence, if any, of potential hazardous materials at the Project Site that were identified as a result of the Phase I ESA, and would assist in determining further mitigations required to address human health and/or the environment impacts due to potential hazardous materials exposures.

MM-HAZ-4 The Project shall need to adhere to all required permit applications and permit conditions, and local, state and federal requirements (e.g., regulatory framework, site-specific environmental permits and plans).

7. IMPACTS AFTER MITIGATION MEASURES

Impacts after implementing mitigation measures MM-HAZ-1 through MM-HAZ-4 would result in less than significant impact related to hazards and hazardous materials during construction and operations.

8. REFERENCES

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Southern California Regional Rail Authority (SCRRA), OCTA, Project Study Report for Orange County Maintenance Report, 2019

SCRRA, Metrolink System Map, October 2019, Available at: https://metrolinktrains.com/about/agency/

Appendix F
Technical Memorandum
Noise and Vibration

Metrolink Orange County Maintenance Facility

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Noise & Vibration Technical Memorandum	01/14/21
1	Draft Noise & Vibration Technical Memorandum (Incorporating OCTA's comments)	02/25/21

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Glossary

Term	Abbreviation	Description
A-Weighted Decibels	dBA	A-weighted sound levels represent the overall noise at a receiver that is adjusted in frequency to approximate typical human hearing sensitivity. This is expressed as A-weighted decibels (dBA), the basic noise unit for transit noise analyses.
Community Noise Equivalent Level	CNEL	CNEL is a single number result that is calculated for a complete 24-hour period and usually made up of results taken at shorter intervals such as 5 minutes or 1 hour and then averaged over the whole 24 hours. This measurement is similar to L_{dn} except with a 5 dBA penalty added for hours between 7 PM and 10 PM. The logic behind this applied penalty is that since most residents in a given area are somewhat sensitive to noise during evening hours, a weighting factor is applied.
Day-Night Sound Level	L_{dn}	L_{dn} describes a receiver's cumulative noise exposure from all events over 24 hours. Events between 10 PM and 7 AM are increased by 10 dB to account for humans' greater nighttime sensitivity to noise. L_{dn} is used to assess transit noise for residential land uses.
Equivalent Sound Level	$L_{eq(t)}$	The equivalent sound level $L_{eq(t)}$ describes a receiver's cumulative noise exposure from all events normalized to a specified period of time "t". $L_{eq(t)}$ represents a hypothetical, constant sound level and contains the same overall sound energy as the actual varying sound energy during the time period "t". For transit noise impact assessments, the equivalent sound level metric is A-weighted and all events are normalized over a one-hour time period, $L_{eq(1hr)}$. For transit noise assessments, this metric is appropriate for non-residential land uses and is computed for the loudest hour of project related activity during hours of noise sensitivity.
Maximum Sound Level	L_{max}	The maximum level describes the maximum noise level reached during a single noise event. For transit noise impact assessments, it is appropriate to consider the A-weighted maximum level (L_{max}) to understand the full context of the scenario. It is not appropriate to use this metric for transit noise impact assessments. This metric is commonly used in vehicle noise specifications and commonly measured for individual vehicles.
Peak Particle Velocity	PPV	The peak signal value of an oscillating vibration velocity waveform. Usually expressed in inches/second in the United States. Often used to assess potential building damage due to ground-borne vibration.
Sound Exposure Level	SEL	SEL is the cumulative noise exposure from a single noise event, normalized to one second. SEL contains the same overall sound energy as the actual varying sound energy during the event. It is the primary metric for the measurement of transit vehicle noise emissions and is an intermediate metric in the measurement and calculation of both $L_{eq(t)}$ and L_{dn}.
Vibration Decibels	VdB	The vibration velocity level in decibel scale. Often used to assess annoyance due to ground borne-vibration.

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

This technical memo provides the summary results of the noise and vibration analysis associated with the construction and operation of the proposed OCMF. This document provides concise sections regarding the project description, environmental setting, noise and vibration prediction methodology, impact analysis and recommended mitigation measures associated with the Project.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval,

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 2.2-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 2.2-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)

Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

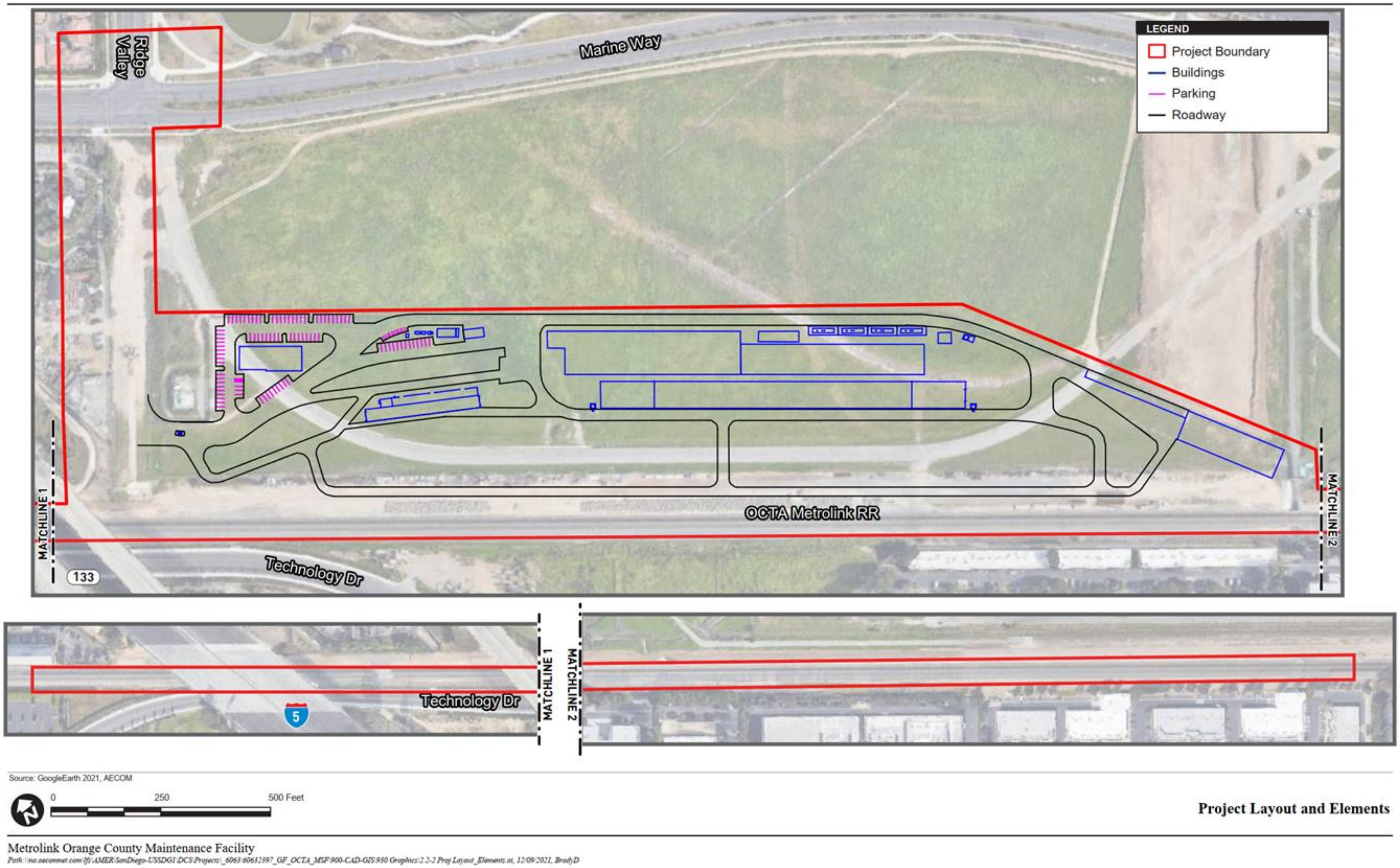
A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette. Approximately 120 automobile parking spaces would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 2.2-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.

Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink’s “Orange” Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. ENVIRONMENTAL SETTING

3.1 Existing Conditions

Noise measurements were conducted at the Project Site and selected nearby noise sensitive locations on July 30-31, 2020. The measurements were conducted with American National Standards Institute (ANSI) Type 1 sound level meters within their manufacturer's recommended 1-year calibration period. Measurements were conducted and documented in keeping with standard environmental noise measurement procedures. Weather conditions during the measurement period were generally typical for this location during this time of year, with observed temperatures between 70° and 80° F (degrees Fahrenheit) and wind speeds generally less than 5 miles per hour (mph).

Noise measurements were conducted at five locations in the vicinity of the Project Site, including one Long-Term (LT) measurement location for an entire 24-hour duration, and four short-term (ST) locations with durations of approximately 20 to 30 minutes each. The noise measurement locations are shown in Figure 3.1-1.

The noise measurement locations were selected to represent the following acoustical environments:

- LT-1. This location was conducted at the Project's northern fence line and was intended to represent the typical hour to hour variation of noise levels in the general Project Area over the course of an entire day. Contributing sound sources here included traffic from highways I-5 and State Route 133 (SR-133) and local roads, and occasional rail activity on the nearby Metrolink/Amtrak mainline tracks as well as occasional, short-term contributions for other miscellaneous local sound sources (aircraft overflights, individual vehicle pass-bys, trash collection, etc.).
- ST-1. This measurement location represented the residential development to the north of the Marine Way and Ridge Valley intersection. The contributing sound sources here included traffic on SR-133 and local roadways, with lesser contributions from traffic on I-5, rail activity, and other local noise sources.
- ST-2. This location represents a passive use area within the park (quiet area near the reflecting pond) and with direct exposure to the Project Area. Contributing sound sources here were similar to LT-1.
- ST-3. This location represents an active sports area within the park (soccer field) with direct exposure to the Project Area. Noise sources here were similar to those observed at LT-1 and ST-2.
- ST-4. This measurement location represents an informal exterior use area in a commercial area south of the mainline tracks (a bench within a grassy median in the parking area, presumably used as a short-term break area for employees).

Figure 3.1-1 Noise Measurement Locations

Figure 3.1-2 provides the LT noise measurement data displaying the equivalent average (L_{eq}), maximum (L_{max}) and minimum (L_{min}) value for each 10-minute measurement interval over the entire 24-hour measurement period (between 10:00 AM on 7/30/2020 and 10:00 AM on 7/31/2020). The L_{eq} values range mostly between 45 A weighted decibels (dBA) (during the early morning hours) and 60 dBA (during peak morning and afternoon periods). Individual spikes in the L_{eq} and L_{max} data are mostly caused by train pass-by events (the LT location was situated about 450 feet from the mainline tracks).

Figure 3.1-2 Long-Term Noise Measurement Data

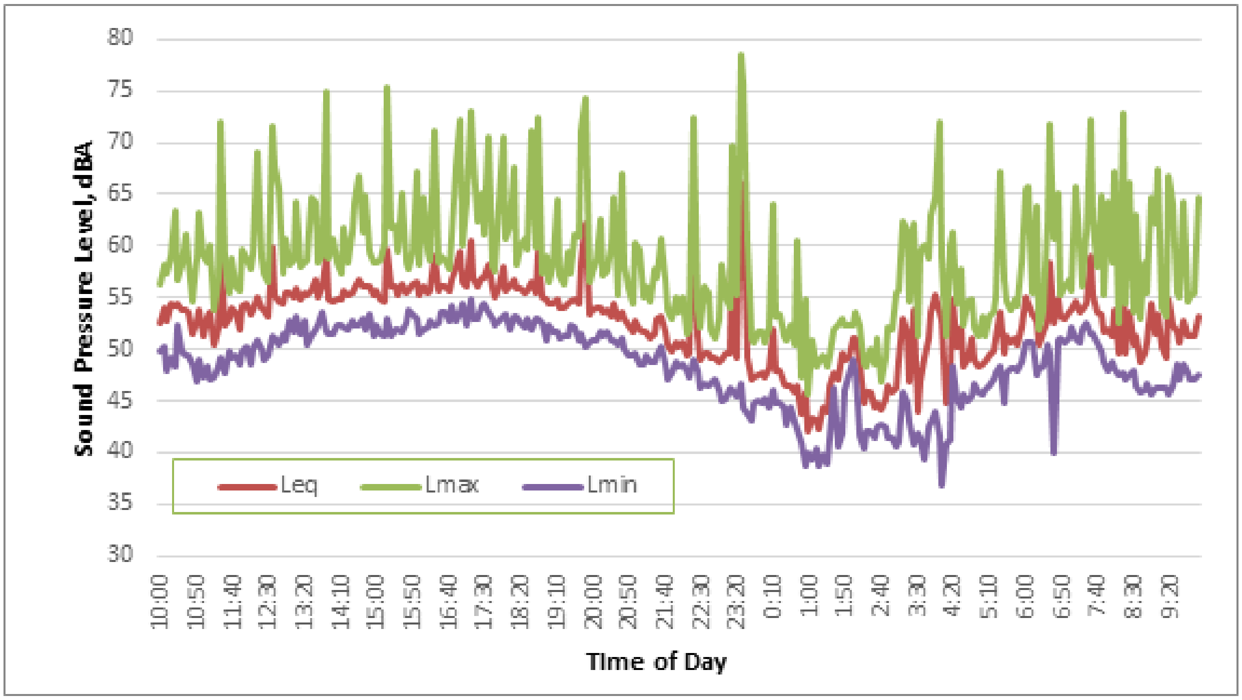


Table 3-1 provides a summary of the collected ST measurement data. Measurements were conducted twice at each ST location and the long-term metrics (L_{eq}-day, L_{dn}, and community noise equivalent level [CNEL]) at each ST location were calculated by using a relative comparison to the 24-hour data collected at the central LT measurement location.

Table 3-1 Short-term Noise Measurement Summary

Measurement Time and Duration				Duration	Measured or Calculated[2] Sound Level, dBA			
ID	Date	Start	End		L_{eq}-ST	L_{eq}-Day	L_{dn}	CNEL
ST-1[1]	7/30/20	10:58	11:30	0:32	61	63	67	68
	7/31/20	10:00	10:24	0:24	62			
ST-2	7/30/20	12:46	13:12	0:26	55	55	59	59
	7/31/20	9:45	10:04	0:19	53			
ST-3	7/30/20	13:25	13:52	0:27	63	60	64	65
	7/31/20	9:05	9:24	0:19	58			
ST-4	7/30/20	14:10	14:40	0:30	52	52	56	56
	7/31/20	8:30	8:50	0:20	50			

Source: AECOM, 2020.
Notes:
[1] Reported ambient noise levels for Measurement location ST-1 were reduced by 5 dBA to estimate the influence of an existing 8- to-10-foot-high noise wall between the actual exterior sidewalk noise measurement location near Marine Way and the residential backyards for the adjacent homes. This reduction was limited to 5 dBA due to traffic noise contributions from nearby elevated ramps and lanes on SR-133.
[2] L_{eq}-day, LDN and CNEL values were calculated by comparing measured ST noise measurement values to calculated L_{eq}-day, L_{dn} and CNEL from LT measurement location.

3.2 Regulatory Framework

Federal

Federal Transit Administration: As a transit Project, the primary source used for the prediction and assessment impacts associated with noise and vibration for the Project would come from the Federal Transit Administration (FTA) Noise and Vibration Impact Assessment Manual (2018), which provides prediction methodology and impact assessment guidance for both construction and operational phases of the Project as outlined below.

Construction Noise and Vibration

FTA-recommended construction noise impact criteria are presented in Table 3-2 below, as a function of land use.

Table 3-2 Construction Noise Impact Criteria

Land Use	$L_{eq\text{-}equip.(8hr)}$, dBA Day	Night	$L_{dn\text{-}equip.(30\ day)}$, dBA 30-day Average
Residential	80	70	75
Commercial	85	85	80*
Industrial	90	90	85*

Note: *Use a 24-hour $L_{eq(24hr)}$ instead of $L_{dn\text{-}equip(30day)}$
Source FTA 2018, Table 7-3

For construction vibration, FTA guidance provides impact criteria for two different impact types, potential building damage and potential human annoyance, both categorized by building type or land use, which are presented in Table 3-3 and Table 3-4, respectively.

Table 3-3 Construction Vibration Damage Criteria

Building/ Structural Category	PPV, in/sec	Approximate L_v*
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

*RMS velocity in decibels, VdB re 1 micro-in/sec
Source FTA 2018, Table 7-5

Table 3-4 Indoor Ground-Borne Vibration (GBV) and Ground-Borne Noise (GBN) Impact Criteria for General Vibration Assessment

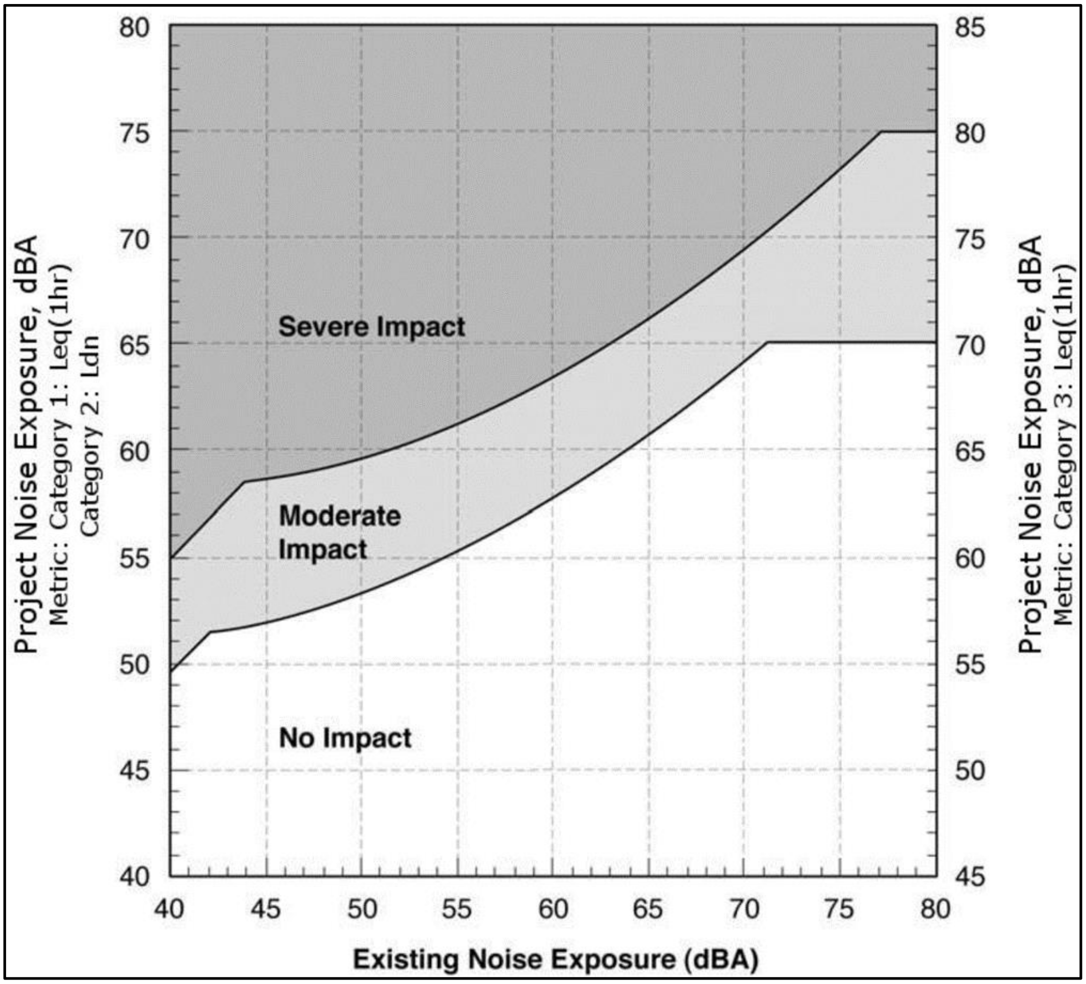
Land Use Category	GBV Impact Levels (VdB re 1 micro-inch /sec)			GBN Impact Levels (dBA re 20 micro Pascals)		
	Frequent Events†	Occasional Events$^{\alpha}$	Infrequent Events$^{\beta}$	Frequent Events†	Occasional Events$^{\alpha}$	Infrequent Events$^{\beta}$
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB *	65 VdB *	65 VdB *	N/A **	N/A **	N/A **
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

*This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a Detailed Vibration Analysis must be performed.
** Vibration-sensitive equipment is generally not sensitive to ground-borne noise; however, the manufacturer's specifications should be reviewed for acoustic and vibration sensitivity.
†Frequent events- More than 70 events per day (most rapid transit)
$^{\alpha}$Occasional events- 30-70 events per day (most commuter trunk lines)
$^{\beta}$Infrequent events- Fewer than 30 events per day (most commuter rail branch lines)
Source: FTA 2018, Table 6-3.

Operational Noise and Vibration

FTA operational noise impacts are determined as a function of the predicted project noise, existing noise exposure, and land use category, as shown in Figure 3.2-1. Generally, the higher the existing noise exposure, the higher the noise level threshold for moderate and severe impacts. For example, at a Category 2 (residential) receptor location with an existing noise exposure level of 55 dBA L_{dn}, a moderate noise impact would be triggered with a project-only noise exposure of 56 dBA L_{dn} and a severe impact at a project-only noise level of 61 dBA L_{dn}. However, for the same receiver location with an existing exposure of 60 dBA L_{dn}, a moderate impact would occur at a project-only noise level of 58 dBA L_{dn}, and a severe impact at 63 dBA, L_{dn}. Operational ground-borne vibration impact criteria are the same as for construction activity, as shown in Tables 3-3 and 3-4.

Figure 3.2-1 FTA Operational Noise Impact Criteria



Source: FTA 2018, Figure 4-2

Local

City of Irvine General Plan, Noise Element- The noise standards specified in the City's General Plan, 2015, Section F, Noise Element (shown in Table 3-5) are used as a guideline to evaluate the acceptability of the noise levels generated by the traffic flow. These standards are for the assessment of long-term vehicular traffic noise impacts. The City has exterior noise criteria for outdoor living areas associated with residential uses and requires that interior areas of new residential homes not exceed 45 dBA CNEL and that exterior active use areas not exceed 65 dBA CNEL. Other short-term noise impacts (e.g., construction activities or on-site stationary sources) are regulated by the noise ordinance.

Table 3-5 City of Irvine Interior and Exterior Noise Standards

Land Use Categories		Energy Average (CNEL)	
Categories	Uses	Interior[1]	Exterior[2]
Residential	Single-Family, Multiple-Family	45[3], 55[4]	65[7]
	Mobile Home	—	65[5]
Commercial/ Industrial	Hotel, Motel, Transient Lodging	45	65[6]
	Commercial, Retail, Bank, Restaurant	55	—
	Office Building, Professional Office, Research & Development	50	—
	Amphitheater, Concert Hall, Auditorium, Meeting Hall	45	—
	Gymnasium (Multipurpose)	50	—
	Health Clubs	55	—
	Manufacturing, Warehousing, Wholesale, Utilities	65	—
	Movie Theater	45	—
Institutional	Hospital, School Classroom	45	65
	Church, Library	45	—
Open Space	Parks	—	65

Notes:
[1] Interior environment excludes bathroom, toilets, closets, and corridors.
[2] Outdoor environment limited to private yard of single-family or multifamily residences private patio which is accessed by a means of exit from inside the unit; mobile home park; hospital patio; park picnic area; school playground; and hotel and motel recreation area.
[3] Noise level requirement with closed windows. Mechanical ventilating system or other means of natural ventilation shall be provided pursuant to Appendix Chapter 12, Section 1208 of UBC.
[4] Noise level requirement with open windows, if they are used to meet natural ventilation requirement.
[5] Exterior noise level shall be such that interior noise level will not exceed 45 dBA CNEL.
[6] Except those areas affected by aircraft noise.
[7] Multifamily developments with balconies that do not meet the 65 dBA CNEL are required to provide occupancy disclosure notices to all future tenants regarding potential noise impacts.
CNEL = Community Noise Equivalent Level, UBC = Uniform Building Code
Source: City of Irvine General Plan Supplement No. 3, Noise Element, Table F-1 (2005).

Municipal Code. Section 6-8-204 of the City's Municipal Code (City of Irvine, 2015b) establishes the maximum permissible noise level that may intrude into a neighbor's property. The Noise Ordinance (adopted in 1975 and revised in 2015) establishes noise level standards for various land use categories affected by stationary noise sources. Land use categories in the City are defined in four noise zones, as listed below. Table 3-6 provides the City's maximum noise standard based on the noise zone, the assessment location (exterior/interior), and the time period. As shown in Table 3-6, the City's noise standards do not apply to multifamily residence private balconies (City of Irvine 2015b).

1. Noise Zone 1: All hospitals, libraries, churches, schools, and residential properties.
2. Noise Zone 2: All professional office and public institutional properties.
3. Noise Zone 3: All commercial properties excluding professional office properties.
4. Noise Zone 4: All industrial properties.

Table 3-6 City of Irvine Maximum Noise Level Standards

Noise Zone	Exterior/ Interior	Time Period	L_{50} (30 mins)	L_{25} (15 mins)	L_8 (5 mins)	L_2 (1 min)	L_{max} (Anytime)
1	Exterior	7:00 AM to 10:00 PM	55	60	65[1]	70	75
		10:00 PM to 7:00 AM	50	55	60	65[1]	70
	Interior	7:00 AM to 10:00 PM	—	—	55	60	65
		10:00 PM to 7:00 AM	—	—	45	50	55
2	Exterior	Anytime	55	60	65	70	75
	Interior	Anytime	—	—	55	60	65
3	Exterior	Anytime	60	65	70	75	80
	Interior	Anytime	—	—	55	60	65
4	Exterior	Anytime	70	75	80	85	90
	Interior	Anytime	—	—	55	60	65

Note:
It shall be unlawful for any person at any location within the City to create any noise or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person which causes the noise level when measured on any property within designated noise zones either within or without the City to exceed the applicable noise standard. Each of the noise standards specified above shall be reduced by 5 dBA for impact, or predominant tone noise or for noises consisting of speech or music. In the event the noise source and the affected property are within different noise zones, the noise standards of the affected property shall apply.
[1] This standard does not apply to multifamily residence private balconies. Multifamily developments with balconies that do not meet the 65 dBA CNEL are required to provide occupancy disclosure notices to all future tenants regarding potential noise impacts.
Source: City Municipal Code (City 2015a).

The City's Municipal Code Noise Ordinance has not established any upper limits for construction noise because construction noise is temporary and will stop after project construction is complete. Section 6-8-205a of the City's Municipal Code Noise Ordinance regulates the timing of construction activities and includes special provisions for sensitive land uses. *Construction activities shall occur only between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday and between 9:00 a.m. and 6:00 p.m. on Saturday. No construction shall be permitted outside of these hours or on Sundays and federal holidays, except for Columbus Day, unless a temporary waiver is granted by the Chief Building Official or his or her authorized representative. Trucks, vehicles, and equipment that are making or are involved with material deliveries, loading, or transferring materials, equipment service, maintenance of any devices or appurtenances for or within any construction project in the City shall not be operated or driven on City streets outside of these hours or on Sundays and federal holidays unless a temporary waiver is granted by the City. Any waiver granted shall take into consideration the potential impact on the community. No construction activity will be permitted outside of these hours except in emergencies, including maintenance work on the City rights-of-way that might be required.*

Zoning Ordinance. Sections 5-8-4.A.5a and 5-8-4.A.5b of the City's Zoning Ordinance (City of Irvine, 2015b) establish requirements to minimize construction noise and vibration impacts. Although these requirements are intended for residential and mixed-use spaces in the Irvine Business Complex, the requirements listed below are applicable for the Project. Section 5-8-4.A.5a of the City's Zoning Ordinance requires that before the issuance of grading permits, the Project applicants shall incorporate the following measures as a note on the grading plan cover sheet to ensure that the greatest distance between noise sources and sensitive receptors during construction activities has been achieved:

- Construction equipment, fixed or mobile, shall be equipped with properly operating and maintained noise mufflers consistent with manufacturer's standards.
- Construction staging areas shall be located away from off-site sensitive uses during the later phases of project development.
- The project contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the Project Site, whenever feasible.
- For construction of sound walls that have been incorporated into the project design, prior to construction of the building foundation, installation of temporary sound blankets (fences typically composed of poly-vinyl-chloride-coated outer shells with absorbent inner insulation) shall be placed along the boundary of the Project Site during construction activities.

Section 5-8-4.A.5b of the City's Zoning Ordinance requires that before the issuance of a grading permit, applicants for individual projects that involve vibration-intensive construction activities (e.g., pile drivers, jackhammers, and vibratory rollers) near sensitive receptors shall submit a noise and vibration analysis. If construction-related vibration is determined to exceed the FTA vibration annoyance criterion of 78 vibration decibels (VdB) for residential uses during the daytime (FTA, 2018), additional requirements, such as the use of less vibration-intensive equipment or construction techniques, shall be implemented during construction (e.g., drilled piles to eliminate use of a vibration-intensive pile driver). In the same FTA guidelines, 84 VdB is the vibration annoyance criterion for offices and non-sensitive areas.

4. METHODOLOGY

The methodologies for predicting noise and vibration levels from Project construction and operation are taken primarily from the general assessment methodology of the FTA Noise and Vibration Impact Assessment Manual with additional information from FHWA Roadway Construction Noise Model (RCNM) and Traffic Noise Model (TNM), as discussed in the following section.

4.1 Construction Noise and Vibration

Construction noise and vibration prediction procedures are covered in Section 7 of the FTA Manual and supplemented by reference information from the FHWA RCNM.

Construction Noise Prediction Procedure

Construction noise impacts were assessed by predicting construction noise levels using methods consistent with the FTA Noise and Vibration Manual and comparing these values to identified impact thresholds. This methodology starts with the reference noise level for each piece of construction equipment to be used under conservative worst-case conditions for each identified construction phase. This value is adjusted for the distance from the source to the noise-sensitive receptor, the fractional portion of time that the equipment is operating at full power (acoustical usage factor), and any acoustical shielding that may be present (such as buildings or terrain), and then summing together the contributed noise from all sources.

Construction equipment rosters and usage are provided by the Project contractors to represent typical worst-case noise conditions. The acoustical contribution for each piece of equipment at each activity area is calculated using the following equation:

$$L_{eq} = L_{max(ref)} - 20\log\left(\frac{D}{D_{ref}}\right) + 10\log\left(\frac{AUF\%}{100}\right) + 10\log(N) - S$$

Where:

L_{eq} =	the equivalent sound level energy-averaged over the period of time over which the equipment is operating, in dBA
$L_{max(ref)}$ =	the maximum operating equipment sound level operating at full power as measured at the reference distance
D =	the distance between the operating equipment and the noise-sensitive receptor location (distances conservatively assumed to be from the receiver location to the acoustic center of the construction site)
D_{ref} =	the reference distance for the $L_{max(ref)}$, typically 50 feet
AUF =	the Acoustic Use Factor (typical fractional value of time that equipment is operating at full power)
N =	number of similar pieces of equipment operating in the same area
S =	the estimated noise reduction shielding value between that source and noise-sensitive receptor, in dBA

The acoustic contribution for all equipment assumed to be operating during the defined construction phase is summed together on an energy basis to determine the combined construction noise level for each studied noise-sensitive receptor. The equipment to be used for the various construction phases of the Project, selected from the RCNM equipment list, the reference maximum noise level (L_{max}) and acoustic use factor (AUF) are shown in Table 4-1 below.

