



City of San José Trail Program

Guadalupe River Trail UPRR Tracks Undercrossing Widening Study

June 2015

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1. Executive summary

The subject of this study is to propose recommendations for enhancing safety and access to the existing Guadalupe River Trail undercrossing at Union Pacific Railroad (UPRR) Bridge Number Four located between Coleman Avenue and West Julian Street in San José, California (Figure 1). The existing asphalt-concrete (AC) trail undercrossing is approximately 550 feet long and 8 feet wide. This segment of trail has a retaining wall up to four feet in height on its western side (riverside) and a retaining wall up to 15 feet in height on the eastern side (landside).

The current trail undercrossing was installed as part of the Guadalupe River Project (Contract 3A, Phase 3); based on the date of the as-built construction drawings for this project phase, GHD understands this trail segment was built by the United States Army Corps of Engineers (ACE) in 2010 and subsequently transferred to City of San José Redevelopment Agency.

The undercrossing is built on land owned by UPRR and the Sobrato Development Corporation. The trail is built in an area covered by an easement granted to the Santa Clara Valley Water District (SCVWD) for flood protection services and recreational use; an agreement exists between the City of San José (City) and the SCVWD outlining operations and maintenance responsibilities for flood control and recreational facilities along the Guadalupe River Park (City of San José and SCVWD, 2003).

The City has retained GHD to explore alternatives for improving the safety of the trail undercrossing. City staff believes that a range of alternatives could increase visibility and safety for trail users.

This report presents a low- and higher-cost alternative for improving this segment of the trail system. The low-cost option would include supplemental signage, striping, and parabolic mirrors, while the higher-cost option would involve trail realignment to further improve visibility. Each alternative presented must be acceptable to regulatory agencies with jurisdiction and/or permitting responsibility over the project site, including the ACE, Regional Water Quality Control Board (RWQCB), California Department of Fish and Wildlife (CDFW), SCVWD, and the Santa Clara Valley Habitat Agency (Habitat Agency).

Each alternative is accompanied by a site plan showing the proposed location and/or layout of improvements. A simple statement of purpose is included for all recommended solutions.

2. Existing Conditions

Information obtained for this report was provided through a variety of sources:

- Guadalupe River Project Contract 3A – Phase 3 (Replacement of UPRR Bridges Nos. 3 and 4) as-built construction drawing documents (as-built drawings)
- *Final General Re-Evaluation & Environmental Report for Proposed Project Modifications, Guadalupe River Project Downtown San José, California* (United States Army Corp of Engineers, 2001)
- *City of San José Trail Signage Guidelines* (City of San José, 2013)
- *City of San José Trail Count Data from Annual Counts and Survey* (City of San José, 2014)
- Discussions with City staff (Parks, Recreation & Neighborhood Services, Department of Public Works)
- Discussions with regulatory staff, including the ACE, CDFW, SCVWD, and Habitat Agency.

In addition, site visits were conducted by GHD in February 2015 to assess the existing design of the trail and identify potential areas for improvement.

The undercrossing is approximately 550 feet in length and is eight feet wide (Figure 1). The Guadalupe River lies approximately 60 feet to the west at the bridge undercrossing. From south of the bridge, the trail splits from the main trail/maintenance road and descends over a distance of 264 feet from an elevation of 76 feet to an elevation of 64.25, where the trail flattens underneath the railroad bridge. Vertical clearance between the trail and bridge soffit is 11 feet. On the north side of the bridge, the trail climbs over a distance of 194 feet where it intersects the main trail/maintenance road at an elevation of 78.12 feet (Figure 2). The trail is paved with asphalt concrete.

The landside (eastern side) of the trail is bordered by a retaining wall varying up to 15-feet in height. The riverside (western side) of the trail includes a four-foot high by 1-foot thick retaining wall. Beyond the riverside retaining wall, the area is unimproved, vegetated ground. Alterations to the trail are not easily made due to the retaining walls. An existing, concrete box bypass culvert underlies a portion of this trail segment at its northern and southern ends; over the majority of the trail segment, this culvert lies immediately east of the existing landside retaining wall. No alterations or impacts to the existing concrete box bypass culvert shall be permitted for the trail realignment project.

The main issues identified for improvement are:

- Visibility
 - Obstructed view due to curve approximately 50 feet south of bridge.
 - Obstructed view due to curve on north side of bridge.
- Capacity – trail width is currently eight feet (entire length) and constrained by retaining walls; optimal width for a heavily used trail is twelve feet with two-foot wide shoulders on either side.
- Route Guidance – no striping present, limited signage (entire length).

Figure 3 presents photographs of the trail in its existing condition.

3. Design Requirements

The Guadalupe River Trail is categorized as a Class I bikeway according to the California Highway Design Manual; this trail system is used by approximately 1,100 daily weekday users (City of San José, 2014). The following subsections describe design criteria to be considered when developing the alternatives for improving the trail segment.

3.1 California Department of Transportation Highway Design Manual Criteria

A Class I trail or bikeway is one that provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow by motorists minimized (CalTrans, 2012).

Class I trails meet the following design requirements:

- Width: 8 feet (minimum width for two-way path, measured between railing if present; 12 feet recommended for heavily used paths)
- Shoulder width: Two-foot minimum area shall be provided adjacent to the trail pavement.
- Lateral obstruction clearance: Two-foot wide clearance to be provided for trees, poles, walls, fences, guardrails or other lateral obstructions.
- Vertical obstruction clearance: 8 feet minimum (10 feet recommended) across the clear width of the path.
- Where paved path is contiguous with a continuous fixed object (e.g., retaining wall) a four-inch white edge line is recommended as a visual guide.
- Running-slope: There is no maximum grade requirement; however, a five percent slope is recommended.
- Cross-slope: Recommended 2% cross slope for drainage.
- Signage and delineation requirements shall conform to those provided in the Manual on Uniform Traffic Control Devices (MUTCD).

In addition, CalTrans Design Information Bulletin (DIB) 82-05, *Pedestrian Accessibility Guidelines for Highway Projects* adopts trail standards found in the United States Access Board's *Final Guidelines for Outdoor Developed Areas* (CalTrans, 2013; United States Access Board, 2015); see next section.

The existing trail's 8-foot width is consistent with the CalTrans Highway Design Manual criteria; however, it may not be optimal for the high usage of the Guadalupe River Trail. In addition, the obscured visibility due to the trail's curvature and constraining retaining walls can be improved to enhance safety.

3.2 United States Access Board Standards

Section 1017 of the Architectural Barriers Act (ABA) Standards has the following requirements for trails developed by the federal government (United States Access Board, 2015); these requirements are adopted by CalTrans for shared trails (i.e., bicycle and pedestrian joint use) within the State highway right of way and may be used as guidelines for this segment of the Guadalupe River Trail:

- Width: 36 inches minimum.
- Cross-slope: 2% maximum.
- Running-slope: Maximum 12% at any location; slopes must not exceed 8.33% for more than 30% of trail length.
- Landing/ resting interval: For running-slopes between 5% and 8.33% resting intervals required every 200 feet; between 8.33% and 10% every 30 feet; between 10% and 12% every 10 feet. Resting interval length is 60 inches minimum and width shall be equal to or greater than trail width.

3.3 Usability and ADA Requirements

The Americans with Disabilities Act (ADA) requirements do not provide guidelines for recreational trails. However, the City's trail design approach has been to seek to meet the intent of the ADA requirements. The 2010 ADA Standards require the following parameters for accessible routes (United States Department of Justice, 2010):

- Width: 36 inches minimum (between handrails if present)
- Running slope: 5% maximum; ramps are permitted a slope no steeper than 8.33% with exceptions for space limitations. Slopes steeper than 12.5% are prohibited.
- Cross-slope: 2% maximum.
- Landing/resting intervals: Maximum rise for any ramp run shall be 30-inch maximum with landings at top and bottom of each ramp run. Maximum slope at landing is 2%. Width of landing shall be equal to or greater than width of ramp run. Landing length to be 5-foot minimum.
- Handrails: Required where ramp runs have vertical rise greater than 6 inches; handrails not required where grades are less than 5%. Where required, handrails shall be provided on both sides of ramp and shall be continuous for full length of ramp run. Handrail height shall be 34 inches minimum and 38 inches maximum above walking surface (measured to top surface).

Although ADA requirements do not specifically apply to this trail, they have been taken into consideration for this report's recommendations.

