I-15 Express Lanes Project Southern Extension

RAPID ASSESSMENT OF STREAM CROSSINGS

Project Limits:
Riverside I-15, PM 20.3/PM 40.1
Project ID: ***08-18000063***

EA: RIV 08-0J0820

December 2021

Prepared for:

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REGISTERED CIVIL ENGINEER CERTIFICATION

This Rapid Assessment of Stream Crossings has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

12/8/21

Perla Abarca DATE

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Table of Contents

List of Tables

List of Figures

Technical Appendices

1 Introduction

The I-15 currently experiences heavy congestion with existing traffic volumes that often exceed current highway capacity along several segments of Interstate 15 (I-15) between State Route 74 (SR-74) (Central Avenue) and El Cerrito Road. Due to forecasted population growth and the continued development to support the projected growth in the region, the I-15 corridor is expected to continue to experience increased congestion and longer commute times that are projected to negatively affect traffic operations along the freeway mainline. The purpose of the I-15 Express Lanes Project Southern Extension (ELPSE or the Project) is to provide a long-term solution to reduce existing congestion, improve traffic operations, and accommodate future traffic volumes that are forecasted in this area.

1.1 Project Description

The Riverside County Transportation Commission (RCTC), in cooperation with the California Department of Transportation (Caltrans), is proposing to construct new lanes along Interstate 15 (I-15) between Post Mile (PM) 21.2 and PM 38.1 in Riverside County, California. The primary component of the I-15 Express Lanes Project Southern Extension (Project) would be the addition of two tolled express lanes[1] in both the northbound and southbound directions within the median of I-15 from State Route 74 (SR-74) (Central Avenue) (PM 22.3) in the City of Lake Elsinore, through the unincorporated Riverside County community of Temescal Valley, to El Cerrito Road (PM 38.1) in the City of Corona, for a distance of approximately 15.8 miles. The proposed Project would also add a southbound auxiliary lane between both the Main Street (PM 21.2) off-ramp and SR-74 (Central Avenue) on-ramp (approximately 0.75 mile), and the SR-74 (Central Avenue) off-ramp and Nichols Road on-ramp (PM 23.9) (approximately 1 mile). Along with the lane additions, which would extend from PM 21.2 to 38.1, the proposed Project would include widening of up to 14 bridges, potential construction of noise barriers, retaining walls, drainage systems, and implementation of electronic toll collection equipment and signs. In addition, due to the southbound express lanes access between the Cajalco Road and Weirick Road interchanges, the southbound I-15 Weirick Road off-ramp would be configured as a dual lane exit. Associated improvements for the toll lanes, including advance signage and transition striping, would extend approximately 2 miles from each end of the express lane limits to PM 20.3 in the south and PM 40.1 in the north. The proposed lane additions and supporting infrastructure are expected to be constructed primarily within the existing State right of way. This Project is included in the 2019 Federal Transportation Improvement Program (FTIP) as Project ID RIV170901. It is also included in the Southern California Association of Governments' (SCAG) Connect SoCal 2020–2045 Regional Transportation Plan (RTP)/Sustainable Communities Strategy (SCS) as Project ID 3160001.

[1] Express lanes are traffic lanes that are separated from general purpose lanes where users are charged a toll to use the lanes.

This Project is included in the 2019 Federal Transportation Improvement Program (FTIP) as Project ID RIV170901. It is also included in the Southern California Association of Governments' (SCAG) Connect SoCal 2020–2045 Regional Transportation Plan (RTP)/Sustainable Communities Strategy (SCS) as Project ID 3160001.

The FTIP and RTP listings for this Project were amended in April 2021 to accurately reflect the scope and limits of the Project as currently proposed. The amended FTIP and RTP listings will state the following:

> *IN WESTERN RIVERSIDE COUNTY - ON I-15, ADD 2 EXPRESS LANES IN EACH DIRECTION, GENERALLY IN THE MEDIAN, FROM SR-74 (CENTRAL AVENUE) (PM 22.3) IN THE CITY OF LAKE ELSINORE TO EL CERRITO ROAD (PM 38.1) IN THE CITY OF CORONA. CONSTRUCT SOUTHBOUND AUXILIARY LANE FROM MAIN STREET (PM 21.2) TO SR-74 (CENTRAL AVENUE) (PM 22.3) AND FROM SR-74 (CENTRAL AVENUE) (PM 22.3) TO NICHOLS ROAD (PM 23.9). SIGNAGE AND TRANSITION STRIPING EXTENDS TO PM 20.3 TO THE SOUTH AND PM 40.1 TO THE NORTH.*

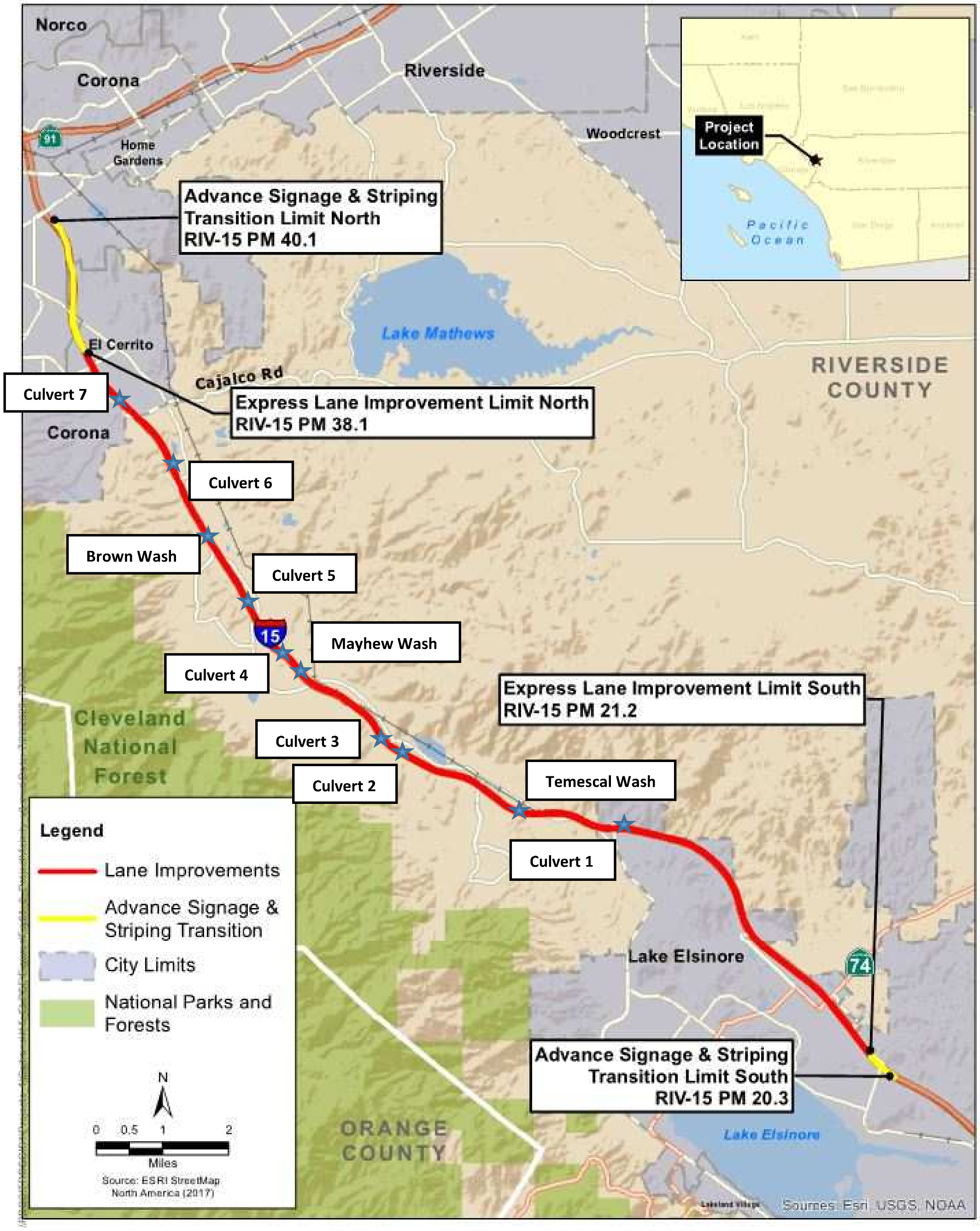


Figure 1-1: I-15 ELPSE Location Map

1.2 Purpose and Need for the Project

This section separately summarizes the recognized purpose and need for the proposed ELPSE.

1.2.1 Purpose

The purpose of the proposed Project is to:

- Improve and manage traffic operations, congestion, and travel times along the corridor
- Expand travel choice along the corridor
- Provide an option for travel time reliability
- Provide a cost-effective mobility solution
- Expand and maintain compatibility with the express lane network in the region

1.2.2 Need

Existing traffic volumes often exceed current highway capacity along several segments of I-15 between SR-74 (Central Avenue) and El Cerrito Road. Due to forecasted population growth and the continued development to support the projected growth in the region, the I-15 corridor is expected to continue to experience increased congestion and longer commute times that are projected to negatively affect traffic operations along the freeway mainline.

The adopted SCAG 2016 RTP Growth Forecast estimates a 36.7-percent increase in population in Riverside County between 2015 and 2040. SCAG's recently adopted Connect SoCal (2020–2045 RTP/SCS) Growth Forecast estimates a 38.3-percent increase in population in Riverside County between 2020 and 2045, with the number of households and employment increasing by approximately 30.5 percent and 34.02 percent, respectively. In the City of Corona, the 2020–2045 RTP/SCS Growth Forecast estimates an 11.6-percent increase in population from 2016 to 2045 and an 11.7-percent increase in households. The 2020–2045 RTP/SCS also found of the top three counties where Los Angeles residents migrate, Riverside County places third. In 2017, the number of Los Angeles migrants to Riverside County was approximately 11,000. Additionally, based on the 2016–2040 RTP/SCS Final Growth Forecast by Jurisdiction, the City of Corona is estimated to experience a 3.7-percent increase in population between 2020 and 2045. According to the same source, the City of Lake Elsinore is projected to see a 76.8-percent increase in population. This projected growth is expected to place a high demand on existing transportation facilities and services.

Existing regional transit in Riverside County includes the Riverside Transit Agency (RTA) and Metrolink, which connects to various local transit services offered by municipalities (i.e., Corona Cruisers). RTA operates a weekday commuter bus service (Route 205/206) along I-15 and State Route 91 (SR-91) for passengers traveling between the City of Temecula in Riverside County and the City of Orange in Orange County. Within the proposed Project limits, this route offers stops at Dos Lagos, Temescal Canyon Road (Tom's Farms), and Nichols Road. Metrolink and Amtrak also operate within the northwestern portion of Riverside County but do not currently offer rail transit options that would serve the populations traveling through Temescal Valley between Corona and Lake Elsinore. Overall, regional transit options are limited for travelers south of Corona's city limits.

