

PHYSICAL ENVIRONMENT

2.8 Hydrology and Floodplains

2.8.1 Regulatory Setting

Executive Order (EO) 11988 (Floodplain Management) directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only practicable alternative. The Federal Highway Administration (FHWA) requirements for compliance are outlined in 23 Code of Federal Regulations (CFR) 650 Subpart A.

To comply, the following must be analyzed:

- The practicability of alternatives to any longitudinal encroachments.
- Risks of the action.
- Impacts on natural and beneficial floodplain values.
- Support of incompatible floodplain development.
- Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values affected by the project.

The base floodplain is defined as “the area subject to flooding by the flood or tide having a one percent chance of being exceeded in any given year.” An encroachment is defined as “an action within the limits of the base floodplain.”

2.8.2 Affected Environment

This section is based on the *Location Hydraulic Study* (2017) and the *Water Quality Assessment Report* (2017) prepared for the proposed project.

2.8.2.1 Regional Hydrology

The Study Area is located in the San Diego Creek/Newport Bay Watershed, which encompasses approximately 154 square miles in the Cities of Irvine and Tustin and parts of the Cities of Lake Forest, Santa Ana, and Costa Mesa, and incorporated areas of Orange County. The watershed is geographically bound by the Santa Ana Mountains to the east and the San Joaquin Hills to the west and southwest.

Drainage channels in the Study Area, from north to south, include the El Modena-Irvine Channel, the Peters Canyon Wash, the Central Irvine Channel, the Marshburn Channel, the Bee Canyon Wash, and the Agua Chinon Wash. All of these channels drain to San Diego Creek Reach 1, which ultimately discharges to the Upper Newport Bay, Lower Newport Bay, and eventually to the Pacific Ocean.

2.8.2.2 100-Year Floodplains

There are several 100-year floodplains within the Study Area as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Nos. 06059C0283J, 06059C0281J, 06059C0284J, 06059C0292J, 06059C0315J, and 06059C0313J. Portions of the Study Area are in special flood hazard areas Zone A and Zone AH, which are areas in the 100-year floodplain. Specifically, areas designated Zone A are subject to flooding by the 1 percent annual chance flood (100-year flood) with no base flood elevations or flood depths because detailed hydraulic analyses have not been performed. Areas designated as Zone AH are subject to flooding by the 100-year flood with average flood depths between 1 and 3 ft (ft). There are also portions of the Study Area that are located in 500-year Zone X, which consists of areas outside of the 100-year flood but within the 0.2 percent annual chance floodplain (500-year flood). The FEMA FIRMs are included in Appendix I (December 3, 2009). The floodplains are described in further detail below.

El Modena-Irvine Channel

The El Modena-Irvine Channel originates north of the State Route 261 (SR-261)/ Interstate 5 (I-5) interchange at the base of the Santa Ana Mountains and flows south via a concrete channel that crosses I-5 south of Tustin Ranch Road and connects to Peters Canyon Wash approximately 0.5 mile (mi) south of the Study Area.

The portion of the channel within the Study Area is classified as a 100-year Flood Hazard Zone A. There is also a 70-acre (ac) Zone AH area located north of the channel before it passes under I-5. Other areas around the channel are in 500-year Floodplain Hazard Zone X. This portion corresponds to FIRM panels 06059C0283J and 06059C0281J.

The existing I-5 Bridge over the El Modena-Irvine Channel (Bridge No. 55-0655) is a pair of single-span structures. The bridge is supported by open-ended reinforced-concrete seated abutments, all on driven reinforced-concrete piles. The existing FEMA FIRM map shows flooding occurring on northbound I-5 and adjacent properties during the 100-year flood (shown as Zone AE on FIRM panel 06059C0281J). Although the as-built plans are up to date for this crossing, the Bridge Soffit Elevation is not shown and FEMA FIRMs are likely out of date and do not reflect reconstruction of the channel and bridge, which included raising the bridge deck, in 1990 or 1991. A field survey was conducted for the project to verify the current configuration of the El Modena – Irvine bridge and channel. The bridge is currently built over the channel while the FEMA FIRMS are based on the low chord

of the bridge being within the channel. In addition, the channel depth at this location was measured to be 13.0 ft while the as-built plans describe it to be a 9.2 ft clearance. Hydraulic modeling was conducted for the proposed project to reflect the current configuration of the bridge and channel. Unlike the FEMA FIRM, which likely do not reflect the current bridge and channel configuration, the modeling conducted for the project indicates that the 100-year flood would be contained within the channel which further confirms that the FEMA FIRM maps are outdated. However, there is still a potential that the existing bridge may not meet the Orange County Public Works (OCPW) freeboard¹ requirements of 1.5 ft for a non-leveed channel with a design frequency of 100-years.

