



Application for a  
Central Valley Flood Protection Board Encroachment Permit

**Two Rivers Trail Phase II Project**

Submitted by:  
City of Sacramento  
915 I Street, Room 2000  
Sacramento, CA 95814

Contact:  
Adam Randolph, Project Manager  
916-808-7803  
arandolph@cityofsacramento.org

December 1, 2020

Application for a  
Central Valley Flood Protection Board Encroachment Permit

## Two Rivers Trail Phase II Project

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*City of*  
SACRAMENTO

December 1, 2020

Ms. Leslie Gallagher  
Executive Officer  
Central Valley Flood Protection Board  
3310 El Camino Avenue  
Sacramento, CA 95821

Subject: Central Valley Flood Protection Board Encroachment Permit Application  
City of Sacramento - Two Rivers Trail (Phase II) Project

Dear Ms. Gallagher,

The City of Sacramento (City) is hereby submitting this Application for a Central Valley Flood Protection Board Encroachment Permit for work associated with the Two Rivers Trail (Phase II) Project. As required, enclosed are two (2) copies of the Encroachment Permit Application (DWR 3615) and Environmental Questionnaire (DWR 3615a) with supporting documentation. Permits and consultations from other agencies are in process and will be submitted once finalized. This permit application and all supporting documentation is also available for download at:

<https://geiconsultants.sharefile.com/d-sb0f16f063204935a>

If you have any question or need additional information regarding the proposed project, please contact me at (916) 808-7803 or by email at [arandolph@cityofsacramento.org](mailto:arandolph@cityofsacramento.org).

Sincerely

Adam Randolph, Senior Engineer  
City of Sacramento

Enclosures

cc: Tim Kerr, American River Flood Control District  
Ray Weiss, GEI Consultants

# 1. Form 3615 and Environmental Questionnaire 3615a

APPLICATION FOR A CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMIT

Application No. [Redacted] (For Office Use Only)

1. Description of proposed work being specific to include all items that will be covered under the issued permit.

The City of Sacramento proposes 2.25 miles of Class 1 bicycle and pedestrian trail along the South Bank of the American River levee that extends from near Sutter's Landing Park to the H Street Bridge in Sacramento, California. Trail design also includes a proposed railroad bridge undercrossing debris catchment structures. See the attached #2. "Work Description including Maps and Photos" for construction and operation details of the project.

2. Project

Location: Sacramento County, in Section N/A Township: N/A (N) (S), Range: N/A (E) (W), M. D. B. & M. Latitude: See attached supplement Longitude: See attached supp. Stream: Lower American River, Levee: South Bank Am. River Designated Floodway: Lower American River APN: See attached supplement

3. City of Sacramento of 915 I Street, Room 2000 Name of Applicant / Land Owner Address

Sacramento California 95814 916-808-7803 City State Zip Code Telephone Number arandolph@cityofsacramento.org E-mail

4. N/A of Name of Applicant's Representative Company

City State Zip Code Telephone Number E-mail

5. Endorsement of the proposed project from the Local Maintaining Agency (LMA):

We, the Trustees of American River Flood Control District approve this plan, subject to the following conditions: Name of LMA

Conditions listed on back of this form Conditions Attached No Conditions

Trustee Date Trustee Date Trustee Date Trustee Date

### APPLICATION FOR A CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMIT

6. Names and addresses of adjacent property owners sharing a common boundary with the land upon which the contents of this application apply. If additional space is required, list names and addresses on back of the application form or an attached sheet.

Name	Address	Zip Code
See attached supplemental information.		

7. Has an environmental determination been made of the proposed work under the California Environmental Quality Act of 1970?     Yes     No     Pending

If yes or pending, give the name and address of the lead agency and State Clearinghouse Number:

Environmental Impact Report (EIR) for the Two Rivers Trail Phase II Project. See attached supplemental information.  
Lead Agency: City of Sacramento, 915 I Street, Room 2000, Sacramento, CA 95814

SCH No. 2018102058

8. When is the project scheduled for construction? Spring/Summer 2021 through 2022

9. Please check exhibits accompanying this application.

- A.  Regional and vicinity maps showing the location of the proposed work.
- B.  Drawings showing plan view(s) of the proposed work to include map scale.
- C.  Drawings showing the cross section dimensions and elevations (vertical datum?) of levees, berms, stream banks, flood plain,
- D.  Drawings showing the profile elevations (vertical datum?) of levees, berms, flood plain, low flow, etc.
- E.  A minimum of four photographs depicting the project site.

\_\_\_\_\_  
Signature of Applicant

\_\_\_\_\_  
Date

Include any additional information:

Attached Page(s) - For Items 1, 2, 6 and 7, above:  
Form 3515 Supplemental Information, Work Description Maps, Photos and Plans, CEQA and Other Environmental Documentation

## Form 3615 – Supplemental Information

### 2. Project Location

The project is located along the south bank of the American River and extends from Sutter’s Landing Park to the H Street Bridge in Sacramento, California, at the following approximate coordinates (WGS 84):

- Western end of the Project Site: 38°35’21.99” N, -121°27’05.03” W
- Eastern end of the Project Site: 38°34’07.36” N, -121°25’26.25” W

The Project Site is located outside of the Township-Range-Section boundaries.

### 6. Adjacent Property Owners

All Assessor Parcel Numbers (APN) adjacent to the project’s study area are included in the table below.

APN	Current Owner	Address	City	State	Zip Code
001-0160-005	WESTERN PACIFIC RAILROAD CO	1400 DOUGLAS ST	OMAHA	NE	68179
001-0160-006	S M U D	PO BOX 15830	SACRAMENTO	CA	95852
001-0160-021	WESTERN PACIFIC RAILROAD CO	1400 DOUGLAS ST	OMAHA	NE	68179
001-0160-029	SACRAMENTO NORTHERN RAILWAY	1400 DOUGLAS ST	OMAHA	NE	68179
001-0160-044	WESTERN PACIFIC RAILROAD CO	1400 DOUGLAS ST	OMAHA	NE	68179
001-0160-047	UNION PACIFIC	1400 DOUGLAS 1640	OMAHA	NE	68179
001-0160-050	SACRAMENTO NORTHERN RAILWAY	1400 DOUGLAS ST	OMAHA	NE	68179
001-0170-003	SOUTHERN PACIFIC TRANSPORTATION CO	1400 DOUGLAS ST	OMAHA	NE	68179
001-0170-004	SOUTHERN PACIFIC TRANSPORTATION CO	1400 DOUGLAS ST	OMAHA	NE	68179
001-0170-006	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814
001-0170-020	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814
001-0170-026	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814
003-0032-025	CALIFORNIA ALMOND GROWERS EXCHANGE	PO BOX 1768	SACRAMENTO	CA	95812
005-0010-002	COUNTY OF SACRAMENTO	4040 BRADSHAW RD	SACRAMENTO	CA	95827
005-0010-004	STATE OF CALIFORNIA	SEWARD CT	SACRAMENTO	CA	95819
005-0010-005	STATE OF CALIFORNIA	SEWARD CT	SACRAMENTO	CA	95819
005-0010-024	AMERICAN RIVER FLOOD CONTROL DIST	165 COMMERCE CIR	SACRAMENTO	CA	95815
005-0010-026	COUNTY OF SACRAMENTO	4040 BRADSHAW RD	SACRAMENTO	CA	95827
005-0010-033	COUNTY OF SACRAMENTO	4040 BRADSHAW RD	SACRAMENTO	CA	95827
005-0081-001	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814
005-0091-021	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814
005-0222-009	SCOTTISH RITE TEMPLE	PO BOX 19497	SACRAMENTO	CA	95819
005-0232-003	SCOTTISH RITE TEMPLE	6151 H ST	SACRAMENTO	CA	95819
005-0233-003	CITY OF SACRAMENTO	915 I ST	SACRAMENTO	CA	95814

## ENVIRONMENTAL ASSESSMENT QUESTIONNAIRE FOR APPLICATIONS FOR CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMITS

This environmental assessment questionnaire must be completed for all Central Valley Flood Protection Board applications. Please provide an explanation where requested. Incomplete answers may result in delays in processing permit applications. Failure to complete the questionnaire may result in rejection of the application.

1. Has an environmental assessment or initial study been made or is one being made by a local or State permitting agency in accordance with the California Environmental Quality Act?  Yes  No

If yes, identify the Lead Agency, type of document prepared or which will be prepared, and the State Clearinghouse Number:

Environmental Impact Report (EIR) for the Two Rivers Trail Phase II Project, SCH # 2018102058.  
Lead Agency: City of Sacramento (Appendix C).

2. Will the project require certification, authorization or issuance of a permit by any local, State or federal environmental control agency?  Yes  No

List all other governmental permits or approvals necessary for this project or use, including U.S. Army Corps of Engineers' 404 and Section 10 permits, State Water Quality Certification, Department of Fish and Game 1600 agreement, etc. Attach copies of all applicable permits.

Several permits and consultations are in process, including:  
CDFW Section 1600 Streambed Alteration Agreement, CWA Section 401 Water Quality Certification, NMFS and USFWS Section 7 Biological Opinions, Rivers and Harbor Act Section 14 (408) authorization, Encroachment Permits (Caltrans, ARFCD, and Union Pacific Railroad), City's Grading Permit, and Sacramento County RPD lease agreement. Copies of the applicable permits consultations will be submitted once finalized.

3. Give the name and address of the owner of the property on which the project or use is located. Please submit a copy of your current Title Report (Grant Deed), if your proposed project includes a private residence.

The proposed project lies entirely within the City of Sacramento and the planning areas of the American River Parkway Plan (ARPP). The American River Flood Control District (ARFCD) is responsible for maintenance of levee infrastructure and the Sacramento County Regional Parks Department is responsible for parkway maintenance and security.

4. Will the project or use require issuance of a variance or conditional use permit by a city or county?

Yes  No

Explain:

ARFCD (and CVFPB) trail variance (received March 2019) for the construction of a "levee-top" trail along a 0.25-mile section (Segment 4) just east of the Capital City Freeway. No other City or County land use approval required.

5. Is the project or use currently operating under an existing use permit issued by a local agency?

Yes  No

Explain:

The proposed trail project is identified as an improvement in the American River Parkway Plan and the project has been designed in compliance with this plan.



**ENVIRONMENTAL ASSESSMENT QUESTIONNAIRE FOR APPLICATIONS  
FOR CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMITS**

6. Describe all types of vegetation growing on the project site, including trees, brush, grass, etc.

Vegetation at the Project site includes annual grassland, mixed scrub, and valley foothill riparian. Natural features include the American River and its riparian vegetation.

7. Describe what type of wildlife or fish may use the project site or adjoining areas for habitat, food source, nesting sites, source of water, etc.

The American River provides habitat for anadromous fish species. The American River also provides habitat for a multitude of bird species, such as Canada goose, mallard and several other species. The river provides habitat for reptiles such as western pond turtle. The mixed scrub and riparian habitat provides shelter for raptors, beaver, and numerous bird species. Effects to species have been addressed in the EIR.

8. Has the Department of Fish and Game, U.S. Fish and Wildlife Service, or National Marine Fisheries Service been consulted relative to the existence of, or impacts to, threatened or endangered species on or near the project site?

Yes       No

Explain:

The City of Sacramento is consulting with USFWS and NMFS to identify potential effects to federally listed and proposed (endangered and threatened) plant and wildlife species pursuant to the Federal Endangered Species Act Section 7.

9. Will the project or use significantly change present uses of the project area?

Yes       No

Explain:

The majority of the project site is already being used for recreational purposes. Additionally, the project was identified as a future improvement in the American River Parkway Plan, and the project has been designed in compliance with this plan, and with related requirements of the ARFCD.

10. Will the project result in changes to scenic views or existing recreational opportunities?

Yes       No

Explain:

Construction would temporarily effect the visual environmental, recreation, and access to the project site. Short-term and temporary would be related to removal of some existing vegetation, staging equipment, and disturbance of informal recreational usage. See EIR, Sections 3.1 and 3.9 for detailed discussions.

11. Will the project result in the discharge of silt or other materials into a body of water?

Yes       No

Explain:

The project would include excavation and grading to establish the trail alignment, which could discharge silt or other materials into the river. The City will secure permits under Section 401 of the Clean Water Act.

**ENVIRONMENTAL ASSESSMENT QUESTIONNAIRE FOR APPLICATIONS  
FOR CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMITS**

12. Will the project involve the application, use, or disposal of hazardous materials?  Yes  No

If yes, list the types of materials, proposed use, and disposal plan. Provide copies of all applicable hazardous material handling plans.

Construction activities would use minor amounts of hazardous materials, such as fuels (gasoline and diesel), oils and lubricants, and cleaners (which could include solvents and corrosives in addition to soaps and detergents) that are commonly used in construction projects. The City or its contractor will prepare and implement a SWPPP and secure all construction-related materials overnight. See EIR, Section 3.2, Mitigation Measure BIO-3: Prepare and Implement a Storm Water Pollution Prevention Plan, Spill Prevention and Control Plan, and Associated Best Management Practices for a detailed discussion.

13. Will construction activities or the completed project generate significant amounts of noise?

Yes  No

Explain:

Implementation of the proposed project would generate construction noise but would not exceed County noise standards, generate traffic noise above applicable thresholds, expose people to excessive groundborne vibration noise levels, and would not result in an increase in ambient noise levels. There would also be no substantial new noise sources following the completion of construction activities. See EIR, Section 3.8 for a detailed discussion.

14. Will construction activities or the completed project generate significant amounts of dust, ash, smoke, fumes, or odors?

Yes  No

Explain:

The project includes only construction-phase emissions associated with importing, material hauling, and commuting vehicle trips. Construction emissions would be under the SMAQMD threshold however all projects that would involve construction activities are required to implement SMAQMD's applicable Basic Construction Emission Control Practices. No ash, dust, or smoke would be generated. See EIR Section 1.4.3 for a detailed discussion.

15. Will the project activities or uses involve the burning of brush, trees, or construction materials, etc?

Yes  No

Explain, and identify safety and air pollution control measures:

No burning is proposed.

16. Will the project affect existing agricultural uses or result in the loss of existing agricultural lands?

Yes  No

Explain:

There are no agricultural land uses in the project site. See EIR, Section 1.4.2, Table 1-5 for detailed discussion.

**ENVIRONMENTAL ASSESSMENT QUESTIONNAIRE FOR APPLICATIONS  
FOR CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMITS**

17. Have any other projects similar to the proposed project been planned or completed in the same general area as the proposed project?

Yes     No

Explain and identify any other similar projects:

Several, including American River Common Features Erosion Control Project, North Sacramento Streams, Sacramento River East Levee, Lower American River and Related Flood Improvements Project, Cap City Corridor Project (EIR, Section 5.5, Table 5-2 for details). City staff coordinate directly with Caltrans and USACE project staff

18. Will the project have the potential to encourage, facilitate, or allow additional or new growth or development?

Yes     No

Explain:

The proposed trail project would not include the expansion of buildings or directly generate additional population growth in the surrounding area. Because the project does not create new connections to undeveloped land, no impacts to growth, economics, affordable housing, or crime would occur. See EIR, Section 5.2.

19. Will materials be excavated from the floodplain?  Yes     No    If yes, please answer the remaining questions.

**THE REMAINING QUESTIONS MUST ONLY BE ANSWERED IF THE ANSWER TO QUESTION  
NO. 19 WAS "YES". IF THE ANSWER TO QUESTION NO. 19 WAS "NO", YOU DO NOT  
NEED TO COMPLETE THE REMAINING QUESTIONS.**

- A. What is the volume of material to be excavated?

Annually n/a    Total 3,710 cubic yards

- B. What types of materials will be excavated?

Excavated material would include aggregate/soil material.

- C. Will the project site include processing and stockpiling of material on site?

Yes     No

Explain:

The excavated material will be transported offsite by the construction contractor as part of the project and will be disposed at a permitted disposal site, such as the Sacramento County Kiefer Landfill.

- D. What method and equipment will be used to excavate material?

The equipment used for excavation/grading would include bobcat, backhoe, bulldozers, excavators, front-end loaders, and dump trucks. Standard excavation and construction methods will be used to complete the work.

ENVIRONMENTAL ASSESSMENT QUESTIONNAIRE FOR APPLICATIONS  
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E. What is the water source for the project?

Construction Contractor will be responsible for on site water source.

F. How will waste materials wash water, debris, and sediment be disposed of?

The project would not generate any wash water. Prior to any construction activity, a Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Plan (WPPP), as applicable, would be obtained and would include erosion control measures and construction waste containment measures to ensure that waters of the State are protected during and after project construction. The Plan (a SWPPP or WPCP) shall include site design to minimize offsite storm water runoff that might otherwise affect adjacent waters of the U.S. and State. Any debris or sediment that would need to be disposed of will be transported offsite by the construction contractor as part of the project and will be disposed at a permitted disposal site, such as the Sacramento County Kiefer Landfill.

G. What is the proposed end land use for the project site?

Land uses on the project site will not change as a result of the proposed project. The area will still be open space.

H. Has a reclamation plan been prepared for this site in accordance with the Surface Mining and Reclamation Act of 1975?

Yes  No If yes, please attach a copy.

## 2. Work Description including Maps and Photos

## 1. Background

The proposed Two Rivers Trail (Phase II) new Class 1 bicycle and pedestrian trail (Project) would create approximately 2.25 miles of trail comprising 4 segments (see **Figures 1 and 2**).

*Note:* Project CEQA/NEPA documentation covers the entire approximately 3.5-mile trail, that will eventually extend from Jibboom Street to the H Street Bridge. However, due to funding constraints, and ongoing remediation of the Sutter's Landing Landfill along Segments 1 and 2, the City is only requesting an Encroachment Permit for construction of Segments 3-6 of the trail, in this application.

## 2. Project Location

The Project is located along the South Bank of the American River levee that extends from near Sutter's Landing Park to the H Street Bridge in Sacramento, California (**Figure 2**).

## 3. Description of Existing Conditions

The existing conditions along South Bank of the American River levee project area are generally characterized by riparian vegetation between the levee toe and the riverbank. A dirt or gravel track or road extends along most of the levee toe, and the levee slopes are kept clear of vegetation other than grass and ruderal vegetation. A gravel maintenance road extends along the crown of the levee. There are no existing paved trails.

Prohibition of access to any portion of the flood management system (i.e. the levee toe or crown) is under the jurisdiction of the applicable local maintaining agency (ARCFD) and the decision to restrict access to any portion of the American River Parkway is under the jurisdiction of County Parks. ARCFD and County Parks do not currently place any restrictions on access to public lands in the project vicinity, including any portion of the levee or the American River Parkway, except for areas where locked gates or fencing may be present (i.e. pumping facilities); the areas are open to recreation and associated ambient noise levels associated with allowed recreational activities.

## 4. Description of Proposed Work

The proposed multi-use trail design would meet California Department of Transportation (Caltrans) Class 1 bikeway design criteria and would also be based on the State Water Code Title 23 standards for recreation trails on levees and the ARCFD Recreational Trails Policy. The trail would generally consist of an 8-foot-wide paved path with a 2-foot-wide compacted shoulder on the inner side and a similar 6-foot-wide shoulder on the waterside to provide space for walking and jogging adjacent to the paved portion of the trail, bringing the total trail cross section along most of its length to 16 feet wide. However, due to space limitations in some locations, the waterside shoulder of the trail would be narrowed to 4 feet wide. The trail would be paved and engineered to be load-bearing and has been designed to meet flood control objectives and to have the least amount of impact on levee operations and maintenance (O&M) (see *Appendix A: 65% Design Drawings*).

**Segment 3** is approximately 0.3 miles long and begins on the east side of Sutter's Landing Park at the end of an existing trail. From here, the trail would run along an existing bench at the toe of the levee, first crossing under another portion of the UPRR and eventually under the Capital City Freeway (SR 80) where Segment 4 begins.

**Segment 4** is also approximately 0.25 miles long and would begin just east of the Capital City Freeway. This segment is proposed as a "levee-top" trail alignment.

**Segment 5** is 1.4 miles long and passes Paradise Beach and Glenn Hall Park. This trail segment has a bench all along the waterside toe where the trail would be aligned, but bench width varies such that this segment has been subdivided into three subsegments (to accommodate topographic conditions). Subsegment 5A is approximately 2,900 feet in length, and the waterside bench, although well-defined, is narrower in this area than in Subsegment 5B. Subsegment 5B is approximately 4,300 feet in length and has a well-defined, much wider and flatter, bench to accommodate the trail. Subsegment 5C is approximately 500 feet in length and its waterside bench characteristics are similar to Subsegment 5A.

**Segment 6** begins at the east end of Subsegment 5C along the levee toe, is approximately 0.3 miles long, and includes a transition back to the levee crown where the trail would connect to the existing paved trail near the H Street Bridge. While there is a bench along the toe in this segment, the bench is much narrower than in other locations requiring a reduced path width to limit impacts.

During development of the trail design, many options were considered, including a mid-height bench alignment along the waterside levee slope of the entire length of the proposed trail, to minimize habitat impacts along the waterside toe and to address visibility and privacy concerns raised by residents of the River Park neighborhood. However, in order to address concerns from the U.S. Army Corps of Engineers (USACE) and ARCFD, the trail alignment in the proposed project now avoids any construction that would require “benching” of the levee, and trail construction is confined to the levee toe along Segment 3, 5 and 6, and a portion of Segment 4, and is confined to the levee crown for the western portion of Segment 4.

A lower bench alignment mostly along the waterside toe of the easterly segment of the levee is proposed which will ensure adequate levee performance. This alignment would separate the trail users from levee maintenance operations, limit visibility to neighboring residences on the landside of the levee and have little or no effect on levee stability. However, on March 29, 2019, the ARCFD Board granted the City a variance to construct a “levee-top” trail along a 0.25-mile section just east of the Capital City Freeway. With no defined bench on the water side of the existing levee in this area, the “levee-top” alignment (for a portion of the trail) would minimize the risk to levee performance by removing the need to construct the trail on an artificial bench offset from the top of the levee. The move to a levee top alignment in this location would also reduce the project’s overall biological resource impacts.

#### *Union Pacific Railroad Undercrossing*

The trail in Segment 3 would cross under an active railway line. In this location, fencing would be constructed to prevent trail users from accessing the Union Pacific Railroad (UPRR) right-of-way. Fencing would be placed near the tops of the levee, directly adjacent (but not connecting) to the ends of the existing railroad bridge on one end and existing fences on the land side of the levee. Fencing would be designed to meet UPRR requirements. Gates would be placed at the tops of the levee near the existing at-grade crossings to allow levee maintenance and patrol vehicles to use the crossings. Protective covers would be constructed to protect trail users crossing under the railroad bridges from potential falling debris from above (see *Appendix A: 65% Design Drawings*).

## 5. Hydraulic Statement

The Project, as proposed, would result in no significant impact to the Sacramento River Flood Control Project. Model results indicate that the Project only causes localized increases in water surface elevation (WSE) in the vicinity of the railroad undercrossing location, while differences in flow velocity occur in various locations throughout the proposed trail alignment. The trail footprint itself does not impact modeled river WSEs due to limited topographic change. The modeled WSE impact at the railroad undercrossing structure is small and localized with slightly elevated WSEs (~0.1 ft) at the upstream end of the structure. This rise dissipates quickly and has no impact at the adjacent bridge structures or at the levee. Modeled velocity magnitudes are reduced downstream of the structure with a localized increase (< 0.5 ft/s) between the structure and the left bank in an area that is vegetated with large trees and turf, and partially paved in crushed rock. See *Appendix B* for the Hydraulic Impact Evaluation Technical Memorandum, prepared by cbec, October 2020, which provides additional details.

## 6. Operations and Maintenance

Upon completion, the trail would be operated as a recreational Class 1 trail by the City of Sacramento. The trail operator would implement several operation and maintenance (O&M) measures, including but not limited to public safety, litter control, graffiti control, signage, access control, security, compliance enforcement, repair, rehabilitation, replacement, and removal of recreational trails facilities. Typical maintenance activities would include routine inspections, debris removal, and repair of cracks and slope failures.

In addition to the maintenance tasks listed above, typical vegetation management activities would routinely occur, including the following:

- **Mowing** – Mowing activities would occur up to 4 times annually, performed by ARFCD. Mowing would generally occur within a 4-foot area on each side of the trail. Mowing within the drip-line of elderberry shrubs would be limited to the season when adult valley elderberry longhorn beetles (VELB) are not active (August - February) and would avoid damaging the elderberry shrub.
- **Trimming** – Trimming of vegetation and hazard tree/limb removal along the trail would occur once annually. Woody vegetation would be trimmed back up to 4 feet from the sides of the trail, with a 12-foot vertical clearance. Vegetation less than 3 inches in diameter would be cleared by hand or small engine weed-eaters or chainsaws. Small material or grasses would be mowed close to the ground with low impact rubber-tired tractors. Vegetation over 3 inches in diameter may require larger equipment such as telescoping chainsaws, hoe-mounted flail mowers, bucket machines to hoist the crew and equipment, and climbing crew with chainsaws.
- **Removal of Vegetation from Trail Surfaces** – The removal of invasive vegetation would be eradicated through very limited and selective application of herbicides. Per U.S. Fish and Wildlife Service (USFWS) recommendations, the use of insecticides, herbicides, fertilizers, or other chemicals would not be used within 98 feet of elderberry shrubs.

As much as feasible, all O&M activities that could occur within 165 feet of an elderberry shrub, would be conducted outside of the flight season of the VELB (March - July) to minimize impacts to VELB. However, it is assumed that up to 5 elderberry shrubs may be affected as part of maintenance activities. High river flow events, and some levee, railroad, and trail maintenance activities may also require temporary closure of sections of trail from time to time. During such closures, signs would be placed by the trail operator or ARFCD crew at access points to the trail alerting users of the closure and designating alternate routes.



## 7. Environmental Compliance

### CEQA

Compliance with the California Environmental Quality Act (CEQA) has concluded. The City of Sacramento prepared an Environmental Impact Report (EIR) to support project development. The *Final Environmental Impact Report [EIR], Two River Trail (Phase II)*, was issued in December 2019. The State Clearinghouse Number is 2018102058. The Draft and Final EIR are included as **Appendix C**. The Final EIR and corresponding documents were certified and adopted by the Sacramento City Council under Resolution No. 2020-0045 in February 4, 2020 (see **Appendix C**).

### NEPA

Compliance with the National Environmental Policy Act is in process by Caltrans (acting as the Federal Lead Agency, on behalf of the Federal Highway Administration) through preparation of a Categorical Exclusion. The Finding of No Significant Impact is expected January 2021. Additionally, per a Memorandum of Understanding (dated December 23, 2016), the USACE recognizes the assumption of NEPA federal Lead Agency status to Caltrans for the Project.

### Permitting

Several other permits and consultations are in process for the Project (listed below) and copies of these documents will be submitted, once finalized.

- CDFW Section 1600 Streambed Alteration Agreement
- CWA Section 401 Water Quality Certification
- NMFS and USFWS Section 7 Biological Opinions
- Union Pacific Railroad Encroachment permit
- Sacramento County RPD Lease Agreement
- ARFCD Encroachment Permit
- California Department of Transportation Encroachment Permit
- City of Sacramento General Construction Permit

Figure 1 – Regional Location



Figure 2 – Proposed Trail Alignment



25May2018 BMC Z:\Projects\1610789\_TwoRiversTrail\1610789\_G013\_No\_APE\_Seg3-5.mxd

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## Representative Site Photos



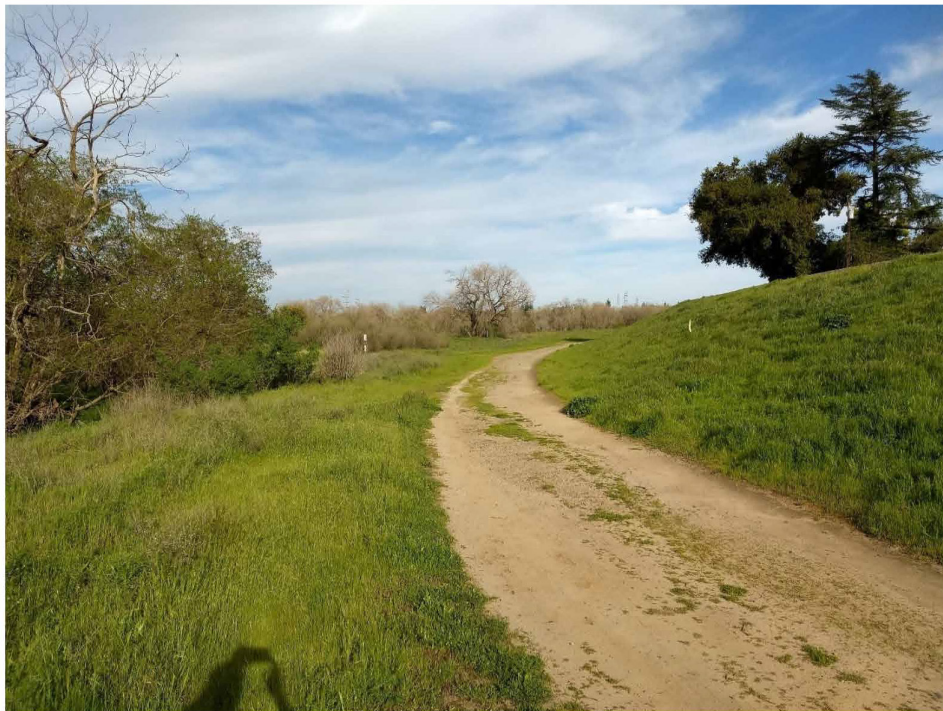
View facing east towards Business 80 Bridge. Typical riparian vegetation at left, and grassy levee slope at right. Proposed trail would follow existing gravel toe road at this location.



Facing west towards Business 80 bridge. The proposed trail would be on the top of the levee here due to the lack of a levee toe road.



Facing east on Segment 4. The proposed trail would require vegetation removal at this location due to narrow width of existing track on levee toe.



Facing east in the Paradise Beach Area. View of riparian vegetation to the left and levee slope to the right. Proposed trail would follow existing toe road in this location.



Facing east toward connection to existing trail at H Street.

# Appendix A - Two Rivers Trail Phase II Project - 65% Design Drawings and Specifications



## Appendix B - Hydraulic Impact Evaluation of the Two Rivers Trail Phase II Project

## Appendix C – Environmental Documentation

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**GENERAL NOTES**

- ALL WORK SHALL BE DONE IN ACCORDANCE WITH: CITY OF SACRAMENTO DESIGN & PROCEDURES MANUAL, DATED SEPTEMBER 1990, CITY STANDARD SPECIFICATIONS, DATED JUNE 2007 WITH APPLICABLE ADDENDA, CALTRANS STANDARD PLANS, 2010 EDITION EXCEPT FOR TRAFFIC SIGNAL POLES AND FOUNDATIONS SHALL BE PER 2006 EDITION, AND THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), CURRENT EDITION.
- THREE WORKING DAYS PRIOR TO REQUIRING PROJECT STAKING, THE CONTRACTOR SHALL SUBMIT TO THE RESIDENT ENGINEER OR INSPECTOR A COMPLETED CONSTRUCTION STAKING REQUEST FORM.
- THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR FURNISHING, INSTALLING AND MAINTAINING ALL WARNING SIGNS AND DEVICES NECESSARY TO SAFEGUARD THE GENERAL PUBLIC AND THE WORK, AND FOR PROVIDING PROPER AND SAFE ROUTING OF THE VEHICULAR AND PEDESTRIAN TRAFFIC DURING THE PERFORMANCE OF THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND SHALL NOT BE LIMITED TO WORKING HOURS. THE USE OF FLAGGERS, BARRICADES AND CONSTRUCTION SIGNING SHALL COMPLY WITH THE CURRENT EDITION OF THE CALIFORNIA MUTCD.
- THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF ALL EXISTING UTILITIES AND PROTECTING AND REPAIRING DAMAGE TO EXISTING UTILITIES. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (1-800-642-2444) TWO WORKING DAYS PRIOR TO COMMENCING WORK.
- THE CONTRACTOR SHALL MAINTAIN ALL EXISTING SEWER AND/OR DRAINAGE FACILITIES WITHIN THE CONSTRUCTION AREA UNTIL THE PROPOSED SEWER AND/OR DRAINAGE IMPROVEMENTS ARE PLACED AND FUNCTIONING.
- THE RESIDENT ENGINEER SHALL DETERMINE THE EXACT LIMITS OF PAVEMENT REMOVAL IN THE FIELD. EXISTING ASPHALT AND CONCRETE SHALL BE SAWCUT IN A NEAT STRAIGHT LINE A MINIMUM OF 2-1/2" DEEP. THE EXPOSED VERTICAL EDGES SHALL BE TACKED WITH EMULSION PRIOR TO ASPHALT CONCRETE PAVING.
- DEMOLITION OF EXISTING FEATURES SHALL BE LIMITED TO THE ITEMS SHOWN ON THE PLANS AND DESCRIBED IN THE SPECIAL PROVISIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO REPAIR AND/OR REPLACE ALL EXISTING FEATURES DAMAGED BY HIS OPERATIONS, AT HIS EXPENSE.
- THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR PROTECTING EXISTING TREES NOT SCHEDULED TO BE REMOVED BY THIS CONTRACT. ANY TREE DAMAGED SHALL BE REPLACED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER, AT HIS EXPENSE.
- THE CONTRACTOR SHALL HAVE A CURRENT AND ACTIVE CLASS A - GENERAL ENGINEERING CONTRACTOR LICENSE ISSUED BY THE CCSLB AT THE TIME OF THE BID SUBMITTAL AND THROUGHOUT THE CONSTRUCTION PERIOD. THE CONTRACTOR, AND/OR SUBCONTRACTORS PERFORMING ELECTRICAL WORK, SHALL ALSO HAVE A CURRENT AND ACTIVE CLASS C10 - ELECTRICAL CONTRACTOR LICENSE ISSUED BY THE CCSLB AT THE TIME OF THE BID SUBMITTAL AND THROUGHOUT THE CONSTRUCTION PERIOD.
- ALL CURB, GUTTER AND SIDEWALK SHOWN TO BE REMOVED SHALL BE REMOVED TO THE NEAREST EXPANSION JOINT OR SCORE MARK. DAMAGE TO EXISTING CURB, GUTTER, AND SIDEWALK WHICH IS SHOWN ON THE PLANS TO REMAIN, SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
- THE CONTRACTOR SHALL OBTAIN A PERMIT FROM THE DIVISION OF OCCUPATIONAL SAFETY & HEALTH (2424 ARDEN WAY SUITE 165, SACRAMENTO, CA PHONE 263-2800) PRIOR TO ANY TRENCHING EXCAVATION 5 FEET OR MORE IN DEPTH. A COPY OF THIS PERMIT SHALL BE AVAILABLE AT THE CONSTRUCTION SITE AT ALL TIMES.
- THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR PRESERVING ALL EXISTING MONUMENTS WHICH WILL BE DISTURBED OR REMOVED AS REQUIRED BY CONTRACTOR'S WORK. CONTRACTOR SHALL COORDINATE WITH ENGINEER/SURVEYOR PRIOR TO DISTURBANCE OF EXISTING MONUMENTS, AND SHALL HAVE A LICENSED LAND SURVEYOR RESET MONUMENTS, PROVIDE PERMANENT WITNESS MONUMENTS, AND FILE DOCUMENTATION WITH THE COUNTY SURVEYOR PURSUANT TO THE BUSINESS AND PROFESSIONS CODE.
- GUTTER SLOPES FROM THE FLOWLINE TO LIP SHALL BE 5% MAXIMUM FOR THE FULL-WIDTH OF ALL CURB RAMPS. THE 5% CROSS SLOPE SHALL TRANSITION TO THE STANDARD CURB AND GUTTER CROSS-SLOPE OVER A DISTANCE OF 3 FEET UNLESS NOTED OTHERWISE.
- ANY NEW CONCRETE SURVEY MONUMENT (PER CITY STANDARD SPECIFICATION DETAIL) SHALL BE PLACED BY A LICENSED LAND SURVEYOR.

# CITY OF SACRAMENTO

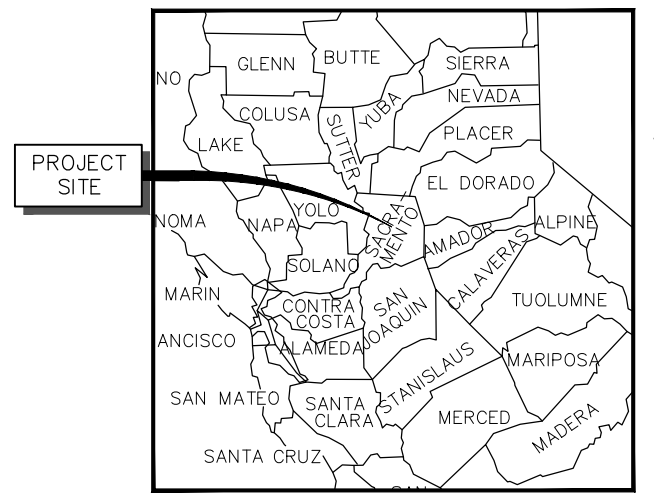
## CONSTRUCTION PLANS FOR

### TWO RIVERS TRAIL PROJECT (PHASE II)

APPROVED BY: \_\_\_\_\_ DATE \_\_\_\_\_  
 JUDITH S. MATSUI-DRURY, R.C.E. 59096  
 SUPERVISING ENGINEER  
 DEPARTMENT OF PUBLIC WORKS

APPROVED BY: \_\_\_\_\_ DATE \_\_\_\_\_  
 RYAN MOORE, R.C.E 61088  
 CITY TRAFFIC ENGINEER  
 DEPARTMENT OF PUBLIC WORKS  
 (SIGNING AND STRIPING)

LOCATION MAP 65% DESIGN 10/23/20

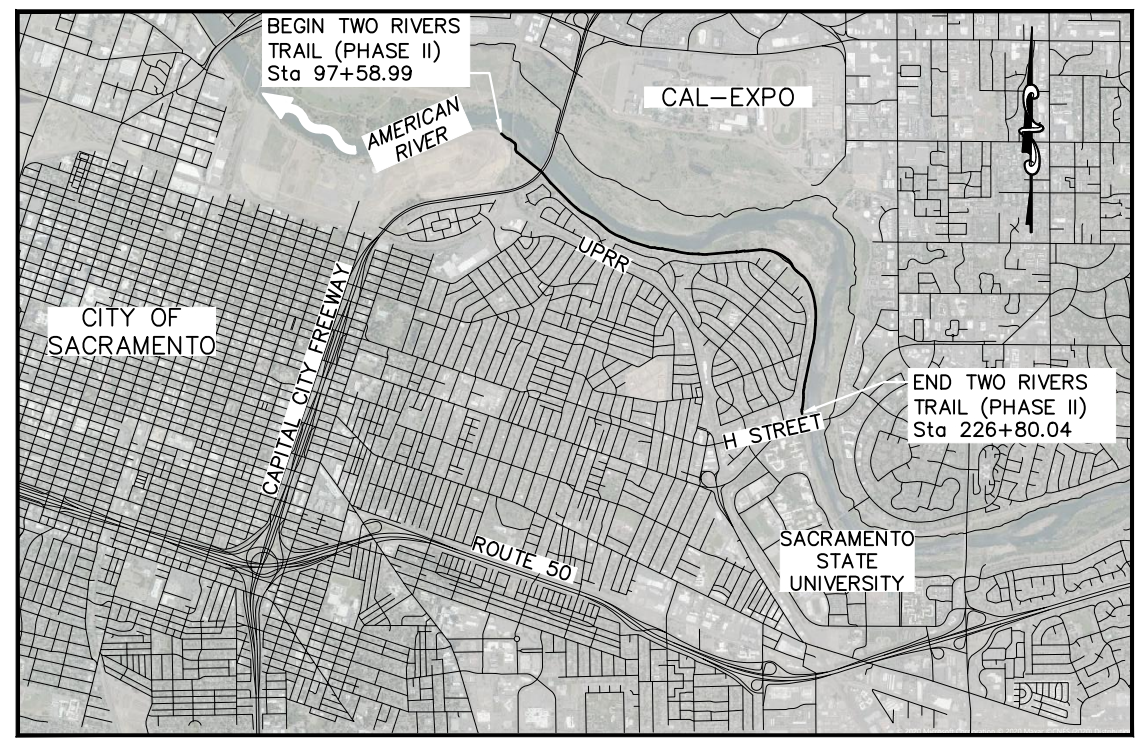


**INDEX OF TRAIL SHEETS**

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4	KEY MAP
5-19	PLAN AND PROFILE
20-30	CONSTRUCTION DETAILS
31-37	EROSION CONTROL AND TREE REMOVAL PLAN

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39	FOUNDATION PLAN
40	TYPICAL SECTION



SITE PLAN

**STANDARD ABBREVIATIONS**

AB	AGGREGATE BASE	(E) or EXIST	EXISTING	PVC	POLY VINYL CHLORIDE
AC	ASPHALT CONCRETE	FL	FIRE HYDRANT	R	RADIUS
AP	ANGLE POINT	FM	FORCE MAIN	RCP	REINFORCED CONC. PIPE
AVE	AVENUE	FOC	FACE OF CURB	RT	RIGHT
BLDG	BUILDING	FOW	FACE OF WALK	R/W, ROW	RIGHT-OF-WAY
BC	BEGIN CURVE	G	GAS	S =	SLOPE
BOC	BACK OF CURB	GB	GRADE BREAK	SD	STORM DRAIN
BOW	BACK OF WALK	GD	GUTTER DRAIN	SDMH	STORM DRAIN MH
CAB	CABINET	GV	GATE VALVE	SDWK	SIDEWALK
C&G	CURB AND GUTTER	JP	JOINT POLE	SHT	SHEET
CG&S	CURB, GUTTER AND SIDEWALK	LF	LINEAR FEET	SNS	STREET NAME SIGN
CL or C	CENTER LINE	LIP	LIP OF GUTTER	SPECS	SPECIFICATIONS
CMP	CORROGATED METAL PIPE	LT	LEFT	SS	SANITARY SEWER
C/O	CLEANOUT	MB	MAIL BOX	SSMH	SANITARY SEWER MH
CONC	CONCRETE	MFR'S	MANUFACTURE'S	ST	STREET
CONST	CONSTRUCT	MH	MAINTENANCE HOLE	STA	STATION
CTV	CABLE TV	MAX, MIN	MAXIMUM, MINIMUM	STD	STANDARD
CR	CURB RAMP	N/A	NOT APPLICABLE	SW	SIDEWALK
CS	COMBINATION SYSTEM	No., #	NUMBER	T or TEL	TELEPHONE
CSMH	COMBINATION SYSTEM MH	N.T.S.	NOT TO SCALE	T.O.N.	TOP OF NAIL
CUT	CUTLINE	PG	PROPOSED GRADE	TOB	TOP OF BANK
DB	DITCH BOX	PI	POINT OF INTERSECTION	TOE	TOE OF SLOPE
DI	DROP INLET	PL	PROPERTY LINE	T.O.P.	TOP OF PIPE
DRWY	DRIVEWAY	PP	POWER POLE	TYP	TYPICAL
DWG	DRAWING	PCC	PORTLAND CEMENT CONCRETE	TS	TRAFFIC SIGNAL
E or ELECT	ELECTRICAL	(P), PROP.	PROPOSED	W	WATER
EC	END CURVE	PERF	PERFORATED	WKWY	WALKWAY
EG	EXISTING GRADE	PM	PARKING METER	WM	WATER METER
EL or ELEV	ELEVATION			WV	WATER VALVE
EP, EOP	EDGE OF PAVEMENT				



Know what's below.  
Call 811 before you dig.