Table 4-1 Acoustical Properties of Construction Equipment

Equivalent Type	L_{max} Ref dBA (50 feet)	AUF%
Auger Drill	84	20
Backhoe	78	40
Boring Jack Power Unit	83	50
Chain Saw	84	20
Compactor (ground)	83	20
Compressor (air)	78	40
Concrete Mixer Truck	79	40
Concrete Pump Truck	81	20
Concrete Saw	90	20
Crane	81	16
Dozer	82	40
Drill Rig Truck	79	20
Drum Mixer	80	50
Dump Truck	76	40
Excavator	81	40
Flat Bed Truck	74	40
Front End Loader	79	40
Generator (>25KVA)	81	50
Generator (<25KVA)	73	50
Gradall	83	40
Grader	85	40
Horizontal Boring Jack	82	25
Hoe Ram	90	20
Impact Pile Driver	101	20
Jackhammer	89	20
Man Lift	75	20
Pavement Scarafier	90	20
Paver	77	50
Pickup Truck	75	40
Pneumatic Tools	85	50
Pumps	81	50
Roller	80	20
Scraper	84	40
Shears (on backhoe)	96	40
Tractor	84	40
Vacuum Excavator	85	40
Vacuum Street Sweeper	82	10
Ventilating Fan	79	100
Vibrating Hopper	87	50
Vibratory Concrete Mixer	80	20
Warning Horn	83	5
Welder/Torch	74	40

Source: RCNM User Guide 2006, Table 1 (actual measured L_{max}), FTA 2018, Table 7-1.

Construction Vibration Prediction Procedure

Construction-related vibration is assessed using two different metrics. Peak Particle Velocity (PPV) in inches per second (in/sec) is used to assess potential structural damage from vibration, and Vibration Velocity Level (L_v) in VdB is used to assess human annoyance from vibration. These are calculated using the following equations.

Structural Damage Equation (PPV):

$$\mathrm{PPV} = \mathrm{PPV_{ref}} * \left(\frac{25}{\mathrm{D}}\right)^{1.5}$$

Where:

PPV = Peak Particle Velocity at the nearest structure

PPV_{ref} = the reference PPV value for a piece of equipment at reference distance of 25 feet

D = the distance from the construction equipment to the structure

Human Annoyance Equation (L_v)

$$\mathrm{L_v} = \mathrm{L_{v(ref)}} - 30\log\left(\frac{\mathrm{D}}{25}\right)$$

Where:

L_v = the Vibration Velocity Level at the nearest structure

$L_{v(ref)}$ = the reference L_v value for a piece of equipment at a reference distance of 25 feet

D = the distance from the construction equipment to the receiver

Not all construction equipment produces significant ground-borne vibration. Of the equipment listed to be used on this Project shown in Table 4-1, the equipment with the highest reference vibration level would be "Impact Pile Driver" which has a upper range reference PPV ref value of 1.518 in/sec at 25 feet and Lv(ref) equal to 112 VdB at 25 feet. Other construction equipment types expected to be used on the Project that generate ground borne vibration are listed in Table 4-2 (from FTA 2018, Table 7-4).

Potential vibration impacts for both damage and human annoyance are typically assessed using the closest distance to the potentially impacted structure.

Table 4-2 Reference Vibration Properties of Selected Construction Equipment

Equipment Type		PPV at 25 ft, in/sec	L_v, VdB at 25 ft.
Pile Driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile Driver (sonic)	Upper range	0.734	105
	Typical	0.17	93
Vibratory Roller		0.21	94
Hoe-Ram		0.089	87
Large Bulldozer		0.089	87
Caisson/Auger Drilling		0.089	87
Loaded Trucks		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

Source: FTA 2018, Table 7-4

4.2 Operational Noise and Vibration

Operational Noise Prediction Procedure

Operational noise prediction for this Project follows the general noise prediction techniques identified in Section 4.4 of the FTA Transit Noise and Vibration Impact Assessment Manual, 2018, as detailed below.

The FTA manual includes procedures for the computation of noise levels for various types of stationary rail noise sources, including "Rail Yards and Shops". For this computation, it is assumed that the resulting noise level is inclusive of the typical variety of activities and noise sources normally associated with "Rail Yards and Shops" including rail vehicle movements coming in and out of revenue service, vehicle storage and inspection tracks, routine rail vehicle maintenance and refueling areas, vehicle wash stations, shop and storage building, and internal movement of worker and delivery vehicles. Existing mainline rail activity is considered part of the existing environment and therefore is excluded from the noise impact analysis. The equations used to calculate the L_{eq} and L_{dn} values at the various receptor locations are presented below.

$$L_{eq(1hr)} \text{ at 50 feet} = SEL_{ref} + 10*Log(N_T/20) - 35.6$$

Where:

$L_{eq(1hr)}$ = the Equivalent Sound Level over 1-hour (peak)
SEL_{ref} = Reference Sound Exposure Level (118 dBA for Rail Yard and Shops)
N_T = Train Movements During Peak Hour

The Day-Night Noise level (L_{dn}) is calculated from Daytime and Nighttime L_{eq} levels at 50 feet given number of train movements and then converted to L_{dn} with the following equation:

$$L_{dn} = 10*\log(15*10^{(L_d/10)} + 9*10^{((L_n+10)/10)}) - 13.8$$

Where:

Ldn = Day-Night Noise Level
Ld = Daytime L_{eq}
Ln = Nighttime L_{eq}

Finally, the distance correction for Stationary Sources is estimated using the following equation:

$$L_{rec} = L_{50ft} - 25*\log(D_{rec}/50) - S$$

Where:

Lrec = the resulting sound level at the receiver location, dBA
L50ft = the calculated source level at 50 feet (L_{eq} or L_{dn}), dBA
Drec = the distance from the source to the receiver, in feet
S = the shielding between the source and receiver locations, in dBA

In addition to the sound levels predicted from Yards and Shops as described above, operational traffic noise, including sound from staff trips and some heavy truck deliveries, was calculated for receivers along the haul route using the FHWA Traffic Noise Model Version 2.5, and those values added to the Yards and Shops noise source for impact assessment.

Operational Vibration Prediction Procedure

While operational ground vibration may be generated by some types of operational rail or industrial activity, no significant ground vibrations sources are anticipated from the operation of the maintenance facility.

5. IMPACT ANALYSIS

5.1 Construction Noise and Vibration

Construction activity for the Project was defined in terms of two construction phases. Phase 1 would consist of the primary build-out of the facility and would last up to 30 months in duration. Phase 2 is a secondary build-out of up to 24 months in duration. Both phases identify 13 sub-phases, including Survey, Clear and Grub, Site Utility/Electric, Demo, Earthwork, Foundations, Roadway/Paving, Buildings, Trackwork (ballasted and direct fixation), Major Equipment, and Commissioning, each with a defined set of equipment to be used (with combined total of over 50 individual types of equipment listed). It was assumed that all construction activity would be restricted to daytime hours between 7 AM and 7 PM as required by the City noise ordinance.

Resulting noise levels for each of the four identified noise-sensitive receptors were calculated in accordance with the procedures outlined in Section 4 and are reported in Table 5-1, below.

Table 5-1 Construction Noise Levels and Impacts Summary (Worst Case for All Phases)

Receiver ID/ Land Use	Impact Metric	Impact Threshold (L_{dn}/L_{eq})	Distance to Project Center (ft)	Acoustical Shielding (dBA)	Predicted Range (L_{dn}/L_{eq})	Impact
ST-1/Residential	L_{dn}	75	1275	5[1]	50-68	None
ST-2/Park	L_{eq}	80	1100	0	57-74	None
ST-3/Park	L_{eq}	80	1220	0	56-73	None
ST-4/Commercial	L_{eq}	80	650	5[2]	56-73	None

Notes:
[1] ST-1 receives estimated minimum 5 dBA shielding from construction activity due to existing 8-to-10-foot-high noise wall.
[2] ST-4 receives estimated minimum 5 dBA shielding due to intervening row of buildings.

The range of predicted construction values presented in Table 5-1 represent the predicted noise levels over the 30-month Phase 1 schedule (i.e. for ST-1, 50 dBA during the least noisy month up to 68 dBA during the noisiest month).

Construction vibration typically only generates potential impacts at existing structures within a maximum of a few hundred feet, and only then with the use of equipment with particularly high vibration levels such as vibratory roller and impact pile drivers. Of these, impact pile drivers were identified for potential use on just two construction sub-phases, Foundations and Bridges. The exact locations of the potential pile driving activity is currently unknown, but if pile driving is conducted within approximately 250 feet of an occupied commercial building, a short-term significant impact could occur with a predicted vibration level of 75 VdB or greater (corresponding to vibration annoyance for “frequent” events). Only the commercial buildings on the south/west side of the existing mainline tracks could potentially be within this distance.

Ground-borne vibration for construction activity would not be expected to approach potential damage thresholds at any nearby structures. The closest distance at which a pile driver might be to an existing building would be approximately 120 feet at existing commercial building south of mainline tracks, with an estimated vibration level from impact pile driving of 0.144 in/sec PPV, well below the damage threshold of 0.5 in/sec PPV for modern commercial buildings.

5.2 Operational Noise and Vibration

The following operations assumptions were used in calculating potential noise levels and impacts for the noise-sensitive land-uses near the Project.

- Train movements in and out of Maintenance Facility: Peak Hour, 10 daytime (9-10 PM) and 10 nighttime (6-7 AM)
- Vehicle Trips: Average hourly traffic volumes of 10 autos/hour + 1 heavy truck/hour daytime (7 AM to 10 PM), 3 autos/hour + 0 Heavy Trucks/hour nighttime (10 PM to 7 AM)

Table 5-2 below provides a summary of the operational noise level prediction and impact assessment. The Total Project noise level includes contributions from both on-site operational noise sources associated with Rail Shops and Yard as well as automobile and truck traffic in and out of the sight.

Table 5-2 Operational Noise Levels and Impacts Summary

Receiver info						Impact Thresholds (dBA)		Prediction (dBA)
ID	Land Use	Distance to Project Center (feet)	Analysis Metric	Existing Noise Level	Total Project-Only Sound Level	Moderate Impact Threshold	Severe Impact Threshold	Impact
ST-1	Residential	1275	L_{dn}	67	52*	63	67	None
ST-2	Park	1100	$L_{eq\text{-}1hr}$	55	41	61	66	None
ST-3	Park	1220	$L_{eq\text{-}1hr}$	60	39	63	68	None
ST-4	Industrial	650	$L_{eq\text{-}1hr}$	52	51	60	65	None

*Predicted project-only noise level at ST-1 includes contributions from both facility site and project-related traffic on adjacent local roads.

6. MITIGATION MEASURES

All operational noise and vibration levels as well as construction noise associated with the Project would not result in any impacts. The only construction impacts that could be considered significant would be construction vibration annoyance resulting from pile-driving equipment if these are used within 250 feet of an existing structure during Project construction. Only the commercial buildings on the south/west side of the existing mainline tracks could potentially be within this distance. The following mitigation measures should be implemented to reduce or eliminate vibration impacts associated with the use of impact pile drivers during construction:

MM-NOI-1 If feasible, relocate Project elements requiring pile driving to locations greater than 250 feet from occupied buildings.

MM-NOI-2 If MM-NOI-1 is not feasible, use a less intrusive form of pile insertion, such as pre-augured piling.

MM-NOI-3 Arrange to conduct pile driving activities during a period when the affected building(s) are not in use (such as Saturdays).

7. IMPACTS AFTER MITIGATION MEASURES

The only potential Project impacts are associated with vibration annoyance impacts associated with Pile Driving activity. Upon implementation of MM-NOI-1 through MM-NOI-3, all impacts can be reduced to less than significant.

8. REFERENCES

Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, 2018. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf.

City of Irvine, 2015a, Noise Element of the Irvine General Plan, 2015 https://legacy.cityofirvine.org/civica/filebank/blobdload.asp?BlobID=20695#:~:text=maximum%20interior%20noise%20levels%20of,7%20a.m.%20for%20typical%20occupancy.

____________, 2015b,Municipal Code Irvine, Chapter 2, NOISE, https://library.municode.com/ca/irvine/codes/code_of_ordinances?nodeId=TIT6PUWO_DIV8PO_CH2NO

SCRRA, Metrolink System Map, October 2019, Available at: https://metrolinktrains.com/about/agency/

Appendix G
Technical Memorandum
Paleontological Resources

Metrolink Orange County Maintenance Facility

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Paleontological Resources Technical Memorandum	01/08/21
1	Draft Paleontological Resources Technical Memorandum (Incorporating OCTA's comments)	4/27/21

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. Approximately 80 employees would report to the Project. The Project consists of buildings that would have a total building area of approximately 90,000 square feet when combined. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

The purpose of this memorandum is to present the results of a paleontological resources investigation and to describe the potential impacts to paleontological resources as defined by CEQA that may be associated with the Project.

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) would require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine, (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from I-5 at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval,

The Project would be developed in two phases with an anticipated completion date of 2028. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 2.2-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 2.2-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (February 2022)
Note: sq. ft. = square feet; ft = feet

A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette.

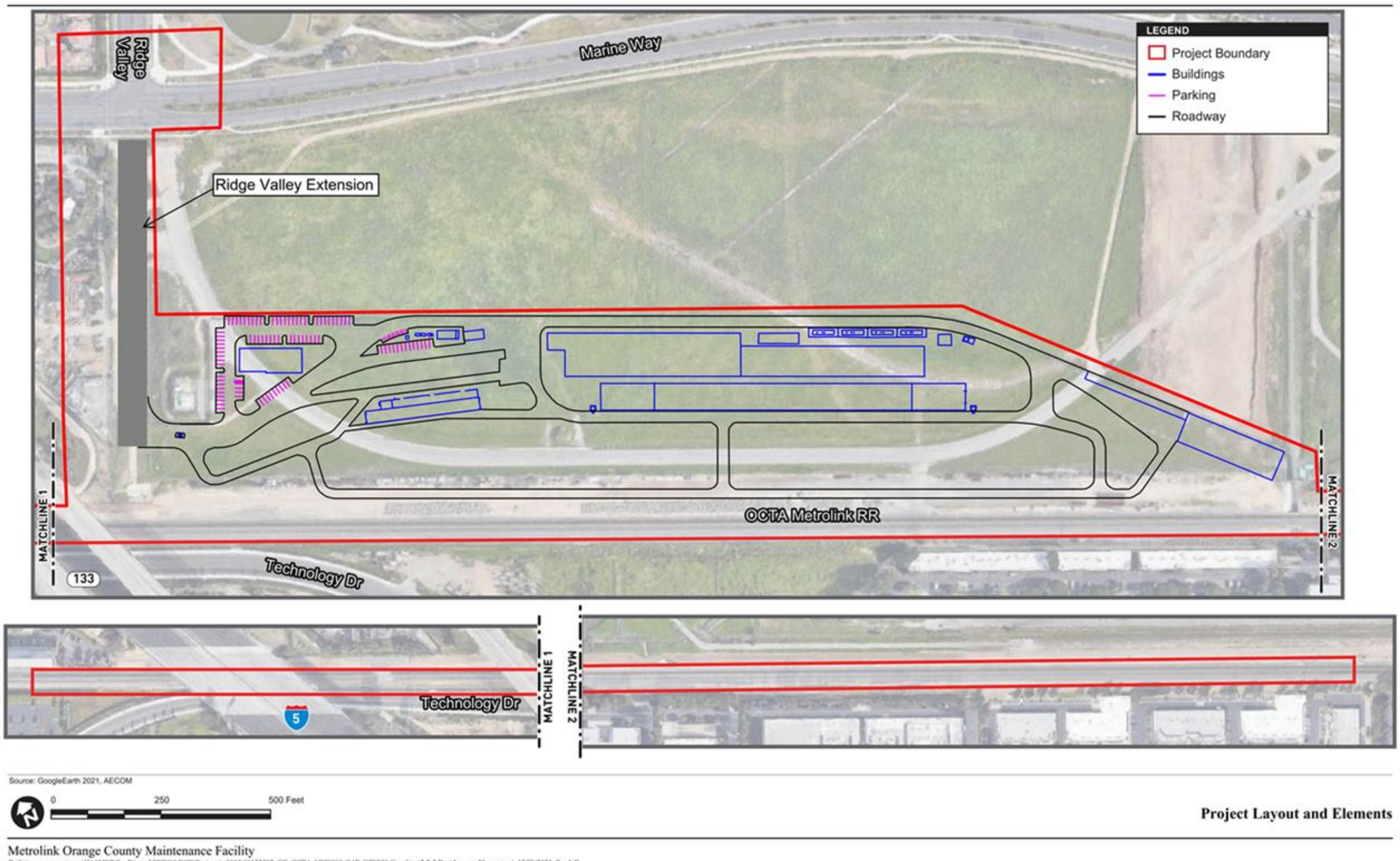
Parking would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (**Error! Reference source not found.**). The shop would have capabilities to perform regular three-month, six-month and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.

Access to the OCMF would require a roadway extension along Ridge Valley from the intersection of Ridge Valley and Marine Way. The Project includes the southern extension of Ridge Valley Road from Marine Way and associated traffic signal improvements to provide access to the OCMF.

The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink’s “Orange” Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. REGULATORY FRAMEWORK

3.1 CALIFORNIA ENVIRONMENTAL QUALITY ACT

CEQA (Public Resources Code [PRC] Sections 21000–21177) is intended to prevent significant avoidable impacts to the environment by requiring feasible alternatives or mitigation measures. If cultural resources are identified within the Project Site, the sponsoring agency must take those resources into consideration when evaluating the Project's effects. The level of consideration may vary with the importance of the cultural resource.

Paleontological resources are not explicitly mentioned in the text of California Register of Historical Resources (CRHR) (PRC Section 5024.1, Title 14 California Code of Regulations [CCR], Section 4852). However, they are specifically identified for protection in Section V(c) of Appendix G, the "Environmental Checklist Form," which asks whether the Project would "Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

A paleontological resource is typically considered "unique" if it provides significant information about past environments or ancient life.

3.2 PUBCIC RESOURCES CODE SECTION 5097.5

PRC Section 5097.5 states that no person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological, or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. "Public lands" refers to land owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

4. METHODOLOGY

A paleontological resources assessment was obtained for this Project from the Natural History Museum of Los Angeles County (LACM). Pertinent geological information was reviewed for the Project extent, including a review of paleontological literature; no paleontological field survey was performed. Paleontological sensitivity of the Project Site was addressed, and potential paleontological mitigation measures offered, as appropriate.

5. ENVIRONMENTAL SETTING

5.1 GEOLOGIC OVERVIEW

Geologic maps indicate that the entire Project Site is covered with surficial deposits of Qyf, (Morton and Miller, 2006). These deposits consist of young Quaternary alluvial fan deposits. They consist of slightly consolidated to cemented deposits of unsorted boulders, cobbles, gravels, and sands deposited by fluvial processes. Shallow Qyf deposits date to the Holocene (approximately 11,650 calibrated radiocarbon years before present to today). The guidelines of the Society of Vertebrate Paleontology state that fossils as young as 5,000 years can be significant paleontological resources. But older Qyf deposits may date to the late Pleistocene (approximately 129,000 to 11,650 calibrated radiocarbon years before present). Thus, the sensitivity of Qyf deposits for significant paleontological remains increases with depth. Moreover, in this vicinity Qof deposits, which consist of older Quaternary alluvium dating to the late to middle Pleistocene, typically underlies the Qyf younger Quaternary alluvium at varying depths. Older Quaternary alluvium, which also dates to the Pleistocene, has yielded significant fossils in the Irvine area.

5.2 ARCHIVAL RESEARCH

Archival research included a records search conducted by the Los Angeles County Museum of Natural History (NHM) and a review of reports in AECOM's library. AECOM requested a paleontological records search be conducted by the NHM on July 8, 2020. Dr. Samuel MacLeod responded on behalf of the museum in a letter dated July 22, 2020. The records search found that no paleontological localities are documented within the Project Site. However, fossil localities are documented nearby in older Quaternary deposits (Table 5.2-1).

The closest NHM vertebrate fossil locality from older Quaternary deposits is LACM 7867, approximately 0.6-mile northeast of the Project Site near the intersection of C Street and 5th Street, that produced fossil specimens of pocket gopher, *Thomomy*s, at a depth of 25 feet below the surface.

The next closest vertebrate fossil from older Quaternary deposits is in Borrego Canyon, located approximately one mile east of the Project Site. Two fossil localities are found there. The lower one, 7.5 feet below the surface, produced remains of ground sloth, reptiles, amphibians, and freshwater fish (Stewart, 2006). Directly over that horizon is another that produces fossils of Pleistocene plants including manzanita and has been radiocarbon dated at about 28,000 calibrated radiocarbon years before present.

The next closest vertebrate locality is LACM 7713, located approximate 1.5 miles southwest of the Project Site on the western side of the Laguna Freeway (State Route 133 [SR-133]) at the southern end of the interchange with the San Diego Freeway (I-405), that produced a fossil specimen of ground sloth, *Mylodontidae*, from unstated but shallow depth.

Table 5.2-1. Previously Recorded Paleontological Resources Closest to the Project

Locality	Location	Age/ Formation	Findings
LACM 7867	Immediately northeast of the Project Site near the intersection of C Street and 5th Street, 25 feet below surface.	Quaternary deposit	*Thomomys* (pocket gopher)
LACM 7713	Southwest of the Project Site on the western side of the Laguna Freeway (SR-133) at the southern end of the interchange with the San Diego Freeway (I-405), from unstated but shallow depth.	Quaternary deposit	*Mylodontidae* (ground sloth)
Borrego Canyon Wash	Immediately east of the Project Site in Borrego Canyon Wash at a depth of 5 feet.	Quaternary deposit	*Arctostaphylos* manzanita)
Borrego Canyon Wash	Immediately east of the Project Site in Borrego Canyon Wash at a depth of 7.5 feet.	Quaternary deposit	Freshwater fish, amphibians, reptiles, ground sloth

Source: NHM (2020)

6. IMPACTS ANALYSIS

The sensitivity of the Project to encounter significant fossil remains appears high. Geologic maps indicate that the surficial deposits at the Project Site consist of younger Quaternary alluvium. These Holocene deposits are too young to typically contain significant fossils. The depth of excavations required for the Project could encounter Pleistocene horizons as shallow as 5 feet from the existing surface elevation. Moreover, soils at very shallow depths can reasonably be assumed to have been disturbed in the recent past by grading, by utilities excavations, and by activities related to the railroad and Marine Corps Station El Toro. However, the conditions at the Project Site are unknown.

Nevertheless, it is possible that the Project would encounter older Qyf deposits or Qof deposits during excavations. Unknown fossil resources may exist within these deposits, which have yielded significant fossils in the near vicinity of the Project. The sensitivity for the Project to encounter significant fossils increases with depth.

7. MITIGATION MEASURES

It is not anticipated that the Project would impact known paleontological resources. However, the possibility exists for the Project to encounter unknown paleontological resources in the course of excavation, if excavations exceed a depth of 5 feet. The following mitigation measures are recommended to reduce any impacts to unknown paleontological resources encountered during excavations to a less than significant level.

MM-PAL-01 **Worker Environmental Awareness Program.** Prior to construction, OCTA shall retain a qualified paleontologist who meets the requirements to be included in Orange County's list of qualified paleontologists. The qualified paleontologist shall prepare a Worker Environmental Awareness Program (WEAP). The WEAP will describe the types of resources that may be encountered during construction, the laws protecting those resources, and the procedures to follow when finds are encountered. The WEAP will be presented either in person or in video form to all construction employees involved in ground-disturbing activities before they begin work at the Project Site. If Project excavations are expected to exceed a depth of 5 feet below the surface, the qualified paleontologist shall prepare a Paleontological Resources Monitoring and Mitigation Plan that includes sampling and wet screening of sediment samples.

MM-PAL-02 **Response to Unanticipated Paleontological Finds.** If buried paleontological resources are uncovered during construction, all work shall be halted in the vicinity of the discovery until a qualified paleontologist can visit the site of discovery and assess the significance of the resource and, if necessary, recommend treatment.

8. IMPACTS AFTER MITIGATION

There are no known paleontological resources that would be impacted by the Project. Implementation of Mitigation Measure MM-PAL-01 would contribute to the successful identification of unanticipated fossil deposits that are encountered during construction. In the event that any unknown paleontological resources are found during construction, implementation of Mitigation Measure MM-PAL-02 would reduce any potential impacts to less than significant.

9. PREPARER'S QUALIFICATIONS

Dr. Marc Beherec has worked in the field of cultural resources management for approximately 20 years. He obtained his B.A. in Anthropology with a Geology minor from the University of Texas, Austin, and his M.A. and Ph.D. in Anthropology from the University of California, San Diego. He coordinated paleontological monitoring for various local agencies and assisted in the preparation of paleontological impact studies for the purposes of CEQA, as well as paleontological monitoring plans and memoranda documenting the results of paleontological monitoring.

Dr. Joe Stewart is a vertebrate paleontologist with over 40 years of experience in paleontology and 30 years of experience in the geology and paleontology of California, particularly in Merced, Fresno, Kern, Santa Barbara, Los Angeles, Orange, San Bernardino, Riverside, Imperial, and San Diego counties. Dr. Stewart has been involved in the permitting or construction of more than ten power plants and has directed the paleontological monitoring and mitigation program for Path 15, a major transmission line Project. He is also a certified paleontologist for the Counties of Orange and Riverside. His publications include 40 peer-reviewed articles in books and journals. His research specialties are fossil fishes and Pleistocene vertebrate faunas.

10. REFERENCES

Morton, D.M., and F.K. Miller, 2006, *Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California.* Reston, VT: United States Geological Survey.

Stewart, J.D. 2006. *Paleontological Resources Update and Review, Heritage Fields / The Great Park, City of Irvine, Orange County, California.* Document prepared by PCR Services Corporation for Heritage Fields El Toro, LLC, Orange County Great Park Corporation Community Development Department, and City of Irvine.

SCRRA, Metrolink System Map, October 2019, Available at: https://metrolinktrains.com/about/agency/

Appendix H
Technical Memorandum
Traffic

Metrolink Orange County Maintenance Facility

Prepared for:

Orange County Transportation Authority

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February 2022

REVISION	DESCRIPTION	DATE
0	Draft Traffic Technical Memorandum	01/26/21
1	Draft Traffic Technical Memorandum (Incorporating OCTA's comments)	03/17/21
2	Draft Traffic Technical Memorandum (Incorporating OCTA's comments)	10/4/2021
3	Draft Traffic Technical Memorandum (Incorporating City of Irvine's comments on the Conditional Use Permit)	2/7/2022
4	Draft Traffic Technical Memorandum (Incorporating City of Irvine's comments on the Conditional Use Permit)	2/16/2022

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1. INTRODUCTION

The Southern California Regional Railroad Authority (SCRRA) Metrolink Commuter Rail System (Metrolink) is proposing to construct a new Orange County Maintenance Facility (hereafter referred to as "OCMF" or "the Project"). The Project would include several facilities including a transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth, sand silos, a maintenance facility, a maintenance facility extension, and 11 tracks. The Project consists of buildings that, when combined, would have a total building area of approximately 90,000 square feet. Approximately 80 employees would report to the Project. Metrolink currently operates two maintenance facilities across its service area: Central Maintenance Facility (CMF) in Los Angeles and Eastern Maintenance Facility (EMF) in San Bernardino County. Due to projected population expansion within its service area and the agency's goal to be prepared for the 2028 Los Angeles Summer Olympic Games, Metrolink will require an increased number of commuter rail services, as well as additional train storage and maintenance facilities associated with an increased fleet size. As a significant proportion of the expanded services will operate in Orange County, the Project would provide an optimal location for a new Metrolink maintenance facility. Metrolink's member agency, the Orange County Transportation Authority (OCTA), proposes to build this facility on an OCTA-owned parcel in the City of Irvine. OCTA is the lead agency under the California Environmental Quality Act (CEQA). The City of Irvine and SCRRA are the responsible agencies under CEQA.

This traffic study has been prepared to identify the short-term traffic deficiencies (level of service [LOS]) and CEQA transportation impacts (vehicle miles travelled [VMT]) resulting from the Project. The study meets the requirements of a Limited Scope Traffic Study as defined by the City of Irvine (City) and has been prepared in accordance with applicable sections of the City of Irvine Traffic Study Guidelines (November 2021) and the City of Irvine Transportation Design Procedures (February 2007).

2. PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

As a result of the projected population expansion within the five-county area (Orange County, Los Angeles County, San Bernardino County, Riverside County, and Ventura County) currently served by the SCRRA, Metrolink will require an increased number of commuter rail services to support the growth. Consequently, the Metrolink system (Figure 2.1-1) will require additional train storage and maintenance facilities to support an increased fleet size.

Figure 2.1-1 Metrolink System Map

Source: SCRRA (2019)

Metrolink's CMF facility is located on the east bank of the Los Angeles River near the Interstate 5 (I-5) and Interstate 10 (I-10) highways, just south of the location of the former Southern Pacific Taylor Yard. The CMF is currently near capacity, which will impact the ability to provide the necessary train servicing for planned service-expansion of various Metrolink lines throughout the system under the Southern California Optimized Rail Expansion (SCORE) program. By transferring a portion of the current fleet from CMF to the proposed OCMF (specifically the Orange County Line trains), capacity for the non-Orange County trains will be increased at CMF. The Orange County Line has the highest ridership within the Metrolink system; therefore, a maintenance facility to serve the Orange County area with sufficient storage and servicing capabilities for both locomotives and rail cars is critical to controlling operating costs. In order to optimize rail service in the region, the proposed facility development would need to be completed by 2028. The SCORE program may also require heavy overhaul capabilities at OCMF, subject to pending decisions regarding fleet technology and management.

The expansion of Orange County and overall Metrolink commuter rail service will ultimately require additional or expanded equipment servicing capabilities for both locomotives and rail cars. Since a significant portion of the fleet will be in Orange County, a maintenance facility located along the Metrolink route through Orange County would be the optimal location as it would reduce operating costs by limiting non-revenue moves to the existing SCRRA storage and maintenance facilities in the cities of Los Angeles and San Bernardino. The proposed maintenance facility would provide equipment to inspect, clean, and maintain cars and locomotives on a regular and efficient basis. Much of the inspection and maintenance activity is federally mandated and must be performed at specific intervals. The OCMF will also provide refueling services thus reducing fuel costs, reducing fuel consumption, and will reduce emissions. Currently trains operating in the Orange County Region must travel either the CMF or EMF for refueling, which are sometimes non-revenue runs. The location of the Project is on a 21.3-acre OCTA-owned parcel on Ridge Valley south of Marine Way in the City of Irvine (Project Site). The Project Site is located within the boundaries of a closed military base (Marine Corps Air Station [MCAS] El Toro) formerly owned by the United States Department of the Navy (DON). After MCAS El Toro was closed, the site was quitclaimed by the Navy to Heritage Fields El Toro, LLC in 2011, and then by way of grant deed conveyed by Heritage Fields to the City of Irvine that same year. OCTA then purchased the fee ownership of the Project Site from the City of Irvine. Regional vehicle access to the Project Site is from Interstate 5 (I-5) at Sand Canyon Avenue. Local vehicle access is via Marine Way to Ridge Valley.

