California Regional Water Quality Control Board

Central Coast Region

Attachment 4
A Cost Analysis

for

Amendment to the Water Quality Control Plan for the Central Coastal Basin to Adopt Total Maximum Daily Loads for Turbidity in the Gabilan Creek Watershed, Monterey County California (Resolution No. R3 -2022-0002)

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Prepared For:

Ghulam Ali, WACOR
Matthew Mitchell, Alternative WACOR
U.S. Environmental Protection Agency
Office of Science and Technology, Engineering and Analysis Division
1200 Pennsylvania Ave., NW
Washington, D.C. 20460

Prepared By:

PG Environmental
14555 Avion Parkway, Suite 125
Chantilly, VA 20151

And

Eastern Research Group
110 Hartwell Ave
Lexington, MA 02421

Under U.S. EPA Contract No. EP-C-17-041

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Executive Summary

This report documents an analysis of the economic costs associated with the Central Coast Regional Water Quality Control Board's (Central Coast Water Board) Total Maximum Daily Load (TMDL) for Turbidity in the Gabilan Creek Watershed, Monterey County California (hereinafter, the proposed Gabilan Creek TMDL or proposed TMDL). PG Environmental was tasked with the development of this analysis by the United States Environmental Protection Agency (EPA) and the Central Coast Water Board.

The California Water Code requires the Central Coast Board to take "economic considerations," among other factors, into account when they establish water quality objectives and TMDLs. This analysis catalogued a range of reasonably foreseeable methods of compliance with the wasteload allocations, load allocations, and implementation provisions within the proposed TMDL, and estimated the incremental costs associated with meeting the objectives.

The proposed TMDL would require point source dischargers within the watershed permitted under the National Pollutant Discharge Elimination System (NPDES) program to meet wasteload allocations for turbidity, while non-point sources (e.g., irrigated land agriculture sources, cannabis growers, and the regional flood control agency) would be required to meet load allocations for turbidity. Wasteload allocations and load allocations in the proposed TMDL are designed to restore the beneficial uses of local waterbodies impaired for turbidity.

PG Environmental reviewed the requirements under the existing policy status quo (i.e., the baseline scenario) and under the proposed TMDL scenario, and identified the reasonable means and methods each class of regulated entities would be likely to employ to achieve compliance with each scenario. Costs associated with compliance activities were estimated under each scenario and compared to estimate an incremental cost of compliance associated with the Gabilan Creek TDML. The incremental costs associated with monitoring activities and watershed planning activities are summarized in the following table.

Table ES-1. Summary of Estimated Incremental Compliance Costs Due to Monitoring and Watershed Planning under the proposed Gabilan Creek TMDL

Category	Incremental Cost Estimate ($/year)
NPDES Stormwater Permittees	$6,050 - $24,600
NPDES Municipal and Industrial Wastewater Permittees	$0
NPDES Low Threat Wastewater General Permittees	$0
Irrigated Land Program	$62,000
Cannabis Growers	$2,970

Category	Incremental Cost Estimate ($/year)
Flood Control Pump stations and Agricultural Field Drainage Pumps	$36,500 - $772,000
Total	**$107,000 - $882,000 per year**

Compliance costs for additional control activities (e.g., implementation of additional stormwater control best management practices [BMPs]) which may be necessary to comply with wasteload allocations and load allocations under the TMDL were not estimated due to data limitations—data was insufficient to identify permittees and entities which cannot immediately comply with the proposed wasteload allocations or load allocations. In addition, costs for stormwater BMPs are highly site-specific and require site data input which are beyond the scope of this project to collect. Consequently, costs associated with these activities were not assessed in this analysis. However, Appendix A provides unit cost information associated with a wide variety of control activities—including BMP implementation, turbidity monitoring, and pollution control planning activities—which are applicable to the community of entities regulated under the proposed TMDL. Members of the regulated community may refer to Appendix A information to develop estimates of possible compliance costs under the TMDL which are more narrowly tailored to their specific individual circumstances.