3.4 Union Pacific Railroad, California Public Utilities Commission, and Existing Landowner Requirements

The land upon which the bridge undercrossing was constructed is owned by multiple entities. According to the Santa Clara County Assessor's Office website, a portion of the land bounded on the south by the railroad bridge is owned by UPRR (APN 25923024). This area includes the ending point of the undercrossing where the trail re-joins the main trail/maintenance road. At its southern end, land is owned by the Sobrato Development Corporation (Sobrato). The trail is built on an area covered by an easement granted to the SCVWD for flood protection services and recreational use; an agreement exists between the City and the SCVWD outlining operations and maintenance responsibilities for flood control and recreational facilities along the Guadalupe River Park which includes this undercrossing trail (City of San José and SCVWD, 2003). Any modifications to the existing trail are subject to requirements stipulated by these entities.

At the time of the development of this report, these requirements have not been communicated by these entities and will require additional investigation before project design. It is anticipated that

UPRR will have requirements related to the landside retaining wall, drainage, vertical clearances, and protective canopy. According to BNSF Railway – UPRR *Guidelines for Railroad Grade Separation Projects* (BNSF and UPRR, 2007), vertical clearances between the trail and railroad bridge soffit shall be no less than eight feet for pedestrian trails. As this trail is considered a Class I trail, with shared use by pedestrians and bicycles, it is not certain that this vertical clearance is applicable. Further, since the existing trail clearance was specified in the design as 11 feet and given the relatively recent construction of the existing undercrossing, it is assumed that 11 feet is the clearance that would be required by UPRR at this location. Because this project involves modification to an existing railroad crossing, any design changes will ultimately need to be approved by the California Public Utilities Commission (CPUC) through the General Order No. 88-B authorization process. The CPUC has jurisdiction over railroad crossings to ensure public safety and will have its own requirements for vertical clearance between the trail and railroad bridge soffit. Preliminary discussions with the CPUC indicated a vertical clearance of nine feet may be acceptable to the CPUC; however, further coordination with the agency is needed during the project design phase to adopt this clearance.

At the time of development of this report, the original agreement between UPRR and the City of San José was not available for review. In order to minimize the duration and cost of UPRR's and CPUC's review, it is recommended this agreement be provided by the City of San José to the reviewing agencies.

In issuing an encroachment permit, the SCVWD will require demonstration that any modification of the trail does not cause significant impact to the hydraulics of the Guadalupe River and that the existing box culvert which runs underneath and adjacent to the location of the trail undercrossing remains protected; hydraulic modelling is anticipated as a separate project to demonstrate the effects, if any, on the river hydraulics (please see Section 9.5.5 for further details regarding the SCVWD's permitting requirements).

Efforts to reach out and coordinate with Sobrato were made, but no response has been received at the time of development of this report. Therefore, it is unclear what requirements Sobrato will have for trail modification. The modified alignment will not encroach into the upland area where the owner may have further development opportunities.

4. Low-Cost and Higher-Cost Recommendations

The following sections present the low- and higher-cost alternatives for improvements to the Guadalupe River Trail UPRR Bridge No. 4 undercrossing.

4.1 Low-Cost Alternative

The low-cost approach is provided to offer improvements that require fewer resources and support improved safety. The low-cost alternative (Alternative 1) includes signage, striping, and mirror improvements to the trail segment. Figure 4 shows modification made to the trail under Alternative 1. Key modifications under this alternative are presented in Table 1.

Table 1. Alternative 1 Components

Category	Alternative Component	Description
Striping	Solid yellow striping	To be installed along the entire length of the trail undercrossing indicating that passing is not permitted.
	Solid white shoulder striping	To reinforce the presence of the retaining walls and railing on either side of the trail. To maximize trail tread width, the white shoulder striping should be installed at the base of the retaining wall but not further than four inches away from the base of the retaining wall. In this layout, the 4" stripe on either side of the trail will leave a 6' 8" wide travel lane (40" per direction of travel).
Signage	Sign CSJ-TW1, Bikeway Narrows	To alert users of reduced travel lane width along this undercrossing.
	Sign CSJ-TW8, High Water	Update existing sign to alert trail users of the potential for seasonal flooding of the undercrossing
	Sign CSJ-TW7, Steep Grade Ahead	Warns users of approaching downhill segment of trail.
	Sign CSJ-TW9, Slow	Warns users that the section of trail requires cautious movement
	Sign CSJ-TG6.2, Trail Continues Right	Informs users on the main trail/maintenance road of the approaching junction with the undercrossing segment to the right
	Sign CSJ-TG6.3, Trail Continues Left	Informs users on the main trail/maintenance road of the approaching junction with the undercrossing segment to the left
	Parabolic mirrors	Pole- or wall-mounted at designated curves (see Figure 4) to increase visibility of oncoming

Category	Alternative Component	Description
		bicyclist and pedestrian traffic

4.2 Higher-Cost Alternative

The higher-cost alternative (Alternative 2) includes a realignment of the trail undercrossing. Figure 5 shows plan and section views of Alternative 2. Under this alternative the entire trail would be widened to 12 feet. Key modifications to the trail layout under this alternative are presented in Table 2.

Table 2. Alternative 2 Components

Category	Alternative Component	Description
Trail Layout	Trail alignment	The trail would be straightened to eliminate the curve approximately 50 feet south of the bridge. On the north side of the bridge, the trail would be extended westward to allow for larger radius curves to be incorporated into the trail to enhance sight distance.
	Slopes and resting intervals/landings	Cross-slopes would be maintained at one percent and running slopes would vary from 7.0% to 8.3%. Six-foot long resting intervals/landings would be provided every 50 feet in accordance with prevailing trail accessibility standards (United States Access Board, 2015).
Retaining Walls	Existing retaining wall removal	The existing riverside retaining wall would be partially demolished and much of the existing trail would be backfilled to existing grade on the north side.
	New retaining wall	The realigned trail segment would be built with retaining walls on either side of the trail where required to support soils above finished grade of the trail. Any new retaining wall will be constructed to a height a minimum six inches above the top of existing grade on the riverside of the trail and would be constructed to match the existing conditions. The reconstructed retaining wall would vary in height from 0.5 feet to 4.2 feet, will be one foot in width, and approximately 184 feet in length. See Figure 5 for the extent of the proposed retaining wall.
	Fencing/Safety Barriers	Near the southern part of the trail segment, a portion of the concrete retaining wall would be reconstructed at a reduced height and fencing would be installed behind it as an enhanced safety feature to reduce potential for bicyclists to

Category	Alternative Component	Description
		leave the trail.
	Handrails	Handrails would be maintained on the landside retaining wall left in place and in areas where a retaining wall is greater than 34 inches in height. Portions of the realigned trail without a retaining wall would not include handrails to reduce the potential for bicycle collisions, reduce future maintenance or repairs required after a flood event, and prevent debris collection during high-water flows which could alter the channel hydraulics and lead to higher water surface elevations.
Striping	Solid yellow striping	To be installed along the entire length of the trail undercrossing indicating that passing is not permitted.
	Solid white shoulder striping	To reinforce the presence of the retaining walls and railing on either side of the trail where present. To maximize trail tread width, the white shoulder striping should be installed at the base of the retaining wall but not further than four inches away from the base of the retaining wall.
Signage	Sign CSJ-TW1, Bikeway Narrows	To alert users of reduced travel lane width along this undercrossing.
	Sign CSJ-TW8, High Water	Update existing sign to alert trail users of the potential for seasonal flooding of the undercrossing.
	Sign CSJ-TW9, Slow	Warns users that the section of trail requires cautious movement.
	Sign CSJ-TG6.2, Trail Continues Right	Informs users on the main trail/maintenance road of the approaching junction with the undercrossing segment to the right.
	Sign CSJ-TG6.3, Trail Continues Left	Informs users on the main trail/maintenance road of the approaching junction with the undercrossing segment to the left.

If the 11-foot clearance between trail and bridge soffit is required by the CPUC and UPRR, the bottom elevation of the undercrossing would be maintained at 64.25 feet. The 11-foot clearance is believed to be a requirement stipulated by the CPUC and UPRR for construction of the trail undercrossing in 2010. It would be desirable to raise the undercrossing elevation by three feet to 67.25 feet with eight feet of clearance below the bridge soffit to allow gentler running slopes along the realigned trail segment; although preliminary discussions with the CPUC suggest a nine-foot clearance may be possible, further consultation with the CPUC and UPRR is required during the

design phase to determine the acceptability of this modification. For this report, it is assumed the trail elevation at the undercrossing will be maintained at 64.25 feet.