Prior to the current construction of the storage/set-out track, the Project Site was mostly vacant. The site currently includes 1,000-foot-long storage for miscellaneous rail equipment including temporary railroad bridges, signal houses, railroad ties, and signal components. Although not part of the Project, OCTA is currently installing a single 1,000-foot-long, single-ended storage track and fencing of the perimeter of the property to provide temporary storage of two trainsets and/or track maintenance equipment when necessary. There is a segment of an abandoned road, stormwater drains, and underground water transfer vault with a network of pipelines, valves and associated vents, that are currently not in use.

2.2 PROJECT DESCRIPTION

The OCMF would be located in the City of Irvine, on a 21.3-acre parcel owned by OCTA and adjacent to Marine Way and the Metrolink Orange subdivision between mileposts 183.50 and 184.00 on Metrolink's "Orange" Subdivision (Figure 2.2-1). The Project Site is located within Planning Area 51 of the updated City of Irvine General Plan, adopted in June 2015, and designated for the Great Park (formerly known as the Orange County Great Park (OCGP)) land use under the General Plan. Per the City's zoning ordinance, the proposed use is a conditionally allowable use under the existing zone; therefore, OCTA is submitting a Conditional Use Permit to the City of Irvine for approval.

The Project would be developed in two phases with an anticipated completion date of 2028. For traffic analysis purposes, the Project is assumed to be fully built-out by short-term interim year. Phase 1 focuses on developing facilities needed for the storage and routine cleaning, inspection and servicing of the anticipated trainsets. The total area of the Phase 1 buildout would be approximately 20,996 square feet and would be comprised of the following facilities: the transportation building, employee parking area, train-wash building, pump house, utility building, guard booth, equipment booth and sand silos (Table 2.2-1). A total of 11 tracks would be built. The Phase 1 layout situates the train wash, fueling/sanding, and service and inspection tracks on the two tracks with the greatest tangent length, which are the ones nearest the railroad right of way ("ROW"). This is important in fitting a second fueling/sanding facility so that there is one at each end of the service and inspection platform to support having the locomotive at either end, all within tangent track. Additionally, six storage tracks and appurtenant features (air, water, head end power and toilet dump facilities) would be constructed. The storage tracks would be built near the middle of the site east of the service and inspection tracks. Phase 1 of the buildout would anticipate approximately 52 employees total throughout the entire day, split across three eight-hour shifts.

Table 2.2-1 Building Specifications

Building/Facility/Item	Building Area	Building Height
Transportation Building	7,495 sq. ft.	20 ft
Train Wash Building	11,110 sq. ft.	21 ft
Maintenance Building	40,392 sq. ft.	48 ft
Maintenance Building Expansion	27,880 sq. ft.	---
Utility Building	981 sq. ft.	20 ft
Pump House	750 sq. ft.	14 ft
Guard Booth	36 sq. ft.	---
Equipment Booth	48 sq. ft.	---
Sand Silos (2 Total)	576 sq. ft.	---
Total	89,268 sq. ft.	

Source: Gannett Fleming, Metrolink (2022)

Note: sq. ft. = square feet; ft = feet

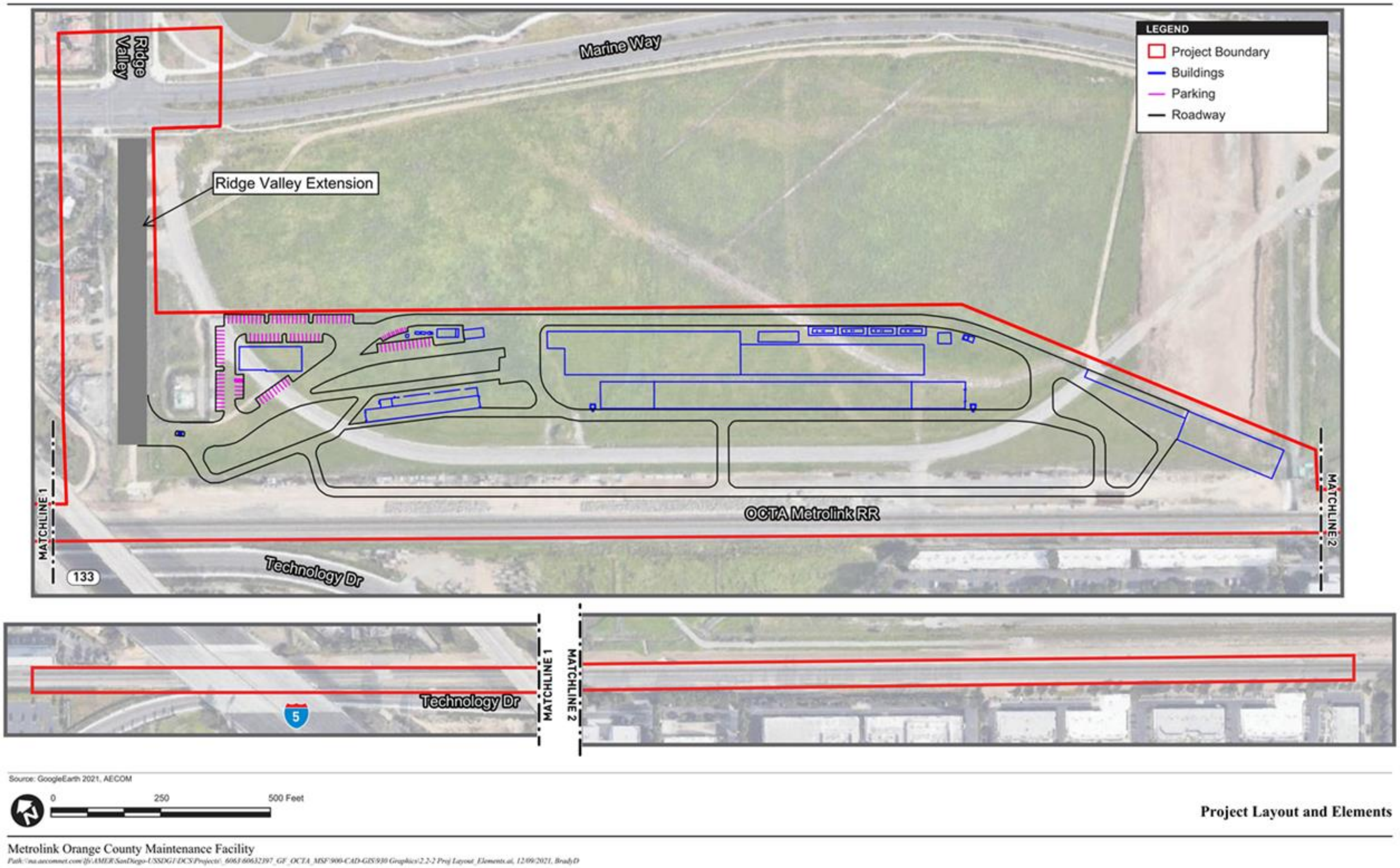
A runaround track would be provided between the service and inspection tracks and storage tracks. Additionally, two temporary stub-ended set out tracks would be provided in the Phase 1 layout that occupies the footprint of the future shop tracks (one at the north and one at the south end of the yard). These set out tracks would be converted to shop access tracks in Phase 2 and, therefore, would no longer be available as set out tracks. A new set out track would then be provided as part of Phase 2.

A transportation building that would be utilized for administrative purposes is also included in Phase 1. This building would house managerial offices, welfare spaces for train crews and on-site personnel. This facility would include restrooms, showers, locker rooms, a break/day room, vending space and a kitchenette. Approximately 120 automobile parking spaces would be provided for staff reporting to the site. Fire department compliant roadways would be developed to permit circulation of the site for Metrolink vehicles as well as delivery trucks (sand and fuel).

Phase 2 completes the full buildout of the Project. It would include development of the maintenance shop building and its future extension that would comprise of a total buildout area of 68,272 square feet (Table 2.2-1). The shop would have capabilities to perform regular three-month, six-month, and one-year preventive maintenance cycles on trainsets. Phase 2 of the buildout would consist of approximately 28 employees. With the full buildout of Phase 1 and Phase 2, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts.The 11 new east and west lead tracks, as discussed in this section above, would be constructed within the existing railroad corridor between MP 183.0 and MP 184.00 on Metrolink's "Orange" Subdivision to connect the existing mainline railroad to the proposed OCMF rail yard. A new single span concrete bridge over the Bee Canyon Channel (Channel) would be built for the east lead track. A segment of the Channel and utilities that are found to be in conflict would be lowered by approximately 2.5 feet to facilitate the construction of the bridge.

Regional vehicle access to and from the Project Site is provided primarily by I-5 at Sand Canyon Avenue, with supplemental access by State Route (SR) 133, which provides connections to SR-241 and I-405. Local vehicle access is provided by Marine Way and Ridge Valley. Direct access in and out of the Project Site would be provided by a driveway opening onto a dead-end (cul-de-sac) extension of Ridge Valley southwest from Marine Way. A detailed site plan showing the Ridge Valley extension and proposed driveway is included in Attachment B.

Figure 2.2-1 Project Layout and Elements



Source: ESRI (2021), OCTA (2021)

3. ANALYSIS METHODOLOGY AND APPROACH

For reference, the scope of work for this traffic analysis, as submitted to the City of Irvine, is included as Attachment A to this technical memorandum.

3.1 STUDY AREA

The roadway network in the vicinity of the Project Site is illustrated in Figure 3.2-1.

The study area includes the following four signalized study intersections (illustrated in Figure 3.2-1) and three study roadway segments:

- **Study intersections:**
    1. Sand Canyon Avenue / I-5 Northbound Ramps
    2. Sand Canyon Avenue / Marine Way
    3. Sand Canyon Avenue / I-5 Southbound Ramps
    4. Ridge Valley / Marine Way

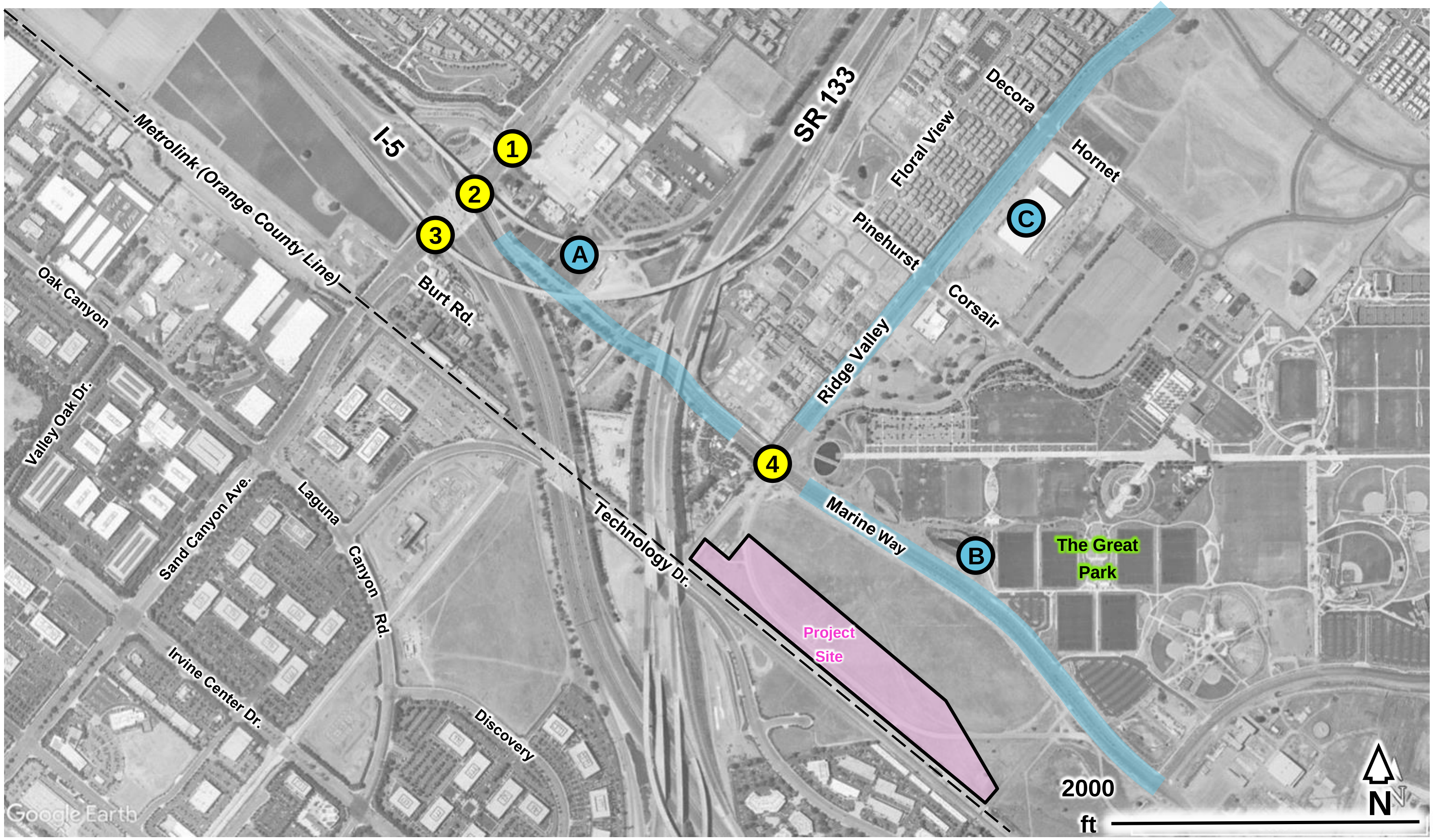
- **Study roadway segments:**
    A. Marine Way between Sand Canyon Avenue and Ridge Valley
    B. Marine Way east of Ridge Valley
    C. Ridge Valley between Great Park Boulevard and Marine Way

3.2 PERFORMANCE CRITERIA

Intersections and Roadway Segments

Peak-hour operations at the study intersections were analyzed according to the intersection capacity utilization (ICU) methodology, which compares the volume-to-capacity (v/c) ratios of conflicting turn movements at an intersection to identify the critical movements for each intersection approach. The v/c ratios for the identified critical movements are then summed together to determine the overall v/c ratio (or ICU) of the intersection, which can then be expressed in terms of LOS, where LOS A represents free-flow conditions and LOS F represents operations exceeding the capacity of the intersection. The analysis includes parameters set by the City for ICU calculations, including lane capacity, right-turn treatment, and clearance intervals.

Figure 3.2-1 Study Intersections



Source: Google Earth (2018)

The relationship between ICU and LOS is summarized in Table 3.2-1.

Table 3.2-1 Level of Service Definitions

Level of service	v/c range (ICU and roadway segments)	Delay range (HCM, signalized intersections)
A	0.00 ≤ x ≤ 0.60	x ≤ 10.0
B	0.61 ≤ x ≤ 0.70	10.0 < x ≤ 20.0
C	0.71 ≤ x ≤ 0.80	20.0 < x ≤ 35.0
D	0.81 ≤ x ≤ 0.90	35.0 < x ≤ 55.0
E	0.91 ≤ x ≤ 1.00	55.0 < x ≤ 80.0
F	1.00 < x	80.0 < x

Source: *City of Irvine Traffic Study Guidelines* (June 2020); Transportation Research Board, *Highway Capacity Manual* (2017)

For signalized intersections under the jurisdiction of the California Department of Transportation (Caltrans), LOS was also calculated according to the Highway Capacity Manual (HCM) methodology [Transportation Research Board (TRB), 2017].(1) The HCM methodology determines LOS based on average delay (in seconds per vehicle) at the intersection, as summarized in Table 3.2-1.

For roadway segments, v/c ratios were calculated using theoretical daily capacities (as defined in the *City of Irvine Traffic Study Guidelines*) by roadway type (as defined in the Circulation Element of the City's General Plan), as summarized in Table 3.2-2.

According to the *City of Irvine Traffic Study Guidelines* and consistent with the City's General Plan, acceptable conditions are generally defined as LOS D or better, calculated according to the City's ICU methodology. The City applies several special exceptions for specific locations and / or development sites, but none of these exceptions apply to the study intersections and roadway segments analyzed in this study.

The City applies the following performance criteria to identify whether a project results in, or substantially contributes to, an LOS deficiency:

- A location is at an acceptable LOS in the baseline condition and the project causes the location to become deficient; or
- A location is deficient (i.e., at unacceptable LOS) in the baseline condition and the project causes the location to further deteriorate by two percent or more.(2)

(1) HCM-based results are presented for informational purposes only, and are not used in the determination of significant impacts.
(2) For v/c ratios, the two-percent threshold is applied as an increase of 0.02 or greater in the v/c ratio (based on the City's ICU methodology for intersections and daily capacity methodology for roadway segments).

Table 3.2-2 Theoretical Daily Capacity of Roadways

Facility type	Lanes	Capacity†
Freeway	10	210,000
	8	176,000
	6	135,000
	4	90,000
Freeway ramps	2	22,000
	1	16,000
Expressway	6	135,000
Major highway	8	72,000
	6	54,000
Primary highway	4	32,000
Secondary highway	4	28,000
Commuter	2	13,000
Commuter (rural)	2	18,000

Source: *City of Irvine Traffic Study Guidelines* (June 2020)
Notes: Capacity may be interpolated for roadways that do not specifically fall into one of the facility type–lane combinations indicated above.
† vehicles per day of the roadway

For roadway segments determined to be deficient based on daily capacity, the City requires an additional peak-hour link analysis (PHLA) to make a final LOS deficiency determination. The peak-hour link analysis determines v/c ratios for each direction of the roadway segment, for both the weekday a.m. and p.m. peak hours.[3] The roadway capacity is determined by multiplying the number of lanes (at an appropriate mid-block location) by a lane capacity of 1,600 vehicles per hour (vph). Where the distance between controlled intersections is one mile or more, the assumed lane capacity is increased to 2,000 vph.

Where a project is determined to result in or substantially contribute to a LOS deficiency, the given project is required to improve operations to baseline conditions or better.

Transportation Design Procedures

The proposed vehicle access—including the Project's driveway and the proposed cul-de-sac extension of Ridge Valley—were analyzed based on the design criteria described in the *City of Irvine Transportation Design Procedures* (June 2020). The Transportation Design Procedures (TDPs) establish uniform policies and procedures for reviewing traffic design plans within the City and are used in this study to evaluate roadway design as it relates to the Project. Discussion and analysis of applicable design criteria are provided in later sections of this study.

[3] The a.m. and p.m. peak hours are typically defined as the peak 60-minute periods (i.e., four consecutive 15-minute periods) with the highest total intersection volume within each of the a.m. and p.m. peak periods (7:00–9:00 a.m. and 4:00–6:00 p.m., respectively).

3.3 ANALYSIS SCENARIOS

Given the size and nature of the Project, this study is designed to meet the City's requirements for a Limited Scope Traffic Study, and includes analysis of the following scenarios:

- **Existing Baseline**
  This scenario represents existing conditions in 2020, assuming the continuation of traffic levels and growth trends prior to the shelter-in-place restrictions and other effects associated with the COVID-19 pandemic.
- **Existing Baseline plus Project**
  This scenario represents the Existing Baseline scenario plus the effects of the Project, including Project-generated traffic.
- **Short-Term Interim Year Baseline**
  This scenario represents a five-year horizon (2025) beyond the Existing Baseline scenario, and accounts for development projects approved by the City and expected to be completed by that time.
- **Short-Term Interim Year Baseline plus Project**
  This scenario represents the Short-Term Interim Year Baseline scenario plus the effects of the Project, including Project-generated traffic.

3.4 COMMITTED IMPROVEMENTS

Currently, Marine Way intersects Sand Canyon Avenue in between the two ramp intersections at I-5's interchange with Sand Canyon Avenue. While the portions of Marine Way approaching Sand Canyon Avenue and Ridge Valley are built to a minimum cross-section of four lanes, the mid-block portion crossing over the Marshburn Channel flood control facility only features two lanes.

The City is actively working on a future realignment of Marine Way at its northern end intersecting Sand Canyon Avenue. The new alignment would begin approximately where Marine Way passes underneath SR 133, swinging to the northeast along the south edge of the Caltrans District 12 Transportation Management Center and the OCTA's Sand Canyon Bus Base and tying into Sand Canyon Avenue as the southern leg of the existing intersection at the I-5 Northbound Ramps. The realigned segment would feature a minimum cross-section of four lanes for its entire length.

To account for the Marine Way realignment, the Short-Term Interim Year scenarios each include two alternatives: Alternative 1 assuming Marine Way as it is currently, and Alternative 2 assuming the planned realignment.

City of Irvine staff also identified a future lane striping modification at the Sand Canyon Avenue / Marine Way intersection proposed as part of a separate development on the nearby Traveland site. These modifications would convert one of the southbound left-turn lanes into a through lane, leaving only a single southbound left-turn lane.

A review of committed improvements identified in the City's latest Circulation Phasing Analysis Report (March 2020) did not find any other relevant improvements affecting the study intersections and roadway segments analyzed in this study.

4. PROJECT TRAFFIC

4.1 TRIP GENERATION

Due to the specialized nature of the Project, trip generation for the Project was estimated based on the number of employees, plus allowances to account for fleet vehicles, deliveries (e.g., fuel, sand, maintenance equipment, etc.), visitors, and other ancillary traffic.

Based on existing operations at other commuter rail maintenance facilities, approximately 80 employees are expected to access the Project Site daily, split across three eight-hour shifts. As much of the actual fleet maintenance activities would take place overnight, when locomotives and passenger cars are not in revenue service, the majority of employees are expected to work the overnight shifts, with 60 percent working the 4:00 p.m.–12:00 a.m. shift and 30 percent working the 12:00–8:00 a.m. shift. The remaining 10 percent of employees are assumed to work the daytime shift (8:00 a.m.–4:00 p.m.). The trip generation conservatively assumes an automobile mode share of 100 percent, with an average vehicle occupancy of 1.00. Thus, no reductions were taken to account for other modes—including public transit or active transportation (walking or biking)—or carpooling.

The Project would also serve as a base for approximately 10 fleet vehicles, each of which were conservatively assumed to be used for off-site duties once daily, proportionally distributed across the three work shifts based on the number of workers assigned to each shift. For both peak hours, the analysis conservatively includes fleet vehicles assigned to both the leading shift and following shift. For the a.m. peak hour, for example, the Project's trip generation includes both inbound fleet vehicles arriving back at the site (for the work shift ending at 8:00 a.m.) and departing the site (for the work shift beginning at 8:00 a.m.). The fleet vehicles are assumed to be off-site for most of the corresponding shift to conduct repair, regular maintenance, and other duties within Metrolink right-of-way and at Metrolink facilities; thus, any fleet vehicles assigned to a given peak hour are assigned to that peak hour only once.

To account for deliveries, visitors, and other ancillary traffic, an additional allowance of 20 vehicles per day, spread uniformly across the typical eight-hour workday, was assumed.

The estimated trip generation for the Project is summarized in Table 4.1-1. As the site is currently vacant, there are no existing trips or uses to be considered for this study.

Table 4.1-1 Project Trip Generation

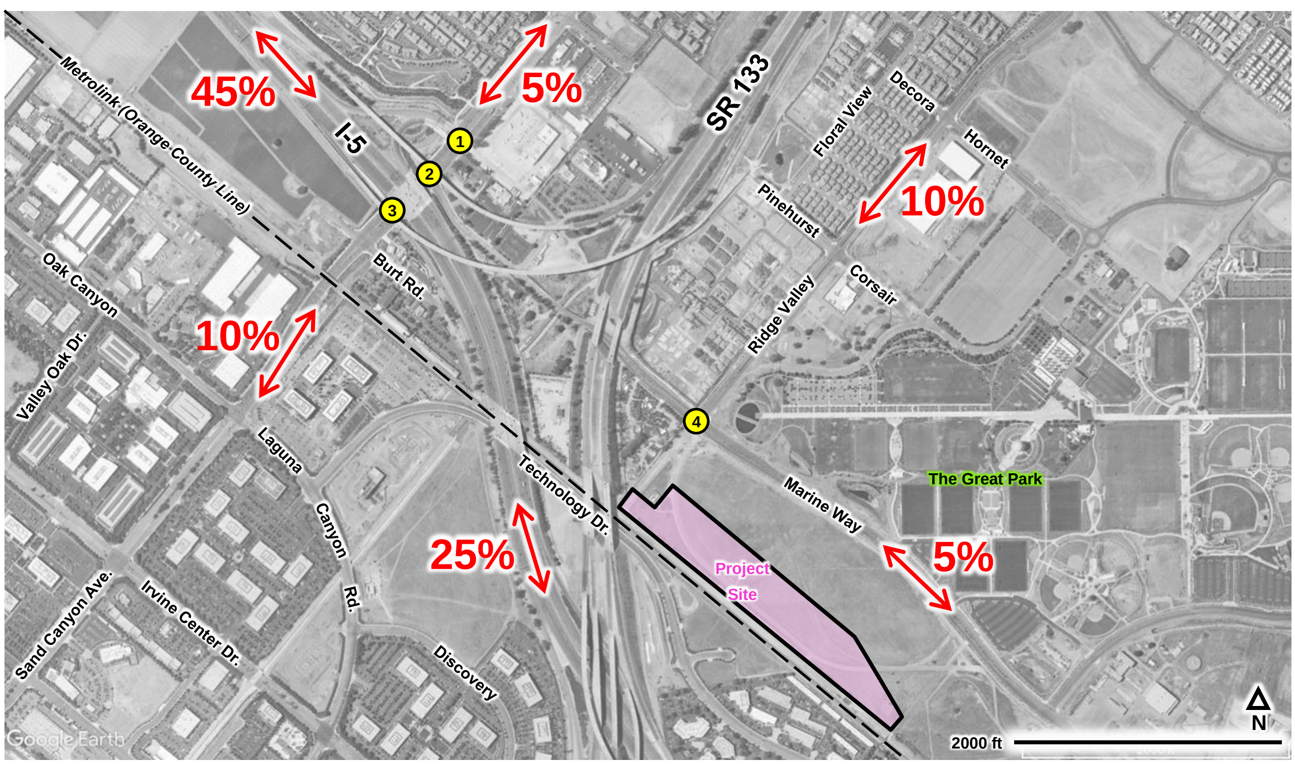
Trip category		Vehicle-trips								
		Daily			AM peak hour			PM peak hour		
		In	Out	Total	In	Out	Total	In	Out	Total
Worker commutes	80 employees	80	80	160	8	24	32	0	8	8
Fleet vehicles	10 vehicles	10	10	20	3	1	4	1	6	7
Other		20	20	40	3	3	6	3	3	6
Total		**110**	**110**	**220**	**14**	**28**	**42**	**4**	**17**	**21**

Notes: "Other" includes deliveries, visitors, and other ancillary traffic. No "other" trips assumed during a.m. and p.m. peak hours.
Source: AECOM (2022)

4.2 TRIP DISTRIBUTION AND ASSIGNMENT

The assumed trip distribution and assignment is illustrated in Figure 4.2-1, and is based on existing travel and land use patterns. I-5 is the primary access for the regional roadway network, as it is a major north–south freeway and provides additional connections to and from I-405 (via SR-133). Smaller percentages of Project trips are distributed on major local streets, including Sand Canyon Avenue to / from the southwest and northeast, Ridge Valley to / from the northeast, and Marine Way to / from the southeast.

Figure 4.2-1 Project Trip Distribution



Source: Google Earth (2018)

The Project Site is located within Irvine, which is on the periphery of Greater Los Angeles, with areas beyond (such as southern Orange County) generally less dense and constrained by geography. As such, the trip distribution is weighted more heavily to the north, favoring the contiguous, built-up areas in northern Orange County and adjacent Los Angeles County.

5. EXISTING CONDITIONS

5.1 EXISTING ROADWAY NETWORK

Key roadways in the vicinity of the Project include Sand Canyon Avenue, Marine Way, and Ridge Valley.

Sand Canyon Avenue

According to the Circulation Element of the City's General Plan, Sand Canyon Avenue is classified as a six-lane Major Highway and functions as a Thruway. Sand Canyon Avenue is oriented in the north–south direction[(4)] and provides direct access to / from I-5, with a posted speed limit of 50 miles per hour (mph). In the vicinity of the Project Site, Class II bikeways (on-street bicycle lanes) and sidewalks are generally provided on both sides of the street but may be discontinuous in some locations. On-street parking is not permitted.

Marine Way

The Circulation Element of the City's General Plan classifies Marine Way as a Primary Highway, functioning as a Parkway. Marine Way is oriented in the east–west direction, with a posted speed limit of 45 mph. Marine Way is originally a two-lane roadway that served as an access road and perimeter road for MCAS El Toro, but it is planned to be realigned and widened to a four-lane facility. Work on the segment in the immediate vicinity of the Project Site (between Ridge Valley and Skyhawk) has been completed, but portions of Marine Way north of Ridge Valley and south of Skyhawk have not yet been improved and will retain their previous alignment and cross-section (two lanes) as a temporary scenario only. Future roadway improvements- as mentioned above in this section and not a part of the scope of this Project- plans to realign and widen this portion of Marine Way from a two-lane facility to a four-lane facility..

In the vicinity of the Project Site, Class II bikeways are provided in both directions north of Skyhawk, but sidewalks may be discontinuous, particularly north of SR-133 (where the roadway was never fully improved) and on the north side east of Ridge Valley (where construction is currently underway for the Great Park). On-street parking is not permitted.

Ridge Valley

According to the Circulation Element of the City's General Plan, Ridge Valley is classified as a Secondary Highway and functions as a Collector. Ridge Valley is a four-lane facility oriented in the north–south direction, with a posted speed limit of 45 mph. In the vicinity of the Project Site, Class II bikeways are

(4) For roadways in the vicinity of the Project Site, the City's standard convention defines I-5 and Marine Way in the east–west direction and Sand Canyon Avenue and Ridge Valley in the north–south direction.

provided in both directions, but sidewalks along the east side of the street may be discontinuous as redevelopment on the former MCAS El Toro site is still underway. On-street parking is not permitted.

5.2 LEVEL OF SERVICE ANALYSIS

Due to shelter-in-place restrictions and other effects associated with the COVID-19 pandemic, traffic levels are currently depressed, and traffic counts collected during this period would not give an accurate representation of "normal" conditions prior to the pandemic. As described in Section 3.3, an Existing Baseline scenario was therefore developed assuming the continuation of traffic levels and growth trends prior to COVID-19.