REVISIONS				FIELD BOOK
NO.	DESCRIPTION	DATE	BY	

SCALE  
 HORIZ. NO. SCALE  
 VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

DRAWN BY: B. HARRISON  
 DESIGN BY: G. MCLAUGHLIN  
 CHECKED BY: DES\_CHK

DATE \_\_\_\_\_ DATE \_\_\_\_\_ DATE \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 TITLE SHEET

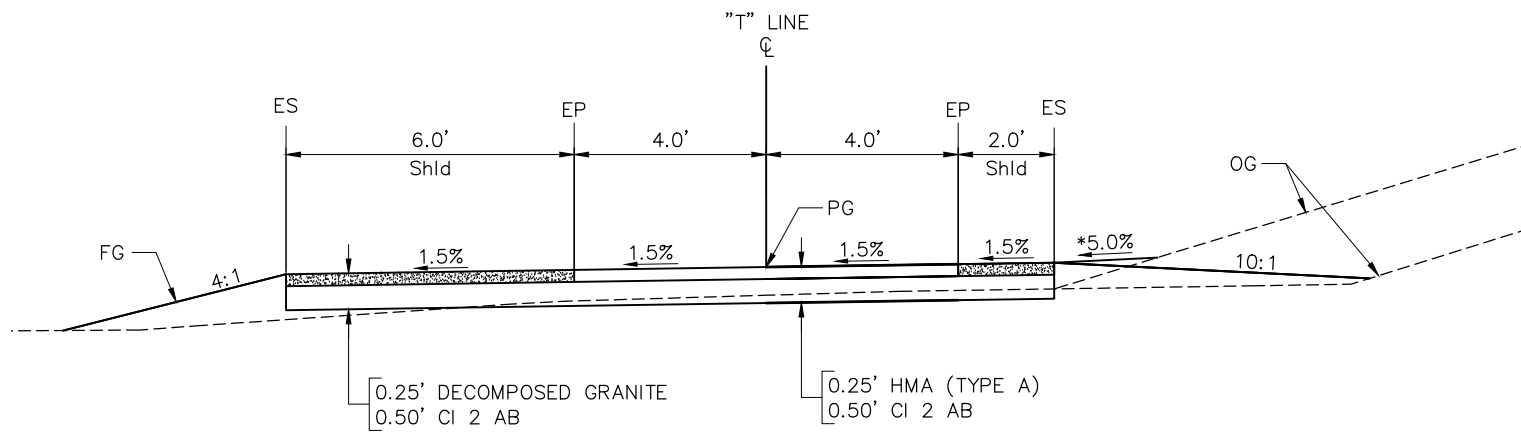
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SHEET 1 OF 40

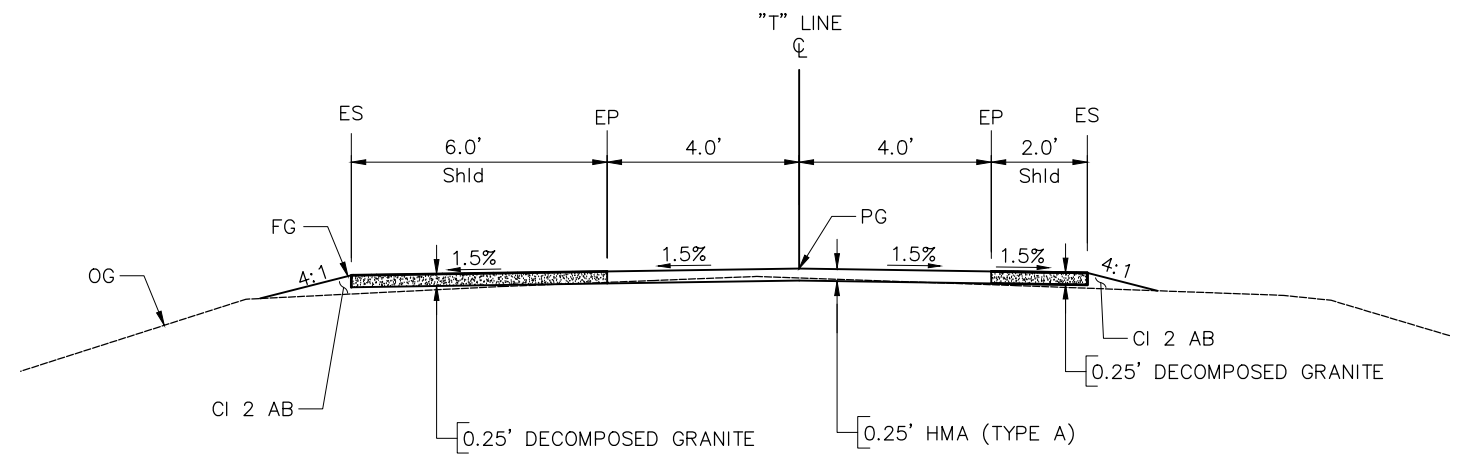
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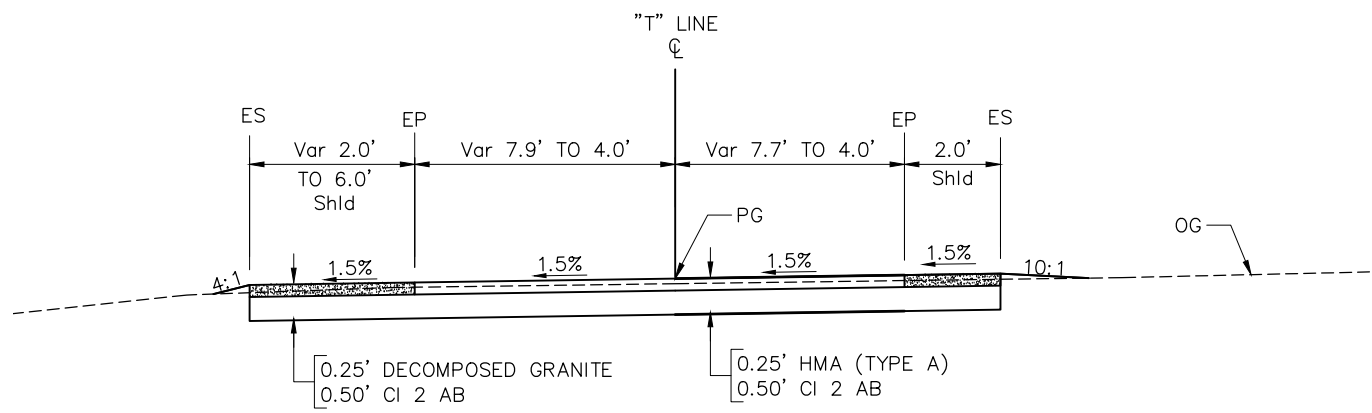


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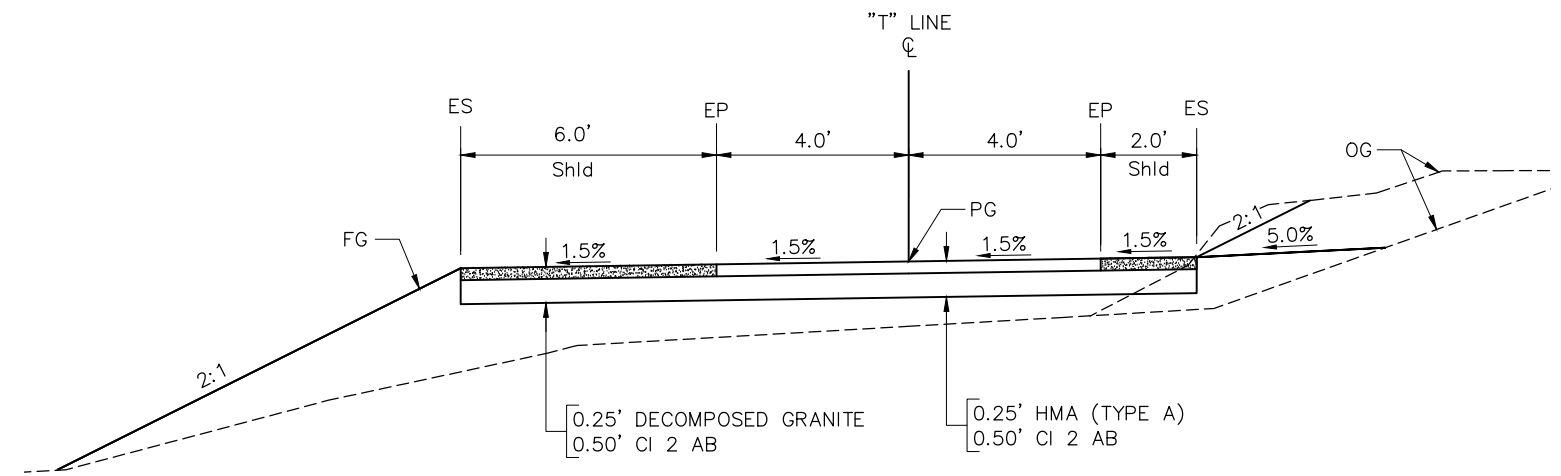
**\*NOTE:**  
IF A 5.0% SLOPE WILL NOT CATCH, THEN FILL AT A 10:1 SLOPE



**TWO RIVERS TRAIL**  
Sta "T" 115+00.00 TO Sta "T" 127+60.00



**TWO RIVERS TRAIL**  
Sta "T" 98+75.00 TO Sta "T" 99+48.50



**TWO RIVERS TRAIL**  
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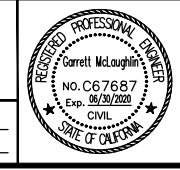
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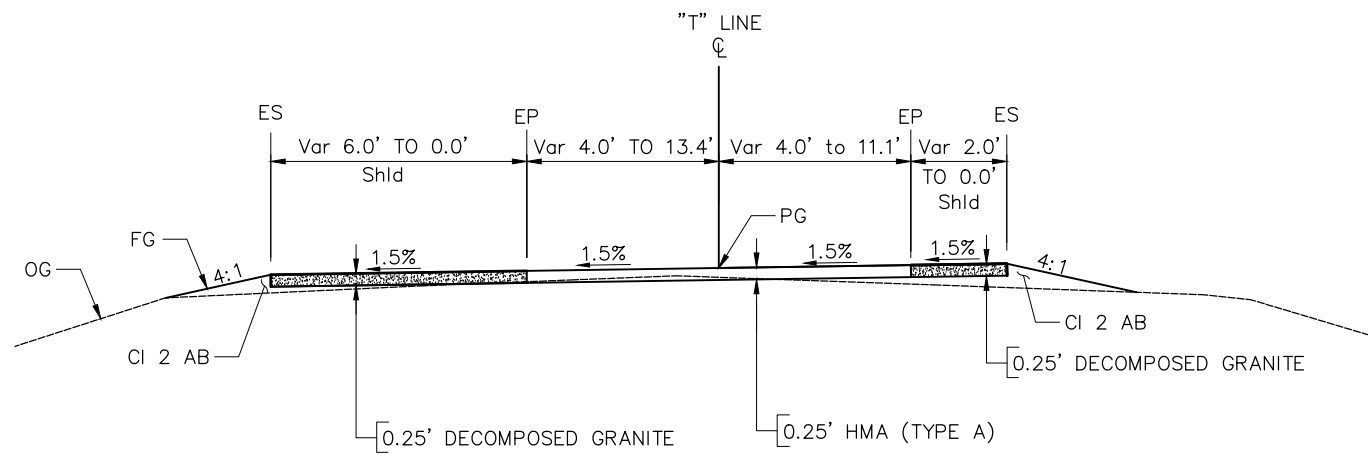
DRAWN BY: D. Polglase      DESIGN BY: G. McLaughlin      CHECKED BY: DES\_CHK  
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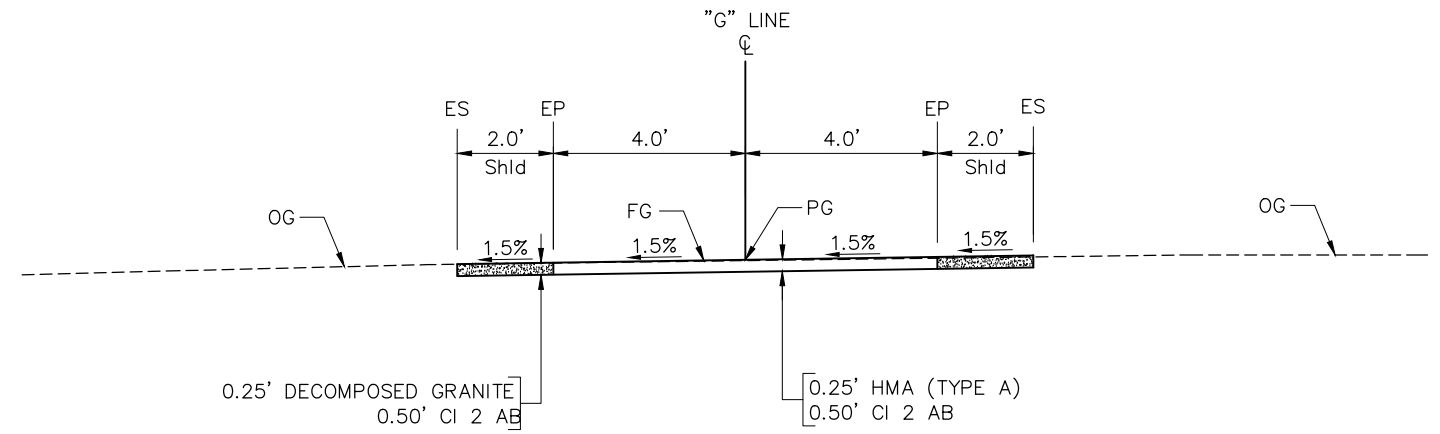
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
TYPICAL CROSS SECTIONS

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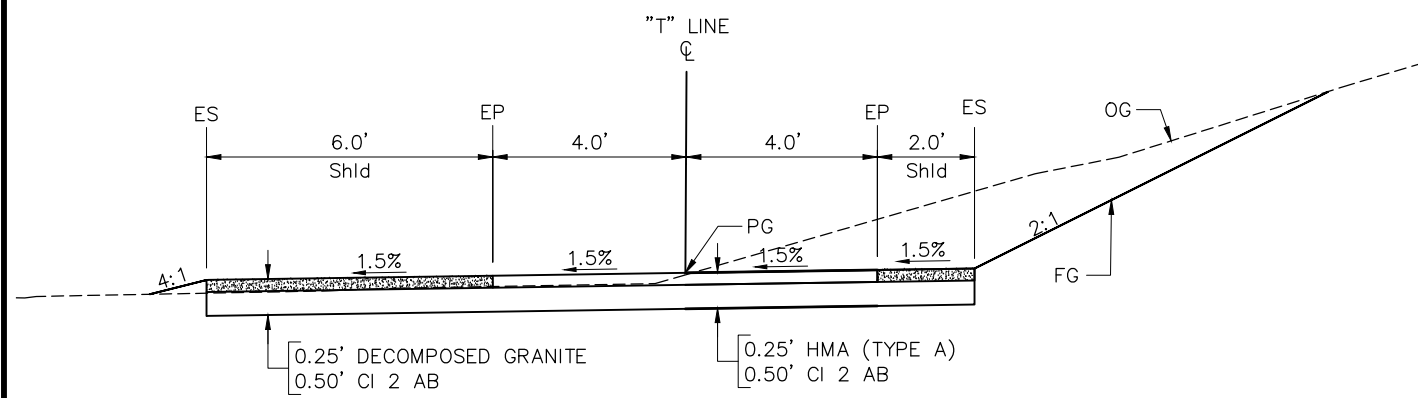
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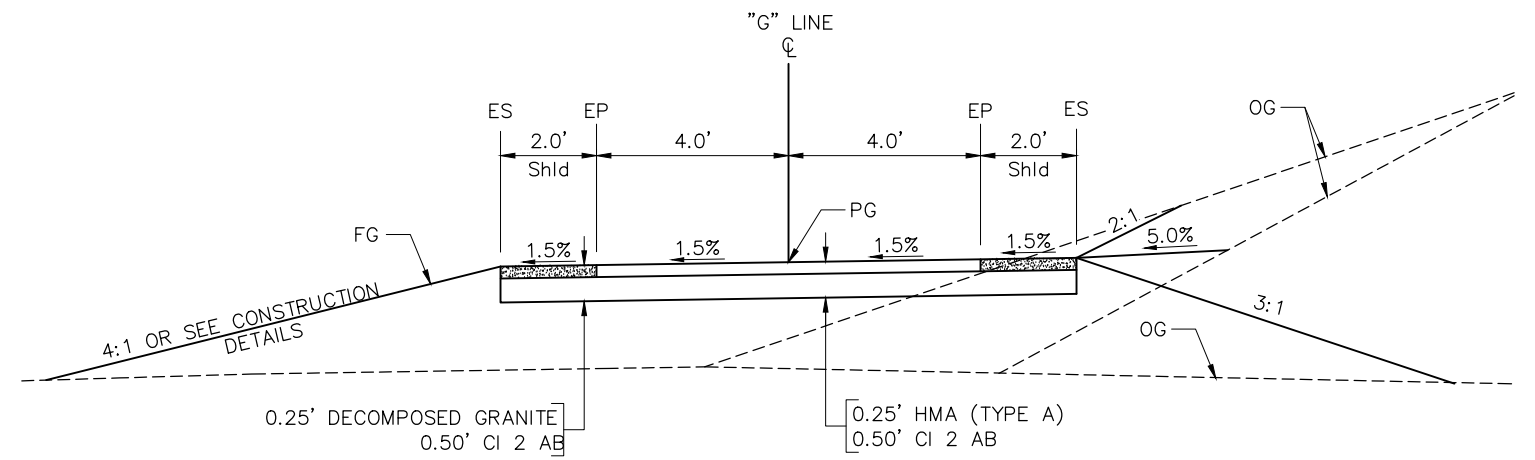
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**GLENN HALL ACCESS**  
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**TWO RIVERS TRAIL**  
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**GLENN HALL ACCESS**  
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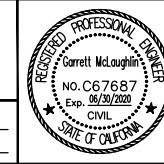
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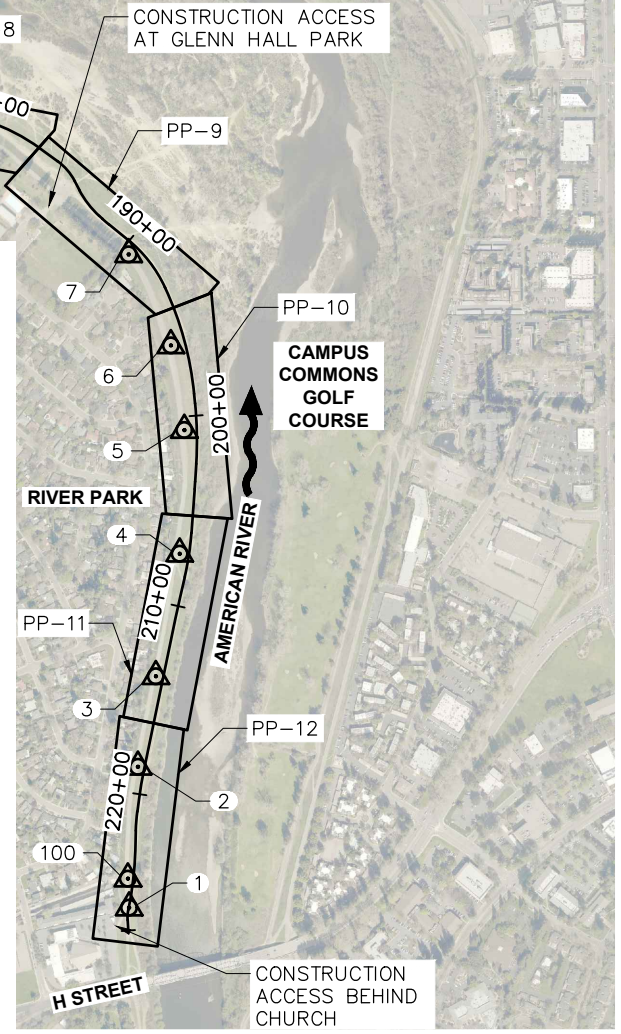
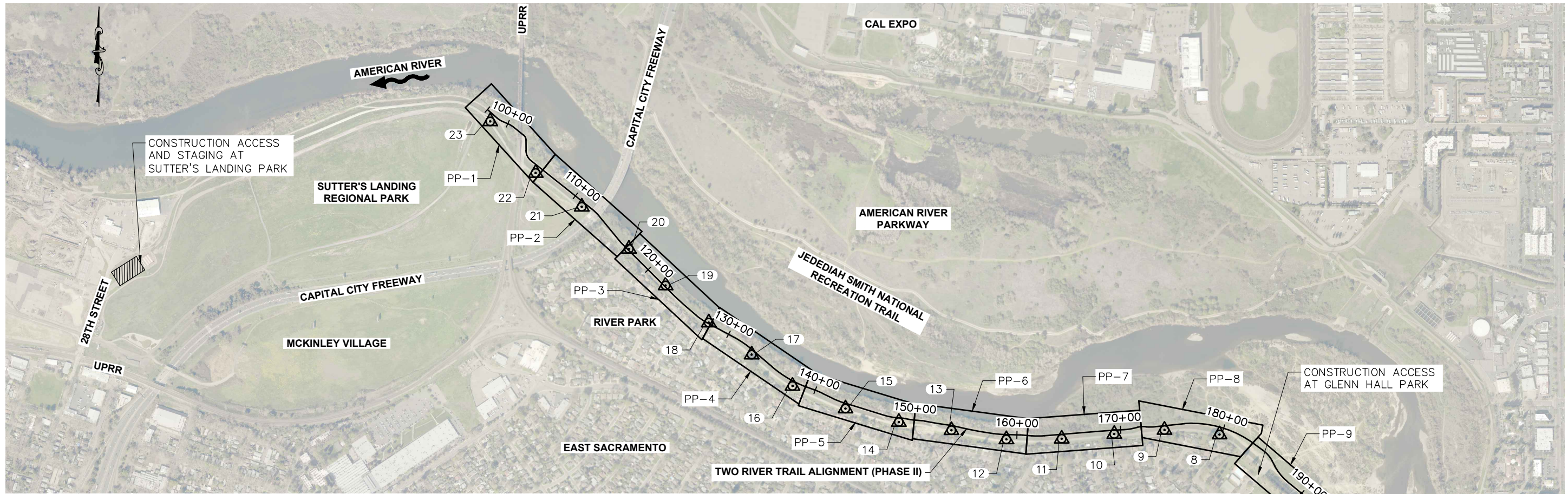
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
TYPICAL CROSS SECTIONS

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**SURVEY CONTROL POINTS**

No.	NORTHING	EASTING	ELEVATION	LINE	STATION	OFFSET	Rt/Lt	DESCRIPTION
1	1969837.79	6726303.46	49.20	"T"	225+93.99	1.41'	Lt	REBAR
2	1970571.48	6726349.27	48.99	"T"	218+61.99	34.33'	Rt	REBAR WT. YELLOW CAP
3	1971043.12	6726442.76	49.39	"T"	213+81.19	38.78'	Rt	REBAR WT. YELLOW CAP
4	1971681.24	6726566.97	49.31	"T"	207+28.38	48.97'	Rt	REBAR WT. YELLOW CAP
5	1972324.94	6726591.34	49.93	"T"	200+73.80	64.49'	Rt	REBAR WT. YELLOW CAP
6	1972766.30	6726521.25	49.64	"T"	196+09.92	74.30'	Rt	REBAR WT. YELLOW CAP
7	1973240.16	6726301.06	49.23	"T"	190+47.06	54.73'	Rt	REBAR WT. YELLOW CAP
8	1973876.66	6725513.29	48.06	"T"	179+79.58	69.97'	Rt	REBAR WT. YELLOW CAP
9	1973921.34	6724983.55	48.04	"T"	174+20.75	39.95'	Rt	REBAR WT. YELLOW CAP
10	1973882.09	6724500.74	47.33	"T"	169+36.52	36.84'	Rt	REBAR WT. YELLOW CAP
11	1973836.53	6723994.87	47.42	"T"	164+27.79	42.21'	Rt	REBAR WT. YELLOW CAP
12	1973830.43	6723463.15	47.04	"T"	158+99.94	46.55'	Rt	REBAR WT. YELLOW CAP
13	1973918.46	6722934.47	46.76	"T"	153+70.87	45.00'	Rt	REBAR WT. YELLOW CAP
14	1973997.48	6722428.55	46.45	"T"	148+53.73	40.02'	Rt	REBAR WT. YELLOW CAP
15	1974126.71	6721915.15	46.29	"T"	143+32.02	49.23'	Rt	REBAR WT. YELLOW CAP

**SURVEY CONTROL POINTS**

No.	NORTHING	EASTING	ELEVATION	LINE	STATION	OFFSET	Rt/Lt	DESCRIPTION
16	1974344.70	6721405.54	46.38	"T"	137+85.23	45.49'	Rt	REBAR WT. YELLOW CAP
17	1974646.40	6721012.52	47.00	"T"	132+98.68	39.53'	Rt	REBAR WT. YELLOW CAP
18	1974954.86	6720600.10	45.83	"T"	127+78.77	8.69'	Lt	REBAR WT. YELLOW CAP
19	1975312.12	6720185.12	46.70	"T"	122+26.79	11.54'	Lt	REBAR WT. YELLOW CAP
20	1975664.64	6719832.04	46.75	"T"	117+27.85	11.85'	Lt	REBAR WT. YELLOW CAP
21	1976069.48	6719378.41	44.80	"T"	111+13.56	43.87'	Rt	REBAR
22	1976394.70	6718935.16	45.63	"T"	105+64.21	65.20'	Rt	REBAR
23	1976891.45	6718497.65	44.70	"T"	98+53.94	68.45'	Rt	REBAR
100	1969989.03	6726297.20	49.62	"T"	224+44.36	28.06'	Rt	REBAR

DATUM: NAD 83 SPC ZONE II

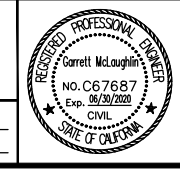
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HORIZ. 1" = 5000'	
VERT. 1" = 500'	



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase      DESIGN BY: G. McLaughlin      CHECKED BY: DES\_CHK  
DATE: \_\_\_\_\_      DATE: \_\_\_\_\_      DATE: \_\_\_\_\_



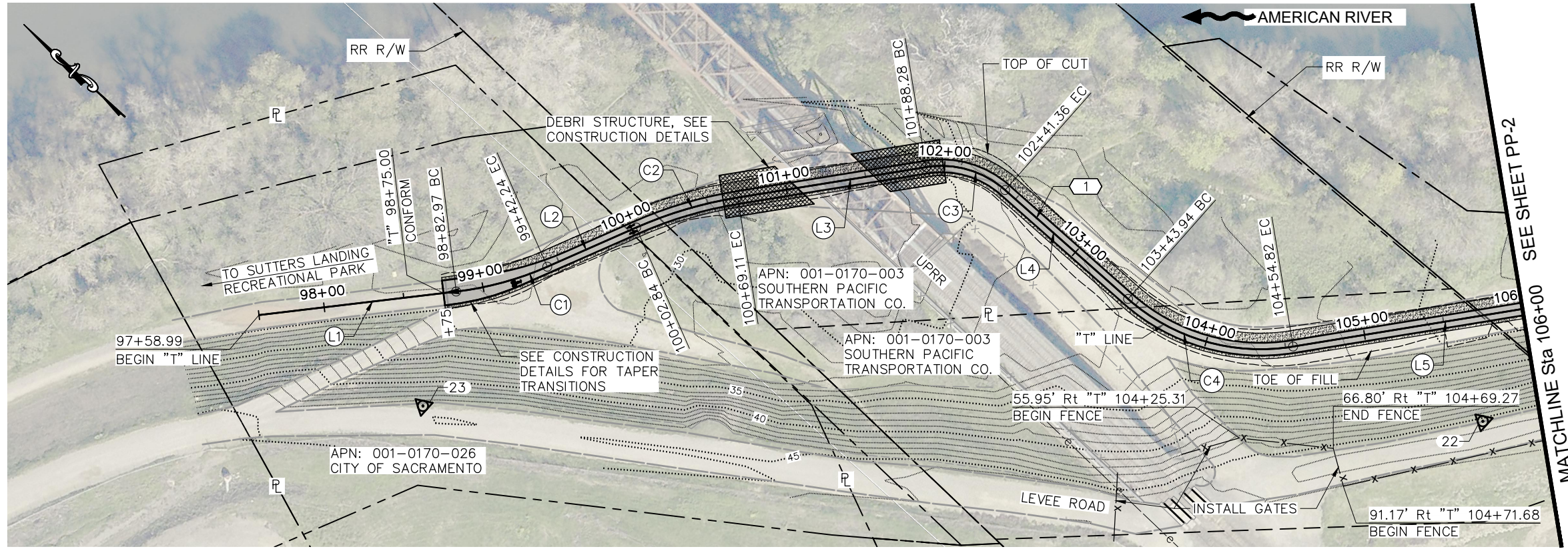
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
KEY MAP

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4  
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40

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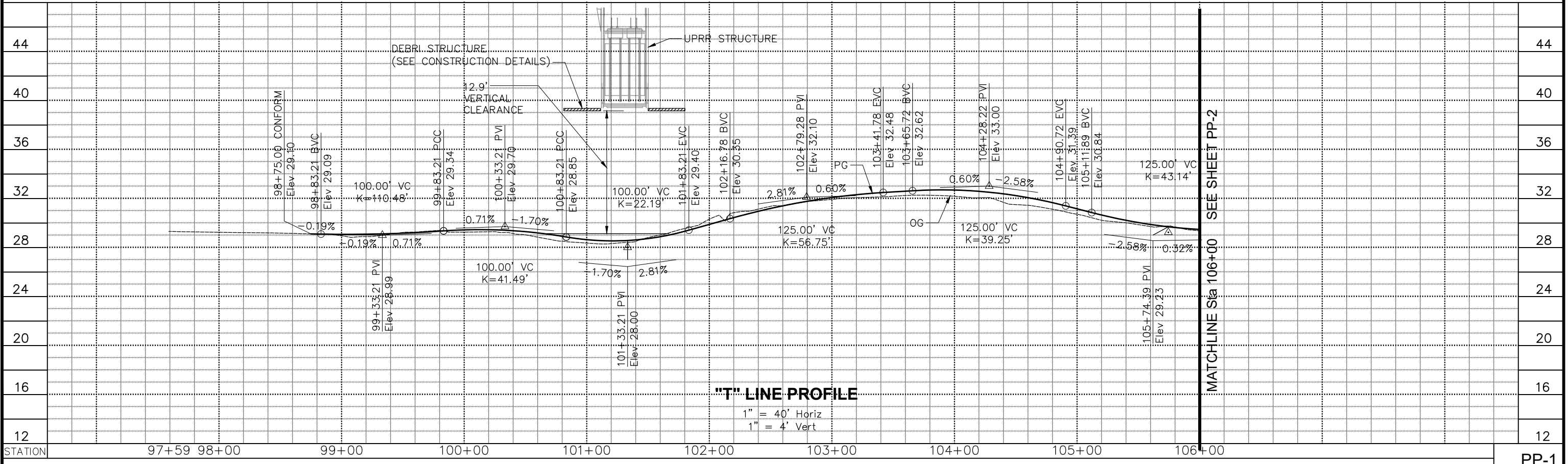
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**LEGEND**

- (Cx) CURVE DATA NUMBER
- (Lx) LINE DATA NUMBER
- △ SURVEY CONTROL POINT
- TOP OF CUT
- TOE OF FILL
- HMA
- DECOMPOSED GRANITE
- (XX) ROADSIDE SIGN NO.
- ┆ BEGIN OR END STRIPING DETAIL
- 1 PLACE 4" PAINTED YELLOW LINE
- ➔ BIKE LANE ARROW
- 🚲 BIKE LANE SYMBOL WITH PERSON
- LL LIMIT LINE
- ┆ ROADSIDE SIGN (ONE POST)
- TE TRAIL EASEMENT
- TRAIL EASEMENT
- jt---(oh)--- OVERHEAD UTILITY LINE



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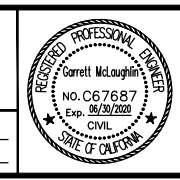
FIELD BOOK

SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 97+58.99 to Sta 106+00

Page 3

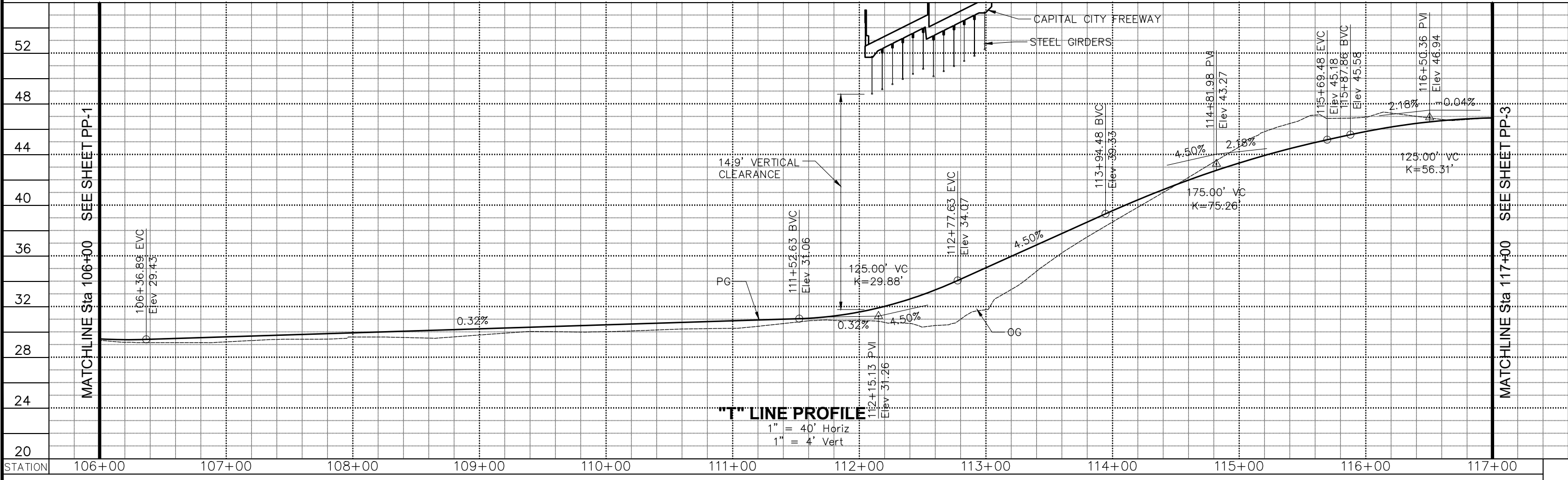
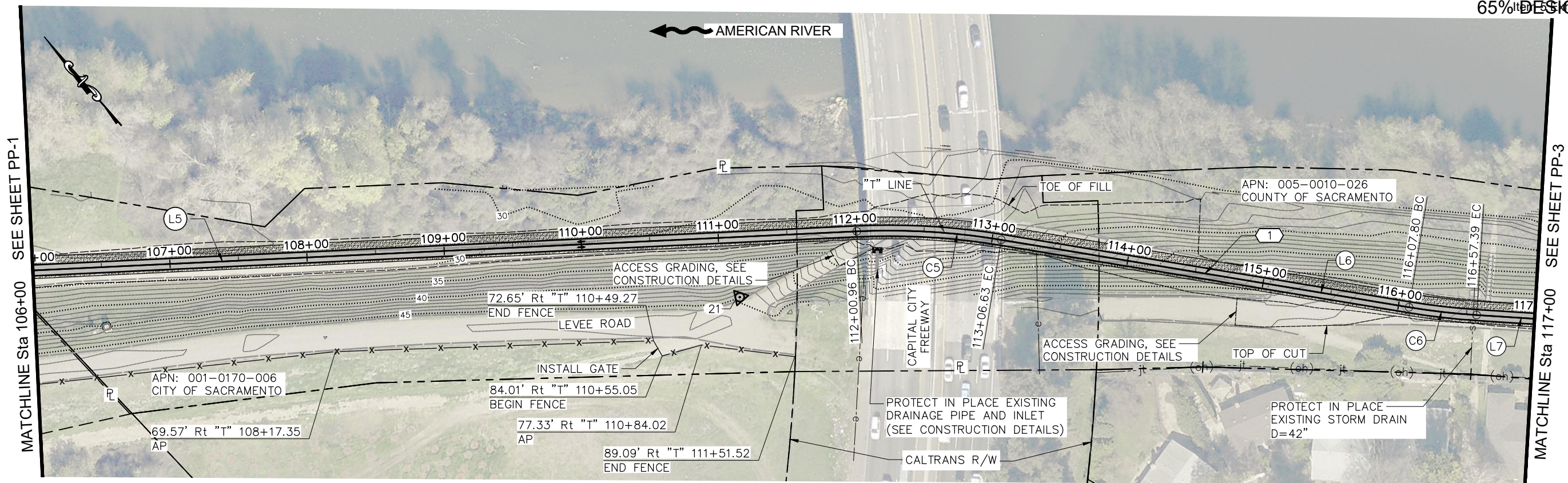
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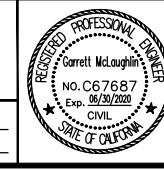
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FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'



**CITY OF SACRAMENTO**  
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DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 106+00 to Sta 117+00

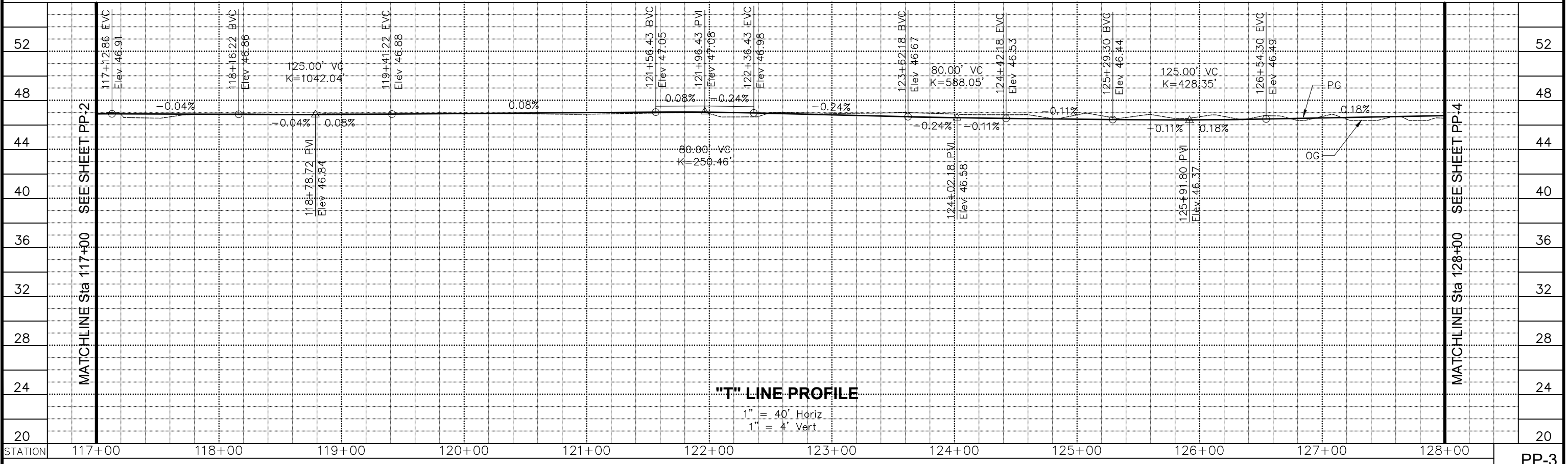
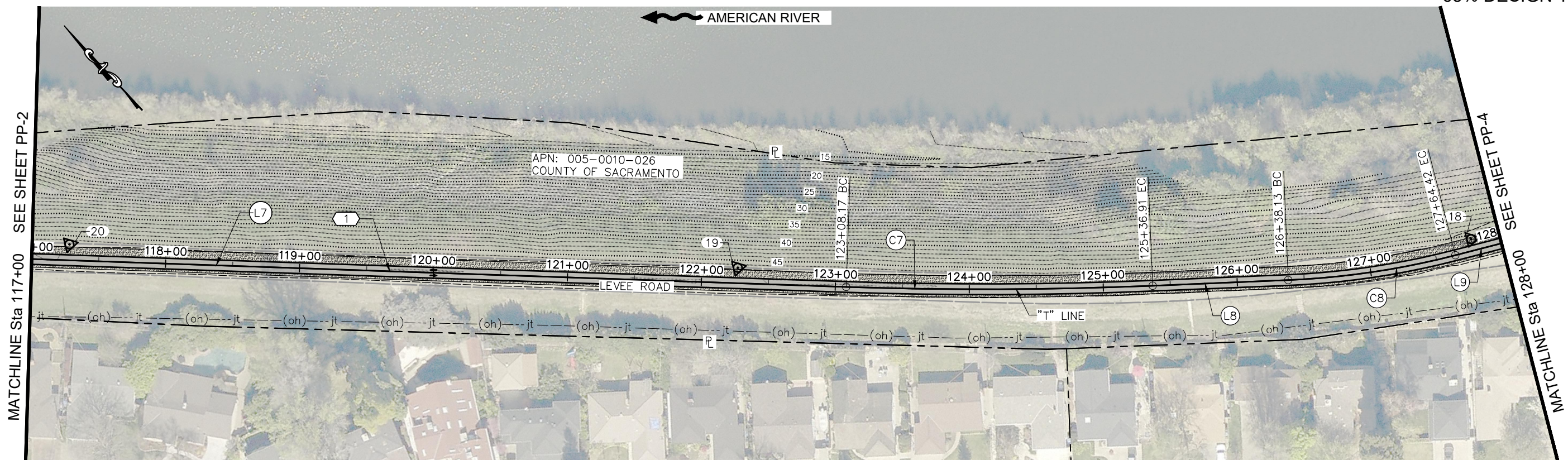
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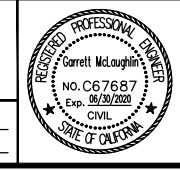
FIELD BOOK

SCALE  
 HORIZ. 1" = 40'  
 VERT. 1" = 4'

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

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 DESIGN BY: G. McLaughlin  
 CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 PLAN AND PROFILE  
 Sta 117+00 to Sta 128+00