5. Retaining Wall

The eastern, landside retaining wall serves as an abutment for the railroad bridge, protects the existing box culvert, and retains soil above the trail system and at the railroad bridge. No modifications are planned to the landside retaining wall. However, under Alternative 2 portions of the existing trail on the north side of the bridge would be backfilled to existing grade. The proposal to backfill this section of trail would require structural analysis and approval from UPRR.

Based on discussions with SCVWD and City staff, the riverside retaining wall was installed to protect the existing handrails and reduce the amount of debris deposited on the trail during flooding events; it was not installed for flood protection as flood elevations exceed the retaining wall elevations over a significant portion of this trail segment. Under Alternative 1, no modifications to the retaining wall would be required. Under Alternative 2, the riverside retaining wall will be demolished to accommodate the new trail alignment. It will be replaced in sections needed to retain soil at higher elevations than the trail.

6. Wayfinding and Regulatory Signage and Striping

Under Alternative 2, the trail would be realigned to increase sight distances and enhance safety. On the south side of the bridge, the alignment would remain the same, while the trail itself is widened. On the north side, the trail would be straightened, with a larger-radius curve incorporated starting from the point of connection to the main trail/maintenance road to eliminate the existing trail's tighter curves. The selected alignment was chosen for simplicity, enhanced visibility and to keep the trail as high on the hillside as possible to minimize encroachment within the top of bank of the river channel and riparian zone.

Signage and striping will be incorporated in accordance with the California Manual on Uniform Traffic Control Devices (MUTCD) and CalTrans *Highway Design Manual* (CalTrans, 2014). Solid yellow centerline striping is proposed for the entire length of the trail undercrossing to discourage bicycle passing on this segment of trail given the curves and grade characteristic of this section of trail. Solid white shoulder striping will be incorporated in sections of the trail bordered by a retaining wall to draw extra attention to the wall. Striping will be per City's specifications for highly-reflective thermoplastic striping.

Existing signs will be updated in conformance with the City's guidelines.

7. FEMA 100-Year Flood

According to the Federal Emergency Management Agency (FEMA), the 1% annual flood (i.e., 100-year flood) has a one percent chance of being equaled or exceeded in any given year. FEMA defines a Special Flood Hazard Areas as an area subject to flooding during the 1% annual flood. Based on the flood insurance rate map (FIRM) number 06085C0234H developed by FEMA, Panel 234 of 830 indicates the study area is located in flood Zone A, a Special Flood Hazard Area where no base flood elevations (water surface elevation of the 1% annual flood) are determined. However, information provided in the as-built drawings indicates that a base flood elevation of 71.8 feet was used for design purposes; therefore this study adopts this same base flood elevation.

A base-flood elevation of 71.8 indicates that a substantial portion of the trail undercrossing will be inundated during a 100-year flood. As such, adequate signage must be provided to trail users to alert them to this potential hazard. Existing signage indeed communicates this message (see photograph shown on Figure 3). Furthermore, any improvements to the trail will also be flooded during such a flood event. As such, efforts will be made to keep the trail as high on the embankment as possible while achieving the primary objectives of improving line of sight and user safety.

The City's *Draft Trail Design Guidelines* also recommend constructing trails above the 10-year flood level. Based on HEC-RAS model results produced during the design of the existing trail in 2006 and provided by SCVWD, the existing trail and the proposed realigned trail may be at elevations near or below the 10-year flood elevation. Updated survey data and an updated HEC-RAS model should be obtained to more accurately evaluate where the existing and proposed realigned trail would lie in relation to the 10-year flood elevation.

8. Engineer's Opinion of Probable Construction Costs

The preliminary opinion of probable construction cost for the two alternatives are presented on Table 3. The cost includes mobilization and demobilization as well as a 20% contingency for the low-cost alternative and a 40% contingency for the higher-cost alternative. In addition, the estimate includes contractor overhead (10%), profit (10%), and bonds (1.5%). The unit costs are based on estimated equipment and labor costs current as of April 2015 for the San Francisco Bay Area. The probable construction costs will be reviewed and updated during project design.

Table 3. Engineer's Opinion of Probable Construction Cost Summary ⁽¹⁾

Description	Alternative 1 Costs	Alternative 2 Costs
General ⁽²⁾	\$1,000	\$15,000
Civil/Site Work	\$14,500	\$73,000
Structural	\$0	\$145,000
TOTAL DIRECT COST	\$15,500	\$233,000
Contractor's Bonds, Insurance, Overhead and Profit	\$3,300	\$50,100
Construction Contingency	\$3,100	\$93,200
TOTAL ESTIMATED CONSTRUCTION COST	\$21,900	\$376,300

Note:

- (1) These costs do not include the preparation of construction documents, design review, California Environmental Quality Act (CEQA) documentation, construction inspection and management. Environmental permitting costs are included in Table 4 below.
- (2) General costs include mobilization/demobilization, site preparation, waste disposal, and survey and staking.

9. Environmental Permitting and CEQA Requirements

The environmental permitting and CEQA requirements described in this report are based on conceptual design. Additional research and coordination are required during the project design when project details become finalized.

9.1 Project Environmental History

The UPRR Bridge No. 4 trail undercrossing was constructed as part of the Guadalupe River Trail Project. In 2001, the ACE and SCVWD prepared a joint CEQA / National Environmental Policy Act (NEPA) Environmental Impact Report (EIR) / Supplemental Environmental Impact Statement (EIS) for the overall Guadalupe River Trail Project. The UPRR Bridge No. 4 trail was contemplated in the environmental document as either a bridge or underground crossing, and is included within the geographic scope of Segment 3A (ACE and SCVWD 2001). Because of limitations associated with construction of a new at-grade railroad crossing, an undercrossing was ultimately selected for the final design, and the UPRR Bridge No. 4 trail was constructed in 2010.

The EIR/Supplemental EIS found that construction and operation of the overall project would have significant but mitigatable impacts to riparian vegetation and aquatic habitat; a less-than-significant construction and operation impact to wildlife because the trails would be located outside of the riparian areas; and no significant impacts to special-status plant and animal species for Segment 3A (Army Corps and SCVWD 2001). Based on conversations with the SCVWD, it appears that permits from the ACE, U.S. Fish and Wildlife Service (USFWS) and RWQCB were required; however it is not known if these permits were required for the trail undercrossing, or for another part of the overall Guadalupe River Trail project.

9.2 Existing Conditions

The existing trail is located within the banks of the Guadalupe River. According to information provided by the SCVWD, the top of bank is located at an elevation of approximately 74 feet; therefore, the trail is below the top of bank and within the overall channel. The existing trail is adjacent to riparian habitat and was designed to avoid existing riparian vegetation. It appears that the trail is located above the ordinary high water line, although this has not been confirmed.

9.3 CEQA / NEPA Compliance

9.3.1 CEQA Compliance

Construction of the two alternatives would be subject to CEQA. Both Alternative 1 and Alternative 2 would likely qualify for Categorical Exemption 15301, Existing Facilities. This exemption covers minor alterations to existing facilities, including bicycle and pedestrian trails, provided that the project would involve negligible or no expansion of use. Because Alternative 1 and Alternative 2 are designed to construct minor alterations to improve the safety and functionality of the trail, with no expansion of use, it is likely that this exemption would apply.

Categorical exemptions are subject to several exceptions listed under Section 15300.2 of the CEQA Guidelines. If any of these exceptions apply to the project, the project would not be eligible for

coverage under any categorical exemption. One exception is for Significant Effects. This exception states that a project may not qualify for an exemption if there is a reasonable possibility that the project will have a significant effect on the environment due to unusual circumstances. Examples of significant effects from unusual circumstances could be removal of sensitive habitat, riparian habitat, or adverse effects to special-status species. If the project is designed and constructed in a manner that is consistent with the Santa Clara Valley Habitat Plan¹ (applicable conditions are listed in Section 9.4.3 below), and does not remove riparian or sensitive habitat or adversely affect special-status species, the project would not likely trigger this exception.

The other exceptions (cumulative impact; scenic highway; hazardous waste sites; and historical resources) do not appear to apply, because the project is not known to cause a cumulative effect, is not visible from a designated State scenic highway, is not located on a known hazardous waste site, and would not adversely affect the railroad bridge.