Peters Canyon Wash

The Peters Canyon Wash originates at the base of the Santa Ana Mountains northeast of I-5. The channel flows south via a concrete channel, crosses under I-5 south of the SR-261/I-5 interchange, and flows into San Diego Creek south of the Study Area. Part of the channel on the southern side of I-5 has an earthen bottom and vegetation. The portion of the channel in the Study Area is in 100-year Flood Hazard Zone A. Other areas around the channel are in 500-year Flood Hazard Zone X. The portion of the channel within the Study Area corresponds to FIRM panels 06059C0281J and 06059C0283J. The FIRM panel and hydraulic modeling conducted for the proposed project shows that the 100-year flood is contained within the channel.

The existing Peters Canyon Wash Bridge (Bridge No. 55-0663) crossing I-5 is a pair of single-span structures. One bridge supports northbound I-5 and the other supports southbound I-5. The bridge is supported by open-end seated abutments, all on driven reinforced-concrete piles. The existing bridge meets the OCPW freeboard requirement of 1.5 ft² for a non-leveed channel with a design frequency of 100-years.

Central Irvine Channel

The Central Irvine Channel originates northeast of the I-5 and Jeffrey Road interchange in the City of Irvine. It is roughly 24 ft wide and is located roughly 2 ft northeast of the existing I-5 right-of-way. The channel flows along Jeffery Road and Trabuco Road and connects to Peters Canyon Wash underneath I-5 at the Peters Canyon Bridge (Bridge No. 55-0663). The portion of the channel in the Study Area is in the 500-year Flood Hazard Zone X and corresponds to FIRM panels 06059C0283J

¹ Freeboard is the distance between the flood elevation and the deck of the bridge

and 06059C0284J. The FIRM panel shows that the 500-year flood is contained within the channel.

Marshburn Channel

The Marshburn Channel originates northeast of the I-5/State Route 133 (SR-133) interchange at the base of the Santa Ana Mountains. The channel flows south in a concrete channel and crosses under I-5 in reinforced-concrete boxes and pipes at the SR-133/I-5 interchange. The channel flows into the San Diego Creek south of the Study Area.

The portion of the channel located in the Study Area is in 100-year Flood Hazard Zone A. Additionally, there is a 20 ac area located in 100-year Flood Hazard Zone A southeast of where the channel traverses I-5. Other areas around the channel are in 500-year Flood Hazard Zone X. The portion of the channel within the Study Area corresponds to FIRM panels 06059C0292J and 06059C0315J. The FIRM panels show that a 100-year flood would be contained within the channel.

Bee Canyon Wash

Bee Canyon Wash originates northeast of the I-5 and SR-133 interchange at the base of the Santa Ana Mountains and flows south into San Diego Creek. The portion of the Bee Canyon Wash in the southwest portion of the Study Area is in 100-year Flood Hazard Zone A. The portion of the channel that passes under the I-5 is in 500-year Flood Hazard Zone X. Bee Canyon Wash, which is located between Barranca Parkway and the OCTA Metrolink railroad tracks on the north side of I-5 and which is approximately 80 ac in size, is in 500-year Flood Hazard Zone X. The portion of the channel within the Study Area corresponds to FIRM panels 06059C0292J and 06059C0315J. The FIRM panels show that a 100-year flood would be contained within the channel.