Pre-COVID count data (from May 2018 and February 2019) were provided by the City for use in the study and extrapolated to 2020 levels assuming a uniform growth rate of two percent per year. These extrapolated traffic volumes were then compared to a separate set of 2020 traffic projections obtained by interpolating between traffic volumes for 2018 and 2023 used for the City's latest Circulation Phasing Analysis Report.(5) For the study intersections common to this study and the Circulation Phasing Analysis Report, the latter dataset generally showed higher total intersection volumes during the a.m. and p.m. peak hours, and was therefore conservatively carried forward for use in this study.

Count data provided by the City only included a daily count for one of the three roadway segments (Marine Way between Sand Canyon Avenue and Ridge Valley). With current traffic levels substantially depressed due to COVID-19, initial estimates of daily traffic volume for the remaining two roadway segments were developed by multiplying the peak hour traffic volume (calculated as entering / exiting volumes from the adjacent study intersections) by 10, a common rule of thumb frequently used when data are not readily available. The calculation was done separately using the a.m. and p.m. peak hour volumes, with the higher of the two selected for further analysis. Separately, existing daily traffic volumes were also referenced from the Circulation Phasing Analysis Report and compared against the rule-of-thumb estimates. The approach resulting in the higher traffic volume was then conservatively carried forward for use in the v/c analysis.

The results of the intersection and roadway segment LOS analyses are summarized in Table 5.2-1 and Table 5.2-2, respectively. Detailed ICU and HCM LOS calculation worksheets for the study intersections, including traffic volume projections for each scenario, are provided in Attachment C and Attachment D, respectively.

As shown in Table 5.2-1 and Table 5.2-2, all study intersections and roadway segments would operate at acceptable LOS (LOS D or better), even with the addition of the Project. Therefore, the Project would not result in or substantially contribute to any LOS deficiencies under the Existing Baseline scenario.

(5) Traffic projections from the Circulation Phasing Analysis Report were developed using Model No. 18 of the City's travel demand forecasting and analysis model, the Irvine Transportation Analysis Model (ITAM). The ITAM is the OCTA-sanctioned subarea traffic model for the City of Irvine.

Table 5.2-1 Intersection Level of Service Summary: Existing

Intersection		ITAM node	Methodology	Existing Baseline				Existing Baseline plus Project				ICU change	
				AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour	PM peak hour
				ICU or Delay	LOS	ICU or delay	LOS	ICU or delay	LOS	ICU or delay	LOS		
1	Sand Canyon Ave. / I-5 NB Ramps	303	ICU	0.58	A	0.68	B	0.59	A	0.68	B	0.01	0.00
			HCM	28.1	C	39.8	D	26.8	C	39.8	D	—	—
2	Sand Canyon Ave. / Marine Way	304	ICU	0.62	B	0.58	A	0.62	B	0.58	A	0.00	0.00
3	Sand Canyon Ave. / I-5 SB Ramps	305	ICU	0.60	A	0.58	A	0.61	B	0.58	A	0.01	0.00
			HCM	18.6	B	24.4	C	18.8	B	24.5	C	—	—
4	Ridge Valley / Marine Way	—	ICU	0.39	A	0.24	A	0.38	A	0.25	A	(0.01)	0.00

Source: AECOM (2022)

Table 5.2-2 Roadway Segment Level of Service Summary: Existing

	Roadway segment	Capacity	Existing Baseline			Existing Baseline plus Project			v/c change
			ADT	v/c ratio	LOS	ADT	v/c ratio	LOS	
A	Marine Way between Sand Canyon Avenue and Ridge Valley	13,000	11,400	0.88	D	11,600	0.89	D	0.01
B	Marine Way east of Ridge Valley	32,000	7,200	0.22	A	7,200	0.22	A	0.00
C	Ridge Valley between Great Park Boulevard and Marine Way	28,000	14,800	0.53	A	14,800	0.53	A	0.00

Source: AECOM (2022)

6. FUTURE CONDITIONS

6.1 LEVEL OF SERVICE ANALYSIS

Similar to the derivation of Existing Baseline traffic volumes, traffic projections for the Short-Term Interim Year scenarios were developed using two different methods: one assuming a uniform growth rate of two percent per year applied to the Existing Baseline volumes, and another applying it to the 2023 volumes from the City's Circulation Phasing Analysis Report. For intersections and roadway segments common between this study and the Circulation Phasing Analysis Report, the method resulting in the higher traffic volume was conservatively carried forward for use in this study.

Alternative 1

The results of the intersection and roadway segment LOS analyses for Alternative 1 (existing Marine Way alignment) are summarized in Table 6.1-1 and Table 6.1-2, respectively. As shown in Table 6.1-1 and Table 6.1-2, all study intersections and roadway segments would operate at acceptable LOS (LOS D or better) based on the City's LOS thresholds, even with the addition of the Project, with the exception of the segment of Marine Way between Sand Canyon Avenue and Ridge Valley, which would be deficient in terms of daily LOS. A peak-hour link analysis, however, shows that both directions of this segment would operate at LOS A under both the a.m. and p.m. peak hours, even with the addition of the Project (refer to Table 6.1-3). Therefore, the Project would not result in or substantially contribute to any LOS deficiencies under the Short-Term Interim Year scenario with Alternative 1.

Alternative 2-Realigned Marine Way

For Alternative 2, all traffic turning into or out of Marine Way under Alternative 1 was manually redistributed to the new intersection at the I-5 Northbound Ramps. The existing Marine Way ("Old Marine Way") alignment is assumed to remain to provide local access for adjacent properties, such as the Caltrans Marine Way Maintenance Station at 6641 Marine Way. To account for traffic that would continue to use Old Marine Way, volumes turning into or out of Old Marine Way at Sand Canyon Avenue were referenced from the recent traffic study for the Hoag Hospital Irvine (LSA, 2020). The referenced volumes represent 2040 traffic projections, but were conservatively taken as is, without adjustments to omit potential growth occurring after the Short-Term Interim Year horizon (2025) for this study.

Table 6.1-1 Intersection Level of Service Summary: Short-Term Interim Year Alternative 1

Intersection		ITAM node	Methodology	Short-Term Interim Year Baseline Alternative 1				Short-Term Interim Year Baseline Alternative 1 plus Project				ICU change	
				AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour	PM peak hour
				ICU or Delay	LOS	ICU or delay	LOS	ICU or delay	LOS	ICU or delay	LOS		
1	Sand Canyon Ave. / I-5 NB Ramps	303	ICU	0.72	C	0.86	D	0.72	C	0.86	D	0.00	0.00
			HCM	37.8	D	69.4	E	38.5	D	73.4	E	—	—
2	Sand Canyon Ave. / Marine Way	304	ICU	0.59	A	0.77	C	0.59	A	0.78	C	0.00	0.01
3	Sand Canyon Ave. / I-5 SB Ramps	305	ICU	0.66	B	0.72	C	0.66	B	0.72	C	0.00	0.00
			HCM	19.6	B	27.9	C	19.9	B	28.0	C	—	—
4	Ridge Valley / Marine Way	—	ICU	0.44	A	0.27	A	0.45	A	0.28	A	0.01	0.01

Source: AECOM (2022)

Table 6.1-2 Roadway Segment Level of Service Summary: Short-Term Interim Year Alternative 1

	Roadway segment		Capacity	Short-Term Interim Year Baseline Alternative 1			Short-Term Interim Year Baseline Alternative 1 plus Project			v/c change
				Volume	v/c ratio	LOS	Volume	v/c ratio	LOS	
A	Marine Way between Sand Canyon Avenue and Ridge Valley		13,000	17,400	1.34	F	17,600	1.35	F	—
	AM peak hour	Eastbound	1,600	364	0.23	A	376	0.24	A	0.01
		Westbound	1,600	728	0.46	A	752	0.47	A	0.01
	PM peak hour	Eastbound	1,600	875	0.55	A	878	0.55	A	0.00
		Westbound	1,600	689	0.43	A	704	0.44	A	0.01
B	Marine Way east of Ridge Valley		32,000	10,800	0.34	A	10,800	0.34	A	0.00
C	Ridge Valley between Great Park Boulevard and Marine Way		28,000	16,300	0.58	A	16,300	0.58	A	0.00

Source: AECOM (2022)

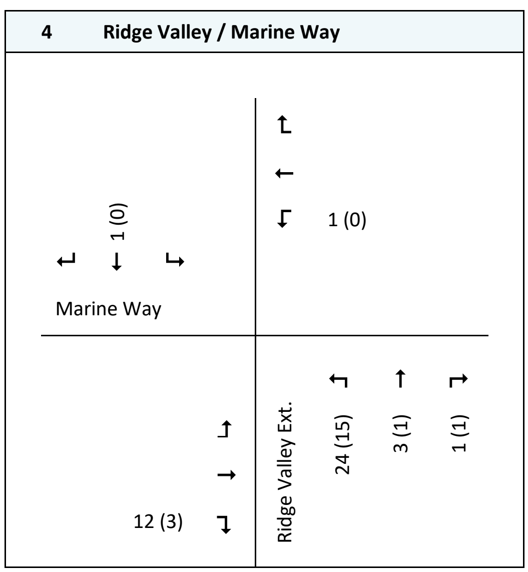
The results of the intersection and roadway segment LOS analyses for Alternative 2 (realigned Marine Way) are summarized in Table 7.1-1and Table 7.1-2, respectively. As shown in Table 7.1-1 and Table 7.1-2, all study intersections and roadway segments would operate at acceptable LOS (LOS D or better) based on the City's LOS thresholds, even with the addition of the Project. Therefore, the Project would not result in or substantially contribute to any LOS deficiencies under the Short-Term Interim Year scenario with Alternative 2.

7. SPECIAL ISSUES

7.1 SITE ACCESS ANALYSIS

Access for the Project Site would be provided by extending Ridge Valley south of Marine Way by approximately 675 feet as a cul-de-sac (dead-end street), converting the existing T-intersection at Ridge Valley / Marine Way into a four-way intersection. A turnaround would be provided at the end of the Ridge Valley extension, with a driveway providing access into and out of the Project Site. This would serve as the sole vehicle access for the Project Site, and the estimated traffic using the Project driveway and the new Ridge Valley extension would generally be as shown in the Project's trip generation in Table 4.1-1. Project trip assignments at the Ridge Valley / Marine Way intersection are illustrated in Figure 7.1-1, based on the trip distribution shown in Figure 4.2-1.

Figure 7.1-1 Project Trip Assignment at Ridge Valley / Marine Way



(##): AM (PM) peak hour volumes
Source: AECOM (2022)

Table 7.1-1 Intersection Level of Service Summary: Short-Term Interim Year Alternative 2

Intersection		ITAM node	Methodology	Short-Term Interim Year Baseline Alternative 2				Short-Term Interim Year Baseline Alternative 2 plus Project				ICU change	
				AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour	PM peak hour
				ICU or Delay	LOS	ICU or delay	LOS	ICU or delay	LOS	ICU or delay	LOS		
1	Sand Canyon Ave. / I-5 NB / Marine Way	303	ICU	0.74	C	0.73	C	0.73	C	0.73	C	(0.01)	0.00
			HCM	78.7	E	> 80	F	75.9	E	> 80	F	—	—
2	Sand Canyon Ave. / Old Marine Way	304	ICU	0.53	A	0.58	A	0.53	A	0.58	A	0.00	0.00
3	Sand Canyon Ave. / I-5 SB Ramps	305	ICU	0.66	B	0.72	C	0.66	B	0.72	C	0.00	0.00
			HCM	30.4	C	31.6	C	34.1	C	31.6	C	—	—
4	Ridge Valley / Marine Way	—	ICU	0.44	A	0.27	A	0.45	A	0.28	A	0.01	0.01

Source: AECOM (2022)

Table 7.1-2 Roadway Segment Level of Service Summary: Short-Term Interim Year Alternative 2

Roadway segment		Capacity	Short-Term Interim Year Baseline Alternative 2			Short-Term Interim Year Baseline Alternative 2 plus Project			v/c change
			Volume	v/c ratio	LOS	Volume	v/c ratio	LOS	
A	Marine Way between Sand Canyon Avenue and Ridge Valley	32,000	17,400	0.54	A	17,600	0.55	A	0.01
B	Marine Way east of Ridge Valley	32,000	10,800	0.34	A	10,800	0.34	A	0.00
C	Ridge Valley between Great Park Boulevard and Marine Way	28,000	16,300	0.58	A	16,300	0.58	A	0.00

Source: AECOM (2022)

It should be noted that there may also be some marginal traffic associated with other properties along the Ridge Valley extension, such as the gardening / landscaping supply businesses located on the southwest quadrant of the Ridge Valley / Marine Way intersection. While the Project does not preclude driveways for other properties along the extension, such improvements are not expressly part of the Project and would be evaluated separately should the relevant property owners desire access. The design of the proposed Ridge Valley extension would, however, allow for future local access for other properties on either side of the extension via a future "A Street", intersecting the extension approximately midway between Marine Way and the cul-de-sac. As such, driveway / intersection spacing for this future A Street is evaluated where appropriate in later subsections of this memorandum.

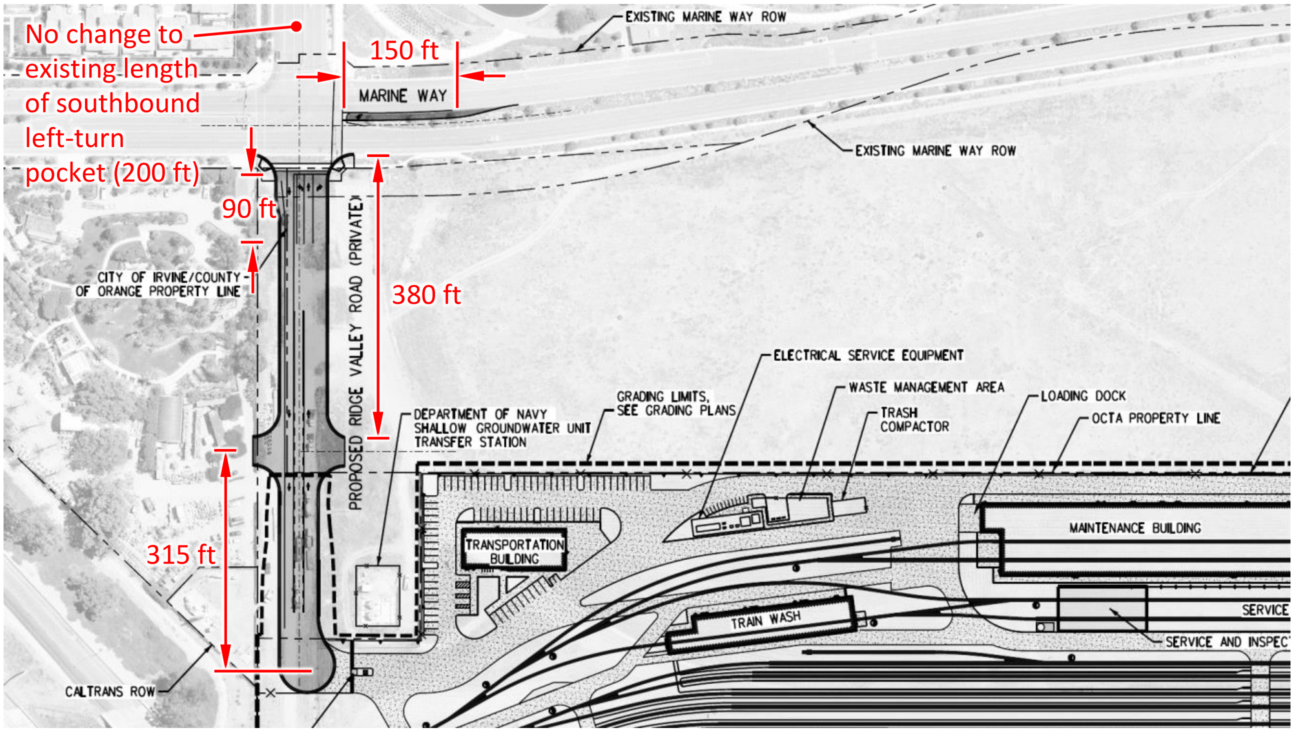
The new northbound approach at the Ridge Valley / Marine Way intersection would be striped with three lanes: a left-turn lane, a through lane, and a right-turn lane. To accommodate the new northbound approach at the intersection, the existing outer left-turn lane on the southbound (Ridge Valley) approach would be restriped as a through lane. With this change, the existing southbound and new northbound approaches would operate with protected left-turn phasing in a lead–lag sequence. Actuation through detector loops or other means would minimize impacts to background traffic along Marine Way and Ridge Valley, allowing the northbound approach to be served only when there is demand.

In addition, the Project would provide a new westbound left-turn pocket at the intersection (replacing a portion of the landscaped median along Marine Way), operating with protected phasing in a lead–lag sequence with the eastbound left-turn movement. Signal phasing for the southbound right-turn movement would also be modified to provide an overlap phase with the eastbound left-turn movement.

The LOS results summarized in Table 5.2-1, Table 6.1-1, and Table 7.1-1 already incorporate all of these lane configurations and signal phasing assumptions and show that the modified intersection would operate at LOS A during the a.m. and p.m. peak hours.

An analysis of relevant criteria from the *City of Irvine Transportation Design Procedures (TDP)* (June 2020) is provided in the following subsections. Proposed turn pocket lengths and driveway spacing are illustrated in Figure 7.1-2. Detailed plans are provided in Attachment B to this memorandum.

Figure 7.1-2 Proposed Turn Pocket Lengths and Driveway Spacing



TDP-1: Turn Lane Pocket Lengths

At the Ridge Valley / Marine Way intersection, the Project would add two new left-turn movements (northbound left and westbound left) and modify the southbound left-turn movement by converting the shared left-through lane into a through lane (leaving only one left-turn lane). A Leish nomograph analysis of turn pocket lengths was conducted for these three left-turn movements, together with the southbound left-turn movement at Sand Canyon Avenue / Marine Way, which will be reduced to a single lane in the future as part of striping modifications proposed by a proposed development on the nearby Traveland site. The results of the Leish nomograph analysis are shown in Figure 7.1-3 and Figure 7.1-4.

As shown in Figure 7.1-3, left-turn pocket lengths at Ridge Valley / Marine Way would exceed the recommended (desirable) distance for all three left-turn movements under the Short-Term Interim Year Baseline plus Project scenarios.[6] The peak-hour left-turn volume is on the order of 25–35 vehicles or less in all cases, and is generally below the meaningful range of the nomograph analysis.

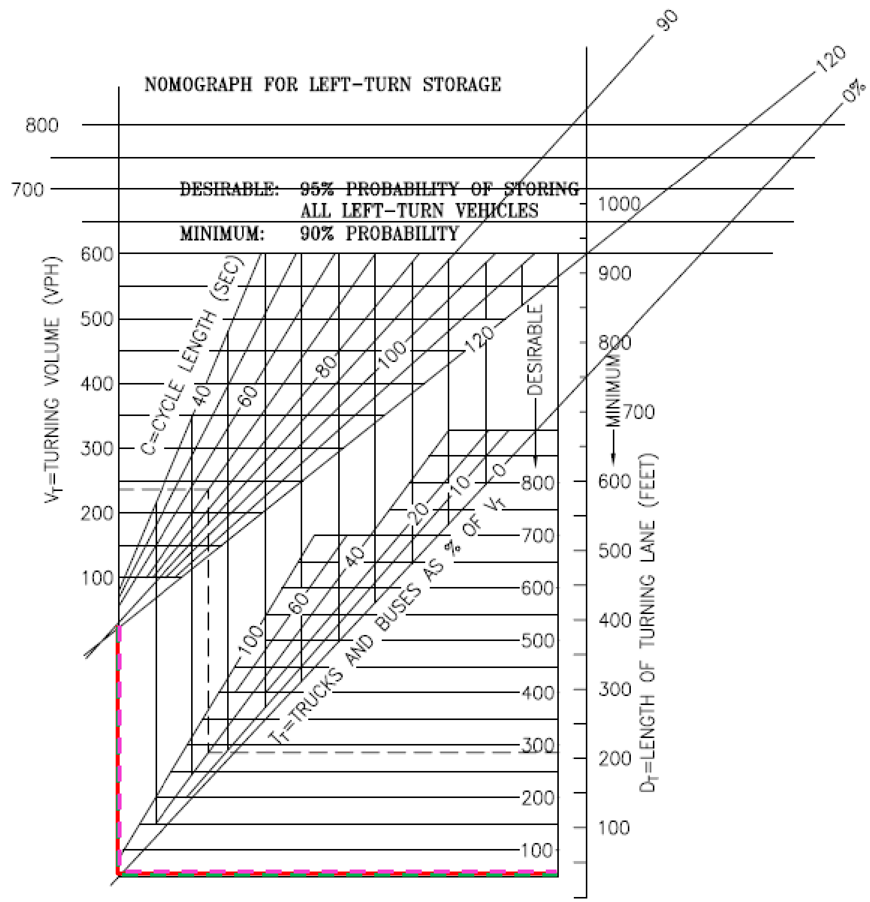
As shown in Figure 7.1-4, the existing length of the southbound left-turn pocket at Sand Canyon Avenue / Marine Way would fall below the recommended (desirable) distance in both the AM peak hour and PM peak hour under the Short-Term Interim Year Baseline Alternative 1 plus Project scenario. The Project is estimated to add approximately four vehicles to this movement in the AM peak hour and one vehicle to this

[6] Alternative 1 and Alternative 2 are the same for purposes of this Leish nomograph analysis, as traffic volumes and lane configurations at the Ridge Valley / Marine Way intersection are the same for both alternatives.

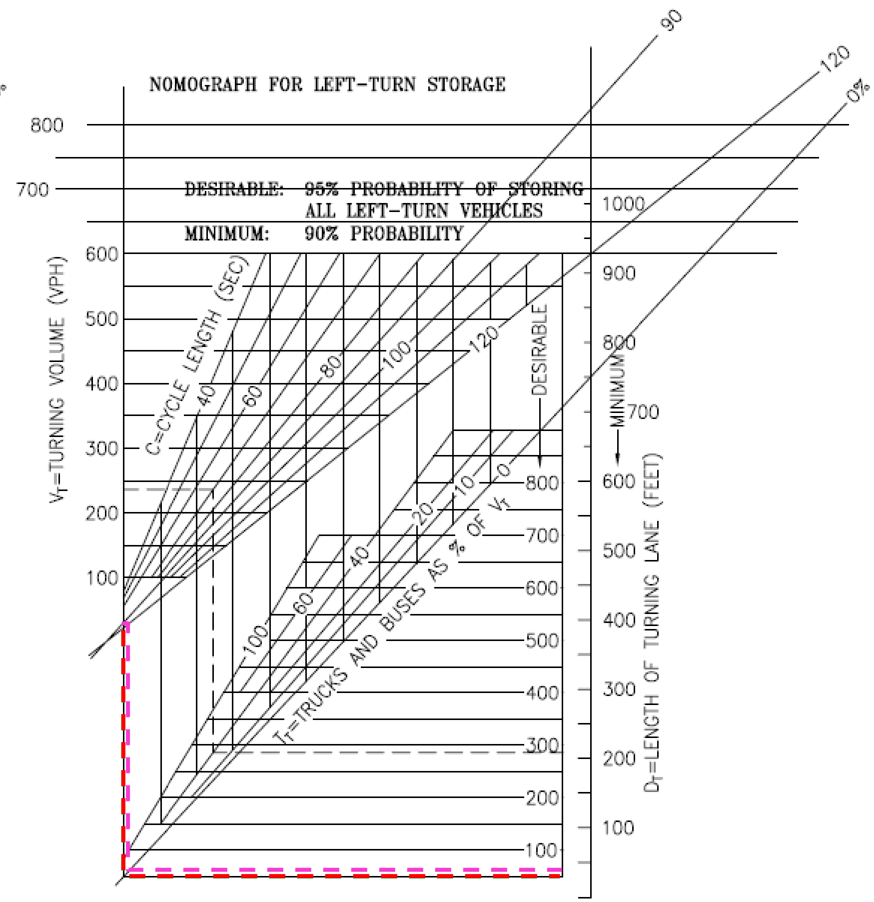
movement in the PM peak hour, which is on the order of 1–3 percent of the total peak-hour volume on this movement. This is an interim condition until Marine Way is realigned to reflect Alternative 2, which aligns with the northbound I-5 off-ramp. Two southbound left turn lanes will be provided at that time.

Figure 7.1-3 Leish Nomograph – Ridge Valley / Marine Way

AM peak hour



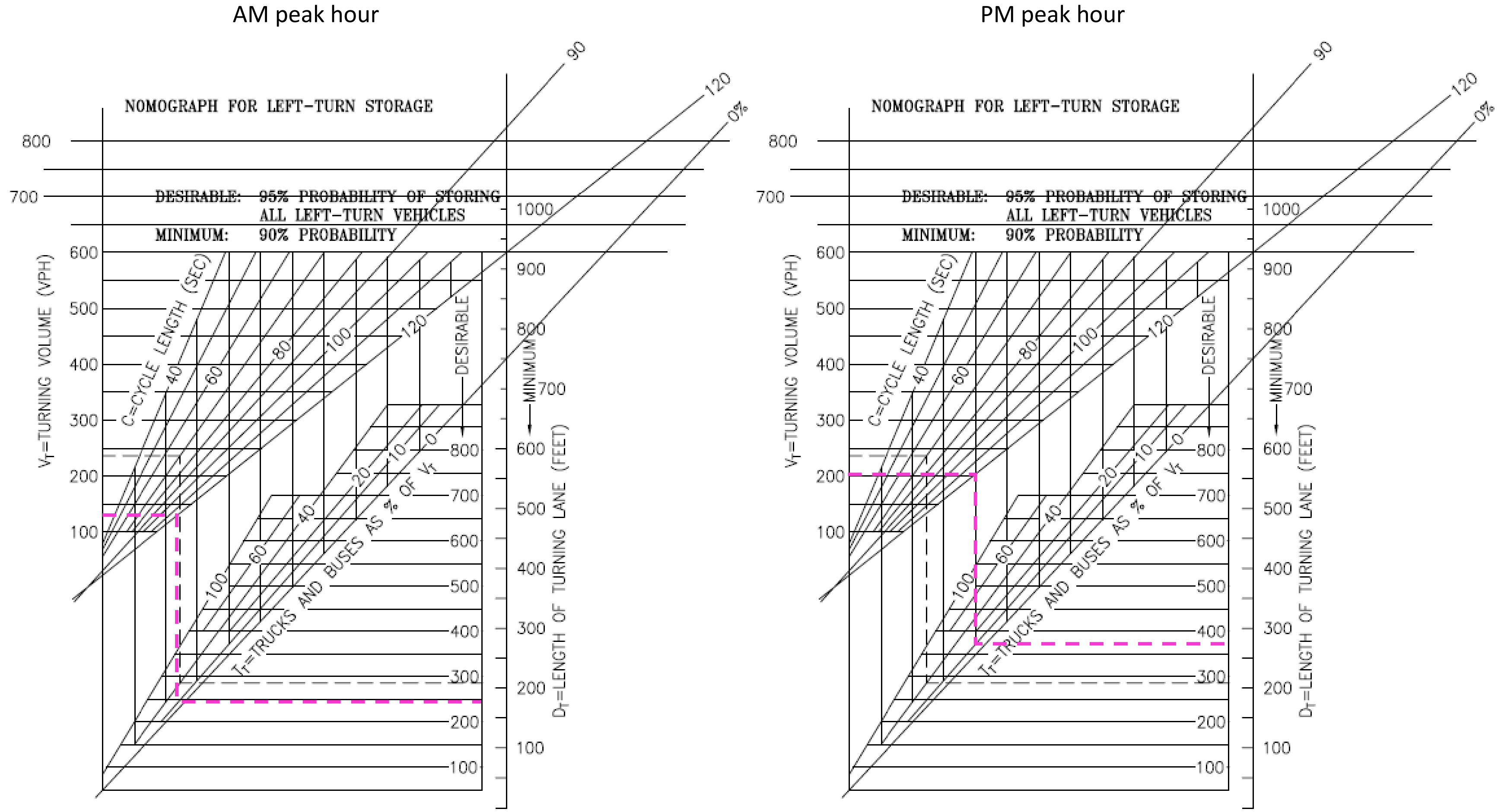
PM peak hour



	V_T	D_T (desirable)	D_T (actual/proposed)		V_T	D_T (desirable)	D_T (actual/proposed)
Northbound left	24	< 25	90	Northbound left	15	< 25	90
Southbound left	26	< 25	200	Southbound left	35	≈ 25	200
Westbound left	1	< 25	150	Westbound left	0	< 25	150

Note: Assume cycle length C = 120 sec and conservatively assume heavy vehicle percentage T_T = 10%

Figure 7.1-4 Leish Nomograph – Sand Canyon Avenue / Marine Way (Alternative 1)



	V_T	D_T (desirable)	D_T (actual/proposed)
Southbound left	128	245	185

	V_T	D_T (desirable)	D_T (actual/proposed)
Southbound left	202	365	185

Note: Assume cycle length C = 120 sec and conservatively assume heavy vehicle percentage T_T = 10%

TDP-10: Distance Between Driveways and Intersections

The recommended minimum spacing between a driveway and an intersection (or between two driveways) is 90 feet for a roadway classified as a Private Way, although this classification applies only to residential streets. Based on the width of the proposed roadway, the City of Irvine has recommended application of the Commuter roadway classification for the analysis of driveway spacing. For Commuter roadways, the minimum spacing is 150 feet.

As indicated in Figure 7.1-2, the nearest driveway / intersection (the future “A Street”) is 380 feet from the Ridge Valley / Marine Way intersection (measured from Marine Way nearest curb face to A Street nearest curb face). The Project’s proposed driveway would be located 315 feet from A Street (measured from centerline to centerline). In both cases, the spacing would exceed the minimum spacing prescribed in TDP-10.

Furthermore, the proposed Ridge Valley extension would be a cul-de-sac primarily intended to provide local access for the Project and adjacent properties, with no through traffic and minimal traffic volumes. The Project driveway would be located at the end of this private road (the proposed turnaround is actually located within the Project’s property lines), such that any queues at the proposed controlled gate access would not obstruct access to other properties, much less background traffic at the upstream intersection with Marine Way.

Therefore, the Project would satisfy TDP-10.