Following project approval, a Notice of Exemption should be filed with the County Clerk, which begins the 35-day statute of limitations during which the categorical exemption may be challenged. The CEQA exemption should be made available to the permit agencies as part of the permit applications prior to filing if necessary.

9.3.2 NEPA Compliance

NEPA documentation would not be required if sources other than federal funding are used. Local City funds as well as regional and state grants might be considered as alternative funding sources.

9.4 Permit Requirements

The following section describes the anticipated permitting requirements for Alternative 1 and Alternative 2. GHD has attempted to locate copies of existing permits, but none have been located. It is recommended that the existing permits be located and reviewed to determine if any conditions or measures were set that would restrict trail realignment (e.g., restricted covenants or other protections). GHD spoke with Dave Johnston at CDFW about the project. Dave Johnston indicated that it was unlikely that permit conditions were issued for the trail, and it was likely that the project was approved via op-law; CDFW received notification of the project, but did not reply within the 60-day timeline, therefore the project was allowed to proceed under Fish and Game Code 1602(a)(4)(D) (CDFW 2015).

Table 4. Permit Summary

Agency	Permit/Approval	Fee
Army Corps of Engineers	Written Certification of No Permit Required (for SCVWD encroachment permit)	None
Regional Water Quality Control Board	Section 401 Water Quality Certification or Waste Discharge Requirement	Varies ⁽¹⁾
California Department of Fish and Wildlife	Section 1600 Lake and Streambed Alteration Agreement	Varies ⁽²⁾

¹ The Habitat Plan states in Section 6.7.1, Evaluation Process for Permittee Projects, that projects exempt from CEQA may still be covered activities under the Habitat Plan and require compliance with the conditions of this Plan as described in this chapter.

Agency	Permit/Approval	Fee
City of San José Planning Department / Santa Clara Valley Habitat Agency	Santa Clara Valley Habitat Plan, Reporting Form for Public Projects	Varies ⁽³⁾
Santa Clara Valley Water District, Community Project Review Unit	Encroachment Permit	\$250 filing fee ⁽⁴⁾

Notes:

- (1) See Section 9.5.2, Fees
- (2) See Section 9.5.3, Fees
- (3) See Section 9.5.4, Fees
- (4) Minimum \$250 filing fee

9.4.1 Army Corps of Engineers

Background

The ACE has permitting authority over activities affecting waters of the United States. Under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, the ACE has authority over all waters including wetlands that have sufficient nexus to interstate commerce (e.g., navigable waters and their tributaries, such as Guadalupe River). If jurisdictional waters (i.e., below the ordinary high water line [OHWL]) or wetlands are impacted during construction or operation of the project, then an ACE Section 404 permit would be required.

Applicability

Alternative 1

Alternative 1 is not expected to require a Section 404 permit. This alternative would not require ground disturbance or any impact below the OHWL of this reach of Guadalupe River.

Alternative 2

Alternative 2 is not expected to require disturbance (e.g., dredging, filling, temporary construction access) below the OHWL of this reach of Guadalupe River and there are no known wetlands within the proposed construction area. Therefore an ACE permit is not anticipated for Alternative 2.

However, the OHWL and presence/absence of wetlands should be confirmed during project design, to confirm that Alternative 2 would not require disturbance within the Army Corps' jurisdiction. This effort can be combined with the verified land cover map required for the Habitat Plan, discussed in Section 9.5.4, below.

If wetlands are present within the project construction area, a wetlands and waters delineation map should be prepared and verified in the field with the ACE and to the extent feasible, the project should be designed to avoid all impacts to wetlands. If temporary or permanent impacts cannot be avoided, an ACE Section 404 permit would be required.

The SCVWD requires copies of all required environmental permits before they issue an encroachment permit. If no permit is required, the SCVWD requires written confirmation from the regulatory agency. Therefore, project information on Alternative 2 would need to be submitted to the ACE for compliance with the SCVWD encroachment application process.

Application Process

For a written confirmation of no permit required, project information should be submitted to Katerina Galacatos, South Branch Chief (katerina.galacatos@usace.army.mil), who will then assign a staff

person to the task. This should include a description of the project relative to the OHWL, a wetlands and waters delineation or survey, and project drawings.

Schedule

The schedule is not defined for a request for written confirmation of no permit required. However, the ACE has experienced significant staff reduction and as a result, the average review time has significantly increased. It is recommended that this request be submitted to the ACE at the same time as other permit applications.

Fees

No fees are expected for this process.

9.4.2 Regional Water Quality Control Board

Background

Under California's Porter-Cologne Water Quality Control Act (Porter-Cologne), the RWQCB regulates the discharge of waste to waters of the State, including wetlands, that are not within the ACE's jurisdiction.

All parties proposing to discharge waste that could affect waters of the State must file a report of waste discharge with the RWQCB. The RWQCB will then respond to the report of waste discharge by issuing waste discharge requirements (WDRs) in a public hearing, or by waiving WDRs (with or without conditions) for that proposed discharge. While Section 404 permits and 401 certifications are required when the activity results in fill or discharge directly below the OHWL of waters of the United States, any activity that results or may result in a discharge that directly or indirectly impacts waters of the State or the beneficial uses of those waters are subject to WDRs. In practice, this typically includes a stream channel up to the top of bank, and associated riparian areas.

Applicability

Alternative 1

Alternative 1 is not expected to result in temporary or permanent impacts to the Guadalupe River channel, banks, or riparian zone because no ground disturbance would occur. A permit from the RWQCB would not be required for Alternative 1.

Alternative 2

Alternative 2 would require grading and cut/fill within the banks of Guadalupe River. No riparian vegetation is anticipated for removal at this time. No wetlands are known to be present within the construction area, but should be confirmed as per discussion in Section 9.5.1, above. Because Alternative 2 would require fill/discharge within the banks of the Guadalupe River, a waste discharge permit from the RWQCB would be required.

Application Process

The San Francisco RWQCB has a combined 401 certification/waiver of WDRs application form. Alternative 2 would require submittal of a combined 401 certification/waiver of WDRs application form. The application process would include the following:

- Submittal of notification of permit application form.
- The project CEQA document.
- Complete project description, project drawings, and quantification of project impacts.

- Proposed mitigation for temporary and permanent impacts.
- A biological study describing potential impacts to special-status species and habitat types.
- Payment of fees.

Schedule

The RWQCB generally determines completion of an application within 30 days of receipt. However, the San Francisco RWQCB has recently taken much longer to respond to application submittals.

Fees

The RWQCB fee varies depending on the size of the discharge. Based on the 2015 calculator, fill and excavation discharges are calculated at a rate of \$13.50/LF or \$5,670/acre, whichever is greater. Additional charges include an annual active discharge fee, and an annual post discharge monitoring fee.

A minimum \$640 fee deposit is required as part of a completion application.

9.4.3 California Department of Fish and Wildlife

Background

Fish and Game Code section 1602 requires notification to the CDFW prior to commencing any activity that may: 1) substantially divert or obstruct the natural flow of any river, stream or lake; 2) substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or 3) deposit debris, waste or other materials that could pass into any river, stream or lake. If the project alters the existing streambed or banks of Guadalupe River, including removing or impacting riparian vegetation, a Lake and Streambed Alteration Agreement (Agreement) would be required.

Applicability

Alternative 1

Alternative 1 is not expected to result in temporary or permanent impacts to the Guadalupe River channel, banks, or riparian zone because no ground disturbance would occur. An Agreement would not be required for Alternative 1.

Alternative 2

Alternative 2 would require grading and cut/fill within the banks of Guadalupe River. No riparian vegetation is anticipated for removal at this time. Because Alternative 2 would alter the existing banks of Guadalupe River, an Agreement would be required.

Application Process

Alternative 2 would require submittal of a notification to the CDFW. The notification process would include the following:

- Submittal of notification of lake or streambed alteration form.
- The project CEQA document and record of CEQA filing fee if applicable.
- Complete project description, project drawings, and accompanying reports, including project cost.
- Estimated number and type of trees to be removed, if any (all trees greater than 2 inches in diameter at breast height).

- Biological study describing potential impacts to special-status species and habitat types.
- A hydrological study may be required.
- Payment of fees.

