Hydrology, Floodplain, Water Quality, and Stormwater Runoff Impact Analysis

for the

Monterey Peninsula Light Rail Project

Prepared for

TAMC
TRANSPORTATION AGENCY FOR MONTEREY COUNTY

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1. INTRODUCTION

The Monterey Peninsula Light Rail Transit Project would restore 15.2 miles of passenger rail service along the existing Monterey Branch Line (MBL) rail right-of-way from Castroville to downtown Monterey. Ridership projections for the project assume the completion of an extension of commuter rail (Caltrain) service to Monterey County. Figure 1-1 shows the project location along the Monterey peninsula, and with respect to the proposed future Caltrain service.

As part of the planning process, the Transportation Agency for Monterey County (TAMC) prepared a corridor-level analysis of light rail transit (LRT), enhanced bus, and bus rapid transit (BRT) alternatives to provide adequate information for TAMC to be able to select a locally preferred alternative. On October 28, 2009, the TAMC Board of Directors selected the LRT Alternative as the locally preferred alternative (LPA), based on its ability to provide superior transportation in the long-term while best meeting the project's purpose and need. As a result, two alternatives will be evaluated in the EIR/EA, the LRT Alternative and the No-Build Alternative.

The LRT Alternative would be implemented in two phases. In the first phase, the MBL railroad track would be restored or constructed for a distance of 10 miles between downtown Monterey and north Marina, with bus service continuing to Castroville on local roadways. The second phase would extend the LRT an additional 5.2 miles to Castroville rail station north of Blackie Road.

The objectives of this Hydrology, Floodplain, Water Quality and Stormwater Runoff Report are to describe existing water resources and determine potential impacts to water resources from the construction and operation of the Monterey Peninsula Light Rail Project. It also identifies temporary and permanent controls to minimize impacts associated with the project due to: 1) stormwater flows, 2) work within floodplains, and 3) non-stormwater discharges. The report includes an assessment of the overall drainage of the project area and provides recommendations for replacement, retrofitting or relocation of drainage to meet the needs for restoration of passenger service along the MBL.

The findings in this report are based on available information, field assessment, conceptual engineering and cost estimates. Note that design and construction shall be in general accord with the latest edition (at the time of construction) of the General Storm Water National Pollutant Discharge Elimination System (NPDES) Permit for Small Municipal Storm Sewer Systems (MS4) and the General NPDES Permit for Storm Water Discharges associated with Construction and Land Disturbance Activities.

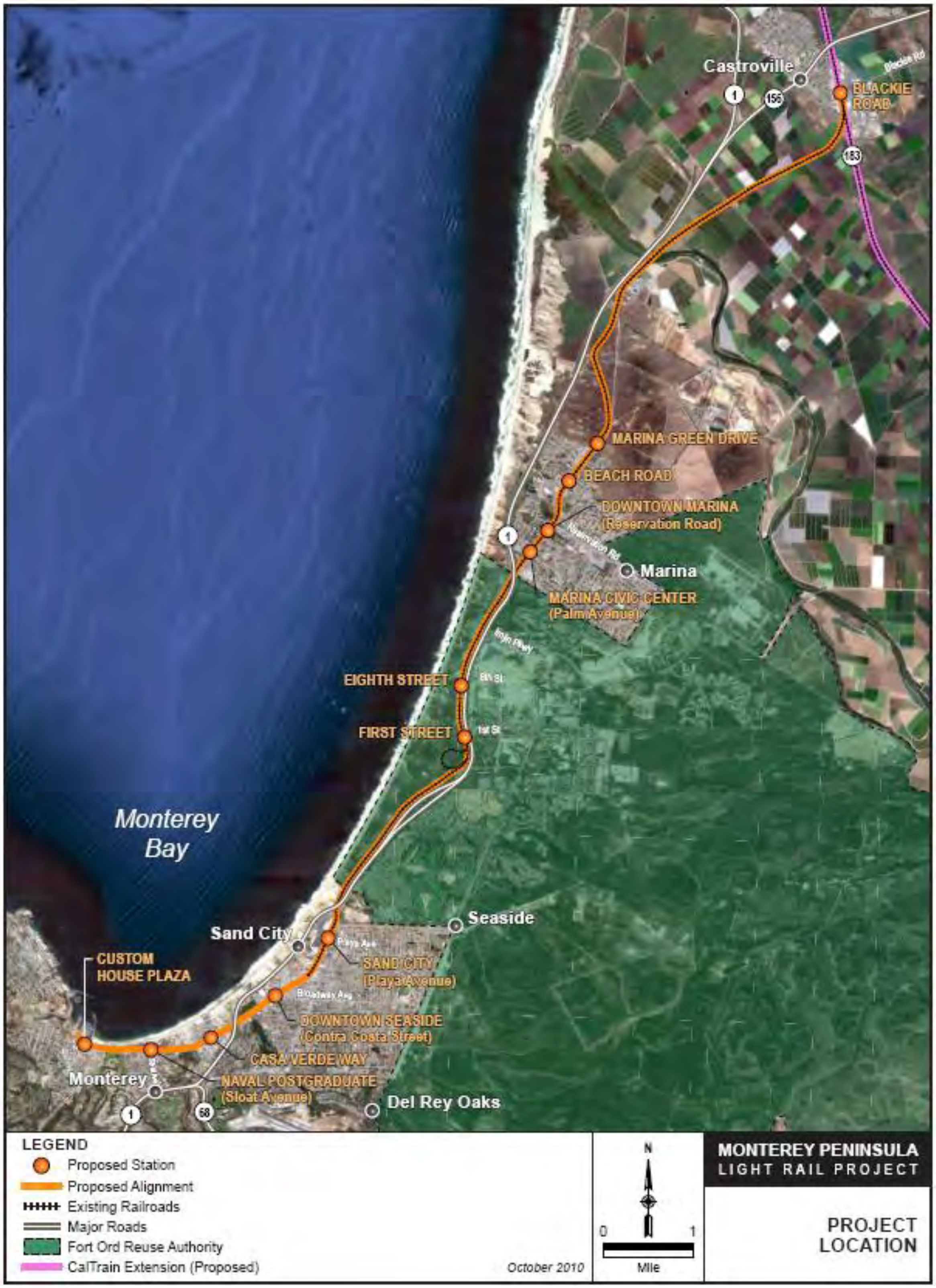
2. PROJECT DESCRIPTION AND ALTERNATIVES

2.1 Project Location and Setting

The location of the proposed LRT project is shown on Figure 2-1. The 15.2 mile corridor extends between Monterey and Castroville on the publicly-owned tracks adjacent to

Figure 1-1. Project Vicinity Map

Figure 2-1. Project Location Map



Highway 1. The alignment traverses the cities of Monterey, Seaside, Sand City, Marina, and the unincorporated community of Castroville. The MBL right-of-way is generally 100 feet wide. The original corridor right-of-way widens to about 400 feet near the project terminus at Custom House Plaza.

The Salinas Valley has a Mediterranean climate characterized by year-round moderate temperatures with a short, cool winter rainy season and warm, dry summers. The mean annual precipitation averages between 9.8 to 16.1 inches with the higher precipitation occurring in the northern areas of the valley.

2.2 Project Purpose

The proposed project would provide improved access between Monterey and Salinas. In this regard, it would facilitate access to jobs, health care and shopping. It would provide commuters with a reduced-stress alternative for vehicular travel between these two cities, and to San Francisco Bay Area rail connections. An additional benefit of the project would be inducement of economic growth in the vicinity of proposed station sites.

2.3 Project Alternatives

Light Rail Transit Alternative. The LRT alternative would provide light rail service, to be located predominantly within the existing MBL right-of-way. The proposed action would be implemented in two phases. In the first phase, MBL railroad track would be restored or constructed for a distance of 10 miles between downtown Monterey and north Marina, with bus service continuing to Castroville on local roadways. Phase 1 service is anticipated to be operational by 2015. The second phase would extend LRT service an additional 5.2 miles to the Castroville rail station north of Blackie Road. Standard bus service would connect with the LRT stations, including between Marina and the intercity rail station at Salinas. Phase 2 is funding dependent and could be built by 2030. Primary project features under the proposed LRT Alternative would include:

Fixed Facilities. Except for approximately two miles of track across the former Fort Ord area, the existing track is unusable and would be replaced. The Monterey Branch single-track rail line would be restored with new ties, ballast and 115 pound continuous welded rail. Based on field observations, it appears that where the new track is on the existing alignment, the existing ballast can be re-used as sub-ballast, with cleaning and some additional material added. Passing sidings would be built where needed to allow for two-way light rail train operations. Access to a new LRT maintenance facility would be provided through restoration of the railroad spur track connection from just north of the First Street station to the former Fort Ord quartermaster warehouses at Fifth Street, or just south of the First Street Station, adjacent to the Fort Ord “balloon spur” track. The asphalt overlay to the rail track would be removed.

Special trackwork (turnouts, diamond crossings, and derails) would be constructed along the route. Turnouts would be constructed at passing sidings and junctions of the Branch Line with the Main Line in Castroville (if provided). For unsignalized operation, turnouts at passing sidings would have spring switches. For turnouts where facing point movements to either track are required, such as at the turnout to the maintenance yard, a push-button operated switch machine is proposed.

Rolling Stock. TAMC would purchase and Monterey-Salinas Transit would operate hybrid diesel electric or diesel multiple unit, Federal Railroad Administration (FRA)-noncompliant light rail vehicles.

Stations/Stops. Stations would be constructed at the approximate locations shown on Figure 2. Light rail transit service would serve one Castroville station at Blackie Road. Five stops are proposed to serve Marina at Marina Green Drive, Beach Road, Reservation Road, Palm Avenue and Eighth Street. Three are proposed to serve Seaside and Sand City at First Street, Playa Avenue, and Contra Costa Street. In Monterey, three stops are proposed at Casa Verde Way, U.S. Naval Postgraduate School (Sloat Avenue), and Custom House Plaza. Modifications to the Castroville commuter rail station would be required during Phase 2 to accommodate a separate station track and platform for non-FRA-compliant vehicles.

Each station would consist of a low-level platform with passenger amenities. A 2-foot wide tactile strip would be installed along the guideway facing the platform edge. One stand alone (i.e., no communications connections) ticket vending machine would be installed on each platform. At the Eighth and First Street Stations within the former Fort Ord area, vertical access facilities (staircase and elevator) are assumed for connection with adjacent streets.

Bridge Structures. The rail alignment crosses several bridge structures: Salinas River Bridge; Tembladero Slough Bridge; four ballast deck trestle bridges; and a pre-stressed concrete trestle bridge at Roberts Lake. Bridge repair or replacement is recommended for all bridges except the span crossing Roberts Lake in Seaside. The 715-foot-long Salinas River Bridge would be replaced with a span bridge. The Tembladero Creek bridge would be constructed using pre-stressed, precast concrete girders supported on driven pile bents. Four smaller trestle crossings would be replaced using culvert structures.

Streets and Traffic Signals. With a few exceptions, the existing street crossing surfaces are in poor condition and need to be replaced. Each crossing would typically be constructed with a high durability pre-cast concrete crossing surface. Signals at adjacent intersections would be preempted to prevent waiting traffic from blocking the tracks. In most cases this would involve adding preemption to existing traffic signals. New signals with pre-emption would be constructed at Roberts Avenue in Monterey. Track intersections with cross streets would be controlled by gates for safety. Except as noted, the grade crossing warning devices need to be replaced with new equipment due to obsolescence.

No grade separations are proposed as part of this project; all points where the proposed LRT alignment is proposed to intersect local roadways would be at-grade. Most roadway crossings would be constructed with a high durability pre-cast concrete crossing surface.

Operations. Light rail transit service would operate between the cities of Monterey and Marina initially, with connecting bus service to Castroville and Salinas. At project start-up, 15 to 30-minute headways would be offered from 5:00 a.m. to 7:00 p.m., with less frequent service running to midnight. All train equipment would be interchangeable, thereby minimizing requirements for spare vehicles.

The Phase 1 light rail service is planned to run without train signals. Trains would be diverted to passing sidings with spring switches as described above. Some signals would be needed at track junctions and crossings. The signals proposed would consist of wayside signal masts at specific locations. At motorized turnouts, the signals would display the orientation of the switch points as set by the operator using the wayside push buttons. Automatic block signaling is an optional item.

Maintenance. A new layover facility for inspection and maintenance of LRT facilities is included as part of the proposed action. This facility would be constructed on the south (east) side of Highway 1, on TAMC/MST lands formerly used for Fort Ord quartermaster housing. Alternatively, this facility may be constructed on TAMC-owned land located west of Highway 1 and adjacent to the "balloon-spur" track. This facility, to be accessed via the Fifth Street undercrossing of Highway 1, would be fenced to minimize visual impact. The maintenance building itself would be set back 100 or more feet from the highway, and building height would be 45 feet or less. Parking lot space would be designed to accommodate approximately 50 vehicles.

Property Acquisition. Some property would need to be acquired as part of the proposed action. Property would be leased or acquired for the local track adjacent to the Union Pacific Coast Main Line. Property is also proposed to be acquired in association with development of park-and-ride lots at Casa Verde Way, Playa Avenue, and the Naval Postgraduate School (Sloat Avenue); and for local street circulation improvements near the Highway 1/Fremont Boulevard interchange in Seaside and Sand City.

Construction Considerations. The proposed action would require redevelopment of the previously-used railroad corridor, including work within cross-streets, to accommodate the rail line restoration. New LRT stations, parking lots, as well as street and drainage improvements would be constructed as part of the project. Station construction would involve platform development, then installation of components such as canopies, ticket vending equipment, drinking fountains, railings, lighting, signage, and station furniture. Construction of park-and-ride lots would involve subgrade preparation of the parking area, paving, and striping. Curbs, lighting, driveways, and sidewalks would be reconstructed as necessary, as well as landscape planting.

Because the LPA would be mostly aligned along an existing railroad right-of-way, very little earthwork is anticipated for this project. Pedestrian facilities involving earthwork would include walkways and recreational trail reconstruction at various locations where its current location conflicts with the proposed railroad track alignment. Local street circulation improvements would be constructed at the Highway 1/Fremont Boulevard interchange to ease traffic congestion.

Very little drainage improvements other than the repair or replacement of the four timber trestles and the improvements to or repair of the Salinas River Bridge would be needed. No major utility relocations have been identified along the corridor.

The recreation trail would be reconstructed at various locations where its current location conflicts with the proposed railroad track alignment. The locations of the relocated segments of the recreation trail were selected to minimize grade crossings of the track.

It is estimated that the construction duration for Phase 1 would be less than 12 months.

No-Build Alternative. With the No-Build Alternative it is assumed that rail service restoration would not occur within the study area. The No-Build Alternative would continue MST bus services as existing. This alternative includes Monterey-Salinas Transit (MST) Line 20 bus service from the Monterey Peninsula to Salinas. This service stops at the expanded Salinas Intermodal Transportation Center, where transfers can be made to the planned commuter rail service to the San Francisco Bay region, and/or to Amtrak's Coast Starlight and proposed Coast Daylight services. This alternative also includes a continuation of MST Line 55, Monterey–San Jose Express. Riders using this service can transfer to Caltrain commuter rail trains, Altamont Commuter Express trains, and Capitol Corridor intercity rail trains at the San Jose Diridon station.

3. DRAINAGE SYSTEM

3.1 Overall Hydrologic Conditions

Regional and local hydrologic conditions are described in the following paragraphs.

Soils. The Salinas Valley Ground Water Basin is a deep alluvial basin that was formed as the Salinas River meandered across the valley towards the Pacific Ocean. The Salinas River deposited fluvial sediments, and tributary streams that originate in the surrounding mountain ranges, deposited alluvial fan sediments. The Pliocene to Holocene water-bearing sediments comprises a sequence of interbedded sands, gravels and clays of at least 650 meters thick (Durbin et al, 1978). The Monterey County Soil Survey identifies the soils in this area with soil permeability ranges from 6 inches to 20 inches per hour. The estimated 100-year 24-hour rainfall depth for the area within California State University Monterey Bay's (CSUMB's) footprint is 6 inches, based on the Monterey County Department of Public Works Plate 25, Rainfall Intensities Chart. It can be shown that even under saturated conditions and given enough pervious area, all runoff generated within CSUMB may easily be percolated back into the ground within their property.

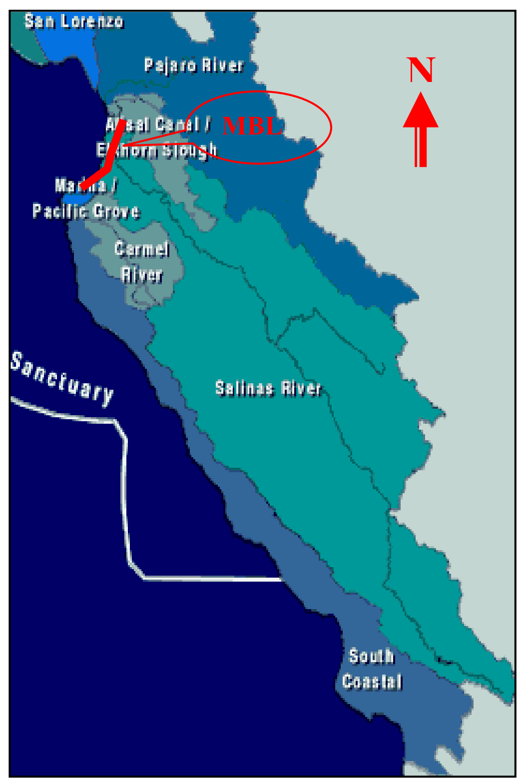


Figure 3-1 Salinas River Watershed

Surface Hydrology. The Monterey peninsula area is drained by numerous watersheds, or basins, that eventually consolidate at the Salinas River, Pajaro River, and Elkhorn Slough for release into Monterey Bay. The MBL lies within Salinas River Watershed as shown in Figure 3-1. Subwatersheds within the Salinas River Basin are described below.