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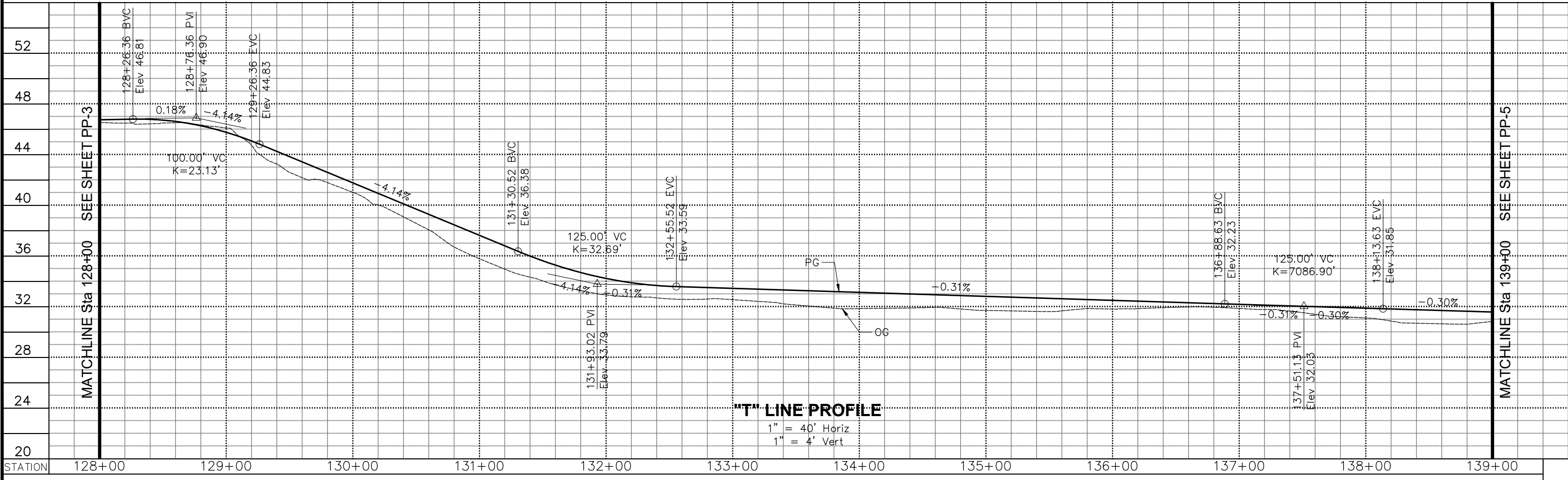
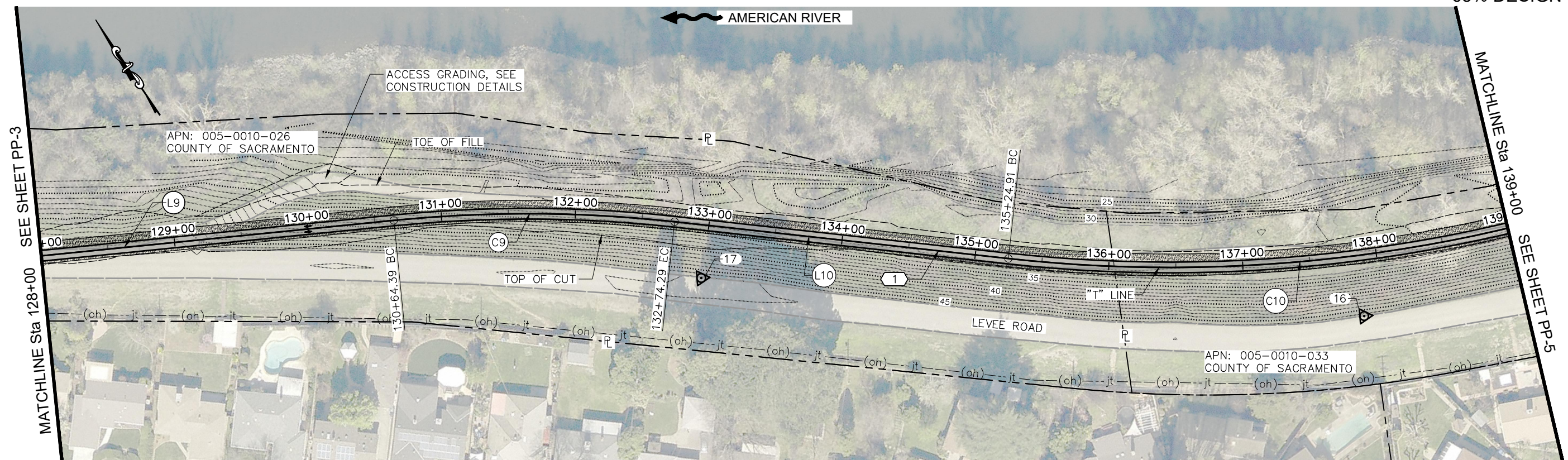
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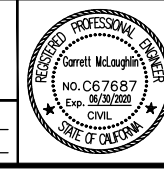
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK	

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

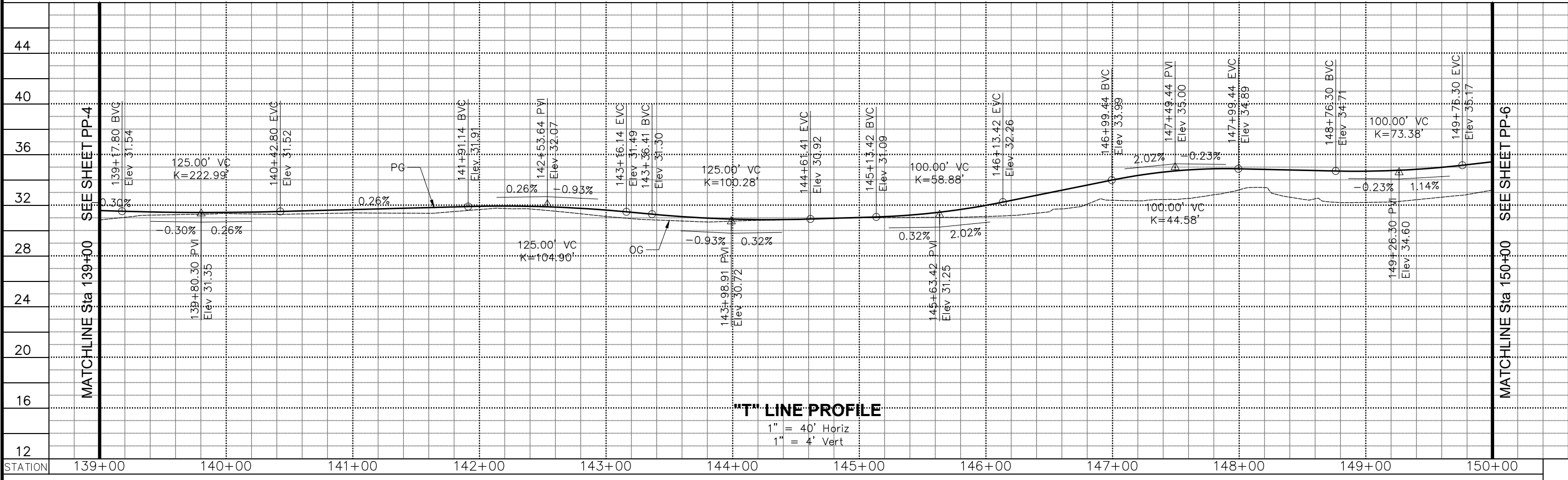
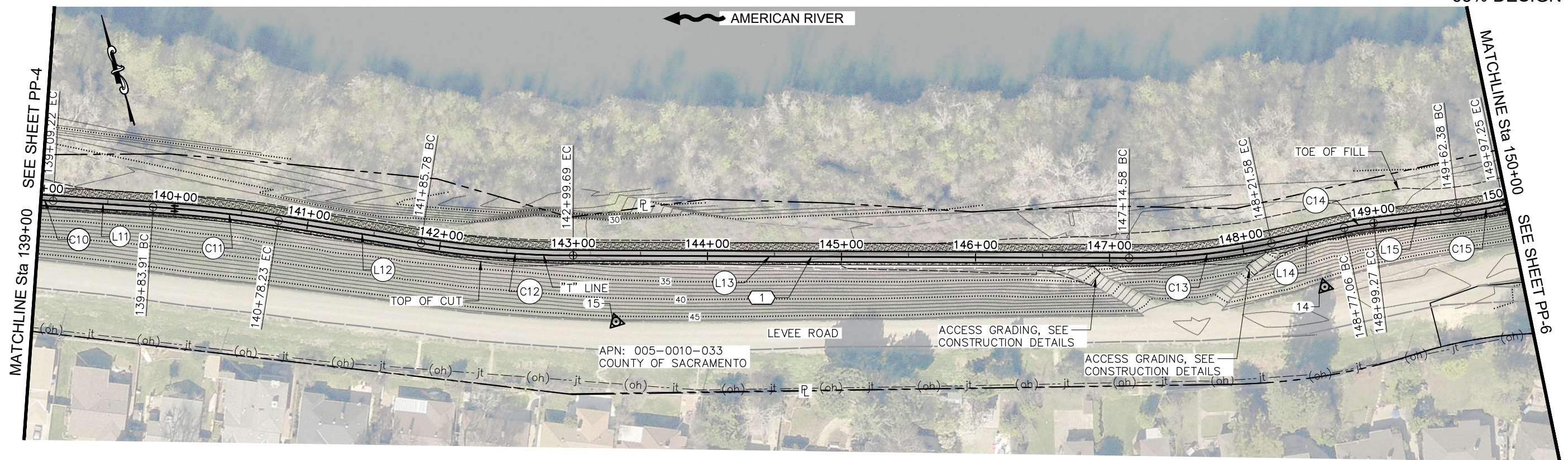
DRAWN BY: D. Polglase  
 DESIGN BY: G. McLaughlin  
 CHECKED BY: DES\_CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 PLAN AND PROFILE  
 Sta 128+00 to Sta 139+00

PLOT STAMP: Friday, October 23, 2020 5:26:35 PM

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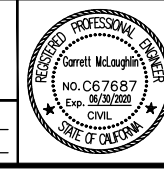
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



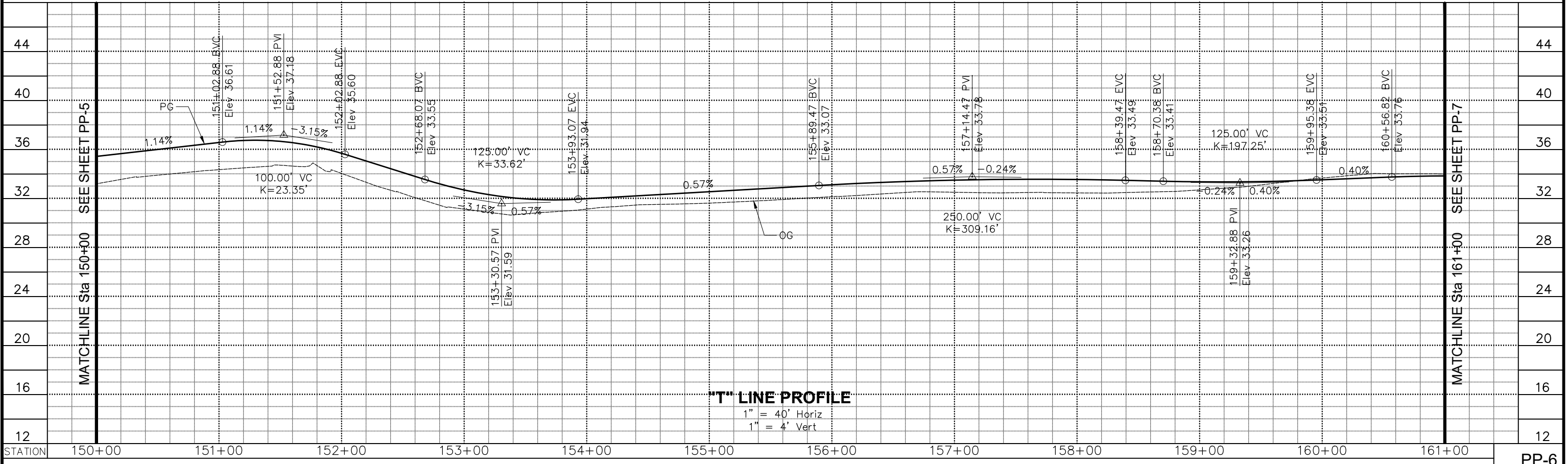
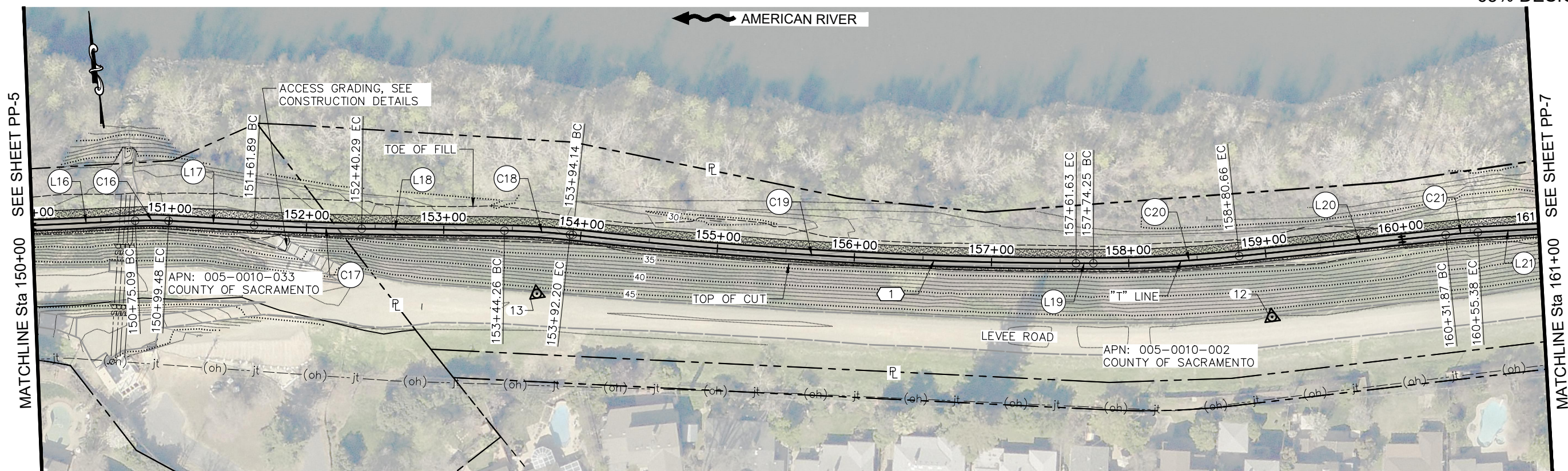
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 139+00 to Sta 150+00

Page 35 of 40  
PN: TXXXXXXX

PP-5  
SHEET 9 OF 40

PLOT STAMP: Friday, October 23, 2020 5:26:44 PM

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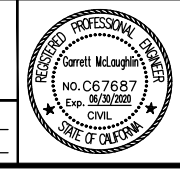
NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. N/A



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK

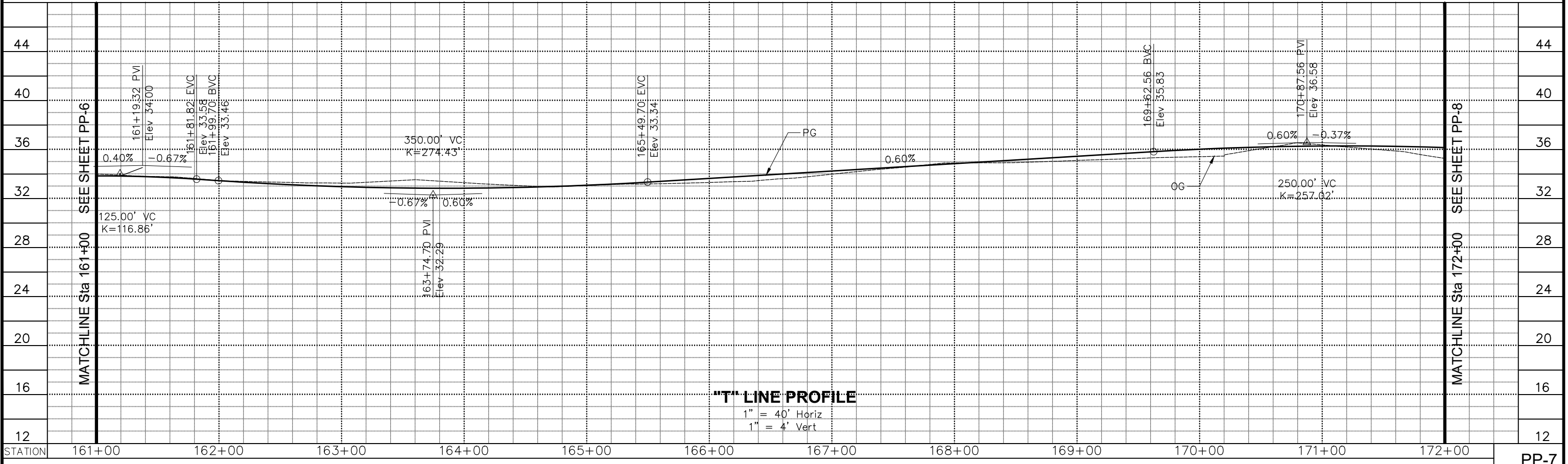
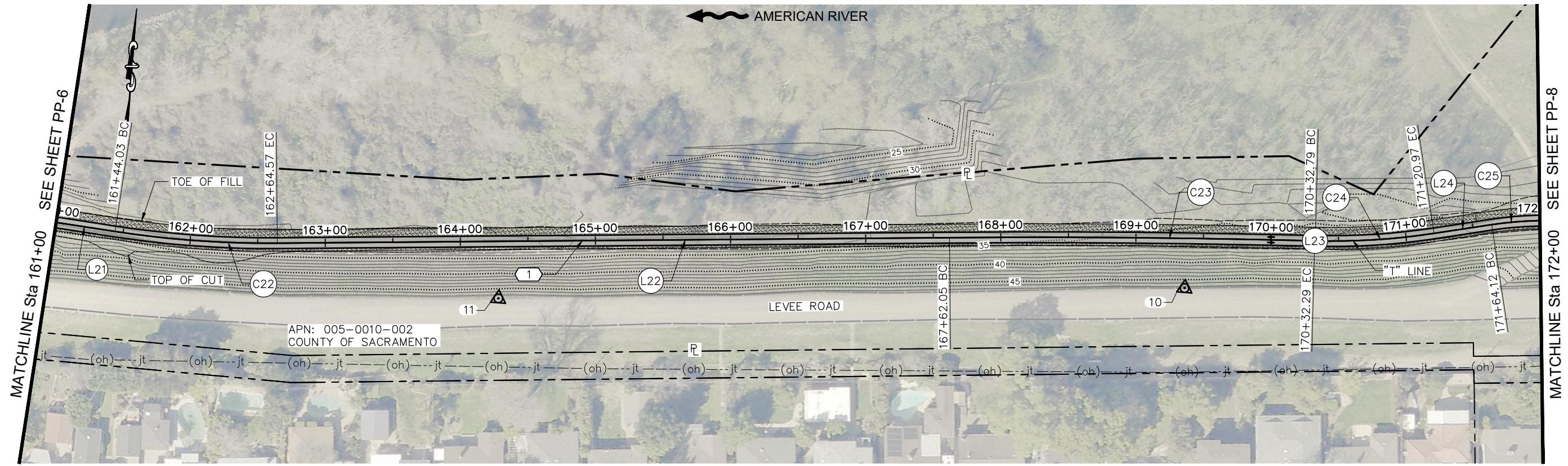


CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 150+00 to Sta 161+00

Page 36 of 40  
SHEET 10 OF 40  
PN: TXXXXXXX

PLOT STAMP: Friday, October 23, 2020 5:27:17 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_req-002.dwg



NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK

SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'

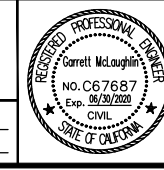
**QUINCY ENGINEERING**

11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK

DATE \_\_\_\_\_ DATE \_\_\_\_\_ DATE \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 161+00 to Sta 172+00

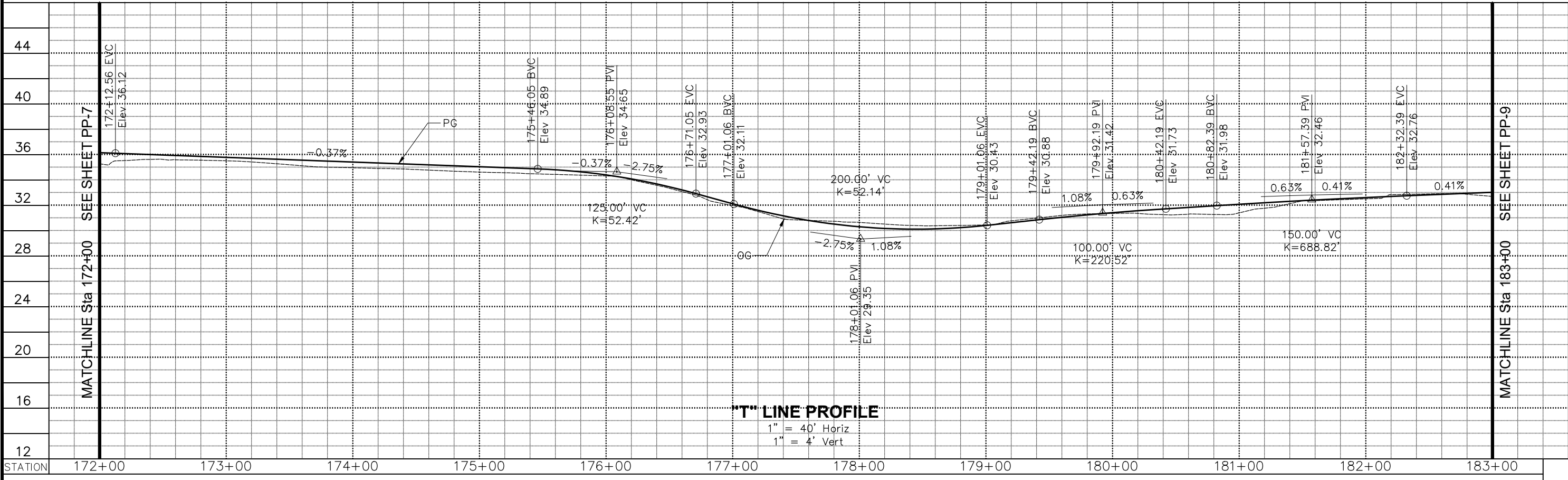
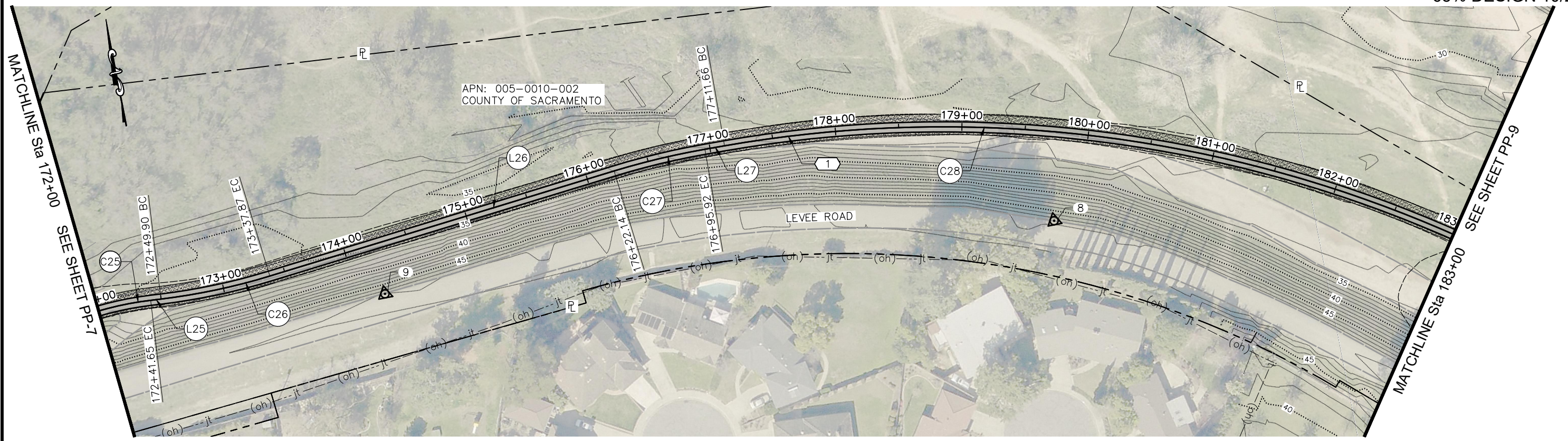
Page 37

PN: TXXXXXXX

SHEET  
11  
OF  
40

PLOT STAMP: Friday, October 23, 2020 5:27:29 PM

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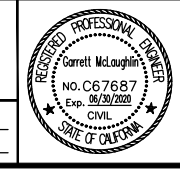
NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



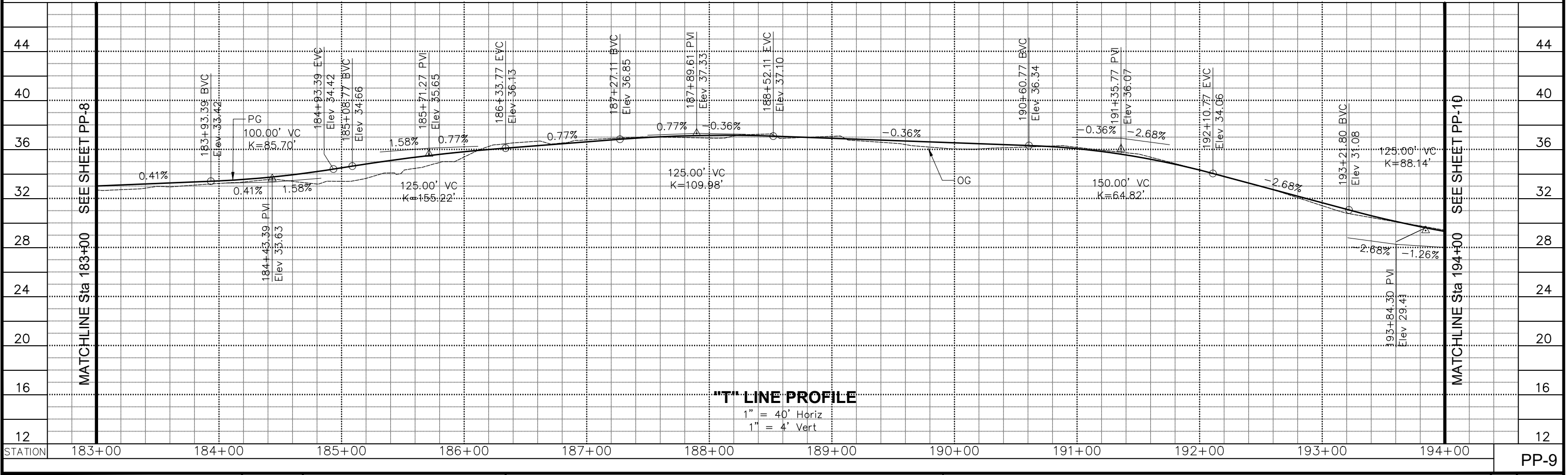
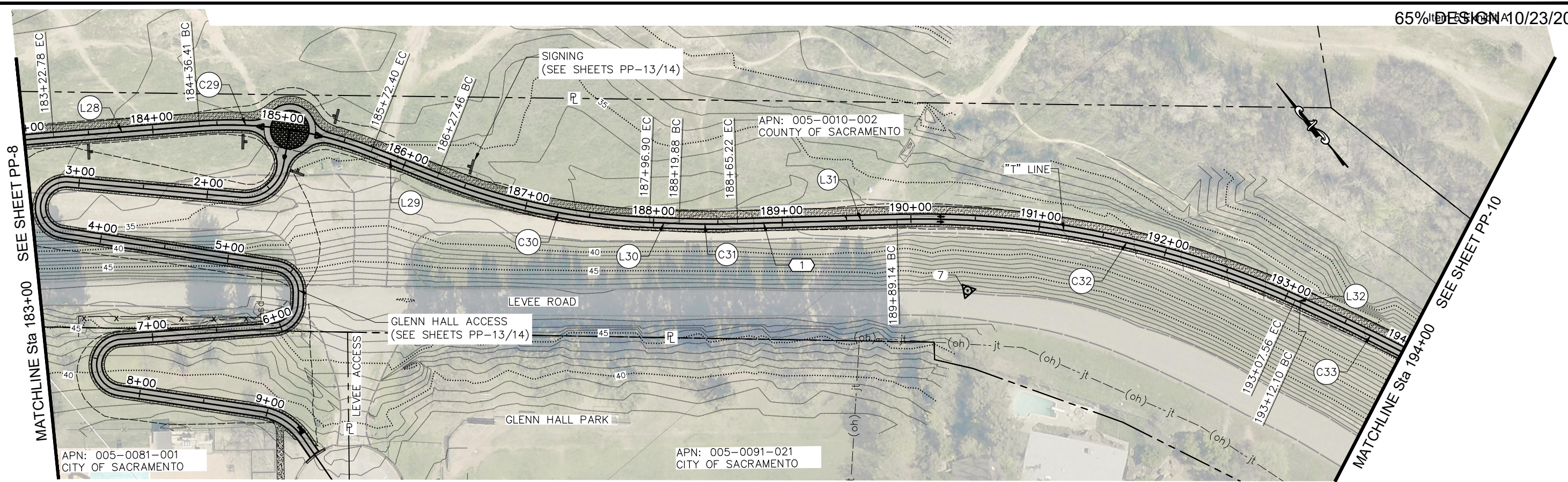
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 172+00 to Sta 183+00

Page 38

PP-8  
SHEET 12 OF 40  
PN: TXXXXXXX

PLOT STAMP: Friday, October 23, 2020 5:27:39 PM

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NO.	REVISIONS DESCRIPTION	DATE	BY

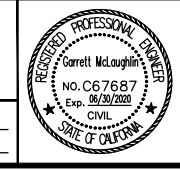
FIELD BOOK

SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 183+00 to Sta 194+00

Page 39

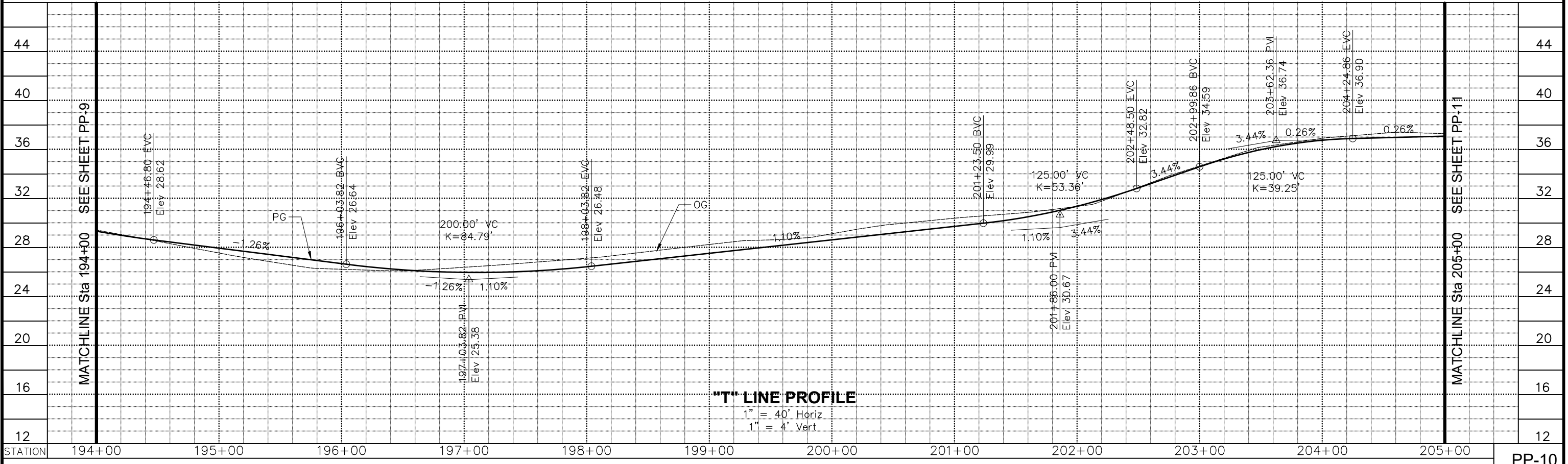
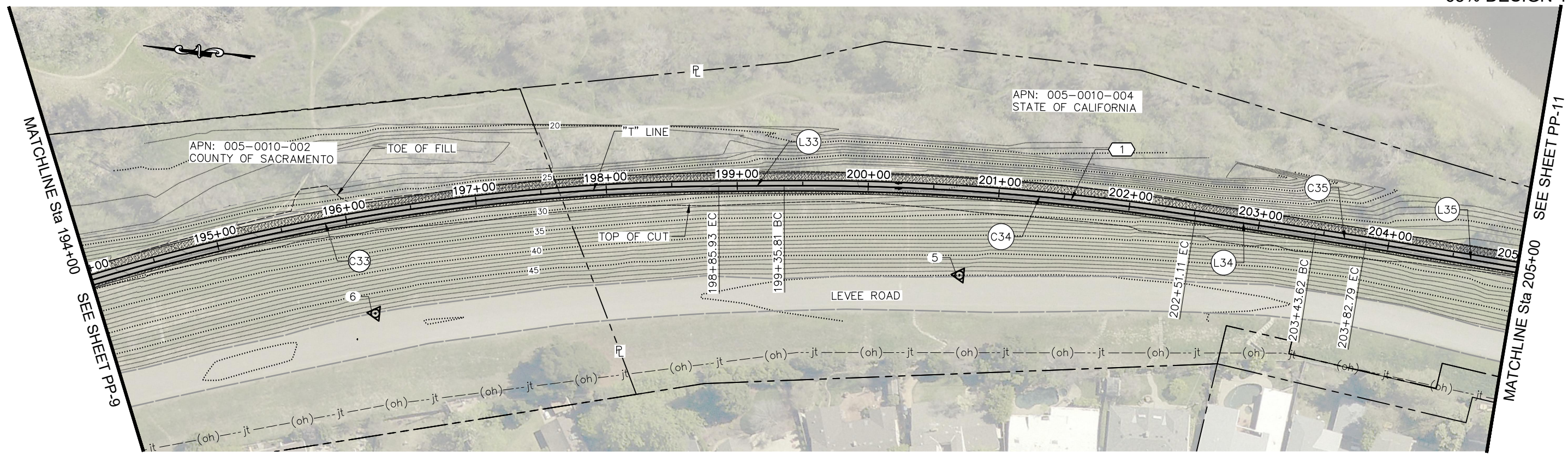
PP-9

SHEET 13 OF 40

PN: TXXXXXXX

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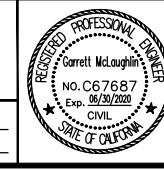
NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK



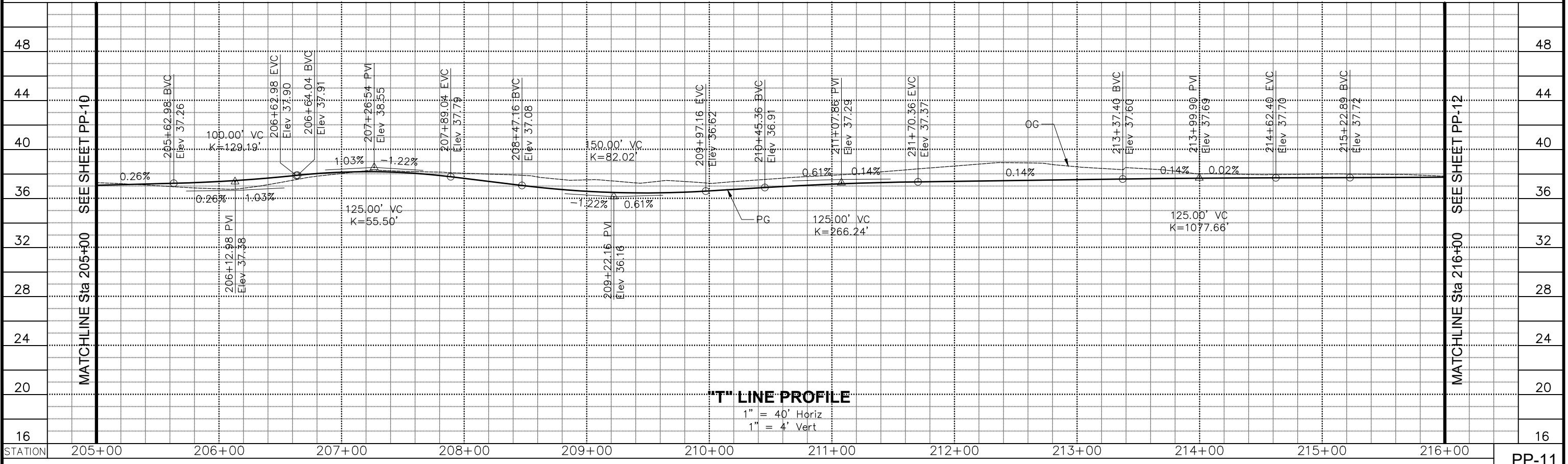
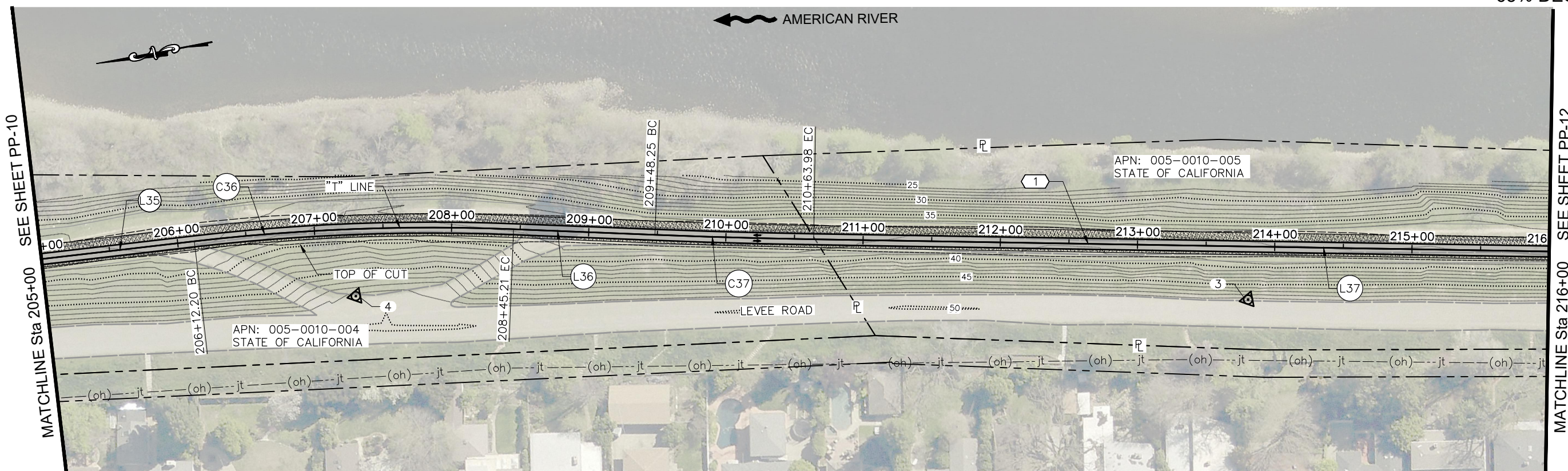
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 194+00 to Sta 205+00

PP-10  
SHEET 14 OF 40  
Page 40



PLOT STAMP: Friday, October 23, 2020 5:27:58 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_req-002.dwg



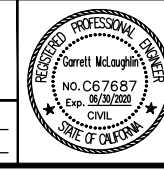
NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 205+00 to Sta 216+00

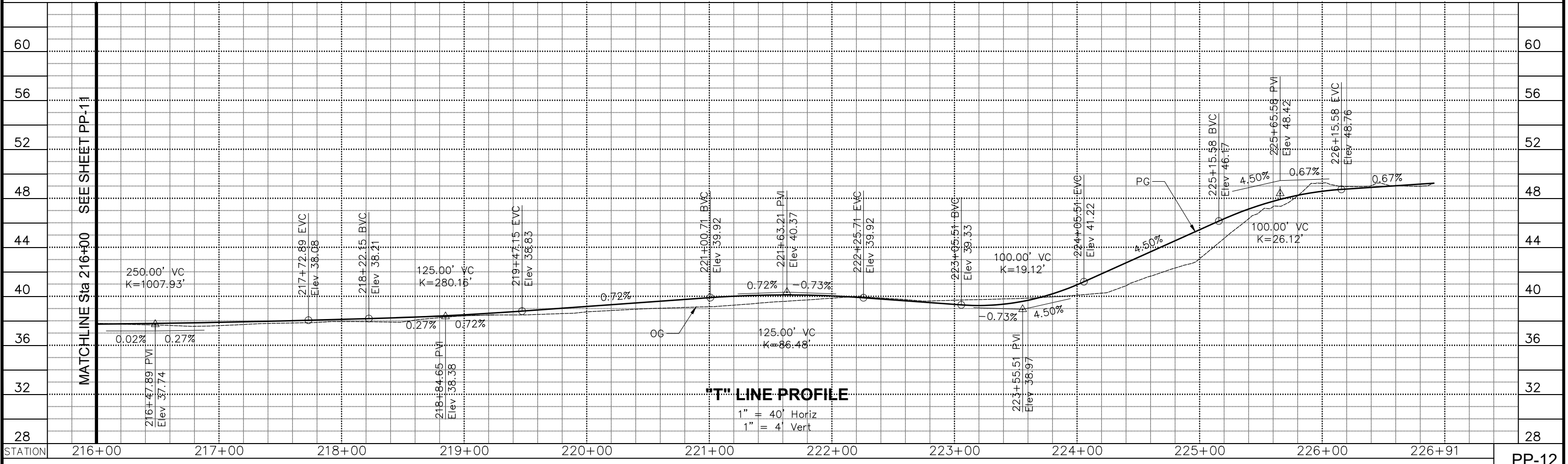
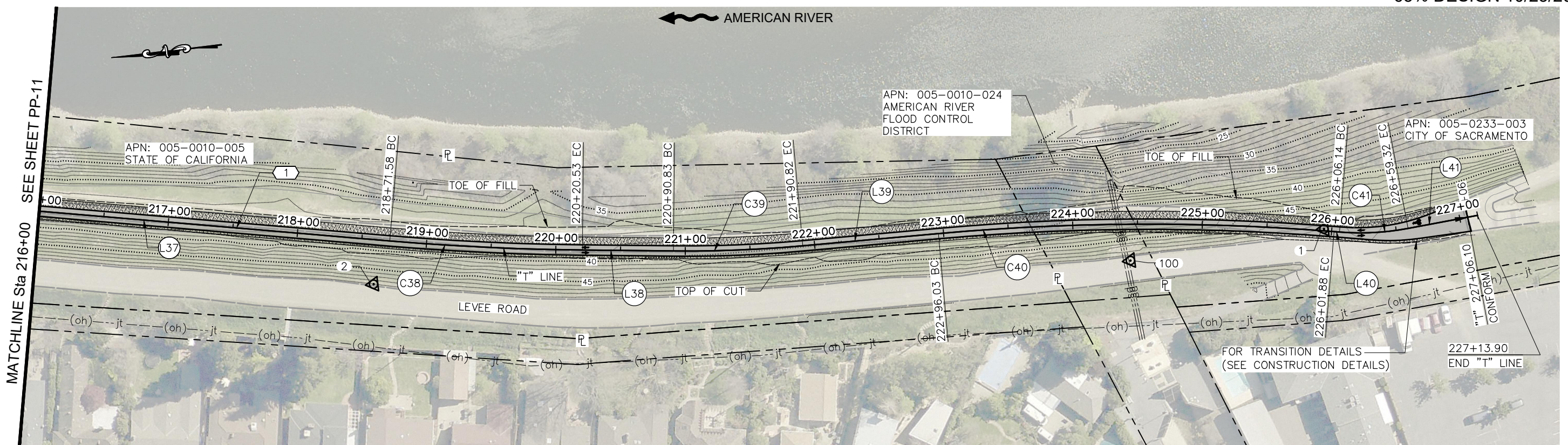
Page 4

PN: TXXXXXXX

SHEET 15 OF 40

PLOT STAMP: Friday, October 23, 2020 5:28:08 PM

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REVISIONS			
NO.	DESCRIPTION	DATE	BY

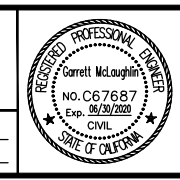
FIELD BOOK

SCALE  
HORIZ. 1" = 40'  
VERT. 1" = 4'

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
PLAN AND PROFILE  
Sta 216+00 to Sta 226+91