Agua Chinon Wash

The Agua Chinon Wash originates northeast of the I-5 and Alton Parkway interchange at the base of the Santa Ana Mountains and flows south into San Diego Creek. Agua Chinon Wash crosses underneath I-5 south of Alton Parkway in the City of Irvine. The channel is concrete-lined and crosses under I-5 in a reinforced-concrete box culvert and flows directly into the San Diego Creek. The portion of Agua Chinon Wash in the Study Area is in 100-year Flood Hazard Zone A, contained in a culvert. This portion corresponds to FIRM panels 06059C0313J and 06059C0315J. The FIRM panels show that a 100-year flood would be contained within the culvert.

2.8.2.3 Natural and Beneficial Floodplain Values

Floodplains in their natural or relatively undisturbed state provide natural and beneficial floodplain values including, but not limited to, fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge. The values fall into three main categories including water resource values (e.g., natural moderation of floods, water quality maintenance, and groundwater recharge), living resource values (e.g., fish, wildlife, and plant species), and cultural resource values (e.g., open space, archaeological, historical natural beauty, scientific study, outdoor education, and recreation).

Channels crossed by the Build Alternative are disturbed, and floodplains are not in a natural state within the Study Area with the exception of Peters Canyon Wash. Peters Canyon Wash contains wetland vegetation in an earthen-bottomed channel for reaches south of the I-5 bridge crossing. According to the *Natural Environment Study* (April 2017) and the *Jurisdictional Delineation Report* (February 2017) prepared for the project, potential United States Army Corps of Engineers (Corps) jurisdictional wetlands and non-wetlands and California Department of Fish and Wildlife (CDFW) jurisdictional areas are present within channels in the Study Area.

Wetlands and other potential jurisdictional waters have functions and values that provide water resource, cultural resource, and living resource values. Water resource functions and values include hydrologic regime, flood storage and flood flow modification, sediment retention, nutrient retention and transformation, and toxicant trapping. Cultural resource functions and values include social significance. Living resource functions and values include wildlife habitat and aquatic habitat. According to the *Jurisdictional Delineation Report* (February 2017), all channels, with the exception of Peters Canyon Wash, are concrete with little or no vegetation; therefore, the value for water resources and living resources is low. Because of the natural bed and wetland areas, Peters Canyon Wash provides low hydrologic regime value; moderate storage and flood flow modification, toxicant trapping, and social significance values; and high sediment retention, nutrient retention and transformation, wildlife habitat, and aquatic habitat values.

Beneficial uses of surface waters are identified in the *Water Quality Control Plan for the Santa Ana River Basin* (Santa Ana Regional Water Quality Control Board [RWQCB], 1995) as various ways that water can be used for the benefit of people and/or wildlife. Surface water resource intermittent beneficial uses of El Modena-

Irvine Channel, Peters Canyon Wash, Central Irvine Channel, Bee Canyon Wash, and the Agua Chinon Wash include Groundwater Recharge (GWR), Water Contact Recreation (REC-1), Noncontact Water Recreation (REC-2), Warm Freshwater Habitat (WARM), and Wildlife Habitat (WILD). Marshburn Channel has intermittent beneficial uses including preservation of biological habitats of special significance (BIOL); contact water recreation (REC-1); non-contact water recreation (REC-2); wildlife habitat (WILD); commercial and sport fishing (COMM); estuarine habitat (EST); marine habitat (MAR); shellfish harvesting (SHEL); spawning or early development areas for aquatic organisms (SPWN); and habitat for rare, threatened, or endangered species (RARE).

In addition to the values listed above, some channels provide cultural resource value. The only channel within the Study Area that provides beneficial cultural resource value is Peters Canyon Wash. This channel provides aesthetic and recreational beneficial values because it contains a trail and has a partially natural streambed. The Peters Canyon Regional Trail and Bikeway is a multi-use recreational trail that parallels the west side of Peters Canyon Wash within the project area. The Peters Canyon Wash floodplain wetland area is an aesthetic component that enhances the enjoyment of users of the Peters Canyon Regional Trail and Bikeway. Because the Peters Canyon Wash floodplain contributes to the recreational uses in the area, the floodplain is considered to have cultural resource values.