1. Introduction

This report documents an analysis of the economic costs associated with the Central Coast Regional Water Quality Control Board's (Central Coast Water Board's) *Total Maximum Daily Load (TMDL) for Turbidity in the Gabilan Creek Watershed, Monterey County California* (hereinafter, the proposed Gabilan Creek TMDL or proposed TMDL). PG Environmental was tasked with developing this analysis by the United States Environmental Protection Agency (EPA) and the Central Coast Water Board.

Background

The Clean Water Act (CWA) directs states, with oversight by the EPA, to adopt water quality standards to protect the public health and welfare, enhance the quality of water, and serve the purposes of the CWA. Under Section 303, state water quality standards must include: (1) designated uses for all water bodies within their jurisdictions, (2) water quality criteria sufficient to protect the most sensitive of the uses, and (3) an antidegradation policy consistent with the regulations at 40 CFR 131.12.

States must periodically assess the attainment of water quality standards and identify waters which are impaired or threatened. The catalogue of threatened and impaired waters is referred to as a state's "303(d) list" (in reference to the Clean Water Act section imposing the requirement). Once a waterbody has been 303(d)-listed, a TMDL is developed and implemented to restore the waterbody to achieve attainment with water quality standards.

A TMDL is an accounting of pollutants within a waterbody to define a loading condition consistent with returning an impaired waterbody to a non-impaired and non-threatened status. The TMDL identifies the impairment and pollutant sources within a watershed, and computes the maximum allowable loading from each source necessary to restore the waterbody. Mathematically, the TMDL is the sum of the wasteload allocation, the load allocations, and a margin of safety. Once adopted by the Central Coast Water Board and approved by EPA, the requirements of a TMDL are implemented through regulatory instruments like National Pollutant Discharge Elimination System (NPDES) permits and the jurisdiction's non-point source program.

The Central Coast Water Board is proposing to adopt the Gabilan Creek TDML in order to restore the beneficial uses of impaired waterbodies in the Gabilan Creek watershed. The watershed is located in the northern portion of Salinas River watershed in the Central Coast region of California, United States (Figure 1).