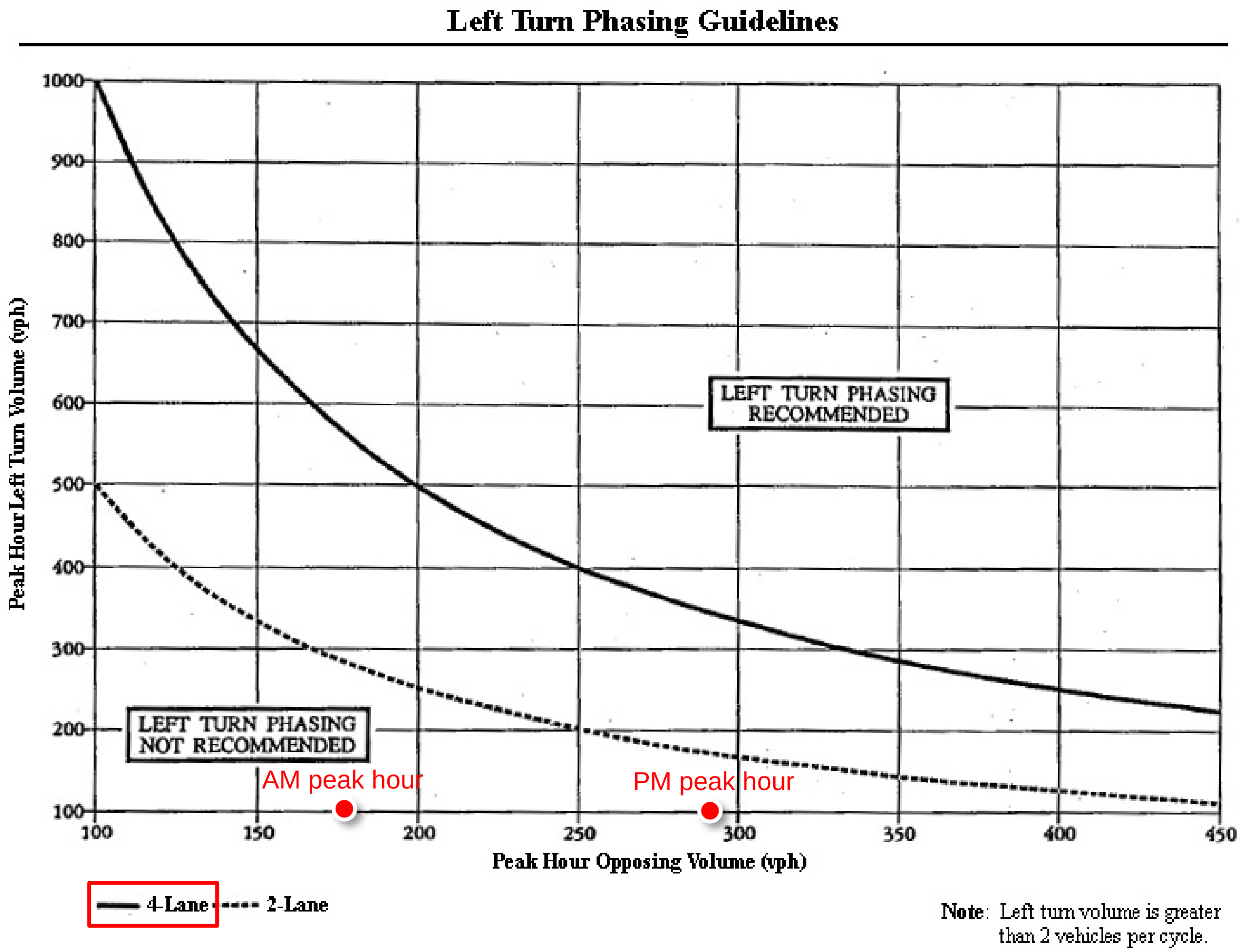
TDP-11: Corner Clearance

As the proposed Ridge Valley extension is a cul-de-sac primarily intended for local access for the Project (and, potentially in the future, adjacent properties), there would be no through traffic, and the only adjacent intersection for consideration is the Ridge Valley/ Marine Way intersection. As mentioned above, the Project would meet TDP-10 criteria for minimum distance between driveways and intersections and would, therefore, also generally satisfy TDP-11.

TDP-13: Left-Turn Signal Phasing

As illustrated in Figure 7.1-1, the Project is expected to add 1 vehicle during the AM peak hour and 0 vehicles during the PM peak hour to the westbound left-turn movement at Ridge Valley / Marine Way. Under the Short-Term Interim Year Baseline plus Project scenarios, there would be no other traffic expected on this turn movement outside of Project-generated traffic. As such, the peak-hour volume on this movement would be negligible. However, a left-turn signal phasing analysis was conducted to determine the need for protected signal phasing for this turn movement and is illustrated in Figure 7.1-5.

Figure 7.1-5 Left-Turn Signal Phasing Analysis



Source: *Traffic Engineering Handbook, 4th Edition, ITE, Chapter 9, pg. 295.* **Figure 13.1**

As indicated in Figure 7.1-5, the expected traffic volume on this movement under the Short-Term Interim Year Baseline plus Project scenarios is well below the meaningful range of the analysis, which is approximately 100 vehicles per hour for the left-turn volume (2 vehicles per cycle or more). Despite these conclusions, protected left-turn phasing can still be considered appropriate at this location due to several factors:

- Permitted left-turn movements with high-volumes of opposing traffic can present a risk for pedestrians in the crosswalk, as motorists are frequently focused on finding gaps in opposing traffic flow and may not pay adequate attention to pedestrian activity in the far-side crosswalk.
- The opposing eastbound approach features double left-turn lanes, which may complicate permitted left-turn movements from the westbound approach.
- Fuel trucks and other large vehicles that may need to visit the site on a regular basis may access the site from this westbound left-turn movement. Providing protected phasing for this movement would ensure adequate time and protection for these vehicles, which may require additional time and larger turning clearances. As indicated in the detailed plans in Attachment B, the Project proposes to use lead–lag sequencing to avoid potential conflicts between the eastbound and westbound left-turn movements.
- Future development of adjacent properties along the Ridge Valley extension as part of other projects may eventually warrant protected phasing for this movement, even if the Project alone may not warrant it.
- A protected left-turn phase at this location offers safer opportunities for potential U-turn movements. Currently, the large intersection spacing and lack of side streets along Marine Way between Ridge Valley and Skyhawk can complicate traffic circulation.

For these reasons, protected signal phasing is considered appropriate at this location and the Project would satisfy TDP-13.

TDP-15: Vehicle Stacking and Gate Stacking Analysis

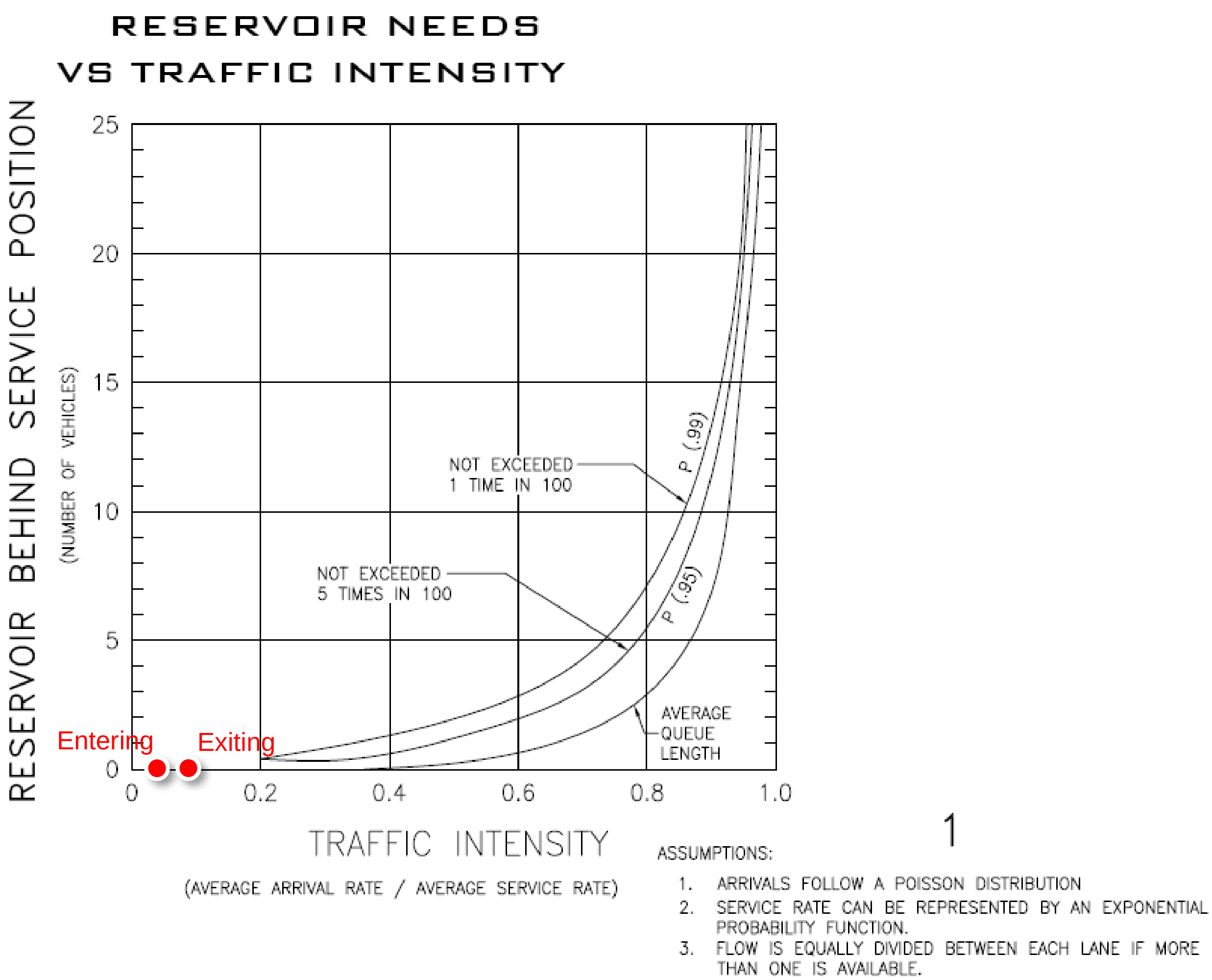
As indicated in the site plan shown in Attachment B, ingress / egress at the Project driveway would be restricted by a controlled gate access. For analysis of gate stacking at office and retail developments, TDP-15 prescribes use of the Crommelin methodology. Figure 7.1-6 and Figure 7.1-7 show the results of this analysis for the Project based on the estimated trip generation summarized in Table 4.1-1.

As shown in Figure 7.1-6, the estimated traffic intensity of the Project would fall well below the meaningful range of the Crommelin methodology. However, the gate arm would be located to provide at least 25 feet of ingress stacking (measured from the curb line of the turnaround), which would be sufficient to accommodate one standard passenger car. In addition, there would be no conflicting traffic when entering or exiting the Project site, as the Project driveway would be located at the end of a dead-end, private road primarily intended to provide local access for the Project, as mentioned above. Therefore, no queuing due to conflicting traffic is expected within or external to the site.

As shown in Figure 7.1-7, the amount of parking provided and the estimated directional peak-hour volumes would not warrant more than a single lane in each direction.

Overall, the Project would satisfy TDP-15.

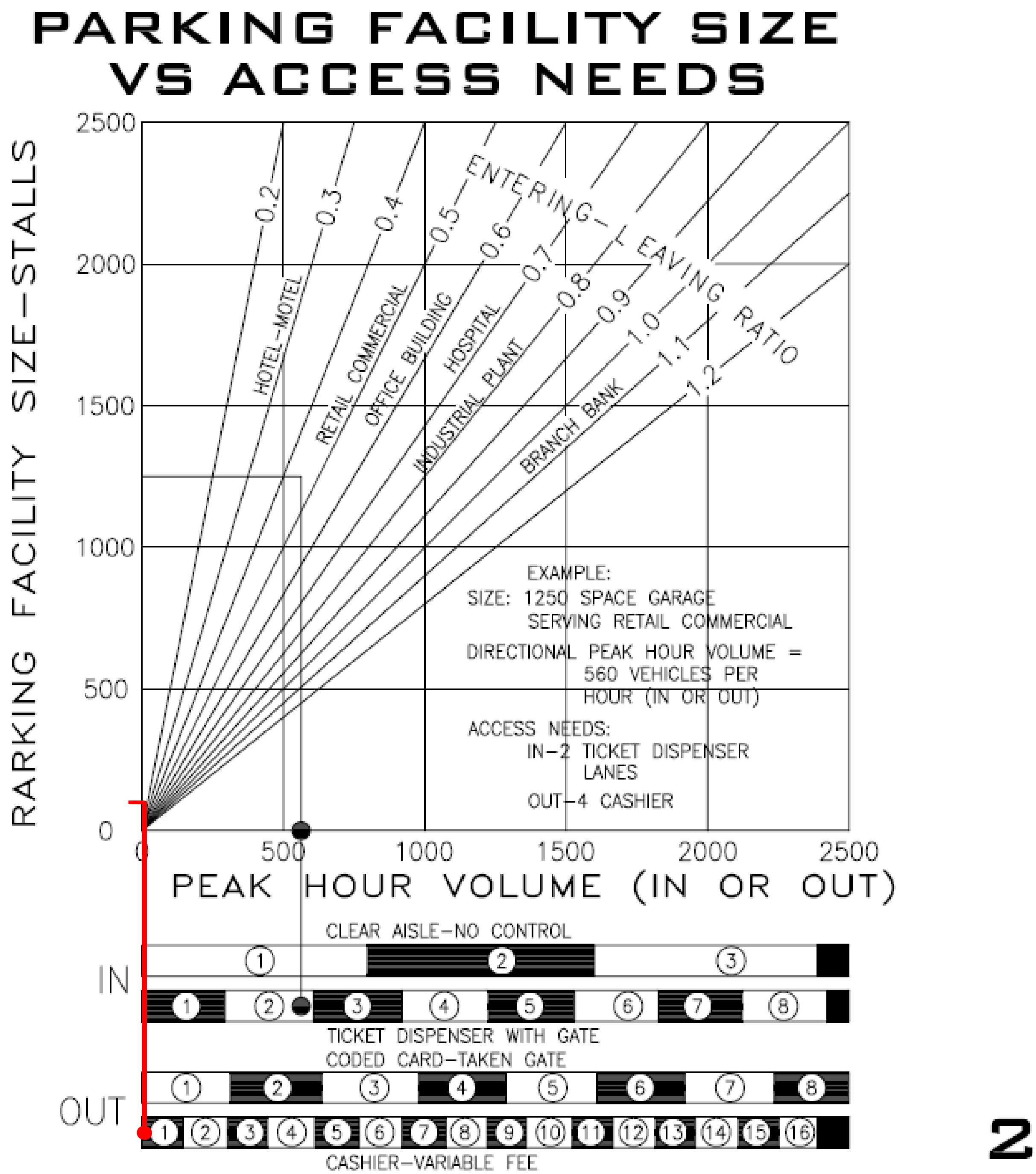
Figure 7.1-6 Gate Stacking Analysis – Reservoir Needs



Entering
Average arrival rate = 14 vehicles per hour (Table 4.1-1)
Average service rate = 340 vehicles per hour (coded-card operated gate)
Traffic intensity = 14 ÷ 340 ≈ 0.04

Exiting
Average arrival rate = 28 vehicles per hour (Table 4.1-1)
Average service rate = 320 vehicles per hour (coded-card operated gate)
Traffic intensity = 28 ÷ 340 ≈ 0.09

Figure 7.1-7 Gate Stacking Analysis – Access Needs



Parking facility size = 120 stalls (Section 2.2)
Directional peak hour volumes (Table 4.1-1):
Entering = 14 vehicles (AM peak hour)
Exiting = 28 vehicles (AM peak hour)

Entering–leaving ratio:
Entering = 14 ÷ 120 = 0.12
Exiting = 28 ÷ 120 = 0.23

7.2 CIRCULATION PHASING

The City's latest Circulation Phasing Analysis Report (March 2020) did not identify any affected locations within the area in the vicinity of the Project Site. Based on the results of the LOS analysis described earlier, the Project would not result in or substantially contribute to LOS deficiencies at any study intersections or roadway segments.

7.3 CONGESTION MANAGEMENT PROGRAM CONSISTENCY

As shown in Table 4.1-1, the Project would generate approximately 220 daily trips, which would be well below the general threshold of 2,400 daily trips for all development projects and the specific threshold of 1,600 daily trips for development projects with direct access to, or in close proximity to, the Congestion Management Program (CMP) Highway System. Therefore, a CMP Traffic Study to determine the Project's consistency with the CMP is not required, in accordance with Exhibit 6 ("CMP Traffic Impact Analysis Exempt Projects") of the *City of Irvine Traffic Study Guidelines* (City of Irvine, 2007).

7.4 PEDESTRIAN CIRCULATION

Objective B-3 of the Circulation Element of the City's General Plan is to "establish a pedestrian circulation system to support and encourage walking as a mode of transportation". The Circulation Element includes the following three policies to support Objective B-3:

- Link residences with schools, shopping centers, and other public facilities, both within a planning area and to adjacent planning areas, through an internal system of trails.
- Require development to provide safe, convenient, and direct pedestrian access to surrounding land uses and transit stops. Issues such as anticipated interaction between pedestrians and vehicles, proposed infrastructure improvements, and design standards shall be considered.
- Design and locate land uses to encourage access to them by nonautomotive means.

The Project is a specialized use without access for the general public and would not be a major activity generator or attractor. Pedestrian circulation from the general public is not anticipated for the Project and therefore sidewalks would not be provided on the Ridge Valley extension. The Project would provide two sidewalk curb ramps on the Ridge Valley and Marine Way intersection. These modifications would generally support Objective B-3 and the three associated policies by providing safe, convenient, and direct pedestrian access. Proposed modifications would also be designed in accordance with applicable standards (such as City of Irvine street design standards and Americans with Disabilities Act [ADA] design standards) and would facilitate safe pedestrian circulation at this location.

7.5 BICYCLE CIRCULATION

Objective B-4 of the Circulation Element of the City's General Plan is to "plan, provide and maintain a comprehensive bicycle trail network that together with the regional trail system, encourages increased use of bicycle trails for commuters and recreational purposes". The Circulation Element includes several supporting policies to expand and enhance bicycle circulation, as well as a separate objective (Objective B-5) and associated policies regarding riding and hiking trails.

While the Project is a specialized use with limited access for the general public and would not be a major activity generator or attractor, bicycle access would be provided by existing Class II bikeways along Marine Way, Ridge Valley, and Sand Canyon Avenue, as well as Class I bikeways along Sand Canyon Avenue (Sand Canyon Side Path) and within the Great Park and the surrounding neighborhoods. The Project would not physically alter existing bikeways, and the proposed modifications at the Ridge Valley / Marine Way intersection as part of the Ridge Valley extension would be designed in accordance with applicable standards to facilitate safe bicycle circulation at this location.

7.6 TRANSIT FACILITIES

There are no transit services in the immediate vicinity of the Project Site. The closest major route is OCTA's Route 90 (Tustin–Dana Point) traveling along Irvine Center Drive, with the closest stops located at Sand Canyon Avenue, approximately 1.3 miles away from the Ridge Valley / Marine Way intersection.

Supplemental peak-period-only bus service is provided by two OCTA iShuttle routes (402C and 403D) out of Metrolink's Irvine station. These two routes are designed to connect Metrolink passengers with workplaces in the areas surrounding the station, and only operate in the commute direction (departing the station during the a.m. peak period and arriving at the station during the p.m. peak period). The closest stops for these routes are as follows:

- For Route 402C: Sand Canyon Avenue at the Capital Group complex (north side, between Oak Canyon and Irvine Center Drive), approximately 1.1 miles away from the Ridge Valley / Marine Way intersection
- For Route 403D: Sand Canyon Avenue at Waterworks Way, approximately 1.4 miles away from the Ridge Valley / Marine Way intersection

The Project is a specialized use with limited access for the general public and would not be a major activity generator or attractor.

7.7 VEHICLES MILES TRAVELED ANALYSIS

As indicated in Table 4.1-1, the Project's weekday daily trip generation would not exceed 250 trips. As such, a VMT impact analysis is not required for the Project, in accordance with the project screening criteria established in Exhibit 8 ("VMT Impact Analysis Guidelines (SB 743)") of the *City of Irvine Traffic Study Guidelines* (City of Irvine, 2007).

8. REQUIRED IMPROVEMENTS AND RECOMMENDATIONS

Based on the results of the intersection and roadway segment LOS analysis in Section 5.2 and Section 6.1, the Project would not result in or make a substantial contribution to any LOS deficiencies. Therefore, no LOS deficiency improvements are required.

9. CONCLUSION

As discussed in further detail in Section 7.1, the Project would create a new northbound approach at the Ridge Valley / Marine Way. The new Ridge Valley northbound approach would be striped with three lanes (a left, through, and right turn) and Marine Way would be provided with a new westbound left-turn pocket. The southbound approach would be restriped to provide a left, through and right turn lane. Signal phasing would be modified to north/south and east/west lead-lag operation with southbound right turn overlap at the Ridge Valley / Marine Way intersection for the revised roadway configuration.

The Project does not result in or make a substantial contribution to any LOS deficiencies under either the Existing Baseline scenario or the two Short-Term Interim Year Baseline scenario alternatives (with and without the Marine Way realignment). All study intersections and roadway segments would operate at acceptable LOS under all scenarios based on the City's LOS thresholds, with the exception of the segment of Marine Way between Sand Canyon Avenue and Ridge Valley, which would be deficient in terms of daily LOS under Short-Term Interim Year Alternative 1, with and without the Project. However, a peak-hour link analysis indicates that this segment would operate at acceptable conditions based on peak-hour LOS, even with the addition of the Project. Therefore, no improvements are required.

All applicable City of Irvine's TDPs were evaluated and adequately addressed, including TDP-1 (Turn Lane Pocket Lengths), TDP-10 (Distance Between Driveways and Intersections), TDP-11 (Corner Clearance), TDP-13 (Left-Turn Signal Phasing), and TDP-15 (Vehicle Stacking and Gate Stacking Analysis).

Based on the Project's trip generation, a CMP Traffic Study and VMT impact analysis are not required.

10. REFERENCES

City of Irvine, (2007).Transportation Design Procedures. Available at: https://legacy.cityofirvine.org/civica/filebank/blobdload.asp?BlobID=10062

___________, (2020). 2020 Citywide Phasing Analysis Report. Available at: https://irvinewatchdog.org/wp-content/uploads/2020/06/Attachment_1_-_2020_Citywide_Circulation_Phasing_Analysis_Report.pdf

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LSA, (October 2020).Traffic Study Hoag Hospital Irvine. Available at: https://www.cityofirvine.org/cmis/views/9d41e22f-0d2b-433c-85a5-547a4fb3627b%253B1.0

Southern California Regional Rail Authority (SCRRA), (2019). Metrolink System Map, Available at: https://metrolinktrains.com/about/agency/

Transportation Research Board (TRB), (2017). Highway Capacity Manual.

Appendix H Attachments
Technical Memorandum
Traffic

Metrolink Orange County Maintenance Facility

Prepared for:

Orange County Transportation Authority

550 S. Main St.
Orange, CA 92868

And

Gannett Fleming
20 Pacifica, Suite 430
Irvine, CA 92618

AECOM
300 S. Grand Ave.
Los Angeles, CA 90071

February 2022

Attachment A

Limited Traffic Study Scope of Work

AECOM
300 S Grand Avenue
Los Angeles, CA 90071
www.aecom.com
213 593 8100 tel
213 593 8623 fax

Memorandum

Date: November 24, 2020

To: Victor Mendez – City of Irvine

From: Jaime Guzman, AECOM
Noel Casil, AECOM

Subject: OCTA Metrolink Maintenance Facility Draft Limited Traffic Study Scope of Work Memorandum

---

AECOM is responsible for the preparation of a Traffic Study for the OCTA Metrolink Orange County Maintenance Facility Project (OCMF). Discussion and coordination of the traffic study parameters between OCTA representatives and the City of Irvine resulted in the mutual agreement that a Limited Scope Traffic Study is necessary consistent with the scope format and content as described in the City's Traffic Study Guidelines (April 2020). This scope of work memorandum is intended to document the planned approach for the Limited scope Traffic Study.

Limited Traffic Study Scope of Work

AECOM will conduction the Limited Scope Traffic Study according to the City of Irvine Traffic Study Guidelines (April 2020).

General Assumptions:

- Study Area – will be limited to adjacent intersection/s
- Analysis Scenarios
  - Existing Conditions
  - Opening Year Without Project – this should be called Short-term Interim Year Baseline
  - Opening Year With Project – this should be called Short-term Interim Year Baseline Plus

Limited Traffic Study Outline and Scope of Work Assumptions

I. Executive Summary

The Limited Scope Traffic Study will include an Executive Summary that provides a summary of all calculations and findings of the report.

II. Introduction

A. Study Area

The following five (5) study intersections will be evaluated in this Limited Scope Traffic Study:

- Sand Canyon Ave/I-5 NB Ramps
- Sand Canyon Ave/Marine Way
- Sand Canyon Ave/I-5 SB Ramps
- Ridge Valley/Marine Way
- Ridge Valley/Project

The following three (3) roadway segments will be evaluated in this Limited Scope Traffic Study:

- Marine Way between Sand Canyon and Ridge Valley
- Marine Way east of Ridge Valley
- Ridge Valley between Great Park Blvd and Marine Way

III. Existing Conditions

The study will include an assessment of existing conditions, including existing intersection counts (from data provided by the City of Irvine in pre-COVID-19 conditions) and existing transit information. As there are no existing uses on-site, there is no current contribution of traffic by the existing site.

In communications with the City of Irvine, the City of Irvine states, “The existing conditions data should be based on the most recent counts collected prior to COVID-19 conditions and a 2% growth rate per year should be added to those counts to represent 2020 conditions.

IV. Existing Conditions with Proposed Development (Not required for this Project)

Based on coordination between OCTA and the City of Irvine, there is no need for an Existing Plus Project scenario to be included in the traffic study.

V. Future Traffic Without Proposed Development (Short-term Interim Year only)

The study will include an analysis of the future condition with the proposed Project. Per City of Irvine requirements, “the Short-term Interim Year analysis to identify LOS impacts can be based on ITAM with and without project. Alternatively, the Short-term Interim Year analysis can be based on 2020 volumes with 2% growth per year to represent future conditions five years out. If this alternative is used, manual distribution of project trips is required, and city staff will need to confirm that distribution.”

A. Projected Traffic

For this study, the City of Irvine recommends the following: "There should be two Short-term Interim Year scenarios studied: Alt 1 that is based on the assumption that Marine Way is an existing two-lane roadway that connects to Sand Canyon at its existing location; and Alt 2 that is based on the near-term future assumption that Marine Way is a four-lane roadway that is realigned to connect to Sand Canyon at the Sand Canyon/I-5 NB on-off-ramps. For each of these two alternatives, all study intersections and links must be evaluated."

B. Committed Improvements

The study will include a description of the committed improvements under the interim conditions. Interim improvements are not proposed by OCTA but the team will coordinate with the City of Irvine to identify and committed improvements that need to be considered.

VI. Proposed Project Impacts

As part of the evaluation for project impacts, the following elements will be done as part of the Limited Traffic Study:

A. Model Trip Generation - Manual Trip Generation will be conducted

B. Adjustments to Trip Generation adjustments are not anticipated, but any adjustment requests would be coordinated with the City of Irvine

C. Trip Distribution and Trip Assignment - Manual Trip Distribution will be conducted

D. Phased Projects - although the OCMF project will include a phased approach to construction, the project will analyze the full long-term compliment of trips/traffic anticipated with full build out of the site as planned.

VII. Future Traffic With Proposed Development

This task will be conducted in conjunction with Item V above.

VIII. Cumulative Analysis

OCTA and its contractors need to discuss with City of Irvine if this is applicable based on the need for CUP approval of site use

IX. Analysis/Performance Criteria

This task will be completed consistent with City's Traffic Study Guidelines (April 2020) for intersection and roadway link LOS.

X. Special Issues (As Needed)

A. Site Access Analysis (City requirements shown below)

City of Irvine states, "An access analysis section must be included in the traffic study (i.e., within the Special Issues section) and all applicable Transportation Design Procedures (TDPs) must be evaluated, including but not limited to TDP-1 (turn lane pocket lengths), TDP-14 (driveway throat length), and TDP-3, TDP-4, and TDP-10 (if a second project driveway is proposed to access Marine Way.)”

B. Transit Connectivity and Pedestrian Circulation this is anticipated to not be applicable since the OCMF will not be accessible for pedestrians and no transit service will be provided for the public at this facility.

C. Congestion Management Program (CMP) Consistency/Requirements - the OCMF project is exempt from the mandatory CMP Traffic Impact Analysis per Exhibit 6: CMP Traffic Impact Analysis Projects

D. Circulation Phasing Locations - not applicable for the OCMF project

E. CEQA VMT Analysis Summary - the OCMF project is anticipated to have only 80 employees at peak operation, therefore it does not meet 250 daily trip thresholds, therefore CEQA VMT analysis is not needed as confirmed by City

City of Irvine however states, “The Limited Scope Traffic Study must include this discussion regarding VMT impact analysis. The traffic study cannot be silent regarding VMT analysis.” Therefore, the study will include a section that describes VMT analysis provisions and the rationale for why VMT is not applicable to the project.

F. Others, as appropriate

XI. Required Improvements/Recommendations

Based on City review of the draft Limited Scope Traffic Study, the team will address comments and identify and required improvements if applicable.

Please confirm that you approve of the approach outlined above and/or contact us with additional comments or thoughts on items that should be included in our analysis. We anticipate moving ahead with analysis upon confirmation of this approach. Should you have any questions or comments please contact me at your earliest convenience.

Sincerely,

Jaime R Guzman
AECOM – Deputy Project Manager
(323) 605-1691
jaime.guzman1@aecom.com

cc: Lora Cross, OCTA
Huey Yann Ooi, OCTA
Mrika Simoni, Gannett Fleming
Jason Neff, Gannett Fleming
Rob Hertz, AECOM

Attachment B

Project Site Plan

NOTES:

1. SEE GRADING PLANS FOR GRADING LIMIT.
2. SEE EXISTING SITE PLAN FOR PROPERTY OWNERS.
3. SEE FENCE PLAN FOR PROPOSED FENCE.
4. SEE RETAINING WALL PLANS FOR PROPOSED RETAINING WALL.

100 0 100 200

1"=100'

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REV.	DATE		BY	SUB.	APP.
2	01/05/22	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 2			
1	10/13/21	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 1			
0	6/30/21	CONDITIONAL USE PERMIT SUBMITTAL			

INFORMATION CONFIDENTIAL: All plans, drawings, specifications, and or information furnished herewith shall remain the property of the Southern California Regional Rail Authority and shall be held confidential and shall not be used for any purpose not provided for in agreements with the Southern California Regional Rail Authority.