The Express Lanes Network in both Riverside and San Bernardino Counties has been growing rapidly in response to the increased inter-county travel demand. Development of an extensive regional express lanes network is a key strategy in the 2020–2045 RTP/SCS that aims to improve travel time reliability, provide travel choices, and ensure existing freeway capacity is optimized within the SCAG region. In 2017, RCTC completed construction of the SR-91 Express Lanes in the City of Corona—the first Express Lanes constructed in Riverside County. RCTC's I-15 Express Lanes Project (ELP), which extends the SR-91 Express Lanes Network north and south of SR-91 along I-15 through the Cities of Jurupa Valley, Eastvale, Norco, and Corona, opened to traffic in 2021. North of the I-15 ELP, in 2021 San Bernardino County Transportation Authority will break ground on the I-15 Corridor Project, which will construct Express Lanes in both directions along I-15 between Cantu-Galleano Ranch Road in the City of Jurupa Valley and Duncan Canyon Road in the City of Fontana. In addition to providing continuity of Express Lanes north of the I-15 ELP, the I-15 Corridor Project will connect to the I-10 Corridor Project (Phase 1), which is currently under construction and will add Express Lanes in each direction on I-10 between the Cities of Montclair and Upland. Once these projects are completed in 2021, the southern terminus of the Express Lanes Network in the Inland Empire will terminate at Cajalco Road on I-15.

As federal, state, and local funding becomes constrained and additional projects are developed to maintain the condition of existing roadways, it has become increasingly challenging for transportation agencies to develop, construct, operate, and maintain new projects that improve mobility in heavily congested corridors. Based on this situation, alternative funding streams like federal loans and revenue bonds can be utilized to fill the funding gaps. In some cases, if financial obligations are met on Express Lane projects, excess toll revenue can provide additional funding to invest in other improvements within the corridor.

Currently, north-south mobility options for motorists are limited through this portion of Riverside County. Besides local streets, the only parallel route for motorists is Interstate 215, which is over 10 miles east of I-15 and generally serves a different region within Riverside County. Under Existing Conditions (2019)[1] during the AM peak hour, northbound I-15 experiences heavy congestion at the Cajalco Road interchange due to commuter traffic along the corridor. This heavy congestion during the AM peak hour results in a bottleneck at the Cajalco Road on-ramp that extends to the Indian Truck Trail off-ramp. Through the project limits, during the PM peak hour, the southbound direction experiences heavy congestion due to commuter traffic. The southbound I-15 bottleneck at the Cajalco Road on-ramp extends to the Magnolia Avenue on-ramp during the PM peak hour.

[1] Existing Conditions (2019) do not include the I-15 ELP from SR-60 to Cajalco Road, because that project was not operational in 2019.

1.3 Project Objectives

This report explains the application of a Rapid Stability Assessment (RSA) mandated by permits passed by the State Water Resources Control Board (SWRCB). The RSA was conducted for three separate creeks and seven regional cross culverts (as determined in Table 2.1) that pass through the ELPSE corridor. Stormwater runoff from Caltrans right-of-way and facilities are permitted under the provisions of the 2012 statewide National Pollutant Discharge Elimination System (NPDES) permit. The permit mandates a risk-based approach to be employed during planning and design for assessing stream stability at highway crossings and the potential impact upon existing or planned highway crossing structures. The assessment assists Caltrans in the analysis of pre-project channel stability and implementation of mitigation measures that are appropriate to protect structures and minimize stream channel bank and bed erosion.

2 Procedure

2.1 Rapid Stability Assessment (RSA) Requirements

The first step to performing a Rapid Stability Assessment (RSA) is to identify whether it is required. According to the Caltrans Hydromodification Requirements Guidance Storm Water Best Management Practices - Rapid Assessment of Stream Crossings (Manual), an RSA is performed if the proposed project meets the following four criteria:

1. The project includes any stream crossings.
2. The project includes one acre or more of net new impervious surface.
3. The project's new impervious surface is within a Threshold Drainage Area (TDA).
4. The stream crossings are "Waters of the US" as defined by U.S. Army Corps of Engineers (USACE) latest guidance on determination of jurisdiction for Clean Water Act section 404.

Table 2-1: RSA Requirements

	Stream Crossing			
	1. The project includes a stream crossing.	**2. The project includes one acre or more of net new impervious surface.**	**3. The project's new impervious surface is within a threshold drainage area (TDA).**	**4. The stream crossings are "Waters of the US".**
Wasson Canyon Channel (PM 21.57)		X	X	
Arroyo Del Toro Channel (PM 22.6)	X	X	X	
Stovepipe Canyon Creek (PM 23.50)	X	X	X	
Gavilan Wash (PM 25.55)	X	X	X	
Culvert 1 (PM 26.3)	X	X	X	X
Temescal Wash (PM 28.04)	X	X	X	X
Horsethief Canyon Wash (PM 29.13)	X	X	X	
Indian Wash (PM 30.09)	X	X	X	

	Stream Crossing			
	1. The project includes a stream crossing.	**2. The project includes one acre or more of net new impervious surface.**	**3. The project's new impervious surface is within a threshold drainage area (TDA).**	**4. The stream crossings are "Waters of the US".**
Culvert 2 (PM 30.2)	X	X	X	X
Culvert 3 (PM 30.3)	X	X	X	X
Mayhew Wash (PM 31.97)	X	X	X	X
Culvert 4 (PM 32.3)	X	X	X	X
Cold Water Wash (PM 32.96)	X	X	X	
Culvert 5 (PM 33.6)	X	X	X	X
Brown Canyon Wash (PM 34.72)	X	X	X	X
Culvert 6 (PM 35.7)	X	X	X	X

	Stream Crossing			
	1. The project includes a stream crossing.	**2. The project includes one acre or more of net new impervious surface.**	**3. The project's new impervious surface is within a threshold drainage area (TDA).**	**4. The stream crossings are "Waters of the US".**
Bedford Wash (PM 36.58)	x	x	x	
Culvert 7 (PM 37.2)	x	x	x	x

According to Table 2-1, three stream crossings and seven cross culverts (listed below) qualified for an RSA. Although most of the stream crossings satisfied three out of the four requirements, the distinction of "Waters of the US" ultimately determined which crossings were studied. The jurisdictional determinations for Requirement 4 reference Table A in Appendix C of the Jurisdictional Delineation Report was submitted to Caltrans for approval in November 2021, for the I-15 ELPSE.

In addition, the Santa Ana Region (SAR) Hydromodification Management Plan (HMP) provides a roadmap guide to help identify if a stream within a project is subject to Hydrologic Conditions of Concern (HCOC). An EHM (Engineered, Hardened, and Maintained) stream is one that is constructed for stormwater conveyance and is owned and maintained by responsible agencies. Per the SAR HMP (Section 2.2.i Hydromodification Susceptibility Mapping), the risk of hydromodification is significantly reduced for an EHM stream due to the armoring of the channel and engineered design, thus allowing EHM features to be excluded from future analysis.

Assessments for the vertical and lateral stability of the following stream crossings were completed for the highway crossing structure potentially affected by additional impervious surfaces proposed in the ELPSE:

- Culvert 1 (PM 26.3)
- Temescal Wash
- Culvert 2 (PM 30.2)
- Culvert 3 (PM 30.3)
- Mayhew Wash
- Culvert 4 (PM 32.3)
- Culvert 5 (PM 33.6)
- Brown Canyon Wash
- Culvert 6 (PM 35.7)
- Culvert 7 (PM 37.2)

The TDA is a function of stream width and is an area draining to a location at least 20 channel widths (20W) downstream of the stream crossing.

The estimated channel width is defined by the horizontal distance from the top of the banks. The width is used to determine the areas of focus upstream and downstream of the crossing for each TDA. If there are major discontinuities within the 20W-long reach, such as steps, culverts, grade controls, tributary junctions, or other features and structures, an additional 5W to 7W should be examined past the discontinuity.

After the downstream reach was identified, the contributing TDA was determined using an online tool called StreamStats that was provided by the U.S. Geological Survey (USGS). The TDA for streams analyzed can be found in Exhibits 1 and 2 of Appendix A.

2.2 Office Preparation

Office preparation is required prior to the site visit. This included determining cross section locations, reach classifications, and physiographic province; these are described in more detail below.

2.2.1 Cross Section

Since an RSA was required, the limits of the representative reaches were determined from Section 2-2 in the Manual that indicates reaches should be $20*W_{down}$. The formula assumes the first cross section to be on the downstream end of the representative reach. The subsequent cross sections were calculated at intervals of $(W_{down} + L_{crossing} + W_{up}) / 9$. Variables W_{down} and W_{up} are the lengths of the downstream and upstream reaches, respectively. $L_{crossing}$ is the length of the crossing in the streamwise direction. This method is typically used for bridge and culvert crossings. For culvert crossings where it is difficult to determine the incised channel due to ephemeral flows, a conservative channel width of 1.5 times the culvert diameter was assumed and applied to the stream reach.

The stream centerline was determined in Google Earth and exported to ArcGIS. In ArcGIS, HEC-GeoRAS was used to generate 10 equally spaced cross sections along the stream centerline. Although 10 cross sections are generated, select cross sections may be blank on the field form due to their inaccessible nature or engineered condition. The data was then exported back to Google Earth in the form of a KMZ file. The KMZ file assisted with real-time tracking to ensure accurate spacing between cross sections when in the field.

2.2.2 Reach Classification

Stream channel classification also needed to be determined, requiring a combination of office preparation and field observation. The office preparation required the use of Table 3 – Montgomery-Buffington Stream Classification System and Table 5 – Simplified Channel Reach Classification System in the Manual. Table 3 classifies stream channel reaches into seven categories while Table 5 recognizes only three stream categories of stream channel reaches. Table 3 is used as a more detailed breakdown showing the characteristics of each stream. Ultimately, Table 5 was used to determine the final stream classification; the stream classification was based on bed, slope, geometry, and response type characteristics.

2.2.3 Physiographic Province

California is divided into 11 physiographic regions. As the terrain in each subregion is similar, the geology is easier to identify. The subregion for the ELPSE area was determined using various maps. It is in the Peninsular Ranges region.

3 Site Visit

The site visit for the 1-15 Express Lanes includes 10 stream and culvert crossings that are susceptible to hydromodification. Each natural crossing or stream was evaluated for hydromodification or for notable failures if it is EHM. Natural channels are susceptible to hydromodification resulting from runoff from redevelopment or new development. The location of the streams can be found in Appendix A and Field Forms completed during the site visit can be found in Appendix B.