2.8.3 Environmental Consequences

A discussion of the temporary and permanent impacts associated with Alternative 2A, Alternative 2B (Preferred Alternative), and the No Build Alternative is included below. Alternative 2A and 2B are analyzed simultaneously because the alignment of each alternative is similar to the other and would impact similar floodplains and floodplain values. Option 3 is also outside the 100-year floodplain limits in an Unshaded Zone X and therefore, was not analyzed in the *Location Hydraulic Study* (2017).

2.8.3.1 Temporary Impacts

Build Alternative (Alternative 2A and Alternative 2B [Preferred Alternative])

During construction of the Build Alternative, construction activities would occur in the El Modena-Irvine Channel and the Peters Canyon Wash; and near Central Irvine Channel, Marshburn Channel, Bee Canyon Wash, and Agua Chinon Wash.

Temporary construction impacts related to grading activities, construction of travel lanes, road-widening improvements to on-/off-ramps and bridges, and diversion of drainage channel flows could result in the introduction of pollutants of concern to floodplain areas within the Study Area. Pollutants of concern during construction include sediments, trash, petroleum products, concrete waste, sanitary waste, and chemicals. These substances could enter receiving water bodies and reduce the function of beneficial uses in the floodplains during construction by degrading water quality.

All drainages in the Study Area crossed by I-5, with the exception of a downstream portion of Peters Canyon Wash, are concrete-lined with little or no vegetation; therefore, the functions and values of these waters are low. The Peters Canyon Wash features beneficial floodplain values that have the potential to be degraded by the introduction of pollutants of concern from construction activities. All of the receiving waters in the Study Area have beneficial uses designated by the Santa Ana RWQCB. Construction activities associated with the Build Alternative has the potential to result in indirect impacts to the functions and values of Peters Canyon Wash and downstream receiving waters and to the beneficial uses of all receiving waters in the Study Area through degradation of water quality.

The wetland area in Peters Canyon Wash would also have potential for minor indirect impacts during construction activities associated with the widening of the bridge over the channel. Disturbance of wetland vegetation or introduction of sediment or pollutants into the water in the wetland would result in impacts to water resource values and living resource value provided by the wetland. Additionally, land and vegetation would be cleared, exposing soil to the potential for erosion and the downstream transport of sediments to occur.

The existing Peters Canyon Regional Trail and Bikeway would remain open during and after the new bridge construction in its current location with intermittent closures for work occurring in the channel. During construction, the recreational and aesthetic resource value of the bike path would be degraded by the presence of construction equipment and pollutants of concern in the Peters Canyon Wash that would reduce the natural aesthetics of the wetland areas. Potential impacts to the aesthetic resource values of the trail and channel function would be restored after the completion of construction.

Impacts to beneficial floodplain values created by construction activities in the Peters Canyon Wash would be addressed during construction through biological surveys and monitoring features as described in Project Features PF-BIO-1, PF-BIO-2, PF-BIO-3, PF-BIO-4, and PF-BIO-5 in Section 2.15.3.1. The purpose of these project features is to identify environmentally sensitive areas and oversee construction activities to address incidental disturbance of habitat and Covered Species inside and outside of the Study Area. Restoration of natural habitat disturbed during construction is also included in these project features.

In addition, under the Construction General Permit, the Build Alternative would also be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) and implement construction Best Management Practices (BMPs) aimed at reducing pollutants of concern in storm water runoff. The construction BMPs would include Erosion Control, Sediment Control, and Good Housekeeping BMPs designed to minimize erosion, retain sediment on site, and prevent spills. These actions are described in Project Feature PF-WQ-1 in Section 2.9.3.1 of Section 2.9, Water Quality and Storm Water Runoff. With the inclusion of this project feature, the temporary impacts to beneficial floodplain values would not be adverse.

No Build Alternative (Alternative 1)

The No Build Alternative would not include the construction of any of the proposed project improvements. Therefore, the No Build Alternative would not result in temporary impacts to hydrology and floodplains in the Study Area.

2.8.3.2 Permanent Impacts

Build Alternative (Alternative 2A and Alternative 2B [Preferred Alternative])

Hydraulic Analysis

Hydraulic impacts were analyzed at six locations in the existing facilities that are part of the proposed improvements. Five of the locations are along El Modena-Irvine, Peters Canyon, Marshburn, Bee Canyon, and Agua Chinon Washes as they traverse under I-5, and one location is along Central Irvine Channel as it traverses parallel to I-5.