Schedule

The CDFW has 30 days from receipt of the application package to determine whether a notification is complete. If the CDFW determines the notification is incomplete, the CDFW will specify the information or materials that are lacking and will need to be provided to determine the notification complete. Once an application is complete, if the CDFW determines that an Agreement is required, it will submit a draft Agreement for review within 60 days of determining the notification complete. After receiving the draft Agreement, the applicant has 30 days to notify the CDFW whether the measures in the draft Agreement are acceptable.

Fees

Fees for Standard Agreements (five years or less) are determined based on project cost. Project cost is limited to that portion of the project that is within CDFW's jurisdiction. Fees range as follows:

- \$245.50 if the project costs less than \$5,000.
- \$307.25 if the project costs from \$5,000 to less than \$10,000.
- \$613.75 if the project costs from \$10,000 to less than \$25,000.
- \$921.00 if the project costs from \$25,000 to less than \$100,000.
- \$1,351.50 if the project costs from \$100,000 to less than \$200,000.
- \$1,833.25 if the project costs from \$200,000 to less than \$350,000.
- \$2,763.25 if the project costs from \$350,000 to less than \$500,000.
- \$4,912.25 if the project costs \$500,000 or more.

9.4.4 Santa Clara Valley Habitat Plan Permit

Background

The Santa Clara Valley Habitat Plan (Habitat Plan) was adopted in 2013 to protect endangered species covered under the Endangered Species Act (ESA) and natural resources while allowing for future development in Santa Clara County. The Habitat Plan was adopted by all local participating agencies and permits were issued for covered activities within the Habitat Plan area from the USFWS and CDFW. The Habitat Plan enables the local participating agencies (i.e., Co-Permittees) to allow covered projects and activities to occur in endangered species' habitats and grant endangered species permits to projects and activities under their jurisdiction. In exchange, these projects and activities must incorporate Habitat Conservation Plan (HCP)-prescribed measures to avoid, minimize, or compensate for adverse effects on natural communities and endangered species.

Co-Permittees, such as the City of San José, are authorized to permit their own public projects under the Habitat Plan. The Co-Permittees are required to record their covered project compliance using the reporting materials provided by the Santa Clara Valley Habitat Agency (Habitat Agency). Completed materials, including applicable fees, are then submitted to the Habitat Agency for approval.

Applicability

Alternative 1

Alternative 1 would not require ground disturbance, vegetation removal, or other disturbance to habitat. Based on a conversation with Edmund Sullivan at the Habitat Agency, Alternative 1 as currently designed would not require an application to the Habitat Agency. This should be confirmed during Project design.

Alternative 2

Alternative 2 would include ground disturbance and therefore, it would be subject to the terms and conditions in the Habitat Plan. A preliminary review of the Habitat Plan Fees and Conditions Worksheet for Public Projects and Geobrowser online mapping tool was conducted to determine which terms and conditions are applicable to Alternative 2.

The project area for Alternative 2 (as conceptually shown on Figure 5) was mapped in the Geobrowser to produce an area report. According to the area report, the Alternative 2 project area is located within land cover mapped as “urban-suburban” (estimated 0.16 acre) and “mixed riparian forest and woodland” (estimated 0.1 acre) and fee Zone B, Agricultural and Valley Floor Lands. However, as described in the Worksheet for Public Projects (e.g., instructions), a field-verified land cover map would need to be prepared by a qualified biologist during project design in order to determine actual site conditions.

Alternative 2 appears to be a covered activity under the “In-Stream Capital Projects, Streamside Trails and Crossings” category, and therefore subject to several conditions described in the next section. The term in-stream is defined as the stream bed and bank and the surrounding adjacent riparian corridor. This category includes activities in the stream channel, along the stream bank, and adjacent lands at top-of-bank within the riparian corridor, which would be applicable to Alternative 2.

Conditions

The Habitat Plan sets forth conditions on covered activities in Chapter 6 of the plan. Alternative 2 would likely be subject to the following conditions² in the Habitat Plan because of its partial location in “mixed riparian forest and woodland” land cover.

- *Condition 1: Avoid Direct Impacts on Legally Protected Plant and Wildlife Species.* Impacts to Contra Costa Goldfields, Golden eagle, Bald eagle, American peregrine falcon, Southern bald eagle, White-tailed kite, California condor, and Ring-tailed cat should be avoided. In accordance with the Migratory Bird Treaty Act, nesting birds should be protected.
- *Condition 3: Maintain Hydrologic Conditions and Protect Water Quality.* All avoidance and minimization measures listed in Table 6-2 of the Habitat Plan are required unless it is not appropriate for the activity, or field data collected demonstrates that the measure would not benefit wildlife or reduce impacts on natural communities. Upon initial review, it appears that the measures listed in Table 6-2 would be feasible for the project.
- *Condition 4: Stream Avoidance and Minimization for In-Stream Projects.* All in-stream projects must be designed to minimize adverse impacts on stream morphology, aquatic and riparian habitat, and flow conditions. All in-stream projects must adopt design requirement and construction avoidance and minimization measures to minimize impacts on covered species, natural communities, and wildlife movement. All avoidance and minimization measures listed

² Recreational trails are exempt from Condition 11, Stream and Riparian Setbacks.

in Table 6-2 of the Habitat Plan are required unless it is not appropriate for the activity, or field data collected demonstrates that the measure would not benefit wildlife or reduce impacts on natural communities. Upon initial review, it appears that the measures listed in Table 6-2 would be feasible for the project.

- *Condition 17: Tricolored Blackbird Survey.* Projects require surveys if the project-specific verified land cover map shows that the project area is within 250 feet of any riparian, coastal and valley freshwater marsh (perennial wetlands), or pond land cover types. Because Alternative 2 is within and adjacent to riparian land cover as generally delineated in the Geobrowser area report, a qualified biologist would be required conduct a field investigation to identify and map potential nesting substrate. If potential nesting substrate is found, the project may avoid all areas within a 250-foot buffer around the potential nesting habitat and surveys would be concluded. If the project does not avoid potential nesting habitat and buffer, additional nesting surveys would be required prior to ground disturbance: 1) determine if nesting has occurred within the past five years, including utilizing the California Natural Diversity Database (CNDDDB), contacting local experts and looking for evidence of historical nesting; and 2) if no nesting in the past five years is evident, conduct a preconstruction survey to document presence or absence. A preliminary survey up to 14 days before construction may be conducted. If a tricolored blackbird nesting colony is present, a 250-foot buffer would be applied from the outer edge of all hydric vegetation associated with the site and the site plus buffer would be avoided and the Wildlife Agencies would be notified immediately of nest locations. If construction takes place during the nesting season with an active colony presence, construction monitoring would be required.

Alternative 2 would likely not trigger any covered plant surveys (Condition 20) because Willow riparian forest and scrub land cover and urban-suburban land cover are not listed in land cover/habitat types for which surveys are required, unless a known occurrence is within 0.25 mile of the project site (page 6-76, Habitat Plan 2012). Applicability of Condition 20, and all other applicable conditions, should be confirmed during the application process.

Application Process

Alternative 2 would be subject to the application projects for public projects. Submittal of the Reporting Form for Public Projects to the Habitat Agency would require:

- Submittal of the Reporting Form for Public Projects.
- Project description information, including project impacts, site plans, vicinity map, and CAD files.
- Map of land cover types on site, prepared by a qualified biologist, including a table that shows the amount of each land cover type to the nearest 0.1 acre for all non-stream land covers, or linear foot for streams. Biologist qualifications must be submitted to the Habitat Agency prior to field visit.
- Map of wetlands, ponds, streams, and riparian woodlands on site, prepared by a qualified biologist. A map of all coastal and valley freshwater marsh, seasonal wetlands, ponds, riparian woodland, and streams is required for any project subject to the Habitat Plan that may directly or indirectly affect these aquatic land cover types (this can be a wetland and waters delineation that also maps the ordinary high water line).
- Results of applicable species surveys and monitoring, such as for the tri-colored blackbird, described above.

- Compliance documentation, to verify that applicable conditions have been implemented.
- Payment of fees.

Schedule

The Habitat Plan recommends that preparation of the Habitat Plan documentation package commence as the CEQA project description and alternatives for the project are developed. As the project may qualify for an exemption, it is recommended that the Habitat Plan documentation package commence prior to posting the exemption.

Fees

Alternative 2 would be subject to the following fees because part of the realigned trail is located within mixed riparian forest and woodland land cover. There are no fees for urban-suburban land cover. The actual land cover at the project site would need to be verified and mapped by a qualified biologist to determine the fees applicable to the project.