3.1 Culvert 1 (PM 26.3)

Culvert 1 is a 42-inch RCP that crosses the I-15 at approximately PM 26.3. The culvert is in Lake Elsinore and conveys flows from north of the I-15 to south of the I-15 adjacent to Walker Canyon Road. On the upstream end, erosion was not present. The drainage area upstream is a heavily vegetated basin with no well-defined flow path. The downstream end of Culvert 1 outlets into an incised channel with ephemeral flows. The incised channel and channel banks consist of dense vegetation, causing it to be difficult to observe erosion.

3.2 Temescal Wash

Temescal Wash is a trapezoidal channel located west of Horsethief Road and crosses the I-15 at approximately PM 28.04. The Temescal Wash Bridge (No. 56-0680) is a four-span, continuous reinforced concrete box girder with open-end diaphragm abutments. The bents will be 3-column RC bents and the pier walls are all on steel piles. The spans are (S) 80.7 feet, 107.3 feet, 107.2 feet, and 80.6 feet (N).

The bridge inspection report (BIR) for Temescal Wash Bridge, dated February 19, 2020, states that the channel has soft sandy bottoms with an abundant number of trees and vegetation. The channel does not contain side-slope protection. Abutment 1 near the north end has eroded up to 2 feet wide by 3 feet deep. No obvious scour or exposed foundation was observed during the inspection. Figures 3-1 to 3-4 show aerial images of Temescal Wash taken from Google Earth at various times of the year. As shown in the figures, there is little evidence of geomorphology or channel instability.

The upstream reach of Temescal Wash is a meandering stream that is trapezoidal in shape and crosses under two pedestrian bridges and one local road. The side slopes are flatter in this area and the incised channels have minimal channel confinement. Further down the upstream reach, the channel confinement increases and there is more evidence of mass wasting and bank erosion. The channel bottom is approximately 35 feet wide. On the downstream reach, the channel continues to be confined with exposed channel banks. The banks are densely vegetated and vary from flat to vertical slopes. Human-made debris and large woody debris is present in the channel causing flow and channel alignment to divert. As the reach approaches Temescal Canyon Road, the flow is directed into eight corrugated metal pipes. This downstream-most cross section is fairly confined and has dense vegetation in the channel bed. Channel bank distress can be observed from the presence of root exposure and mass wasting.

The following figures (3-1, 3-2, 3-3, 3-4) show the Temescal Wash area over more than a decade of time.

Figure 3-1: Aerial Image of Temescal Wash November 2009

Figure 3-2: Aerial Image of Temescal Wash April 2014

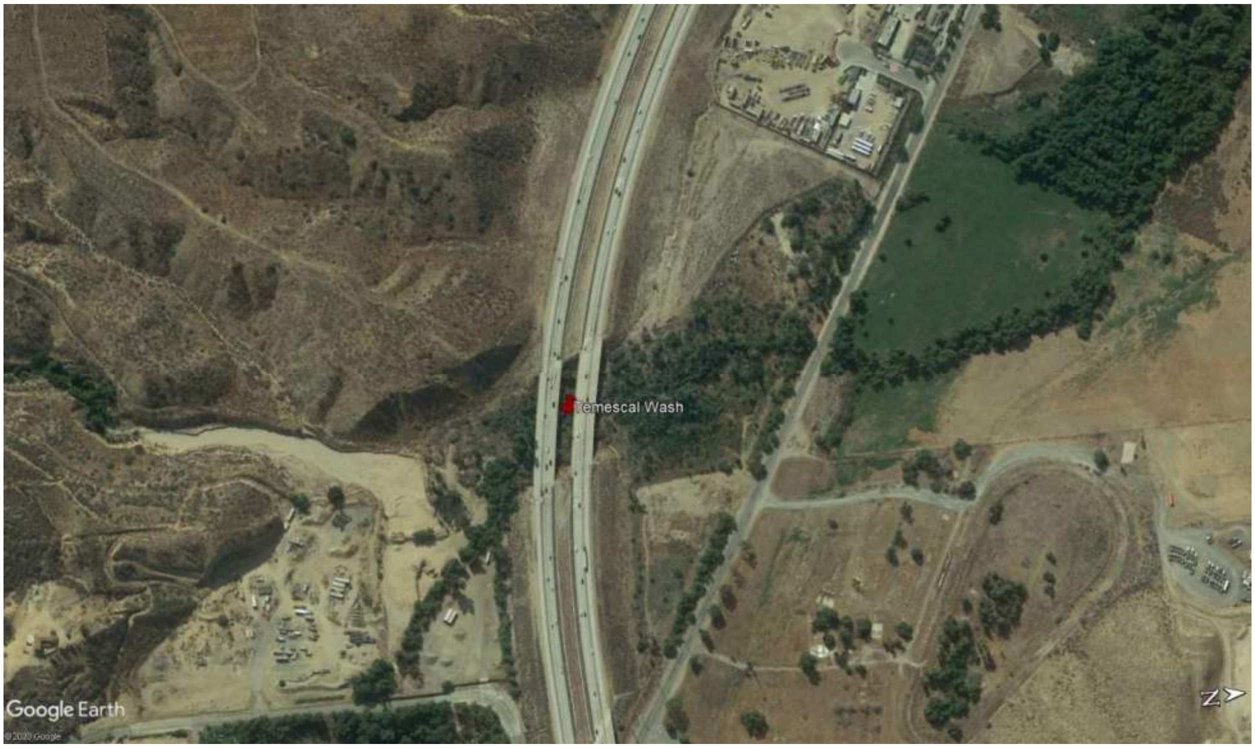


Figure 3-3: Aerial Image of Temescal Wash August 2018

Figure 3-4: Aerial Image of Temescal Wash June 2020

3.3 Culvert 2 (PM 30.2)

Culvert 2 is a 60-inch RCP transition to a 60-inch CSP that crosses the I-15 at approximately PM 30.2. The culvert is in Corona and conveys flows from north of the I-15 SB On-Ramp and directs it south of the I-15 NB Off-Ramp. The upstream reach of Culvert 2 is EHM and was not analyzed. Per Caltrans PIR 201.151 – Drainage System Restoration dated May 2021, the 60-inch CSP will be repaired to extend its design service life. The downstream reach of Culvert 2 consisted of a meandering channel. An incised channel was present and evidence of an ephemeral stream was observed. The channel bed consisted of sand and gravel while the banks consisted of tall grass and shrubs.

3.4 Culvert 3 (PM 30.3)

Culvert 3 is an 8 by 6-foot RCB that crosses the I-15 at approximately PM 30.3. The culvert conveys hillside flows from south of the I-15 and crosses Indian Truck Trail and I-15. It is assumed that the 8 by 6-foot RCB is in good condition, as it is not listed in Caltrans PIR 201.151 – Drainage System Restoration to be in need of repairs. It outlets north of I-15 where the flows join Indian Wash further downstream. The upstream reach of Culvert 3 is heavily vegetated with large gravel and rock. The stream bed is dry and under an ephemeral condition. The stream also shows evidence of bank erosion and obstructions caused by dried vegetation. The downstream reach of the culvert has similar stream characteristics as the upstream reach; some significant headcutting is present.

3.5 Mayhew Wash

Mayhew Wash is a natural, trapezoidal channel and is located between Temescal Canyon Road Interchange (north crossing) and Temescal Canyon Road Interchange (middle crossing); it crosses I-15 at approximately PM 31.97. The Mayhew Wash Bridge (No. 56-0674) is a single span, cast in place prestressed concrete box girder (6 cells) with open-end diaphragm abutments, all on steel "H" piles. The span is (S) 147.27 feet (N). Mayhew Wash belongs to the Temescal Wash Watershed.

The bridge inspection report for Mayhew Wash Bridge dated February 24, 2018 states that the channel has minor vegetation and a soft sandy bottom. The south embankment has partial concrete lined side slope protection; it is roughly 6.5 feet high, while the north embankment has partial rock side slope protection roughly 6.5 feet high with concrete slurry. The channel consists of disturbed open area downstream and of open vegetated areas with pockets of non-vegetated areas upstream.

During the site visit, the observations made substantiated the BIR. Erosion was observed at an abutment on the north end of the bridge. The erosion exposed a minor portion of the concrete side-slope. The channel itself was dry during the site visit, suggesting it was experiencing an ephemeral flow condition. Layers of sand and gravel were present in the channel underneath the bridge.

The upstream reach is a meandering channel that is trapezoidal in shape. The channel crosses under Temescal Canyon Road via an RCB culvert. The side-slopes just upstream and downstream of the crossing are engineered and comprised of rock slope protection. The sections of Mayhew Wash further upstream of this area continue to meander and retain the trapezoidal channel shape. The side-slopes in these areas are natural and exhibit signs of mass wasting and bank erosion. The channel bottom varies from approximately 35 to 200 feet.

The downstream reach of the channel also meanders and is trapezoidal in shape. The channel bed composition continues to be comprised of sand, clay, and gravel. As the sections for analysis move further downstream, the reach joins Temescal Wash. The sections in these areas were inaccessible due to dense vegetation or steep slopes. Figures 3-5 to 3-8 show aerial images of Mayhew Wash taken from Google Earth at various times of the year. As shown in the figures, there is little evidence of geomorphology or channel instability.

The following figures (3-5, 3-6, 3-7 and 3-8) show the Mayhew Wash area over more than a decade of time.