DESIGNED BY	D. SMITH
DRAWN BY	D. SALAZAR
CHECKED BY	J. NEFF
APPROVED BY	M. FREEMAN
DATE	01/05/2022

NOT FOR CONSTRUCTION

METROLINK®

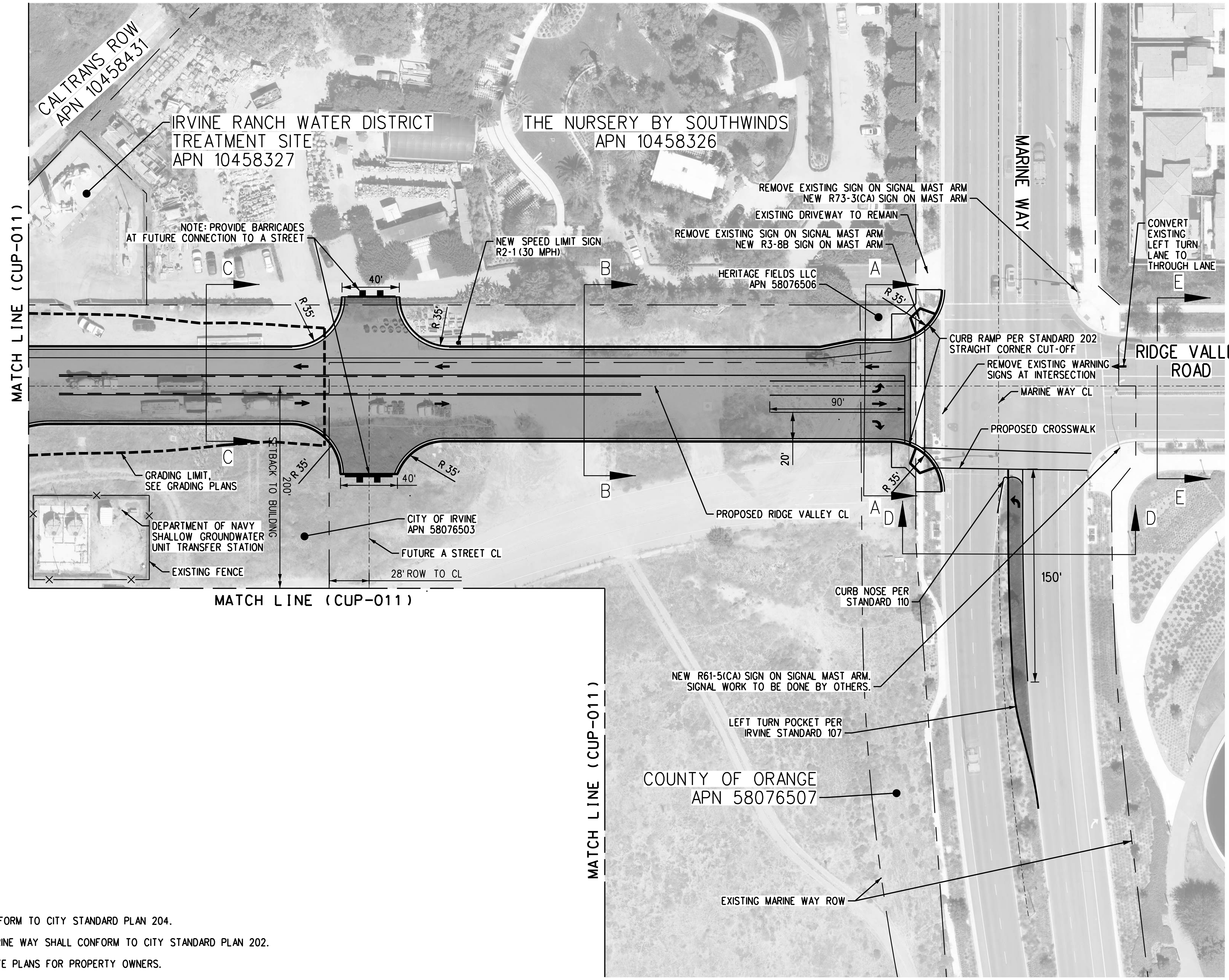
Gannett Fleming

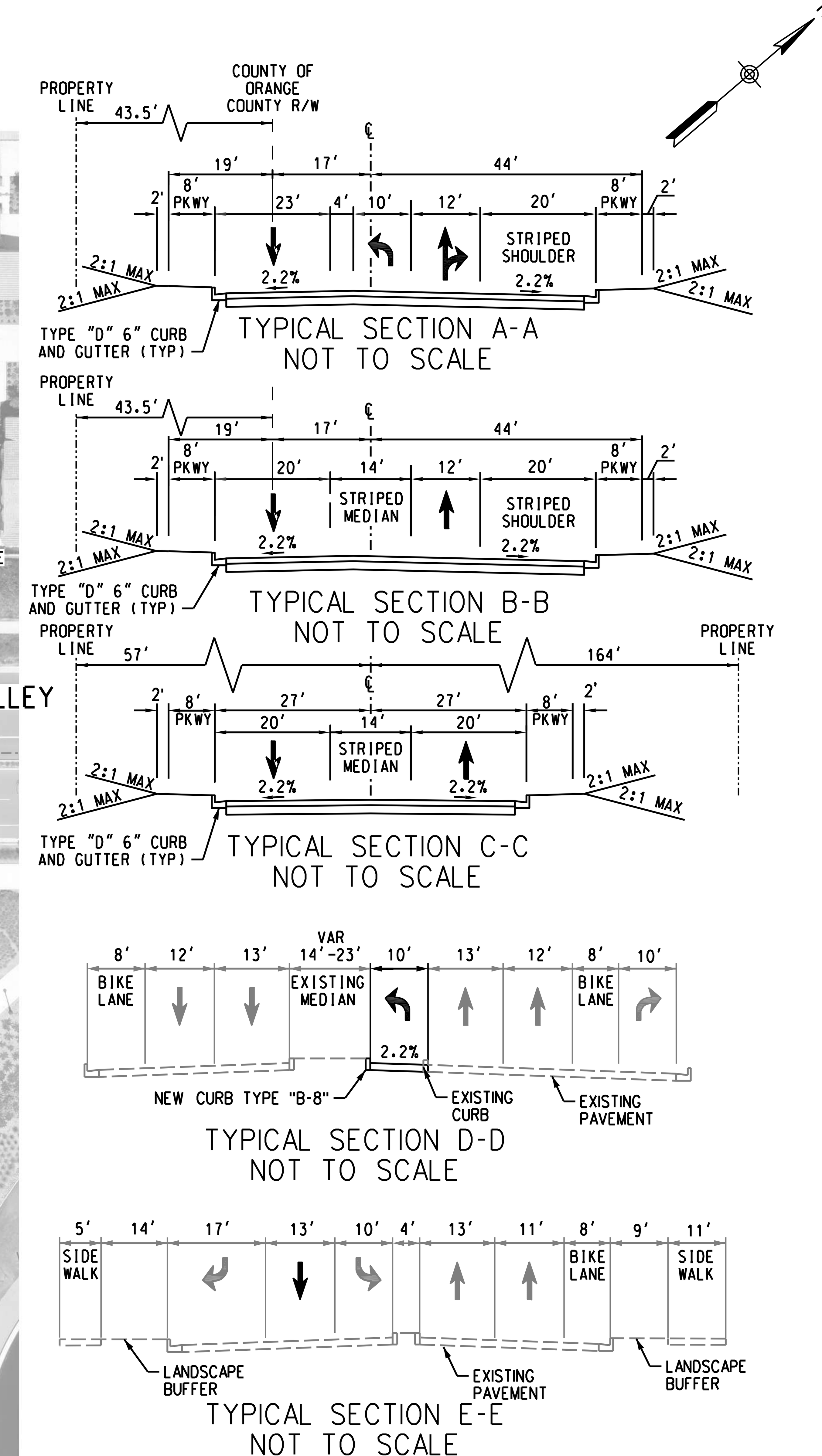
SUBMITTED: ______ PROJECT MANAGER

APPROVED: ______

METROLINK ORANGE COUNTY
MAINTENANCE FACILITY PROJECT
CIVIL
PROPOSED SITE PLAN - OVERALL VIEW

CASE NO.	00846471-PCPU
CONTRACT NO.	C91143
DRAWING NO.	CUP-009
REVISION	2
SHEET NO.	09 OF 55
SCALE	AS SHOWN

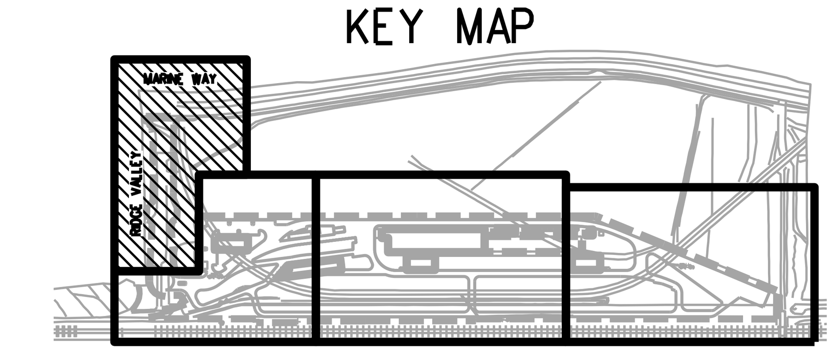




NOTES:

1. DRIVEWAYS SHALL CONFORM TO CITY STANDARD PLAN 204.
2. CURB RETURNS AT MARINE WAY SHALL CONFORM TO CITY STANDARD PLAN 202.
3. REFER TO EXISTING SITE PLANS FOR PROPERTY OWNERS.
4. REFER CUP-016 FOR LINE OF SIGHT DETAIL.
5. EASTMENTS WITH THE CITY OF IRVINE, COUNTY OF ORANGE, AND/OR HERITAGE FIELDS WILL BE PROVIDED IN THE FINAL DESIGN PHASE.
6. IN LEU OF SIDEWALK, DROP-OFF AT END OF CUL DE SAC WILL BE USED FOR WALKING IN FOR ANY ADA COMPLIANCE REQUIRED.

KEY MAP



REV.	DATE		BY	SUB.	APP.
2	01/05/22	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 2			
1	10/13/21	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 1			
0	6/30/21	CONDITIONAL USE PERMIT SUBMITTAL			

DESIGNED BY	D. SMITH
DRAWN BY	D. SALAZAR
CHECKED BY	J. NEFF
APPROVED BY	M. FREEMAN
DATE	01/05/2022

NOT FOR CONSTRUCTION

METROLINK

Gannett Fleming

SUBMITTED: PROJECT MANAGER

APPROVED:

METROLINK ORANGE COUNTY MAINTENANCE FACILITY PROJECT
CIVIL
PROPOSED SITE PLAN
SHEET 1 OF 4

CASE NO.	00846471-PCPU
CONTRACT NO.	C91143
DRAWING NO.	CUP-010
REVISION	2
SHEET NO.	10 OF 55
SCALE	AS SHOWN

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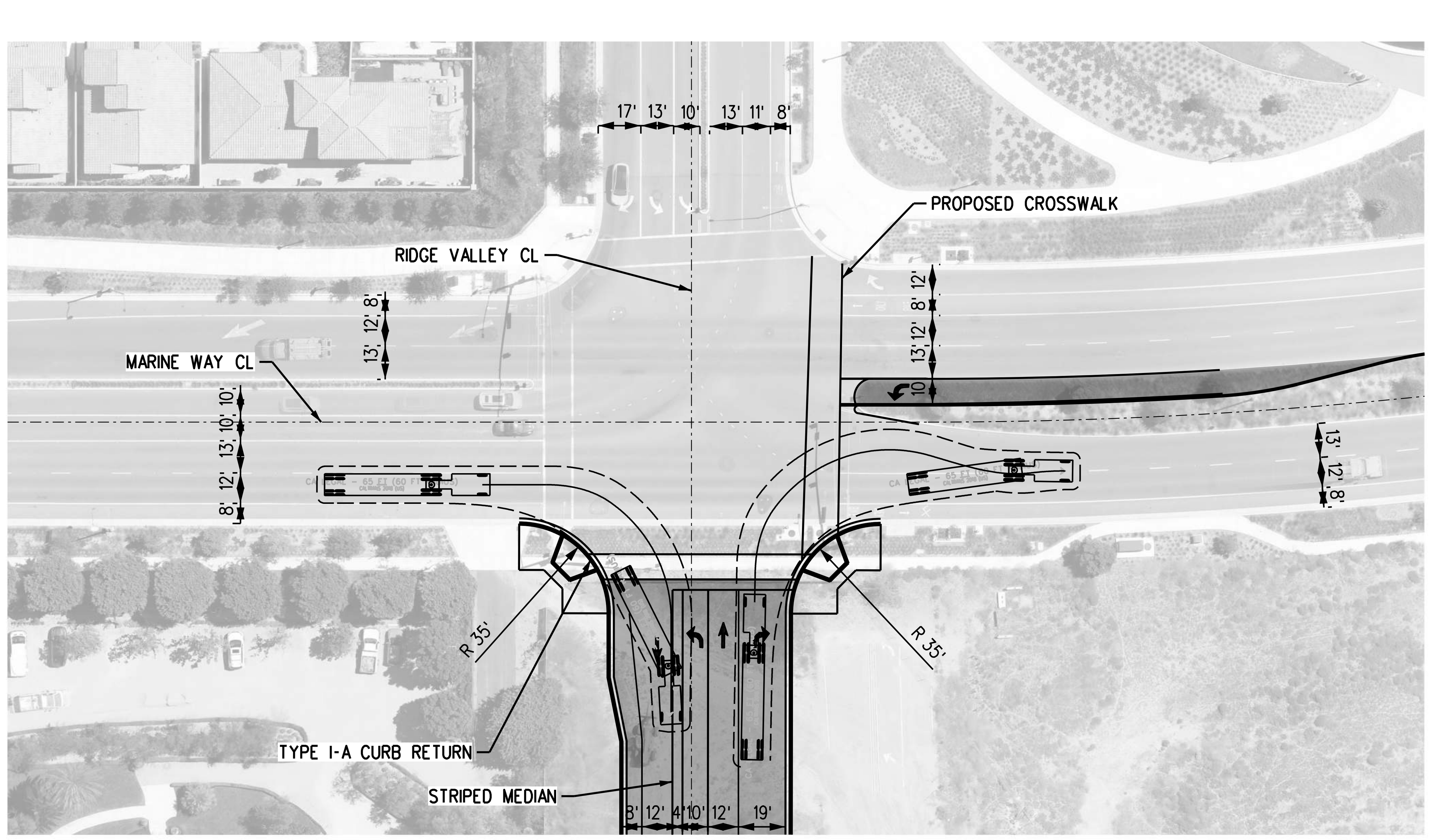
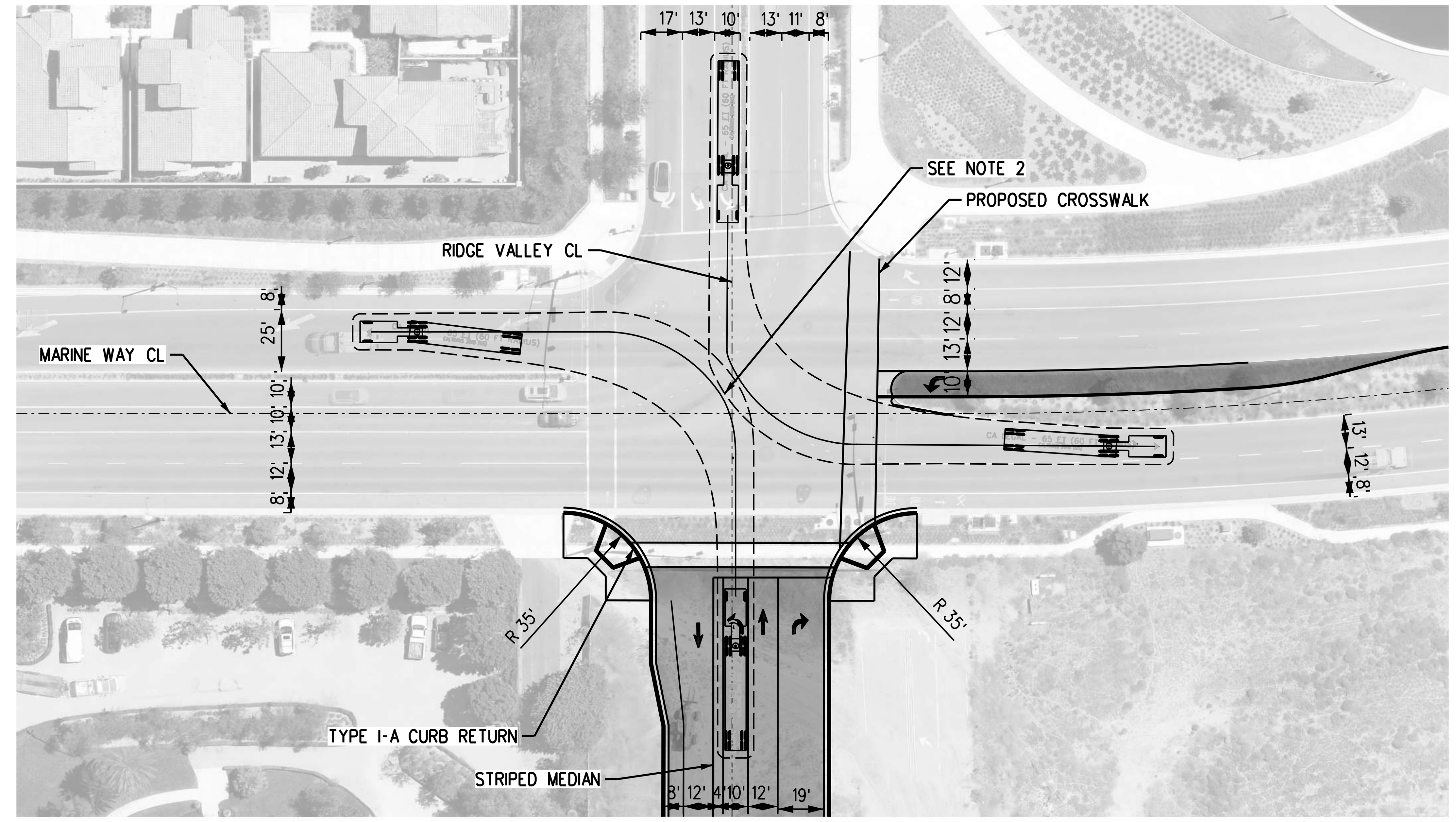
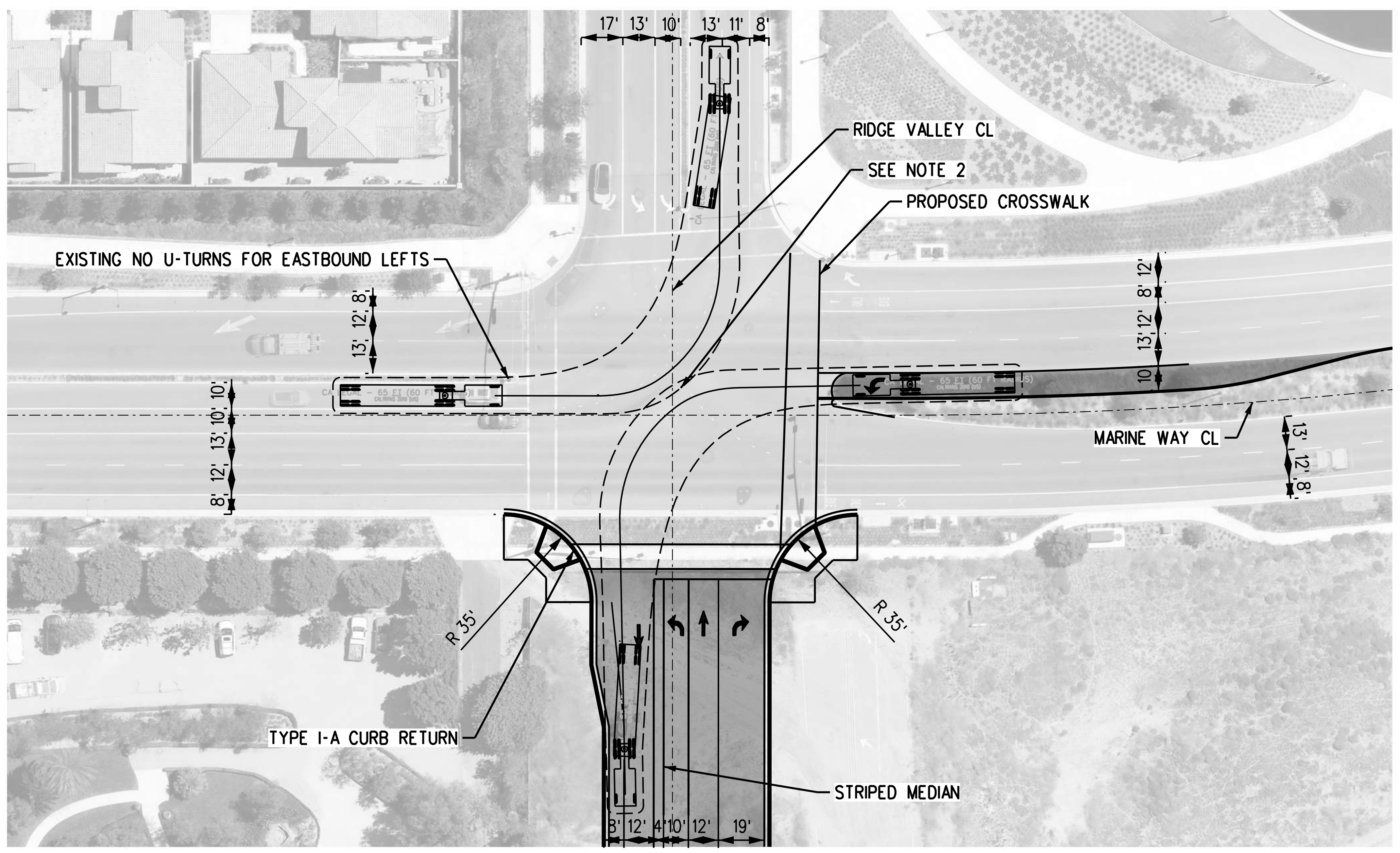


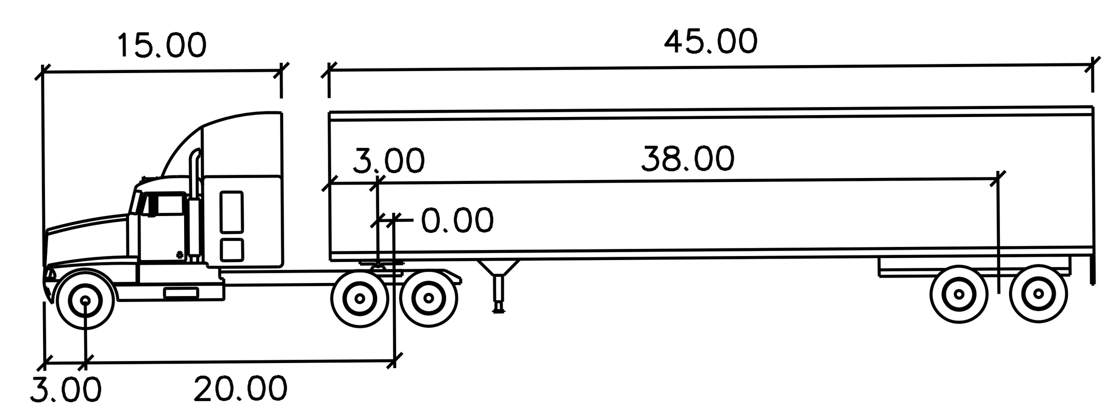
MARINE WAY AND RIDGE VALLEY INTERSECTION
EASTBOUND AND SOUTHBOUND RIGHT TURNS



MARINE WAY AND RIDGE VALLEY INTERSECTION
EASTBOUND AND WESTBOUND LEFT TURNS



MARINE WAY AND RIDGE VALLEY INTERSECTION
NORTHBOUND AND SOUTHBOUND LEFT TURNS



CA LEGAL - 65 FT (60 FT RADIUS)

FEET

TRACTOR WIDTH	: 8.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 8.50	STEERING ANGLE	: 20.9
TRACTOR TRACK	: 8.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 8.50		

NOTES:

1. SEE CUP-016 FOR LINE OF SIGHT DETAIL
2. NORTHBOUND AND SOUTHBOUND LEFTS AS WELL AS EASTBOUND AND WESTBOUND LEFTS WILL BE PROGRAMMED TO OPERATE IN A LEAD-LAG SEQUENCE. A RIGHT-TURN OVERLAP FOR SOUTHBOUND WILL OPERATE CONCURRENTLY WITH EASTBOUND LEFTS.

TRUCK PATH CENTERLINE

3' CLEARANCE

40 0 40 80

1"=40'

REV.	DATE		BY	SUB.	APP.
2	01/05/22	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 2			
1	10/13/21	CONDITIONAL USE PERMIT SUBMITTAL - REVISION 1			
0	6/30/21	CONDITIONAL USE PERMIT SUBMITTAL			

DESIGNED BY	D. SMITH
DRAWN BY	P. NGUYEN
CHECKED BY	J. NEFF
APPROVED BY	M. FREEMAN
DATE	01/05/2022

NOT FOR CONSTRUCTION

METROLINK

Gannett Fleming

SUBMITTED: ______ PROJECT MANAGER

APPROVED: ______

METROLINK ORANGE COUNTY
MAINTENANCE FACILITY PROJECT
GENERAL AUTOTURN LAYOUT PLANS
MARINE WAY AND RIDGE VALLEY

CASE NO.	00846471-PCPU
CONTRACT NO.	C91143
DRAWING NO.	CUP-047
REVISION 2	SHEET NO. 48 OF 55
SCALE	AS SHOWN

Attachment C

ICU Level of Service Calculations

Existing Baseline (2020)

1 (303) Sand Canyon Ave. / I-5 NB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	2	3,400	243	0.07 c	566	0.17 c
NBT	3	5,100	467	0.09	1,657	0.32
NBR	d	1,700	13	0.01	18	0.01
SBL	1	1,700	16	0.01	5	0.00
SBT	3	5,100	1,878	0.37 c	836	0.16 c
SBR	1	1,700	570	0.34	222	0.13
EBL	1.5		322		938	
EBT	0.5	3,400	0	0.09 c	0	0.28 c
EBR	2	3,400	526	0.15	217	0.06
WBL	1	1,700	6	0.00 c	37	0.02 c
WBT	1	1,700	0	0.00	0	0.00
WBR	0	0	3		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W	+	E/W	+
Total capacity utilization				**0.58**		**0.68**
Level of service				**A**		**B**

2 (304) Sand Canyon Ave. / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	3	5,100	548	0.11	2,084	0.41 c
NBR	1	1,700	197	0.12	463	0.27
SBL	2	3,400	99	0.03	141	0.04 c
SBT	3	5,100	2,236	0.44 c	937	0.18
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	2	3,400	448	0.13 c	281	0.08 c
WBT	0	0	0		0	
WBR	1	1,700	146	0.09	130	0.08
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.62**		**0.58**
Level of service				**B**		**A**

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	473	0.07	1,922	0.28 c
NBR	1	1,700	121	0.07	380	0.22
SBL	2	3,400	732	0.22	450	0.13 c
SBT	4	6,800	1,967	0.29 c	726	0.11
SBR	0	0	0		0	
EBL	2.5		254	0.07 c	617	0.12 c
EBT	0	6,800	4		1	
EBR	1.5		893	0.26	250	0.15
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR	0.19 c	EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.60**		**0.58**
Level of service				**A**		**A**

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL		0				
NBT		0				
NBR		0				
SBL	2	3,400	23	0.01 c	32	0.01 c
SBT	0	0	0		0	
SBR	1	1,700	526	0.31	171	0.10
EBL	2	3,400	114	0.03 c	390	0.11 c
EBT	2	3,400	149	0.04	262	0.08
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	2	3,400	80	0.02 c	220	0.06 c
WBR	1	1,700	16	0.01	37	0.02
Right turn adjustment			NBR		NBR	
			SBR	0.28 c	SBR	0.01 c
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.39**		**0.24**
Level of service				**A**		**A**

Existing Baseline (2020) plus Project

1 (303) Sand Canyon Ave. / I-5 NB Ramps

	Lanes	Capacity	AM peak hour Volume	AM v/c		PM peak hour Volume	PM v/c	
NBL	2	3,400	255	0.08	c	573	0.17	c
NBT	3	5,100	469	0.09		1,658	0.33	
NBR	d	1,700	13	0.01		18	0.01	
SBL	1	1,700	16	0.01		5	0.00	
SBT	3	5,100	1,878	0.37	c	836	0.16	c
SBR	1	1,700	570	0.34		222	0.13	
EBL	1.5		322			938		
EBT	0.5	3,400	0	0.09	c	0	0.28	c
EBR	2	3,400	530	0.16		218	0.06	
WBL	1	1,700	6	0.00	c	37	0.02	c
WBT	1	1,700	0	0.00		0	0.00	
WBR	0	0	3			0		
Right turn adjustment			NBR			NBR		
			SBR			SBR		
			EBR			EBR		
			WBR			WBR		
Clearance interval				0.05	c		0.05	c
Split phasing			N/S			N/S		
			E/W	+		E/W	+	
Total capacity utilization				**0.59**			**0.68**	
Level of service				**A**			**B**	

2 (304) Sand Canyon Ave. / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM v/c		PM peak hour Volume	PM v/c	
NBL	0	0	0			0		
NBT	3	5,100	548	0.11		2,084	0.41	c
NBR	1	1,700	203	0.12		463	0.27	
SBL	2	3,400	103	0.03		142	0.04	c
SBT	3	5,100	2,236	0.44	c	937	0.18	
SBR	0	0	0			0		
EBL	0	0	0			0		
EBT	0	0	0			0		
EBR	0	0	0			0		
WBL	2	3,400	457	0.13	c	287	0.08	c
WBT	0	0	0			0		
WBR	1	1,700	159	0.09		137	0.08	
Right turn adjustment			NBR			NBR		
			SBR			SBR		
			EBR			EBR		
			WBR			WBR		
Clearance interval				0.05	c		0.05	c
Split phasing			N/S			N/S		
			E/W			E/W		
Total capacity utilization				**0.62**			**0.58**	
Level of service				**B**			**A**	

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM v/c		PM peak hour Volume	PM v/c	
NBL	0	0	0			0		
NBT	4	6,800	474	0.07		1,922	0.28	c
NBR	1	1,700	121	0.07		380	0.22	
SBL	2	3,400	739	0.22		455	0.13	c
SBT	4	6,800	1,970	0.29	c	727	0.11	
SBR	0	0	0			0		
EBL	2.5		259	0.08	c	617	0.12	c
EBT	0	6,800	4			1		
EBR	1.5		893	0.26		250	0.15	
WBL	0	0	0			0		
WBT	0	0	0			0		
WBR	0	0	0			0		
Right turn adjustment			NBR			NBR		
			SBR			SBR		
			EBR	0.19	c	EBR		
			WBR			WBR		
Clearance interval				0.05	c		0.05	c
Split phasing			N/S			N/S		
			E/W			E/W		
Total capacity utilization				**0.61**			**0.58**	
Level of service				**B**			**A**	