- Zone B (Agricultural and Valley Floor Lands): \$11,806 per acre
- Wetland Fee Zone: Willow Riparian Forest and Mixed Riparian: \$142,838 per acre

9.4.5 Santa Clara Valley Water District Encroachment Permit

Background

The SCVWD Community Projects Review Unit administers the Water Resources Protection Ordinance using the Water Resources Protection Manual in order to protect water resources managed by the SCVWD. The ordinance regulates modifications, entry, use or access to SCVWD facilities and/or SCVWD easements. The SCVWD grants written permission, in the form of an encroachment permit, pursuant to the ordinance, allowing a permittee to enter, use, temporarily access, or undertake any modification to SCVWD facilities and/or easements.

Applicability

Based on preliminary conversations between GHD and Steve Ferranti at the SCVWD, the SCVWD maintains an easement within which the existing trail is located for flood protection and recreational purposes.

Alternative 1

Alternative 1 is not expected to require an encroachment permit from the SCVWD because no ground disturbing activities or physical alterations would be made to the trail.

Alternative 2

Alternative 2 is expected to require an encroachment permit from SCVWD because it includes physical alterations to the trail.

Application Process

An encroachment permit application would need to be completed and submitted to the SCVWD for construction of Alternative 2. The application submittal should include the following:

- The project CEQA document.
- Complete project description, project drawings, and accompanying reports.

- Other required permits (or written certification that no permits are required, refer to the discussion above under Army Corps of Engineers).
- As previously indicated to GHD, in an email dated March 6, 2015, the SCVWD will want documentation that the project would not alter the channel hydraulics.
- \$250 filing fee.

Schedule

Review times vary depending on the complexity of the project and available SCVWD staff resources. At least four weeks would be required for permit requests. If an application is incomplete, SCVWD would notify the Applicant of outstanding information required to process the application.

Fees

Alternative 2 would be subject to the \$250 filing fee for an encroachment permit. Actual permit costs may be greater, and are based on billing rates for staff services and reimbursement of application review costs. Additional fees, such as a construction fee for permanent uses, may also apply.

10. Summary and Recommendations

A comparison of Alternatives 1 and 2 is provided in Table 5.

Table 5. Alternative Comparison Matrix

Alternative	Effects of 100-Year Flood	Usability/ADA	Environmental and CEQA Requirements	Other Requirements	Probable Construction Cost
Alternative 1	As-built elevations indicate trail is partially constructed below 100-year flood elevation; approximately 133 feet would be inundated during 100-year flood.	Existing trail constructed in accordance with ADA requirements for access routes. Max running slopes of 8.33% and resting intervals every 30 feet where slope >5%.	<ul style="list-style-type: none"> • CEQA Categorical Exemption 	None	\$21,900
Alternative 2	Based on as-built elevation data, the realigned undercrossing trail would be partially constructed below the 100-year flood elevation; approximately 254 feet would be inundated during a 100-year flood.	Existing trail would be constructed in accordance with ABA Standards for trails and County of Santa Clara Trail Design Guidelines. Max running slopes of 8.29% and resting intervals every 50 feet where slope >5%.	<ul style="list-style-type: none"> • CEQA Categorical Exemption • ACE Written Confirmation of No Permit Required • RWQCB Section 401 Water Quality Certification/ Waste Discharge Requirement • CDFW Lake and Streambed Alteration Agreement • Habitat Plan Reporting Form • SCVWD Encroachment Permit 	<ul style="list-style-type: none"> • Grading Permit • Potential UPRR requirements • CPUC Railroad Crossing Modification GO-88B Authorization • Potential Sobrato Development Corporation requirements 	\$376,300

Further negotiations with the regulating agencies and landowners will be required to finalize the design and may cause the conceptual design outlined herein to change. The alternatives presented were developed based upon the best available information including as-built documentation, the *Final General Re-Evaluation & Environmental Report for Proposed Project Modifications, Guadalupe River Project Downtown San José, California*, and initial discussions with City and

SCVWD staff; no survey data were available for the development of this report. The proposed higher-cost alternative may change as more detailed information becomes available.