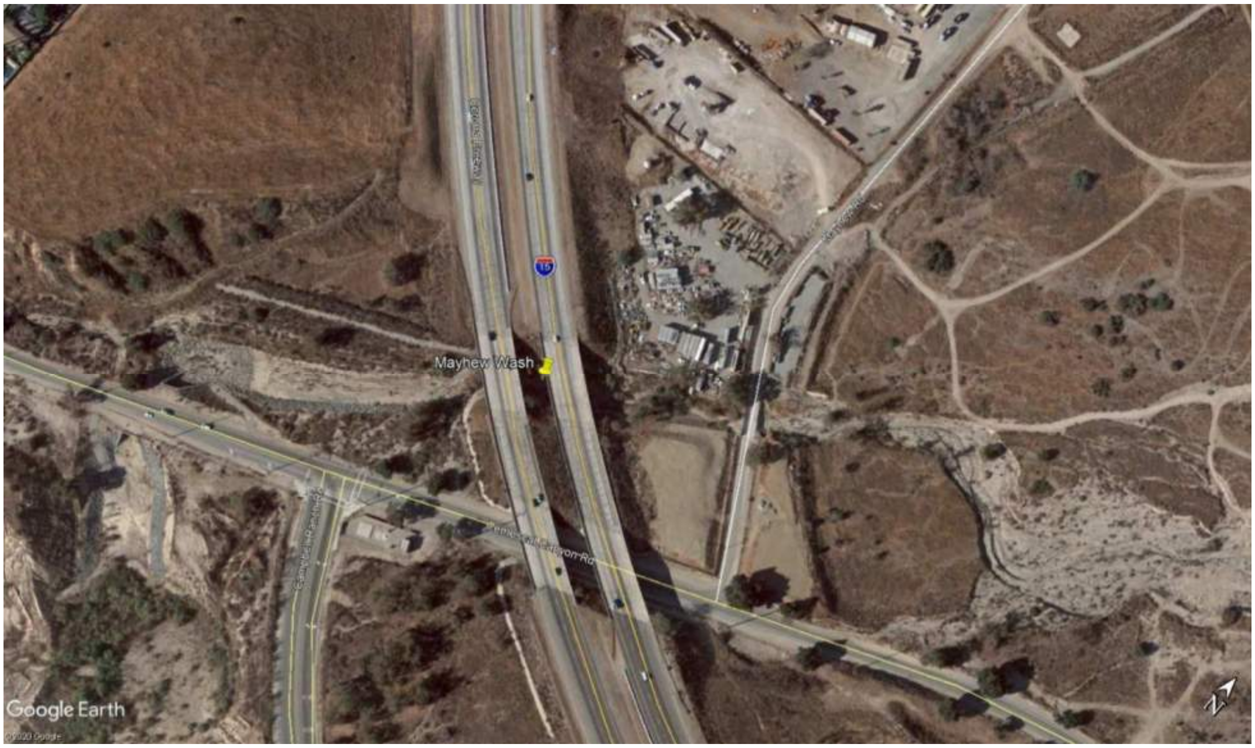


Figure 3-5: Aerial Image of Mayhew Wash November 2009

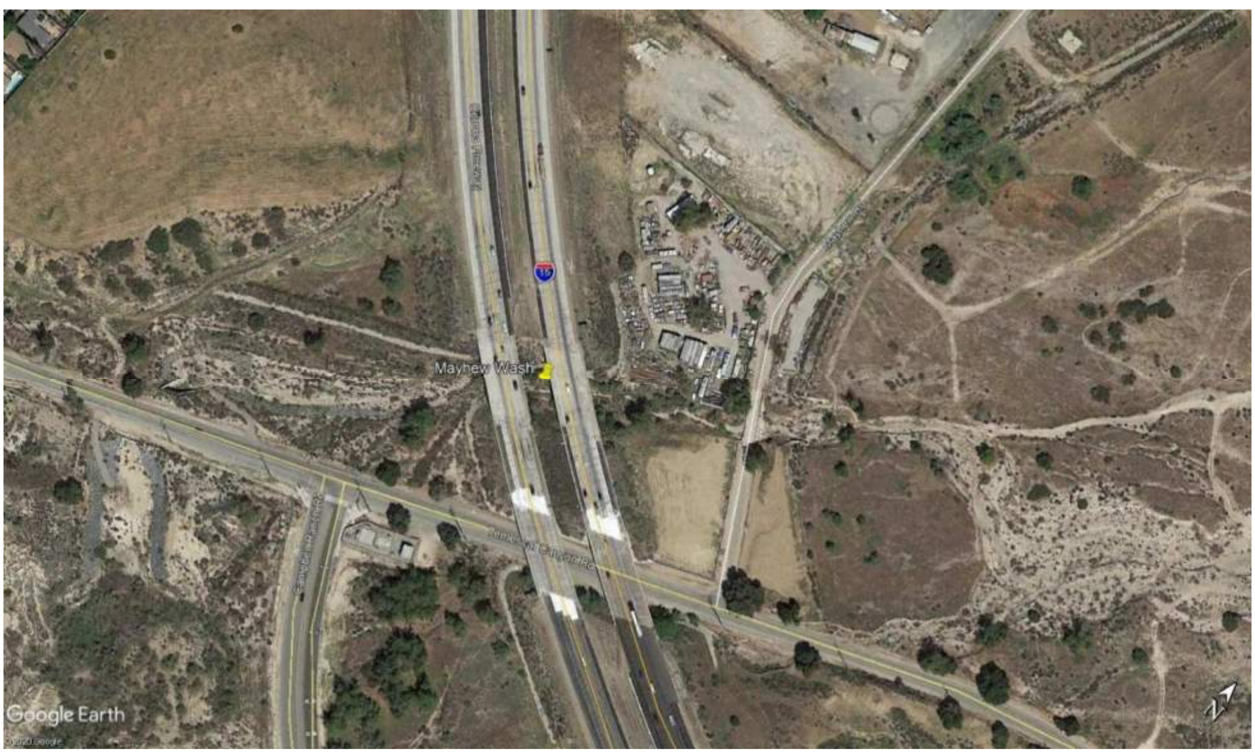


Figure 3-6: Aerial Image of Mayhew Wash April 2014

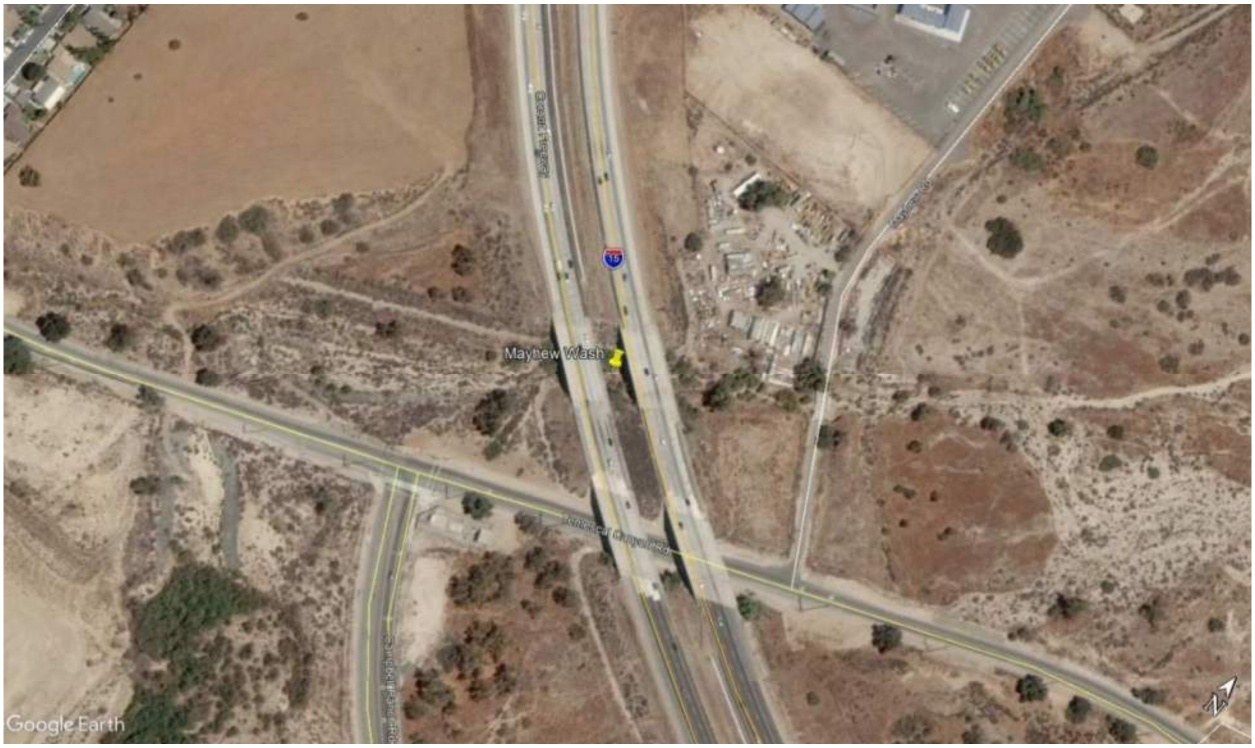


Figure 3-7: Aerial Image of Mayhew Wash June 2018

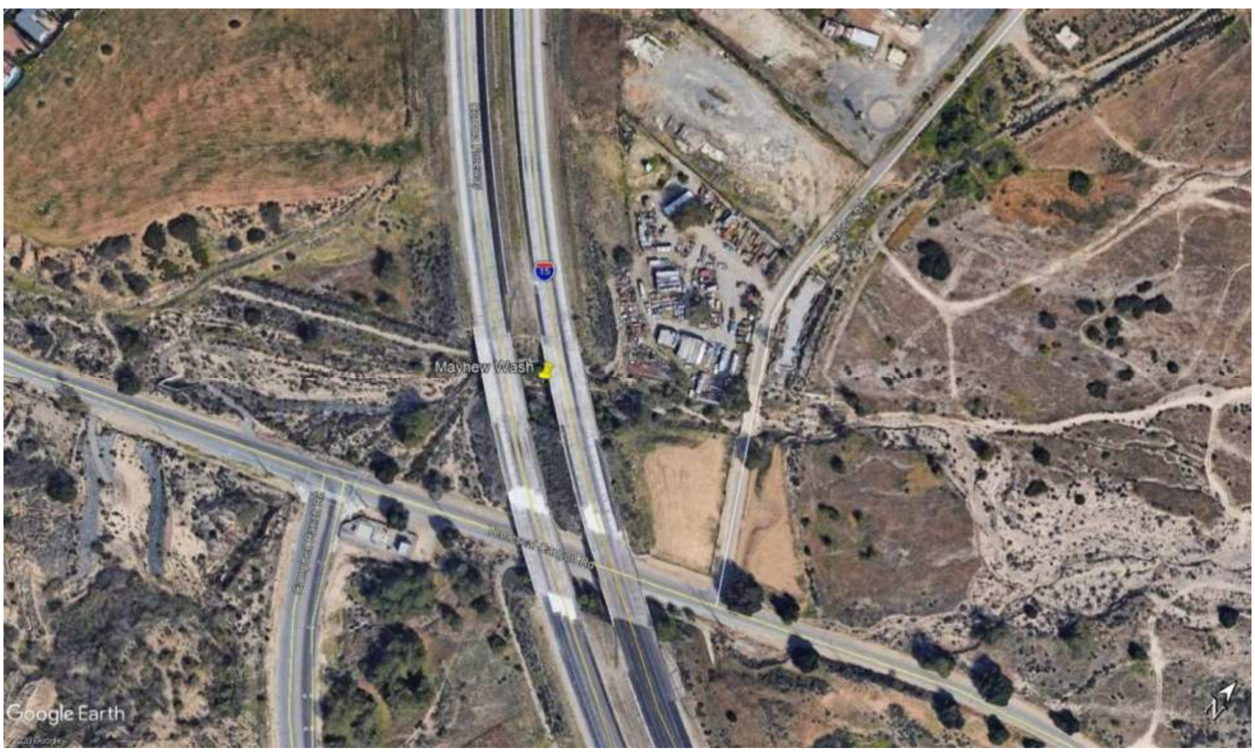


Figure 3-8: Aerial Image of Mayhew Wash June 2020

3.6 Culvert 4 (PM 32.3)

Culvert 4 is a 36-inch CMP that crosses the I-15 at approximately PM 32.2. It is assumed that the 36-inch CMP is in good condition, as it is not listed in Caltrans PIR 201.151 – Drainage System Restoration to be in need of repairs. The culvert conveys flows from a residential development south of the I-15 via an underground CMP. The flow enters an incised stream that is comprised of dense vegetation and a sandy material. The stream is a tributary Temescal Wash.