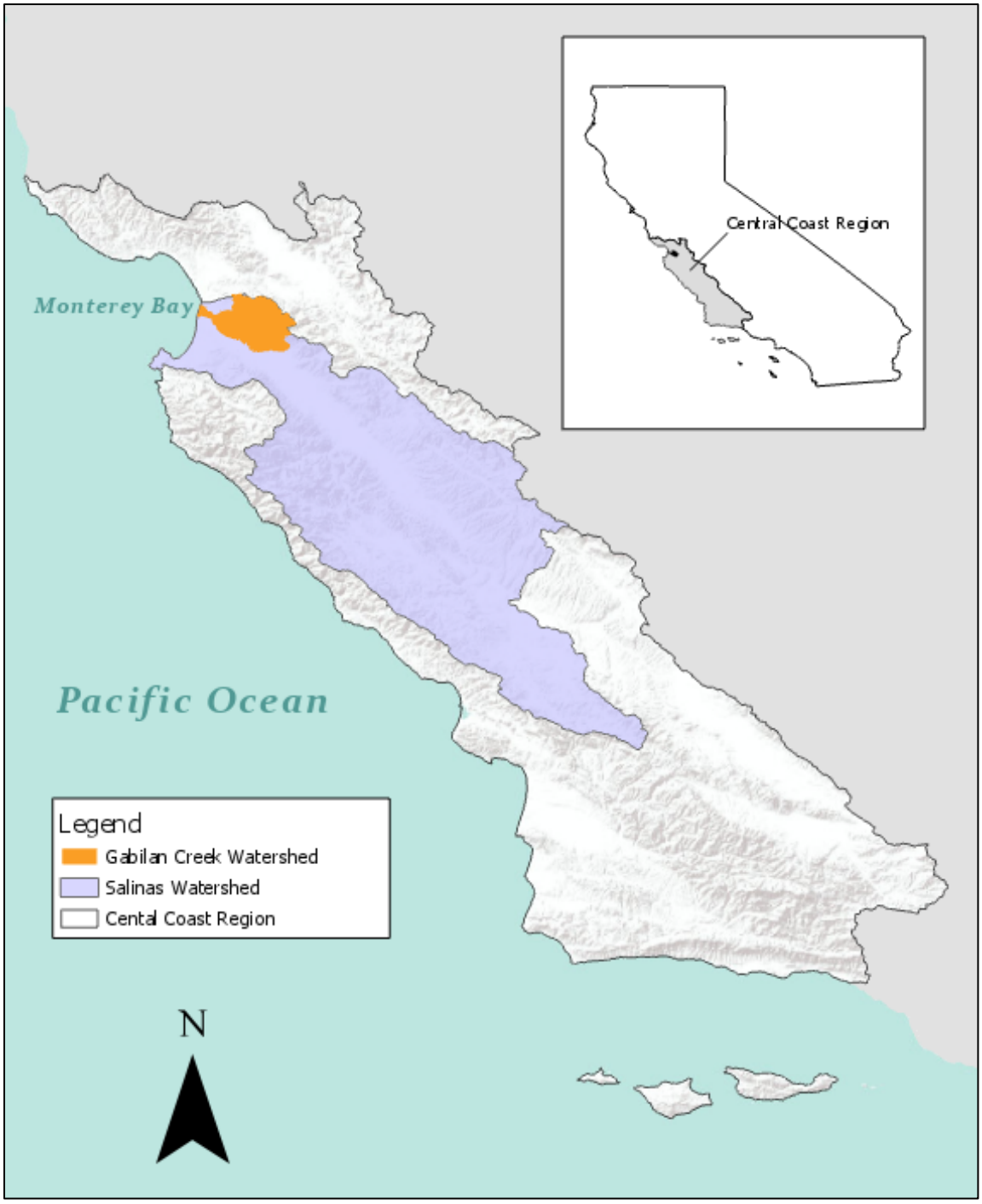

Image Source: Draft TDML Staff Report (Central Coast Water Board, 2021)

Figure 1. Location of the Gabilan Creek watershed near Monterey Bay in California.

The Gabilan Creek watershed is approximately 160 square miles, and covers the area between the Gabilan Mountains and Pacific Ocean. Notable waterbodies present in the watershed include Gabilan Creek, Old Salinas River, the Salinas Reclamation Canal, and Tembladero Slough. The floor of the valley is composed of irrigated agriculture land and urban areas—primarily, the City of Salinas.

Scope of the Analysis

The California Water Code (CWC) require the Central Coast Water Board to take "economic considerations," among other factors, into account when they establish water quality objectives and TMDLs (CWC §13241). In addition, the California Environmental Quality Act (CEQA) requires the Central Coast Water Board to "account for a reasonable range of environmental, economic, and technical factors" in its environmental analysis of the proposed rule (CEQA §21159).

This analysis catalogues a range of reasonably foreseeable methods of compliance with the wasteload allocations, load allocations, and implementation provisions of the proposed TMDL, and estimates the *incremental costs* associated with meeting those objectives. Incremental costs are defined as the change in direct costs[1] directly attributable to the policy change. Mathematically speaking, the incremental cost is defined as the total direct costs of environmental regulation already in place (i.e., the baseline cost) from the total direct costs after a new regulation has been adopted (i.e., the proposed TMDL cost).

In all cases, estimated compliance costs are based on strategies a reasonable regulated entity[2] might adopt to meet regulatory requirements based on currently available data only. This analysis does not specify the actual means of compliance which a regulated entity is obligated to adopt. This analysis does not address potential benefits of the proposed TMDL.

In some instances, it may be infeasible to estimate baseline and/or proposed TMDL costs for a particular regulated entity or class of entities (e.g., stormwater dischargers) due to a lack of adequate information necessary to estimate reasonable costs. In these cases, PG Environmental documented the rationale for not estimating a compliance cost and provided any available information regarding relevant unit costs for reasonable methods of compliance.

Organization of the Report

The remainder of this report is organized as follows:

- **Section 2: Current Regulatory Requirements** – describes the current regulatory requirements applicable to the study area (i.e., the baseline regulatory scenario).