Improvements to the I-5 Bridge over the El Modena-Irvine Channel would consist of widening the bridge above the channel and widening abutments outside the channel lining. No additional piles or other forms of channel restricting structures would be constructed within the channel. The Build Alternative would increase surface water

elevation by less than 0.1 ft, which would not exceed the FEMA threshold of a 1ft increase in base flood elevation. Additionally, hydraulic modeling shows that 100-year storm flows would be contained within the channel. However, as discussed previously, the FEMA FIRM maps and as-built plans are out of date and do not reflect the current configuration of the bridge and channel. Although the bridge deck was raised in 1990 or 1991, a detailed survey of the bridge soffit and channel would be conducted during final design to verify the existing condition.

Improvements to the I-5 Bridge over Peters Canyon Wash would consist of the widening of the bridge and abutment structures outside of the channel lining and extension of the pier wall in the center of the channel on the west side. No additional new piles or other forms of channel-restricting structures would be constructed within the channel. The I-5 Bridge over Peters Canyon Wash would continue to meet minimum OCPW freeboard requirements. The Build Alternative would increase the water surface elevation by less than 0.1 ft for the Build Alternative, which would not exceed the FEMA threshold of a 1 ft increase in base flood elevation.

The Build Alternative would require the Central Irvine Channel reinforced-concrete box to be extended at its confluence with Peters Canyon Wash to support the widened I-5 crossing. Under Alternative 2A, the channel would be lengthened by approximately 22 ft, and under Alternative 2B, it would be lengthened by approximately 18 ft. The I-5 Bridge over Peters Canyon Wash, at the point where there is confluence with the Central Irvine Channel, would continue to meet minimum OCPW freeboard requirements. The extension of the channel would not reduce the ability of the channel to convey the flood flow as the channel would only be extended and not change in size or shape. The base flood elevation would not increase more than 0.1 ft, which would be less than the FEMA-designated threshold of 1 ft increase in base flood elevation.

I-5 crosses over the Marshburn Channel while it traverses through concrete boxes and pipes. The Build Alternative would not affect or encroach upon the existing channel, and no change in surface elevation would occur as a result of the Build Alternative.

The Bee Canyon Wash crosses under I-5 within a culvert. The upstream opening of the channel is within the Study Area, and the Build Alternative would extend the reinforced culvert, moving the culvert opening further upstream. The culvert extension would result in less than a 0.2 ft change in water surface elevation for the

Build Alternative, which would be lower than the FEMA-designated threshold of 1 ft increase in base flood elevation.

The Agua Chinon Wash passes underneath I-5 in a culvert with exposed sections upstream and downstream outside the boundaries of the Build Alternative. The Build Alternative would not affect or encroach upon the existing channel, and no change in surface elevation would occur as a result of the Build Alternative.

In summary, there would be a minimal change in water surface elevation, base flood elevations, and base flood flow volumes and rates in the channels impacted by the Build Alternative. There is low potential for overtopping as a result of construction of the Build Alternative. The increase base flood elevation would be minimal (less than 0.2 ft) and would be below the FEMA requirements of 1 ft and flood flows would continue to be contained within the channels. Additionally, hydraulic modeling confirmed that the OCPW bridge freeboard requirement would be met at all locations with the exception of the El Modena-Irvine Channel. The freeboard of the El Modena-Irvine Channel could not be verified because the as-built plans and FEMA FIRM maps are outdated. Freeboard for this bridge will be verified during final design based on a detailed survey of the bridge and channel. The floodplains for the six channels would remain within the channel lining for the Build Alternative, and improvements associated with the Build Alternative would result in minimal floodplain encroachments. The project would not create an adverse effect on channel hydraulics, and no mitigation would be needed to reduce effects.

100-Year Floodplain Encroachment

Potential Risk from Longitudinal Encroachment

Encroachments, as defined by FEMA, are activities or construction within the floodway including fill, new construction, substantial improvements, and other development. A longitudinal encroachment is an encroachment that is oriented parallel to the direction of flow. A transverse encroachment is an encroachment that is perpendicular or skewed to the direction of flow. The bridges do not traverse over the channels parallel to the flow; therefore, there are no longitudinal encroachments.