3.7 Culvert 5 (PM 33.6)

Culvert 5 is a 36-inch CMP that crosses I-15 at approximately PM 33.6. The culvert conveys hillside and residential flows from south of I-15 to north of I-15. The upstream reach is comprised of leafy vegetation and large woody debris. The stream bed composition is predominantly sand and shows signs of erosion caused by obstructions that consist of large trees and fallen branches, causing the channel to divert or meander. The bank conditions consist of raw banks or partial armoring with large rocks. Downstream of the culvert crossing, similar characteristics exist. The stream bed is also predominantly comprised of sand and the banks are raw due to mass wasting. The obstructions downstream consist of manmade debris or large rocks.

3.8 Brown Canyon Wash

Brown Canyon Wash is a concrete trapezoidal channel that crosses I-15 at approximately PM 34.72. Brown Canyon Wash Bridge (No. 56-0559L) is a continuous two-span reinforced concrete bridge. The bridge has seven T-girders with eight reinforced concrete columns pile bents and open-end diaphragm abutments. The double span is (S) 39 feet (N).

The bridge inspection report for Brown Canyon Wash, dated January 25, 2020, states that the channel is a partial trapezoidal dirt channel with concrete lined side slope protection combined with a rectangular channel under the bridge. No notable scour or erosion was noted.

Brown Canyon Wash is EHM and was not analyzed for erosion along each section. No notable cracks were observed in the field.

3.9 Culvert 6 (PM 35.7)

Culvert 6 is a 54-inch CSP that crosses I-15 at approximately PM 35.7. The culvert conveys residential hillside flows from the west and hillside flows via a concrete swale from the north. The culvert outlets east of I-15 where the flow enters a 54-inch RCP under a residential development. The upstream reach of Culvert 6 is a straight and natural stream with ephemeral flows present. The stream is well confined and does not show signs of bar development or bank erosion. The banks and stream bed are lined with vegetation upstream and engineered where they approach the culvert entrance. Culvert 6 is EHM on the downstream reach and was not analyzed.

3.10 Culvert 7 (PM 37.2)

Culvert 7 is a 12 by 10 foot RCP that crosses I-15 at approximately PM 37.2. The culvert conveys flows from south of the I-15 to north of the I-15. The watershed north of Culvert 7 consists of residential homes that drain into a rectangular channel upstream of Culvert 7.

Downstream of the culvert is a rectangular open channel that drains to an underground RCB. The channel outlets into Temescal Wash. The upstream and downstream reaches of the channel are engineered, hardened, and maintained and were not investigated for hydromodification. The channel and culvert conditions were inspected and appear to be in good condition. No sizable cracks nor notable failures were observed.

4 Results

The results for each creek were tabulated in the Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibility to Hydromodification Induced Instability. The scores for each category per the 10 cross sections were averaged and totaled to form a raw score. The raw score was rated based on the stream channel type that was determined through office analysis and field observation. The Field Forms are found in Appendix B.

4.1 Culvert 1 (PM 26.3)

Culvert 1 was evaluated at 10 cross sections. Based on the Field Form, Culvert 1 received a raw score of 41 and was given a rating of "Excellent" based on a plane-bed stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.2 Temescal Wash

Temescal Wash was evaluated at eight cross sections. Two cross sections (3,6) were inaccessible due to dense vegetation. Based on the Field Form, Temescal Wash received a raw score of 58.5 and was given a rating of "Good" based on an engineered or channelized stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.3 Culvert 2 (PM 30.2)

Culvert 2 was evaluated at six cross sections. The downstream reach has four cross sections that are EHM and were not evaluated. Based on the Field Form, Culvert 2 received a raw score of 53.5 and was given a rating of "Good" based on a step-pool stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.4 Culvert 3 (PM 30.3)

Culvert 3 was evaluated at nine cross sections. The most downstream reach has one cross section that is EHM and was not evaluated. Based on the Field Form, Culvert 3 received a raw score of 52.7 and was given a rating of "Good" based on a pool-riffle stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.5 Mayhew Wash

Mayhew Wash was evaluated at six cross sections. Three cross sections (1-3) were inaccessible due to dense vegetation and the most upstream cross section (10) was located outside of the channel extents. Therefore, 4 cross sections were not evaluated. Based on the Field Form, Mayhew Wash received a raw score of 71.3 and was given a rating of "Good" based on an engineered or channelized stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.6 Culvert 4 (PM 32.3)

Culvert 4 was evaluated at five cross sections. The downstream reach has five cross sections that are EHM and were not evaluated. Based on the Field Form Culvert 4 received a raw score of 72.5 and was given a rating of "Good" based on a plane-bed stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.7 Culvert 5 (PM 33.6)

Culvert 5 was evaluated at 10 cross sections. Based on the Field Form, Culvert 5 received a raw score of 66.3 and was given a rating of "Good" based on a pool-riffle stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.8 Brown Canyon Wash

Although Brown Canyon Wash meets the four criteria required to perform an RSA, the channel crossing is EHM on the upstream and downstream reaches. Therefore, the crossing was not evaluated.

4.9 Culvert 6 (PM 35.7)

Culvert 6 was evaluated at five cross sections. The downstream reach has five cross sections that are EHM and were not evaluated. Based on the Field Form, Culvert 6 received a raw score of 58.5 and was given a rating of "Good" based on a pool-riffle stream. According to Section 5.1 of the Manual, the stream is laterally and vertically stable; it does not require a Level 2 assessment.

4.10 Culvert 7 (PM 37.2)

Although Culvert 7 meets the four criteria required to perform an RSA, the channel crossing is EHM on the upstream and downstream reaches. Therefore, the crossing was not evaluated.

5 Summary

In summary based on the Rapid Stability Assessment of the proposed I-15 Express Lanes Project Southern Extension (Project) the results indicate all channels are in good condition or better, and that a Level 2 Analysis is not needed and Project will not adversely impact the downstream waters.

6 References

California Department of Transportation (Caltrans) Hydromodification Requirements Guidance Storm Water Best Management Practices, Rapid Assessment of Stream Crossings, High Level Stream Stability Analysis, February 2015.

California Department of Transportation Division of Maintenance Bridge Inspection Records Information System (BIRIS). Temescal Wash, February 2020.

California Department of Transportation Division of Maintenance Bridge Inspection Records Information System (BIRIS). Mayhew Wash, February 2018.

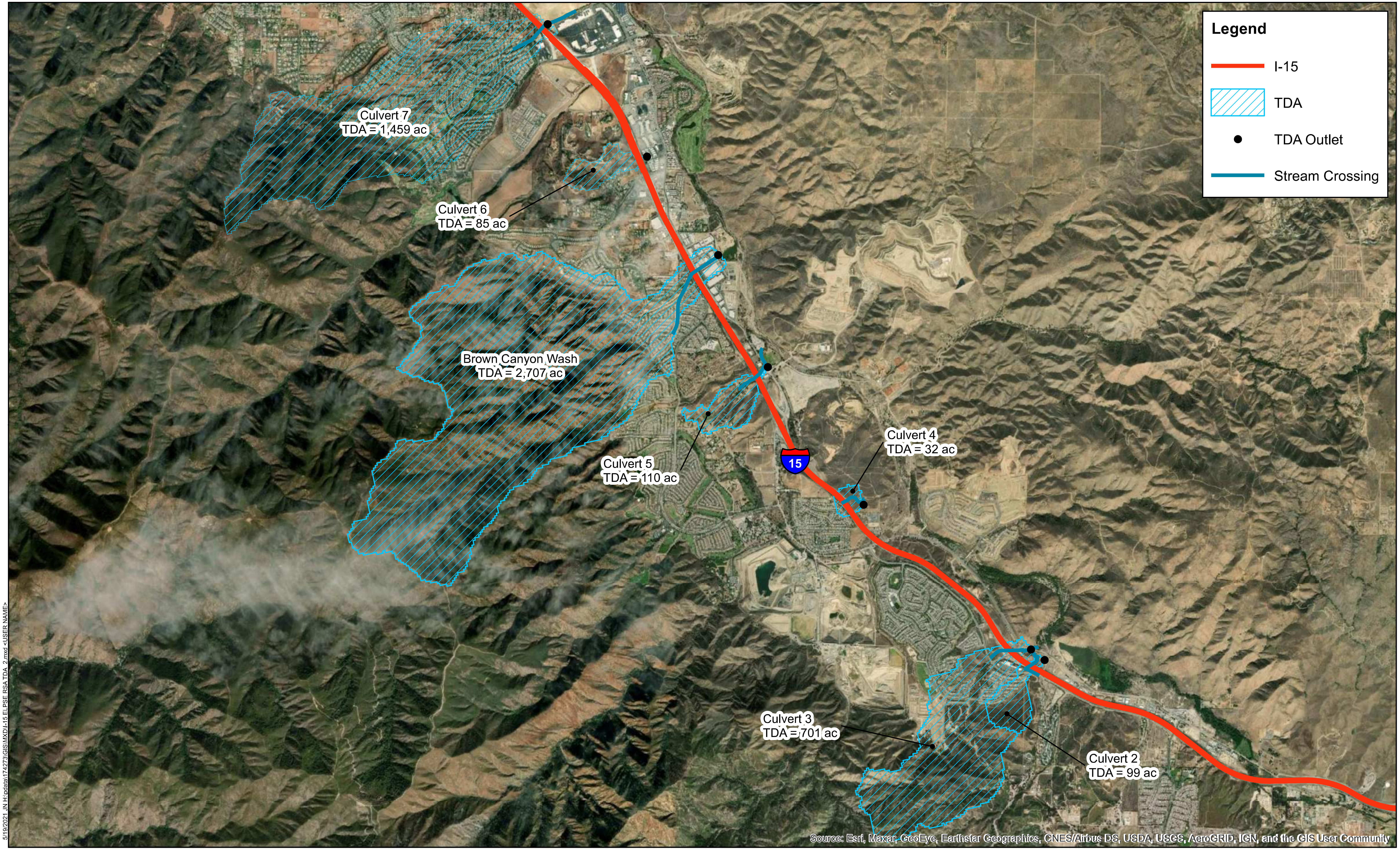
California Department of Transportation Division of Maintenance Bridge Inspection Records Information System (BIRIS). Brown Canyon Wash, January 2020.