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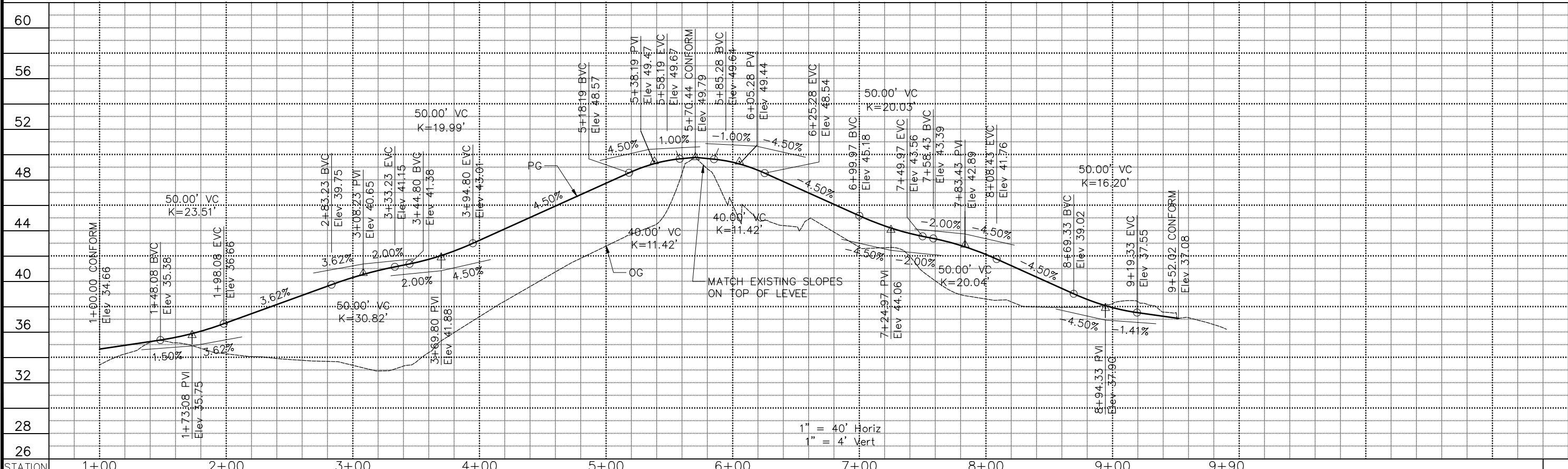
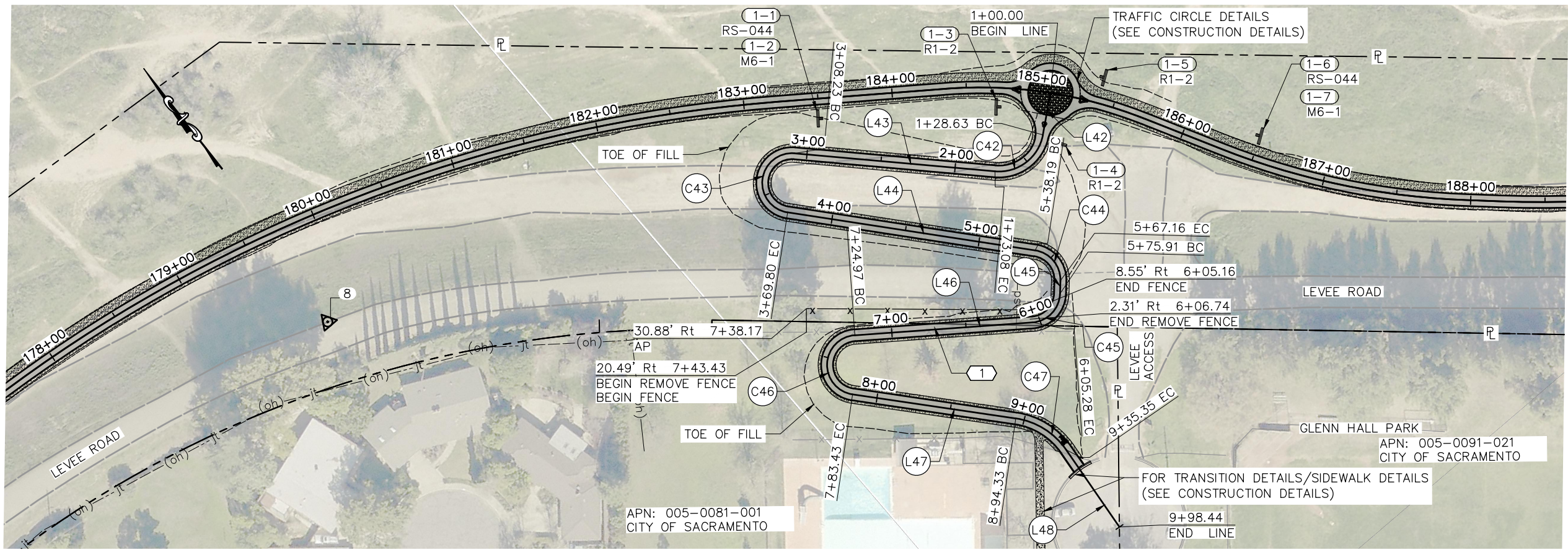
SHEET 16 OF 40

PN: TXXXXXXX

PLOT STAMP: Friday, October 23, 2020 5:28:35 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_req-003\_ROUNDABOUT.dwg

65% DESIGN 10/23/20



STATION 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 9+90

PP-13

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 10'  
VERT. 1" = 4'



CITY OF SACRAMENTO  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: B. Harrison  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES CHK



CONSTRUCTION PLANS FOR  
TWO RIVERS TRAIL PROJECT (PHASE II)  
GLENN HALL ACCESS PLAN AND PROFILE (TRAFFIC CIRCLE)

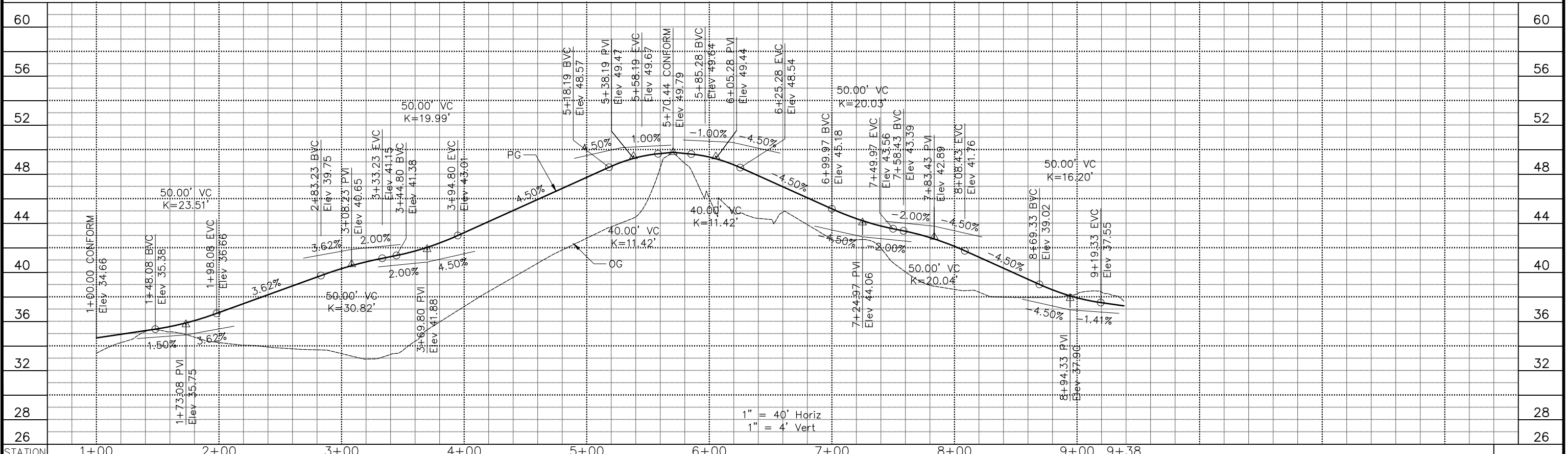
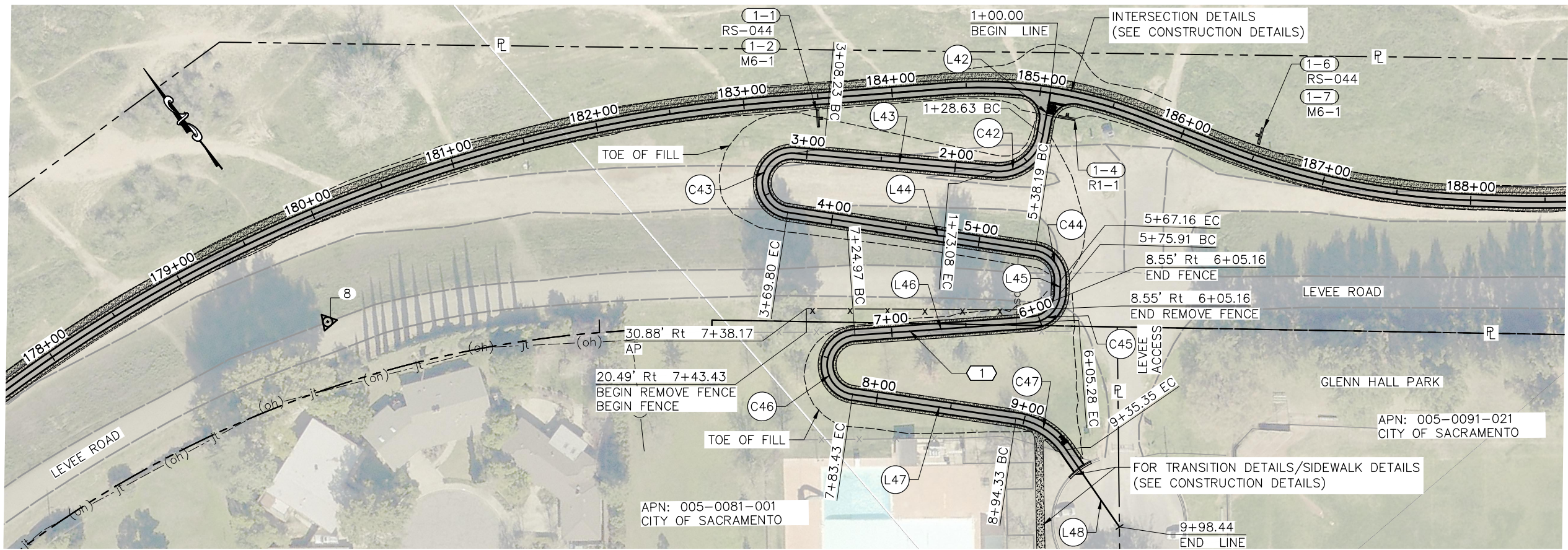
Page 43

SHEET  
17  
OF  
40

PLOT STAMP: Friday, October 23, 2020 5:28:53 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_req-004\_I-T-INTERSECTION.dwg

65% DESIGN 10/23/20



<b>REVISIONS</b>				<b>FIELD BOOK</b>			<b>CITY OF SACRAMENTO</b> DEPARTMENT OF PUBLIC WORKS			CONSTRUCTION PLANS FOR <b>TWO RIVERS TRAIL PROJECT (PHASE II)</b> GLENN HALL ACCESS PLAN AND PROFILE (T-INTERSECTION)			SHEET <b>18</b> OF <b>40</b>
NO.	DESCRIPTION	DATE	BY				SCALE HORIZ. 1" = 10' VERT. 1/4" = 4'	DRAWN BY: <u>B. Harrison</u> DATE: _____	DESIGN BY: <u>G. McLaughlin</u> DATE: _____	CHECKED BY: <u>DES CHK</u> DATE: _____			

PLOT STAMP: Friday, October 23, 2020 5:29:14 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rea-001.dwg

LINE DATA "T" LINE		
NO.	BEARING	DISTANCE
L1	S 48°59'39" E	123.98'
L2	S 65°58'25" E	60.60'
L3	S 51°22'10" E	119.17'
L4	S 00°41'00" E	102.58'
L5	S 51°30'31" E	746.13'
L6	S 39°23'56" E	301.17'
L7	S 45°04'56" E	650.77'
L8	S 49°27'03" E	101.22'
L9	S 61°30'38" E	299.97'
L10	S 49°29'03" E	250.62'
L11	S 69°30'07" E	74.68'
L12	S 64°05'53" E	107.55'
L13	S 72°48'01" E	414.89'
L14	S 85°03'41" E	55.48'
L15	S 79°58'19" E	63.11'
L16	S 84°58'00" E	77.84'
L17	S 79°22'31" E	62.41'
L18	S 81°37'16" E	103.97'
L19	S 82°08'35" E	12.62'
L20	S 88°14'23" E	151.22'
L21	S 85°32'45" E	88.64'

LINE DATA "T" LINE		
NO.	BEARING	DISTANCE
L22	N 85°14'44" E	497.48'
L23	N 87°10'51" E	0.50'
L24	N 77°04'35" E	43.16'
L25	S 85°50'19" E	8.25'
L26	N 84°04'50" E	284.27'
L27	S 88°52'30" E	15.75'
L28	S 53°51'38" E	113.63'
L29	S 27°53'20" E	55.07'
L30	S 47°18'19" E	22.98'
L31	S 51°01'00" E	123.92'
L32	S 24°57'14" E	4.54'
L33	S 05°36'50" E	49.88'
L34	S 03°25'08" W	92.51'
L35	S 04°10'01" W	229.41'
L36	S 13°04'02" W	103.04'
L37	S 11°44'28" W	807.59'
L38	S 07°28'27" W	70.30'
L39	S 01°44'41" W	105.20'
L40	S 11°28'50" W	4.26'
L41	S 03°45'16" E	54.58'

CURVE DATA "T" LINE				
NO.	R	Δ	T	L
C1	200.00'	16° 58' 46"	29.85'	59.27'
C2	260.00'	14° 36' 16"	33.32'	66.27'
C3	60.00'	50° 41' 10"	28.42'	53.08'
C4	125.00'	50° 49' 31"	59.39'	110.88'
C5	500.00'	12° 06' 35"	53.04'	105.68'
C6	500.00'	5° 40' 59"	24.82'	49.60'
C7	3000.00'	4° 22' 07"	114.43'	228.74'
C8	600.00'	12° 03' 35"	63.38'	126.29'
C9	1000.00'	12° 01' 35"	105.34'	209.90'
C10	1100.00'	20° 01' 04"	194.14'	384.32'
C11	1000.00'	5° 24' 15"	47.19'	94.32'
C12	750.00'	8° 42' 08"	57.07'	113.91'
C13	500.00'	12° 15' 41"	53.70'	107.00'
C14	250.00'	5° 05' 22"	11.11'	22.21'
C15	400.00'	4° 59' 41"	17.45'	34.87'
C16	250.00'	5° 35' 30"	12.21'	24.40'
C17	2000.00'	2° 14' 46"	39.21'	78.40'
C18	500.00'	5° 29' 38"	23.99'	47.94'
C19	3500.00'	6° 00' 57"	183.91'	367.49'
C20	1000.00'	6° 05' 48"	53.25'	106.41'
C21	500.00'	2° 41' 38"	11.76'	23.51'

CURVE DATA "T" LINE				
NO.	R	Δ	T	L
C22	750.00'	9° 12' 31"	60.40'	120.54'
C23	8000.00'	1° 56' 08"	135.13'	270.24'
C24	500.00'	10° 06' 16"	44.20'	88.18'
C25	260.00'	17° 05' 05"	39.05'	77.53'
C26	500.00'	10° 04' 50"	44.10'	87.97'
C27	600.00'	7° 02' 40"	36.93'	73.77'
C28	1000.00'	35° 00' 52"	315.44'	611.12'
C29	300.00'	25° 58' 18"	69.18'	135.99'
C30	500.00'	19° 24' 59"	85.54'	169.44'
C31	700.00'	3° 42' 41"	22.68'	45.34'
C32	700.00'	26° 03' 46"	162.01'	318.42'
C33	1700.00'	19° 20' 24"	289.67'	573.83'
C34	2000.00'	9° 01' 58"	157.98'	315.30'
C35	3000.00'	0° 44' 53"	19.58'	39.16'
C36	1500.00'	8° 54' 01"	116.74'	233.01'
C37	5000.00'	1° 19' 34"	57.87'	115.73'
C38	2000.00'	4° 16' 02"	74.51'	148.95'
C39	1000.00'	5° 43' 45"	50.04'	99.99'
C40	1800.00'	9° 44' 09"	153.30'	305.86'
C41	200.00'	15° 14' 06"	26.75'	53.18'

LINE DATA "G" LINE		
NO.	BEARING	DISTANCE
L42	S 50°47'55" W	28.63'
L43	N 44°18'22" W	135.15'
L44	S 40°41'47" E	168.39'
L45	S 42°18'22" W	8.75'
L46	N 53°33'51" W	119.69'
L47	S 41°01'53" E	110.90'
L48	S 05°58'19" W	63.09'

CURVE DATA "G" LINE				
NO.	R	Δ	T	L
C42	30.00'	84° 53' 43"	27.44'	44.45'
C43	20.00'	176° 23' 25"	634.67'	61.57'
C44	20.00'	83° 00' 09"	17.70'	28.97'
C45	20.00'	84° 07' 47"	18.05'	29.37'
C46	20.00'	167° 28' 02"	182.14'	58.46'
C47	50.00'	47° 00' 12"	21.74'	41.02'

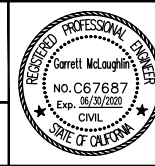
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. NO. SCALE
VERT. N/A



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase	DESIGN BY: G. McLaughlin	CHECKED BY: DES_CHK
DATE	DATE	DATE



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
LINE AND CURVE DATA

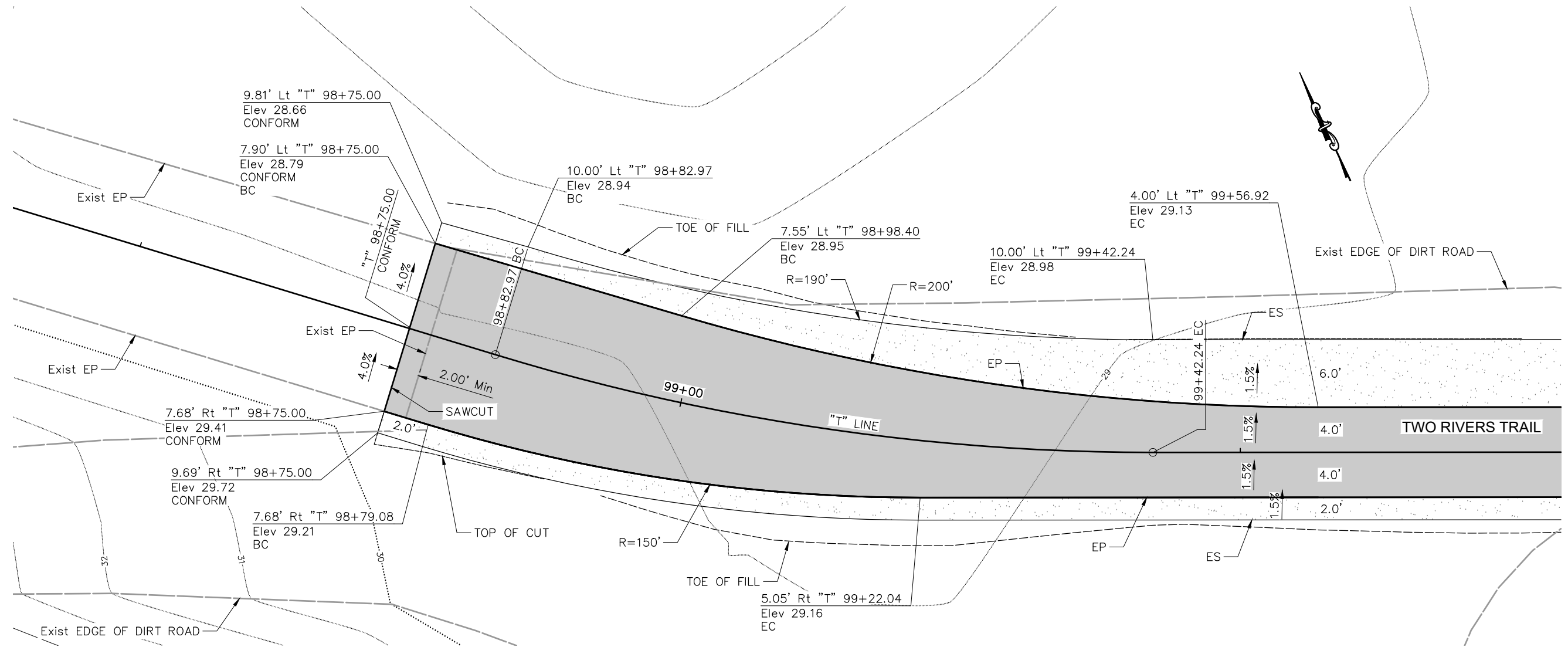
Page 45

PLOT STAMP: Friday, October 23, 2020 5:29:35 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-001.dwg

**LEGEND:**

- EP EDGE OF PAVEMENT
- HP HINGE POINT
- GB GRADE BREAK
- HMA
- NEW RAMP AREA
- TOP OF CUT
- TOE OF FILL



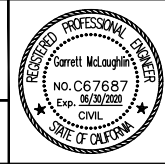
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 5'
VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

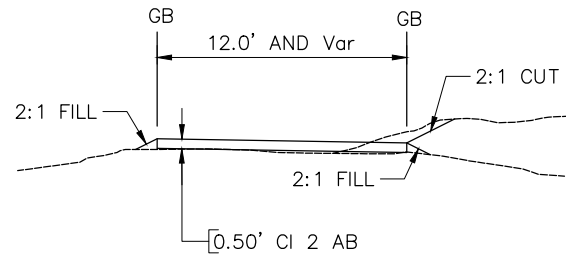
DRAWN BY: D. Polglase	DESIGN BY: G. McLaughlin	CHECKED BY: DES_CHK
DATE	DATE	DATE



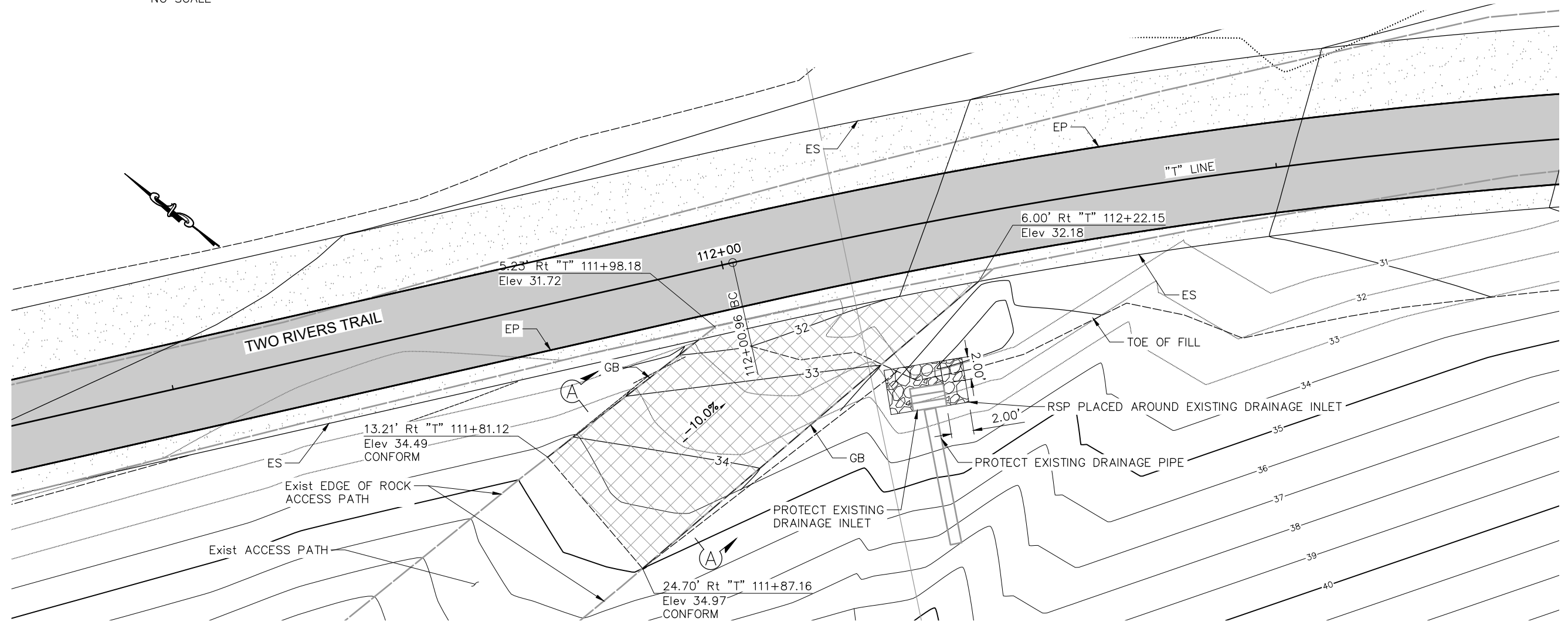
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 CONSTRUCTION DETAILS

PN: TK15125000	SHEET
	20
	OF
Page 46	40

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**SECTION A-A**  
**ACCESS GRADING TYPICAL SECTION**  
 NO SCALE



**ACCESS GRADING**

PLOT STAMP: Friday, October 23, 2020 5:29:39 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-001.dwg

REVISIONS			
NO.	DESCRIPTION	DATE	BY

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SCALE
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VERT. 1" = 5'

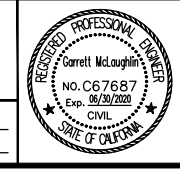
11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
 DATE: \_\_\_\_\_

DESIGN BY: G. McLaughlin  
 DATE: \_\_\_\_\_

CHECKED BY: DES\_CHK  
 DATE: \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 CONSTRUCTION DETAILS

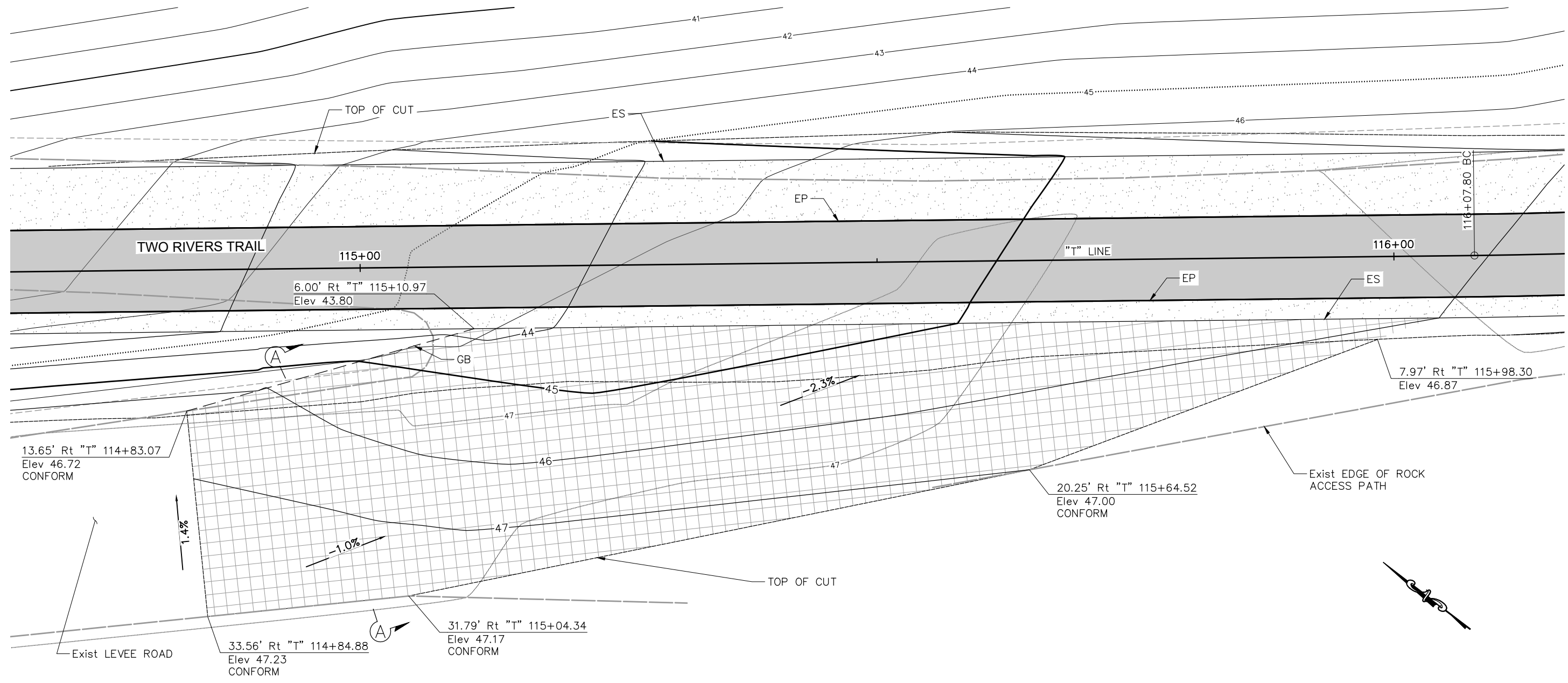
Page 47

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PLOT STAMP: Friday, October 23, 2020 5:29:42 PM

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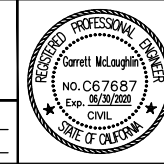
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VERT. N/A

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK

DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

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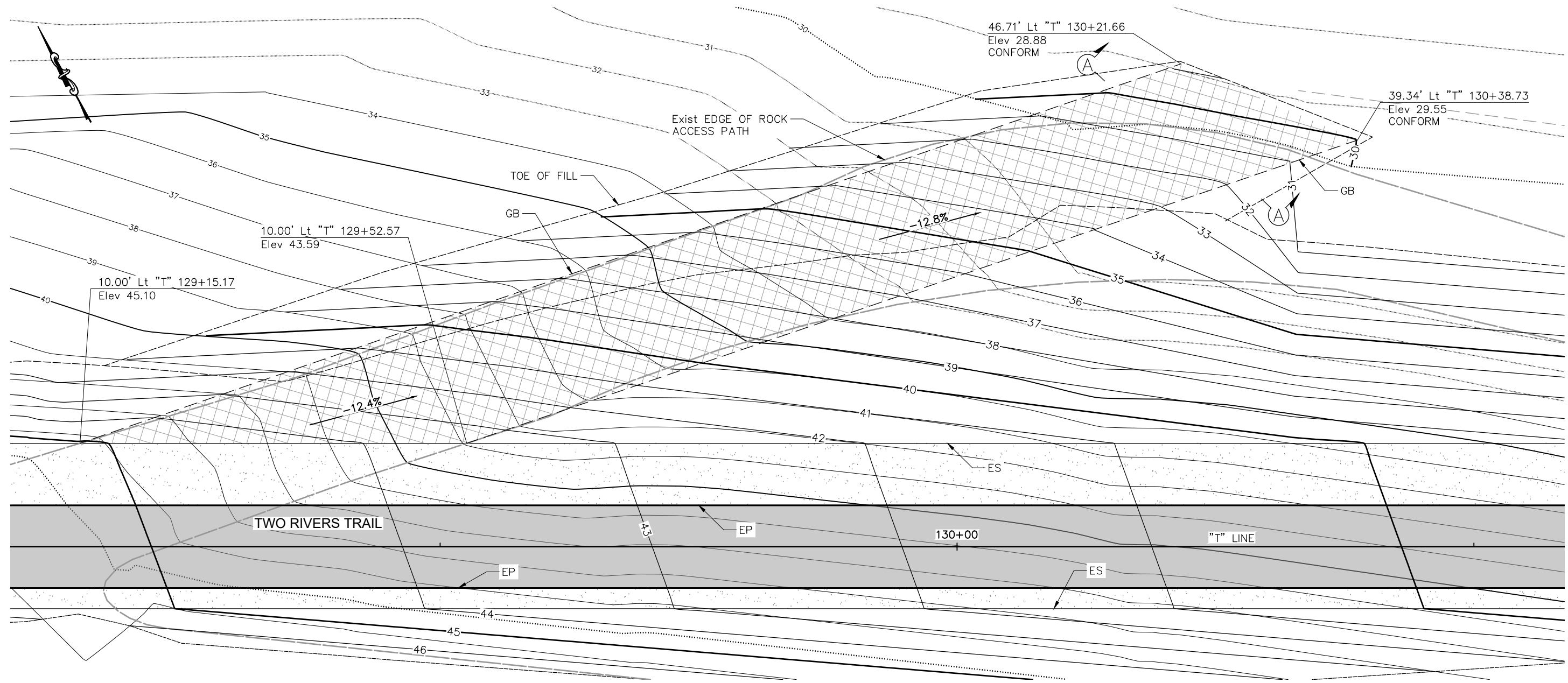
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PN: TK15125000



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**ACCESS GRADING**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 5'
VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

DRAWN BY: B. Harrison      DESIGN BY: G. McLaughlin      CHECKED BY: DES CHK  
 DATE:                              DATE:                              DATE:



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 CONSTRUCTION DETAILS

SHEET	23
	OF
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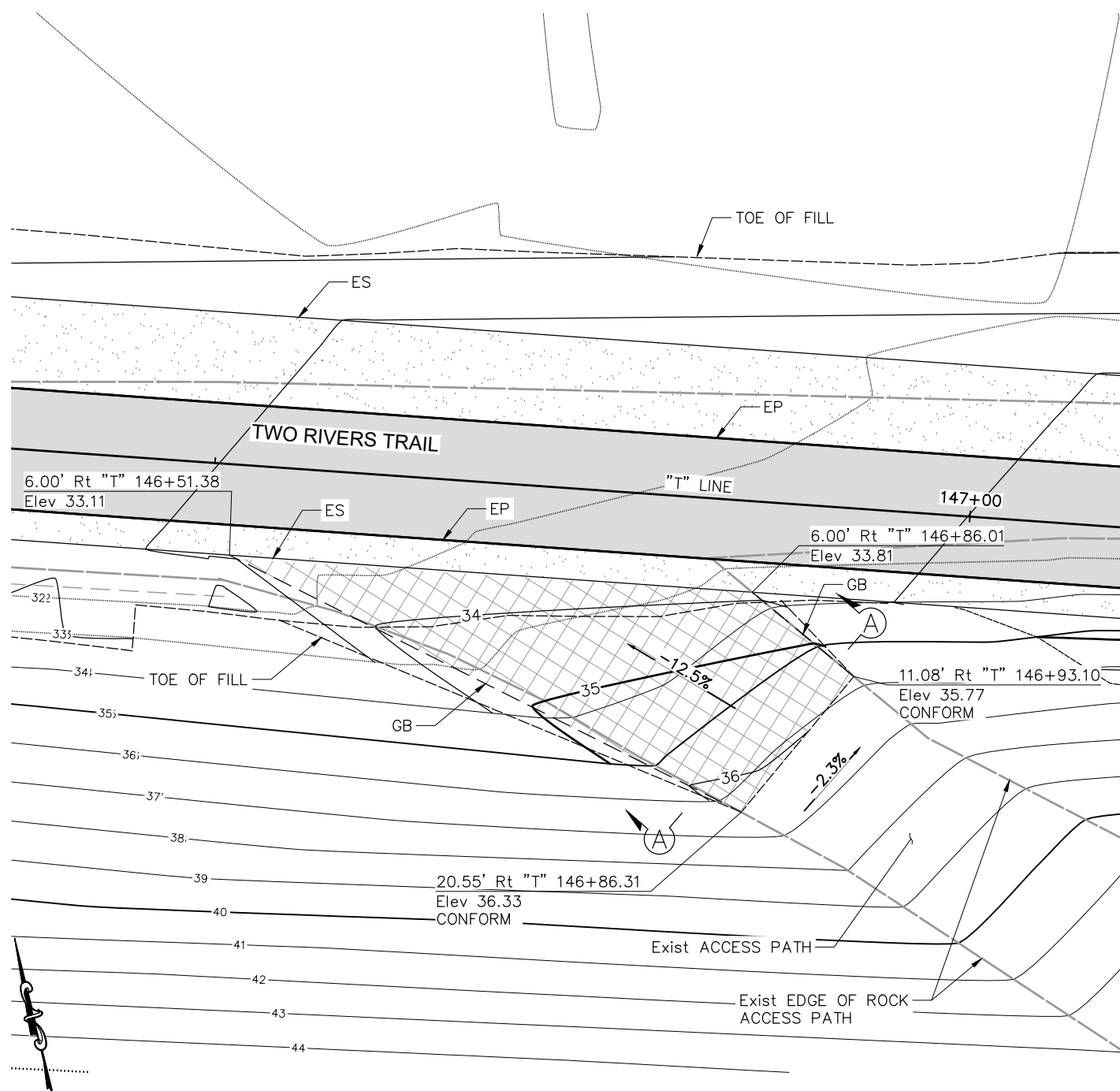
Page 49

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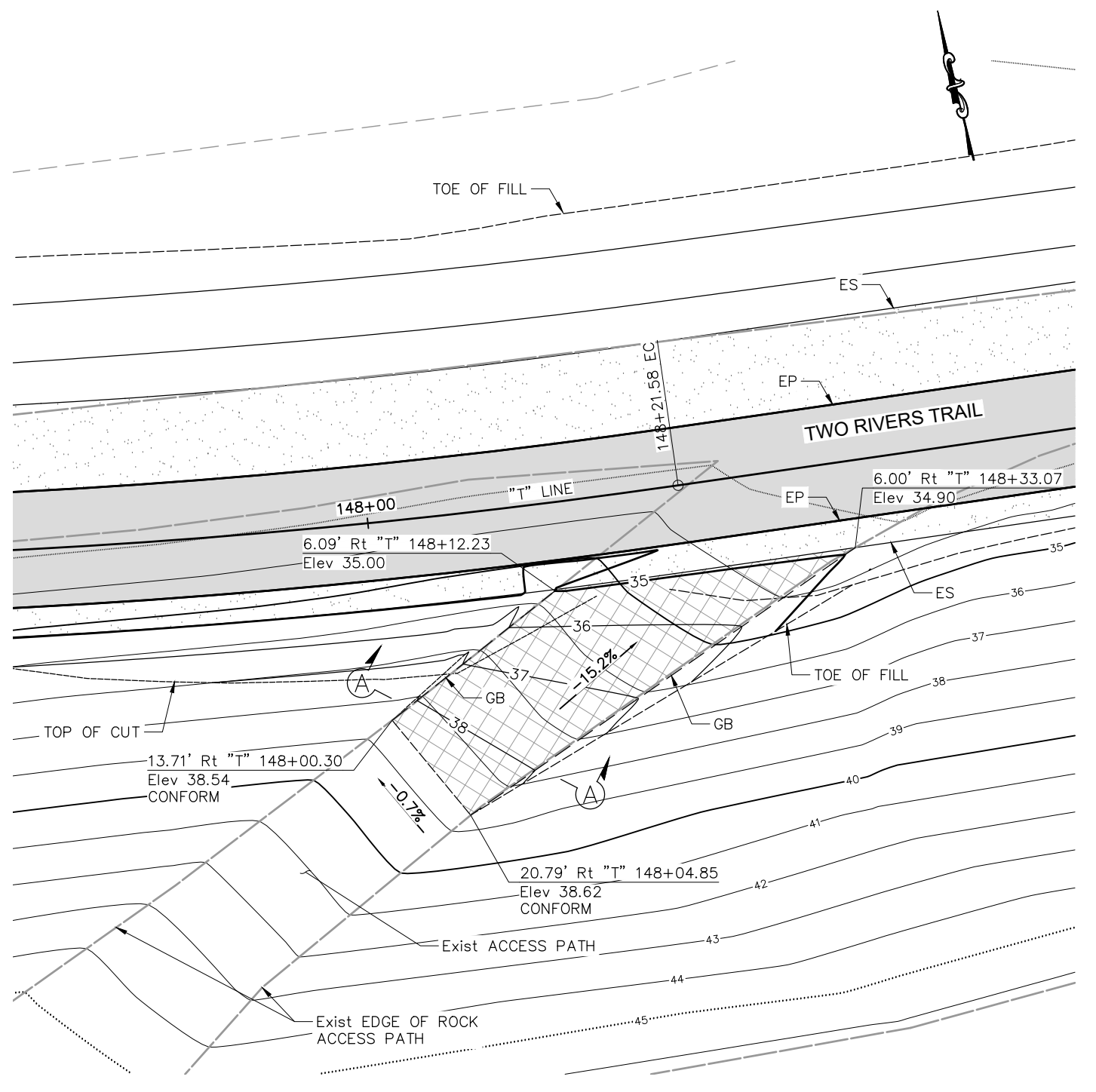
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**ACCESS GRADING**



**ACCESS GRADING**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 5'  
VERT. N/A



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK

DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_

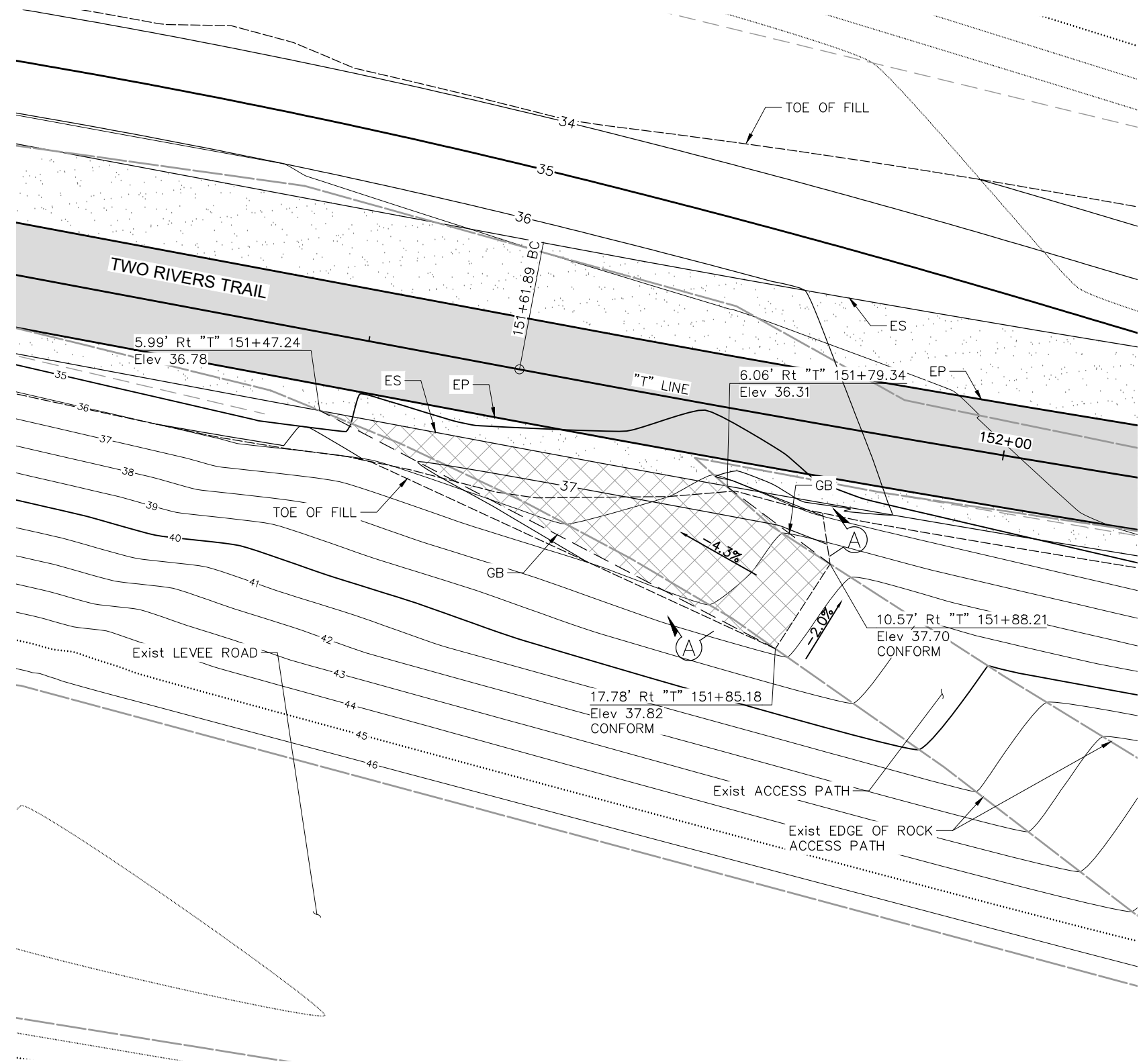


CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

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SHEET 24 OF 40  
Page 50  
PN: TK15125000