Moro Cojo Slough. The Moro Cojo Slough subwatershed lies within the northernmost region of the Salinas River watershed. The watershed includes an area of approximately 17 square miles (CSU Sacramento, 2008) that drains to the south and west through Moro Cojo Slough to Moss Landing Harbor, and Monterey Bay.

Salinas River. The Salinas drainage basin is bounded on the south by the La Panza Range, on the southwest by the Santa Lucia Range, on the northwest by the Sierra de Salinas; and on the northeast by the Diablo Range and the Gabilan Range. The mountains that form the northeastern, northwestern, and southwestern margins of the basin slope steeply and are dissected by streams that have carved steep canyons into the valley walls. The southeastern margin is characterized by gently rolling hills and broad valleys.

To help increase the utilization of Salinas River flows for groundwater recharge and to provide flood control benefits, Nacimiento and San Antonio Reservoirs were developed and began operations in 1957 and 1967, respectively. These reservoirs have been operated to optimize Salinas River recharge by storing winter runoff and making releases in a timely manner during the irrigation season, when the potential for recharge is highest.

From Monterey northerly to Marina, runoff generally drains from east to west into Monterey Bay. Within the Salinas River Watershed the direction of flow is to the northwest. The Salinas River is the largest water system in the county, delivering approximately 282,000 acre-feet per year to the Pacific Ocean at Moss Landing.

Reclamation Canal. A series of ditches, known collectively as the Reclamation Canal, drain the area that stretches from just south of Salinas to Castroville. The Reclamation Canal watershed encompasses both rural and urban lands in northern Monterey County and a small portion of southern San Benito County (MCWRA, 2006). The canal flows to Tembladero Slough in the vicinity of Castroville.

Laguna Seca and Canyon del Rey. The Laguna Seca watershed is located between Monterey and Salinas. Surface flows in the watershed drain to the Salinas River or Monterey Bay. The Canyon del Rey watershed is relatively small and is located in the Seaside/Del Rey Oaks/Highway 68 Corridor (Monterey County, 2006).

The project site is located within the jurisdiction of the Central Coast Regional Water Quality Control Board (RWQCB), Region 3. As shown in Figure 3-2, from north to south the proposed alignment traverses the following Hydrologic Units and Planning Areas: the Bolsa Nueva Hydrologic Unit (HU); the Salinas HU Lower Salinas Valley Hydrologic Area 309.10; and the Salinas HU Monterey Peninsula Hydrologic Area 309.50 (RWQCB, 1994).

Groundwater. The Salinas Valley is an important agricultural area growing a variety of row crops, making it a multi-billion dollar industry. The area is strongly dependent on ground water as it accounts for more than 95% of the water used for irrigated agriculture, industrial and municipal purposes. Recharge to the groundwater basin occurs primarily from precipitation, return flows from irrigated lands, and stream recharge from the Arroyo Seco and Salinas River. It is estimated that stream recharge accounts for approximately half of the total basin recharge (MCWRA, 1997).

The Salinas Valley overlies a single common aquifer that is divided into four hydrologically interconnected subareas known as the Pressure Area, the East Side Area, the Forebay Area, and the Upper Valley Area. The Pressure Area is located near the coast and covers an estimated surface area of 342 square kilometers. In the Pressure Area, three stratified aquifers exist under confined conditions. These aquifers are known as the Pressure 180-Foot, the Pressure 400-Foot, and the Deep Zone and are comprised of permeable sands and gravels separated by confining clay layers. Recharge to the Pressure subarea occurs from surrounding unconfined units. (DWR, 2003).

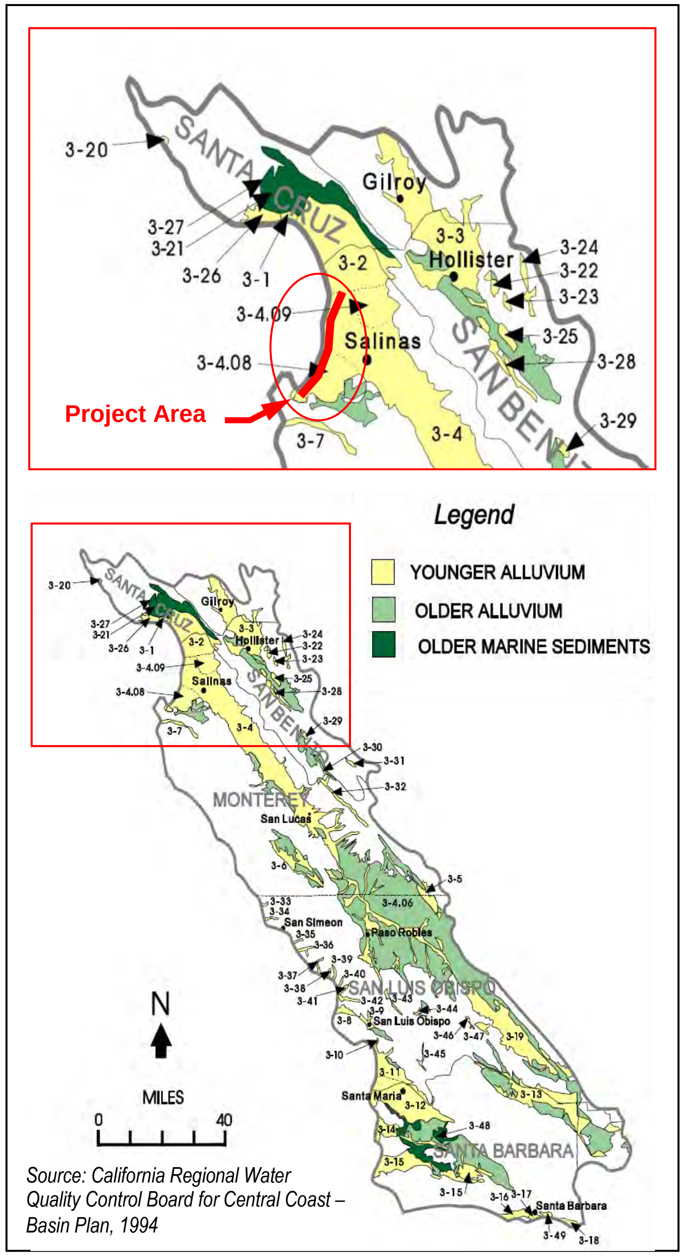


Figure 3-2. Groundwater Subareas for Salinas Valley Basin

Groundwater subareas for the Monterey Bay vicinity are shown on Figure 3-2. The project site crosses Subbasin 3-4.01 (180/400 Foot Aquifer Subbasin) and Subbasin 3-4.08 (Seaside Subbasin). Surface and groundwater basin boundaries are shown in Figure 3-3.

3.2 Existing Drainage System

The proposed site for the Castroville Station is on a slight ridge between Tembladero and Castroville Sloughs. The area south of Blackie Road drains into the Tembladero Slough.

Tembladero Slough forms the southwest side of the proposed Castroville Community Plan boundary and ultimately drains northwesterly to Moss Landing Harbor. The area north of Blackie Road drains to either the Tembladero or Castroville Sloughs. Castroville Slough is the tributary of Moro Cojo Slough, which discharges to the Monterey Bay via Elkhorn Slough. The Castroville Slough begins at a retention pond located on the east side of Castroville near the overpass of Highway 156 and railroad tracks. Both the Tembladero and Castroville Sloughs are influenced by tides, which in turn impact the storm drain system of Castroville (County of Monterey, 2004).

Extending south from the Salinas River to the aforementioned Laguna Seca/Canyon del Rey, there are very few defined drainage channels because the ground is characterized by sandy and highly permeable soils. Water courses that discharge to El Estero and Robert's lakes have been historically controlled in association with development activities, including construction of the original MBL facility.

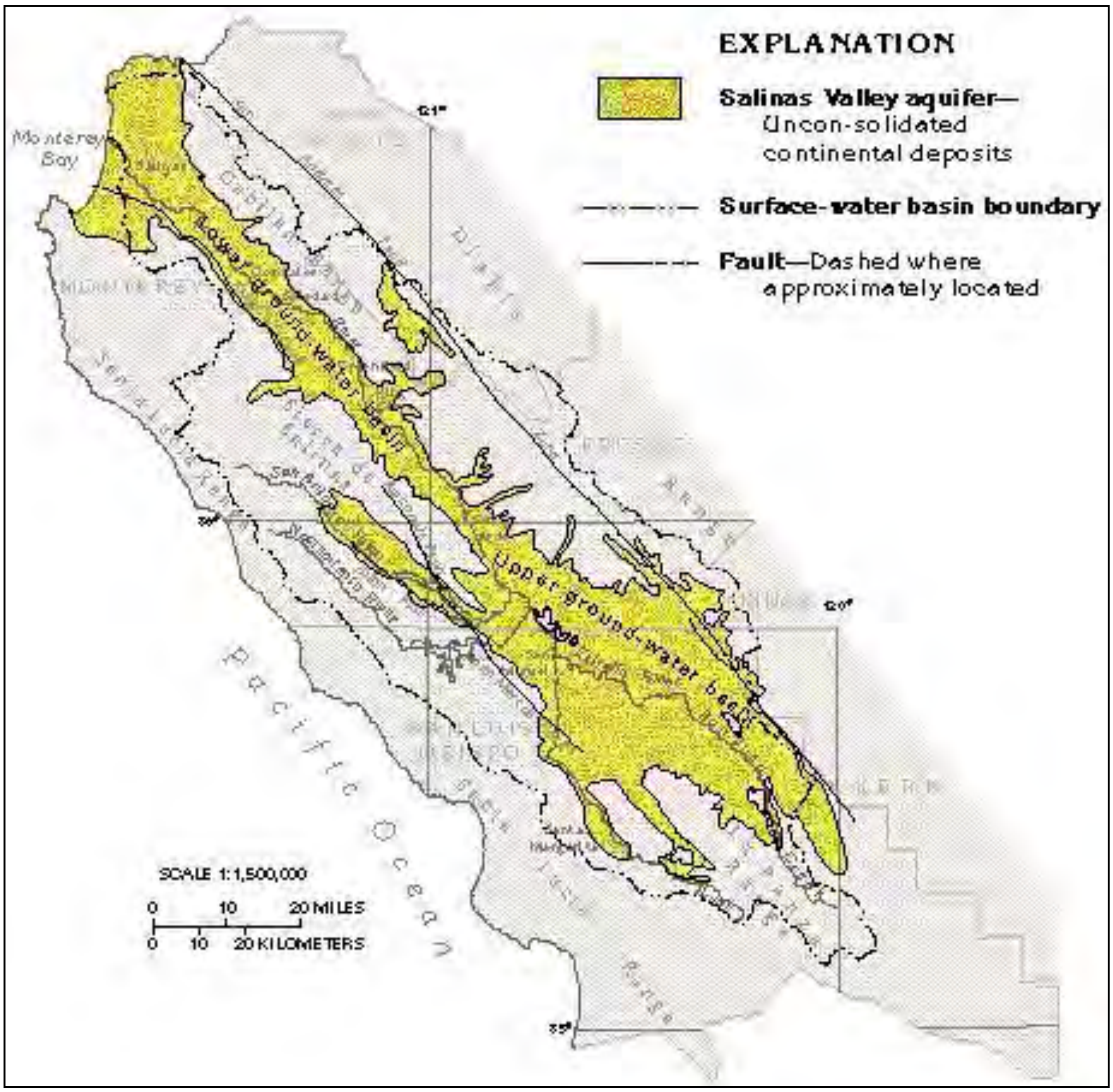


Figure 3-3 Salinas Drainage Basin

At this stage of the project, the drainage system within the MBL corridor has been identified by San Benito Engineering & Surveying, Inc from field investigations and record block maps provided by the respective agencies. A horizontal record of these facilities has been developed as well. No vertical information (i.e., as-built drawings, potholing) have yet been obtained. The list of existing known drainage facilities within the corridor is shown in Table 3-1.

Table 3-1 Known Utility Facilities within the Project Limits

Sheet No./ Improvement	Item	Station	Location/Description	Quantity (LF)
UT-2				
	24-inch storm	3+34	Transverse to tracks	20
	16-inch storm	15+94	Transverse to tracks	20
	Storm drain catch basin	15+94	Right side of tracks	N/A
UT-7				
	36-in storm	153+10 to 166+75	Parallel to tracks	21
UT-13(A)				
	36-inch storm	329+18	Slight diagonal to tracks	21
Del Monte Boulevard Improvements	Storm drain manhole	328+75		N/A
	24-inch storm	328+75	Diagonal to tracks (not cross)	65
	Storm	329+14	Diagonal to tracks (not cross)	39
	Storm	329+35	Diagonal to tracks (not cross)	49
UT-14(A)				
	12-inch CMP	359+14	Transverse to tracks	20
	8-inch water	359+66	Transverse to tracks	20
	24-inch storm	361+54	Transverse to tracks	20
	36-inch storm	432+09	Diagonal to tracks	44
	Storm	436+18	Transverse to tracks	35
	36-inch storm	455+17	Transverse to tracks	35
UT-20(A)				
	12-inch storm (not in use)	539+56	Transverse to tracks	20
	Storm	657+94	Transverse to tracks	35
UT-26(A)				
	24-inch storm	683+70 to 686+64	Diagonal to parallel to tracks	TBD

Sheet No./ Improvement	Item	Station	Location/Description	Quantity (LF)
	36-inch storm	686+64	Transverse to tracks	20
	storm	683+15 to 684+90	Diagonal to tracks(not cross)	TBD
UT-27(A)				
	Storm drain catch basin	715+95	Shown in topo left of tracks	N/A
	Storm drain catch basin	716+78	Shown in topo left of tracks	N/A
	Fire hydrant	714+86	Right of tracks	N/A
	Fire hydrant	721+11	Right of tracks	N/A
Casa Verde Way Track Crossing	Storm	721+13	Slight diagonal to tracks	21
	Storm drain	721+13	Slight diagonal to tracks	13
	Storm drain catch basin	721+19	Right of tracks	N/A
	Storm drain catch basin	721+66	Right of tracks	N/A
	Storm drain	722+04	Diagonal to tracks	31
Monterey WWTP Driveway Track Crossing	12-inch storm	735+51	Transverse to tracks	23
	12-inch storm	735+57	Transverse to tracks	23

SOURCE: San Benito Engineering & Surveying, Inc. 2009

Existing drainage facilities within the regional system either cross perpendicular to or run longitudinally along the rail corridor. The drainage systems crossing within the Transportation Agency for Monterey County (TAMC) right-of-way are located in easements from the TAMC with the respective utility owner.

3.3 Proposed Drainage System

The typical single ballasted track cross section is shown on Figure 3-4 while a typical double track ballasted track cross section is shown on Figure 3-5. Since the center of the track is the high point, runoff percolates into the ballast to the compacted sub-ballast, where it flows longitudinally towards the swales on both sides of the tracks.

The typical retained track cross section is shown in Figure 3-6. Figure 3-7 shows a typical ballasted double track section at an underpass. For these track types, an underdrain is proposed to be installed at both ends of the retained track. Since the center of the track is the high point, runoff percolates into the ballast to the compacted sub-ballast, where it flows longitudinally towards the far end and into the underdrains. The underdrain is connected to the outside drainage system to a runoff discharge point.