[1] Direct costs are those costs that fall directly on regulated entities as the result of the imposition of a regulation.

[2] Permittees, dischargers, agencies, or other persons responsible for turbidity source control actions under the TMDL and associated regulatory instruments (e.g., NPDES permits, agricultural orders, etc.).

- **Section 3: Proposed TMDL Requirements** – describes the turbidity control requirements in the TDML that provide the costs under the new policy proposal (i.e., the proposed TMDL scenario).
- **Section 4: Compliance and Incremental Costs Analysis** – describes the methods for evaluating compliance under the current regulatory requirements and under the proposed TMDL, and provides an estimate of potential incremental costs.
- **Section 5: Conclusion** – provides a summary of the estimated total incremental compliance costs for all regulated entities and discusses uncertainties associated with the estimates.
- **Section 6: References** – provides the bibliographic references used in the analysis.
- **Appendix A**: **Unit Cost Information** – provide cost information for a variety of pollution control activities used in the analysis, as well as additional information on pollution control efforts within the watershed.
- **Appendix B: Flood Control Pump Station Alternatives** – provides design summary of the identified turbidity control alternatives and associated construction and operation costs for the flood control pump stations.
- **Appendix C: Monterey County Stormwater Resource Management Plan Projects** – provides an informational summary of a variety of stormwater management projects underway in Monterey County, including within the Gabilan Creek watershed.

2. Current Regulatory Requirements

This section identifies the current framework for regulating turbidity discharges within the Gabilan Creek watershed. The current regulatory framework is the baseline against which cost changes associated with the proposed TMDL are determined.

Summary of Applicable Turbidity Water Quality Standards

Beneficial uses and water quality objectives applicable to the watershed are established within *The Water Quality Control Plan for the Central Coast Basin* (2019 Basin Plan). Beneficial uses are the social and ecological uses provided by a waterbody which must be protected and maintained, as defined in the water quality standards. Water quality objectives are numeric or narrative statements of water quality designed to be consistent with, and protective of, the beneficial uses of state waterbodies. A waterbody which does not meet the applicable water quality objectives is considered impaired or out of attainment with the beneficial uses assigned to the waterbody.

Beneficial Uses

The Central Coast Water Board identifies beneficial uses for all waterbodies in the Central Coast Region in Table 2-1 of the Basin Plan. All waterbodies not identified by name in Table 2-1 of the Basin Plan are assigned the following beneficial uses: municipal and domestic supply, and protection of both recreation and aquatic life uses. Table 1 lists the beneficial uses identified for waterbodies in the Gabilan Creek watershed.

Table 1. Beneficial uses of local waterbodies.

Waterbodies	**Beneficial Uses**[1]
Old Salinas River	REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, BIOL, RARE, EST, COMM,
Tembladero Slough	REC1, REC2, WILD, WARM, MIGR, SPWN, RARE, EST, COM, SHELL
Alisal Slough	MUN, REC1, REC2, WARM, COLD
Salinas Reclamation Canal	REC1, REC2, WILD, WARM, MIGR, COMM
Merritt Ditch	MUN, REC1, REC2, WARM, COLD
Espinosa Slough	REC1, REC2, WILD, WARM, COMM
Santa Rita Creek	MUN, REC1, REC2, WARM, COLD
Gabilan Creek	MUN, AGR, GWR, REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, BIOL, RARE, COMM
Natividad Creek	MUN, REC1, REC2, WARM, COLD
Alisal Creek	MUN, AGR, GWR, REC1, REC2, WILD, COLD, WARM, SPWN, BIOL, RARE, COMM

Note: Reproduced from Table 2-1 of the Basin Plan.