Potential Risk to Life and Property

The Build Alternative does not propose any improvements that would change channel hydraulics or increase risk of flooding and inundation to residences, businesses, or other buildings. Water surface elevation would change minimally

and waters would remain within their respective channels. Additionally, the Build Alternative would not alter existing flood sources and would not result in traffic disruptions during flood conditions. Therefore, there would be no potential risk to life and property created by the Build Alternative.

Potential Risk to Natural and Beneficial Floodplain Values

Channel conveyance is unchanged for all channels within the project boundaries and, therefore, any downstream beneficial uses or floodplain values, including groundwater recharge and wildlife, will still be served with the implementation of the Build Alternative.

During operations of the Build Alternative, a substantial increase in pollutant load is not expected to occur and BMPs would be included in the project to capture and treat stormwater runoff before it reaches drainages. Therefore, no operational impacts to channel areas are expected. The widening of bridges would require the lengthening of bridge support structures within both the Zone AH and Zone A floodplains. These improvements would result in minimal permanent loss of wetland or riparian areas supporting natural and beneficial flood values within channels in the Study Area and would not pose potential risks to the natural and beneficial floodplain values. Impacts to this area would be not be adverse through the inclusion of Project Feature PF-WET-1 in Section 2.16.3.1 of Section 2.16, Wetlands and Other Waters, which includes permit compliance with the Corps pursuant to Section 404 of the Clean Water Act (CWA), the RWQCB pursuant to Section 401 of the CWA, and the CDFW pursuant to Section 1602 of the California Fish and Game Code.

Potential Risk for Support of Incompatible Floodplain Development

The areas surrounding the Build Alternative are fully developed. Construction for the Build Alternative within both the Zone A and Zone AH locations is limited to the reconstruction and widening of existing bridges and would not contribute to the support of incompatible floodplain development. Because the Build Alternative would not result in additional development in floodplain areas or extend development into new floodplains, the Build Alternative would not support incompatible floodplain development.

Significant Encroachment

“Significant encroachment” as defined at 23 CFR 650.105 is a highway encroachment that would result in:

- A significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route
- A significant risk (to life or property)
- A significant adverse impact on natural and beneficial floodplain values

The Build Alternative is a highway widening project that would require the extension of existing bridge structures within the 100-year floodplains associated with El Modena-Irvine Channel, Peters Canyon Wash, Bee Canyon Wash, Agua Chinon Wash, and the Central Irvine Channel. The Build Alternative would not result in more than a 0.2 ft change in the 100-year floodplain elevations, which is below the FEMA threshold of a 1ft increase in base flood elevation. The 100-year flood flows would continue to be carried within these channels. Additionally, effects on riparian and wetland areas would be minor. The proposed encroachment would not result in any adverse impacts on the natural and beneficial floodplain values, would not result in a substantial change in flood risks or damage, and does not have substantial potential for interruption or termination of emergency services or emergency routes. Therefore, the Build Alternative does not constitute a significant floodplain encroachment as defined in 23 CFR 650.105(q).

Overall Assessment of Risk

As described above, the Build Alternative would not pose any appreciable risk related to traffic disruption, loss of life and property, or natural or beneficial floodplain values. Modifications to floodplain crossings would not result in more than a 0.2 ft change to the base flood elevation. Additionally, effects on riparian and wetland areas would be minor. In summary, the combined assessed level of risk associated with risks to life and property, risks to natural and beneficial floodplain values, and risks of probable incompatible floodplain development is Minimal as defined in in 23 CFR 650 Subpart A.

No Build Alternative (Alternative 1)

The No Build Alternative would not result in the construction and operation of the improvements in the Build Alternative and therefore, would not result in adverse permanent impacts to hydrology and floodplains in the Study Area.

2.8.4 Avoidance, Minimization, and/or Mitigation Measures

The Preferred Alternative will incorporate the project features outlined above in Sections 2.8.3.1 and 2.8.3.2 that will address impacts. No avoidance, minimization, and/or mitigation measures are required.

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