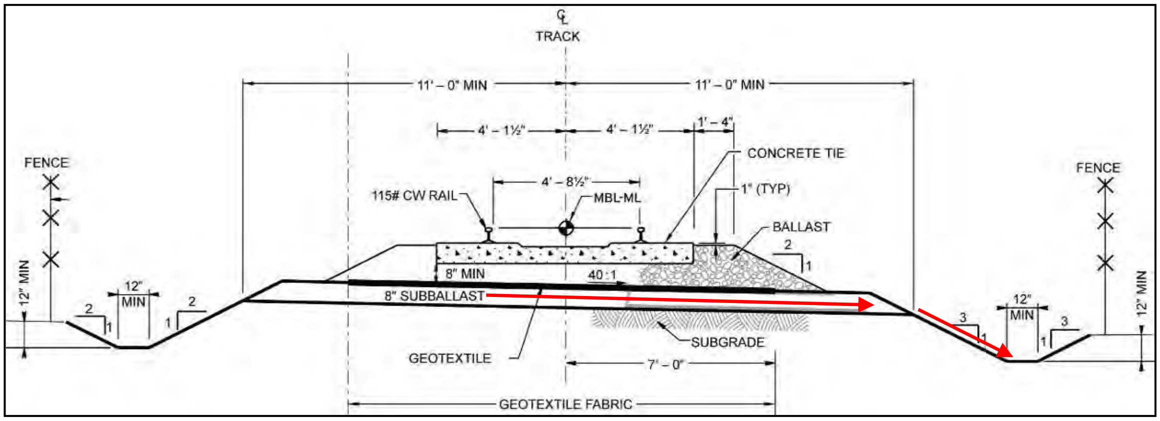


Figure 3-4 Single Track Ballasted Track Cross Section

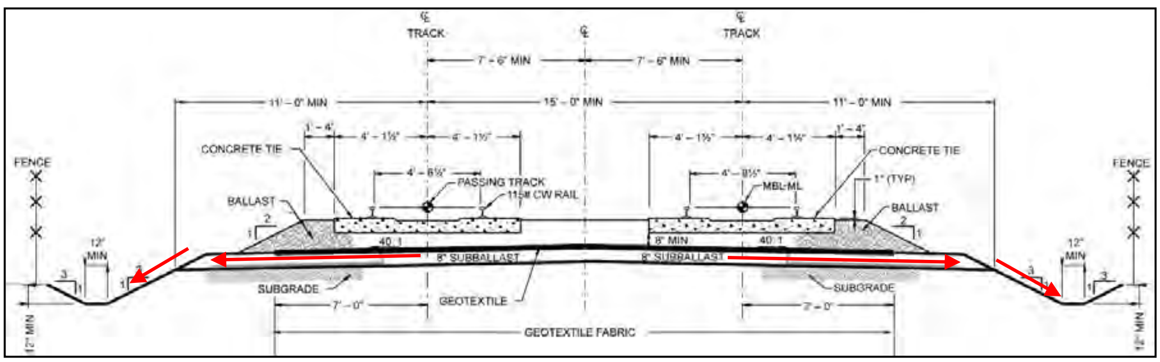


Figure 3-5 Double Track Ballasted Track Section

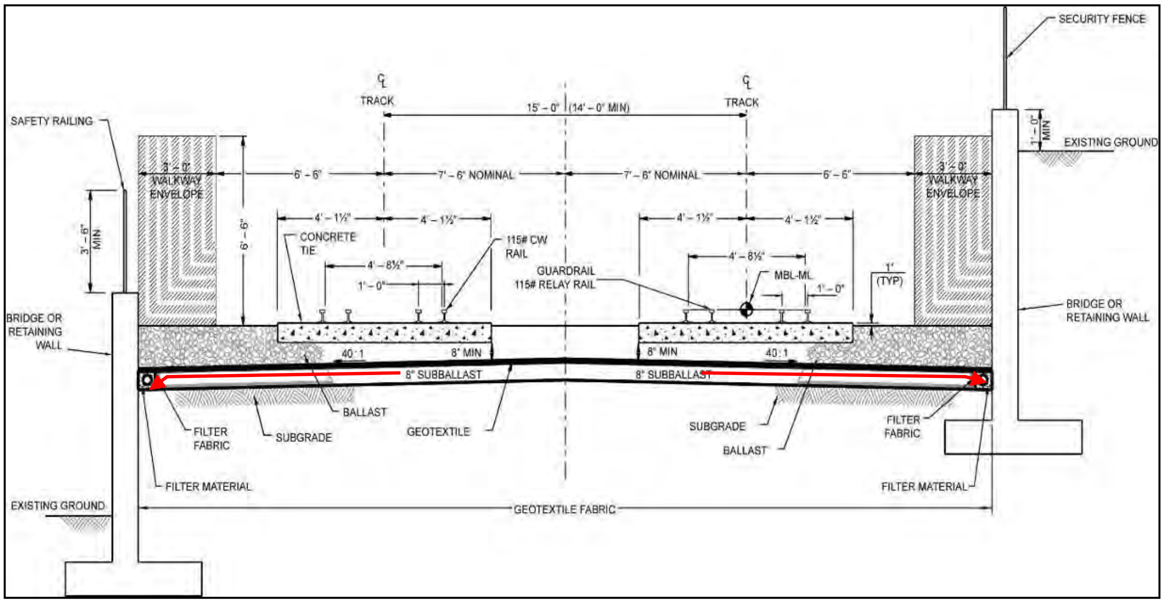


Figure 3-6 Typical Retained Track Section—Tangent

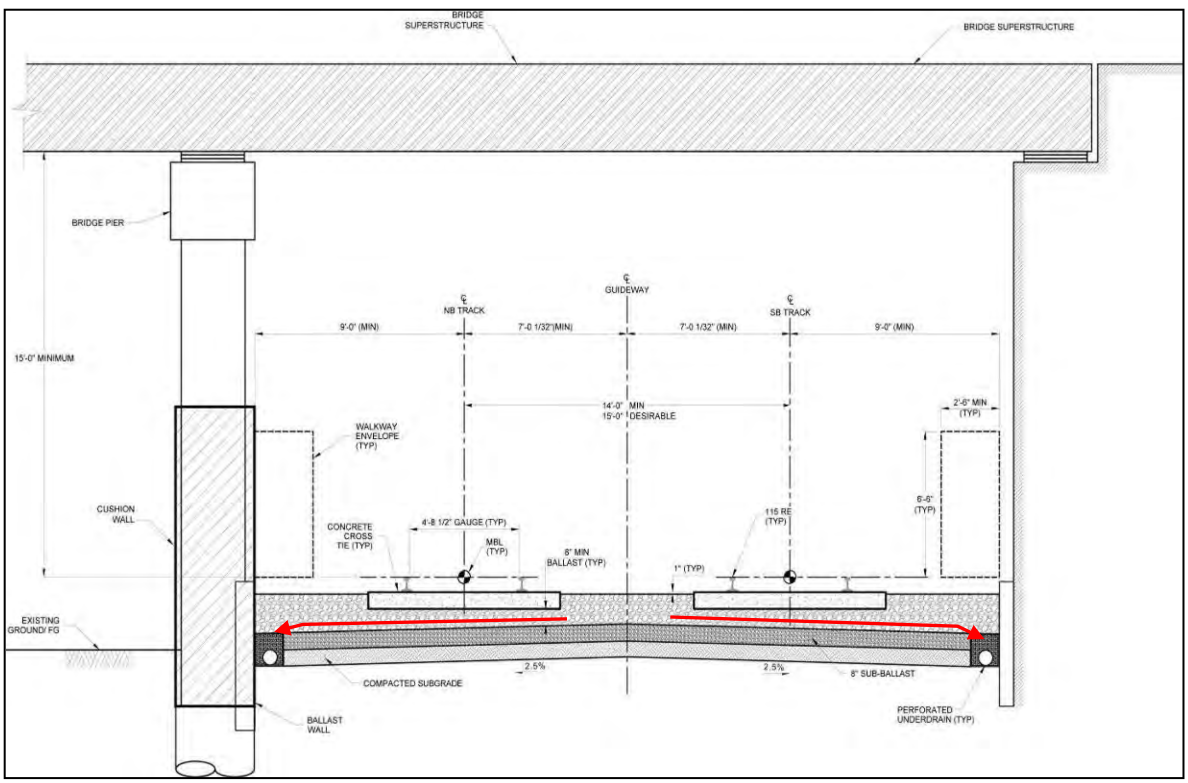


Figure 3-7 Ballasted Double Track Section at Underpass

3.4 Impacts on Existing Drainage System

The vast majority of improvements within the 15.2-mile-long project site would involve only minor increases in impervious surfaces. Since the project entails upgrading of the existing MBL line, pre- and post-project drainage conditions would be similar. It is anticipated that existing drainage flow patterns would be only slightly modified with the project. There would be increases in impervious surfaces at several of the proposed 12 stations along the alignment. New and replacement bridge and culvert crossings would be designed to accommodate storm event flows without increasing upstream water surface elevations. Specific drainage system upgrades will be determined during the project design stage. Best management practices (BMPs) will be included in the project for station waiting platforms (e.g., trash receptacles) and parking lots (e.g., landscaped swales). The project will be designed so that runoff from the station sites would not exceed pre-project conditions. Given these considerations, there would be no permanent hydraulic impact to the drainage network associated with the proposed project.

4. FLOODPLAINS WITHIN SALINAS RIVER WATERSHED

4.1 Pre-Project Conditions

There are two ordinances that regulate floodplain development in Monterey County. Countywide Floodplain Ordinance No. 3272 includes the minimum FEMA requirements for participation in the regular phase of the National Flood Insurance Program and has been codified in Chapter 16.16 of the County Code. Development within Special Flood Hazard Areas (i.e., within 100-year floodplain, within 200 feet of a river, or within 50 feet of a watercourse) is subject to permit review by the Monterey County Floodplain Administrator. As defined in the County Code, development means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations (County of Monterey, 2009).

In general, a floodplain cannot be altered in any way until it has been shown that such alteration will pass the base flood without significant damage to either the floodplain or surrounding property. No bridge abutments or embankment shall encroach on a regulatory floodway.

Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) were reviewed to identify the locations of 100-year floodplains within the area. FIRMs for the project site with alignment shown in red color are provided as Figures 4-1 through 4-10. Several miles of the 15.2-mile project corridor are located within or adjacent to 100-year floodplains. The most substantial encroachments into the 100-year floodplain occur at the following locations: on both sides of Tembladero Slough and the Salinas River; south of Roberts Lake; north of Del Monte Lake; and north of El Estero Lake.

FEMA designates Special Flood Hazard Areas according to zones. The Base Flood Elevation is the water-surface elevation of the 1% annual chance of flood. The zones are described as follows:

Zone A – No Base Flood Elevations determined

Zone AE – Base Flood Elevations determined; areas having a 1 percent chance of being exceeded in a given year

Zone AO – Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet

Zone X – Areas with minimal flood hazard located between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood

Zone V – Areas along the coastline subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves; detailed hydraulic analyses have not been performed and no base flood elevations or flood depths have been prepared

Zone VE – Areas along the coastline subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves; detailed hydraulic analyses have been performed.

A description of surface water hydrology within the project area is provided in Section 3.1 above. Specific site drainage characteristics pertaining to individual project segments are described from north to south in Appendix A. As shown on Figure 4-1, the segment from the beginning of MBL near Blackie Road southerly to the Salinas River traverses land designated both as Zone X and Zone AE. The corridor crosses Tembladero Slough just south of the SR 183 crossing. Farther south, as shown on Figure 4-2, the alignment traverses Zone AE floodplain associated with both Tembladero Slough (north of Nashua Road) and the Salinas River (South of Nashua Road). Within this area the MBL traverses about 2.5 miles of land affected by 100-year storm event flows.

Moving south and traversing the City of Marina and adjacent unincorporated land, there are isolated patches of flood-prone land designated both Zone AE and Zone X. As shown on Figure 4-3 however, most of the existing MBL appears to be elevated above these scattered flood-prone areas. Near Reindollar Avenue, about 300 feet of the MBL is in vicinity of the Flood Zone AE as shown on Figure 4-4.

From 1st Street to Olympia Avenue, in and adjacent to the City of Seaside, the MBL represents the western boundary of Flood Zone X as shown on Figures 4-5 through 4-8. From Olympia Ave to the east end of Roberts Lake, the MBL is located within Flood Zone X, as shown on Figure 4-7. The rail corridor both in the vicinity of Roberts Lake and across Canyon Del Rey is designated as Flood Zone AE for a distance of about 0.25 mile.