1. MUN = municipal and domestic supply
   AGR = agricultural supply

GWR = ground water 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 of special significance
RARE = rare, threatened, or endangered species
EST = estuarine habitat
COMM = municipal and domestic water supply
SHELL = shellfish harvesting

Turbidity Water Quality Objectives

The Basin Plan defines both narrative and numeric water quality objectives for turbidity applicable to the Gabilan Creek watershed. The narrative objective states:

> *Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.*

The Basin Plan numeric objectives state:

> *Increase in turbidity attributable to controllable water quality factors shall not exceed the following limits:*
>
> *1. Where natural turbidity is between 0 and 50 Nephelometric Turbidity Units (NTU), increases shall not exceed 20 percent.*
>
> *2. Where natural turbidity is between 50 and 200 NTU, increases shall not exceed 10 NTU.*
>
> *3. Where natural turbidity is greater than 100 NTU, increases shall not exceed 10 percent.*

Description of Parties Subject to the Gabilan Creek TMDL

This section catalogues the entities point source and non-point source entities subject to the requirements of the proposed TMDL.

NPDES Stormwater Permittees

The watershed includes three municipal separate storm sewer systems (MS4s): the City of Salinas MS4, the Monterey County MS4, and the CalTrans MS4. Discharges of stormwater[3] from these entities are regulated under NPDES permits issued by the Central Coast Water Board. These permits establish requirements governing the quality

[3] Defined in 40 CFR 122.26(b)(13) as storm water runoff, snow melt runoff, and surface runoff and drainage originating from precipitation events.

of discharges which influence the turbidity of receiving waters. Requirements are generally established in NPDES permits as:

- Monitoring and reporting requirements,
- Discharge prohibitions,
- Effluent limitations, and
- Receiving water limitations.

The City of Salinas MS4

The City of Salinas is regulated under Order No. R3-2019-0073 (NPDES No. CA0049981). Under the Order, the permittee is required to monitor turbidity as follows:

- At three outfalls & Pump Station 309U19 during at least three rain events per year (up to four discrete samples per event)
- At Rec Ditch 309ALD monthly October – April, July, and September during the first year of the permit term. Monitoring should include at least storm events.

The existing permit includes an effluent limitation which limit the discharge of pollutants to the maximum extent practicable. Receiving water limitations relevant to turbidity state that discharges from the MS4 “shall not cause or contribute to an exceedance of water quality standards in any receiving water, including those for turbidity”.

Monterey County MS4

The Monterey County MS4 is regulated under the Phase II MS4 General Stormwater Permit (Order No. 2013-0001-DWQ; NPDES No. CAS000004). Under the Order, the permittee is required to monitor turbidity as an indicator pollutant of illicit stormwater connections with the MS4 and must conduct quarterly visual inspections of pollution hotspot sites for readily apparent indicators of inadequate pollution control (e.g., a turbid plume visual in a receiving water). The permit requires Monterey County to develop and implement a Storm Water Management Plan describing the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters.

Caltrans MS4

Caltrans is responsible for the design, construction, management, and maintenance of the state highway system, including freeways, bridges, tunnels, Caltrans’ facilities, and related properties. Stormwater discharges from State-owned highways operated by Caltrans are regulated under the Order No. 2012-0011-DWQ (NPDES No. CAS000003).

The existing permit allows Caltrans to implement best management practices (BMPs) rather than require compliance with numeric effluent limits. The BMPs must achieve

pollutant reductions based on either the Maximum Extent Practicable standard for MS4s or Best Available Technology Economically Achievable/Best Conventional Pollutant Control Technology standard (BAT/BCT), whichever is applicable. In addition, if receiving water quality standards are exceeded, Caltrans is required to submit a written report providing additional BMPs or other measures to be taken that will be implemented to achieve water quality standards. The permit requires Caltrans to develop and implement a Storm Water Management Plan describing the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters.

Construction Stormwater

The construction program requires dischargers whose projects disturb one or more acres of soil, or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, to obtain coverage under the Stormwater General NPDES Permit for construction activity (Order No. 2012-0006-DWQ, NPDES No. CAS000002).

The construction general permit requires the development and implementation of a Stormwater Prevention Plan (SWPPP) that lists BMPs the permittee will use to control the discharge of pollutants in stormwater, including turbidity. Additionally, the SWPPP must contain a visual monitoring program, and a sediment monitoring plan if the site discharges directly to a water body impaired for sediment.