I-15 Express Lanes Project Southern Extension (ELPSE) Jurisdictional Delineation Report, submitted to Caltrans for approval in November 2021.

California Department of Transportation (Caltrans) Project Initiation Report (PIR) 201.151 – Drainage System Restoration, May 2021, Project Limits PM30/PM33.

Santa Ana Region (SAR) Hydromodification Management Plan, January 2017.

APPENDIX A: EXHIBITS



Michael Baker INTERNATIONAL

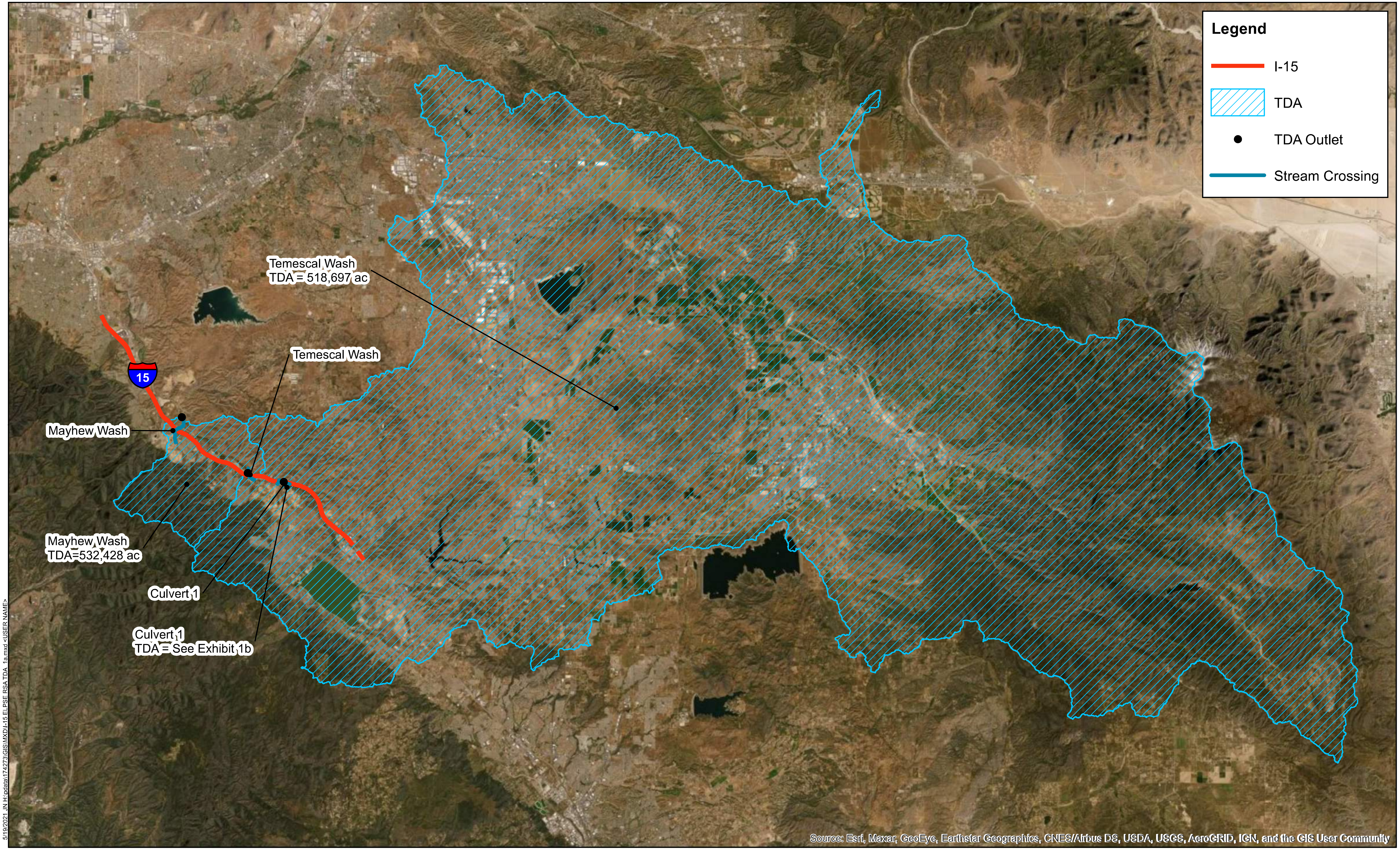
Source:

I-15 ELPSE

Brown Canyon Wash and Culvert 2 through 7 Threshold Drainage Areas

Exhibit 2

5/19/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA TDA_2.mxd <USER NAME>



5/19/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA TDA 1a.mxd <USER NAME>

Michael Baker INTERNATIONAL

Source:

I-15 ELPSE

Temescal Wash, Mayhew Wash, Culvert 1 Threshold Drainage Areas

Exhibit 1a

Michael Baker INTERNATIONAL

I-15 ELPSE

Culvert 1 Threshold Drainage Areas

Exhibit 1b

5/19/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA TDA 1b.mxd <USER NAME>

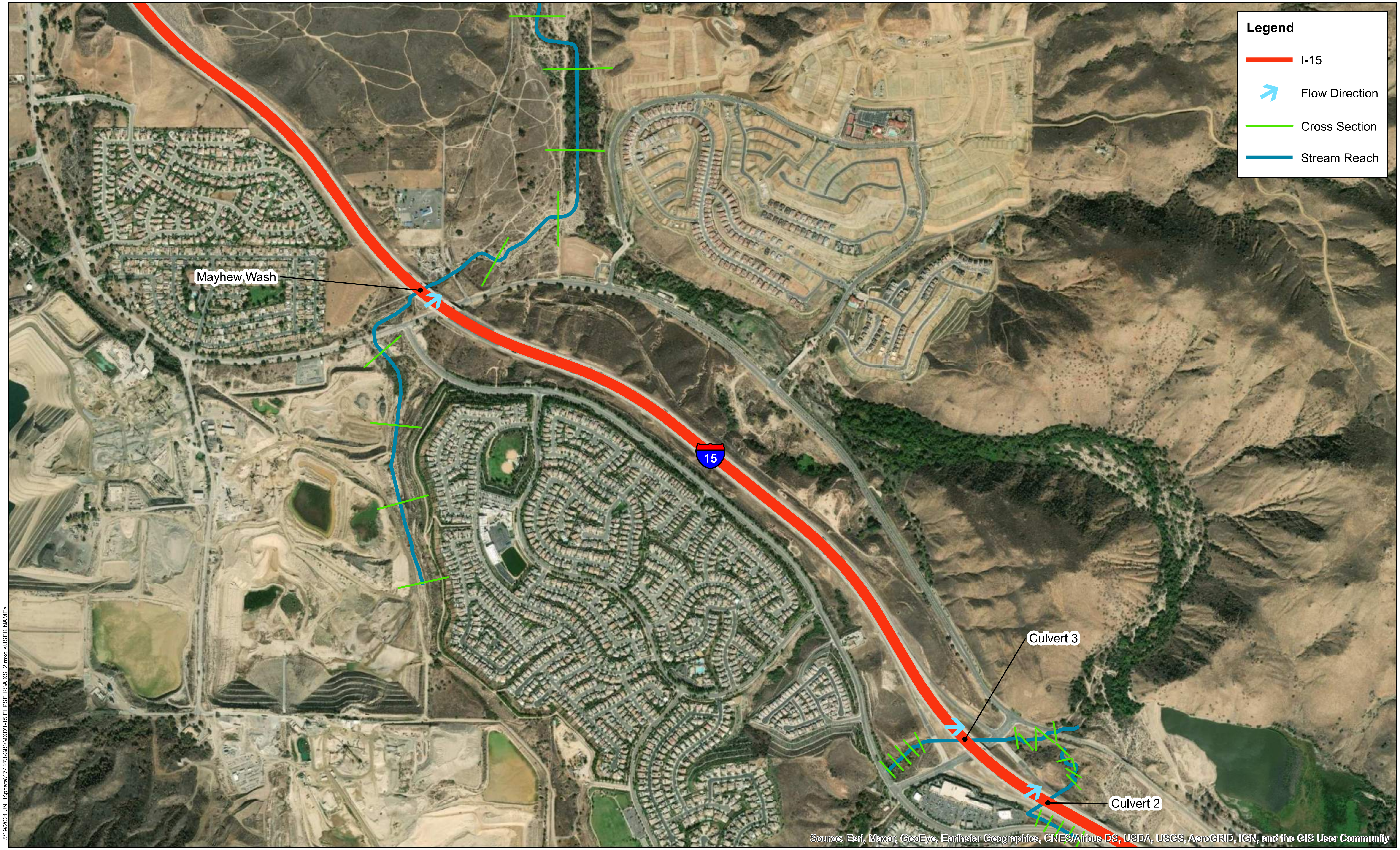
8/4/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA XS_1.mxd <USER NAME>