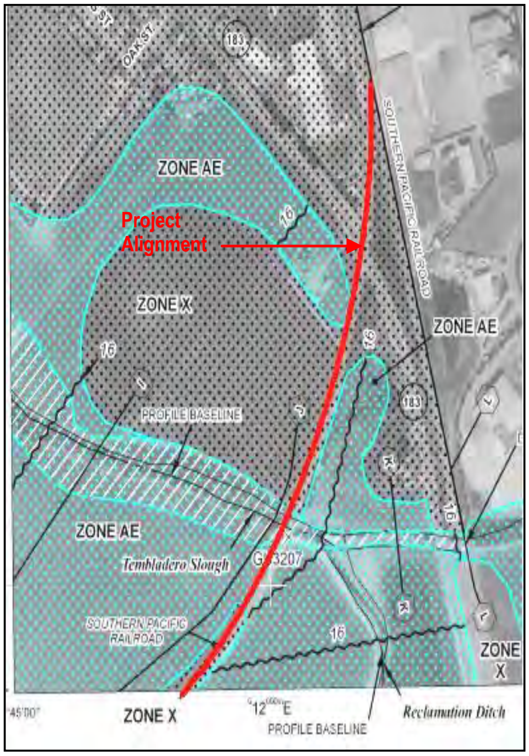


Figure 4-1 Flood Map 06053C0088G

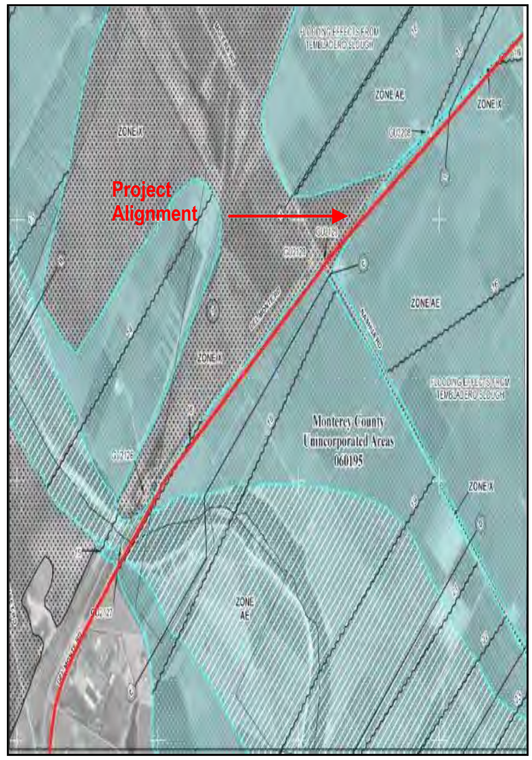


Figure 4-2 Flood Map 06053C0185G

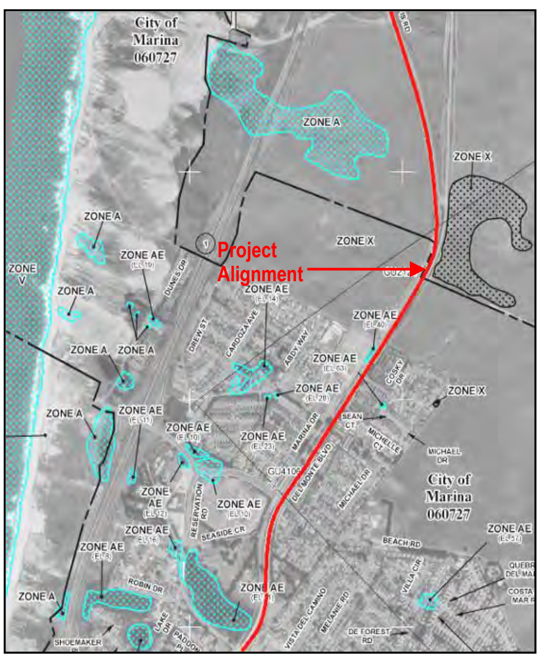


Figure 4-3 Flood Map 06053C0185G

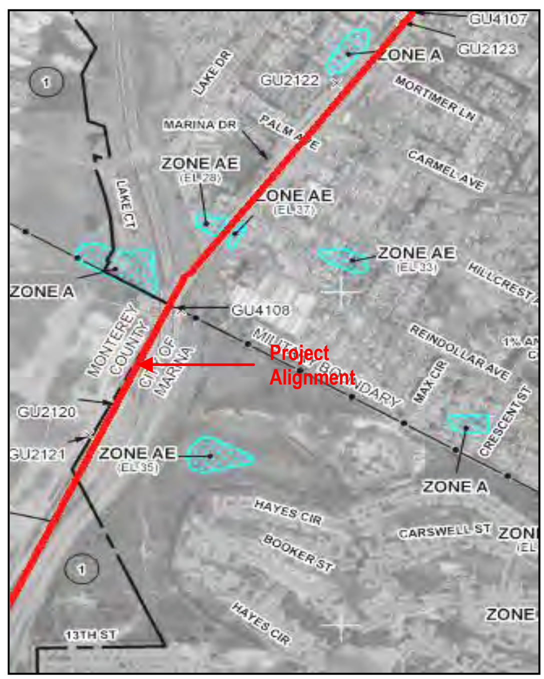


Figure 4-4 Flood Map 06053C0195G

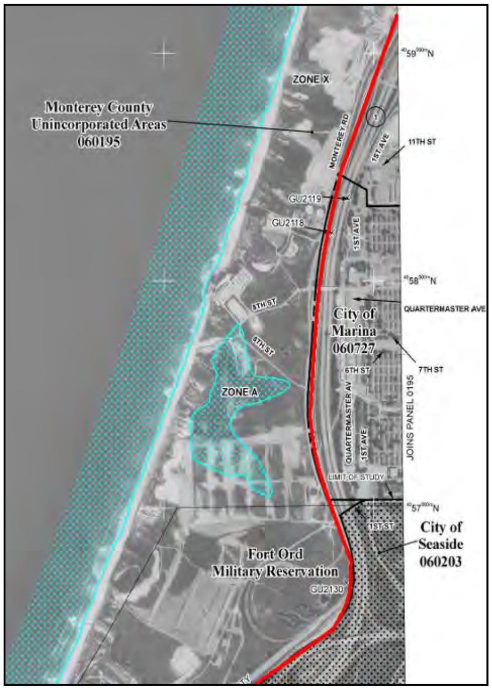


Figure 4-5 Flood Map 06053C0190G-1

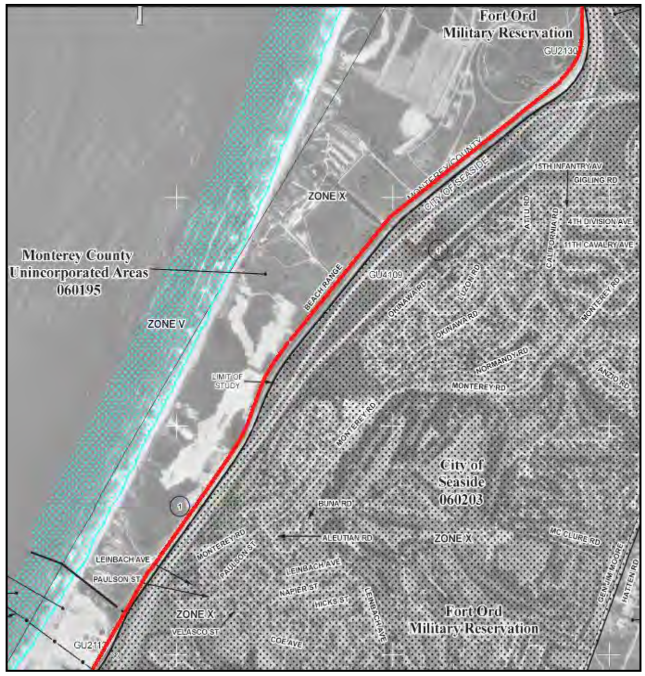


Figure 4-6 Flood Map 06053C0190G-2

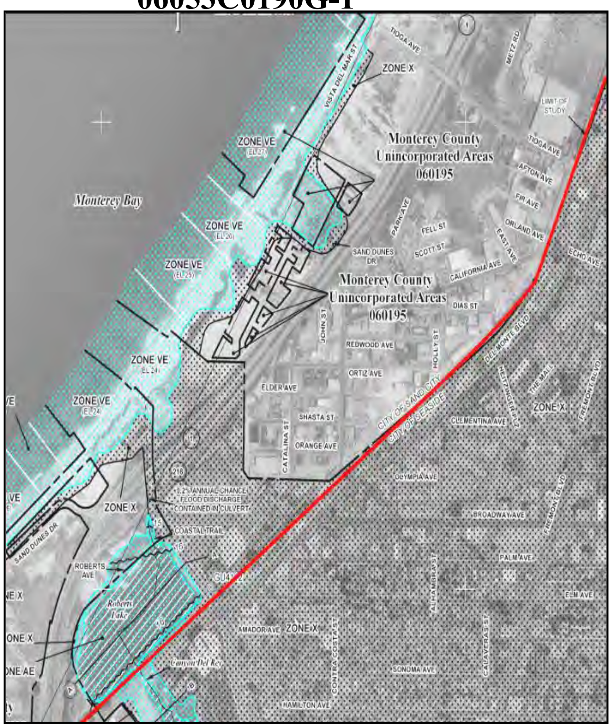


Figure 4-7 Flood Map 06053C0326G

Figure 4-8 Flood Map 06053C03270G

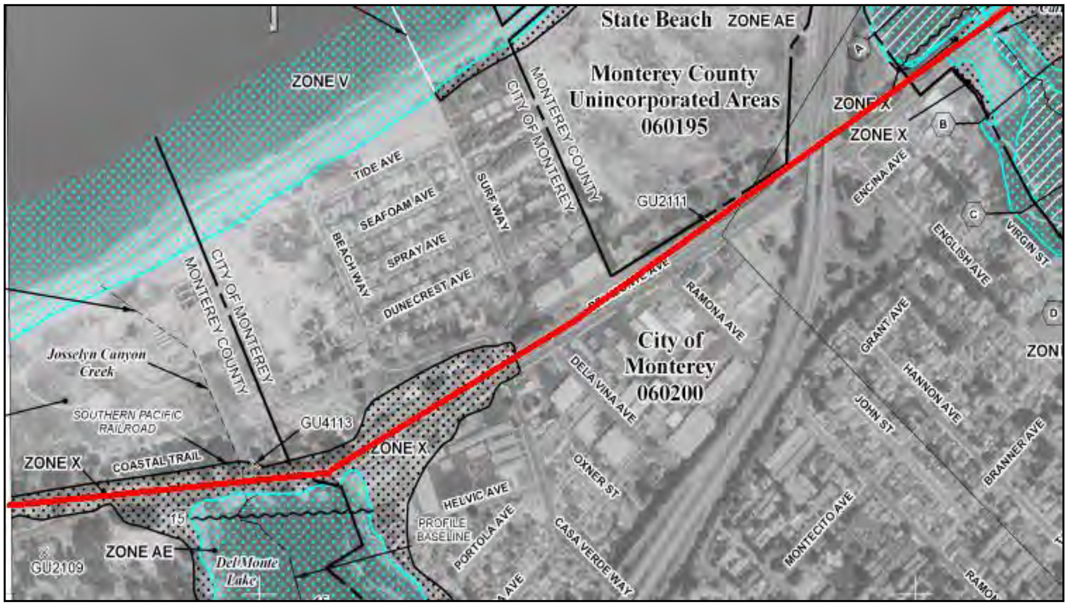


Figure 4-9 Flood Map 06053C0326G

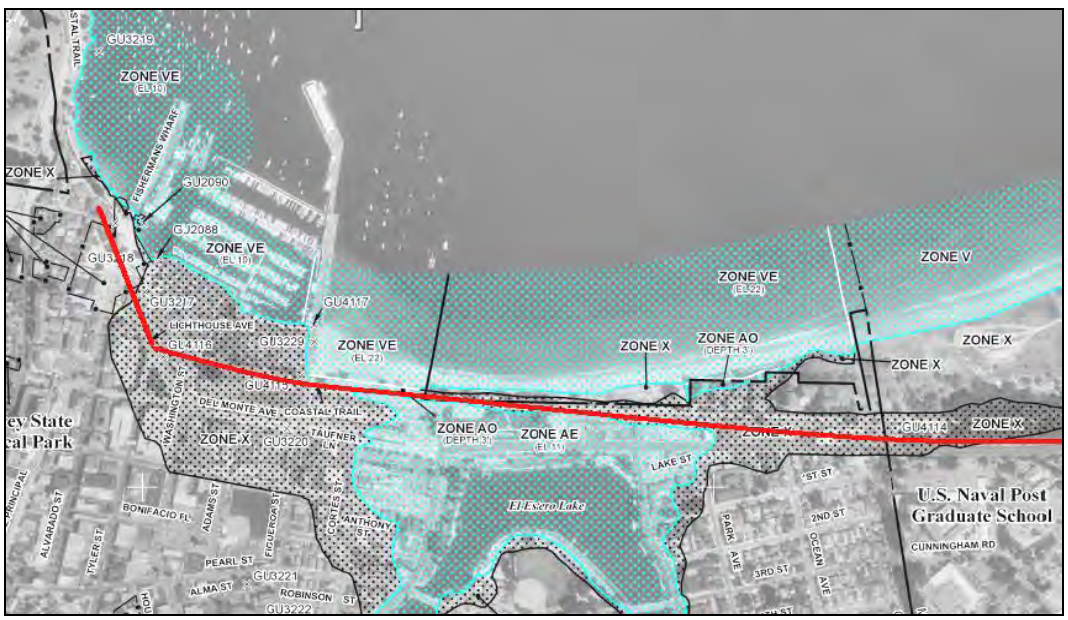


Figure 4-10 Flood Map 06053C0307G

Figures 4-9 and 4-10 show the alignment from Casa Verde Way in the City of Monterey westerly to the project terminus at Fisherman's Wharf. Here, the alignment is predominantly located within the Flood Zone X. The area where the corridor traverses across El Estero Park for 0.40 mile from Park Avenue to Cortes Street is either within or adjacent to Flood Zones AE and AO as shown in Figure 4-10.

4.2 Post-Project Conditions

Regulations governing the National Flood Insurance Program (23 CFR 650, Subpart 6A Section 650) were used as guidance for the evaluation of floodway impacts, which focuses on FEMA-defined floodways. Section 650.111 calls for location hydraulic studies to be performed with detailed engineering design drawings, and lists five location considerations to be examined for floodplain encroachments:

1. Risks associated with implementation of the action.

2. Impacts on the natural and beneficial floodplain values.

3. Support of incompatible floodplain development.

4. Measures to minimize impacts associated with the action.

5. Measures to restore and preserve the natural and beneficial floodplain values impacted by the action.

Appendix G of the California Environmental Quality Act Guidelines contains guidance for determining impact significance with regard to floodplains. In this regard, the environmental analysis should determine if the project would:

1. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface water runoff in a manner which would result in flooding on- or off-site.

2. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

3. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

4. Place within a 100-year flood hazard area structures which would impede or redirect flood flows.

5. Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of failure of a levee or dam.

Impacts of the project with respect to the five federal location considerations and five CEQA criteria are considered in the following discussion. The No-Build Alternative would have no impact on floodplains because it would involve only continuation of existing bus services.

1. The risks associated with implementation of the action. The risks associated with the project are considered to be very low for several reasons. First, the floodplain areas affected by the project are already occupied by a railroad facility; hence, existing drainage patterns would be retained. Second, work within the 100-ft. right-of-way would predominantly entail retention of a use (i.e., railroad track) that, like existing conditions, will be permeable. Third, proposed station/stop, maintenance facility, parking lot, and passing track uses are all located either outside the floodplain or in Zone X. In addition, property protection measures as required by MCWRA, would be implemented prior to and during construction of any sites within the floodplain. The project does not include construction or modification of any levees or dams. With respect to the above CEQA criterion No. 5, given the above considerations, the proposed project would not be expected to expose people or structures to a significant risk of loss, injury or death due to flooding.

2. The impacts on natural and beneficial floodplain values. As described above, major floodplains within the project area are located across a 2.5 mile stretch between the Salinas River and Tembladero Slough. This area is proposed for existing facility (track and bridges) replacements only. Shorter floodplain crossings will occur at Roberts Lake and El Estero Lake in Monterey, and involve replacement track and recreational trail relocation. Track replacement for restoration of train service across floodplains would neither alter the existing drainage regime nor result in any new encroachments. In accordance with the National Flood Insurance Program's (NFIP's) no-rise requirements, all bridge replacements will be designed to ensure that there is no increase in water surface elevation upstream. Therefore the project would not impede or redirect flood flows. The project would beneficially include the removal of sediment from several clogged culverts within the existing railroad right-of-way. The project will incorporate both temporary and permanent BMPs as described in Section 5, Stormwater Quality. Given the above considerations, no long-term adverse impacts on natural beauty, outdoor recreation, aquaculture, natural moderation of floods, or water quality is anticipated. With respect to the above CEQA criterion No. 1, the proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface water runoff in a manner which would result in flooding on- or off-site.

3. The support of incompatible floodplain development. The proposed project would restore passenger rail service along an existing rail line, which as discussed passes through or adjacent to several areas of 100-year floodplain. The existing railroad and recreational uses within floodplains along the railroad right-of-way would be retained. While the proposed project could potentially induce development within the vicinity of the 12 planned stations, all of the stations sites are located in urbanized areas and either outside of FEMA-designated floodplain area or in Zone X above the

base flood elevation height. The design of the proposed facilities must conform to the requirements of the NFIP and policies established by the County Board of Supervisors, with the advice of the MCFCWCD. Pre- and post-project hydraulic modeling of the project stations located either partially or entirely within Zone X (i.e., Blackie Road, Playa Avenue, Contra Costa Street, Casa Verde Way and Sloat Avenue) will be prepared during final design to evaluate the impact of the station platforms on the water surface elevations in the floodplains. Each station platform must be constructed to be at least one (1)-ft. above the base flood elevation. New bridge structures planned within the floodplain as part of Phase 2 will likely reduce the distance between the lowest part of the bridge and the water course because the new bridge spans will be thicker than the ones replaced. This impact on flow capacity can be offset by removing accumulated sediment in the channels and/or through channel widening. With respect to the above CEQA criterion Nos. 3 and 4, given the above considerations, the proposed project would not increase the height or direction of flood flows due to the placement of structures within100-year flood hazard areas. Work within the project area should result in no substantial floodplain/floodway impacts.

4. <u>The measures to minimize floodplain impacts associated with the action.</u> At some locations (e.g., just south of Palm Avenue, see Figure 4-4) where the project corridor passes through narrow or isolated floodplains, TAMC will determine whether it is possible to avoid floodplain encroachment. In these areas, project designers will determine whether it is possible to adjust the locations of station platforms, recreational trails, and appurtenant railroad facilities. See response to items 2 and 3 above regarding use of modeling and appropriate design measures to ensure compliance with NFIP requirements and local floodplain policies. In this regard, all bridge replacements will be designed to ensure that there is no increase in water surface elevation upstream. Therefore, the project would not impede or redirect flood flows. The project would beneficially include the removal of sediment from several clogged culverts within the existing railroad right-of-way. The project will incorporate both temporary and permanent BMPs as described in Section 5, Stormwater Quality. This will include measures for passive control and treatment of stormwater runoff from stations/stops, maintenance facility, and parking lots before discharge to the local storm drain system. With respect to the above CEQA criterion No. 2, given the above considerations, the proposed project would not create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems.

5. <u>The measures to restore and preserve the natural and beneficial floodplain values impacted by the action.</u> The goal of hydraulic design for bridges and culverts is to convey surface and stream waters originating upstream of the drainage facility to the downstream side without causing objectionable backwater, excessive flow velocities,

excessive scour, or unduly affecting traffic safety. The hydraulic drainage design criteria contained in Appendix B have been developed to accomplish this goal.[1]

Culverts will be sized to accommodate the 100-year storm event with a time of concentration equal to the watershed time of concentration. The 100-year storm event should not overtop the embankment or headwall of the culvert. To the extent feasible, construction within designated floodplain areas will be scheduled to occur during the dry season. Erosion and sediment control practices will be implemented during construction, as discussed in the following section.

5. STORMWATER QUALITY

This section addresses existing water quality issues within the project region, as well as projected water quality impacts associated with the proposed project. Where appropriate, mitigation measures to offset potentially adverse impacts are recommended.

5.1 Beneficial Uses and Water Quality Objectives

Surface Water Quality. Through the California Porter Cologne Water Quality Control Act, each RWQCB is required to formulate and adopt water quality control plans, or basin plans, for all areas within the region. In addition, each RWQCB needs to establish water quality objectives to ensure the reasonable protection of beneficial uses and a program of implementation for achieving the water quality objectives within the basin. In California, the beneficial uses and water quality objectives are the State's water quality standards. Beneficial uses identified by the Central Coast RWQCB for water bodies within the study area are identified on Table 5-1.

Water quality objectives are the limits or levels of water quality constituents or the characteristics of a waterbody that are established for the protection of the aforementioned beneficial uses. Water quality objectives are either numeric limits or narrative objectives designed to ensure that bodies of water can support their designated beneficial uses. At concentrations equal to or greater than numeric objectives, constituents (or pollutants) are considered to have impaired the beneficial uses of the state's water.

Section 303(d) of the Clean Water Act mandates that states identify waters that do not meet, or are not expected to meet during the next listing cycle, applicable water quality standards after application of certain technology-based controls. Table 5-2 lists fresh water receiving bodies in the vicinity of the subject project that are listed by the State Water Resources Control Board (SWRCB) under Section 303(d) of the Clean Water Act. Pollutants identified (bacteria, nitrates, pesticides, sedimentation) reflect the agricultural nature of the Castroville region.

[1] State-of-the-art methods and procedures for the hydrologic analysis required to determine the severity and probability of occurrence of flood events are inherently ambiguous. Therefore, the drainage design criteria contained in Appendix B is provided for guidance only and is not intended to establish legal or design standards, which must be strictly adhered to.

Table 5-1 Beneficial Uses of Potentially-Affected Water Bodies

Waterbody	Basin Plan Uses[1]															
	MUN	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	NAV	COMM	AQUA	SHELL
Elkhorn Slough			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Moro Cojo Slough		X	X	X	X	X	X		X	X	X	X		X		X
Old Salinas River Estuary			X	X	X	X	X	X	X	X	X	X		X		X
Tembladero Slough			X	X	X		X		X		X	X		X		X
Robert's Lake	X		X	X	X	X	X							X		
Del Monte Lake	X		X	X	X		X							X		
El Estero Lake	X	X	X	X	X	X	X		X					X		
Salinas River Lagoon (N)			X	X	X	X	X	X	X	X	X	X		X		X

1. MUN = Municipal; GWR = Groundwater Recharge; REC1 = Water Contact Recreation; REC2 = Non-contact Water Recreation; WILD = Wildlife Habitat; COLD = Cold Freshwater Habitat; WARM = Warm Freshwater Habitat; MIGR = Migration of Aquatic Organisms; SPWN = Spawning, Reproduction and/or Early Development; BIOL = Preservation of Biological Habitats; RARE = Rare, Threatened or Endangered Species; EST = Estuarine Habitat; NAV = Navigation; COMM = Commercial and Sport Fishing; AQUA = Aquaculture; SHELL = Shellfish Harvesting

SOURCE: RWQCB 1994.

Total Maximum Daily Loads (TMDLs) denote the quantity of a pollutant that can be assimilated by a waterbody and still meet water quality objectives. TMDLs are also referred to as the loading capacity or assimilative capacity of the waterbody. Table 5-2 also shows the schedule for development of TMDLs.

Groundwater Quality. The water quality in the Salinas Valley basin is generally acceptable for most uses with dissolved solids generally less than 800 mg/liter (Planert and Williams, 1995). However, due to intensive agricultural practices and urban growth, the water needs of the northern Salinas Valley currently exceed the natural recharge of the underlying aquifer. In particular, pumping in excess of replenishment has gradually lowered the ground water table, resulting in a decreased pressure gradient in the confined portion of the aquifer near the coast. This condition causes a landward hydraulic gradient, thus inducing seawater intrusion. This effect has degraded the ground waters of the Pressure 180-Foot, and 400-Foot aquifers along the coastal areas of the valley. High chloride levels have rendered the seawater-intruded ground waters too salty for municipal and agricultural use.