PLOT STAMP: Friday, October 23, 2020 5:30:30 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-002.dwg



**ACCESS GRADING**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK  
SCALE  
HORIZ. 1" = 5'  
VERT. N/A



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

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DATE	DATE	DATE



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

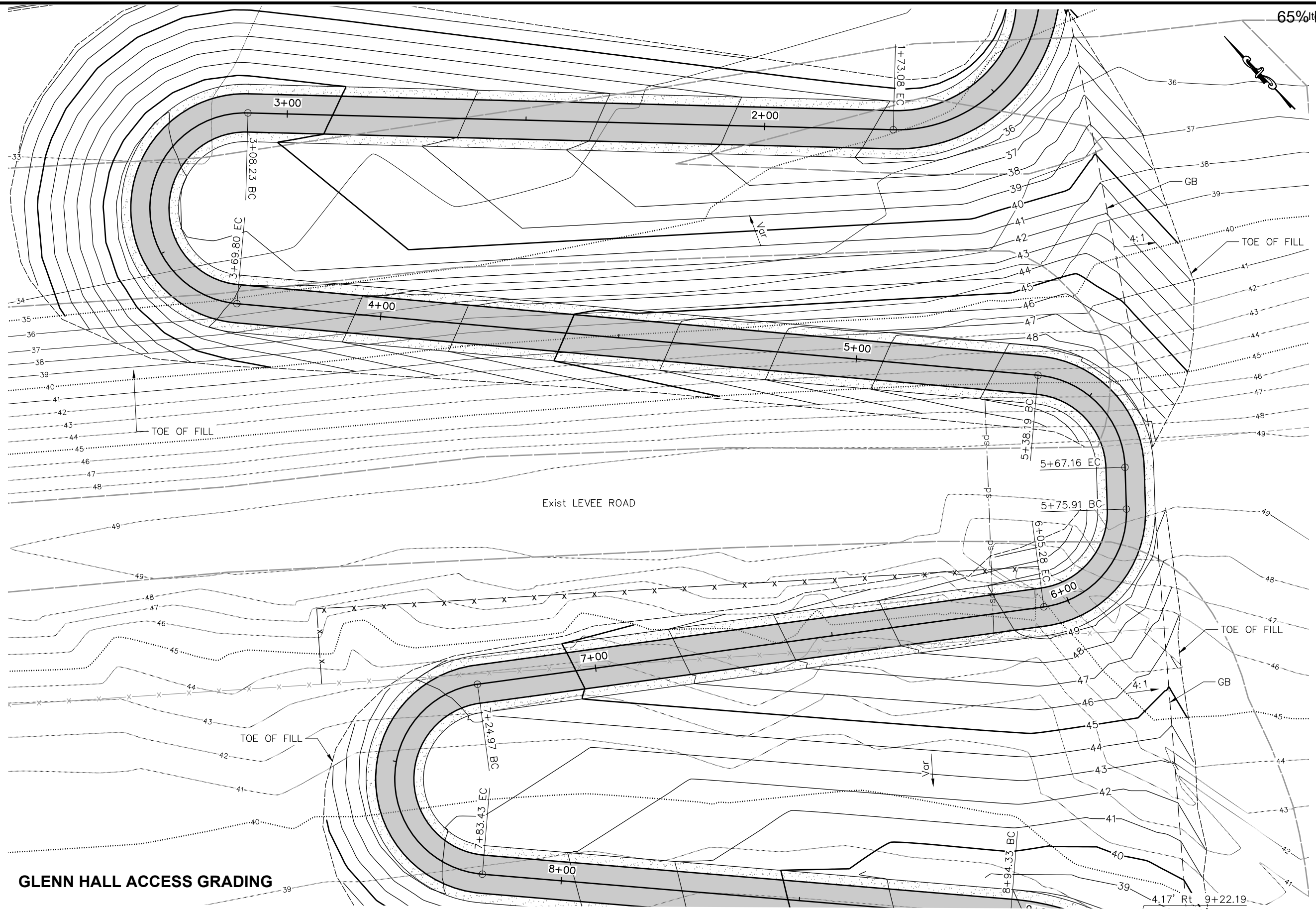
Page 5

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SHEET 25 OF 40

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PLOT STAMP: Friday, October 23, 2020 5:30:34 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-002.dwg



**GLENN HALL ACCESS GRADING**

NO.	REVISIONS DESCRIPTION	DATE	BY

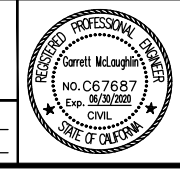
FIELD BOOK  
SCALE  
HORIZ. 1" = 10'  
VERT. 1" = 10'

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

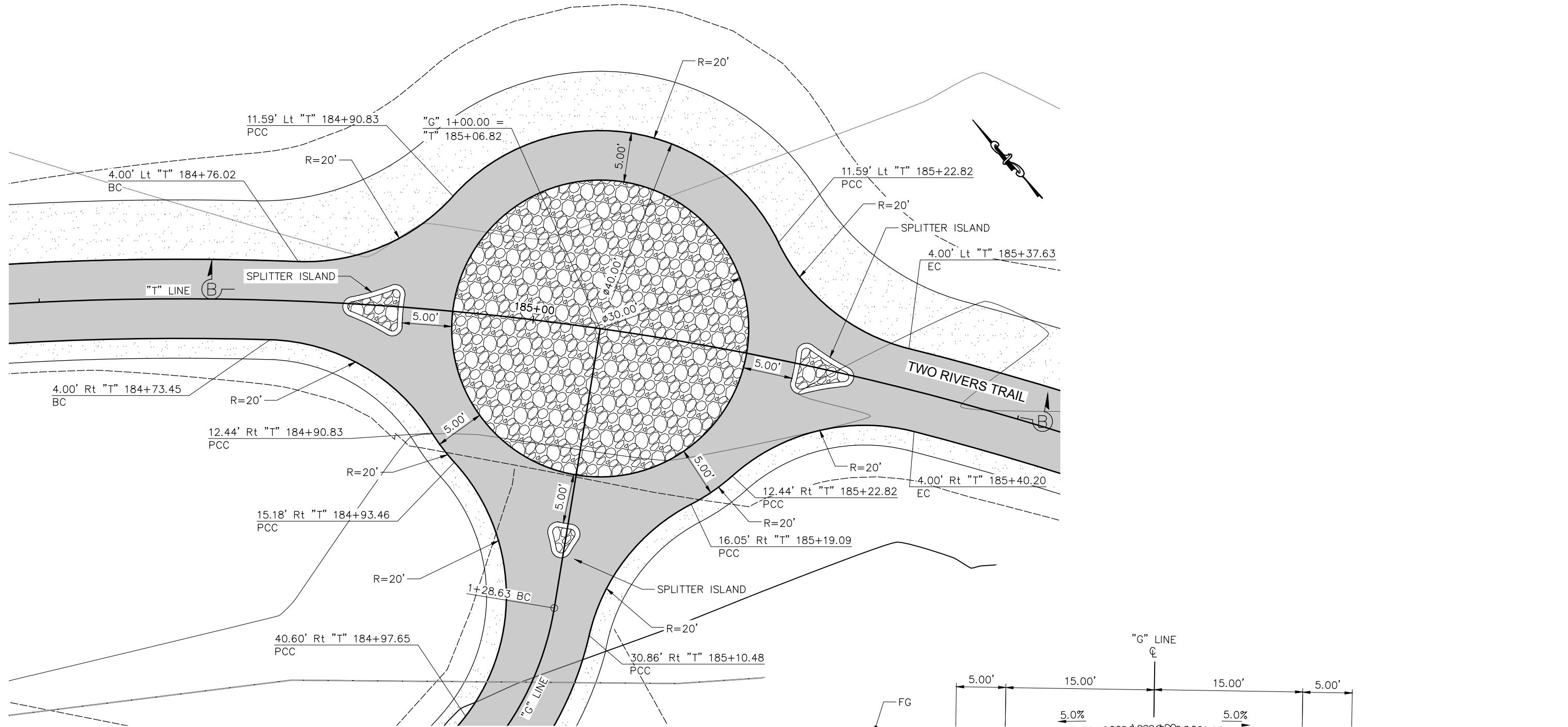
DRAWN BY: B. Harrison  
DESIGN BY: G. McLaughlin  
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DATE \_\_\_\_\_ DATE \_\_\_\_\_ DATE \_\_\_\_\_

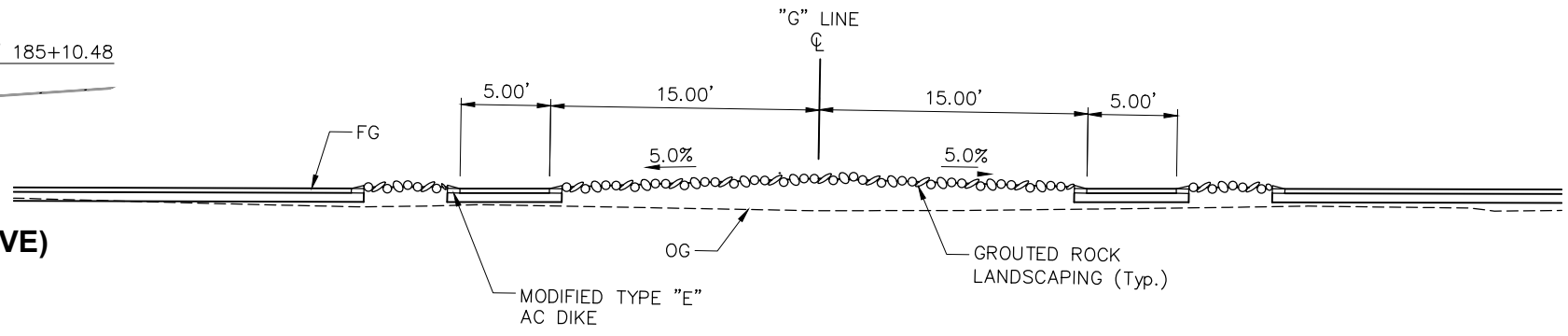


CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

PLOT STAMP: Friday, October 23, 2020 5:30:51 PM  
CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-003\_Roundabout Glenn Hall.dwg



**GLENN HALL ACCESS (TRAFFIC CIRCLE ALTERNATIVE)**



**SECTION B-B**  
NO SCALE

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 5'
VERT. N/A

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11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

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DATE:                                  DATE:                                  DATE:



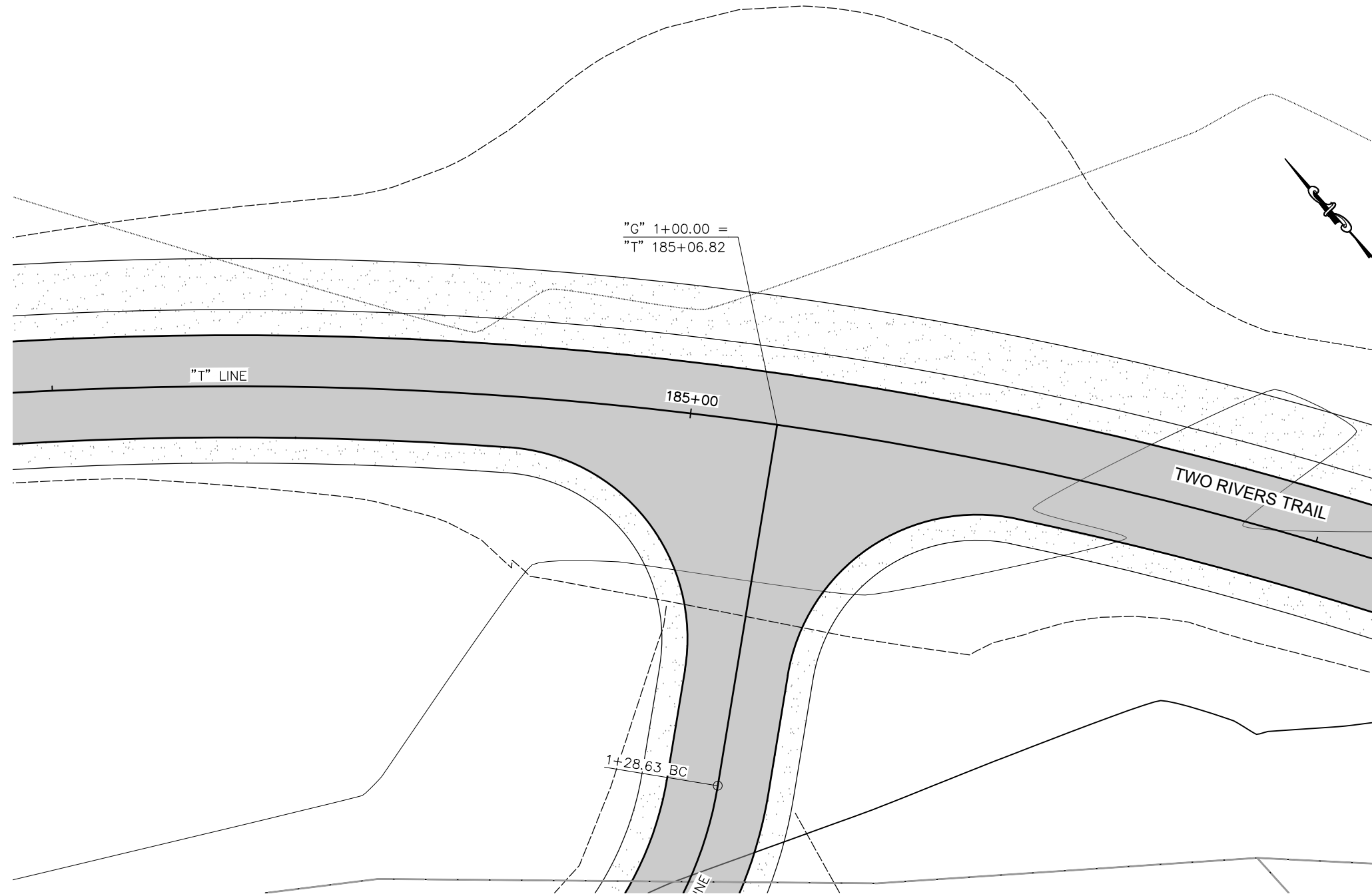
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

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PN: TK15125000

SHEET 27 OF 40

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-003\_I-Intersection Glenn Hall.dwg PLOT STAMP: Friday, October 23, 2020 5:31:08 PM



**GLENN HALL ACCESS (T-INTERSECTION ALTERNATIVE)**

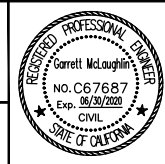
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK  
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HORIZ. 1" = 5'  
VERT. N/A



**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

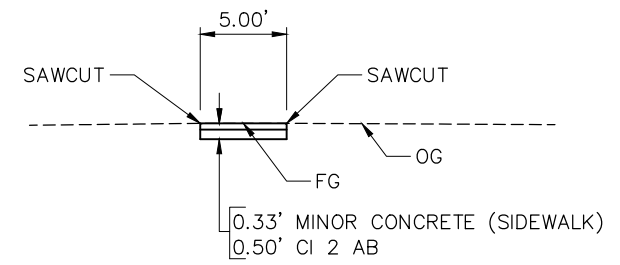
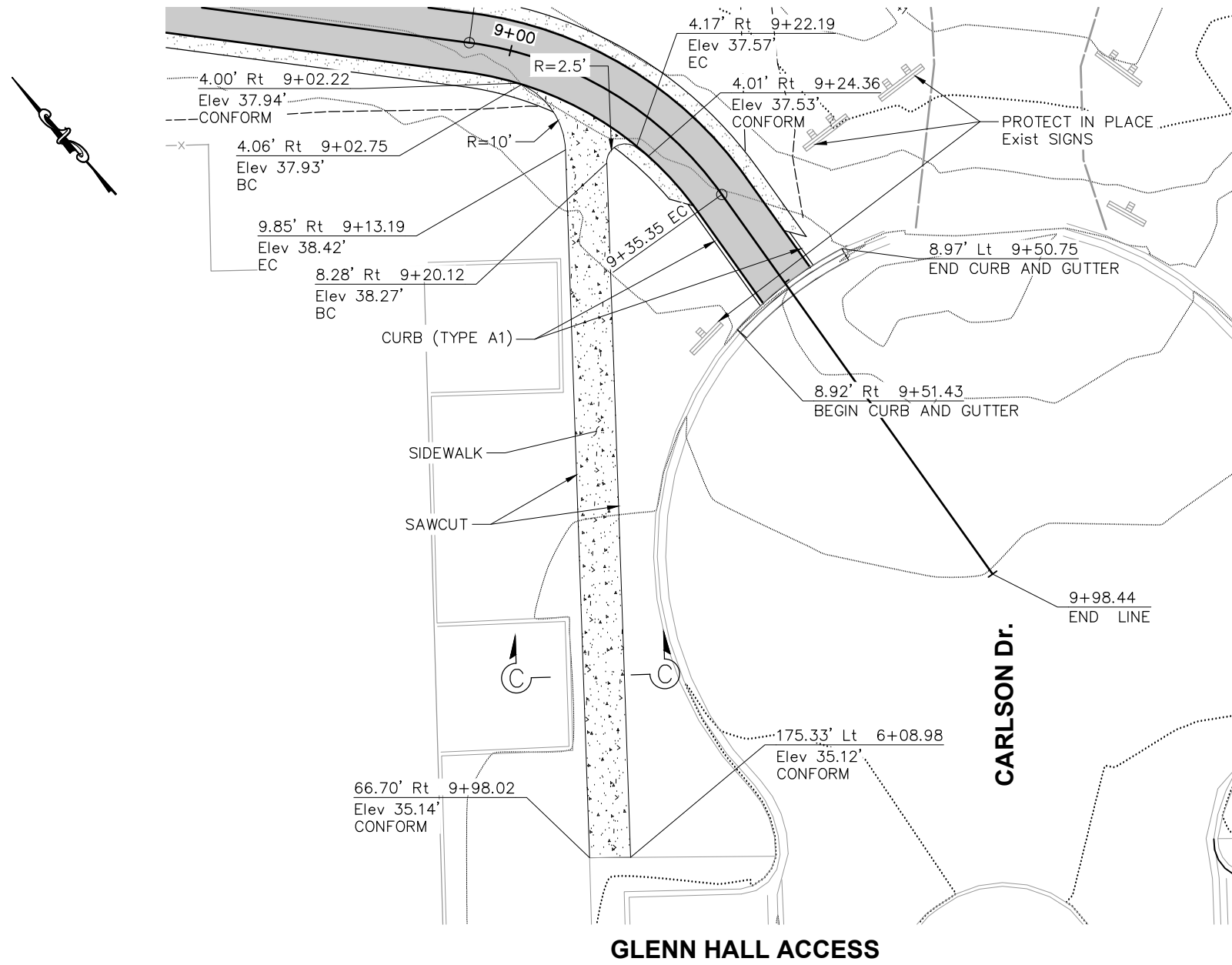
DRAWN BY: B. Harrison	DESIGN BY: G. McLaughlin	CHECKED BY: DES_CHK
DATE	DATE	DATE



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

PLOT STAMP: Friday, October 23, 2020 5:31:24 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-002.dwg



**SECTION C-C**  
NO SCALE

**GLENN HALL ACCESS**

**CARLSON Dr.**

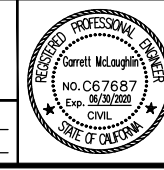
NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 10'
VERT. N/A

11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

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DATE:                              DATE:                              DATE:



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
CONSTRUCTION DETAILS

SHEET	29
	OF
	40

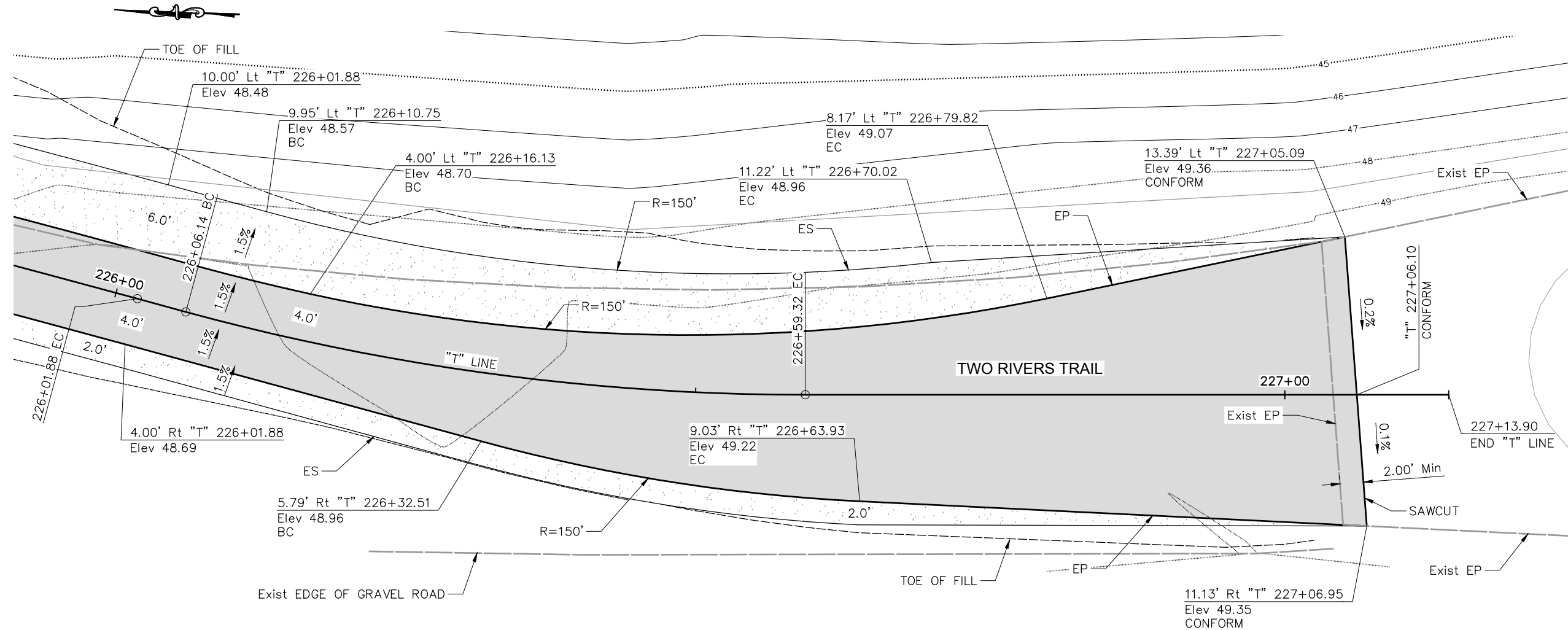
Page 55

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PN: TK15125000

PLOT STAMP: Friday, October 23, 2020 5:31:27 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rga-002.dwg



REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 5'
VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase	DESIGN BY: G. McLaughlin	CHECKED BY: DES_CHK
DATE	DATE	DATE



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 CONSTRUCTION DETAILS

SHEET	30
	OF
SHEET	40
	OF

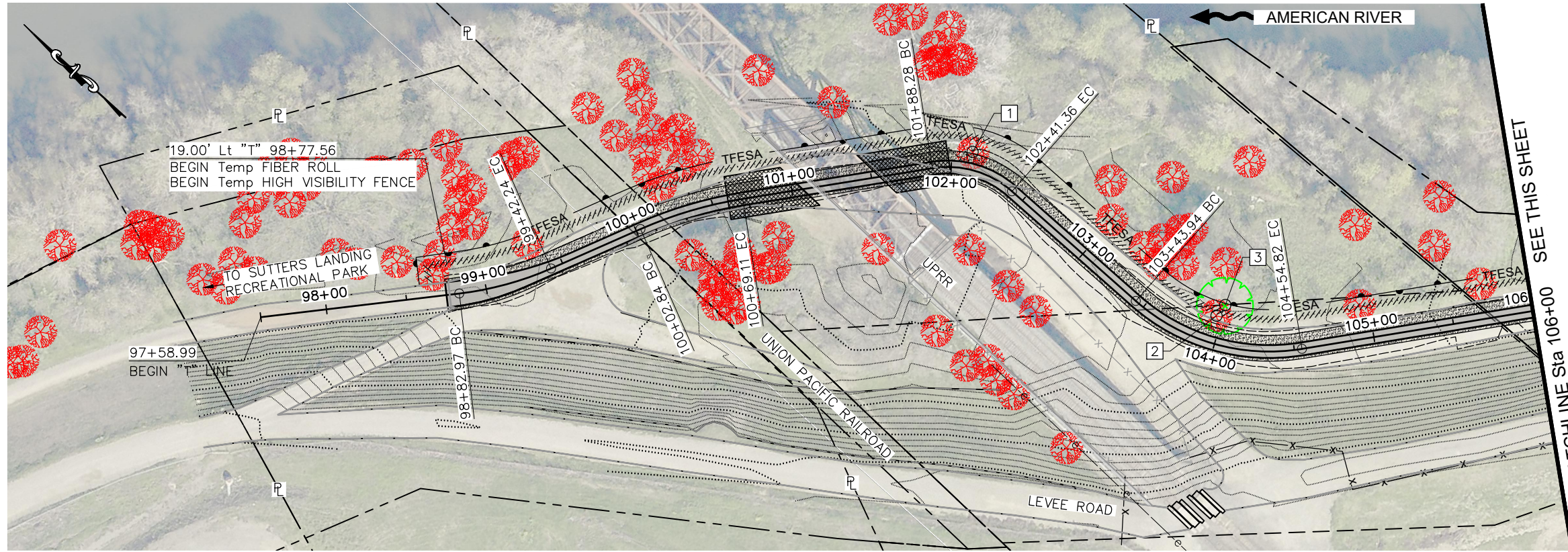
Page 56

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PLOT STAMP: Friday, October 23, 2020 5:32:01 PM

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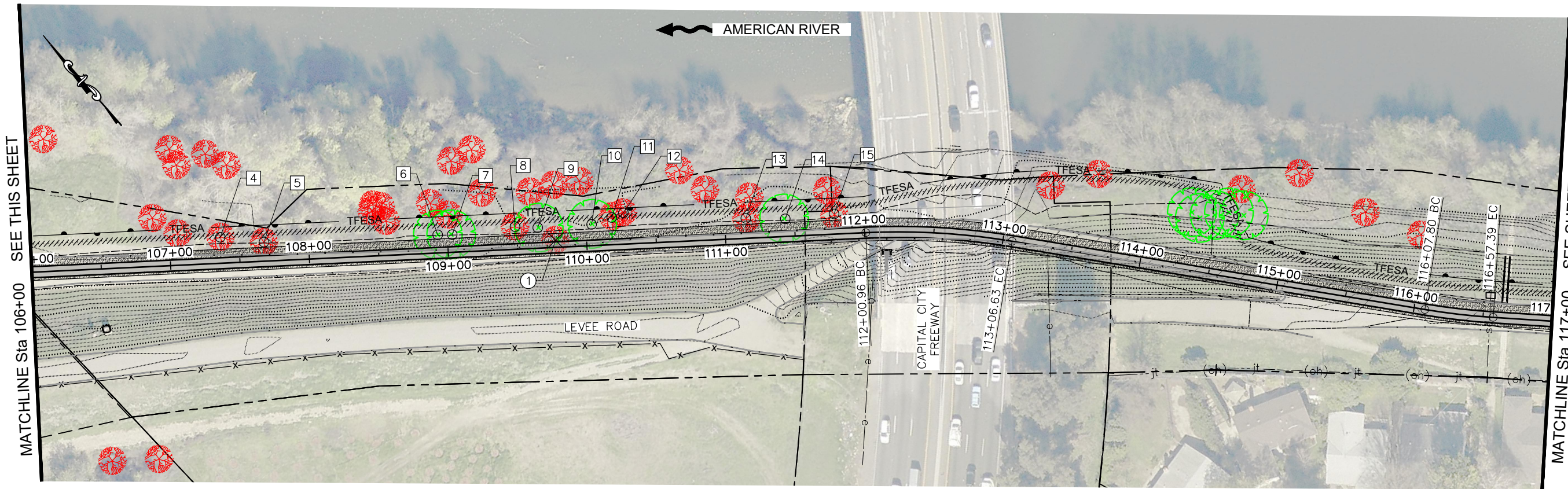
**LEGEND**

- TREES
- ELDERBERRY SHRUB
- TOP OF CUT
- TOE OF FILL
- TFESA — TEMPORARY HIGH VISIBILITY FENCE
- TEMPORARY FIBER ROLL
- TREE/SHRUB TO BE REMOVED
- TREE/SHRUB TO BE TRIMMED AS NECESSARY

**NOTES:**

1. HYDROSEED TO BE PLACED ON ALL CUT OR FILL SLOPES
2. TEMPORARY HIGH VISIBILITY FENCE AND TEMPORARY FIBER ROLL TO BE PLACED 5.0' Max. FROM THE TOP OF CUT OR TOE OF FILL

SEE THIS SHEET  
MATCHLINE Sta 106+00



SEE THIS SHEET  
MATCHLINE Sta 106+00

MATCHLINE Sta 117+00  
SEE SHEET ECTR-2

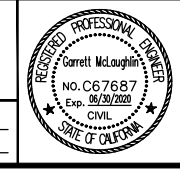
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 40'
VERT. N/A

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

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DATE:                              DATE:                              DATE:



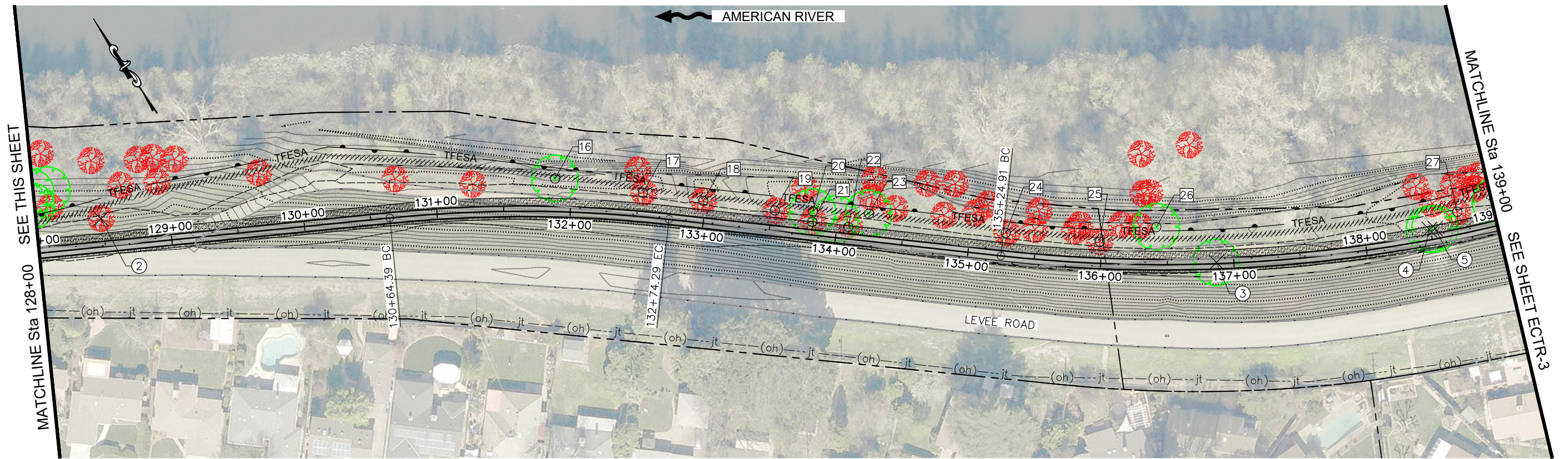
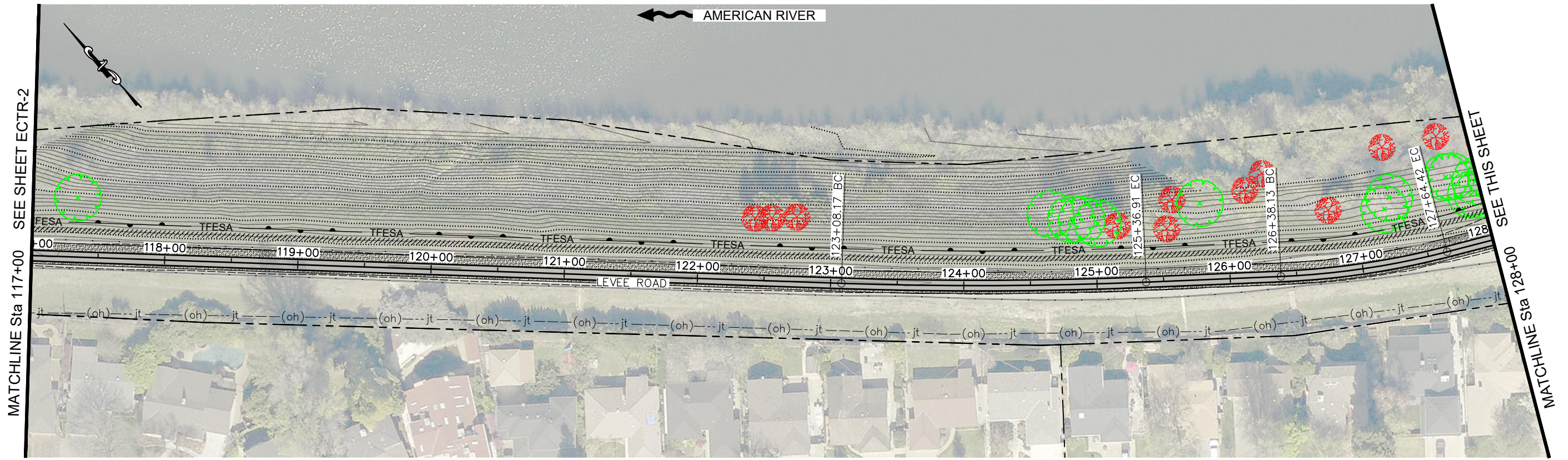
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
EROSION CONTROL AND TREE REMOVAL PLAN

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PLOT STAMP: Friday, October 23, 2020 5:32:15 PM

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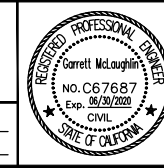
FIELD BOOK
SCALE
HORIZ. 1" = 40'
VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

DRAWN BY: D. Polglase  
 DESIGN BY: G. McLaughlin  
 CHECKED BY: DES\_CHK

DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_



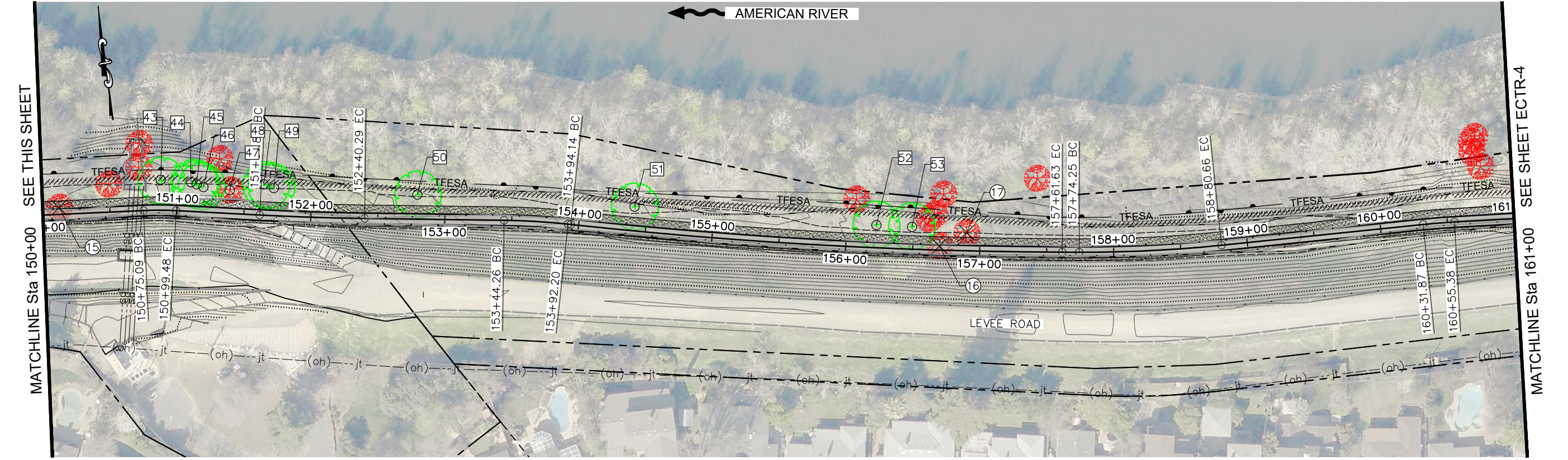
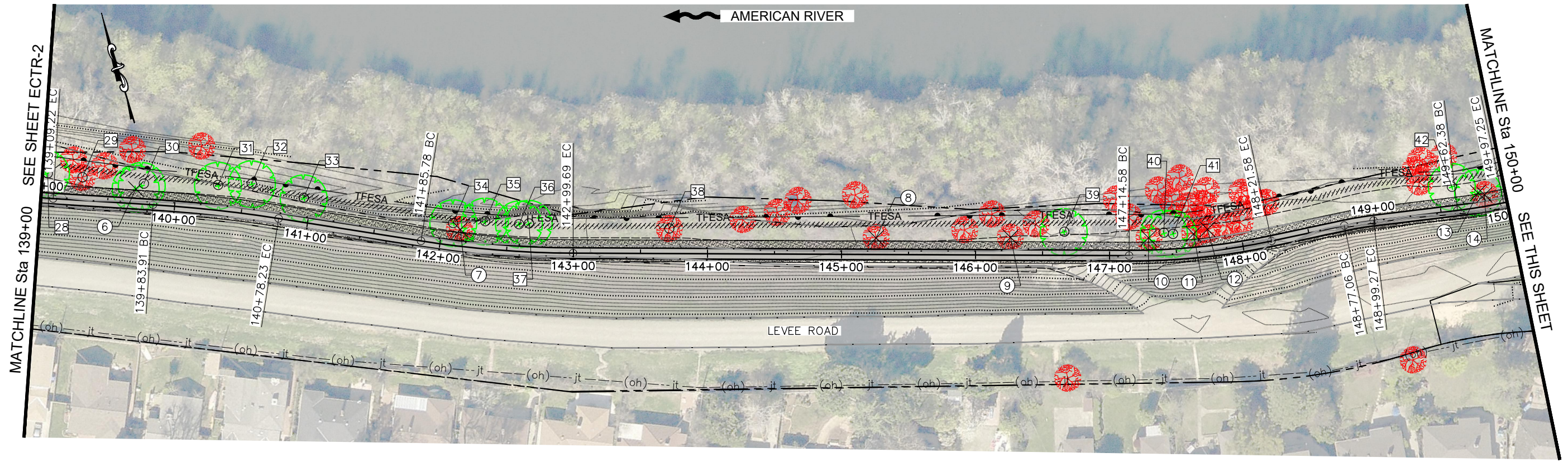
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 EROSION CONTROL AND TREE REMOVAL PLAN

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SHEET
32
OF
40
PN: TXXXXXXX

PLOT STAMP: Friday, October 23, 2020 5:32:31 PM

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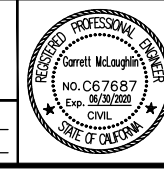
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 40'
VERT. N/A

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
DEPARTMENT OF PUBLIC WORKS

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DATE	DATE	DATE



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
EROSION CONTROL AND TREE REMOVAL PLAN

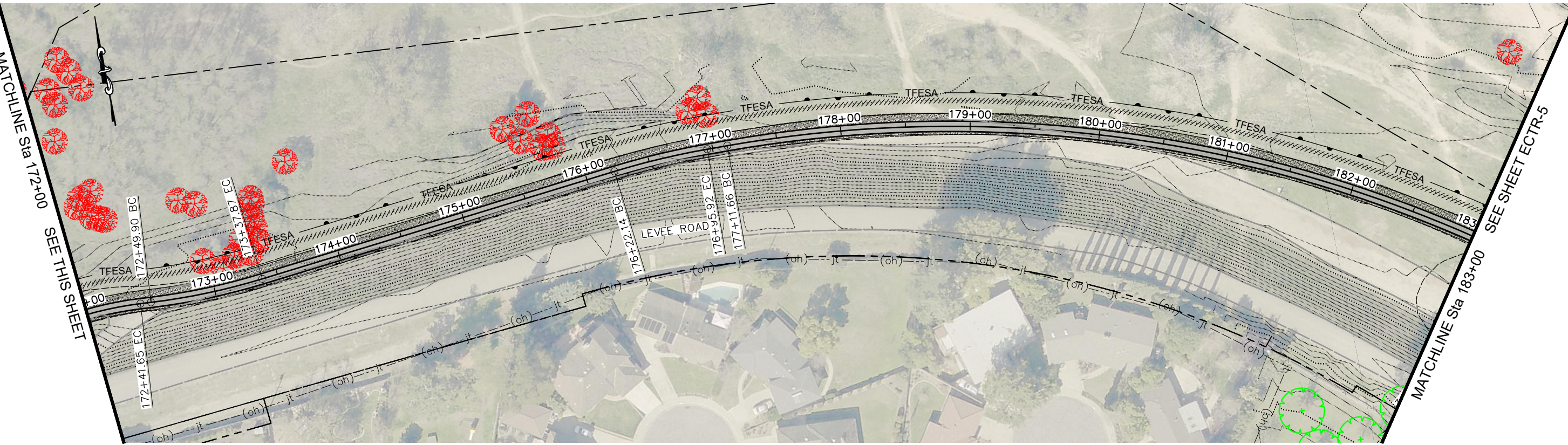
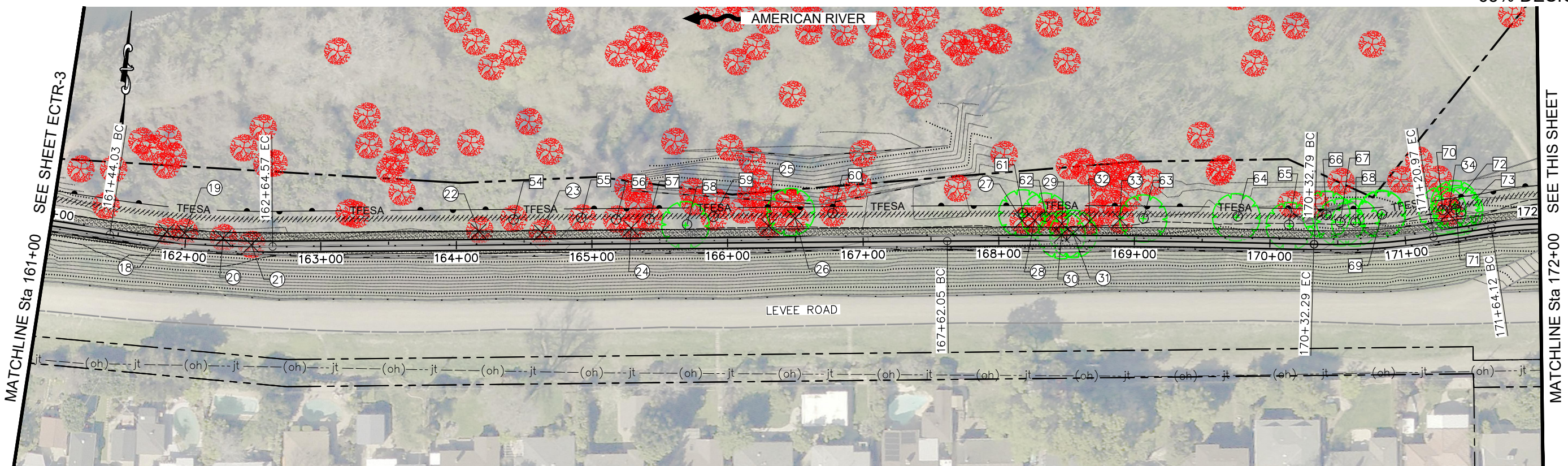
ECTR-3