Michael Baker INTERNATIONAL

I-15 ELPSE

Temescal Wash and Culvert 1 Cross Sections

Exhibit 3



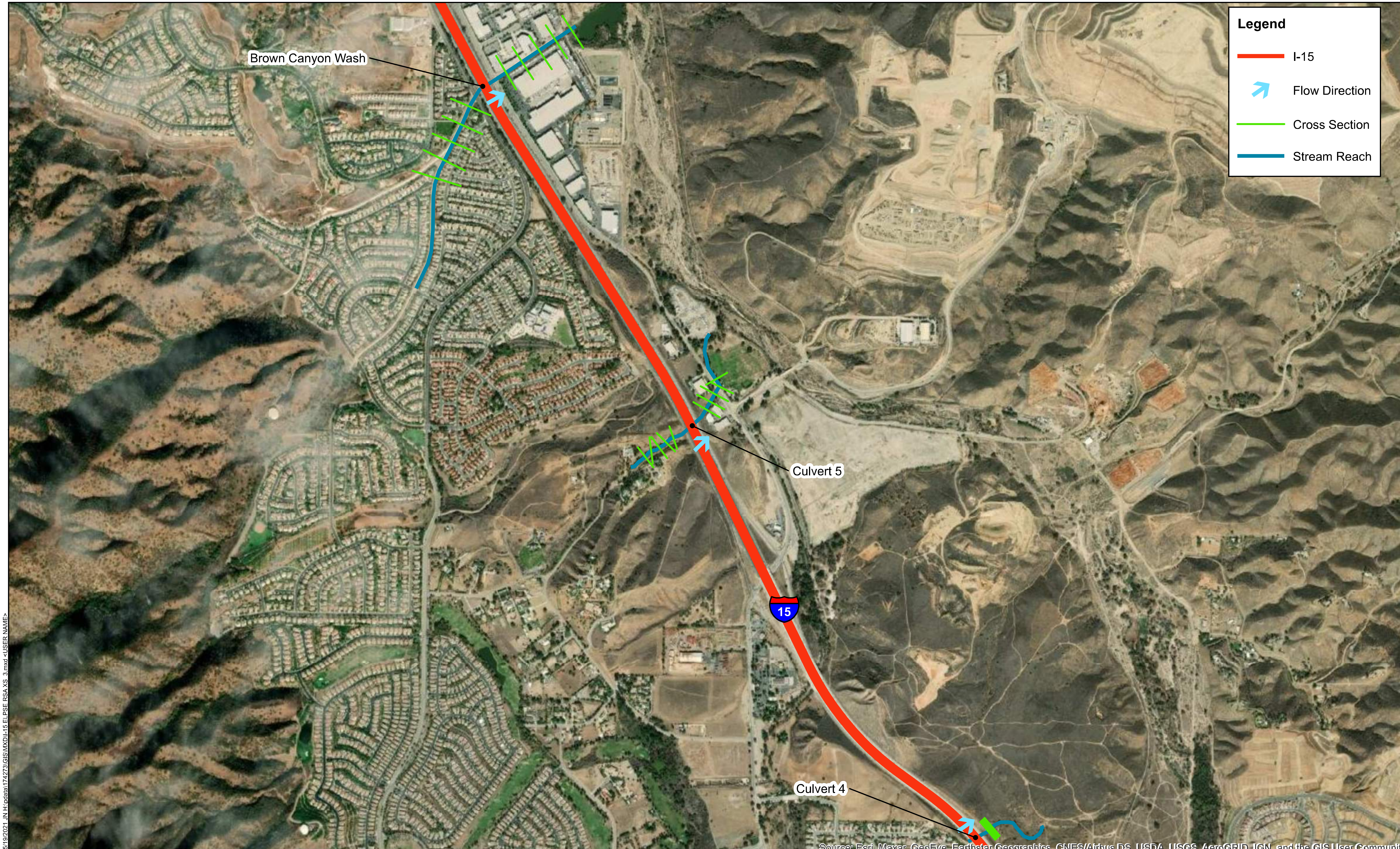
Source:

I-15 ELPSE

Mayhew Wash, Culvert 2, and Culvert 3 Cross Sections

Exhibit 4

5/19/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA XS_2.mxd <USER NAME>



Michael Baker INTERNATIONAL

Source:

0 250 500 1,000 Feet

I-15 ELPSE

Brown Canyon Wash, Culvert 4, and Culvert 5 Cross Sections

Exhibit 5

5/19/2021 JN H:\pdata\174273\GIS\MXD\I-15 ELPSE RSA XS_4.mxd <USER NAME>

Michael Baker INTERNATIONAL

Source:

I-15 ELPSE

Culvert 6 Cross Section

Exhibit 6

I-15 ELPSE

Culvert 7 Cross Sections

Exhibit 7

APPENDIX B: FIELD FORMS

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information	
Date(s):	April 15, 2021
Persons:	Brian Chung Garrett Ribas
Site/Location	Culvert 1 (PM 26.3) Temescal Valley, CA
Conditions:	Clear, sunny
Identify Associated File Locations	
GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province	
☐ Modoc Plateau	☐ Coast Ranges
☐ Cascade Range	☐ Transverse Ranges
☐ Sierra Nevada	☒ Peninsular Ranges
☐ Klamath Mountains	☐ Mojave Desert
☐ Great Valley	☐ Colorado Desert
☐ Basin and Range	

Step 3. Check Stream Type(s)
☐ Bedrock
☐ Cascade
☐ Step-Pool
☐ Engineered/channelized
☒ Plane-Bed
☐ Pool-Riffle
☐ Dune-Ripple
☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score	41
Rating	EXCELLENT

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach		Notes by Cross Section
															1	The upstream cross sections are close in proximity to each other. Stability indicator ratings are similar for all cross sections.
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒				2	
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										4	4	5.5	3	
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										7	7	5.5	4	
3	Channel pattern	4	4	4	4	4	2	2	2	2	2			3	5	
4	Entrenchment/channel confinement	3	3	3	3	3	3	3	3	3	3			3	6	
5	Bed material	2	2	2	2	2	2	2	2	2	2			2	7	
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%				8	
6	Bar development	3	3	3	3	3	2	2	2	2	2			2.5	9	
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	3	3	3	3	3	3	3	3	3	3			3	10	
8	Bank soil texture and coherence	3	3	3	3	3	2	2	2	2	2			2.5	11	
9	Average bank slope angle	2	2	2	2	2	2	2	2	2	2			2	12	
10	Vegetative or engineered bank protection	3	3	3	3	3	7	7	7	7	7			5	13	
11	Bank erosion	2	2	2	2	2	2	2	2	2	2			2	14	
12	Mass wasting or bank failure	2	2	2	2	2	2	2	2	2	2			2	U/S	
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												3	D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information

Date(s):	April 15, 2021
Persons:	Brian Chung Garrett Ribas
Site/Location	Temescal Wash (PM 28.04) Lake Elsinore, CA
Conditions:	Clear, sunny

Identify Associated File Locations

GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province

- ☐ Modoc Plateau
- ☐ Coast Ranges
- ☐ Cascade Range
- ☐ Transverse Ranges
- ☐ Sierra Nevada
- ☒ Peninsular Ranges
- ☐ Klamath Mountains
- ☐ Mojave Desert
- ☐ Great Valley
- ☐ Colorado Desert
- ☐ Basin and Range

Step 3. Check Stream Type(s)

- ☐ Bedrock
- ☐ Cascade
- ☐ Step-Pool
- ☒ Engineered/channelized
- ☐ Plane-Bed
- ☐ Pool-Riffle
- ☐ Dune-Ripple
- ☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score 58.5

Rating GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections / **Notes by Cross Section**

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach		Notes by Cross Section
															1	
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☒	☒	☐	☒	☒	☐	☒	☒	☒	☒				2	
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										7	9	8	3	Dense vegetation. Inaccessible.
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										3	3	3	4	
3	Channel pattern	3	4		6	2		4	2	4	3			3.5	5	
4	Entrenchment/channel confinement	9	7		1	3		5	4	7	5			5.1	6	Dense vegetation. Inaccessible.
5	Bed material	3	3		2	3		3	3	3	3			2.9	7	
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	10%	10%		10%	10%		10%	10%	10%	10%				8	
6	Bar development	4	1		1	1		1	2	1	5			2	9	
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	3	2		10	6		7	3	7	4			5.25	10	Obstructions in the form of branches. Some undercutting, light mass wasting, rocks in slopes.
8	Bank soil texture and coherence	3	5		2	2		5	3	5	3			3.5	11	
9	Average bank slope angle	3	3		2	5		3	3	3	5			3.38	12	
10	Vegetative or engineered bank protection	9	3		5	4		2	10	3	10			5.75	13	
11	Bank erosion	8	5		4	3		3	7	4	5			4.88	14	
12	Mass wasting or bank failure	9	5		1	1		4	4	4	6			4.25	U/S	
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												7	D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information

Date(s):	April 15, 2021
Persons:	Daniel Price Samantha Carlson
Site/Location	Culvert 2 (PM 30.2) Temescal Valley, CA
Conditions:	Clear, sunny
Identify Associated File Locations	
GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province

- ☐ Modoc Plateau
- ☐ Cascade Range
- ☐ Sierra Nevada
- ☐ Klamath Mountains
- ☐ Great Valley
- ☐ Basin and Range
- ☐ Coast Ranges
- ☐ Transverse Ranges
- ☒ Peninsular Ranges
- ☐ Mojave Desert
- ☐ Colorado Desert

Step 3. Check Stream Type(s)

- ☐ Bedrock
- ☐ Cascade
- ☒ Step-Pool
- ☐ Engineered/channelized
- ☐ Plane-Bed
- ☐ Pool-Riffle
- ☐ Dune-Ripple
- ☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score 53.5

Rating GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☒	☒	☒	☒	☒	☒	☐	☐	☐	☐			
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										7	4	5.5
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										10	10	10
3	Channel pattern	4	2	7	6	4	1	EHM	EHM	EHM	EHM			4
4	Entrenchment/channel confinement	3	2	4	2	5	1	–	–	–	–			2.8
5	Bed material	2	2	2	5	5	5	–	–	–	–			3.5
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	20%	20%	20%	50%	50%	50%	–	–	–	–			
6	Bar development	1	1	1	1	1	2	–	–	–	–			1.2
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	2	2	3	2	7	2	–	–	–	–			3
8	Bank soil texture and coherence	2	1	1	1	1	1	–	–	–	–			1.2
9	Average bank slope angle	4	3	5	5	5	4	–	–	–	–			4.3
10	Vegetative or engineered bank protection	6	6	5	5	5	1	–	–	–	–			4.7
11	Bank erosion	1	1	2	2	5	1	–	–	–	–			2
12	Mass wasting or bank failure	1	1	3	1	1	1	–	–	–	–			1.3
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												10

Notes by Cross Section

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
U/S	
D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information		Step 2. Check California Physiographic Province		Step 3. Check Stream Type(s)
Date(s):	April 15, 2021	☐ Modoc Plateau	☐ Coast Ranges	☐ Bedrock
Persons:	Daniel Price Samantha Carlson	☐ Cascade Range	☐ Transverse Ranges	☐ Cascade
Site/Location	Culvert 3 (PM 30.3) Temescal Valley, CA	☐ Sierra Nevada	☒ Peninsular Ranges	☐ Step-Pool
Conditions:	Clear, sunny	☐ Klamath Mountains	☐ Mojave Desert	☐ Engineered/channelized
Identify Associated File Locations		☐ Great Valley	☐ Colorado Desert	☐ Plane-Bed
GPS/*.kml		☐ Basin and Range		☒ Pool-Riffle
Photos				☐ Dune-Ripple
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd			☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score	52.7
Rating	GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☐	☒	☒	☒	☒	☒	☒	☒	☒	☒			
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										10	4	7
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										9	9	9
3	Channel pattern	EHM	2	3	3	5	1	4	1	1	1			2.3
4	Entrenchment/channel confinement	–	1	4	4	4	4	5	1	1	2			2.9
5	Bed material	–	4	5	5	5	2	2	4	5	2			3.8
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	–	40%	50%	50%	50%	20%	20%	40%	50%	20%			
6	Bar development	–	1	2	2	5	1	2	2	4	2			2.3
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	–	4	5	8	7	3	3	5	5	3			4.8
8	Bank soil texture and coherence	–	2	2	2	2	1	2	2	2	1			1.8
9	Average bank slope angle	–	2	7	9	9	5	8	1	1	1			4.8
10	Vegetative or engineered bank protection	–	1	2	7	7	1	1	1	1	1			2.4
11	Bank erosion	–	1	2	7	2	2	7	1	1	1			2.4
12	Mass wasting or bank failure	–	1	2	4	5	4	1	1	1	1			2.2
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												7