Efforts to halt the advancement of seawater intrusion have been implemented by the local water resources agency charged with management of the ground water resources. Some of the measures in place designed to help with the seawater intrusion problem, for example include the implementation during the summer months of scheduled flow releases from two reservoirs located upstream on the Salinas River. The water releases are designed to augment the natural ground water recharge to the aquifers. Also, in lieu of

Table 5-2 Section 303(d) Listed Water Bodies

Name	Calwater Watershed	Pollutant/ Stressor	Potential Sources	Estimated Size Affected	Proposed TMDL Completion
Alisal Creek (Salinas)	30970093	Fecal Coliform	Agriculture Urban Runoff/ Storm Sewers Natural Sources Nonpoint Sources	7.4 miles	2007
		Nitrate	Source Unknown	7.4 miles	2007
Elkhorn Slough	30600014	Pathogens	Natural Sources Nonpoint Source	2034 acres	2015
		Pesticides	Agriculture Irrigated Crop Production Agricultural-storm runoff Agricultural Return Flows Erosion/Siltation Contaminated Sediments Nonpoint Source	2034 acres	2008
		Sedimentation/ Siltation	Agriculture Irrigated Crop Production Agriculture-storm runoff Channel Erosion Nonpoint Source	2034 acres	2015
Lower Salinas River	30917000	Fecal Coliform	Source Unknown	31 miles	2007
		Nitrate as Nitrate (NO3)	Source Unknown	31 miles	2019
		Nutrients	Agriculture	31 miles	2007
Tembladero Slough	30911010	Ammonia (Unionized)	Source Unknown	5 miles	2019
		Fecal Coliform	Agriculture Pasture Grazing-Riparian and/or Upland Urban Runoff/Storm Sewers Natural Sources	5 miles	2007
		Nutrients	Agriculture Iirigated Crop Production Agriculture-storm runoff Agriculture-irrigation tailwater Agricultural Return Flows Nonpoint Source	5 miles	2006

ground water, growers are now using recycled water to irrigate crops farmed near the coastal areas of the valley. The purpose of using recycled water is to reduce or cease ground water pumping near the coast. The reduction in pumping is expected to raise the ground water levels of the aquifer and thus, stop and/or reverse the movement of seawater intrusion by maintaining the ground water hydraulic gradiet seaward.

Seawater intrusion into the Pressure Subarea was occurring at an annual rate of approximately 14,000 AFY prior to initiation of operations of the Monterey County Water Recycling Projects (MCWRP). The MCWRP delivers recycled water as irrigation water for the Castroville Seawater Intrusion Project. As the MCWRP becomes fully operational, delivering approximately 13,300 AFY of recycled water, the annual rate of seawater intrusion is projected to decrease to approximately 8,800 AFY.

5.2 Water Quality Impacts and Mitigation

Anticipated pollutants generated from access and parking facilities associated with the project include heavy metals, organic compounds (e.g., petroleum hydrocarbons), sediments, trash and debris, and oil and grease.

The total disturbed area is estimated at approximately 75 acres, of which approximately 60 acres is expected to flow to ballasted track. The ballasted track acts as an infiltration trench. The ballast is rock underlain by a sub-base that drains to perforated plastic pipes located on the outer sides of the tracks. The perforated plastic pipes are surrounded by permeable material, making the system act as an infiltration trench. Water from the underdrains enters the local storm drain system that flows to the Pacific Ocean either directly or via the aforementioned water bodies.

Because of the nature of the light rail, there will be very few pollutants of concern. There is little potential for hydrocarbon contamination and trash/debris will be caught in the ballast. Placement of ballast and underdrains along the track actually reduces the impervious surface and would generally improve water quality since it acts as a 60 acre infiltration trench, approximately 1 foot deep (60 acre-ft of volume).

At each station/stop, treatment BMPs will be selected for removal of such pollutants and will mitigate any stormwater pollution that could be attributed to the proposed project. Proposed parking lots (either by TAMC or others) at the LRT Maintenance Facility, Blackie Road, Eighth Street, Playa Avenue, Casa Verde Way, Sloat Avenue, and Custom House Plaza are located on developed sites partially or totally covered with impervious surfaces. The parking facilities will be equipped with bio-swales or other BMPs depending upon site limitations. Locations for these facilities will be determined during the design stage of the project. Media filters in the storm drain system will also be considered. Other BMPs to be evaluated would include: infiltration basins or infiltration trenches; however, these may not be practical depending upon site-specific soil and groundwater considerations, or may require too much space for treatment in developed areas. Incorporation of BMPs into each site’s drainage system should result in improved water quality of runoff.

5.3 Evaluation of Best Management Practices

BMP Removal Efficiencies. BMPs are designed and implemented to reduce the discharge of pollutants from the storm drain system to the maximum extent practicable. Since this project comprises more than 5000 sq. ft. of paved surface, it falls into projects categorized as requiring BMPs to be used in the project. Permanent BMPs contained in the Monterey Regional Storm Water Management Program (County of Monterey, 2010) will be implemented as part of the project. Permanent treatment BMPs evaluated for the LPA are mentioned in Section 5.2, with a primary focus for this project on biofiltration swales. Landscaped swales are generally considered to have medium pollutant removal efficiency for sediment; metals; oil and grease; and organic compounds. For trash, biofiltration swales have low removal efficiency unless they are equipped with a grate or trash rack at the outlet. They have low removal efficiency for bacteria. Removal efficiencies are categorized as low (20 to 50 percent), medium (50 to 80 percent), and high (80 to 100 percent).

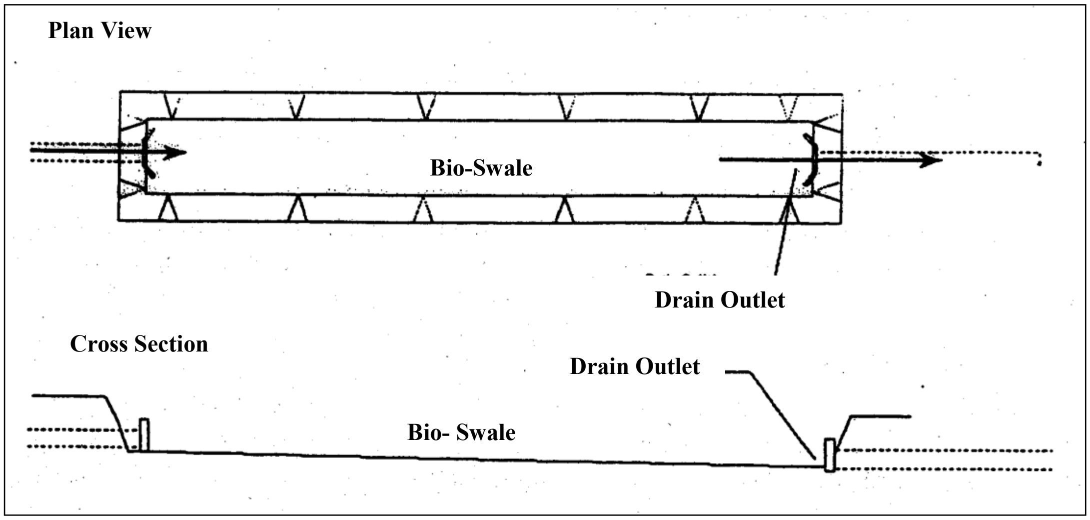
As the primary BMPs for the subject project, biofiltration swales are described in greater detail below.

Biofiltration Swales. Biofiltration swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Biofiltration swales can serve as part of a stormwater drainage system and can replace curbs, gutters, and storm sewer systems. Table 5-3 presents detailed descriptions of design concerns, while Figure 5-1 displays a bio-swale schematic.

Table 5-3 Biofiltration Swale Design Details

Description	Issues	Preliminary Design Factors
• Bio-swales are vegetated channels that receive and convey stormwater. • Treatment Mechanisms: – Filtration through the grass – Sedimentation – Adsorption to soil particles – Infiltration • Pollutants removed: – Debris and solid particles – Some dissolved constituents	• Site conditions and climate must allow vegetation to be established. • Flow velocities must be low enough to avoid scour. • Maintenance required to prevent excess vegetative growth.	• Bio-swales sized as a conveyance system (per Caltrans flood routing and scour procedures). • Bio-swale water depth as shallow as the site will permit. • No minimum dimensions or slope restrictions for treatment purposes with the exception of velocity constraints. • Vegetation mix should be appropriate for climate, aesthetic, and flow requirements.

Figure 5-1 Schematic of Biofiltration Swale



5.4 Temporary Construction Best Management Practices

While the project involves construction of an above-grade facility along an existing railroad corridor, there would be extensive grading and excavation required to develop the new track, install or move utilities, construct stations and parking lots, etc. This work would require exposure and stockpiling of soil, development of fill slopes, and minor alterations of drainage patterns. There would also be a temporary reduction in impervious surfaces at some station locations. Exposed soil and slopes could result in erosion and concentrated flow conveyance during storm events, resulting in on- and off-site erosion and downstream sedimentation into surface waters.

The water quality of the surface water courses could be degraded due to additional pollutant concentrations in runoff from the disturbed areas. Other potential sources of storm water pollution during construction include: delivery, handling and storage of construction materials and waste; spills and leaks from heavy vehicle equipment; staging areas for the use of paints, solvents, cleaning agents, metals, and other materials during construction; hazardous materials from demolition of existing structures; spilled concrete rinsate; and vegetation requiring irrigation with fertilizers and pesticides.

To minimize impacts associated with construction activities, temporary stormwater pollution prevention practices are required in accordance with the State of California NPDES General Permit for Storm Water Discharges associated with Construction Activities. Temporary BMPs contained in the Monterey Regional Storm Water Management Program (County of Monterey, 2010) will also be implemented as part of the project. The BMPs must be incorporated into a Storm Water Pollution Prevention Plan (SWPPP), which details the placement, staging, and monitoring of BMPs required for project construction. These include BMPs are designed to control discharges of pollutants from both stormwater and non-stormwater discharges.

General protection measures will be applied to the proposed project in accordance with the aforementioned General Construction Permit, the County Stormwater Management Program, and the project-specific SWPPP. These are typically required for soil stabilization and sediment control, non-stormwater management, and waste management.

The site designs would include erosion control measures to address site soil stabilization and reduce deposition of sediments in the adjacent surface waters. Typical measures include the application of soil stabilizers such as hydroseeding, netting, erosion control mats, rock slope protection, and others. During construction, other erosion control procedures would be applied such as the use of mulch on all disturbed areas, the use of fiber rolls along slopes, the use of silt fences at the boundaries of the construction site, stabilized construction entrances and exits equipped with tire washing capability, and check dams placed strategically to reduce flow velocity and to filter flows in defined drainage-ways.

Because the proposed project will be constructed over the Salinas River, Tembladero Slough, and other water courses, special construction BMPs are required to minimize the potential for debris deposition into these waterways. In accordance with the aforementioned NPDES General Permit for Construction Activities, potential BMPs for such activities include the following:

- Demolition and construction activities either within or over waterways should be limited to the dry season (April 1to October 31).
- Demolition should be accomplished using non-shattering methods that would normally scatter debris (e.g., wrecking balls will not be acceptable).
- Place platforms under/adjacent to bridges to collect debris.
- Provide watertight curbs or toe-boards on bridges to contain spills and prevent materials, tools, and debris from falling from the bridge.
- Secure all materials on the bridge to prevent discharges into the channel via wind.
- Use attachments on equipment, such as backhoes, to catch debris from small demolition operations.
- Stockpile accumulated debris and waste generated from demolition away from channels.
- Work areas within channels are to be isolated from the river or stream flows using sheet piling, K-rail, or other methods of isolation.
- Drip pans are to be used during equipment operation, maintenance, cleaning, fueling, and storage for spill prevention. Drip pans are to be placed under all vehicles and equipment on the bridge when expected to be idle for more than 1 hour.
- Keep equipment used in the channel leak-free.

- Direct water from concrete curing and finishing operations away from inlets and water courses to collection areas for dewatering.

- Convey groundwater discharge from dewatering operations for pile installation into an acceptable sediment containment bin or basin. Test and treat the contained water prior to discharge as per requirements set forth by the Central Coast RWQCB.

The SWPPP would emphasize the use of both source reduction and source control measures. Source reduction measures include preventative maintenance, chemical substitution, spill prevention, housekeeping, pollution prevention training, and materials management. Source control measures include materials segregation and covering, water diversion, and dust control.

With application, monitoring, and maintenance of these BMPs, water quality impacts associated with the project are not expected to be adverse.

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7. LIST OF PREPARERS

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APPENDIX A

SITE DRAINAGE CHARACTERISTICS

The following narrative describes the land use, floodplain terrain, and other drainage characteristics observed from a ground reconnaissance of the Monterey Branch Line.

From North Terminus to State Route 183

The project begins/ends just north of Blackie Road and runs parallel to a local street, Del Monte Road. The runoff from the street drains to the two storm drains at track station 3+34 as shown on sheet DR-01 at the end of this section.

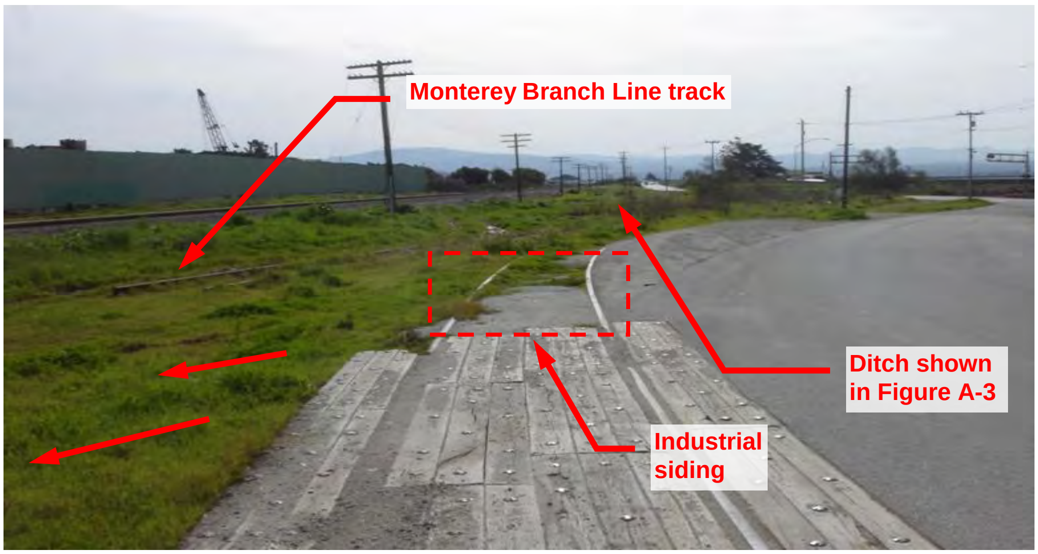


Figure A-1. Rail East of State Route 183 Looking South

Figure A-2. Ditch at the Southeast Corner of State Route 183 and Light Rail Looking North

Away from the street, the runoff from Del Monte Road drains east to the grassland and south to the culvert as shown in Figure A-1. The culverts drain to the ditch shown on Figure A-2 at the southeast corner of State Route 183.

The runoff near the track just north of State Route 183 drains east to the grassland and north to the culvert as shown in Figure A-3. There is ponding at the southeast corner of State Route 183 and the rail right-of-way as shown in Figure A-4.

Figure A-3. Drainage at Southeast Corner of State Route 183 and Rail Looking South

Figure A-4. Ponding at the Northwest Corner of State Route 183 and Rail

State Route 183 to Tembladero Slough

The grade crossing at Merritt Street (State Route 183) is shown in Figure A-5. The track will be embedded and the drainage at the grade crossing will be accommodated by the drainage of the roadway.

Figure A-5. Grade Crossing at State Route 183 Looking South

The runoff discharges to the ditch on the southeast as shown in Figure A-6. The ditch on the east drains south to the Tembladero Creek. West of the track is the agricultural field, and east of the ditch on the east side is a small ranch.

Figure A-6. Rail South of Merritt Street Looking South

The culvert at station 15+94 is shown in Figure A-7. The location of this culvert is shown in Figure A-8. Half of the culvert has been filled up and needs to be cleaned. The culvert carries runoff west to the ditch on the east, as shown in Figure A-8, and then discharges to Tembladero Creek.

The bridge over the Tembladero Slough at MP 111.05 is a 150-foot-long pile trestle, ballast deck timber bridge and is on a one degree curve as shown in Figure A-9. The bridge will be replaced with pre-stressed concrete girders on driven concrete piles with an increased length of 180 feet. The replacement will not affect the encroachment of the floodplain. At the rail bridge, the reclamation ditch flows westerly and joins the Tembladero Slough, which flows west as shown in Figure A-8.