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	33
	OF
	40

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PLOT STAMP: Friday, October 23, 2020 5:32:49 PM

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REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK

SCALE  
 HORIZ. 1" = 40'  
 VERT. N/A



**CITY OF SACRAMENTO**  
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DRAWN BY: D. Polglase  
 DESIGN BY: G. McLaughlin  
 CHECKED BY: DES\_CHK



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 EROSION CONTROL AND TREE REMOVAL PLAN

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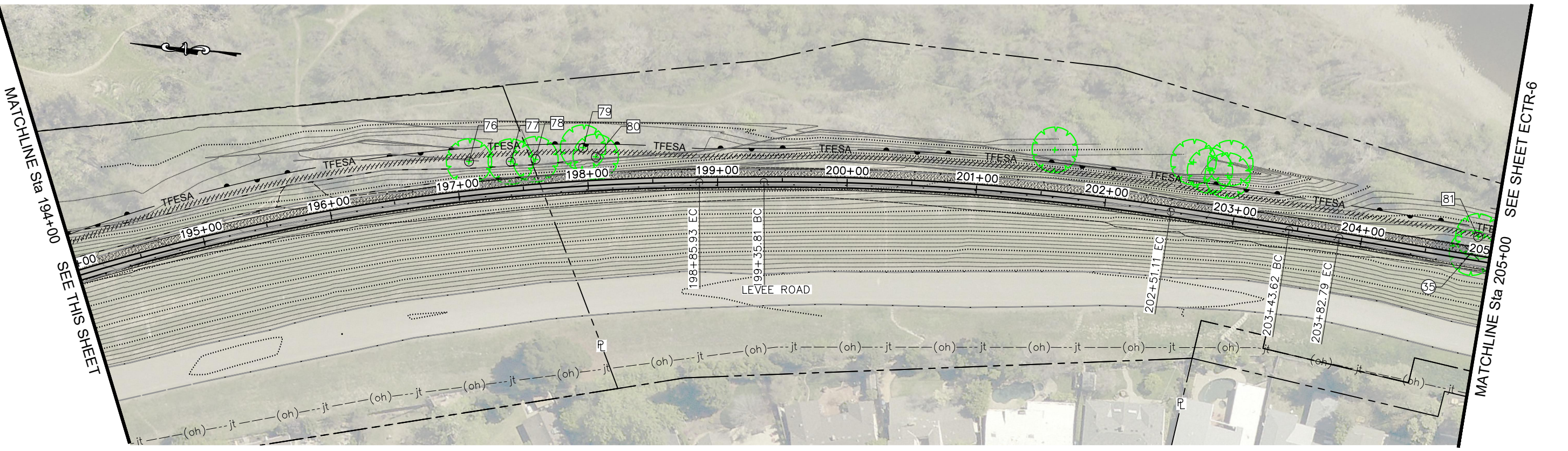
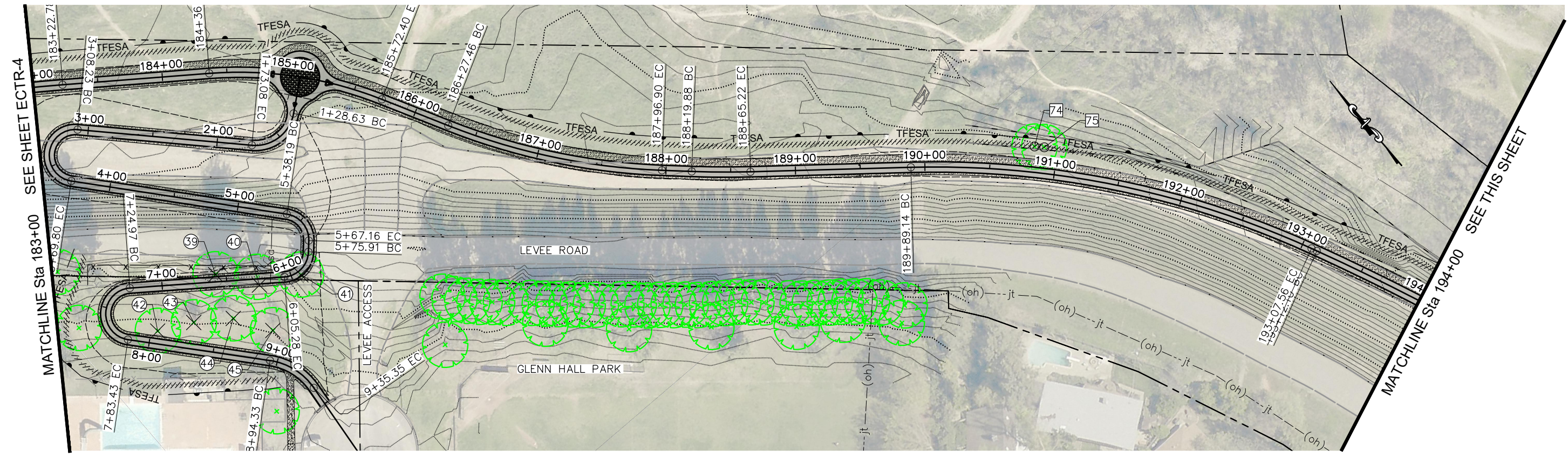
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SHEET  
 34  
 OF  
 40

PN: TXXXXXXX

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NO.	DESCRIPTION	DATE	BY

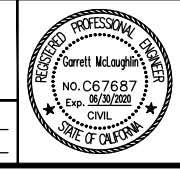
FIELD BOOK
SCALE
HORIZ. 1" = 40'
VERT. N/A

**QUINCY ENGINEERING**  
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
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DESIGN BY: G. McLaughlin  
CHECKED BY: DES\_CHK

DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
EROSION CONTROL AND TREE REMOVAL PLAN

ECTR-5

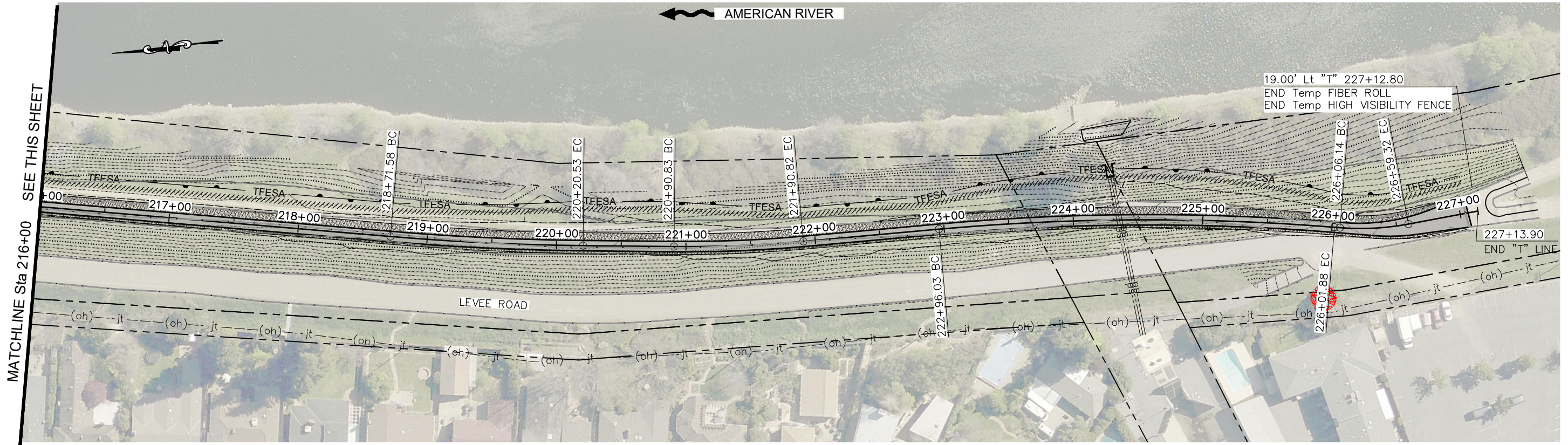
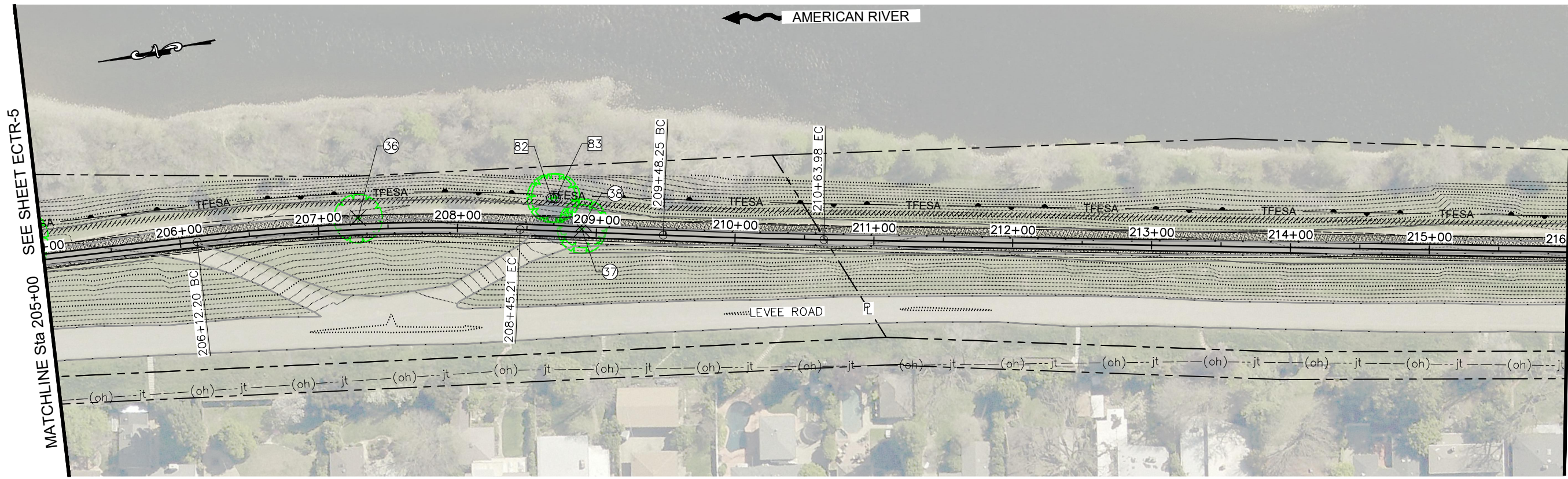
Page 6

PN: TXXXXXXX

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PLOT STAMP: Friday, October 23, 2020 5:33:16 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rgh\_trp-001.dwg



NO.	REVISIONS DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. 1" = 40'
VERT. N/A

**QUINCY ENGINEERING**  
 11017 COBBLEROCK DRIVE SUITE 100  
 RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
 DEPARTMENT OF PUBLIC WORKS

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 DATE:                              DATE:                              DATE:



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
 EROSION CONTROL AND TREE REMOVAL PLAN

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**36**  
 OF  
**40**

PN: TXXXXXX

PLOT STAMP: Friday, October 23, 2020 5:33:17 PM

CAD FILE: S:\Client\Sac City\G14-100 Two Rivers Trail\500-Design\505 - CADD Files\G14-100\_rgh\_trp-001.dwg

TREE TO BE TRIMMED		
TREE	DIAMETER	TYPE
1	NA	ELDERBERRY SHRUB
2	NA	ELDERBERRY SHRUB
3	25.0"	TREE
4	NA	ELDERBERRY SHRUB
5	NA	ELDERBERRY SHRUB
6	12.0"	TREE
7	6.0"	TREE
8	NA	ELDERBERRY SHRUB
9	30.0"	TREE
10	6.0"	TREE
11	NA	ELDERBERRY SHRUB
12	NA	ELDERBERRY SHRUB
13	NA	ELDERBERRY SHRUB
14	7.0"	TREE
15	NA	ELDERBERRY SHRUB
16	6.0"	TREE
17	NA	ELDERBERRY SHRUB
18	NA	ELDERBERRY SHRUB
19	NA	ELDERBERRY SHRUB
20	12.0"	TREE
21	NA	ELDERBERRY SHRUB
22	NA	ELDERBERRY SHRUB
23	15.0"	TREE
24	NA	ELDERBERRY SHRUB
25	NA	ELDERBERRY SHRUB
26	31.0"	TREE
27	NA	ELDERBERRY SHRUB
28	15.0"	TREE
29	NA	ELDERBERRY SHRUB
30	6.0"	TREE
31	7.0"	TREE
32	10.0"	TREE
33	12.0"	TREE
34	12.0"	TREE
35	18.0"	TREE
36	15.0"	TREE
37	6.0"	TREE
38	NA	ELDERBERRY SHRUB
39	50.0"	TREE
40	12.0"	TREE
41	8.0"	TREE
42	8.0"	TREE
43	9.0"	TREE
44	8.0"	TREE
45	10.0"	TREE
46	35.0"	TREE
47	NA	ELDERBERRY SHRUB

TREE TO BE TRIMMED		
TREE	DIAMETER	TYPE
48	10.0"	TREE
49	35.0"	TREE
50	8.0"	TREE
51	22.0"	TREE
52	15.0"	TREE
53	30.0"	TREE
54	NA	ELDERBERRY SHRUB
55	NA	ELDERBERRY SHRUB
56	NA	ELDERBERRY SHRUB
57	NA	ELDERBERRY SHRUB
58	25.0"	TREE
59	NA	ELDERBERRY SHRUB
60	NA	ELDERBERRY SHRUB
61	14.0"	TREE
62	28.0"	TREE
63	15.0"	TREE
64	22.0"	TREE
65	50.0"	TREE
66	7.0"	TREE
67	8.0"	TREE
68	6.0"	TREE
69	11.0"	TREE
70	16.0"	TREE
71	35.0"	TREE
72	30.0"	TREE
73	25.0"	TREE
74	6.0"	TREE
75	6.0"	TREE
76	12.0"	TREE
77	30.0"	TREE
78	12.0"	TREE
79	13.0"	TREE
80	12.0"	TREE
81	30.0"	TREE
82	6.0"	TREE
83	6.0"	TREE

TREE REMOVAL		
TREE	DIAMETER	TYPE
1	NA	ELDERBERRY SHRUB
2	NA	ELDERBERRY SHRUB
3	30.0"	TREE
4	10.0"	TREE
5	50.0"	TREE
6	10.0"	TREE
7	NA	ELDERBERRY SHRUB
8	NA	ELDERBERRY SHRUB
9	NA	ELDERBERRY SHRUB
10	NA	ELDERBERRY SHRUB
11	NA	ELDERBERRY SHRUB
12	NA	ELDERBERRY SHRUB
13	32.0"	TREE
14	7.0"	TREE
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16	NA	ELDERBERRY SHRUB
17	NA	ELDERBERRY SHRUB
18	NA	ELDERBERRY SHRUB
19	NA	ELDERBERRY SHRUB
20	NA	ELDERBERRY SHRUB
21	NA	ELDERBERRY SHRUB
22	NA	ELDERBERRY SHRUB
23	NA	ELDERBERRY SHRUB
24	NA	ELDERBERRY SHRUB
25	NA	ELDERBERRY SHRUB
26	NA	ELDERBERRY SHRUB
27	NA	ELDERBERRY SHRUB
28	NA	ELDERBERRY SHRUB
29	NA	ELDERBERRY SHRUB
30	6.0"	TREE
31	6.0"	TREE
32	NA	ELDERBERRY SHRUB
33	NA	ELDERBERRY SHRUB
34	NA	ELDERBERRY SHRUB
35	6.0"	TREE
36	38.0"	TREE
37	6.0"	TREE
38	20.0"	TREE
39	42.0"	TREE
40	24.0"	TREE
41	36.0"	TREE
42	12.0"	TREE
43	20.0"	TREE
44	14.0"	TREE
45	16.0"	TREE

REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIELD BOOK
SCALE
HORIZ. NO. SCALE
VERT. N/A



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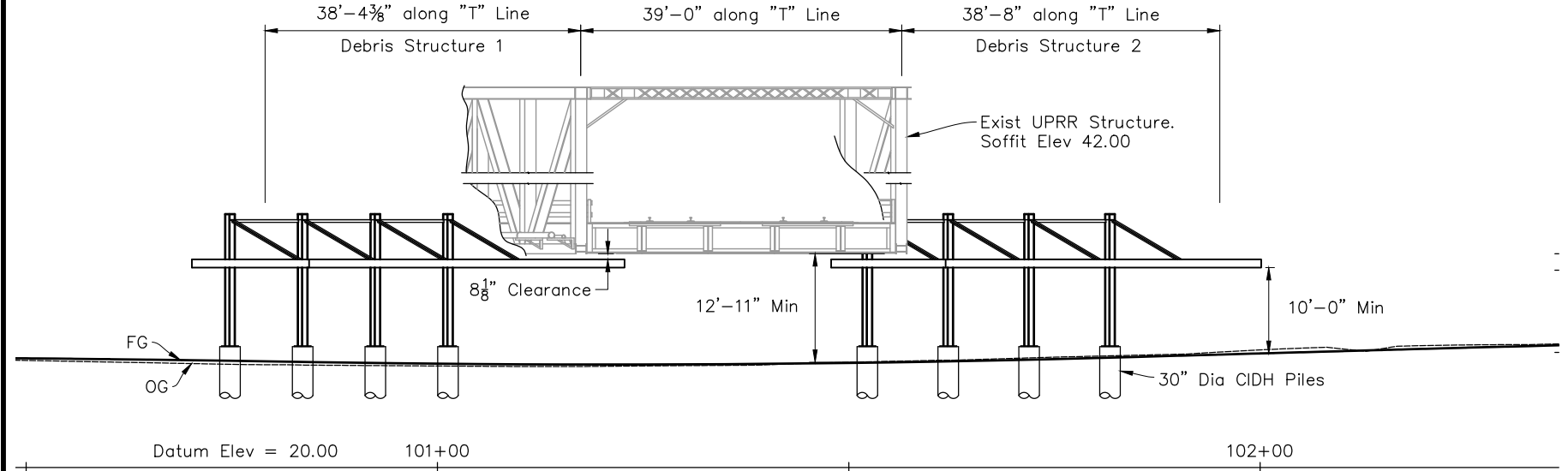
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DATE \_\_\_\_\_      DATE \_\_\_\_\_      DATE \_\_\_\_\_



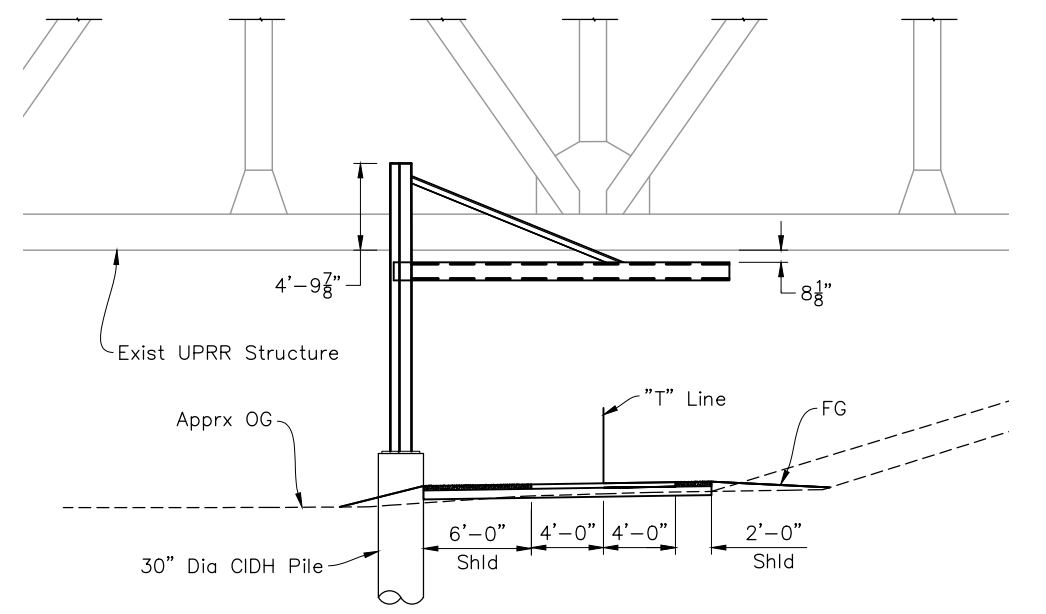
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
**EROSION CONTROL AND TREE REMOVAL PLAN**

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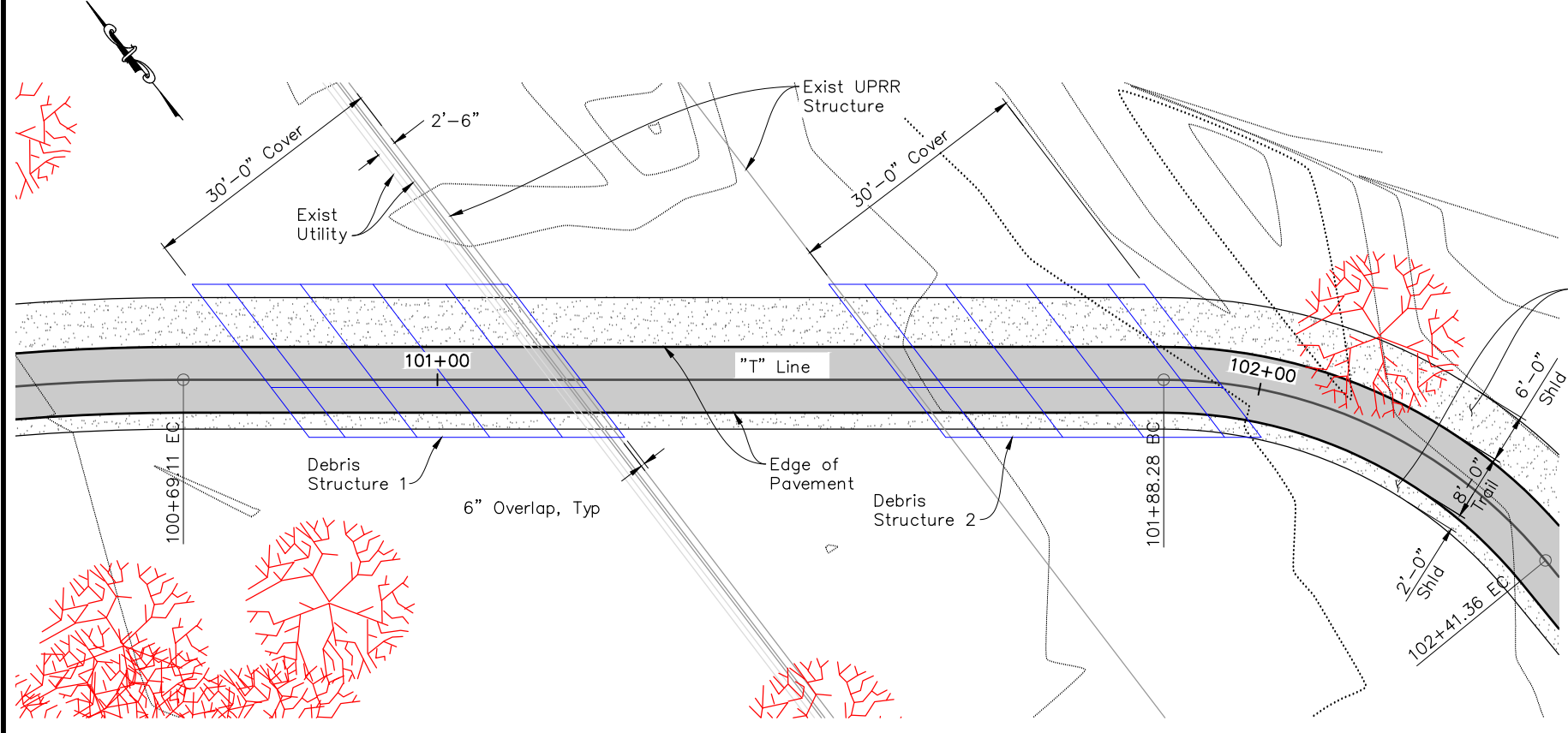
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**ELEVATION**  
Scale: 1"=10'



**TYPICAL SECTION**  
Scale: 3/16"=1'-0"



**PLAN**  
Scale: 1"=10'

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FIELD BOOK
SCALE
HORIZ. 1" = 10'
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**QUINCY ENGINEERING**

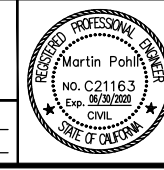
11017 COBBLEROCK DRIVE SUITE 100  
RANCHO CORDOVA, CA 95670

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DRAWN BY: I. Kotsyubuk  
DATE: \_\_\_\_\_

DESIGN BY: I. Kotsyubuk  
DATE: \_\_\_\_\_

CHECKED BY: DES\_CHK  
DATE: \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
GENERAL PLAN

GP-1

SHEET 38 OF 40

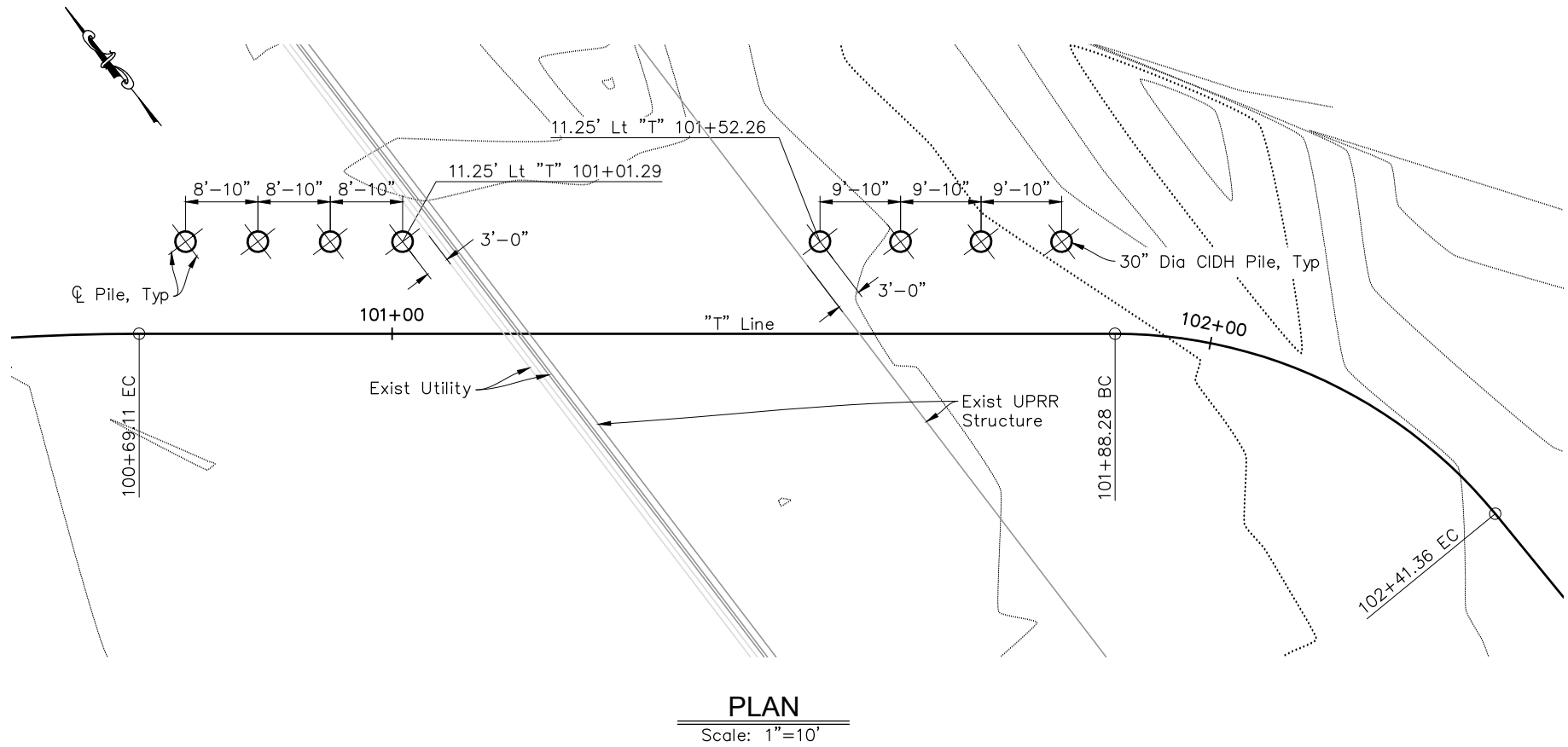
Page 64

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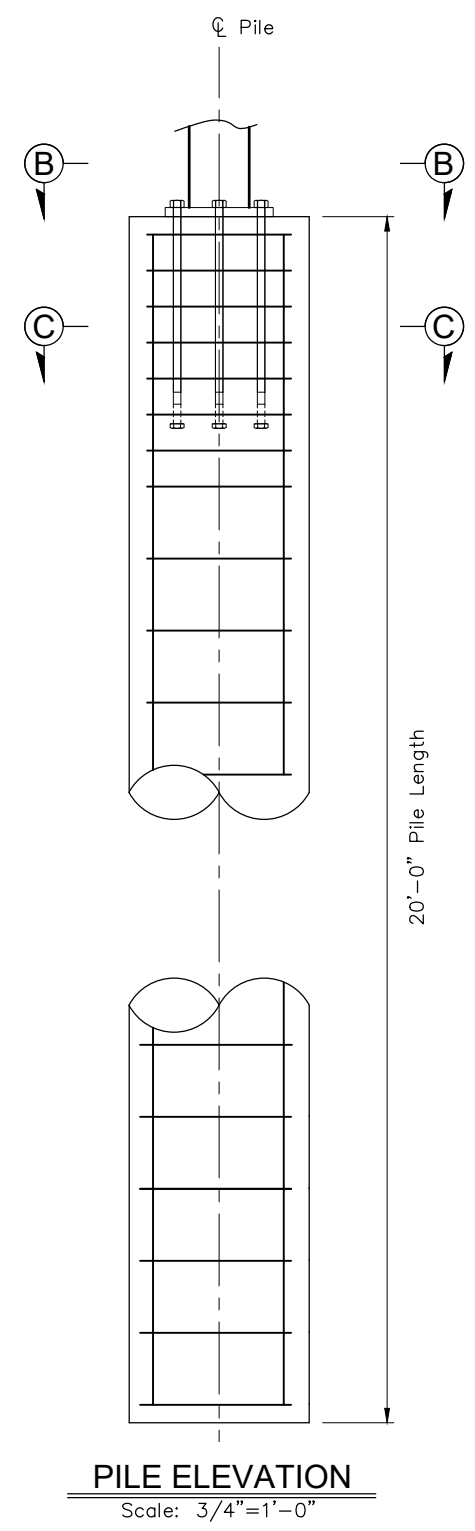


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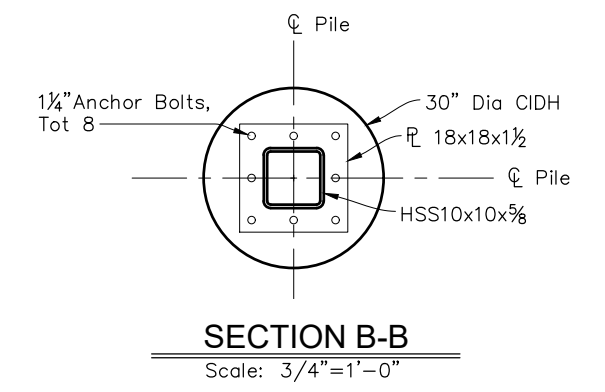
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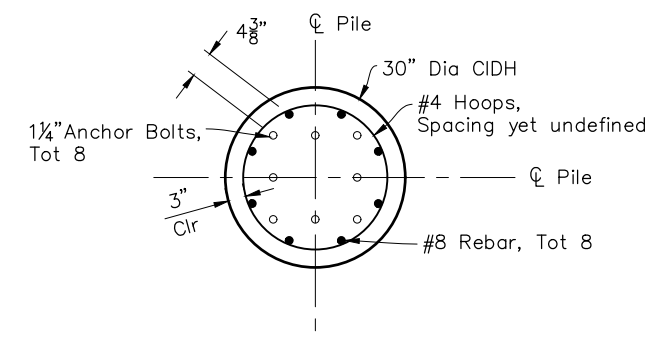
**PLAN**  
Scale: 1"=10'



**PILE ELEVATION**  
Scale: 3/4"=1'-0"



**SECTION B-B**  
Scale: 3/4"=1'-0"



**SECTION C-C**  
Scale: 3/4"=1'-0"

**PILE DATA TABLE**

LOCATION	PILE TYPE	PILE HEAD ELEVATION	DESIGN LOADING	NOMINAL RESISTANCE		DESIGN TIP ELEVATION	SPECIFIED TIP ELEVATION
				COMPRESSION	TENSION		
Structure 1	30" CIDH	30.70	XXXXX	XXXXX	XXXXX	XXXXX	10.7
Structure 2	30" CIDH	30.70	XXXXX	XXXXX	XXXXX	XXXXX	10.7

Notes: Design Tip Elevation is controlled by the following demands:  
(1) Compression, (2) Tension, (3) Lateral Loads.

REVISIONS				FIELD BOOK
NO.	DESCRIPTION	DATE	BY	

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RANCHO CORDOVA, CA 95670

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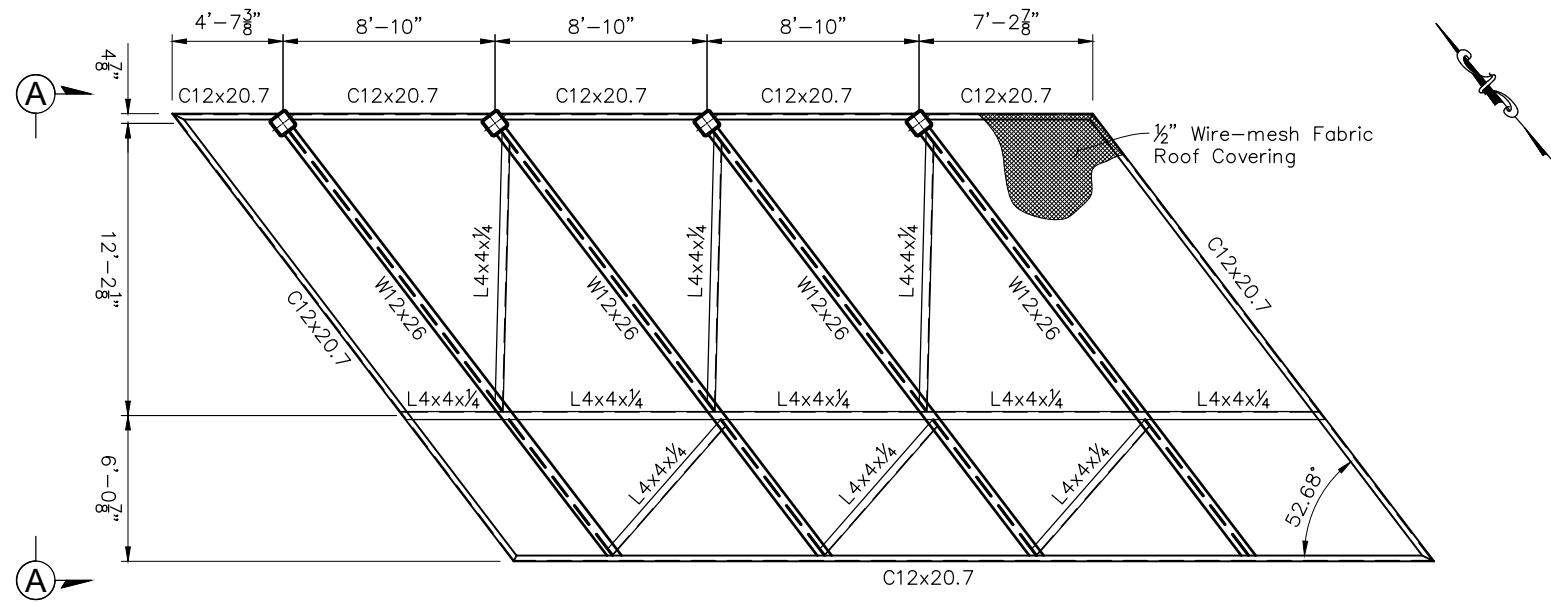
CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
FOUNDATION PLAN

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SHEET 40 OF 40  
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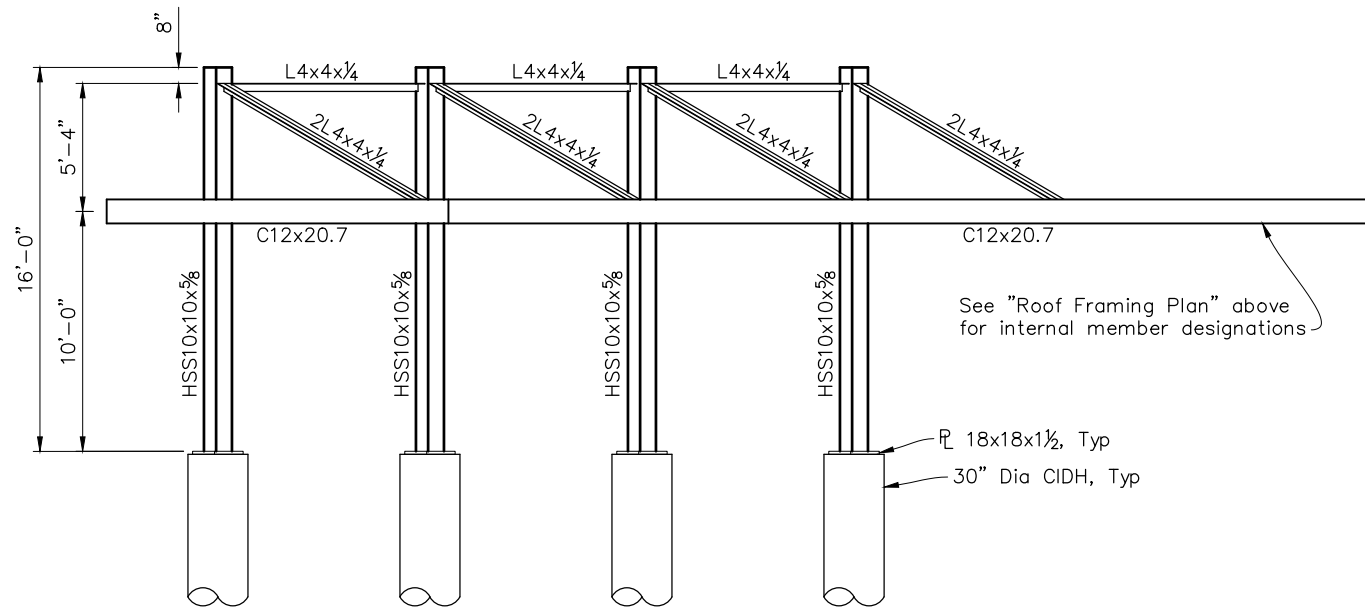
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Note: Dimensions shown for Structure 1. Structure 2 dimensions similar. Member designations same. Base plates and CIDH piles not shown.

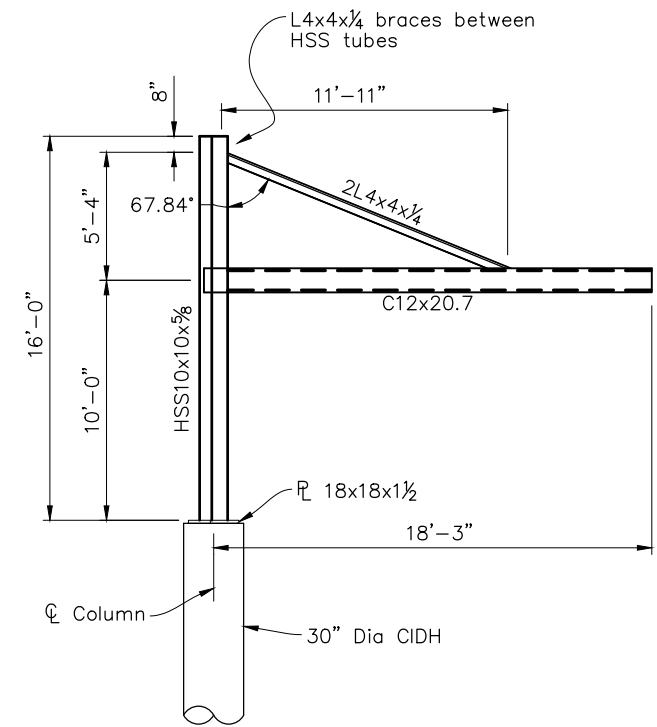
**ROOF FRAMING PLAN**

Scale: 1/4"=1'-0"



**ELEVATION**

Scale: 1/4"=1'-0"



**SECTION A-A**

Scale: 1/4"=1'-0"

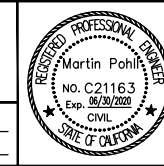
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NO.	DESCRIPTION	DATE	BY

FIELD BOOK	
SCALE	
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RANCHO CORDOVA, CA 95670

**CITY OF SACRAMENTO**  
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DATE: \_\_\_\_\_    DATE: \_\_\_\_\_    DATE: \_\_\_\_\_



CONSTRUCTION PLANS FOR  
**TWO RIVERS TRAIL PROJECT (PHASE II)**  
TYPICAL SECTION

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XS-1

PIN: TK15125000

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## TECHNICAL MEMORANDUM

<b>Date:</b>	November 13, 2020
<b>To:</b>	Ray Weiss, GEI
<b>From:</b>	Haley Tupen, Matthew Weber, Sam Diaz, Chris Bowles; cbec
<b>Project:</b>	16-1025 – City of Sacramento Two Rivers Trail Phase 2
<b>Subject:</b>	Hydraulic Assessment of Existing and Project Conditions

## 1 HYDRODYNAMIC MODEL DEVELOPMENT

### 1.1 OVERVIEW

To assess the flood impacts of the proposed Two Rivers Trail (Phase II) Project (Project), cbec adapted an HEC-RAS two-dimensional (2D) model (cbec 2019) that was developed by cbec under contract with the Sacramento Water Forum (Water Forum) and the Sacramento Area Flood Control Agency (SAFCA). The current conditions digital elevation model (DEM) and 2D hydrodynamic model have been reviewed and approved by the U.S. Army Corps of Engineers (USACE), Water Forum, and SAFCA for use in evaluating the full range of lower American River (LAR) flows (i.e., baseflow to 192,000 cfs). This memorandum briefly describes the model development, the calibration/validation results, and the steps taken to adapt the model for use in assessing hydraulic impacts on this Project.