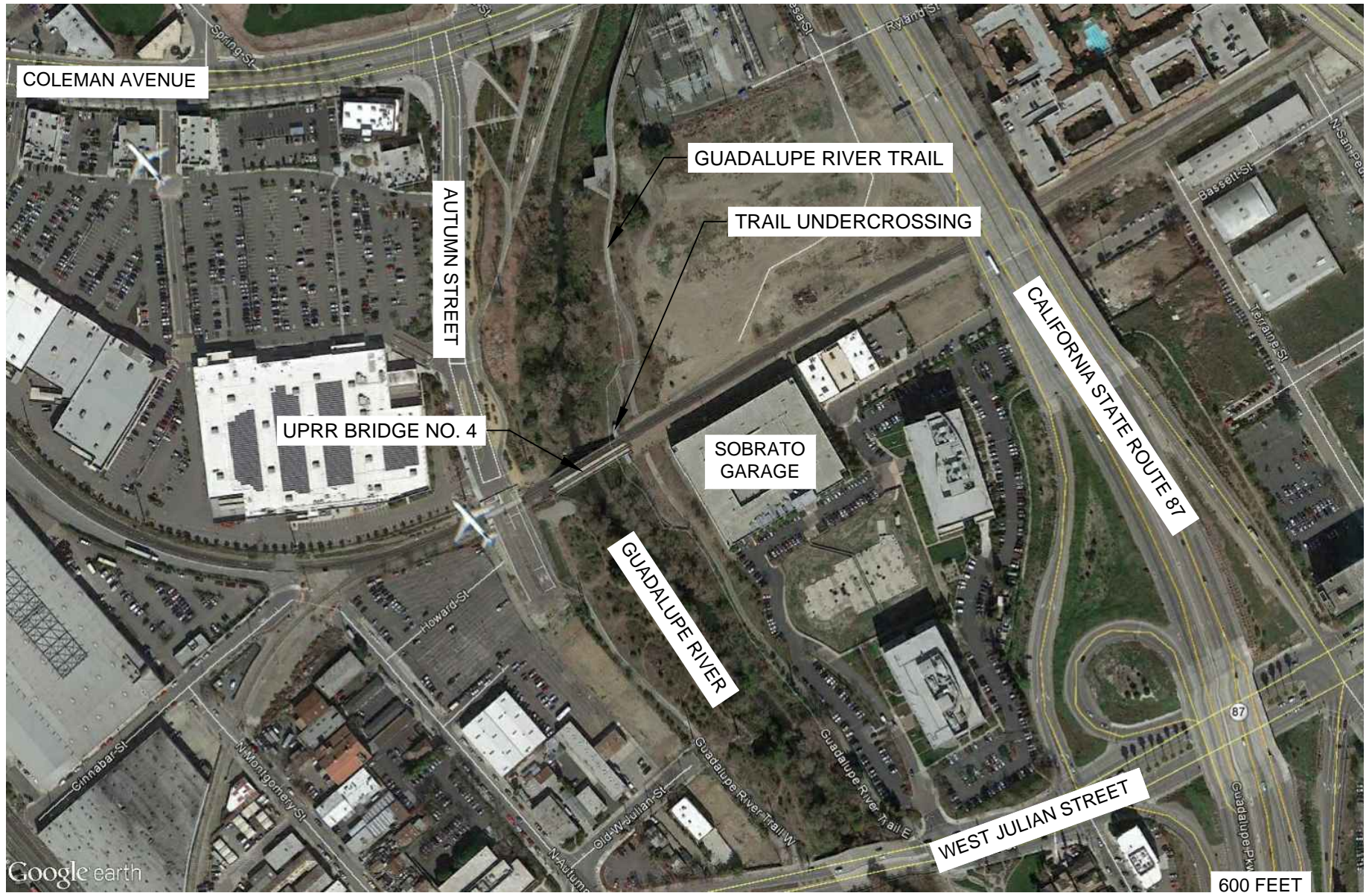
11. References

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FIGURES





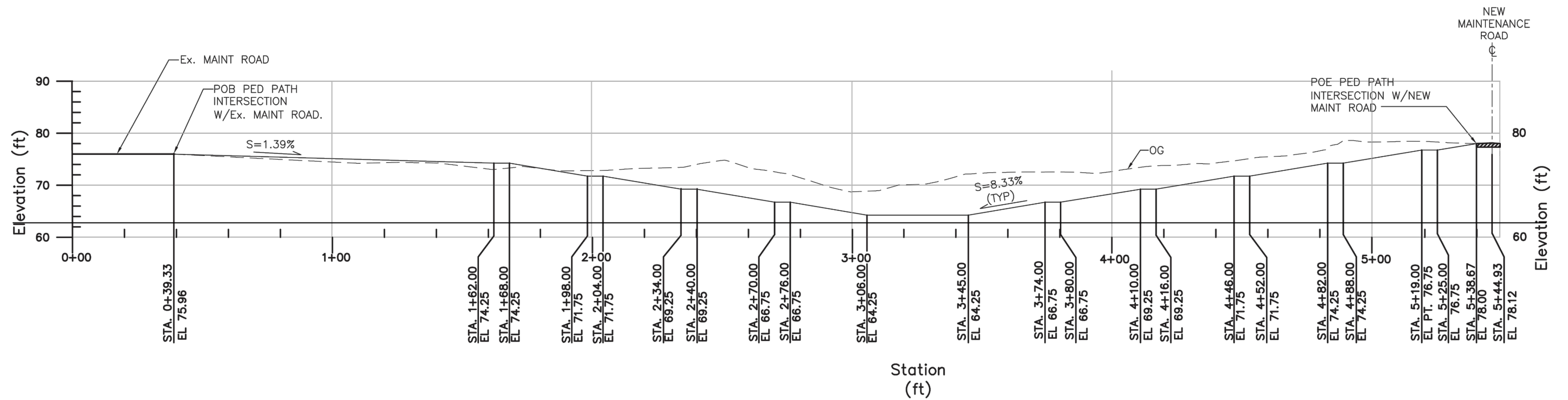
SOURCE: GOOGLE EARTH, IMAGERY DATE: 2/23/2014



City of San Jose
 Guadalupe River Trail
 UPRR Bridge No. 4 Undercrossing Improvements
 Existing Site Layout

Job Number | 8411683
 Revision |
 Date | June 2015
Figure 1

1735 North First Street Suite 301 San Jose California 95112 USA T 1 408 451 9615 F 1 408 451 9665 W www.ghd.com



PROFILE @ CENTERLINE OF
PEDESTRIAN PATH

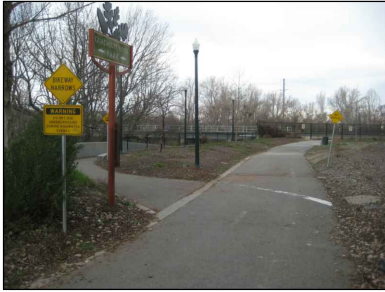
SCALE: H: 1"=20', V: 1"=10'

IMAGE SOURCE: GUADALUPE RIVER PROJECT CONTRACT 3A - PHASE 3 (REPLACEMENT OF UPRR BRIDGES NOS. 3 & 4), SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA, AS-BUILT DRAWINGS (US ARMY CORPS OF ENGINEERS).



City of San Jose
Guadalupe River Trail
UPRR Bridge No. 4 Undercrossing Improvements
**Existing Trail Profile
From As-Built Drawings**

Job Number | 8411683
Revision |
Date | June 2015
Figure 2



SOUTH JUNCTION WITH MAIN TRAIL/MAINTENANCE ROAD



STARTING LOCATION OF RETAINING WALLS



FENCE SOUTH OF UNDERCROSSING TRAIL



RETAINING WALLS AND RAILROAD BRIDGE

1 IMAGE SEQUENCE - SOUTH OF BRIDGE
SCALE : NTS



CURVE NORTH OF BRIDGE



VIEW LOOKING SOUTH, BOTH RETAINING WALLS VISIBLE



STARTING LOCATION OF RETAINING WALLS



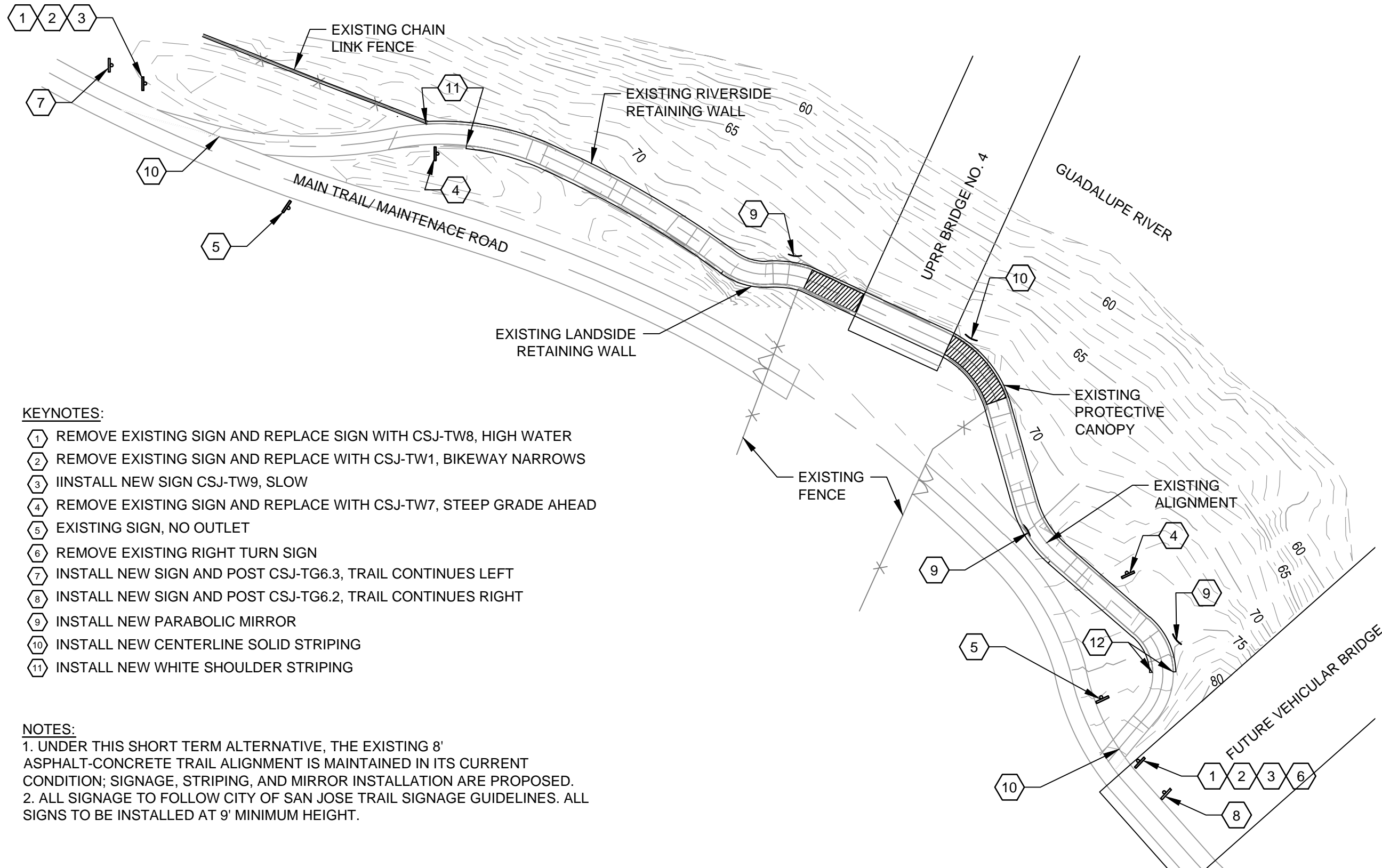
NORTH JUNCTION WITH MAIN TRAIL/MAINTENANCE ROAD