Figure A-7. Culvert at Tembladero Slough

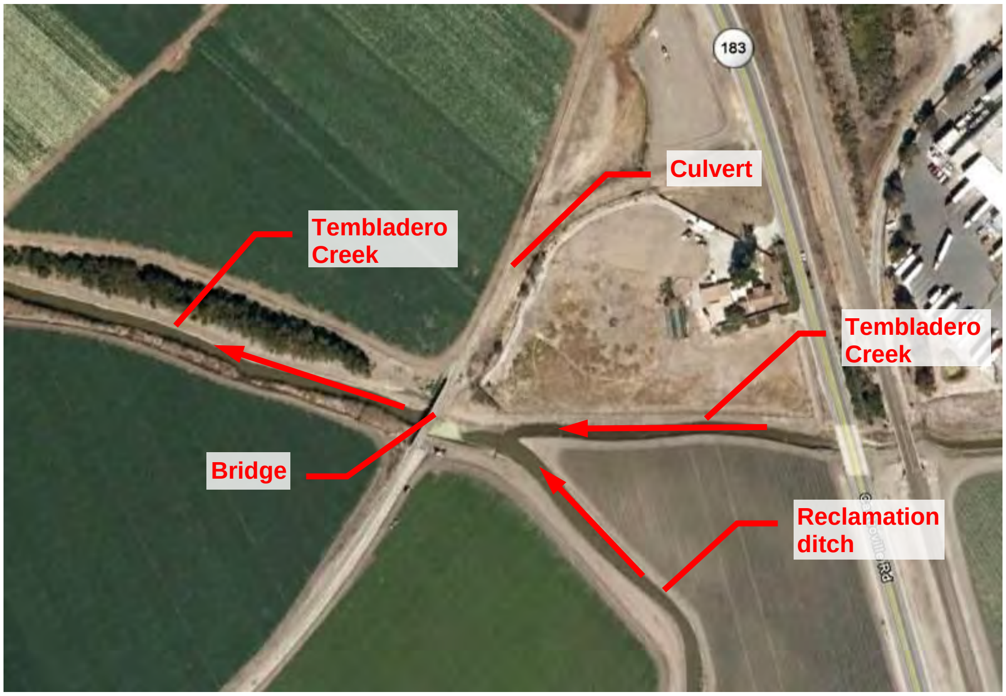


Figure A-8. Drainage Features near Tembladero Slough

Figure A-9. Bridge at Tembladero Creek

Tembladero Slough to Alisal Slough

South of Tembladero Creek, the east side of the track is lower than the west side, and the east side has a naturally formed ditch along the edge of the subballast as shown in Figure A-10. The track runoff flows off the center of the track, and flows north to the Tembladero Creek. There are ponding spots, especially when there is heavy farm equipment traffic as shown in Figure A-11. From Tembladero Creek to Alisal Slough, the track runoff drains off the center of the track and south to the Alisal Slough.

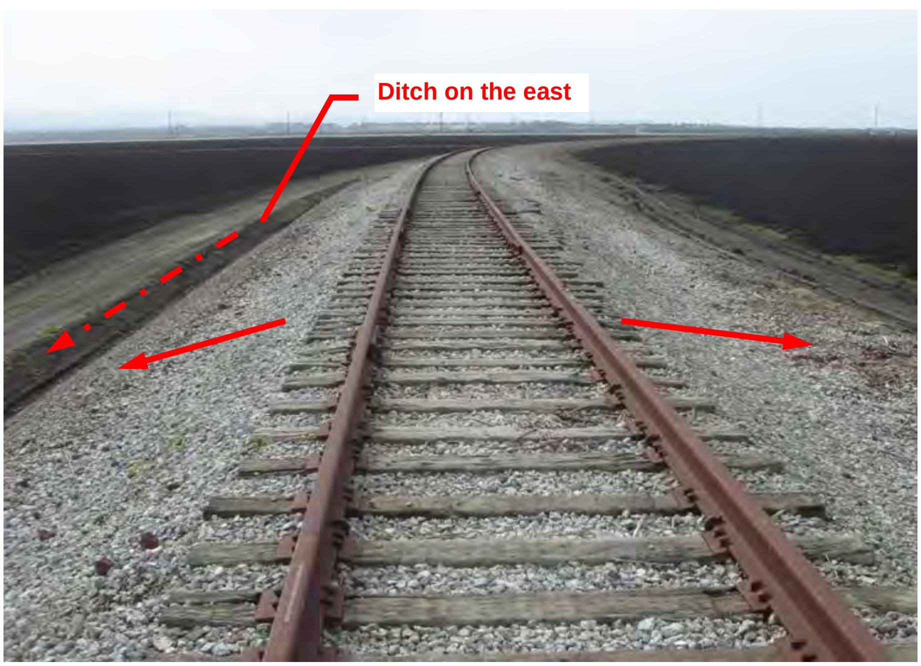


Figure A-10. South of Tembladero Slough Looking South

Figure A-11. Ponding along the Edge of Rail Looking South

At MP 112.54, as shown in Figure A-12, a timber trestle bridge crosses over the Alisal Slough. The overcrossing has been backfilled to remedy a mosquito abatement problem caused by the adjacent agricultural pump station. A culvert crosses under the embankment to convey water pumped from south of the track to the north into the Alisal Slough. Figure A-13 shows the cross-section at the embankment, and Figure A-14 shows the north side of the track, and the location of the pump station.

Figure A-12. Alisal Earth Embankment at MP 111.93

Figure A-13. Alisal Slough Looking East

Figure A-14. Alisal Slough North of the Track

Alisal Slough to Nashua Road

From Alisal Slough to Nashua Road, the track runoff drains off the center of the track and south to Alisal Slough. Figure A-15 shows the track looking east at Alisal Slough from Nashua Road. There is ponding on the north side of the track. The runoff travels off the center of the track and into the side ditches which have been filled by the adjacent land owners to create farm access unpaved roads. The elevation on the north side is much lower than that on the south side of the track. From Alisal Slough to Nashua Road, the track runoff drains off the center to the adjacent agricultural fields.

Figure A-15. Looking East from Nashua Road

Nashua Road to Bridge at MP 112.54

Figure A-16 shows the grade crossing at the Nashua Road. The runoff travels to the floodplain located south of Nashua Road. As shown in Figure A-17, south of Nashua Road, the elevation south west of the track is lower than that of the east side. Runoff drains away from the center of the track into the ditches on the sides, and drains south to the floodplain at MP 112.54.

Figure A-16. Crossing at Nashua Road Looking South

Figure A-17. Rail looking Southwest from Nashua Road

The existing bridge at MP 112.54 is a 120 feet long 8-span timber ballast deck trestle bridge over a drainage channel as shown in Figure A-18.

Figure A-18. Bridge at MP 112.54

From Nashua Road to track station 98+00, and from track station 98+00 to 111+23.29, the track runoff drains off the center and into the ditches on both sides, and to the low area around track station 98+00 (MP 112.54) as shown in Figure A-18. A culvert drains the runoff west to the ditch on the northwest side of Monte Road as shown in Figures A-19 and A-20. The ditch then connects to the Salinas River via a ditch along the Cabrillo Highway (State Route 1) as shown in Figure A-21. The existing bridge at MP 112.54 will be replaced with an earth embankment and a concrete culvert.

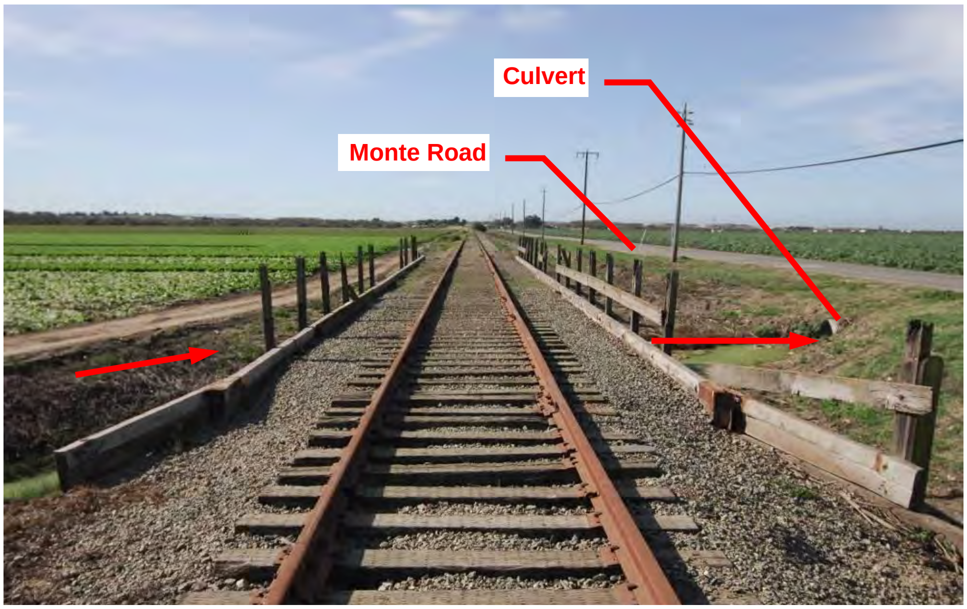


Figure A-19. Track at MP 112.54 Looking North

Figure A-20. Culvert at MP 112.54

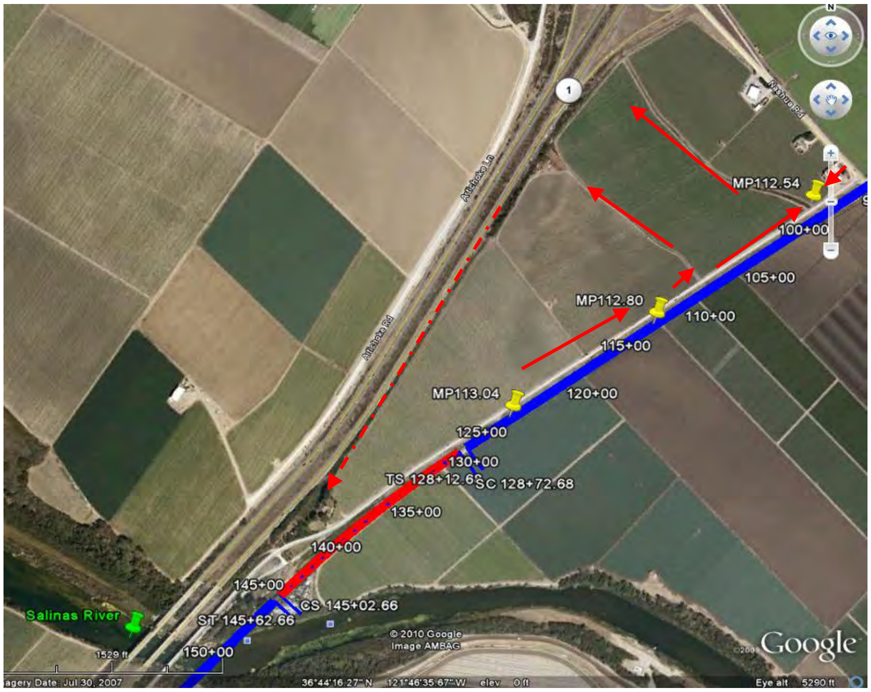


Figure A-21. Drainage at MP112.54

Bridge at MP 112.80

The existing floodplain equalizer at MP 112.80 is a 225-foot-long, 15-span timber ballast deck trestle bridge over the low area as shown in Figures A-22 and A-23. From track station 114+00 to track station 124+00 (MP 113.04), the track runoff drains off the center of the tracks and drains to the low area at track station 124+00 (MP 113.04); the low area then drains north to the ditch north of Monte Road via the culvert at Monte Road as shown in Figure A-24. The runoff drains north along the swale to the ditches around track station 108+00, and track 98 (MP 112.80) as shown in Figure A-21.

Figure A-22. Floodplain Equalizer Trestle Bridge at MP 112.8

Figure A-23. Ponding at Equalizer Trestle Bridge at MP 112.8

The existing bridge will be replaced with an earth embankment and a concrete culvert. The low area will be filled and be graded sloped north so that there will be no standing water and runoff will drain north to the two ditches.

Figure A-24. Culvert at Monte Road

Bridge at 113.04

The floodplain equalizer at MP 113.04 is a 90-foot, 6-span timber ballast deck trestle bridge as shown in Figures A-25 and A-26. From track station 125+00 to track station 146+00 (Salinas River), the track runoff drains off the center and to the ditch between the track and Monte Road. The runoff that does not percolate into the ground eventually drains to the two ditches on the north. The bridge will be replaced with an earth embankment with a concrete culvert. The low area will be filled to eliminate the standing water.

Figure A-25. Floodplain Equalizer Timber Trestle Bridge at MP 113.04

Figure A-26. Ponding at the Floodplain Equalizer at MP 113.04

There is ponding just north of the Salinas River as shown in Figure A-27. Proper grading will improve the overall drainage condition and eliminate the standing water at this location.

Figure A-27. Ponding at Low Area North of the Salinas River

Salinas River Bridge

The Salinas River Bridge is shown in Figure A-28. Typical land use in the vicinity of the bridge is shown in Figure A-29.

Figure A-28. Salinas River Bridge

Figure A-29. Land Use at Salinas River

North and South Dole Entrances

From 153+00 to track station 168+00 (North Dole entrance), the track runoff drains off the center of the track and drains to the grass swales along the track on both sides. Figure A-30 shows a picture of the North Dole entrance grade crossing. Ponding between the North Dole and South Dole entrances, as can be seen in Figure A-31, is caused by the low elevation of the land. Proper grading will address the drainage issue and eliminate the standing water at this location.

Figure A-30. North Dole Grade Crossing

Figure A-31. Ponding between South Dole and North Dole Entrances

From track station 168+00 (North Dole entrance) to Del Monte Boulevard, the track runoff drains off the center and into the two swales on both sides. The runoff that does not percolate into the ground drains north along the swales. Figure A-32 shows the grade crossing at South Dole. A typical cross-section is shown in Figure A-33.

Figure A-32. South Dole Grade Crossing

Figure A-33. Drainage South of Lapis Road

The grade crossing at Lapis Road is shown in Figure A-34. From Lapis Road to track station 246+00, the track runoff drains off the center into the side ditches along the track. The runoff that does not percolate into the ground drains north along the swales on both sides. The typical cross-sections around Lapis Road and Del Monte Boulevard are shown in Figures A-35 and A-36.

Figure A-34. Lapis Road Grade Crossing

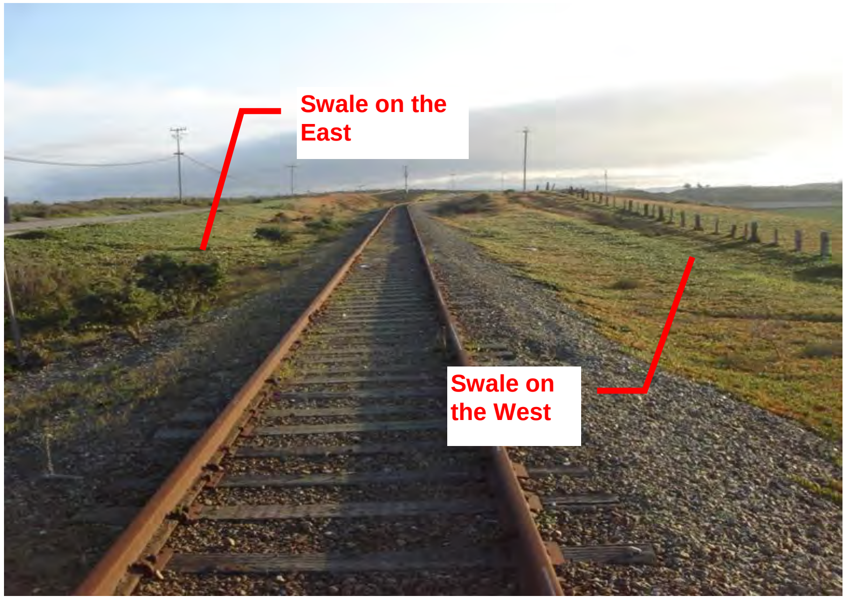


Figure A-35. Drainage Looking South around Lapis Road

Figure A-36. Land Use Looking North at Del Monte Boulevard

North of track station 246+30.80, the track runoff drains north. South of track station 246+30.80, the track runoff drains south. Around track station 265+00, there is a low elevation in Lapis Road as shown in Figure A-37. There may be drainage issues at this location for Lapis Road, but this will not affect the track drainage. From track station 246+30.80 to track station 272+47.02 the track runoff drains off the center and into the low point at track station 260+56.83.

Figure A-37. Low Elevation Area on Lapis Road around Station 256+00

Marina Green Drive

From track station 272+47.02 to track station 306+21.55, the track runoff drains off the center and to the swales on both sides. The runoff that does not percolate into the ground drains into the low point at track station 283+61.28. Figure A-38 shows the Marina Green Drive grade crossing around track station 280+00. The runoff drains south before 283+61.28, and into the ditch around 283+61.28 as shown in Figure A-39. A culvert directs the runoff from north to south to the ditch in the south east corner of Marina Green Drive and the track as shown in Figure A-39.

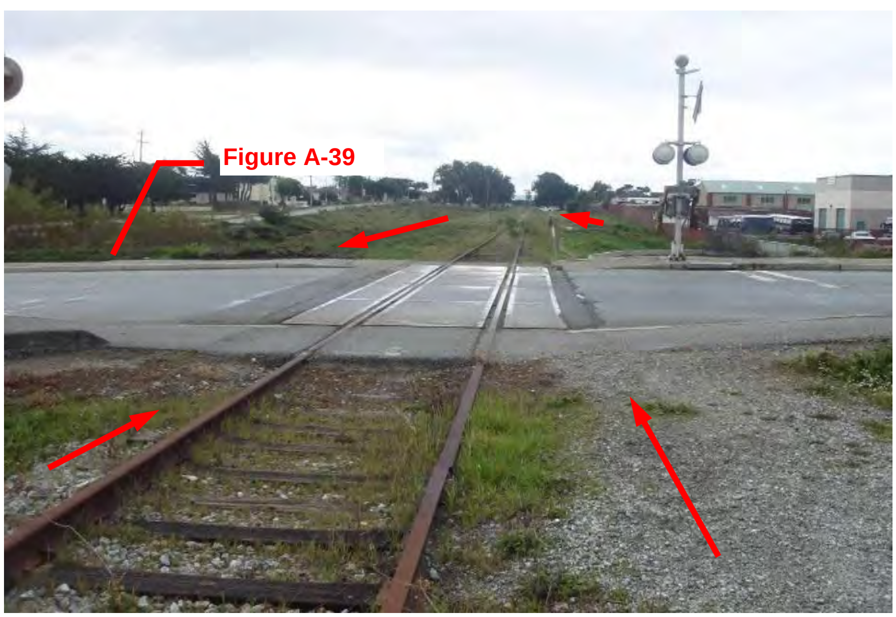


Figure A-38. Marina Green Drive Grade Crossing Looking South

Figure A-39. Swale at the Southeast of Marina Green and Rail with a Culvert

Beach Road to Palm Avenue

From Marina Green Drive to Beach Road, the land use around the track is residential and light industrial. From track station 306+21.55 (Beach Road) to 350+85.90 (Palm Avenue) the track runoff drains off the center and into the grass swales on both sides. The runoff that does not percolate into the ground drains off to the lake at Locke-Paddon Park at Reservation Road near track station 330+28.58. Figure A-40 shows the grade crossing at Beach Road. Figure A-41 shows the track north of Reservation Road, while Figure A-42 shows the track south of Reservation Road.