The 2D model was run at four different flows for existing and Project conditions. Project conditions were approximated by modifying the existing conditions DEM with proposed trail grading surface data provided by Quincy Engineering and refining the mesh within the grading extent to provide higher resolution velocity calculations. In addition, two proposed railroad bridge undercrossing debris catchment structures were included as roughness elements in the landcover layer and added to the DEM to block flow.

### 1.2 FLOOD MODEL DOMAIN

The LAR is approximately 23 miles long and extends from Nimbus Dam downstream to the confluence with the Sacramento River. The upper portion of the river has a steeper gradient with a bed slope of approximately 0.001 ft/ft. Downstream of Watt Avenue, the river experiences tidal fluctuations and the bed slope drops to approximately 0.00035 ft/ft. Non-Federal and Federal levees begin approximately 14 U.S. Geological Survey (USGS) river miles (RM) upstream of the confluence with the Sacramento River and continue downstream to the confluence with the Sacramento River.

The model domain covers the lower 16 miles, beginning upstream of Ancil Hoffman Park at USGS RM 16 (Figure 1). This allows the model to cover the entire portion of leveed river. The downstream boundary condition is located near the confluence with the Sacramento River near Jibboom Street bridge. More discussion on boundary conditions for each scenario is provided in Section 1.4.

### 1.3 BATHYMETRY AND TOPOGRAPHY

The 2017 current conditions DEM was developed by cbec under contract with the Water Forum and SAFCA (cbec 2018). The DEM comprises of topo-bathymetric LiDAR (i.e., green and near-infrared LiDAR), singlebeam sonar, and wading RTK-GPS surveys. LiDAR data were collected by Quantum Spatial in October 2017. Single-beam sonar and wading RTK-GPS surveys were conducted by cbec in December 2017 through February 2018 in the areas too deep or obstructed for the green LiDAR to accurately survey the channel bed. Top-of-levee surveys were conducted by Psomas in November and December of 2017. Finally, bridge piers were added to the DEM using the bridge pier footprints captured by the 2017 LiDAR data and/or field-measured by cbec. Combined, these datasets provide seamless, high-resolution (2-ft raster grid) topography and bathymetry for the entire model domain (Figure 2).

Project conditions topography was provided by Quincy Engineering as a CAD surface that cbec converted to a raster and merged with the current conditions DEM. The Project conditions surface consists of a multi-use trail corridor extending from the Union Pacific Railroad Bridge (RM 3.65) at its downstream end to the H-Street Bridge (RM 6.4) at its upstream end (see Figure 1).

### 1.4 BOUNDARY CONDITIONS

The boundary conditions for calibration and validation runs were based on high-water marks (HWMs) acquired during the 1986 and 1997 high flow events and surveyed water surface elevation (WSE) observations that cbec collected for the 2017 water year. The model was calibrated by adjusting roughness values to match the WSEs with the 1997 HWMs. The model was validated by simulating the 1986 and 2017 water year flows and checking for agreement with the HWMs and the observed WSEs, respectively. The calibration/validation boundary conditions are shown in Table 1. LAR flow data comes from the American River at Fair Oaks USGS gage (AFO, #11446500).

**Table 1.** Calibration and validation boundary conditions

Date	LAR Inflow (cfs)	NEMDC Inflow (cfs)	Stage at I-St. (ft, NAVD88)	Stage at Watt Ave. (ft, NAVD88)
02/19/1986	134,000	-5000	33.2	49.85
01/02/1997	117,000	-5000	32.7	47.87
12/20/2016	20,500	-500	24.4	29.31
01/11/2017	60,300	-1500	28.7	39.55
02/10/2017	82,200	-2000	29.3	43.7

To compare Project conditions to existing conditions, the model was run with LAR inflows of 115,000, 160,000, 180,000, and 192,000 cfs. The downstream boundary condition, located at ~ River Mile 0.2, was extracted from the USACE HEC-RAS Common Features model (USACE 2007). These boundary conditions are shown in Table 2.

**Table 2.** Boundary condition scenarios for Project impact assessment

Scenario	LAR Inflow (cfs)	WSE at Confluence (ft, NAVD88)	Notes
1	115,000	33.24	100-yr return interval flow
2	160,000	34.75	LAR Design flow and 200-yr return interval flow
3	180,000	35.04	Flow of Record (1951)
4	192,000	35.29	200-yr return interval flow + 3 ft freeboard <sup>1</sup>

<sup>1</sup>This is the equivalent flow that results in 3 ft of freeboard above the 160,000 cfs WSE at Howe Avenue Bridge.

## 1.5 MODELING PARAMETERS AND ASSUMPTIONS

The HEC-RAS 2D mesh consists of mostly square elements in a 20-ft grid. A grid size sensitivity test was conducted to achieve the best balance of accuracy and computational run times. The mesh was further refined with break lines along the levee crests and toes, channel banks, slope grade breaks, topographic high and low points, and bridge piers. The break lines ensure that the model mesh is enforced along topographic features that direct or prevent flow paths (e.g., a levee crest or bridge pier). The cell spacing along the bridge piers and levee toes were reduced to ~8 to 12 ft (i.e., smaller sizes to increase resolution of velocity calculations). Lastly, breaklines were added to define the edge of the proposed trail to capture topographic changes in the Project condition simulations. Figure 3 shows the mesh breaklines and Table 3 provides an overview of the model parameters.

**Table 3.** HEC-RAS 2D flood model parameters

Parameter	Value	Notes
HEC-RAS	Version 5.0.7	-
flow module	2D unsteady	-
equation set	Full Momentum	-
theta (0.6 – 1.0)	0.9	-
initial condition	dry bed with warmup period	-
inflows	constant, sub-critical	EG slope = 0.001 ft/ft (avg. bed slope)
outflows	constant elevation	observed condition or rating curve
time step	2 seconds	varies by discharge
eddy viscosity	-	default

The roughness map was developed by using the California Department of Fish and Wildlife’s (CDFW) Vegetation Classification and Mapping Program data (CDFW 2015). This map was further refined by using

the 4-band (i.e., blue, green, red, and near-infrared bands) National Agricultural Imagery Program (NAIP) satellite imagery from 2014 (USDA 2014). The imagery was transformed into the normalized difference vegetation index (NDVI),

$$NDVI = \left( \frac{NIR - Red}{NIR + Red} \right)$$

where *NIR* is the intensity of the near-infrared wavelength and *Red* is the intensity of the red wavelength reflected off a surface. The NDVI is based on the premise that healthy plants reflect more NIR wavelengths, and absorb more red wavelengths, so positive, and higher NDVI values indicate healthier, denser vegetation. NDVI was used to refine the landcover zones by delineating specific patches of vegetation into sparse and dense classifications. Figure 4 shows an example of the refined roughness map and Section 2.1 presents the calibrated roughness values.

## 2 FLOOD SIMULATIONS

### 2.1 FLOOD FLOW MODEL CALIBRATION AND VALIDATION

Roughness values for the thirteen landcover domains were adjusted to calibrate the existing conditions model to HWMs obtained after the January 2, 1997 event peak of 117,000 cfs. The model was then validated by applying the same roughness values to the remaining flows. Table 4 shows the final calibrated roughness values and the range of flows over which they are applicable. Roughness values fall within the expected ranges for flood flows (Chow, 1959 and Barnes, 1959). The wetted channel (“Riverine” classification) has a low Manning’s n value of 0.0275 with flow depths over 20-ft for most of the floodway. Most of the vegetation within the floodway is classified as “Sparse Vegetation” or “Dense Vegetation”, which comes from NAIP imagery classification (USDA 2014). Structures, which represent the bridge piers, have a high Manning’s n of 0.2, since those zones should not convey flow. The design footprints of the railroad undercrossing debris catchment structures were assigned a high roughness value of 0.1, which is equivalent to very dense, woody floodplain vegetation to conservatively simulate the potential for debris racking during flood conditions. The remaining landcover classes represent different zones that were identified by the CDFW (CDFW 2015). Since vegetation is largely represented by separate classes, these landcover classes were assigned a relatively low Manning’s n value of 0.03-0.04, which is suitable for bare gravels and grasslands of modest flow depths.

**Table 4.** Calibrated Manning's n values

Landcover	Manning's n
	20,000 – 192,000 cfs
Annual grassland	0.03
Barren	0.03
Blue oak foothill pine	0.035
Bridge piers/structures	0.2
Coastal scrub	0.035
Eucalyptus	0.035

Landcover	Manning's n
	20,000 – 192,000 cfs
Fresh emergent wetland	0.03
Lacustrine, riverine	0.0275
Medium trees	0.055
Montane hardwood	0.035
Orchard	0.035
Shrub/sapling	0.045
Small trees	0.05
Tall trees	0.07
Urban	0.03
Valley foothill riparian	0.035
Wet meadow	0.03

Table 5 provides a summary of the calibration results between modeled and observed WSEs. The average and median WSE differences are largely within 0.1-0.2 ft of the observations. The 82,200 and 117,000 events have the largest deviations. In total, the average and median difference between the model and the observed WSEs is -0.04 and -0.06 ft, respectively, for the lower domain model. These values suggest that the model is representing the observed flood flow conditions well in the Project reach.

**Table 5 . Summary statistics of modeled vs. observed water surface elevations for the lower domain**

Date	Discharge (cfs)	# of Obs.	Modeled minus Observed WSE (ft)				
			Min.	Max.	Average	Median	RMSE
2/19/1986	134,000	64	-1.16	1.63	0.07	-0.02	0.61
1/2/1997	117,000	14	-0.74	0.81	-0.09	-0.09	0.46
12/20/2016	20,500	23	-0.62	0.37	-0.01	-0.09	0.28
1/11/2017	60,300	35	-0.77	0.45	-0.08	-0.03	0.25
2/10/2017	82,200	27	-1.18	0.42	-0.13	-0.10	0.34
All Dates*	All flows	163	-1.18	1.63	-0.02	-0.04	0.43

\*"All Dates" reports the statistics of combing all the lower domain WSE comparisons

## 2.2 SIMULATION RESULTS

The modeled scenarios identified in Table 2 were used to understand differences in water surface elevation and velocity magnitude between existing and Project conditions and to provide flow velocities to inform design of Project features. Model results indicated that the Project only causes localized increases in WSE in the vicinity of the railroad undercrossing location, while differences in flow velocity occur in various locations throughout the proposed trail site. The WSE and velocity difference results shown in Figures 5 through 8 focus on the railroad undercrossing location, and Figures 9 through 14 contrast velocity differences at three upstream locations along the trail. The results are summarized below.

### 2.2.1 Upstream undercrossing location

The modeled WSE impact at the railroad undercrossing is small and localized with slightly elevated WSEs (~0.1 ft) at the upstream end of the structure (Figures 5-8). This rise dissipates quickly and has no impact at the adjacent bridge structures or at the levee. Modeled velocity magnitudes are reduced downstream of the structure with a localized increase (< 0.5 ft/s) between the structure and the left bank in an area that is vegetated with large trees and turf, and partially paved in crushed rock (Figures 5-8). Predicted Project condition velocities in this area range from just under 1 ft/s to 4.5 ft/s in the 160,000 cfs simulation (Figure 15). The high end of that range is on the upper end of tolerance for typical levee grass (Type C turf), but the resulting shear stress on the levee is within the tolerance range of existing vegetation (1 to 2.5 lb/sf) due to the corresponding depth of flow. Design velocities within the undercrossing footprint were just below 5 ft/s (Figure 15).

### 2.2.2 Trail footprint – At large

The trail footprint itself does not impact modeled river WSEs due to limited topographic changes. Project condition modeled velocities along the trail are generally less than 2.5 ft/s, except for the portion of trail from the H-street bridge to Paradise Bend. Here, the river is at its narrowest and modeled velocities are up to 4 to 5 ft/s along the trail. Figures 15 through 18 show predicted river velocities from the 160,000 cfs simulation along the trail, and Figures 17 and 18 focus on the portion of trail from Paradise Bend to the H Street Bridge.

## 3 DISCUSSION AND RECOMMENDATIONS

This hydraulic study provides an in-depth analysis of hydraulic conditions using a 2D hydraulic model to assess predicted changes in WSE and velocity in the Project condition. Results of this analysis identify small local changes to modeled WSEs and velocities (both longitudinal and lateral extent) which rapidly dissipate outside the grading extent of the Project. This is a significant improvement on the typical evaluation with a 1D hydraulic model. Increases in velocity shown in Figures 5 through 14 would be muted in a 1D model analysis, or would not be observed at all, depending on cross-section location. The ability to observe the spatial distribution of impacts allows for efficient and effective assessment of their significance and determination of whether localized mitigation measures are required.

Should trail design alter significantly during 90% design preparation, the need for erosion potential should be further evaluated as the design progresses. In particular, the area of concern just downstream of the undercrossing at the upstream railroad bridge should be assessed to determine the condition of vegetation in the area and its ability to withstand flood velocities. Revisions to structure design may require reassessment through 2D model simulations. Based on assessment of vegetation condition after recent floods and model results of the refined undercrossing design, it can be determined whether to prescribe planting designs to include more robust, flood-tolerant species, or potentially install revetment in the area of concern.



Modeled WSEs and velocities represent fully blocked conditions for the undercrossing structures, which causes the maximum potential WSE increase and maximum velocity increases for areas adjacent to the structure. If the structure is not blocked with flood debris, velocities within the footprint of the structure are likely to be higher than what was modeled.

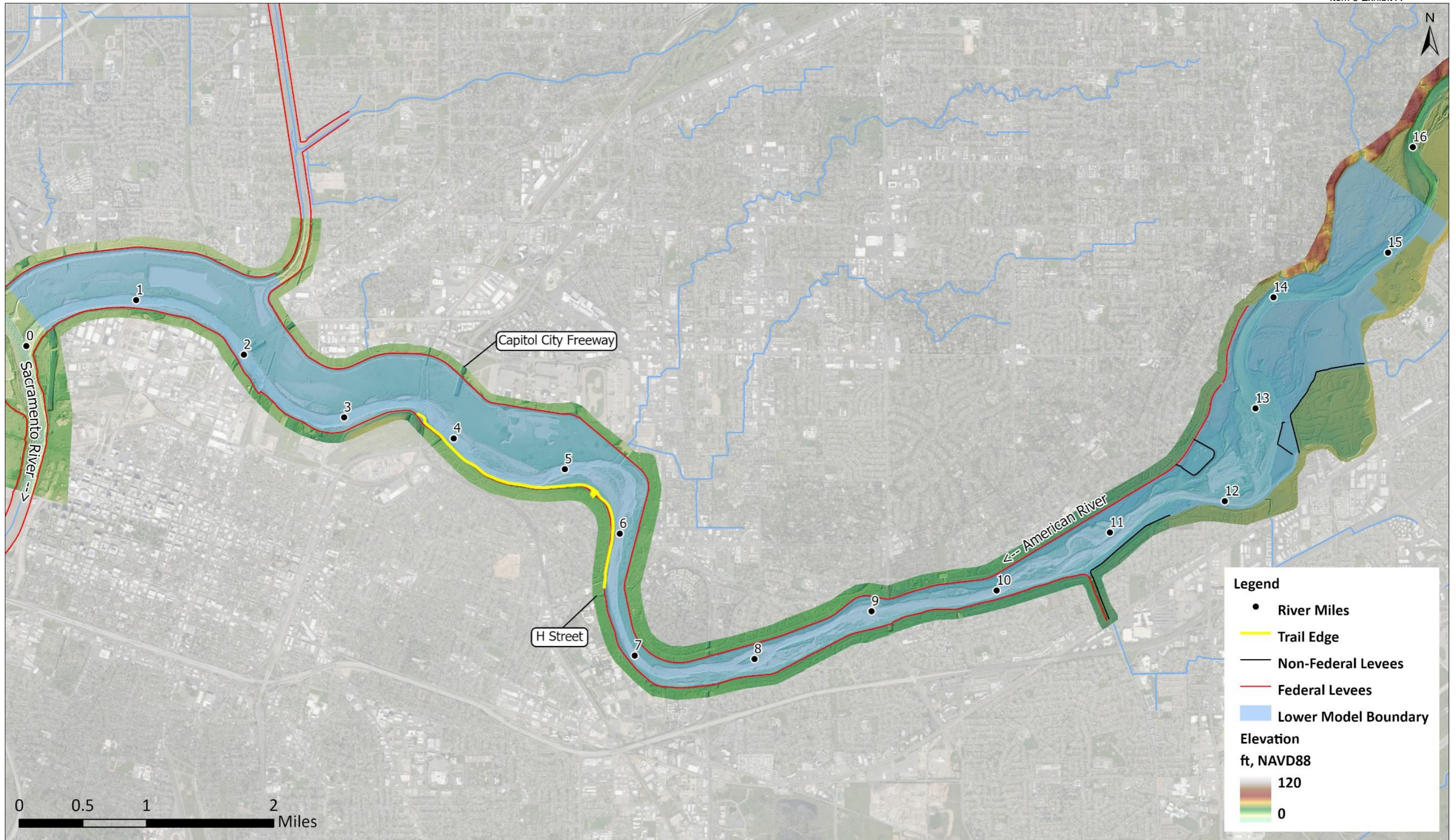
## 4 ACKNOWLEDGEMENTS

cbec, inc. eco engineering would like to acknowledge the Sacramento Area Flood Control Agency (SAFCA) and The Water Forum (WF) for their contribution to the development of the 2017 existing conditions DEM and 2D HEC-RAS LAR model, both used extensively throughout this project.

## REFERENCES

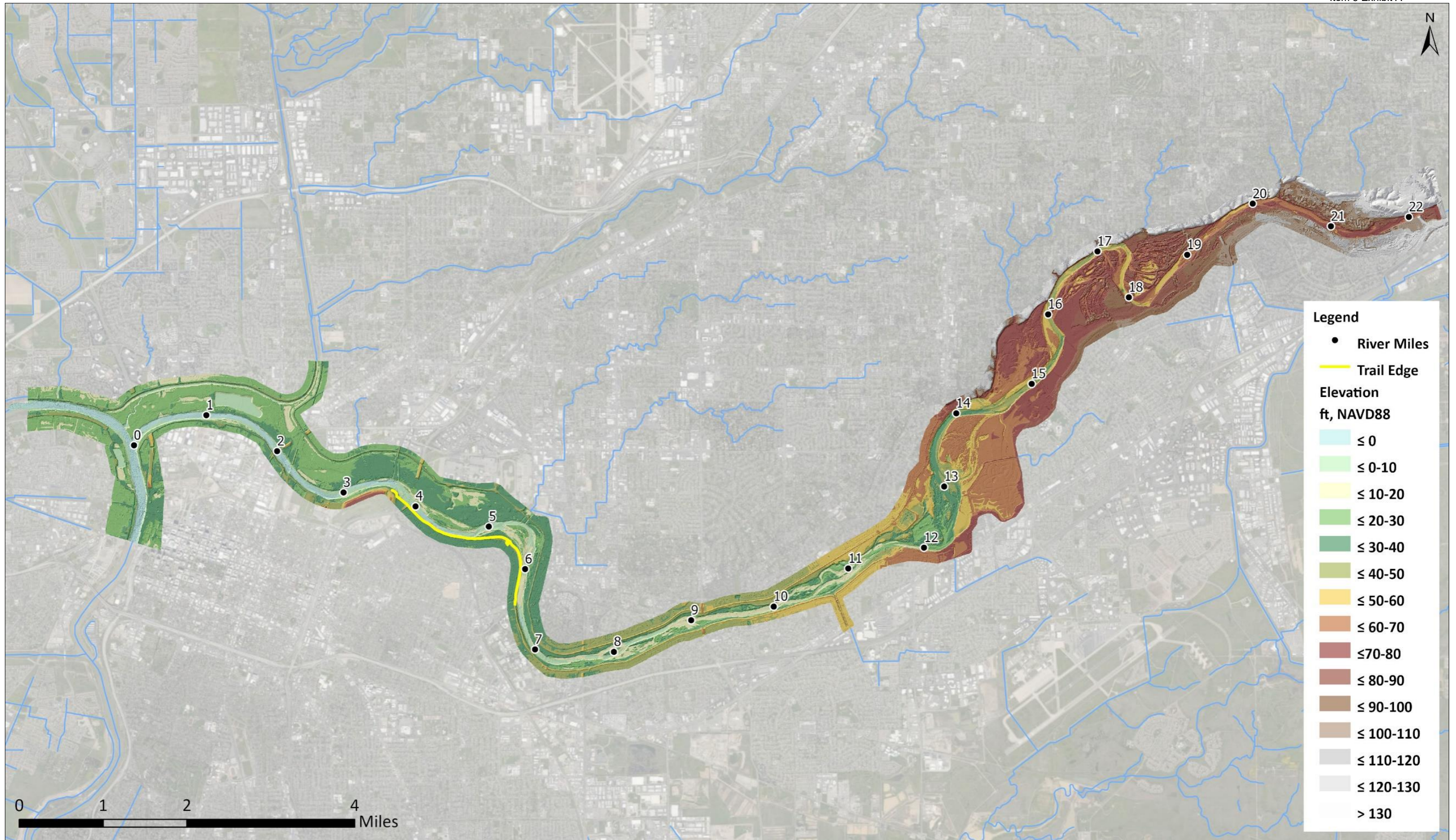
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## FIGURES




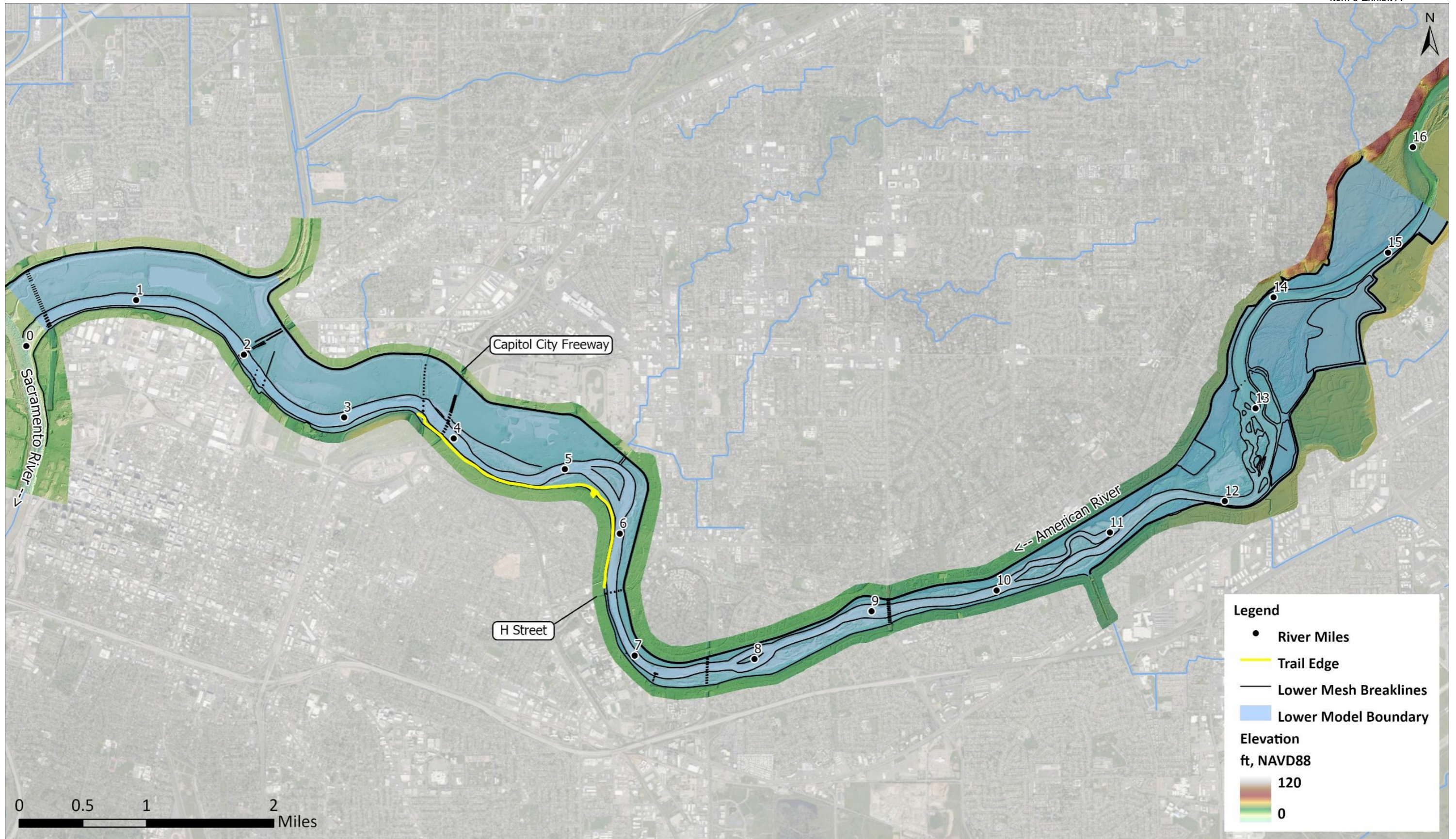
Notes:

	City of Sacramento Two Rivers Trail Phase 2	
	<b>Flood Model Boundary</b>	
Project No. 16-1025	Created By: HT	<b>Figure 1</b>



Notes:

	City of Sacramento Two Rivers Trail Phase 2	
	<b>Digital Elevation Model (DEM)</b>	
Project No. 16-1025	Created By: HT	<b>Figure 2</b>



Notes: Breaklines are located along the channel banks, top and toe of the levees, and edges of the trail and bridge piers. This ensures that the model enforces topographic controls at these locations.



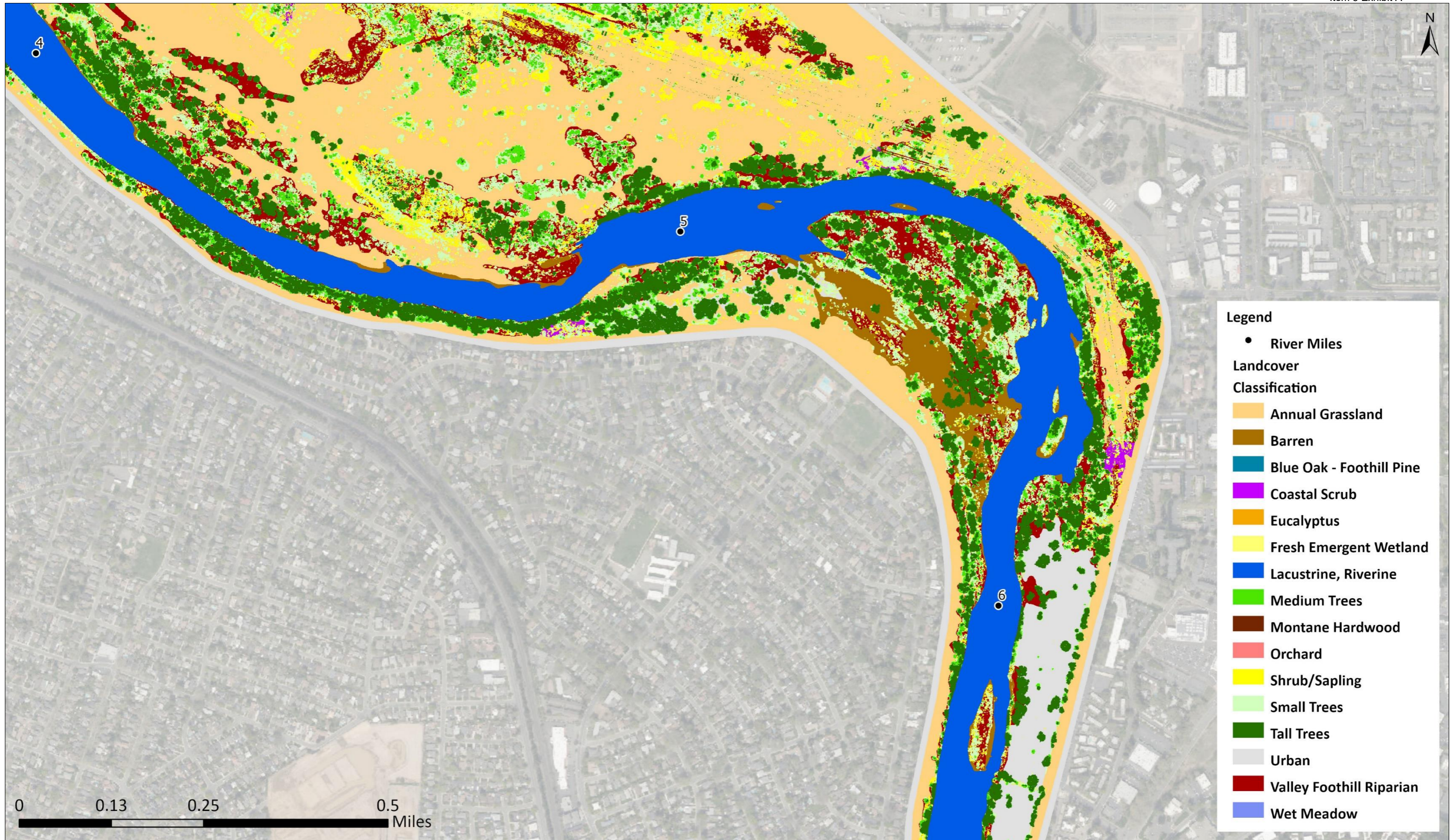
Project No. 16-1025

Created By: HT

City of Sacramento Two Rivers Trail Phase 2

**Model Mesh Breaklines**

**Figure 3**



**Legend**

- River Miles

**Landcover Classification**

- Annual Grassland
- Barren
- Blue Oak - Foothill Pine
- Coastal Scrub
- Eucalyptus
- Fresh Emergent Wetland
- Lacustrine, Riverine
- Medium Trees
- Montane Hardwood
- Orchard
- Shrub/Sapling
- Small Trees
- Tall Trees
- Urban
- Valley Foothill Riparian
- Wet Meadow


Notes: Landcover classifications come from California's Department of Fish & Wildlife fine-scale vegetation mapping and the 2014 NAIP imagery.

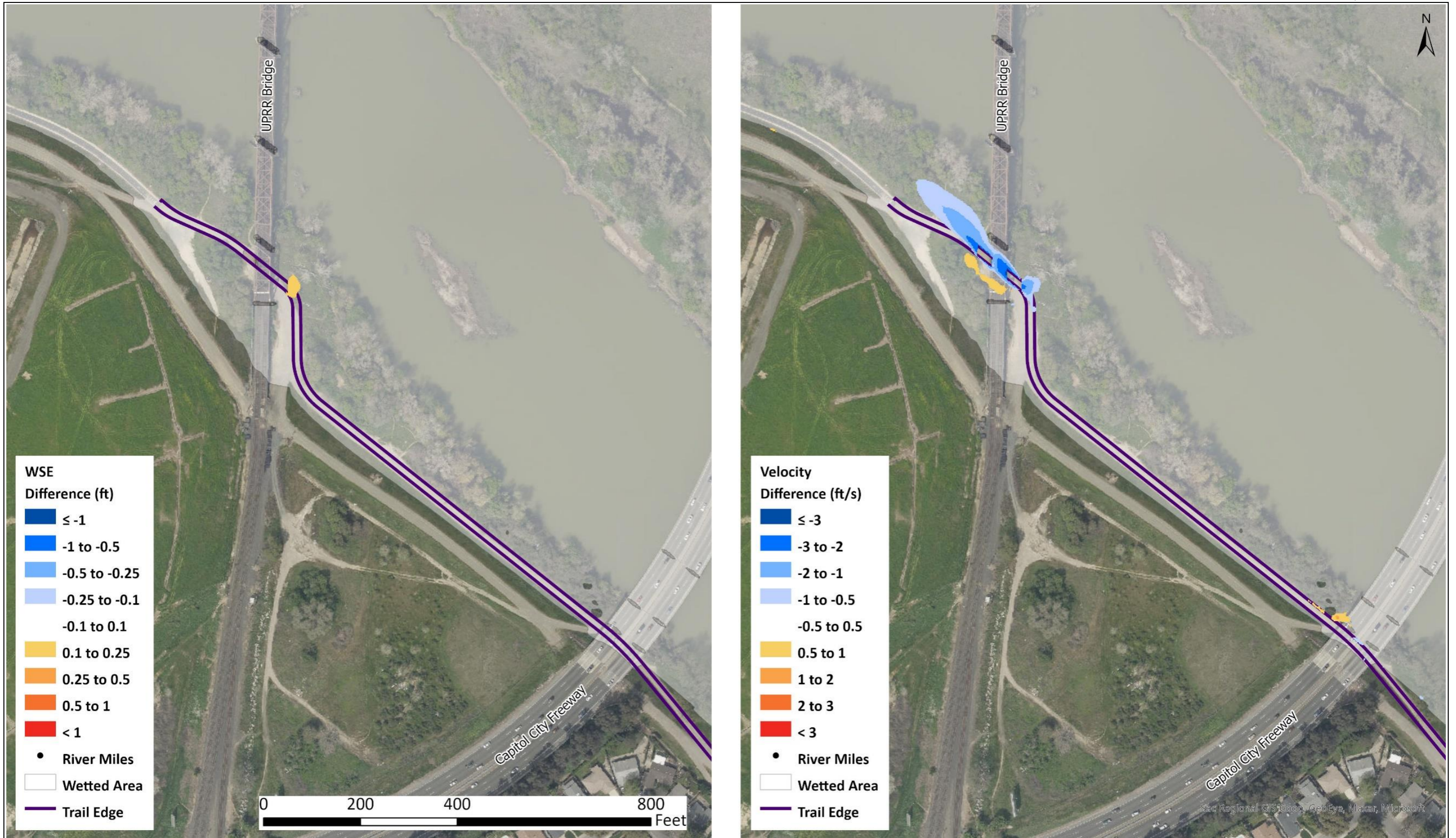
*City of Sacramento Two Rivers Trail Phase 2*

**Landcover Classifications for Roughness Map**

**Figure 4**

Project No. 16-1025      Created By: HT





Notes: Left plot is difference in water surface elevations (With-Project - Existing Condition). Right plot is difference in velocities (With-Project - Existing Condition).

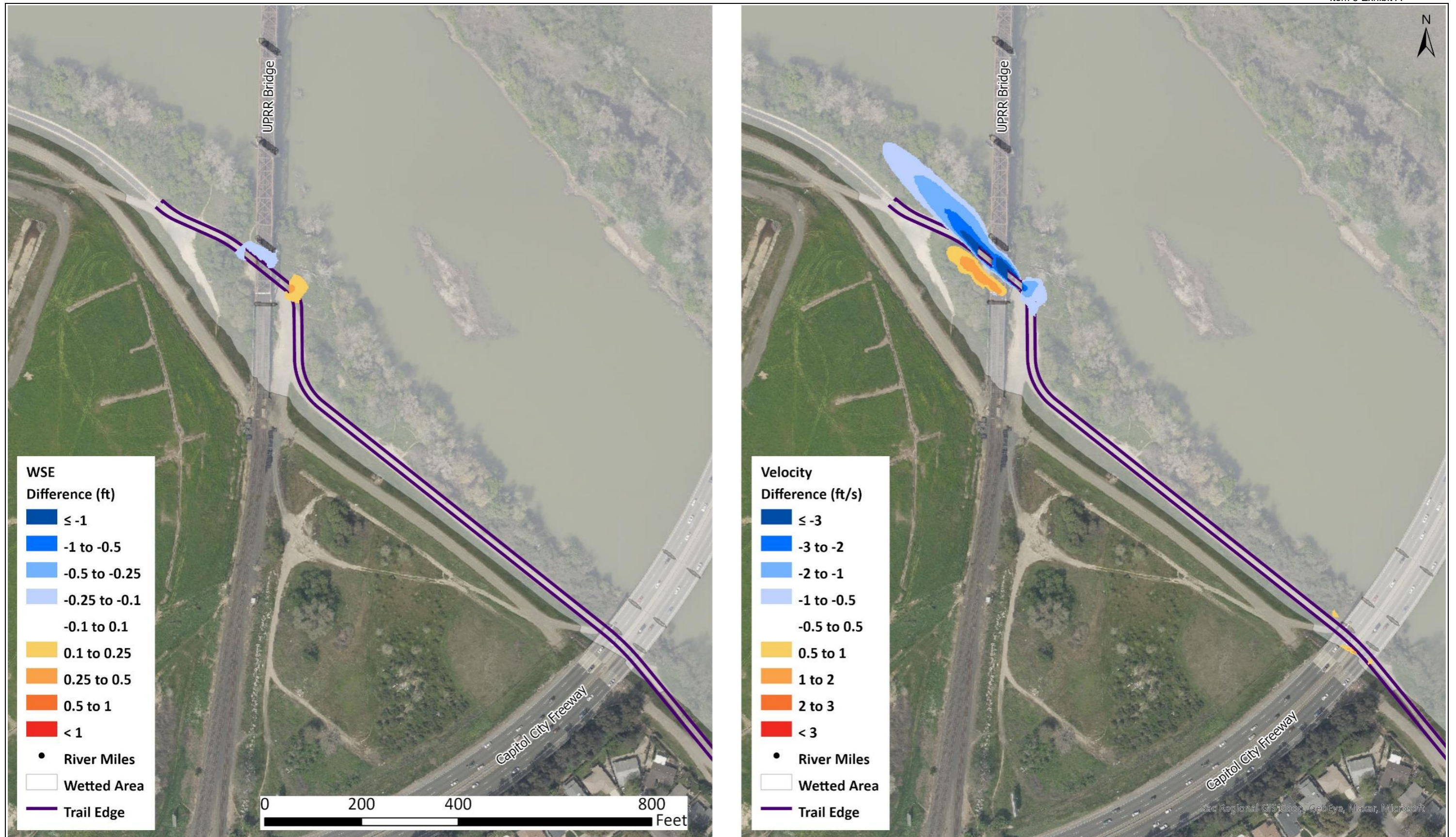


City of Sacramento Two Rivers Trail Phase 2  
**115,000 cfs Results at Undercrossing**

Project No. 16-1025

Created By: HT

**Figure 5**



Notes: Left plot is difference in water surface elevations (With-Project - Existing Condition). Right plot is difference in velocities (With-Project - Existing Condition).



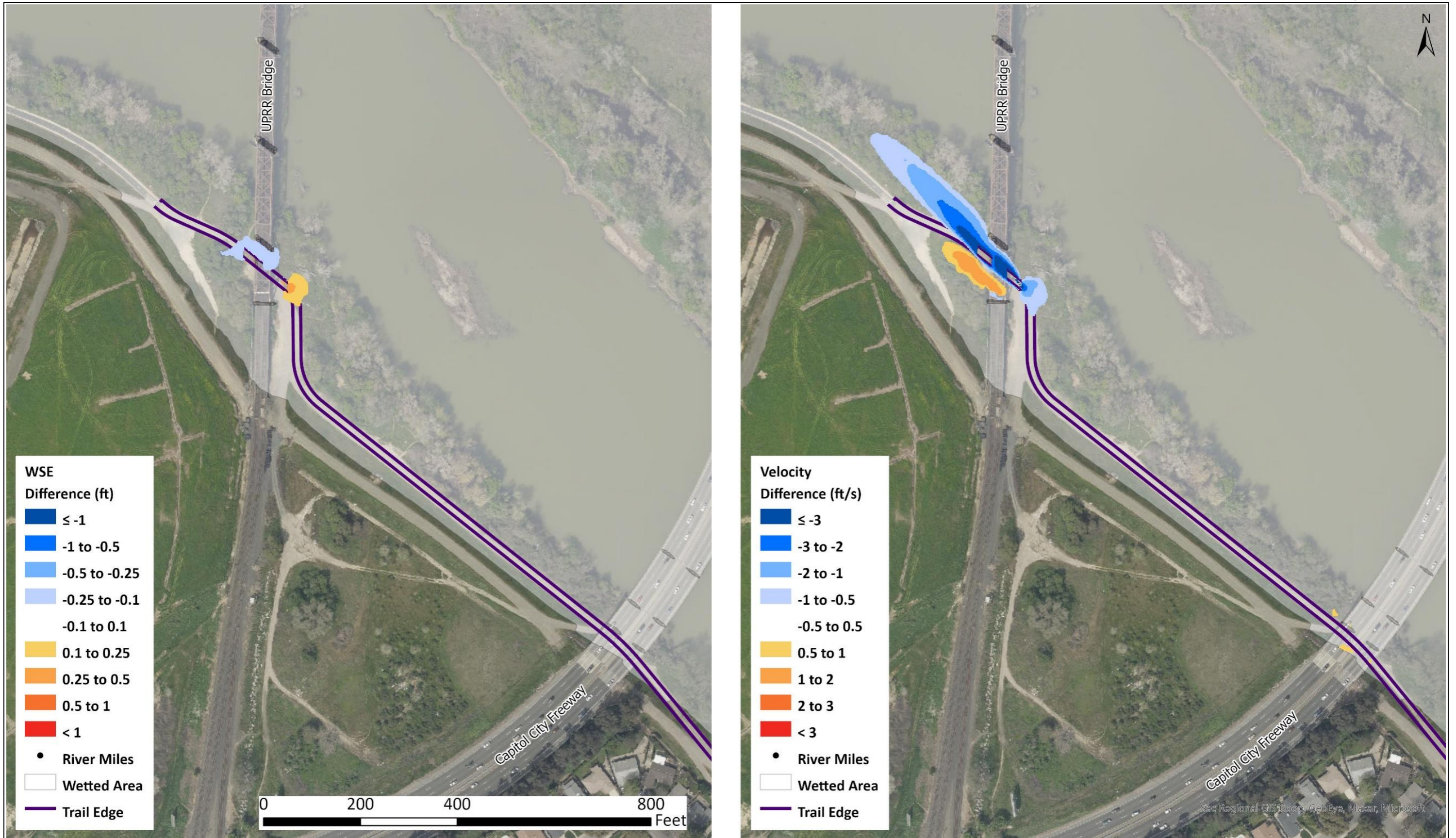
City of Sacramento Two Rivers Trail Phase 2  
**160,000 cfs Results at Undercrossing**

Project No. 16-1025

Created By: HT

**Figure 6**





Notes: Left plot is difference in water surface elevations (With-Project - Existing Condition). Right plot is difference in velocities (With-Project - Existing Condition).