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM v/c		PM peak hour Volume	PM v/c	
NBL	1	1,700	21	0.01		13	0.01	
NBT	1	1,700	2	0.01	c	1	0.01	c
NBR	1	1,700	1	0.00		0	0.00	
SBL	1	1,700	23	0.01	c	32	0.02	c
SBT	1	1,700	1	0.00		0	0.00	
SBR	1	1,700	526	0.31		171	0.10	
EBL	2	3,400	114	0.03	c	390	0.11	c
EBT	2	3,400	149	0.05		262	0.08	
EBR	0	0	10			1		
WBL	1	1,700	0	0.00		0	0.00	
WBT	2	3,400	80	0.02	c	220	0.06	c
WBR	1	1,700	16	0.01		37	0.02	
Right turn adjustment			NBR			NBR		
			SBR	0.26	c	SBR		
			EBR			EBR		
			WBR			WBR		
Clearance interval				0.05	c		0.05	c
Split phasing			N/S			N/S		
			E/W			E/W		
Total capacity utilization				**0.38**			**0.25**	
Level of service				**A**			**A**	

Short-Term Interim Year Baseline (2025) Alternative 1

1 (303) Sand Canyon Ave. / I-5 NB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	2	3,400	291	0.09 c	710	0.21 c
NBT	3	5,100	602	0.12	1,829	0.36
NBR	d	1,700	33	0.02	31	0.02
SBL	1	1,700	40	0.02	10	0.01
SBT	3	5,100	2,175	0.43 c	1,074	0.21 c
SBR	1	1,700	749	0.44	310	0.18
EBL	1.5		461		1,126	
EBT	0.5	3,400	0	0.14 c	0	0.33 c
EBR	2	3,400	622	0.18	268	0.08
WBL	1	1,700	12	0.01 c	94	0.06 c
WBT	1	1,700	0	0.00	0	0.00
WBR	0	0	8		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W	+	E/W	+
Total capacity utilization				**0.72**		**0.86**
Level of service				**C**		**D**

2 (304) Sand Canyon Ave. / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	3	5,100	701	0.14	2,342	0.46 c
NBR	1	1,700	240	0.14	674	0.40
SBL	1	1,700	124	0.07	201	0.12 c
SBT	4	6,800	2,607	0.38 c	1,222	0.18
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	2	3,400	535	0.16 c	487	0.14 c
WBT	0	0	0		0	
WBR	1	1,700	194	0.11	202	0.12
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.59**		**0.77**
Level of service				**A**		**C**

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	611	0.09	2,315	0.34 c
NBR	1	1,700	131	0.08	401	0.24
SBL	2	3,400	844	0.25	649	0.19 c
SBT	4	6,800	2,314	0.34 c	1,012	0.15
SBR	0	0	0		0	
EBL	2.5		305	0.09 c	702	0.14 c
EBT	0	6,800	4		1	
EBR	1.5		911	0.27	236	0.14
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR	0.18 c	EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.66**		**0.72**
Level of service				**B**		**C**

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL		0				
NBT		0				
NBR		0				
SBL	2	3,400	26	0.01 c	35	0.01 c
SBT	0	0	0		0	
SBR	1	1,700	581	0.34	189	0.11
EBL	2	3,400	126	0.04 c	430	0.13 c
EBT	2	3,400	164	0.05	289	0.09
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	2	3,400	88	0.03 c	243	0.07 c
WBR	1	1,700	18	0.01	41	0.02
Right turn adjustment			NBR		NBR	
			SBR	0.31 c	SBR	0.01 c
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.44**		**0.27**
Level of service				**A**		**A**

Short-Term Interim Year Baseline (2025) Alternative 1 plus Project

1 (303) Sand Canyon Ave. / I-5 NB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	2	3,400	304	0.09 c	717	0.21 c
NBT	3	5,100	604	0.12	1,830	0.36
NBR	d	1,700	33	0.02	31	0.02
SBL	1	1,700	40	0.02	10	0.01
SBT	3	5,100	2,176	0.43 c	1,074	0.21 c
SBR	1	1,700	749	0.44	310	0.18
EBL	1.5		461		1,126	
EBT	0.5	3,400	0	0.14 c	0	0.33 c
EBR	2	3,400	626	0.18	270	0.08
WBL	1	1,700	12	0.01 c	94	0.06 c
WBT	1	1,700	0	0.00	0	0.00
WBR	0	0	8		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W	+	E/W	+
Total capacity utilization				**0.72**		**0.86**
Level of service				**C**		**D**

2 (304) Sand Canyon Ave. / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	3	5,100	701	0.14	2,342	0.46 c
NBR	1	1,700	248	0.15	676	0.40
SBL	1	1,700	128	0.08	202	0.12 c
SBT	4	6,800	2,607	0.38 c	1,222	0.18
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	2	3,400	545	0.16 c	494	0.15 c
WBT	0	0	0		0	
WBR	1	1,700	207	0.12	210	0.12
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.59**		**0.78**
Level of service				**A**		**C**

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	612	0.09	2,315	0.34 c
NBR	1	1,700	131	0.08	401	0.24
SBL	2	3,400	851	0.25	655	0.19 c
SBT	4	6,800	2,316	0.34 c	1,013	0.15
SBR	0	0	0		0	
EBL	2.5		311	0.09 c	704	0.14 c
EBT	0	6,800	4		1	
EBR	1.5		911	0.27	236	0.14
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR	0.18 c	EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.66**		**0.72**
Level of service				**B**		**C**

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	1	1,700	24	0.01	15	0.01
NBT	1	1,700	3	0.02 c	1	0.01 c
NBR	1	1,700	1	0.00	1	0.00
SBL	1	1,700	26	0.02 c	35	0.02 c
SBT	1	1,700	1	0.00	0	0.00
SBR	1	1,700	581	0.34	189	0.11
EBL	2	3,400	126	0.04 c	430	0.13 c
EBT	2	3,400	164	0.05	289	0.09
EBR	0	0	12		3	
WBL	1	1,700	1	0.00	0	0.00
WBT	2	3,400	88	0.03 c	243	0.07 c
WBR	1	1,700	18	0.01	41	0.02
Right turn adjustment			NBR		NBR	
			SBR	0.29 c	SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.45**		**0.28**
Level of service				**A**		**A**

Short-Term Interim Year Baseline (2025) Alternative 2

1 (303) Sand Canyon Ave. / I-5 NB Ramps / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	2	3,400	228	0.07 c	653	0.19 c
NBT	4	6,800	472	0.07	1,684	0.25
NBR	1	1,700	274	0.16	705	0.41
SBL	2	3,400	136	0.04	171	0.05
SBT	4	6,800	2,079	0.31 c	913	0.13 c
SBR	1	1,700	749	0.44	310	0.18
EBL	2	3,400	461	0.14	1,126	0.33 c
EBT	1.5	5,100	28	0.02 c	40	0.02
EBR	1.5		595	0.18	228	0.07
WBL	2	3,400	547	0.16 c	581	0.17
WBT	2	3,400	63	0.02	56	0.02 c
WBR	1	1,700	139	0.08	145	0.09
Right turn adjustment			NBR		NBR	
			SBR	0.02 c	SBR	
			EBR	0.11 c	EBR	
			WBR		WBR	0.01 c
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.74**		**0.73**
Level of service				**C**		**C**

2 (304) Sand Canyon Ave. / Old Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	828	0.12	2,911	0.43 c
NBR	d	1,700	114	0.07	105	0.06
SBL	0	0	94	0.06	113	0.07 c
SBT	4	6,800	3,048	0.46 c	1,596	0.25
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	2	3,400	53	0.02 c	89	0.03 c
WBT	0	0	0		0	
WBR	1	1,700	44	0.03	84	0.05
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.53**		**0.58**
Level of service				**A**		**A**

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	611	0.09	2,315	0.34 c
NBR	1	1,700	131	0.08	401	0.24
SBL	2	3,400	844	0.25	649	0.19 c
SBT	4	6,800	2,314	0.34 c	1,012	0.15
SBR	0	0	0		0	
EBL	2.5		305	0.09 c	702	0.14 c
EBT	0	6,800	4		1	
EBR	1.5		911	0.27	236	0.14
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR	0.18 c	EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.66**		**0.72**
Level of service				**B**		**C**

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL		0				
NBT		0				
NBR		0				
SBL	2	3,400	26	0.01 c	35	0.01 c
SBT	0	0	0		0	
SBR	1	1,700	581	0.34	189	0.11
EBL	2	3,400	126	0.04 c	430	0.13 c
EBT	2	3,400	164	0.05	289	0.09
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	2	3,400	88	0.03 c	243	0.07 c
WBR	1	1,700	18	0.01	41	0.02
Right turn adjustment			NBR		NBR	
			SBR	0.31 c	SBR	0.01 c
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.44**		**0.27**
Level of service				**A**		**A**

Short-Term Interim Year Baseline (2025) Alternative 2 plus Project

1 (303) Sand Canyon Ave. / I-5 NB Ramps / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	2	3,400	228	0.07 c	653	0.19 c
NBT	4	6,800	472	0.07	1,684	0.25
NBR	1	1,700	281	0.17	707	0.42
SBL	2	3,400	136	0.04	171	0.05
SBT	4	6,800	2,079	0.31 c	913	0.13 c
SBR	1	1,700	749	0.44	310	0.18
EBL	2	3,400	461	0.14	1,126	0.33 c
EBT	1.5	5,100	32	0.02 c	41	0.02
EBR	1.5		595	0.18	228	0.07
WBL	2	3,400	557	0.16 c	587	0.17
WBT	2	3,400	76	0.02	64	0.02 c
WBR	1	1,700	140	0.08	146	0.09
Right turn adjustment			NBR		NBR	
			SBR	0.01 c	SBR	
			EBR	0.11 c	EBR	
			WBR		WBR	0.01 c
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.73**		**0.73**
Level of service				**C**		**C**

2 (304) Sand Canyon Ave. / Old Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	835	0.12	2,913	0.43 c
NBR	d	1,700	114	0.07	105	0.06
SBL	0	0	94	0.06	113	0.07 c
SBT	4	6,800	3,058	0.46 c	1,603	0.25
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	2	3,400	53	0.02 c	89	0.03 c
WBT	0	0	0		0	
WBR	1	1,700	44	0.03	84	0.05
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.53**		**0.58**
Level of service				**A**		**A**

3 (305) Sand Canyon Ave. / I-5 SB Ramps

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	0	0	0		0	
NBT	4	6,800	612	0.09	2,315	0.34 c
NBR	1	1,700	131	0.08	401	0.24
SBL	2	3,400	851	0.25	655	0.19 c
SBT	4	6,800	2,316	0.34 c	1,013	0.15
SBR	0	0	0		0	
EBL	2.5		311	0.09 c	704	0.14 c
EBT	0	6,800	4		1	
EBR	1.5		911	0.27	236	0.14
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right turn adjustment			NBR		NBR	
			SBR		SBR	
			EBR	0.18 c	EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.66**		**0.72**
Level of service				**B**		**C**

4 Ridge Valley / Marine Way

	Lanes	Capacity	AM peak hour Volume	AM peak hour v/c	PM peak hour Volume	PM peak hour v/c
NBL	1	1,700	24	0.01	15	0.01
NBT	1	1,700	3	0.02 c	1	0.01 c
NBR	1	1,700	1	0.00	1	0.00
SBL	1	1,700	26	0.02 c	35	0.02 c
SBT	1	1,700	1	0.00	0	0.00
SBR	1	1,700	581	0.34	189	0.11
EBL	2	3,400	126	0.04 c	430	0.13 c
EBT	2	3,400	164	0.05	289	0.09
EBR	0	0	12		3	
WBL	1	1,700	1	0.00	0	0.00
WBT	2	3,400	88	0.03 c	243	0.07 c
WBR	1	1,700	18	0.01	41	0.02
Right turn adjustment			NBR		NBR	
			SBR	0.29 c	SBR	
			EBR		EBR	
			WBR		WBR	
Clearance interval				0.05 c		0.05 c
Split phasing			N/S		N/S	
			E/W		E/W	
Total capacity utilization				**0.45**		**0.28**
Level of service				**A**		**A**

Attachment D

HCM Level of Service Calculations

HCM 6th Signalized Intersection Summary
1: I-5 Northbound Ramps & Sand Canyon Ave

Baseline Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	322	0	526	6	0	3	243	467	13	16	1878	570
Future Volume (veh/h)	322	0	526	6	0	3	243	467	13	16	1878	570
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	350	0	572	7	0	3	264	508	14	17	2041	620
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	478	0	1049	22	0	19	680	3053	948	99	2333	753
Arrive On Green	0.13	0.00	0.13	0.01	0.00	0.01	0.06	0.20	0.20	0.06	0.46	0.46
Sat Flow, veh/h	3563	0	3170	1781	0	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	350	0	572	7	0	3	264	508	14	17	2041	620
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	8.5	0.0	0.0	0.4	0.0	0.2	6.6	7.4	0.6	0.8	32.6	29.5
Cycle Q Clear(g_c), s	8.5	0.0	0.0	0.4	0.0	0.2	6.6	7.4	0.6	0.8	32.6	29.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	478	0	1049	22	0	19	680	3053	948	99	2333	753
V/C Ratio(X)	0.73	0.00	0.55	0.32	0.00	0.15	0.39	0.17	0.01	0.17	0.87	0.82
Avail Cap(c_a), veh/h	574	0	1134	99	0	88	680	3053	948	99	2383	769
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.98	0.98	0.98	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.4	0.0	24.6	44.1	0.0	44.0	36.9	17.5	14.8	40.5	22.1	21.3
Incr Delay (d2), s/veh	3.9	0.0	0.5	8.1	0.0	3.6	0.4	0.1	0.0	0.8	5.0	9.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	5.0	0.2	0.0	0.1	2.7	2.6	0.2	0.4	11.9	11.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.3	0.0	25.0	52.2	0.0	47.6	37.2	17.6	14.8	41.3	27.1	31.2
LnGrp LOS	D	A	C	D	A	D	D	B	B	D	C	C
Approach Vol, veh/h		922			10			786			2678	
Approach Delay, s/veh		31.2			50.8			24.2			28.1	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.5	58.3		5.6	22.2	45.6		16.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	47.5		5.0	10.5	42.0		14.5
Max Q Clear Time (g_c+I1), s	2.8	9.4		2.4	8.6	34.6		10.5
Green Ext Time (p_c), s	0.0	3.2		0.0	0.2	6.6		1.6

Intersection Summary	
HCM 6th Ctrl Delay	28.1
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: I-5 Southbound Ramps & Sand Canyon Ave

Baseline Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	254	4	893	0	0	0	0	473	121	732	1967	0
Future Volume (veh/h)	254	4	893	0	0	0	0	473	121	732	1967	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	222	0	1031				0	514	132	796	2138	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1276	0	1136				0	1592	392	844	3485	0
Arrive On Green	0.36	0.00	0.36				0.00	0.25	0.25	0.49	1.00	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	222	0	1031				0	514	132	796	2138	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	3.8	0.0	27.8				0.0	5.9	6.2	19.7	0.0	0.0
Cycle Q Clear(g_c), s	3.8	0.0	27.8				0.0	5.9	6.2	19.7	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1276	0	1136				0	1592	392	844	3485	0
V/C Ratio(X)	0.17	0.00	0.91				0.00	0.32	0.34	0.94	0.61	0.00
Avail Cap(c_a), veh/h	1366	0	1215				0	1592	392	864	3485	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.59	0.59	0.00
Uniform Delay (d), s/veh	19.8	0.0	27.5				0.0	27.7	27.8	22.4	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	9.6				0.0	0.5	2.3	12.3	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	11.4				0.0	2.1	2.4	6.2	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.8	0.0	37.1				0.0	28.2	30.1	34.8	0.5	0.0
LnGrp LOS	B	A	D				A	C	C	C	A	A
Approach Vol, veh/h		1253						646			2934	
Approach Delay, s/veh		34.0						28.6			9.8	
Approach LOS		C						C			A	

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	26.5	26.8				53.3		36.7
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	22.5	19.5				46.5		34.5
Max Q Clear Time (g_c+I1), s	21.7	8.2				2.0		29.8
Green Ext Time (p_c), s	0.3	2.6				23.4		2.4

Intersection Summary	
HCM 6th Ctrl Delay	18.6
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
1: I-5 Northbound Ramps & Sand Canyon Ave

Baseline Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	938	0	217	37	0	0	566	1657	18	5	836	222
Future Volume (veh/h)	938	0	217	37	0	0	566	1657	18	5	836	222
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1020	0	236	40	0	0	615	1801	20	5	909	241
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1103	0	1736	63	66	0	823	2042	634	99	1110	358
Arrive On Green	0.31	0.00	0.31	0.04	0.00	0.00	0.08	0.13	0.13	0.06	0.22	0.22
Sat Flow, veh/h	3563	0	3170	1781	1870	0	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1020	0	236	40	0	0	615	1801	20	5	909	241
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	1870	0	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	24.9	0.0	0.0	2.0	0.0	0.0	15.7	31.2	1.0	0.2	15.3	12.1
Cycle Q Clear(g_c), s	24.9	0.0	0.0	2.0	0.0	0.0	15.7	31.2	1.0	0.2	15.3	12.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1103	0	1736	63	66	0	823	2042	634	99	1110	358
V/C Ratio(X)	0.93	0.00	0.14	0.64	0.00	0.00	0.75	0.88	0.03	0.05	0.82	0.67
Avail Cap(c_a), veh/h	1128	0	1758	99	104	0	823	2042	634	99	1214	392
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	0.63	0.63	0.63	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.1	0.0	10.0	42.9	0.0	0.0	38.8	37.0	23.9	40.3	33.5	32.3
Incr Delay (d2), s/veh	12.5	0.0	0.0	10.4	0.0	0.0	2.4	3.9	0.1	0.2	6.8	9.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.4	0.0	1.1	1.1	0.0	0.0	7.4	14.6	0.3	0.1	6.4	5.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	0.0	10.0	53.2	0.0	0.0	41.2	40.9	23.9	40.5	40.3	42.0
LnGrp LOS	D	A	A	D	A	A	D	D	C	D	D	D
Approach Vol, veh/h		1256			40			2436			1155	
Approach Delay, s/veh		36.4			53.2			40.8			40.7	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.5	40.5		7.7	25.9	24.1		32.4
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	33.5		5.0	17.1	21.4		28.5
Max Q Clear Time (g_c+I1), s	2.2	33.2		4.0	17.7	17.3		26.9
Green Ext Time (p_c), s	0.0	0.3		0.0	0.0	2.3		0.9

Intersection Summary	
HCM 6th Ctrl Delay	39.8
HCM 6th LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: I-5 Southbound Ramps & Sand Canyon Ave

Baseline Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	617	1	250	0	0	0	0	1922	380	450	726	0
Future Volume (veh/h)	617	1	250	0	0	0	0	1922	380	450	726	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	756	0	182				0	2089	413	489	789	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	994	0	295				0	2669	657	861	4593	0
Arrive On Green	0.19	0.00	0.19				0.00	0.41	0.41	0.25	0.71	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	756	0	182				0	2089	413	489	789	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	12.1	0.0	9.5				0.0	25.3	18.6	11.1	3.6	0.0
Cycle Q Clear(g_c), s	12.1	0.0	9.5				0.0	25.3	18.6	11.1	3.6	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	994	0	295				0	2669	657	861	4593	0
V/C Ratio(X)	0.76	0.00	0.62				0.00	0.78	0.63	0.57	0.17	0.00
Avail Cap(c_a), veh/h	1395	0	414				0	2824	696	861	4593	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.95	0.95	0.00
Uniform Delay (d), s/veh	34.7	0.0	33.7				0.0	22.8	20.8	29.6	4.2	0.0
Incr Delay (d2), s/veh	1.6	0.0	2.1				0.0	2.4	4.5	0.8	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	3.7				0.0	8.7	6.7	4.3	0.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.3	0.0	35.8				0.0	25.2	25.3	30.4	4.3	0.0
LnGrp LOS	D	A	D				A	C	C	C	A	A
Approach Vol, veh/h		938						2502			1278	
Approach Delay, s/veh		36.2						25.2			14.3	
Approach LOS		D						C			B	

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	26.9	41.8				68.8		21.2
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	13.5	39.5				57.5		23.5
Max Q Clear Time (g_c+I1), s	13.1	27.3				5.6		14.1
Green Ext Time (p_c), s	0.1	10.0				5.4		2.7

Intersection Summary	
HCM 6th Ctrl Delay	24.4
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
1: I-5 Northbound Ramps & Sand Canyon Ave

Baseline + Project
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	322	0	530	6	0	3	256	469	13	16	1879	570
Future Volume (veh/h)	322	0	530	6	0	3	256	469	13	16	1879	570
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	350	0	576	7	0	3	278	510	14	17	2042	620
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	466	0	1024	22	0	19	664	3070	953	99	2373	766
Arrive On Green	0.13	0.00	0.13	0.01	0.00	0.01	0.13	0.40	0.40	0.06	0.46	0.46
Sat Flow, veh/h	3563	0	3170	1781	0	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	350	0	576	7	0	3	278	510	14	17	2042	620
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	8.5	0.0	0.0	0.4	0.0	0.2	6.7	5.8	0.5	0.8	32.1	29.0
Cycle Q Clear(g_c), s	8.5	0.0	0.0	0.4	0.0	0.2	6.7	5.8	0.5	0.8	32.1	29.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	466	0	1024	22	0	19	664	3070	953	99	2373	766
V/C Ratio(X)	0.75	0.00	0.56	0.32	0.00	0.15	0.42	0.17	0.01	0.17	0.86	0.81
Avail Cap(c_a), veh/h	534	0	1085	99	0	88	664	3070	953	99	2440	788
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.98	0.98	0.98	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.7	0.0	25.2	44.1	0.0	44.0	34.6	12.4	10.9	40.5	21.5	20.7
Incr Delay (d2), s/veh	5.1	0.0	0.6	8.1	0.0	3.6	0.4	0.1	0.0	0.8	4.4	9.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	5.1	0.2	0.0	0.1	2.7	1.8	0.1	0.4	11.6	11.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.8	0.0	25.8	52.2	0.0	47.6	35.0	12.5	10.9	41.3	25.9	29.7
LnGrp LOS	D	A	C	D	A	D	C	B	B	D	C	C
Approach Vol, veh/h		926			10			802			2679	
Approach Delay, s/veh		32.2			50.8			20.3			26.8	
Approach LOS		C			D			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	58.6		5.6	21.8	46.3		16.3				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	48.5		5.0	10.5	43.0		13.5				
Max Q Clear Time (g_c+I1), s	2.8	7.8		2.4	8.7	34.1		10.5				
Green Ext Time (p_c), s	0.0	3.2		0.0	0.2	7.7		1.3				
Intersection Summary												
HCM 6th Ctrl Delay			26.8									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: I-5 Southbound Ramps & Sand Canyon Ave

Baseline + Project
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	4	893	0	0	0	0	474	121	740	1970	0
Future Volume (veh/h)	260	4	893	0	0	0	0	474	121	740	1970	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	228	0	1033				0	515	132	804	2141	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1278	0	1137				0	1576	388	851	3482	0
Arrive On Green	0.36	0.00	0.36				0.00	0.24	0.24	0.49	1.00	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	228	0	1033				0	515	132	804	2141	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	3.9	0.0	27.9				0.0	5.9	6.2	19.9	0.0	0.0
Cycle Q Clear(g_c), s	3.9	0.0	27.9				0.0	5.9	6.2	19.9	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1278	0	1137				0	1576	388	851	3482	0
V/C Ratio(X)	0.18	0.00	0.91				0.00	0.33	0.34	0.95	0.61	0.00
Avail Cap(c_a), veh/h	1366	0	1215				0	1576	388	868	3482	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.63	0.63	0.00
Uniform Delay (d), s/veh	19.8	0.0	27.4				0.0	27.9	28.0	22.3	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	9.7				0.0	0.6	2.4	13.2	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	11.4				0.0	2.1	2.4	6.3	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.8	0.0	37.1				0.0	28.4	30.3	35.5	0.5	0.0
LnGrp LOS	B	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1261						647			2945	
Approach Delay, s/veh		34.0						28.8			10.1	
Approach LOS		C						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	26.7	26.5				53.2		36.8				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	22.6	19.4				46.5		34.5				
Max Q Clear Time (g_c+I1), s	21.9	8.2				2.0		29.9				
Green Ext Time (p_c), s	0.3	2.6				23.4		2.4				
Intersection Summary												
HCM 6th Ctrl Delay			18.8									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
1: I-5 Northbound Ramps & Sand Canyon Ave

Baseline + Project
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	938	0	218	37	0	0	574	1658	18	5	837	222
Future Volume (veh/h)	938	0	218	37	0	0	574	1658	18	5	837	222
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1020	0	237	40	0	0	624	1802	20	5	910	241
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1103	0	1738	63	66	0	825	2042	634	99	1106	357
Arrive On Green	0.31	0.00	0.31	0.04	0.00	0.00	0.08	0.13	0.13	0.06	0.22	0.22
Sat Flow, veh/h	3563	0	3170	1781	1870	0	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1020	0	237	40	0	0	624	1802	20	5	910	241
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	1870	0	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	24.9	0.0	0.0	2.0	0.0	0.0	15.9	31.2	1.0	0.2	15.3	12.1
Cycle Q Clear(g_c), s	24.9	0.0	0.0	2.0	0.0	0.0	15.9	31.2	1.0	0.2	15.3	12.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1103	0	1738	63	66	0	825	2042	634	99	1106	357
V/C Ratio(X)	0.93	0.00	0.14	0.64	0.00	0.00	0.76	0.88	0.03	0.05	0.82	0.68
Avail Cap(c_a), veh/h	1128	0	1761	99	104	0	825	2042	634	99	1203	388
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	0.63	0.63	0.63	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.1	0.0	9.9	42.9	0.0	0.0	38.9	37.0	23.9	40.3	33.6	32.4
Incr Delay (d2), s/veh	12.5	0.0	0.0	10.4	0.0	0.0	2.6	3.9	0.1	0.2	7.0	9.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.4	0.0	1.1	1.1	0.0	0.0	7.5	14.6	0.3	0.1	6.5	5.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	0.0	10.0	53.2	0.0	0.0	41.5	40.9	23.9	40.5	40.6	42.2
LnGrp LOS	D	A	A	D	A	A	D	D	C	D	D	D
Approach Vol, veh/h		1257			40			2446			1156	
Approach Delay, s/veh		36.4			53.2			40.9			40.9	
Approach LOS		D			D			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	40.5		7.7	26.0	24.0		32.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	33.5		5.0	17.3	21.2		28.5				
Max Q Clear Time (g_c+I1), s	2.2	33.2		4.0	17.9	17.3		26.9				
Green Ext Time (p_c), s	0.0	0.3		0.0	0.0	2.2		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			39.8									
HCM 6th LOS			D									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: I-5 Southbound Ramps & Sand Canyon Ave