2 IMAGE SEQUENCE - NORTH OF BRIDGE
SCALE : NTS



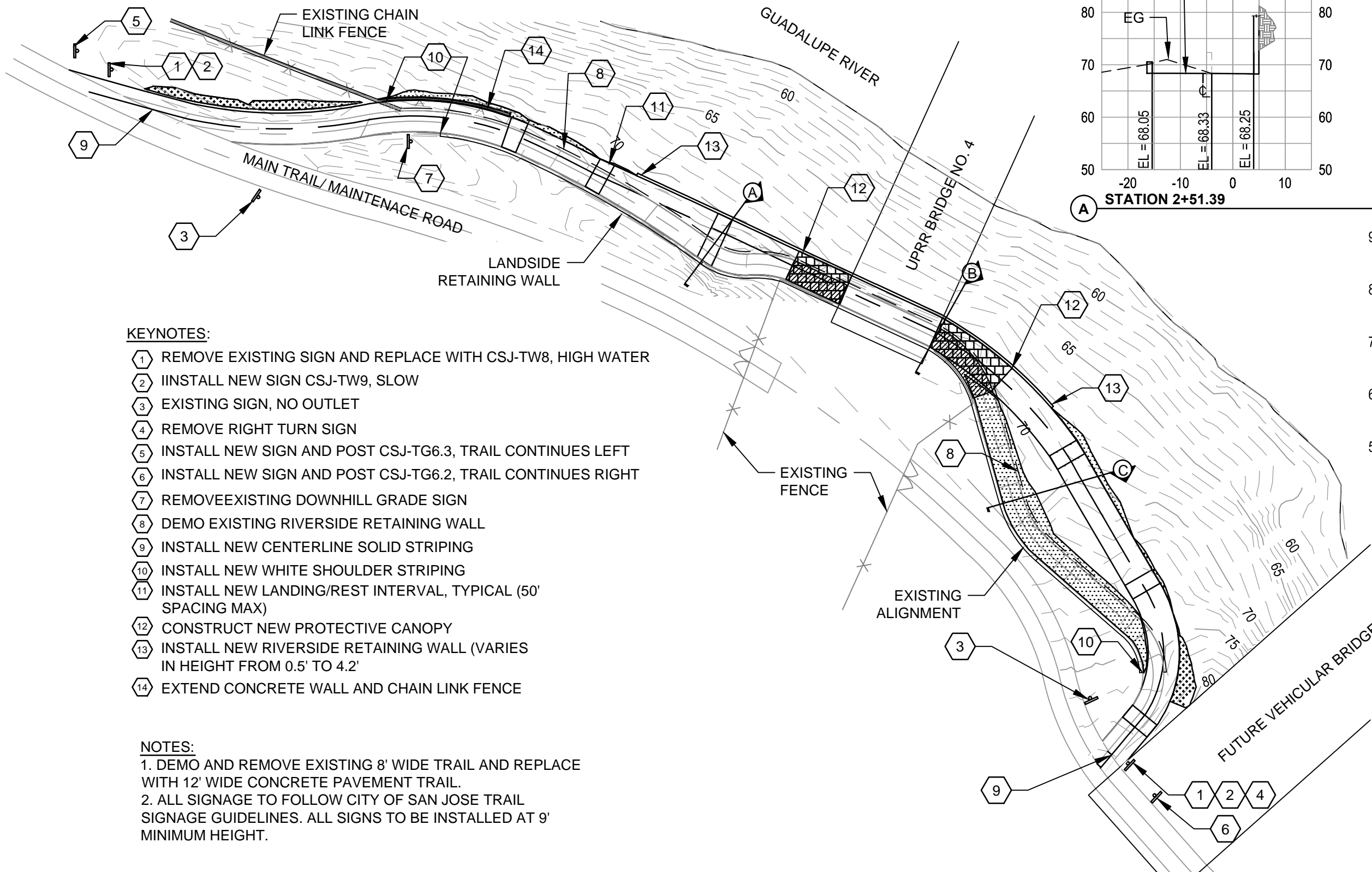
City of San Jose
Guadalupe River Trail
UPRR Bridge No. 4 Undercrossing Improvements
Site Photographs

Job Number | 8411683
Revision |
Date | June 2015
Figure 3



City of San Jose
 Guadalupe River Trail
 UPRR Bridge No. 4 Undercrossing Improvements
Alternative 1
Trail Improvements

Job Number | 8411683
 Revision |
 Date | June 2015
Figure 4

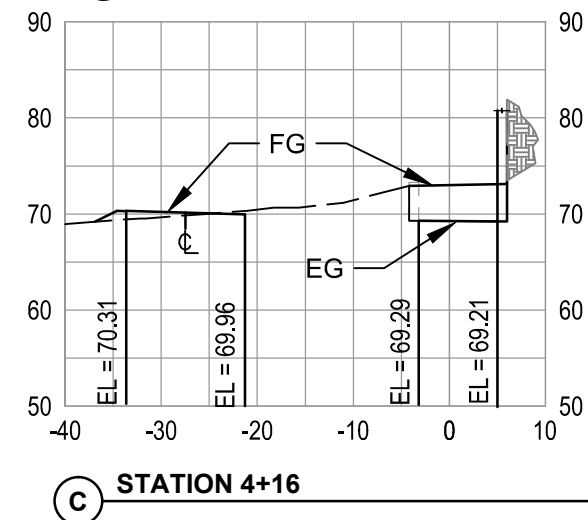
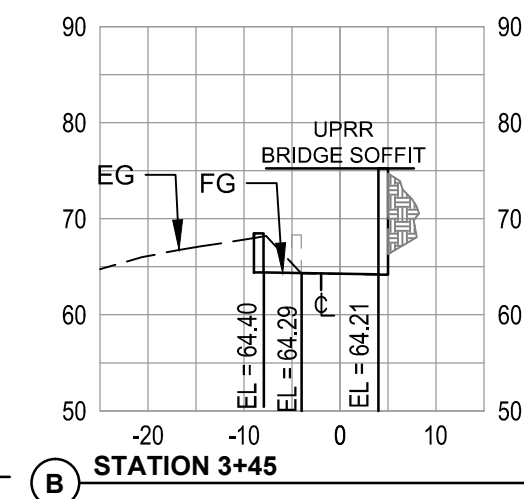
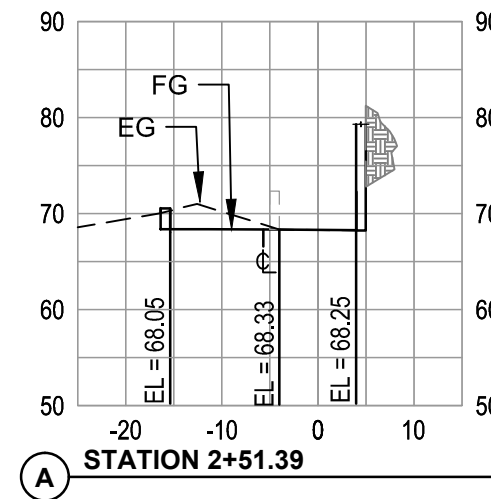


KEYNOTES:

- 1 REMOVE EXISTING SIGN AND REPLACE WITH CSJ-TW8, HIGH WATER
- 2 IINSTALL NEW SIGN CSJ-TW9, SLOW
- 3 EXISTING SIGN, NO OUTLET
- 4 REMOVE RIGHT TURN SIGN
- 5 INSTALL NEW SIGN AND POST CSJ-TG6.3, TRAIL CONTINUES LEFT
- 6 INSTALL NEW SIGN AND POST CSJ-TG6.2, TRAIL CONTINUES RIGHT
- 7 REMOVE EXISTING DOWNHILL GRADE SIGN
- 8 DEMO EXISTING RIVERSIDE RETAINING WALL
- 9 INSTALL NEW CENTERLINE SOLID STRIPING
- 10 INSTALL NEW WHITE SHOULDER STRIPING
- 11 INSTALL NEW LANDING/REST INTERVAL, TYPICAL (50' SPACING MAX)
- 12 CONSTRUCT NEW PROTECTIVE CANOPY
- 13 INSTALL NEW RIVERSIDE RETAINING WALL (VARIES IN HEIGHT FROM 0.5' TO 4.2')
- 14 EXTEND CONCRETE WALL AND CHAIN LINK FENCE

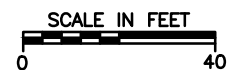
NOTES:

- 1. DEMO AND REMOVE EXISTING 8' WIDE TRAIL AND REPLACE WITH 12' WIDE CONCRETE PAVEMENT TRAIL.
- 2. ALL SIGNAGE TO FOLLOW CITY OF SAN JOSE TRAIL SIGNAGE GUIDELINES. ALL SIGNS TO BE INSTALLED AT 9' MINIMUM HEIGHT.



LEGEND:

- FILL
- CUT
- PROTECTIVE CANOPY (EXISTING)
- PROTECTIVE CANOPY (NEW)



City of San Jose
 Guadalupe River Trail
 UPRR Bridge No. 4 Undercrossing Improvements
Alternative 2
Trail Realignment

Job Number | 8411683
 Revision |
 Date | June 2015

Figure 5

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