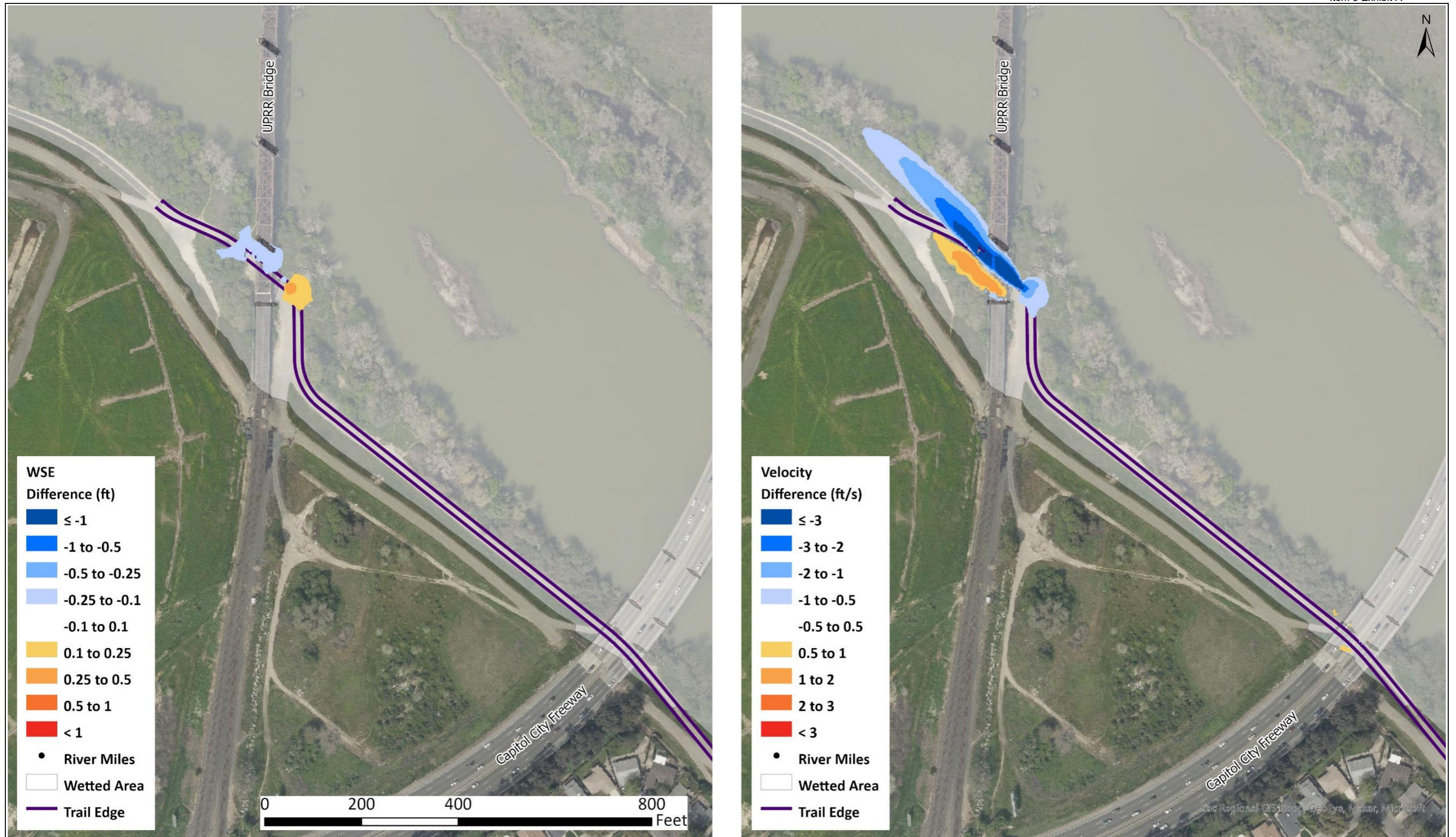


City of Sacramento Two Rivers Trail Phase 2  
**180,000 cfs Results at Undercrossing**

Project No. 16-1025

Created By: HT

**Figure 7**



Notes: Left plot is difference in water surface elevations (With-Project - Existing Condition). Right plot is difference in velocities (With-Project - Existing Condition).

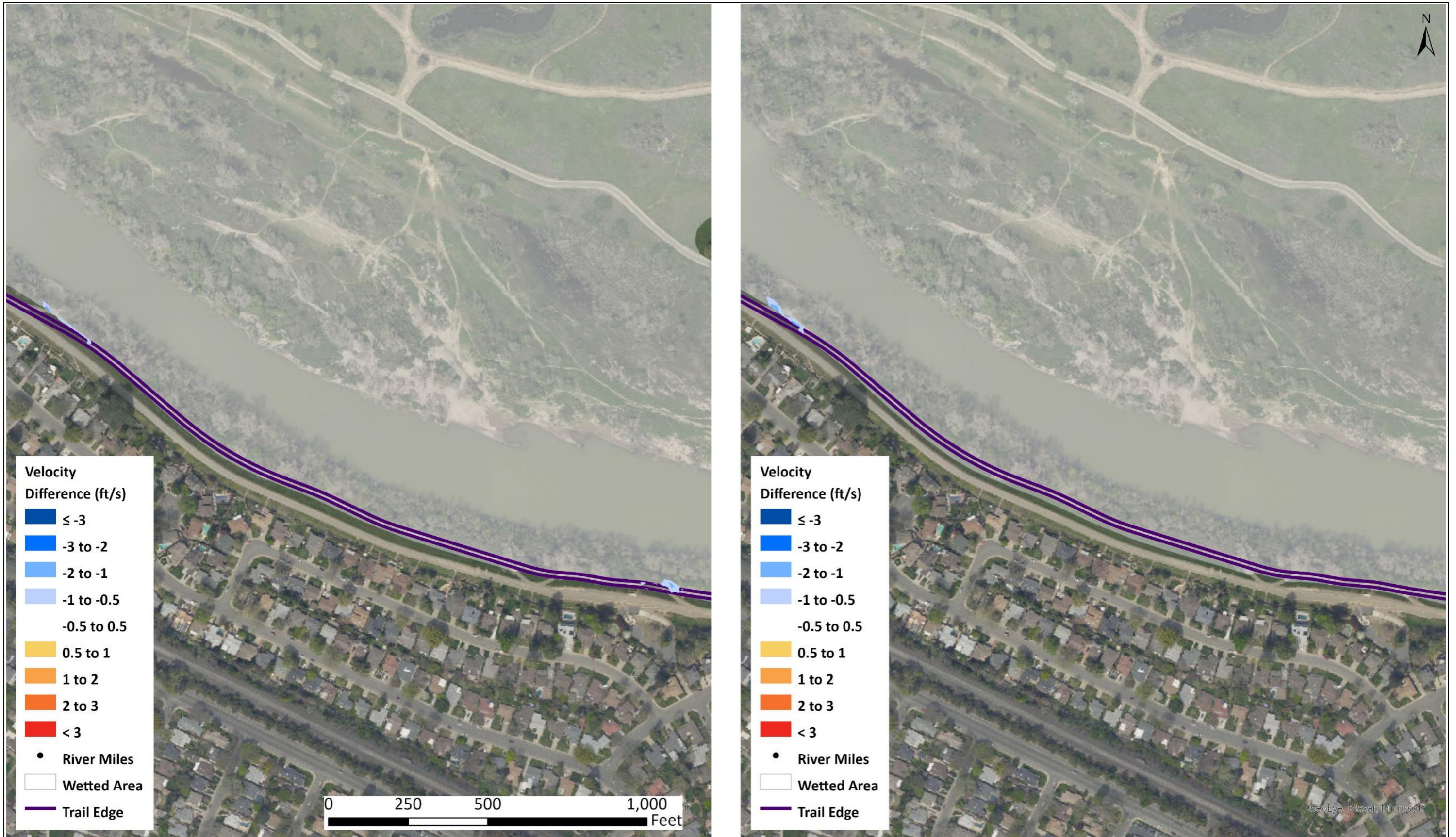


City of Sacramento Two Rivers Trail Phase 2  
**192,000 cfs Results at Undercrossing**

Project No. 16-1025

Created By: HT

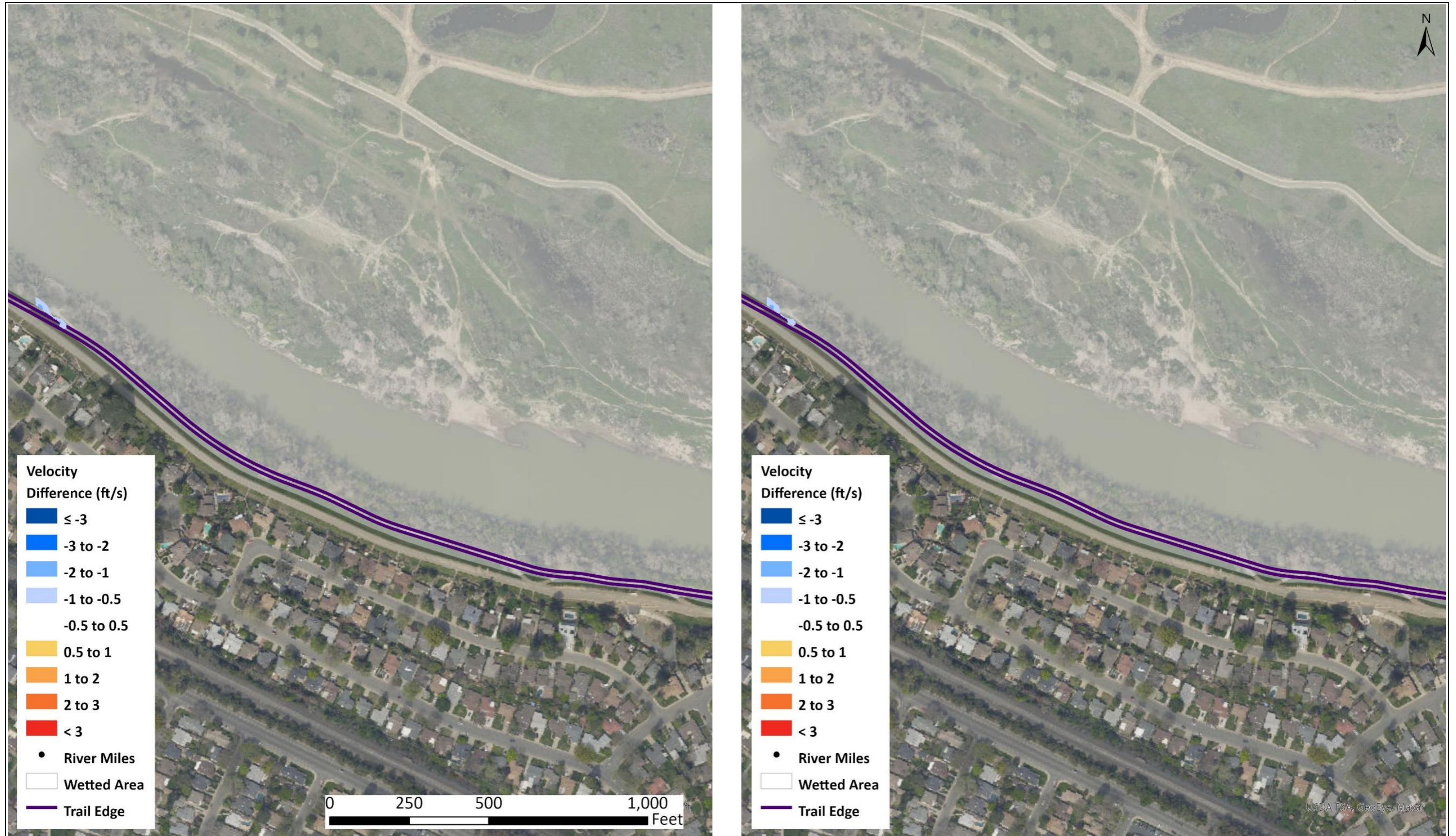
**Figure 8**



Notes: Left plot is difference in velocities at 115,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 160,000 cfs (With-Project - Existing Condition).



<i>City of Sacramento Two Rivers Trail Phase 2</i>		
<b>115k cfs and 160k cfs Results - Upstream of Undercrossing</b>		
Project No. 16-1025	Created By: HT	<b>Figure 9</b>



Notes: Left plot is difference in velocities at 180,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 192,000 cfs (With-Project - Existing Condition).

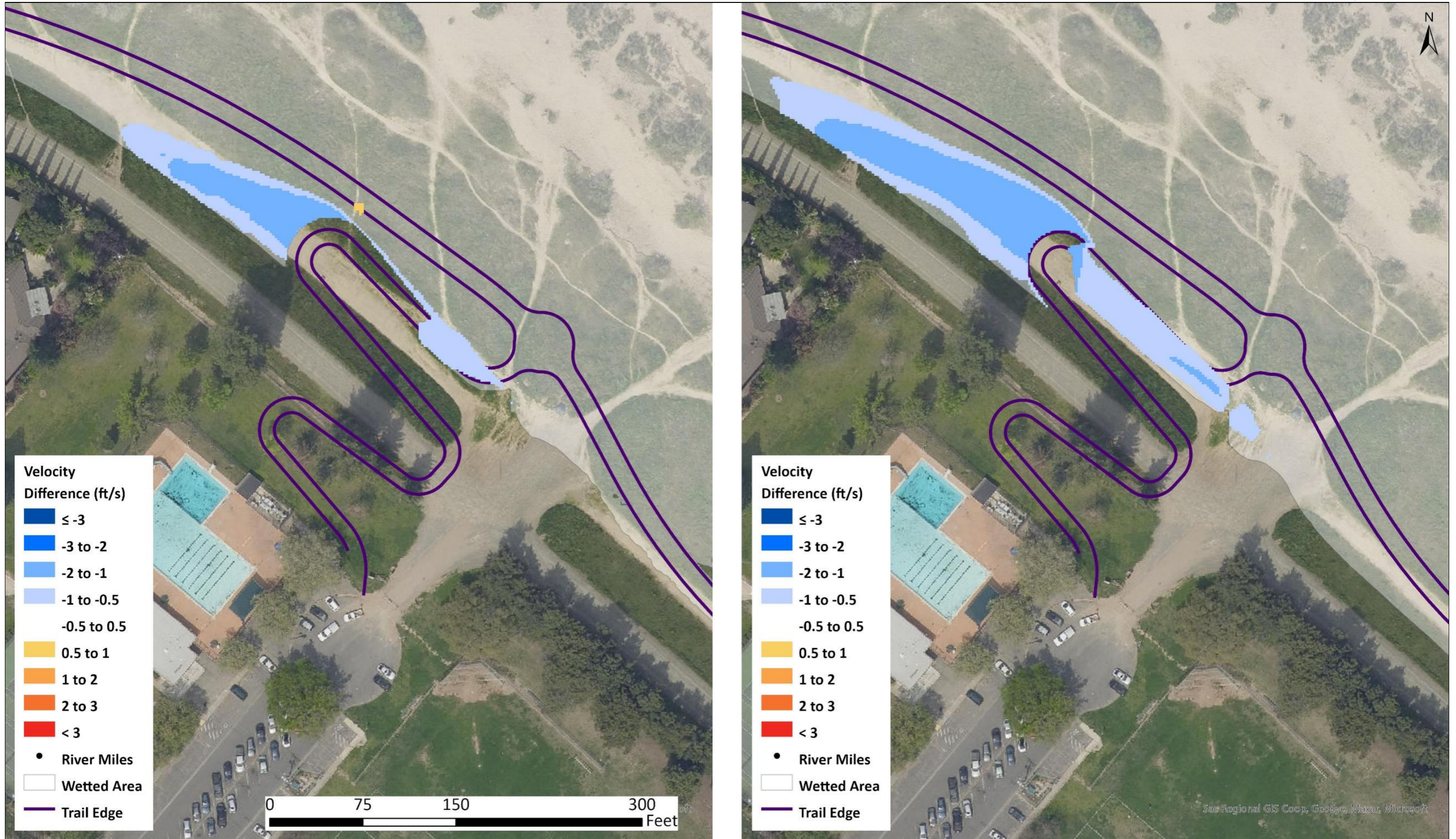


City of Sacramento Two Rivers Trail Phase 2  
**180k cfs and 192k cfs Results - Upstream of Undercrossing**

Project No. 16-1025

Created By: HT

**Figure 10**

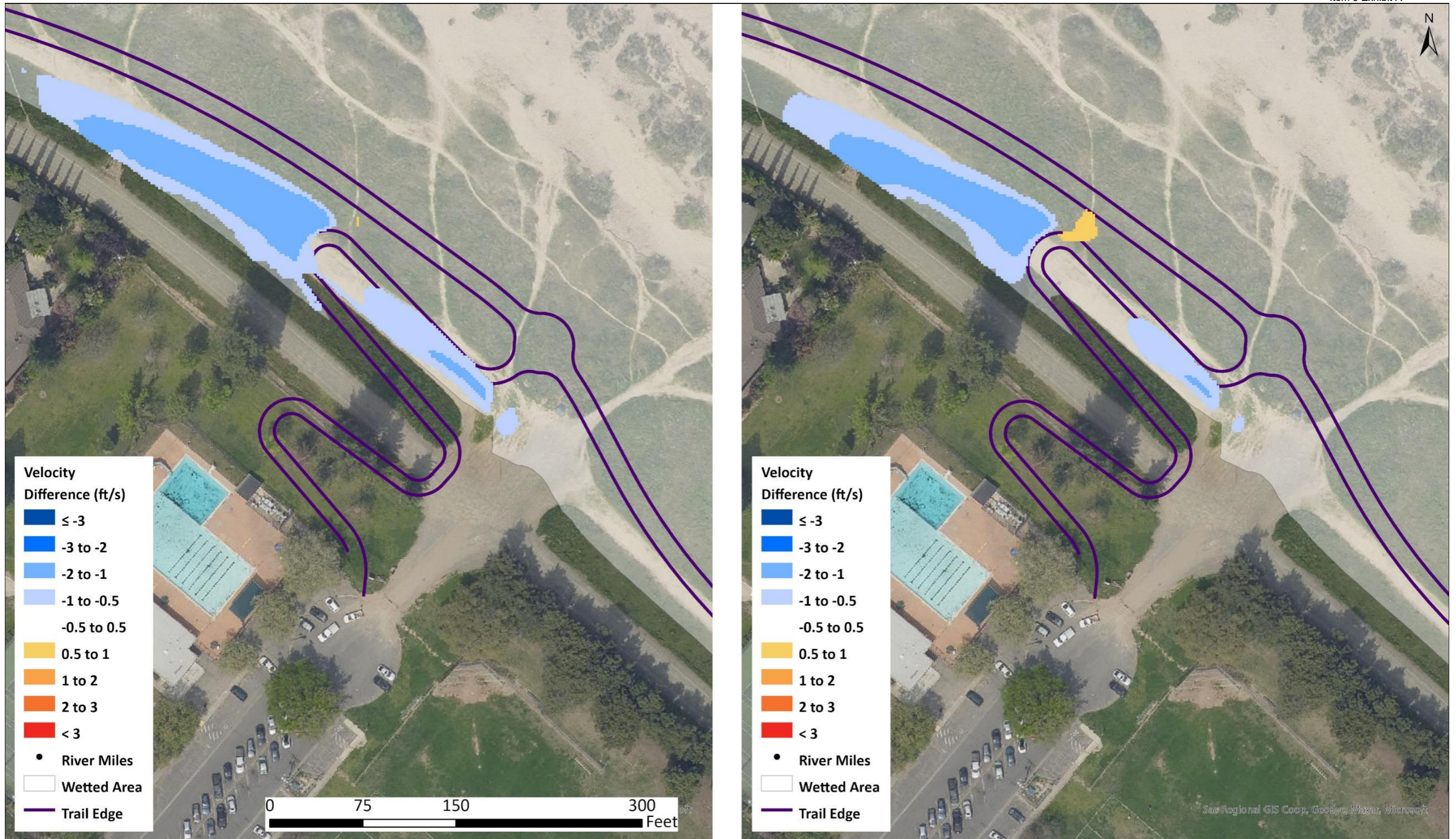


Notes: Left plot is difference in velocities at 115,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 160,000 cfs (With-Project - Existing Condition).



*City of Sacramento Two Rivers Trail Phase 2*  
**115k cfs and 160k cfs Results - Middle of Trail**

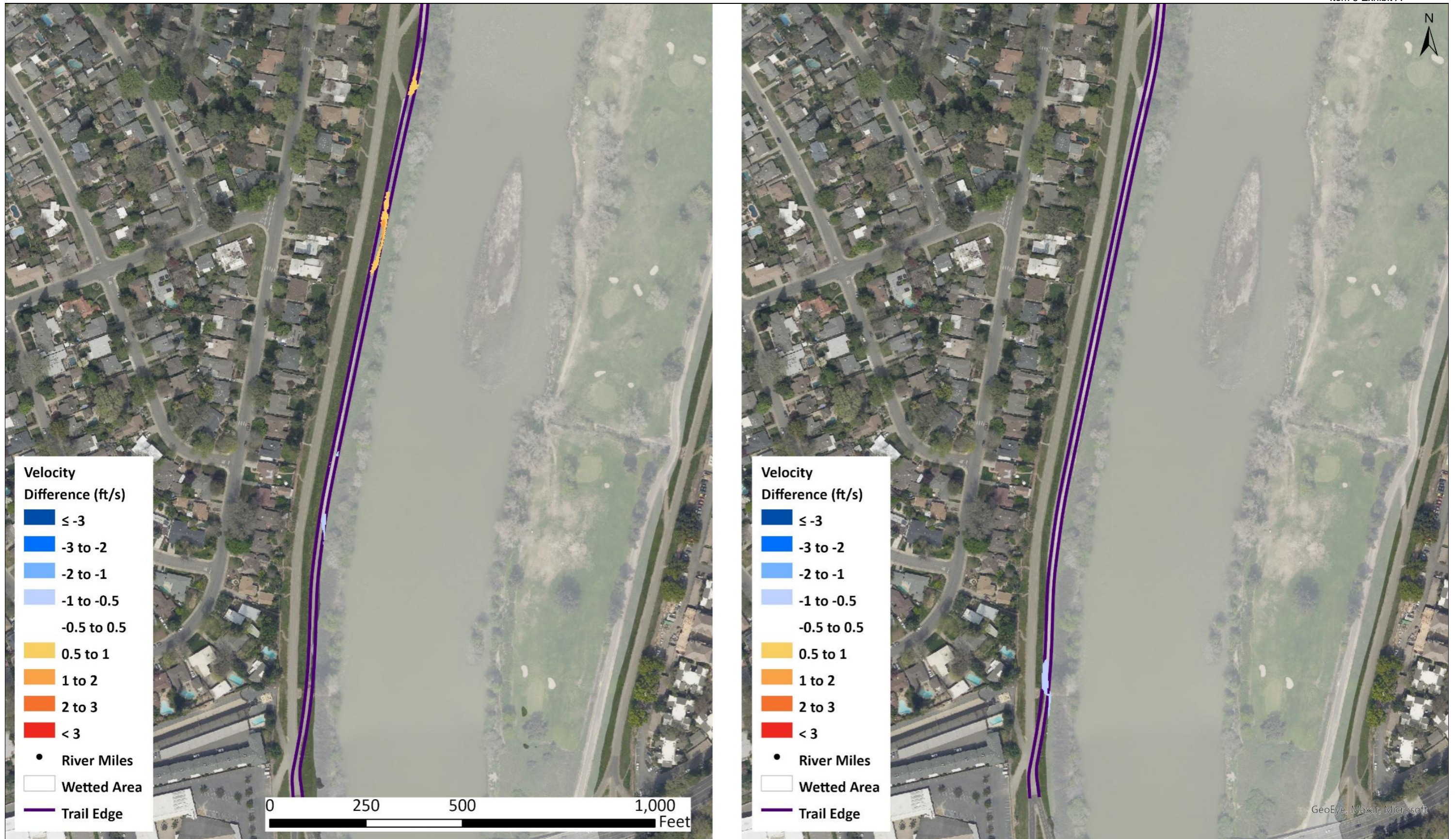
Project No. 16-1025	Created By: HT	<b>Figure 11</b>
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Notes: Left plot is difference in velocities at 180,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 192,000 cfs (With-Project - Existing Condition).



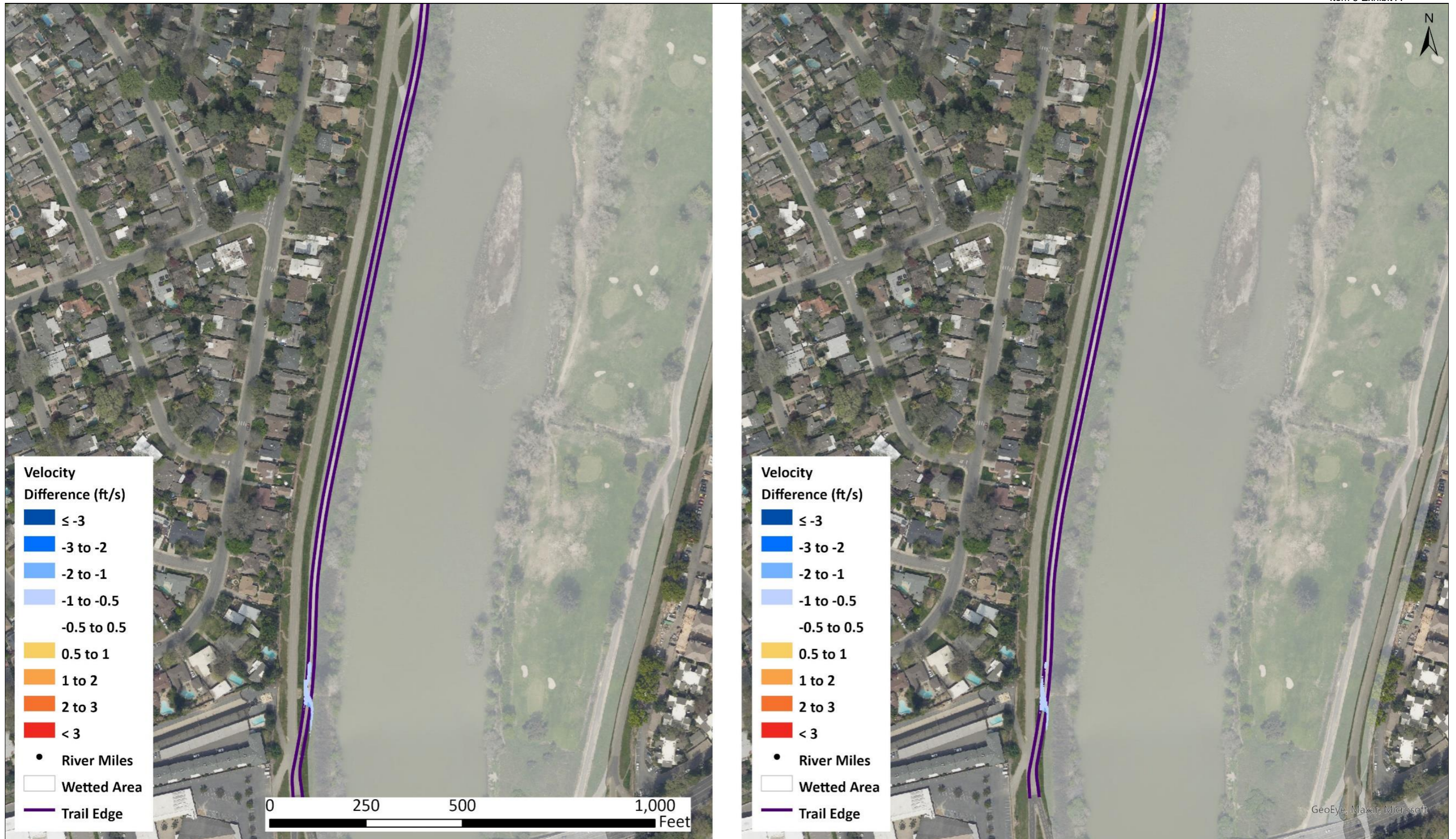
<i>City of Sacramento Two Rivers Trail Phase 2</i>		
<b>180k cfs and 192k cfs Results - Middle of Trail</b>		
Project No. 16-1025	Created By: HT	<b>Figure 12</b>



Notes: Left plot is difference in velocities at 115,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 160,000 cfs (With-Project - Existing Condition).



<i>City of Sacramento Two Rivers Trail Phase 2</i>		
<b>115k cfs and 160k cfs Results - Upstream End of Trail</b>		
Project No. 16-1025	Created By: HT	<b>Figure 13</b>

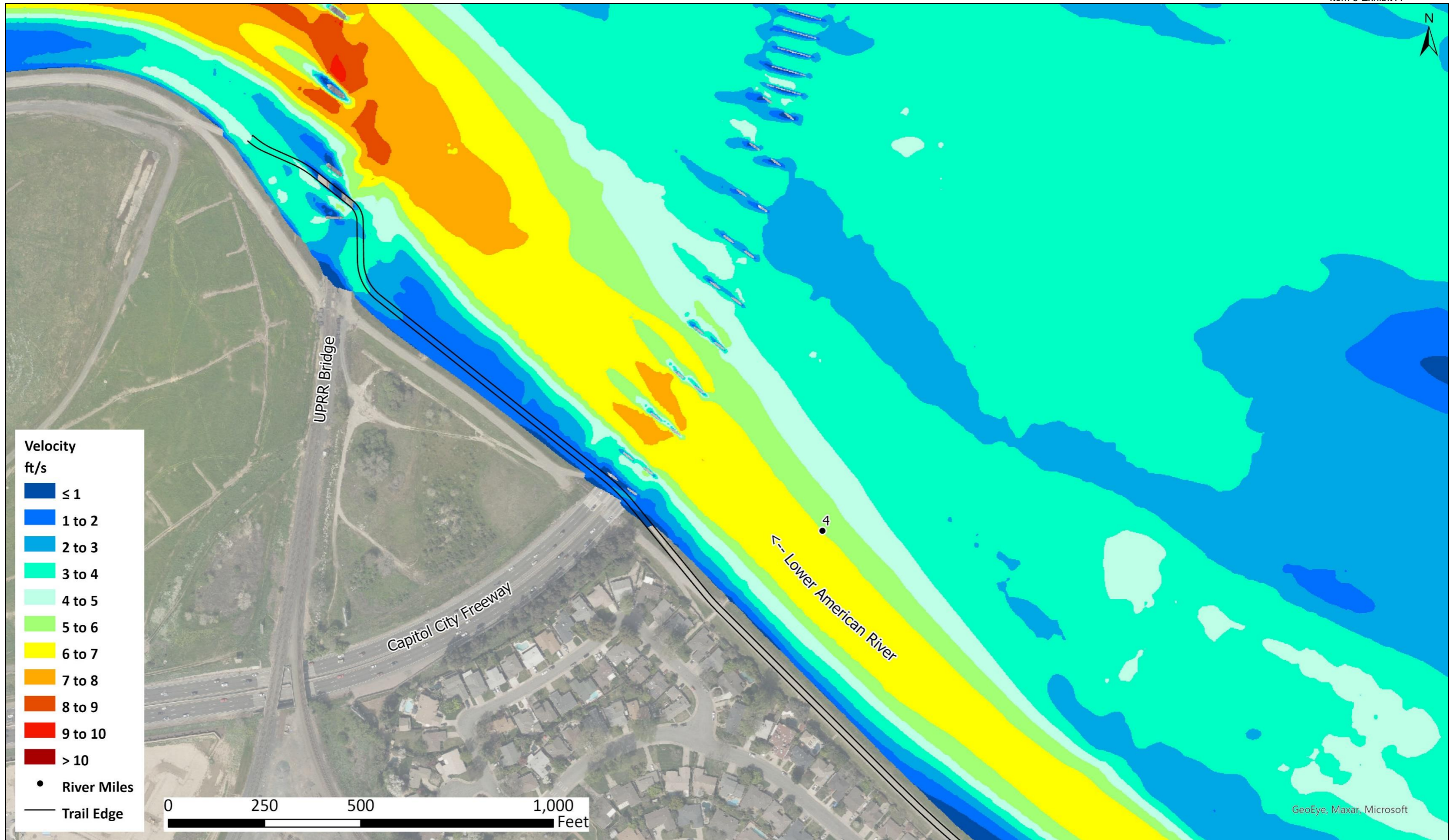


Notes: Left plot is difference in velocities at 180,000 cfs (With-Project - Existing Condition). Right plot is difference in velocities at 192,000 cfs (With-Project - Existing Condition).



<i>City of Sacramento Two Rivers Trail Phase 2</i>		
<b>180k cfs and 192k cfs Results - Upstream End of Trail</b>		
Project No. 16-1025	Created By: HT	<b>Figure 14</b>

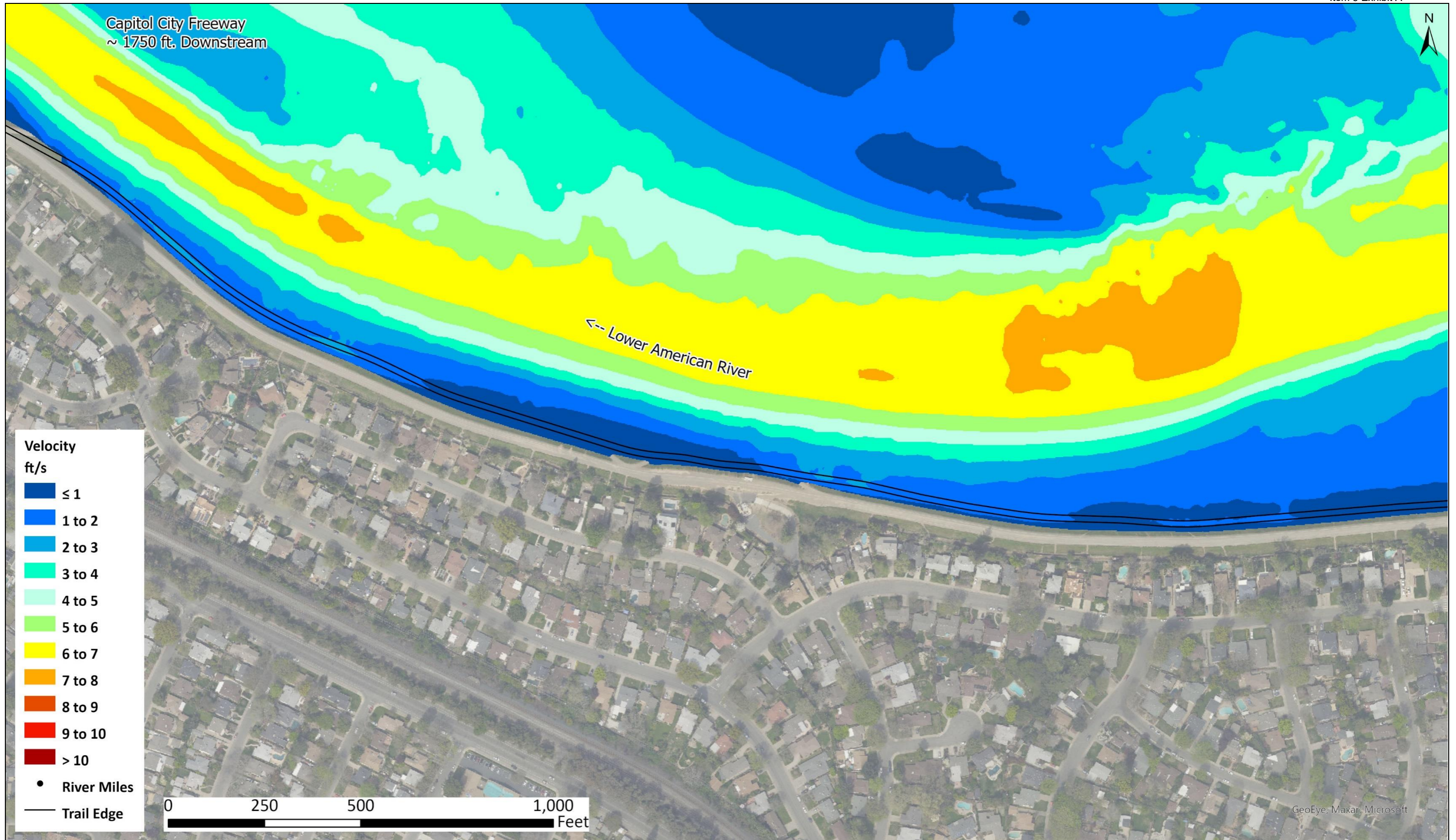




Notes: Velocity magnitudes for 160,000 cfs at most downstream end of trail near bridge undercrossing.



<i>City of Sacramento Two Rivers Trail Phase 2</i>		
<b>Velocities at 160,000 cfs - at Undercrossing</b>		
Project No. 16-1025	Created By: HT	<b>Figure 15</b>



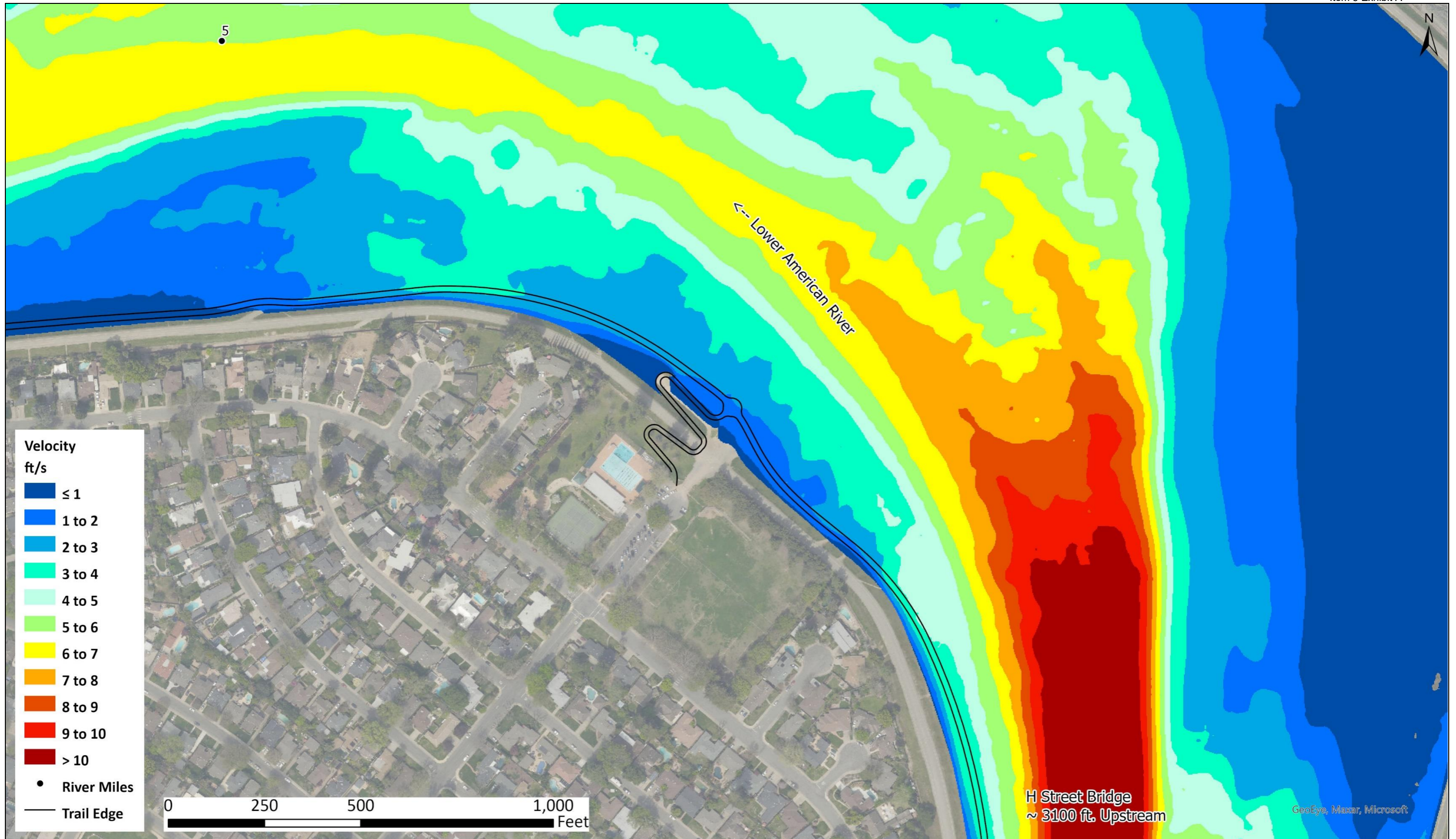
Notes: Velocity magnitudes for 160,000 cfs upstream of bridge undercrossing.



*City of Sacramento Two Rivers Trail Phase 2*

**Velocities at 160,000 cfs - Upstream of Undercrossing**

Project No. 16-1025	Created By: HT	<b>Figure 16</b>
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Notes: Velocity magnitudes for 160,000 cfs at middle of proposed trail.

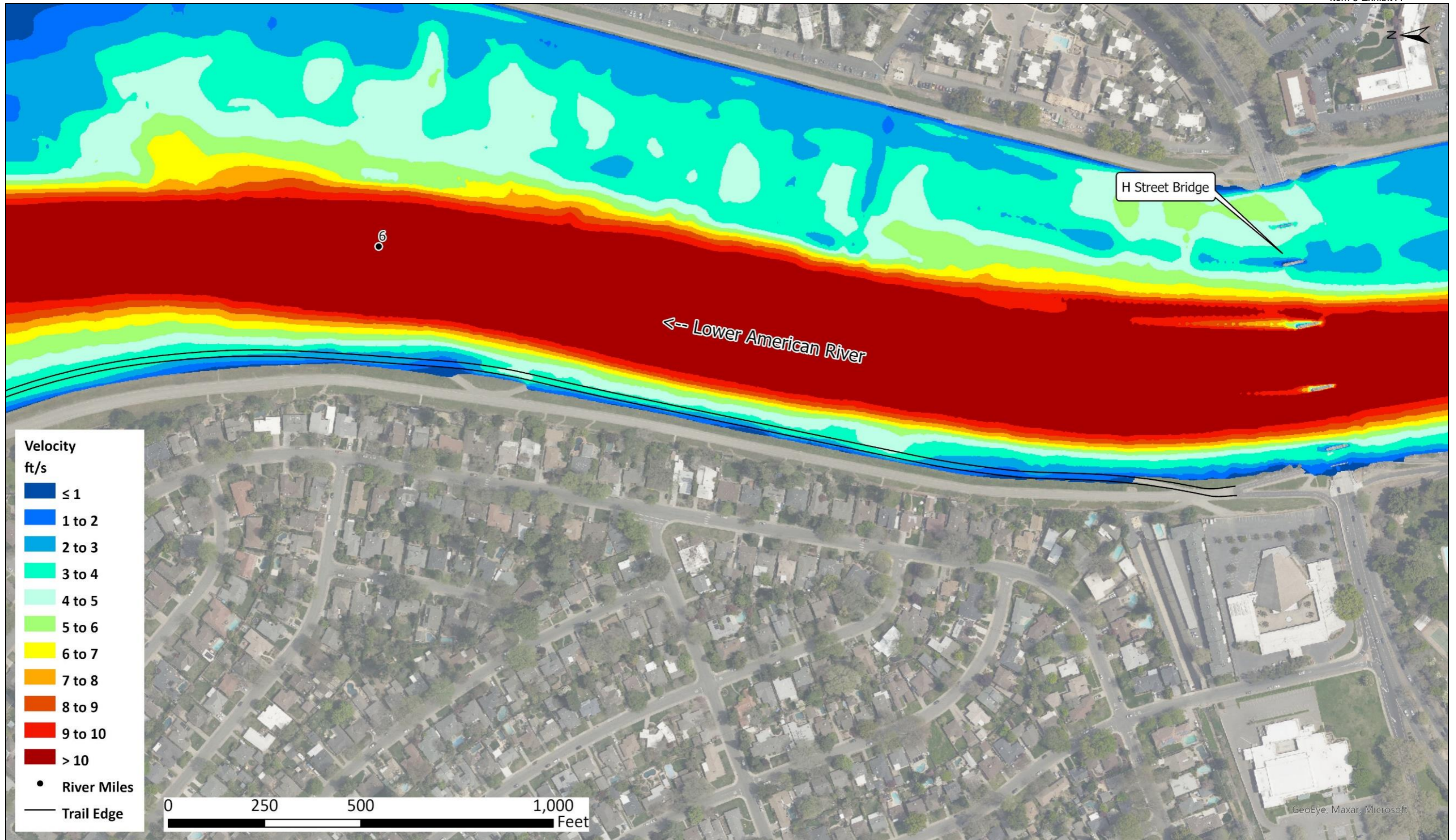


City of Sacramento Two Rivers Trail Phase 2  
**Velocities at 160,000 cfs - Middle of Trail**

Project No. 16-1025

Created By: HT

**Figure 17**



Notes: Velocity magnitudes for 160,000 cfs at most upstream end of proposed trail near H Street Bridge.



*City of Sacramento Two Rivers Trail Phase 2*

**Velocities at 160,000 cfs - Upstream End of Trail**

Project No. 16-1025	Created By: HT	<b>Figure 18</b>
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