Figure A-40. Northerly View at Beach Road Grade Crossing

Figure A-41. Track at Reservation Road Looking North

Figure A-42. Reservation Road Looking South

Palm Avenue to State Route 1 Overpass

Figure A-43 shows the grade crossing at Palm Avenue. From 350+85.90 (Palm Avenue) to 381+20.72 (south of State Route 1 overpass), the track runoff drains off the center of the track, draining to the ditches on both sides. The runoff that does not percolate into the ground drains to the low point at track station 360+52.86 as shown on Figure A-44.

Figure A-43. Westerly View at Palm Avenue Grade Crossing

Figure A-44. Looking North from the Northern State Route 1 Overpass

Figure A-45 is a photograph looking north toward the State Route 1 overpass.

Figure A-45. Land Use Looking North toward State Route 1

Imjin Parkway to Light Fighter Drive

From track station 381+20.72 to track station 488+94.10, the track runoff drains off the center and into the low point at 389+92.07. The land use in this segment is rural grassland. Figure A-46 shows a typical cross-section along with land use in the area.

Figure A-46. Land Use between Imjin Parkway and Light Fighter Drive

U.S. 1 slopes from south to north. East of U.S. 1 and west of the parking lot on the west lies a swamp where runoff is intercepted and contained within the ditch. The parking lot east of the ditch drains north to south and eventually sheet flows to the swamp from the south side of the ditch. The newly built street east of U.S. 1 slopes from north to south.

The topography at the park-and-ride lot around station 440+00 north of Eighth Street generally slopes from the south to north away from Eighth Street and drains to the low lying area north of Eighth Street east of U.S. 1.

South of Eighth Street, the topography slopes from northeast to southwest and drains to the storm drain inlets, which intercept runoff and direct the runoff to the south via the 18 inch storm drains. The runoff south of the storm inlets drains to the two low areas just south of the storm inlet around track station 444+50 to 447+00.

The area south of the two low lying areas drains south. The runoff is intercepted by the drain inlets around track station 455+00. The area north of track station 457+00 drains north to the drain inlets which intercept runoff and drain west to the 36-inch storm drains. The area south of the storm inlets drains north and sheet flows to the landscaping area.

Light Fighter Drive to State Route 1

Figures A-47, A-48, and A-49 show typical track environments along this section of the Monterey Branch Line right-of-way.

From track station 489+00 to 540+79.53, the track runoff drains off the center and south into the low point at 540+79.53. From track station 560+90 to 540+79.53 the track runoff drains off the center and north to the low point area at 540+79.53.

Figure A-47. Land Use between Light Fighter Drive and State Route 1

Figure A-48. Land Use between Light Fighter Drive and State Route 1

Figure A-49. Rail at State Route 1 Overpass

Monterey Road

From track station 560+90 to 592+47.90, the track runoff drains off the center and south into the low point area at 592+47.92. From track station 592+47.92 to 604+71.82, the track runoff drains off the center and north into the low area at 592+47.92. Figure A-50 and A-51 show the grade crossing and the typical cross-section around Monterey Road.

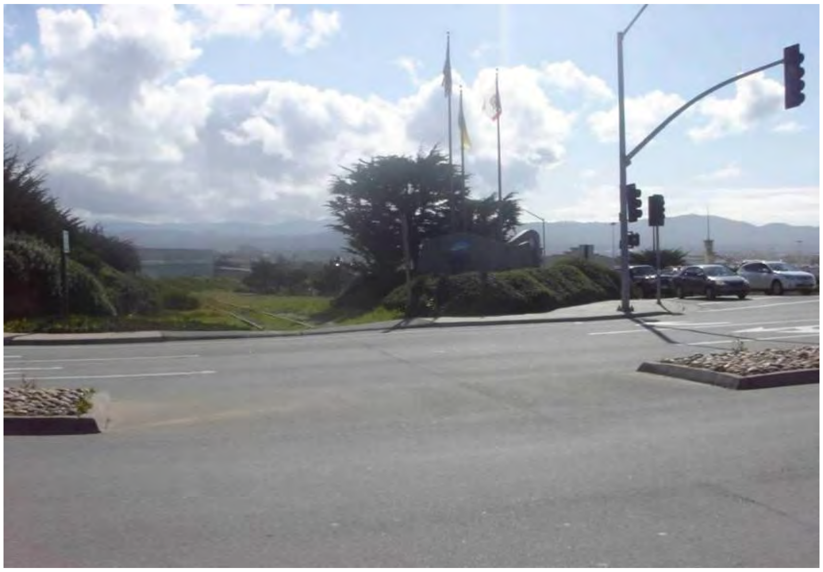


Figure A-50. Monterey Road Grade Crossing (610+00)

Figure A-51. Land Use around Monterey Road

State Route 1 Overpass to Playa Avenue and Tioga Avenue

From the State Route 1 overpass at track station 607+00 to track station 684+00 (Canyon Del Rey Boulevard), the land use is light industrial. From track station 604+71.82 to 632.28+79, the track runoff drains off the center and south to the low point area at track station 632.28.79. Figure A-52 shows the grade crossing at Playa Avenue. Figure A-53 shows the typical cross-section from Playa Avenue to just south of Tioga Avenue. From track station 632.28.79 to 643+52.34, the track runoff drains off the center and north to the low point area at track station 632.28.79. Figure A-54 shows the grade crossing at Tioga Avenue.

Figure A-52. Playa Avenue Grade Crossing

Figure A-53. South of Tioga Looking North toward Tioga Avenue Grade Crossing

Figure A- 54. Grade Crossing at Tioga Avenue

Tioga Avenue to Contra Costa Street

From track station 643+52.34 to 657+53.28, the track runoff drains off the center and south to the low point area at track station 657+53.28. From track station 657+53.28 to 671+88.94, the track runoff drains off the center and north to the low point area at track station 657+53.28. Figures A-55 and A-56 illustrate typical right-of-way conditions in this area. Figure A-56 illustrates that there is a ponding spot north of the intersection. The ponding could be eliminated with proper grading during the construction of the project.

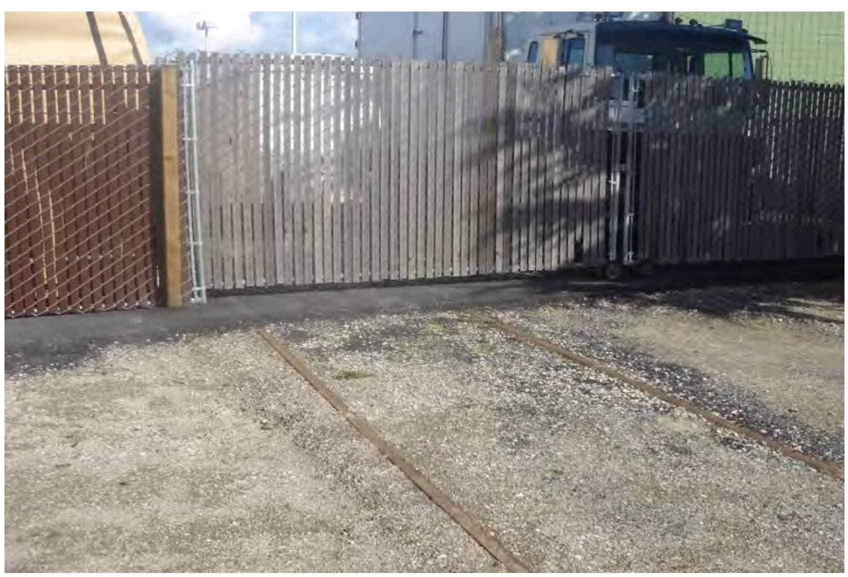


Figure A-55. North of Contra Costa Street and South of Tioga Avenue

Figure A-56. Ponding North of Contra Costa Street Crossing

Contra Costa Street to State Route 1 Overpass

From track station 671+88.94, the track runoff drains off the center and south to the low point area at track station 688+52.27 around the Roberts Lake. From track station 688+52.27 to 706+97.47, the track runoff drains off the center and north to the low point area at track station 688+52.27 around the Roberts Lake. There is a low area with an inlet at the northeast corner of the track and Canyon Del Rey Boulevard as shown in Figure A-57.

Figure A-57. North of Monterey Branch Line Crossing at Canyon Del Rey Boulevard

The track and drainage environment around Roberts Lake is shown in Figure A-58. Figure A-59 shows the grade crossing at Roberts Avenue, which is south of Roberts Lake, while Figures A-60 and A-61 show the Monterey Branch Line right-of-way extending south toward the State Route 1 overcrossing.

Figure A-58. Rail at Roberts Lake

Figure A-59. Grade Crossing at Roberts Avenue

Figure A-60 Swales around Roberts Avenue

Figure A-61. Swale North of State Route 1 Overpass (around Station 698+00)

State Route 1 Overpass to La Playa Street

From track station 706+97.47 to Casa Verde Way, the track runoff drains off the center and drains to the swales on both sides, and south to the low point area near Casa Verde Way, around track station 722+00. From Casa Verde Way to the track station 747+52.36, the track is relatively flat, sloping slightly west. From track station 747+52.36 to La Playa Street, the track drains off the center and west to the low point at track station 777+52.13.

Figueroa Street to End of Project

From track station 790+46.08, around Figueroa Street, to the end of the project, the track runoff drains off the center and north to the low point at track station 790+46.08 around Figueroa Street. Figures A-63, A-64, and A-65 illustrate typical sections along this portion of the project area.

Figure A-63. Cross-section at Naval Postgraduate School (Station 730+00)

Figure A-64. Grade Crossing at Naval Postgraduate School Waste Water Treatment Plant Driveway (Station 735+00)

Figure A-65. North of La Playa Street/Park Avenue Looking South

Figure 9-90 shows a photograph of Window on the Bay waterfront park around station 770. The runoff along the park area drains to the street.

Figure A-66. Window on the Bay (around Station 770)

APPENDIX B

HYDRAULIC CALCULATIONS

B. Preliminary Culvert Design

B.1 Bridge at MP 112.54

For the segment from Nashua Road to MP 112.80, the flow runs north to the bridge at MP 120.54 through the earth swales on both sides.

B.1.1 Time of Concentration

Time of concentration, Tc, for all undeveloped area from Merritt Street to Marina Green Drive was determined using the Soil Conservation Service (SCS) Upland Method, where Tc equals the flow path length divided by a velocity taken from Figure B-1 (shown at the end of this appendix). Using cultivated pasture (overland flow), for a slope of 0.01 percent, the velocity is assumed to be 0.65 feet/second. The flow path length is calculated to be 1,251 feet.

Tc = flow path length ÷ velocity = 1,251 ÷ 0.65 ÷ 60 = 32.08 (s), as shown in column 7 in Table B-1

B.1.2 Rainfall Intensity–Duration–Frequency (IDF) Relationships

From the Monterey County Public Works Plate 25, Figure B-2,

Rainfall intensity $I_t = \text{conversion factor} \times 7.75 \times (\text{i}) / t^{1/2}$

Where:

I_t = maximum intensity of storm of t minutes duration, where I_t is the conversion of the county's two-year, one-hour rainfall intensity "i,"

10-year conversion factor = 1.48,
25-year conversion factor = 1.73,
100-year conversion factor = 2.22,

i = 0.55 inches per hour for the project, from the county's chart,

t = estimated "time of concentration" in minutes (32.08 minutes)

$I_t = 2.22 \times 7.75 \times 0.55 \div 30.8^{1/2}$ = 1.67 in./hour, as shown in column 8 in Table B-1

B.1.3 Peak Discharge Calculation

The storm water discharge will be calculated by the Rational Method equation as follows:

$$Q = C \times I \times A$$

Where:

Q = peak discharge in cubic feet per second (cfs)

C = runoff coefficient = 0.9 for ballasted area and 0.15 for the earth swale. A composite runoff coefficient is calculated as shown in column 14 in Table B-1

I = average rainfall intensity in inches per hour (in./hr) for the selected rainfall return period (I = 1.67 in./hr)

A = contributing drainage area in acres, 3.9 acres.

Q = 0.40 × 1.67 × 3.9 = 2.60 cfs, as shown in column 15 in Table B-1

B.1.4 Hydraulic Capacity Check

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$$

Where:

Q = flow rate, cfs, TBD based on the drainage system. For the segment from Nashua Road to MP 112.80, the flow runs north to the bridge at MP 120.54 through the earth swales on both sides. A typical swale cross-section is chosen at MP 109+43.44. The depth of swale on the north side is 56 feet with a depth of 1.3 feet; the depth on the south side is 0 feet. The Q is shown in column 17 in Table B-1

n = Manning's coefficient (n = 0.15 for earth swale)

S = slope (the flow path is from station 111 to station 99, the slope is 0.01%)

A = flow area of the two swales on both sides, in this case only one swale on the north side. A =1/2 × (depth) × width=36.4 ft^2

R = hydraulic radius = (area ÷ wet perimeter)

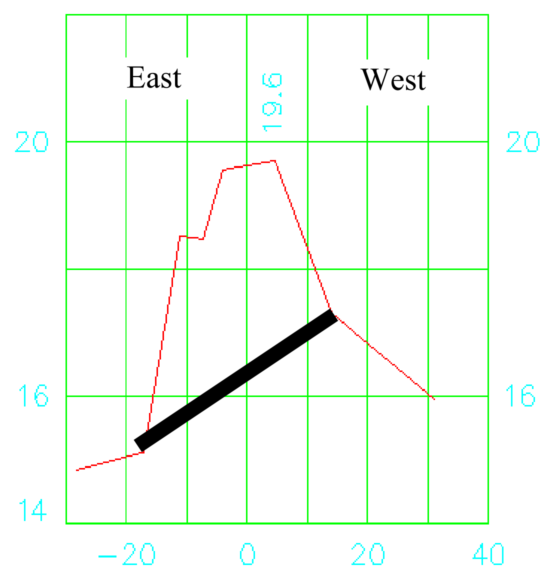
$$Q = \frac{1.49}{0.15} AR^{2/3} S^{1/2}$$ = 2.71 cfs, greater than peak discharge of 2.60 calculated previously

B.1.5 Hydraulic Capacity Check for Culvert at MP 120.54 Bridge

As calculated in section B.1.3, the peak discharge from Nashua Road to MP 120.80, and to the culvert is 2.60 cfs. The closest cross-section survey is at track station 99+23.19. The culvert is proposed to be placed from toe to toe of the track. The upstream invert elevation is 17.32 feet, the downstream invert elevation is at 15.13 feet, and the culvert length is 32 feet. The slope of the culvert is 7 percent, with a Manning's n of 0.012.

The full capacity of the culvert is calculated using Manning's n,

$$Q = \frac{1.49}{0.15} AR^{2/3} S^{1/2}$$ = 65 cfs, as shown in column 12 in Table B-2



Cross-section at 99+23.19

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table B-2, so the culvert design is sufficient.

B.2 Bridge at MP 112.80

The peak discharge from MP 113.04 (track station 124) to MP 128.00 (track station 114) is calculated to be 1.37 cfs, as shown in column 11 in Table B-2.

The cross-section at track station 111+47.90 is used as the cross-section at the bridge at MP 112.80.

The culvert upstream invert elevation is 14.81 feet, the downstream invert elevation is 14.21 feet, and the culvert length is 51 feet. The slope is calculated to be 1.2 percent.

The full capacity of the culvert is calculated using Manning's, n

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = 26.91 \text{ cfs}$$

as shown in column 12 in Table B-2

Cross-section at 111+47.90

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table B-2, so the culvert design is sufficient.

Bridge at MP 113.04

The peak discharge from Salinas River (track station 146) to MP 113.04 (track station 124) is calculated to be 2.66 cfs, as shown in column 11 in Table B-2.

The cross-section at track station 125+08.90 is used as the cross-section at the bridge at MP 113.04.