Baseline + Project
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	618	1	250	0	0	0	0	1922	380	456	727	0
Future Volume (veh/h)	618	1	250	0	0	0	0	1922	380	456	727	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	757	0	182				0	2089	413	496	790	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	995	0	295				0	2669	657	860	4592	0
Arrive On Green	0.19	0.00	0.19				0.00	0.41	0.41	0.25	0.71	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	757	0	182				0	2089	413	496	790	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	12.1	0.0	9.5				0.0	25.3	18.6	11.3	3.6	0.0
Cycle Q Clear(g_c), s	12.1	0.0	9.5				0.0	25.3	18.6	11.3	3.6	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	995	0	295				0	2669	657	860	4592	0
V/C Ratio(X)	0.76	0.00	0.62				0.00	0.78	0.63	0.58	0.17	0.00
Avail Cap(c_a), veh/h	1395	0	414				0	2824	696	860	4592	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.95	0.95	0.00
Uniform Delay (d), s/veh	34.7	0.0	33.7				0.0	22.8	20.8	29.6	4.2	0.0
Incr Delay (d2), s/veh	1.6	0.0	2.1				0.0	2.4	4.5	0.9	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	3.7				0.0	8.7	6.7	4.4	0.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.3	0.0	35.8				0.0	25.2	25.3	30.5	4.3	0.0
LnGrp LOS	D	A	D				A	C	C	C	A	A
Approach Vol, veh/h		939						2502			1286	
Approach Delay, s/veh		36.2						25.2			14.4	
Approach LOS		D						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	26.9	41.8				68.7		21.3				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	13.5	39.5				57.5		23.5				
Max Q Clear Time (g_c+I1), s	13.3	27.3				5.6		14.1				
Green Ext Time (p_c), s	0.0	10.0				5.4		2.7				
Intersection Summary												
HCM 6th Ctrl Delay			24.5									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	461	0	622	12	0	8	291	602	33	40	2175	749
Future Volume (veh/h)	461	0	622	12	0	8	291	602	33	40	2175	749
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	501	0	676	13	0	9	316	654	36	43	2364	814
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	572	0	940	42	0	37	470	2862	888	99	2451	791
Arrive On Green	0.16	0.00	0.16	0.02	0.00	0.02	0.09	0.38	0.38	0.06	0.48	0.48
Sat Flow, veh/h	3563	0	3170	1781	0	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	501	0	676	13	0	9	316	654	36	43	2364	814
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	12.4	0.0	4.9	0.6	0.0	0.5	8.0	7.9	1.3	2.1	40.3	43.2
Cycle Q Clear(g_c), s	12.4	0.0	4.9	0.6	0.0	0.5	8.0	7.9	1.3	2.1	40.3	43.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	572	0	940	42	0	37	470	2862	888	99	2451	791
V/C Ratio(X)	0.88	0.00	0.72	0.31	0.00	0.24	0.67	0.23	0.04	0.43	0.96	1.03
Avail Cap(c_a), veh/h	574	0	942	99	0	88	470	2862	888	127	2451	791
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.96	0.96	0.96	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.9	0.0	28.3	43.2	0.0	43.2	39.0	14.8	12.8	41.1	22.7	23.4
Incr Delay (d2), s/veh	14.2	0.0	2.7	4.1	0.0	3.3	3.6	0.2	0.1	3.0	11.6	39.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	0.0	6.8	0.3	0.0	0.2	3.5	2.7	0.4	0.9	15.8	22.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.1	0.0	31.0	47.4	0.0	46.4	42.5	15.0	12.8	44.1	34.2	63.0
LnGrp LOS	D	A	C	D	A	D	D	B	B	D	C	F
Approach Vol, veh/h		1177			22			1006			3221	
Approach Delay, s/veh		39.6			47.0			23.6			41.6	
Approach LOS		D			D			C			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	54.9		6.6	16.7	47.7		18.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	46.1		5.0	9.3	43.2		14.5				
Max Q Clear Time (g_c+I1), s	4.1	9.9		2.6	10.0	45.2		14.4				
Green Ext Time (p_c), s	0.0	4.3		0.0	0.0	0.0		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			37.8									
HCM 6th LOS			D									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	4	911	0	0	0	0	611	131	844	2314	0
Future Volume (veh/h)	305	4	911	0	0	0	0	611	131	844	2314	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	267	0	1062				0	664	142	917	2515	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1270	0	1130				0	1424	351	941	3498	0
Arrive On Green	0.36	0.00	0.36				0.00	0.22	0.22	0.54	1.00	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	267	0	1062				0	664	142	917	2515	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	4.7	0.0	29.2				0.0	8.1	6.9	23.2	0.0	0.0
Cycle Q Clear(g_c), s	4.7	0.0	29.2				0.0	8.1	6.9	23.2	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1270	0	1130				0	1424	351	941	3498	0
V/C Ratio(X)	0.21	0.00	0.94				0.00	0.47	0.40	0.97	0.72	0.00
Avail Cap(c_a), veh/h	1290	0	1148				0	1424	351	941	3498	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.46	0.46	0.00
Uniform Delay (d), s/veh	20.2	0.0	28.0				0.0	30.4	30.0	20.2	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	14.4				0.0	1.1	3.4	14.4	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	12.6				0.0	3.0	2.7	6.8	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.2	0.0	42.4				0.0	31.5	33.4	34.6	0.6	0.0
LnGrp LOS	C	A	D				A	C	C	C	A	A
Approach Vol, veh/h		1329						806			3432	
Approach Delay, s/veh		38.0						31.9			9.7	
Approach LOS		D						C			A	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	29.0	24.4				53.4		36.6				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	24.5	19.4				48.4		32.6				
Max Q Clear Time (g_c+I1), s	25.2	10.1				2.0		31.2				
Green Ext Time (p_c), s	0.0	3.0				30.8		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			19.6									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1126	0	268	94	0	0	710	1829	31	10	1074	310
Future Volume (veh/h)	1126	0	268	94	0	0	710	1829	31	10	1074	310
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1224	0	291	102	0	0	772	1988	34	11	1167	337
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1093	0	1624	99	104	0	710	1952	606	99	1186	383
Arrive On Green	0.31	0.00	0.31	0.06	0.00	0.00	0.07	0.13	0.13	0.06	0.23	0.23
Sat Flow, veh/h	3563	0	3170	1781	1870	0	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1224	0	291	102	0	0	772	1988	34	11	1167	337
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	1870	0	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	27.6	0.0	0.0	5.0	0.0	0.0	18.5	34.4	1.7	0.5	20.5	17.8
Cycle Q Clear(g_c), s	27.6	0.0	0.0	5.0	0.0	0.0	18.5	34.4	1.7	0.5	20.5	17.8
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1093	0	1624	99	104	0	710	1952	606	99	1186	383
V/C Ratio(X)	1.12	0.00	0.18	1.03	0.00	0.00	1.09	1.02	0.06	0.11	0.98	0.88
Avail Cap(c_a), veh/h	1093	0	1624	99	104	0	710	1952	606	99	1186	383
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	0.46	0.46	0.46	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.2	0.0	11.8	42.5	0.0	0.0	41.9	39.3	25.0	40.4	34.4	33.3
Incr Delay (d2), s/veh	66.6	0.0	0.1	99.0	0.0	0.0	50.4	18.8	0.1	0.5	22.6	23.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.7	0.0	1.5	4.9	0.0	0.0	13.3	18.7	0.6	0.2	10.1	9.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	97.8	0.0	11.8	141.5	0.0	0.0	92.3	58.1	25.1	40.9	57.0	57.3
LnGrp LOS	F	A	B	F	A	A	F	F	C	D	E	E
Approach Vol, veh/h		1515			102			2794			1515	
Approach Delay, s/veh		81.3			141.5			67.1			56.9	
Approach LOS		F			F			E			E	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	38.9		9.5	23.0	25.4		32.1				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	34.4		5.0	18.5	20.9		27.6				
Max Q Clear Time (g_c+I1), s	2.5	36.4		7.0	20.5	22.5		29.6				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.0		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			69.4									
HCM 6th LOS			E									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	702	1	236	0	0	0	0	2315	401	649	1012	0
Future Volume (veh/h)	702	1	236	0	0	0	0	2315	401	649	1012	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	843	0	172				0	2516	436	705	1100	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	960	0	285				0	2805	691	810	4635	0
Arrive On Green	0.18	0.00	0.18				0.00	0.44	0.44	0.23	0.72	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	843	0	172				0	2516	436	705	1100	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	13.8	0.0	9.0				0.0	32.6	19.3	17.7	5.2	0.0
Cycle Q Clear(g_c), s	13.8	0.0	9.0				0.0	32.6	19.3	17.7	5.2	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	960	0	285				0	2805	691	810	4635	0
V/C Ratio(X)	0.88	0.00	0.60				0.00	0.90	0.63	0.87	0.24	0.00
Avail Cap(c_a), veh/h	980	0	291				0	2824	696	810	4635	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.84	0.84	0.00
Uniform Delay (d), s/veh	36.0	0.0	34.0				0.0	23.5	19.8	33.1	4.2	0.0
Incr Delay (d2), s/veh	9.1	0.0	3.4				0.0	5.0	4.3	8.7	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	0.0	3.6				0.0	11.4	6.9	7.7	1.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.0	0.0	37.4				0.0	28.6	24.1	41.8	4.3	0.0
LnGrp LOS	D	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1015						2952			1805	
Approach Delay, s/veh		43.7						27.9			19.0	
Approach LOS		D						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	25.6	43.7				69.3		20.7				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	20.5	39.5				64.5		16.5				
Max Q Clear Time (g_c+I1), s	19.7	34.6				7.2		15.8				
Green Ext Time (p_c), s	0.3	4.6				8.4		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			27.9									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 1 - Short Term Interim Year + Project
1: I-5 Northbound Ramps & Sand Canyon Ave
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	461	0	626	12	0	8	304	604	33	40	2176	749
Future Volume (veh/h)	461	0	626	12	0	8	304	604	33	40	2176	749
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	501	0	680	13	0	9	330	657	36	43	2365	814
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	570	0	947	42	0	37	480	2865	889	99	2440	788
Arrive On Green	0.16	0.00	0.16	0.02	0.00	0.02	0.09	0.38	0.38	0.06	0.48	0.48
Sat Flow, veh/h	3563	0	3170	1781	0	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	501	0	680	13	0	9	330	657	36	43	2365	814
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	12.4	0.0	4.7	0.6	0.0	0.5	8.3	7.9	1.3	2.1	40.6	43.0
Cycle Q Clear(g_c), s	12.4	0.0	4.7	0.6	0.0	0.5	8.3	7.9	1.3	2.1	40.6	43.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	570	0	947	42	0	37	480	2865	889	99	2440	788
V/C Ratio(X)	0.88	0.00	0.72	0.31	0.00	0.24	0.69	0.23	0.04	0.43	0.97	1.03
Avail Cap(c_a), veh/h	570	0	947	99	0	88	480	2865	889	127	2440	788
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.96	0.96	0.96	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.0	0.0	28.2	43.2	0.0	43.2	38.9	14.8	12.7	41.1	22.9	23.5
Incr Delay (d2), s/veh	14.7	0.0	2.6	4.1	0.0	3.3	3.9	0.2	0.1	3.0	12.3	41.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	0.0	6.8	0.3	0.0	0.2	3.6	2.7	0.4	0.9	16.1	22.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.7	0.0	30.8	47.4	0.0	46.4	42.9	15.0	12.8	44.1	35.2	64.5
LnGrp LOS	D	A	C	D	A	D	D	B	B	D	D	F
Approach Vol, veh/h		1181			22			1023			3222	
Approach Delay, s/veh		39.7			47.0			23.9			42.7	
Approach LOS		D			D			C			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	55.0		6.6	17.0	47.5		18.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	46.2		5.0	9.6	43.0		14.4				
Max Q Clear Time (g_c+I1), s	4.1	9.9		2.6	10.3	45.0		14.4				
Green Ext Time (p_c), s	0.0	4.3		0.0	0.0	0.0		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			38.5									
HCM 6th LOS			D									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 1 - Short Term Interim Year + Project
3: I-5 Southbound Ramps & Sand Canyon Ave
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	311	4	911	0	0	0	0	612	131	851	2316	0
Future Volume (veh/h)	311	4	911	0	0	0	0	612	131	851	2316	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	272	0	1063				0	665	142	925	2517	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1272	0	1132				0	1420	350	941	3493	0
Arrive On Green	0.36	0.00	0.36				0.00	0.22	0.22	0.54	1.00	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	272	0	1063				0	665	142	925	2517	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	4.8	0.0	29.2				0.0	8.1	6.9	23.6	0.0	0.0
Cycle Q Clear(g_c), s	4.8	0.0	29.2				0.0	8.1	6.9	23.6	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1272	0	1132				0	1420	350	941	3493	0
V/C Ratio(X)	0.21	0.00	0.94				0.00	0.47	0.41	0.98	0.72	0.00
Avail Cap(c_a), veh/h	1294	0	1152				0	1420	350	941	3493	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.46	0.46	0.00
Uniform Delay (d), s/veh	20.1	0.0	28.0				0.0	30.5	30.0	20.3	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	14.2				0.0	1.1	3.5	16.1	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	12.6				0.0	3.0	2.7	7.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.2	0.0	42.2				0.0	31.6	33.5	36.4	0.6	0.0
LnGrp LOS	C	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1335						807			3442	
Approach Delay, s/veh		37.7						31.9			10.2	
Approach LOS		D						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	29.0	24.4				53.4		36.6				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	24.5	19.3				48.3		32.7				
Max Q Clear Time (g_c+I1), s	25.6	10.1				2.0		31.2				
Green Ext Time (p_c), s	0.0	3.0				30.8		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			19.9									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 1 - Short Term Interim + Project
1: I-5 Northbound Ramps & Sand Canyon Ave
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1126	0	270	94	0	0	717	1830	31	10	1074	310
Future Volume (veh/h)	1126	0	270	94	0	0	717	1830	31	10	1074	310
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1224	0	293	102	0	0	779	1989	34	11	1167	337
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1089	0	1585	109	114	0	672	1929	599	99	1220	394
Arrive On Green	0.31	0.00	0.31	0.06	0.00	0.00	0.06	0.12	0.12	0.06	0.24	0.24
Sat Flow, veh/h	3563	0	3170	1781	1870	0	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1224	0	293	102	0	0	779	1989	34	11	1167	337
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	1870	0	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	27.5	0.0	0.0	5.1	0.0	0.0	17.5	34.0	1.7	0.5	20.3	17.6
Cycle Q Clear(g_c), s	27.5	0.0	0.0	5.1	0.0	0.0	17.5	34.0	1.7	0.5	20.3	17.6
Prop In Lane	1.00		1.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1089	0	1585	109	114	0	672	1929	599	99	1220	394
V/C Ratio(X)	1.12	0.00	0.18	0.94	0.00	0.00	1.16	1.03	0.06	0.11	0.96	0.86
Avail Cap(c_a), veh/h	1089	0	1585	109	114	0	672	1929	599	99	1220	394
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	0.50	0.50	0.50	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.3	0.0	12.4	42.1	0.0	0.0	42.1	39.4	25.3	40.4	33.8	32.8
Incr Delay (d2), s/veh	68.2	0.0	0.1	66.4	0.0	0.0	80.4	23.3	0.1	0.5	17.3	20.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.8	0.0	1.6	4.3	0.0	0.0	15.4	19.2	0.6	0.2	9.5	8.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	99.5	0.0	12.5	108.4	0.0	0.0	122.5	62.7	25.3	40.9	51.1	53.4
LnGrp LOS	F	A	B	F	A	A	F	F	C	D	D	D
Approach Vol, veh/h		1517			102			2802			1515	
Approach Delay, s/veh		82.7			108.4			78.9			51.5	
Approach LOS		F			F			E			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	38.5		10.0	22.0	26.0		32.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	34.0		5.5	17.5	21.5		27.5				
Max Q Clear Time (g_c+I1), s	2.5	36.0		7.1	19.5	22.3		29.5				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.0		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			73.4									
HCM 6th LOS			E									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 1 - Short Term Interim + Project
3: I-5 Southbound Ramps & Sand Canyon Ave
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	704	1	236	0	0	0	0	2315	401	655	1013	0
Future Volume (veh/h)	704	1	236	0	0	0	0	2315	401	655	1013	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	845	0	172				0	2516	436	712	1101	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	961	0	285				0	2805	691	810	4634	0
Arrive On Green	0.18	0.00	0.18				0.00	0.44	0.44	0.23	0.72	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	845	0	172				0	2516	436	712	1101	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	13.9	0.0	9.0				0.0	32.6	19.3	17.9	5.2	0.0
Cycle Q Clear(g_c), s	13.9	0.0	9.0				0.0	32.6	19.3	17.9	5.2	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	961	0	285				0	2805	691	810	4634	0
V/C Ratio(X)	0.88	0.00	0.60				0.00	0.90	0.63	0.88	0.24	0.00
Avail Cap(c_a), veh/h	980	0	291				0	2824	696	810	4634	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.83	0.83	0.00
Uniform Delay (d), s/veh	36.0	0.0	34.0				0.0	23.5	19.8	33.2	4.3	0.0
Incr Delay (d2), s/veh	9.2	0.0	3.4				0.0	5.0	4.3	9.3	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	0.0	3.6				0.0	11.4	6.9	7.8	1.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.1	0.0	37.4				0.0	28.6	24.1	42.6	4.4	0.0
LnGrp LOS	D	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1017						2952			1813	
Approach Delay, s/veh		43.8						27.9			19.4	
Approach LOS		D						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	25.6	43.7				69.3		20.7				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	20.5	39.5				64.5		16.5				
Max Q Clear Time (g_c+I1), s	19.9	34.6				7.2		15.9				
Green Ext Time (p_c), s	0.2	4.6				8.4		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			28.0									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 2 - Short Term Interim Conditions

1: I-5 Northbound Ramps & Sand Canyon Ave — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	461	28	595	547	63	139	228	472	274	136	2079	749
Future Volume (veh/h)	461	28	595	547	63	139	228	472	274	136	2079	749
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	501	30	647	595	68	151	248	513	298	148	2260	814
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	566	242	409	628	540	241	281	2244	697	178	2338	755
Arrive On Green	0.16	0.13	0.13	0.18	0.15	0.15	0.08	0.44	0.44	0.10	0.46	0.46
Sat Flow, veh/h	3563	1870	3170	3456	3554	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	501	30	647	595	68	151	248	513	298	148	2260	814
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1728	1777	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	16.5	1.7	15.5	20.4	2.0	10.7	8.5	7.5	8.4	9.8	51.7	31.2
Cycle Q Clear(g_c), s	16.5	1.7	15.5	20.4	2.0	10.7	8.5	7.5	8.4	9.8	51.7	31.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	566	242	409	628	540	241	281	2244	697	178	2338	755
V/C Ratio(X)	0.89	0.12	1.58	0.95	0.13	0.63	0.88	0.23	0.43	0.83	0.97	1.08
Avail Cap(c_a), veh/h	626	242	409	628	540	241	281	2244	697	270	2340	756
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.4	46.2	52.3	48.5	44.0	47.7	54.6	21.0	6.8	53.0	31.6	10.5
Incr Delay (d2), s/veh	13.4	0.2	272.5	23.8	0.1	5.1	26.5	0.2	1.9	12.6	12.2	55.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	0.8	21.7	10.9	0.9	4.6	4.6	2.8	3.1	4.8	21.7	22.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.7	46.5	324.8	72.3	44.1	52.8	81.0	21.2	8.7	65.7	43.9	66.4
LnGrp LOS	E	D	F	E	D	D	F	C	A	E	D	F
Approach Vol, veh/h		1178			814			1059			3222	
Approach Delay, s/veh		206.2			66.3			31.7			50.6	
Approach LOS		F			E			C			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	16.5	57.2	26.3	20.0	14.2	59.5	23.6	22.7				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	18.2	46.5	21.8	15.5	9.7	55.0	21.1	16.2				
Max Q Clear Time (g_c+I1), s	11.8	10.4	22.4	17.5	10.5	53.7	18.5	12.7				
Green Ext Time (p_c), s	0.2	4.3	0.0	0.0	0.0	1.3	0.5	0.3				
Intersection Summary												
HCM 6th Ctrl Delay			78.7									
HCM 6th LOS			E									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 2 - Short Term Interim Conditions

3: I-5 Southbound Ramps & Sand Canyon Ave — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	305	4	911	0	0	0	0	611	131	844	2314	0
Future Volume (veh/h)	305	4	911	0	0	0	0	611	131	844	2314	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	267	0	1062				0	664	142	917	2515	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1270	0	1130				0	1424	351	941	3498	0
Arrive On Green	0.36	0.00	0.36				0.00	0.22	0.22	0.27	0.54	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	267	0	1062				0	664	142	917	2515	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	4.7	0.0	29.2				0.0	8.1	6.9	23.7	26.4	0.0
Cycle Q Clear(g_c), s	4.7	0.0	29.2				0.0	8.1	6.9	23.7	26.4	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1270	0	1130				0	1424	351	941	3498	0
V/C Ratio(X)	0.21	0.00	0.94				0.00	0.47	0.40	0.97	0.72	0.00
Avail Cap(c_a), veh/h	1290	0	1148				0	1424	351	941	3498	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	20.2	0.0	28.0				0.0	30.4	30.0	32.4	15.4	0.0
Incr Delay (d2), s/veh	0.1	0.0	14.4				0.0	1.1	3.4	23.3	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	12.6				0.0	3.0	2.7	11.9	8.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.2	0.0	42.4				0.0	31.5	33.4	55.7	16.7	0.0
LnGrp LOS	C	A	D				A	C	C	E	B	A
Approach Vol, veh/h		1329						806			3432	
Approach Delay, s/veh		38.0						31.9			27.1	
Approach LOS		D						C			C	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	29.0	24.4				53.4		36.6				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	24.5	19.4				48.4		32.6				
Max Q Clear Time (g_c+I1), s	25.7	10.1				28.4		31.2				
Green Ext Time (p_c), s	0.0	3.0				16.3		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			30.4									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 2 - Short Term Interim Conditions

1: I-5 Northbound Ramps & Sand Canyon Ave — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1126	40	228	581	56	145	653	1684	705	171	913	310
Future Volume (veh/h)	1126	40	228	581	56	145	653	1684	705	171	913	310
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1224	43	248	632	61	158	710	1830	766	186	992	337
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1182	137	232	1054	165	73	745	1806	561	186	1239	400
Arrive On Green	0.33	0.07	0.07	0.31	0.05	0.05	0.22	0.35	0.35	0.10	0.24	0.24
Sat Flow, veh/h	3563	1870	3170	3456	3554	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1224	43	248	632	61	158	710	1830	766	186	992	337
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1728	1777	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	36.5	2.4	5.5	17.1	1.8	4.1	22.3	38.9	38.9	11.5	20.1	21.4
Cycle Q Clear(g_c), s	36.5	2.4	5.5	17.1	1.8	4.1	22.3	38.9	38.9	11.5	20.1	21.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1182	137	232	1054	165	73	745	1806	561	186	1239	400
V/C Ratio(X)	1.04	0.31	1.07	0.60	0.37	2.15	0.95	1.01	1.37	1.00	0.80	0.84
Avail Cap(c_a), veh/h	1182	221	375	1054	165	73	745	1806	561	186	1239	400
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.8	48.4	23.5	32.5	50.9	34.0	42.6	35.5	35.5	49.2	39.1	39.6
Incr Delay (d2), s/veh	35.8	1.3	60.3	0.9	1.4	559.8	22.3	24.6	176.2	65.6	5.5	19.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.6	1.2	5.1	7.3	0.9	13.4	11.2	18.8	42.2	8.2	8.5	10.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	72.5	49.7	83.8	33.5	52.3	593.8	64.9	60.1	211.7	114.8	44.6	58.6
LnGrp LOS	F	D	F	C	D	F	E	F	F	F	D	E
Approach Vol, veh/h		1515			851			3306			1515	
Approach Delay, s/veh		73.7			138.8			96.3			56.4	
Approach LOS		E			F			F			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	16.0	43.4	38.1	12.5	28.2	31.2	41.0	9.6				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	11.5	38.9	28.6	13.0	23.7	26.7	36.5	5.1				
Max Q Clear Time (g_c+I1), s	13.5	40.9	19.1	7.5	24.3	23.4	38.5	6.1				
Green Ext Time (p_c), s	0.0	0.0	1.8	0.6	0.0	2.1	0.0	0.0				
Intersection Summary												
HCM 6th Ctrl Delay			88.1									
HCM 6th LOS			F									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary — Alternative 2 - Short Term Interim Conditions

3: I-5 Southbound Ramps & Sand Canyon Ave — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	702	1	236	0	0	0	0	2315	401	649	1012	0
Future Volume (veh/h)	702	1	236	0	0	0	0	2315	401	649	1012	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	843	0	172				0	2516	436	705	1100	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	988	0	293				0	2811	692	883	4718	0
Arrive On Green	0.18	0.00	0.18				0.00	0.44	0.44	0.26	0.73	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	843	0	172				0	2516	436	705	1100	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	16.8	0.0	10.9				0.0	39.8	23.5	21.0	6.1	0.0
Cycle Q Clear(g_c), s	16.8	0.0	10.9				0.0	39.8	23.5	21.0	6.1	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	988	0	293				0	2811	692	883	4718	0
V/C Ratio(X)	0.85	0.00	0.59				0.00	0.90	0.63	0.80	0.23	0.00
Avail Cap(c_a), veh/h	1093	0	324				0	2837	699	883	4718	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	43.4	0.0	41.0				0.0	28.6	24.1	38.3	4.7	0.0
Incr Delay (d2), s/veh	6.2	0.0	2.3				0.0	4.9	4.3	5.2	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	0.0	4.4				0.0	14.6	8.8	8.9	1.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.6	0.0	43.3				0.0	33.6	28.4	43.5	4.8	0.0
LnGrp LOS	D	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1015						2952			1805	
Approach Delay, s/veh		48.5						32.8			20.0	
Approach LOS		D						C			B	
Timer - Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	32.6	52.6				85.2		24.8				
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5				
Max Green Setting (Gmax), s	25.5	48.5				78.5		22.5				
Max Q Clear Time (g_c+I1), s	23.0	41.8				8.1		18.8				
Green Ext Time (p_c), s	0.7	6.3				8.4		1.6				
Intersection Summary												
HCM 6th Ctrl Delay			31.6									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
1: I-5 Northbound Ramps & Sand Canyon Ave

02/02/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	461	32	595	557	76	140	228	472	281	136	2079	749
Future Volume (veh/h)	461	32	595	557	76	140	228	472	281	136	2079	749
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	501	35	647	605	83	152	248	513	305	148	2260	814
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	575	260	441	659	599	267	233	2146	666	178	2310	746
Arrive On Green	0.16	0.14	0.14	0.19	0.17	0.17	0.07	0.42	0.42	0.10	0.45	0.45
Sat Flow, veh/h	3563	1870	3170	3456	3554	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	501	35	647	605	83	152	248	513	305	148	2260	814
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1728	1777	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	16.5	2.0	16.7	20.6	2.4	10.6	8.1	7.8	9.0	9.8	52.2	30.9
Cycle Q Clear(g_c), s	16.5	2.0	16.7	20.6	2.4	10.6	8.1	7.8	9.0	9.8	52.2	30.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	575	260	441	659	599	267	233	2146	666	178	2310	746
V/C Ratio(X)	0.87	0.13	1.47	0.92	0.14	0.57	1.06	0.24	0.46	0.83	0.98	1.09
Avail Cap(c_a), veh/h	689	260	441	680	599	267	233	2146	666	270	2311	746
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.1	45.3	51.7	47.6	42.5	45.9	55.9	22.4	7.3	53.0	32.3	10.6
Incr Delay (d2), s/veh	10.3	0.2	222.1	17.2	0.1	2.8	76.5	0.3	2.3	12.6	14.3	60.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.2	0.9	20.3	10.5	1.1	4.4	5.9	3.0	3.4	4.8	22.3	23.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.4	45.5	273.7	64.8	42.6	48.7	132.4	22.7	9.6	65.7	46.5	71.3
LnGrp LOS	E	D	F	E	D	D	F	C	A	E	D	F
Approach Vol, veh/h		1183			840			1066			3222	
Approach Delay, s/veh		176.2			59.7			44.5			53.7	
Approach LOS		F			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.5	54.9	27.4	21.2	12.6	58.8	23.9	24.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	18.2	43.5	23.6	16.7	7.4	54.3	23.2	17.1
Max Q Clear Time (g_c+I1), s	11.8	11.0	22.6	18.7	10.1	54.2	18.5	12.6
Green Ext Time (p_c), s	0.2	4.3	0.3	0.0	0.0	0.1	0.9	0.4

Intersection Summary	
HCM 6th Ctrl Delay	75.9
HCM 6th LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: I-5 Southbound Ramps & Sand Canyon Ave

02/02/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	311	4	911	0	0	0	0	612	131	851	2316	0
Future Volume (veh/h)	311	4	911	0	0	0	0	612	131	851	2316	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	272	0	1063				0	665	142	925	2517	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	1322	0	1176				0	1474	363	993	3564	0
Arrive On Green	0.37	0.00	0.37				0.00	0.23	0.23	0.29	0.55	0.00
Sat Flow, veh/h	3563	0	3170				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	272	0	1063				0	665	142	925	2517	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	6.2	0.0	38.1				0.0	10.7	9.1	31.3	34.4	0.0
Cycle Q Clear(g_c), s	6.2	0.0	38.1				0.0	10.7	9.1	31.3	34.4	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1322	0	1176				0	1474	363	993	3564	0
V/C Ratio(X)	0.21	0.00	0.90				0.00	0.45	0.39	0.93	0.71	0.00
Avail Cap(c_a), veh/h	1499	0	1334				0	1474	363	1051	3564	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	25.7	0.0	35.7				0.0	39.8	39.2	41.6	19.6	0.0
Incr Delay (d2), s/veh	0.1	0.0	8.2				0.0	1.0	3.1	13.8	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	15.6				0.0	4.1	3.7	14.4	11.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.8	0.0	43.9				0.0	40.8	42.3	55.4	20.8	0.0
LnGrp LOS	C	A	D				A	D	D	E	C	A
Approach Vol, veh/h		1335						807			3442	
Approach Delay, s/veh		40.2						41.0			30.1	
Approach LOS		D						D			C	

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	39.0	32.0				71.0		49.0
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	36.5	19.5				60.5		50.5
Max Q Clear Time (g_c+I1), s	33.3	12.7				36.4		40.1
Green Ext Time (p_c), s	1.2	2.5				19.0		4.4

Intersection Summary	
HCM 6th Ctrl Delay	34.1
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary Alternative 2 - Short Term Interim Conditions + Project
1: I-5 Northbound Ramps & Sand Canyon Ave

PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1126	41	228	587	64	146	653	1684	707	171	913	310
Future Volume (veh/h)	1126	41	228	587	64	146	653	1684	707	171	913	310
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1945
Adj Flow Rate, veh/h	1224	45	248	638	70	159	710	1830	768	186	992	337
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1182	137	232	1054	165	73	745	1806	561	186	1239	400
Arrive On Green	0.33	0.07	0.07	0.30	0.05	0.05	0.22	0.35	0.35	0.10	0.24	0.24
Sat Flow, veh/h	3563	1870	3170	3456	3554	1585	3456	5106	1585	1781	5106	1648
Grp Volume(v), veh/h	1224	45	248	638	70	159	710	1830	768	186	992	337
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1728	1777	1585	1728	1702	1585	1781	1702	1648
Q Serve(g_s), s	36.5	2.5	5.5	17.3	2.1	4.1	22.3	38.9	38.9	11.5	20.1	21.4
Cycle Q Clear(g_c), s	36.5	2.5	5.5	17.3	2.1	4.1	22.3	38.9	38.9	11.5	20.1	21.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	1182	137	232	1054	165	73	745	1806	561	186	1239	400
V/C Ratio(X)	1.04	0.33	1.07	0.61	0.42	2.16	0.95	1.01	1.37	1.00	0.80	0.84
Avail Cap(c_a), veh/h	1182	221	375	1054	165	73	745	1806	561	186	1239	400
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.8	48.4	23.5	32.6	51.0	34.0	42.6	35.5	35.5	49.2	39.1	39.6
Incr Delay (d2), s/veh	35.8	1.4	59.6	1.0	1.7	565.8	22.3	24.6	177.7	65.6	5.5	19.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.6	1.2	5.1	7.4	1.0	13.6	11.2	18.8	42.5	8.2	8.5	10.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	72.5	49.8	83.1	33.6	52.8	599.7	64.9	60.1	213.2	114.8	44.6	58.6
LnGrp LOS	F	D	F	C	D	F	E	F	F	F	D	E
Approach Vol, veh/h		1517			867			3308			1515	
Approach Delay, s/veh		73.6			139.0			96.7			56.4	
Approach LOS		E			F			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	43.4	38.0	12.6	28.2	31.2	41.0	9.6
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	11.5	38.9	28.6	13.0	23.7	26.7	36.5	5.1
Max Q Clear Time (g_c+I1), s	13.5	40.9	19.3	7.5	24.3	23.4	38.5	6.1
Green Ext Time (p_c), s	0.0	0.0	1.8	0.6	0.0	2.1	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	88.4
HCM 6th LOS	F

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary Alternative 2 - Short Term Interim Conditions + Project
3: I-5 Southbound Ramps & Sand Canyon Ave

PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	704	1	236	0	0	0	0	2315	401	655	1013	0
Future Volume (veh/h)	704	1	236	0	0	0	0	2315	401	655	1013	0
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No						No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870				0	1870	1870	1870	1870	0
Adj Flow Rate, veh/h	845	0	172				0	2516	436	712	1101	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	990	0	294				0	2811	692	882	4716	0
Arrive On Green	0.19	0.00	0.19				0.00	0.44	0.44	0.26	0.73	0.00
Sat Flow, veh/h	5344	0	1585				0	6696	1585	3456	6696	0
Grp Volume(v), veh/h	845	0	172				0	2516	436	712	1101	0
Grp Sat Flow(s),veh/h/ln	1781	0	1585				0	1609	1585	1728	1609	0
Q Serve(g_s), s	16.8	0.0	10.9				0.0	39.8	23.5	21.3	6.1	0.0
Cycle Q Clear(g_c), s	16.8	0.0	10.9				0.0	39.8	23.5	21.3	6.1	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	990	0	294				0	2811	692	882	4716	0
V/C Ratio(X)	0.85	0.00	0.59				0.00	0.90	0.63	0.81	0.23	0.00
Avail Cap(c_a), veh/h	1093	0	324				0	2837	699	882	4716	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	43.4	0.0	41.0				0.0	28.6	24.1	38.4	4.7	0.0
Incr Delay (d2), s/veh	6.2	0.0	2.3				0.0	4.9	4.3	5.6	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.9	0.0	4.4				0.0	14.6	8.8	9.1	1.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.6	0.0	43.2				0.0	33.6	28.4	44.0	4.8	0.0
LnGrp LOS	D	A	D				A	C	C	D	A	A
Approach Vol, veh/h		1017						2952			1813	
Approach Delay, s/veh		48.5						32.8			20.2	
Approach LOS		D						C			C	

Timer - Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	32.6	52.6				85.1		24.9
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	25.5	48.5				78.5		22.5
Max Q Clear Time (g_c+I1), s	23.3	41.8				8.1		18.8
Green Ext Time (p_c), s	0.7	6.3				8.4		1.5

Intersection Summary	
HCM 6th Ctrl Delay	31.6
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

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