Notes by Cross Section

1	Cross section is engineered.
2	
3	
4	
5	
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9	
10	
11	
12	
13	
14	
U/S	
D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information	
Date(s):	April 15, 2021; April 29, 2021
Persons:	Brian Chung, Samantha Carlson Garrett Ribas, Dan Price
Site/Location	Mayhew Wash (PM 31.97) Temescal Valley, CA
Conditions:	Clear, sunny
Identify Associated File Locations	
GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province

- ☐ Modoc Plateau
- ☐ Cascade Range
- ☐ Sierra Nevada
- ☐ Klamath Mountains
- ☐ Great Valley
- ☐ Basin and Range
- ☐ Coast Ranges
- ☐ Transverse Ranges
- ☒ Peninsular Ranges
- ☐ Mojave Desert
- ☐ Colorado Desert

Step 3. Check Stream Type(s)

- ☐ Bedrock
- ☐ Cascade
- ☐ Step-Pool
- ☐ Engineered/channelized
- ☒ Plane-Bed
- ☐ Pool-Riffle
- ☐ Dune-Ripple
- ☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score 71.3

Rating GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

#	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☐	☐	☐	☒	☒	☒	☒	☒	☒	☒			
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										9	8	8.5
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										10	10	10
3	Channel pattern				5	5	3	7	6	9	N/A			5.83
4	Entrenchment/channel confinement				4	4	3	2	3	4	N/A			3.33
5	Bed material				5	9	3	8	10	5	N/A			3.67
	Fs = approximate percentage of sand in bed sediments, 0 to 100.				20%	70%	20%	65%	90%	20%	N/A			
6	Bar development				1	2	1	7	7	6	N/A			4
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.				1	1	1	2	2	3	N/A			1.67
8	Bank soil texture and coherence				2	8	2	7	10	10	N/A			6.5
9	Average bank slope angle				3	2	3	10	9	10	N/A			6.17
10	Vegetative or engineered bank protection				2	5	2	8	10	11	N/A			6.33
11	Bank erosion				2	5	2	10	9	10	N/A			6.33
12	Mass wasting or bank failure				1	5	1	10	10	9	N/A			6
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												3

Notes by Cross Section

1	Dense brush. Inaccessible.
2	Dense brush. Inaccessible.
3	Dense brush. Inaccessible.
4	
5	
6	
7	
8	
9	
10	Not within channel reach.
11	
12	1:1, 45 degree slopes, armored slope
13	
14	
U/S	
D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information

- Date(s): April 15, 2021
- Persons: Daniel Price, Samantha Carlson
- Site/Location: Culvert 4 (PM 32.3) Temescal Valley, CA
- Conditions: Clear, sunny

Identify Associated File Locations

- GPS/*.kml
- Photos
- Other: https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province

- ☐ Modoc Plateau
- ☐ Cascade Range
- ☐ Sierra Nevada
- ☐ Klamath Mountains
- ☐ Great Valley
- ☐ Basin and Range
- ☐ Coast Ranges
- ☐ Transverse Ranges
- ☒ Peninsular Ranges
- ☐ Mojave Desert
- ☐ Colorado Desert

Step 3. Check Stream Type(s)

- ☐ Bedrock
- ☐ Cascade
- ☐ Step-Pool
- ☐ Engineered/channelized
- ☒ Plane-Bed
- ☐ Pool-Riffle
- ☐ Dune-Ripple
- ☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score 72.5

Rating GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐			
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										12	3	7.5
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										10	10	10
3	Channel pattern	2	3	3	4	4	EHM	EHM	EHM	EHM	EHM			3.2
4	Entrenchment/channel confinement	2	2	2	4	4	–	–	–	–	–			2.4
5	Bed material	3	7	7	7	7	–	–	–	–	–			6.2
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	20%	70%	70%	70%	70%	–	–	–	–	–			
6	Bar development	1	1	1	2	2	–	–	–	–	–			3.5
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	6	8	5	4	4	–	–	–	–	–			5.4
8	Bank soil texture and coherence	3	3	3	3	3	–	–	–	–	–			3
9	Average bank slope angle	2	6	6	7	7	–	–	–	–	–			5.6
10	Vegetative or engineered bank protection	2	2	2	2	2	–	–	–	–	–			5
11	Bank erosion	1	2	2	3	3	–	–	–	–	–			5.5
12	Mass wasting or bank failure	2	2	2	5	5	–	–	–	–	–			3.2
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												12

Notes by Cross Section

1	
2	
3	
4	
5	
6	Cross section is underground.
7	Cross section is underground.
8	Cross section is underground.
9	Cross section is underground.
10	Cross section is underground.
11	
12	
13	
14	
U/S	
D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information

Date(s):	April 15, 2021
Persons:	Daniel Price Samantha Carlson
Site/Location	Culvert 5 (PM 33.6) Temescal Valley, CA
Conditions:	Clear, sunny

Identify Associated File Locations

GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province

☐ Modoc Plateau	☐ Coast Ranges
☐ Cascade Range	☐ Transverse Ranges
☐ Sierra Nevada	☒ Peninsular Ranges
☐ Klamath Mountains	☐ Mojave Desert
☐ Great Valley	☐ Colorado Desert
☐ Basin and Range	

Step 3. Check Stream Type(s)

- ☐ Bedrock
- ☐ Cascade
- ☐ Step-Pool
- ☐ Engineered/channelized
- ☐ Plane-Bed
- ☒ Pool-Riffle
- ☐ Dune-Ripple
- ☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score 66.3

Rating GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒			
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										9	10	9.5
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										10	10	10
3	Channel pattern	1	1	1	1	1	4	5	7	7	3			3.1
4	Entrenchment/channel confinement	2	1	1	2	2	4	4	4	4	4			2.8
5	Bed material	6	7	8	8	6	5	5	5	5	5			6
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	70%	70%	80%	70%	40%	60%	60%	60%	60%	60%			
6	Bar development	1	1	1	1	1	1	1	1	1	1			1
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	3	2	1	1	4	8	10	10	8	8			5.8
8	Bank soil texture and coherence	1	1	1	1	1	1	1	1	1	1			1
9	Average bank slope angle	3	4	4	5	7	9	9	9	9	9			7.7
10	Vegetative or engineered bank protection	3	1	1	7	7	4	4	4	4	5			4
11	Bank erosion	1	1	1	1	1	2	2	2	2	2			1.5
12	Mass wasting or bank failure	1	1	1	1	1	4	2	2	2	4			1.9
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												12

Notes by Cross Section

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
U/S	
D/S	

Field Form for Caltrans Rapid Assessment of Stream Channel Stability and Susceptibilty to Hydromodification Induced Instability

Step 1. Provide Basic Information	
Date(s):	April 15, 2021
Persons:	Daniel Price Samantha Carlson
Site/Location	Culvert 6 (PM 35.7) Corona, CA
Conditions:	Clear, sunny
Identify Associated File Locations	
GPS/*.kml	
Photos	
Other	https://giswest.mbakerintl.com/bakerportal/apps/webappviewer/index.html?id=e42638377ebc4b9d976e670c8745dbdd

Step 2. Check California Physiographic Province	
☐ Modoc Plateau	☐ Coast Ranges
☐ Cascade Range	☐ Transverse Ranges
☐ Sierra Nevada	☒ Peninsular Ranges
☐ Klamath Mountains	☐ Mojave Desert
☐ Great Valley	☐ Colorado Desert
☐ Basin and Range	

Step 3. Check Stream Type(s)
☐ Bedrock
☐ Cascade
☐ Step-Pool
☐ Engineered/channelized
☐ Plane-Bed
☒ Pool-Riffle
☐ Dune-Ripple
☐ Braided

Step 5. Review Resulting Score of Hydromodification Susceptibility (Below) Based on Stream Channel Type

Category	Pool-riffle, Plane-bed, Dune-ripple, Engineered Channels	Cascade or Step-pool Channels	Braided Channels
Excellent	R < 49	R < 41	N/A
Good	49 ≤ R < 85	41 ≤ R < 70	R < 94
Fair	85 ≤ R < 120	70 ≤ R < 98	94 ≤ R < 129
Poor	120 ≤ R	98 ≤ R	129 ≤ R

R = Raw Score

Step 6. Summarize Site Score and Rating

Raw Score	58.5
Rating	GOOD

Step 4. Enter Stability Indicator Ratings at 10 Equally-Spaced Cross Sections

	Stability Indicators (Below) and Cross Section (XS) Numbers (Right)	1	2	3	4	5	6	7	8	9	10	Overview Entire Reach: Upstream	Overview Entire Reach: Downstream	Score for Reach	Notes by Cross Section	
	GPS shot? (check boxes for XS where GPS coordinates recorded) >>	☐	☐	☐	☐	☐	☒	☒	☒	☒	☒				1	
1	Watershed and floodplain activity and impacts	Evaluate at watershed-scale for upstream and downstream reaches >										9	12	10.5	2	
2	Flow characteristics	Evaluate at watershed-scale for upstream and downstream reaches >										12	12	12	3	
3	Channel pattern	EHM	EHM	EHM	EHM	EHM	2	2	2	2	2			2	4	
4	Entrenchment/channel confinement	–	–	–	–	–	3	3	3	4	4			3.4	5	
5	Bed material	–	–	–	–	–	7	7	7	7	7			7	6	
	Fs = approximate percentage of sand in bed sediments, 0 to 100.	–	–	–	–	–	5%	5%	5%	5%	5%				7	
6	Bar development	–	–	–	–	–	1	1	1	1	1			1	8	
7	Obstructions, including bedrock outcrops, armor layer, LWD jams, grade controls, bridge bed paving, revetments, dikes, vanes, or riprap.	–	–	–	–	–	1	1	1	1	1			1	9	
8	Bank soil texture and coherence	–	–	–	–	–	1	1	1	1	1			1	10	
9	Average bank slope angle	–	–	–	–	–	1	1	3	4	4			2.6	11	
10	Vegetative or engineered bank protection	–	–	–	–	–	4	4	4	4	4			4	12	
11	Bank erosion	–	–	–	–	–	1	1	1	1	1			1	13	
12	Mass wasting or bank failure	–	–	–	–	–	1	1	1	1	1			1	14	
13	Stream crossing alignment with flow and distance from stream crossing to upstream meander impact point.	Evaluate only for upstream approach >												12	U/S	
															D/S	