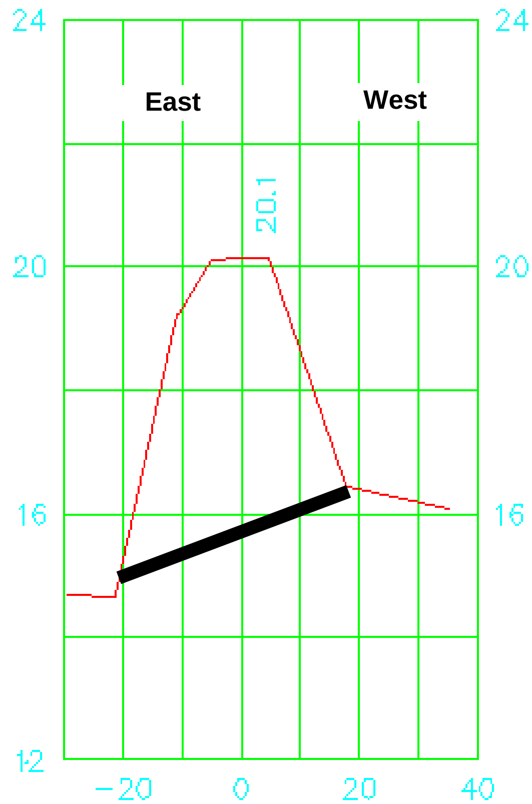
The culvert upstream invert is at 16.42 feet, the downstream invert elevation is 14.63 feet, and the culvert length is 39 feet. The slope is calculated to be 4.6 percent.

The full capacity of the culvert is calculated using Manning's n,

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = 52.68 \text{ cfs}$$

as shown in column 12 in Table B-2

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table B-2, so the culvert design is sufficient.

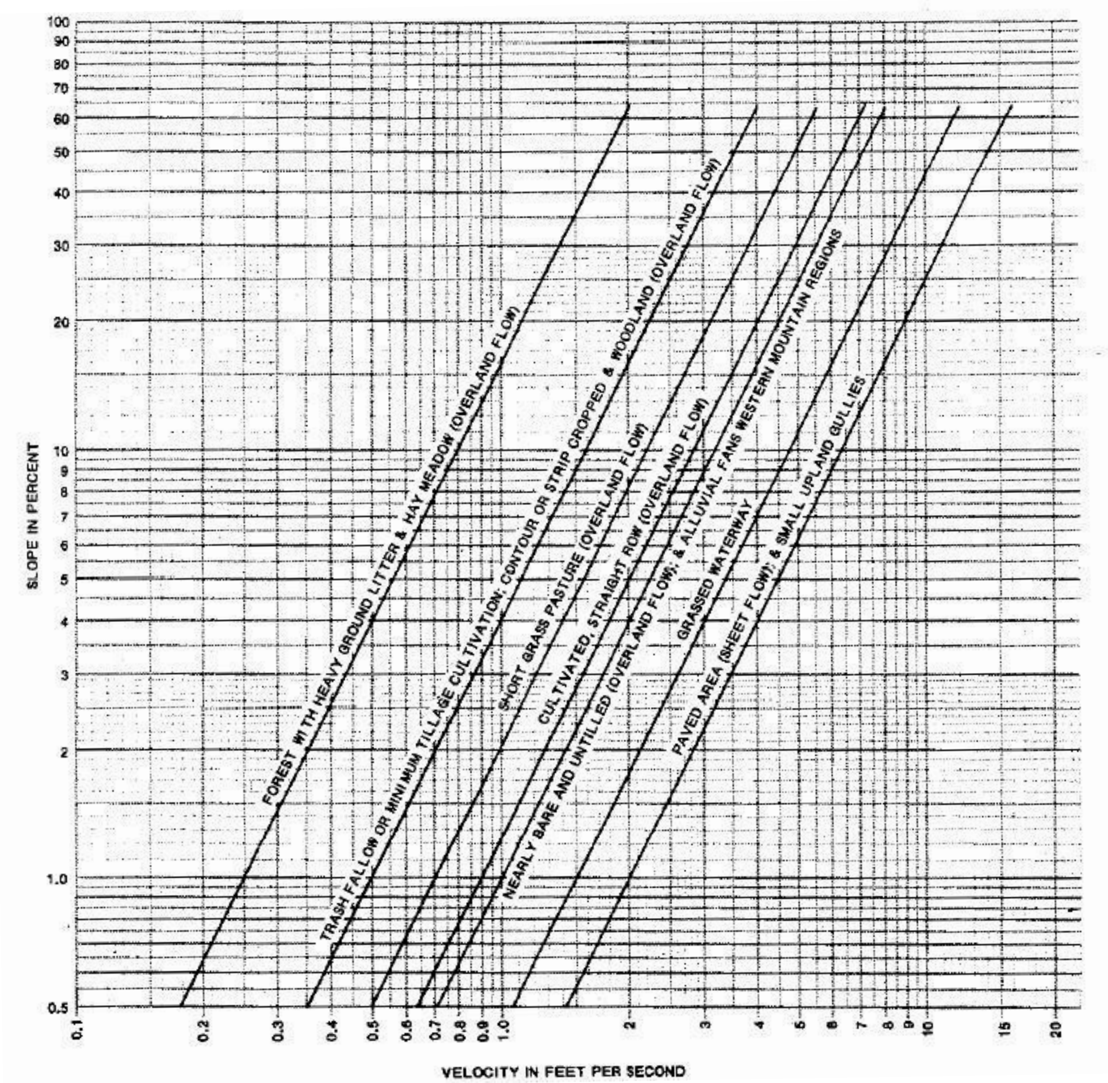


Cross-section at 125+08.90

Based on the previous discussion, it is determined that the existing drainage system is sufficient to intercept and convey the 100-year storm event for this restoration project. No additional drainage design is necessary.

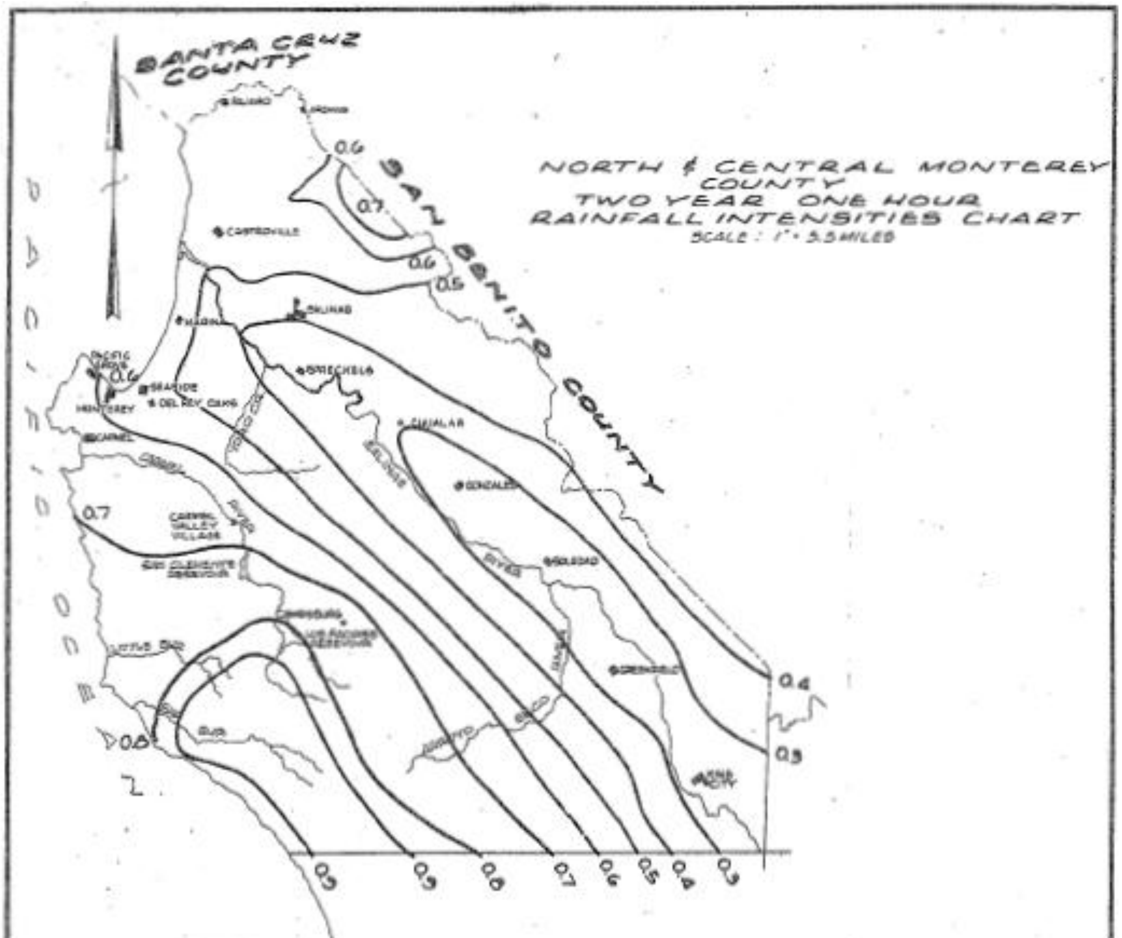
The proposed culvert design is shown below:

Bridge Location	Track Station	Upstream Invert (ft)	Downstream Invert (ft)	Culvert Length (ft)
MP 120.54	99+23.19	17.32	15.13	32
MP 120.80	111+47.90	14.81	14.21	51
MP 113.04	125+08.90	16.42	14.63	39



Source: SCS National Engineering Handbook, Section 4, 1972

Figure B-1. Velocity Graph Used to Determine Time of Concentration (Tc)



NOTE:
1. Intensities for particular location in the Southern part of the County available from County Surveyors Office.
2. Conversion factors:
   Intensity of a 10-year Design storm equals a 2 year Design Storm times 1.46
   " " " 25 year " " " " " " 1.73
   " " " 50 year " " " " " " 1.92
   " " " 100 year " " " " " " 2.22
3. The maximum intensity (I_t) for storms of various duration is determined by the formula. $I_t = 7.75\, I/\sqrt{t}$ in which variable are as follows.
   I_t = maximum intensity of storm of t minutes duration.
   I = one hour rainfall intensity from above chart and note 2.
   t = time in minutes shortest time it takes storm runoff to flow from the farthest point in the drainage area to the point in question.
4. Example:
   Find maximum intensity of 20 minute storm in Chualar, expected to occur on the average of once in 25 years.
   Solution: From chart 0.5"/hr intensity for 2-year design storm
   From note 2, 0.5 times 1.73 equals 0.82"/hr the maximum intensity of a 25 year one hour design storm.
   From note 3, $I = 7.75\, I/\sqrt{t} = (7.75)(0.82)/\sqrt{20} = 1.42$"/hr.
   Therefore: the maximum 20 min. intensity of a storm that on the average would occur once every 25 years would be 1.42"/hr.

MONTEREY COUNTY	DEPT. OF PUBLIC WORKS
STANDARD DETAILS RAINFALL INTENSITIES CHART	
APPROVED [signature]	DATE 10-24-77
REVISED / DATE	PLATE NO. 25

Source: Monterey County Public Works

Figure B-2. Plate No. 25: Rainfall Intensities Chart

Table B-1. Drainage System Hydraulic Capacity Calculations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Area Name	Location from Station to Station	Tributary Area (ft²)	Area (acres)	Slope (%)	Velocity (ft/s)	Flow Length (ft)	Tc (min)	100-Year Rainfall Intensity (in./hr)	Swale Width on the North (ft)	Swale Width on the South (ft)	Depth on the North (ft)	Depth on the South (ft)	Track Width (ft)	Runoff Coefficient (C)	Peak Discharge Q=CIA (cfs)	Typical Cross-Section Used	Drainage Capacity	Meet the Requirement
DA1	Beginning to Merritt Street	76228	1.7	1.34	0.65		13.21	2.60	Ditch on side					0.62	7.09	24" culvert	28.43	Yes
DA2	Merritt Street to Tembladero Slough (10-65)	557,095	12.8	0.07	0.65	4400	112.82	0.89	20.00	17.00	1.45	1.11	14.00	0.35	2.57	40+93.27	2.81	Yes
DA3	Tembladero Slough to Alisal Slough (65-94)	292,539	6.7	0.02	0.65	2900	74.36	1.10	40.00	38.00	1.00	1.00	20.00	0.35	2.26	77+05.11	2.44	Yes
DA4	Nashua Road to MP 112.80 (98-111)	168,863	3.9	0.01	0.65	1251	32.08	1.67	56.00	0.00	1.30		28.00	0.40	2.59	109+43.44	2.71	Yes
DA5	MP 112.80 to MP 113.04 (114-124)	128,317	2.9	0.09	0.65	1182	30.31	1.72	42.00	21.00	0.50	0.50	12.00	0.27	1.37	117+60.68	1.86	Yes
DA6	MP 113.04 to Salinas River (124 to 146)	321,626	7.4	0.42	0.65	2272	58.26	1.24	38.00	36.00	6.50	5.20	17.00	0.29	2.66	129+98.49	316.85	Yes
DA7	Salinas River (153) to 246+37.88	1,002,150	23.0	0.93	0.87	7847	150.33	0.77	18.00	14.00	1.54	0.50	17.50	0.42	7.37	194+08.65	15.25	Yes
DA8	246+37.88 to south of Golf Road 272.47	251,267	5.8	0.75	0.8	1190	24.79	1.90	26.00	20.00	3.30	4.00	19.00	0.37	4.05	266+87.24	96.60	Yes
DA9	South of Golf Road (272.48) to Beach Road (306.21)	347,106	8.0	0.34	0.65	2261	57.97	1.24	26.00	20.00	1.43	0.91	17.00	0.32	3.17	291+11.59	13.51	Yes
DA10	Beach Road (306.21) to Palm Avenue (350+85.90)	445,598	10.2	0.32	0.65	2058	52.77	1.30	18.00	18.00	1.10	1.10	13.00	0.28	3.74	335+15.60	7.47	Yes
DA11	Palm Avenue (350+85.90) to south of U.S. 1 overpass (381.21)	307,579	7.1	1.39	1.2	2068	28.72	1.77	10.00	19.00	0.91	0.22	17.00	0.30	3.69	363+09.98	5.48	Yes
DA12	South of U.S. 1 overpass (381.22) to south of overpass bridge (488.94)	1,163,704	26.7	0.28	0.65	9902	253.90	0.59	20.00	17.00	1.32	0.90	20.00	0.31	4.88	409+25.72	8.72	Yes
DA12A	Northeast of U.S. 1 and 8th Street	146,129	3.4	0.28	2.75	406	2.46	6.03	/	/	/	/	/	0.57	11.60	/	87.14	Yes
DA12B	Southeast of U.S. 1 and 8th Street far east part	433,660	10.0	1.78	2.75	354	2.15	6.46	/	/	/	/	/	0.90	57.88	/	515.87	Yes
DA12C	Small patch around low area within DA12B	53,623	1.2	1.78	2.75	91	0.55	12.74	/	/	/	/	/	0.90	14.12	/	17.23	Yes
DA12D	Southeast of U.S. 1 and 8th Street far west part with the parking lot	432,919	9.9	1.78	2.42	144	0.99	9.50	/	/	/	/	/	0.53	50.21	/	72.89	Yes
DA12E	Southeast of U.S. 1 and 8th Street far south part	294,573	6.8	1.78	2.42	557	3.84	4.83	/	/	/	/	/	0.44	14.45	/	515.87	Yes
DA13	South of overpass bridge (488.95 to 560.90)	1,015,605	23.3	0.77	0.8	5186	108.04	0.91	36.00	13.00	1.11	0.42	15.00	0.33	6.91	538+86.30	13.98	Yes
DA14	560.91 to U.S. 1 overpass 604+71.82	439,195	10.1	1.85	1.25	3158	42.11	1.46	40.00	40.00	0.60	0.10	20.00	0.30	4.41	586+61.96	9.47	Yes
DA15	Overpass 604+71.83 to Tioga Avenue (643+52.34)	404,230	9.3	2.16	1.32	2757	34.81	1.60	16.00	14.00	0.67	0.58	12.00	0.28	4.22	626+10.94	6.77	Yes
DA16	Tioga Avenue (643+52.34) to Contra Costa Street (671+88.94)	281,125	6.5	0.17	1.4	1436	17.10	2.29	16.00	14.00	0.67	2.10	1.20	0.15	2.23	661	3.04	Yes
DA17	Contra Costa Street (671+88.94) to U.S. 1 overpass 706+97.47	349,577	8.0	0.24	1.4	1845	21.96	2.02	10.00	7.50	3.70	1.68	8.00	0.18	2.91	690+99.77	19.58	Yes
DA18	U.S. 1 overpass 706+97.48 to La Playa Street (777+52.13)	757,151	17.4	0.03	1.4	8349	99.39	0.95	43.00	40.00	1.50	1.11	17.00	0.25	4.20	765	8.07	Yes
DA19	La Playa Street (777+52.13) to the end	184,347	4.2	0.03	1.4	8349	99.39	0.95	43.00	40.00	1.50	1.11	17.00	0.18	0.73	766	8.07	Yes

Table B-2. Culvert Calculations under Bridges at MP 112.54, MP 112.80 and MP 113.04

1	2	3	4	5	6	7	8	9	10	11	12	13
Culvert Location	Tributary Area (ft²)	Area (acres)	Location from Station to Station	Slope (%)	Flow Length (ft)	Velocity (ft/s)	Tc (min)	100-Year Rainfall Intensity (in./hr)	Runoff Coefficient (C)	Peak Discharge Q=CIA (cfs)	Culvert Capacity (cfs)	Meet the Requirement
MP 112.54	168,863	3.9	Nashua Road to MP 112.80 (94-111)	7	1251	0.65	32.08	1.67	0.40	2.59	64.98	Yes
MP 112.80	128,317	2.9	MP 112.80 to MP 113.04 (114-124)	1.2	1182	0.65	30.31	1.72	0.27	1.37	26.91	Yes
MP 113.04	321,626	7.4	MP 113.04 to Salinas River (124 to 146)	4.6	2272	0.65	58.26	1.24	0.29	2.66	52.68	Yes