Industrial Stormwater

Under the industrial program, the State Water Board issued a general NPDES permit (Order No. 2014-0057-DWQ, NPDES No. CAS000001) that regulates stormwater discharges associated with broad categories of industrial activities. This general permit requires the implementation of management measures that will achieve the performance standard of BAT/BCT. The permit also requires that dischargers develop a SWPPP and a monitoring plan to control the discharge of pollutants, including turbidity. Through the SWPPP, dischargers are required to identify sources of pollutants, and describe the means to manage the sources to reduce storm water pollution. For the monitoring plan, facility operators may participate in group monitoring programs to reduce costs and resources.

NPDES Wastewater Permittees

Municipal and Industrial Wastewater

The Gabilan Creek watershed does not contain NPDES-permitted facilities which discharge municipal or industrial wastewater. However, as discussed in the previous section, there are a number of industrial facilities which are authorized under the NPDES program to discharge industrial stormwater.

Low Threat

A variety of “low threat” NPDES permits have been issued in the region with includes the Gabilan Creek watershed. These include:

- The Low Threat to Water Quality permit (Order No. R3-2017-0042, NPDES No. CAG993001),
- The Highly Treated Groundwater permit (Order No. R3-2016-0035, NPDES NO. CAG993002),
- Aquaculture Facilities and Aquariums permit (Order R3-2019-0001, NPDES No. CAG993003)

Permittees under the first two permits (the Low Threat to Water Quality permit and the Highly Treated Groundwater permit) are required to comply with turbidity receiving water limitations equivalent to the applicable water quality standard. In addition, permittees are required to monitor for turbidity in their effluent (at startup, then annually) and in their receiving water (at startup, then annually).

Permittees under the Aquaculture Facilities and Aquariums permit are subject to turbidity effluent limitations which state effluent shall not exceed 75 NTU on an average monthly basis, 100 NTU on a weekly average basis, and 225 NTU as an instantaneous maximum. Compliance is evaluated in the effluent on a quarterly basis. Permittees are subject to the same receiving water limitations as those described for the other two general permits.

Regulated Non-Point Sources

Irrigated Lands Program

Agricultural activities that may affect aquatic life can be caused by farming activities that cause excessive erosion, resulting in the presence of turbidity in receiving waters. Over application of irrigation water may result in the runoff of sediments and unsettleable materials which contribute to the presence of turbidity.

Agricultural dischargers do not receive NPDES permits. In California, the Water Boards regulate discharges from irrigated land including storm water runoff, irrigation tailwater, and tile drainage through Waste Discharge Requirements (WDRs) or waivers of WDRs. CWC Section 13269 allows the Regional Water Boards to waive WDRs if it is in the public interest.

The Central Coast Water Board has established conditional waivers for agricultural discharges. Its waiver requires turbidity monitoring for certain classes of agricultural operators, as well as sediment control and erosion management plans.

Cannabis Growers

The State Water Board has established *General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges Associated with Cannabis*

Cultivation Activities (Order WQ 2019-0001-DWQ). It establishes surface water control and monitoring provisions, as well as soil erosion and sediment control requirements for Tier 1 and Tier 2 operations.

These operators are required to monitor turbidity in stormwater when in operations once per calendar month when stormwater runoff is generated onsite. In addition, they must develop and implement plans to manage sediment release from disturbed areas, and a site erosion and sediment control plan,

Other Non-Point Sources

Flood Control Pump Stations and Agriculture Field Drainage Pumps

The Monterey County Water Resources Agency (MCWRA) operates a series of pump stations used to support flood control objectives and keeping productive land free of excess standing water. These pump stations can become a source of turbidity within waterbodies when pump operation results in turbulent flows near inlets which cause resuspension of suspended particles and erosion of nearby stream or ditch banks. The MCWRA pump stations are not currently subject to Clean Water Act regulation regarding turbidity. However, under the proposed TMDL, Monterey County will be subject to load allocations requiring the control sources of turbidity which may impact the pump stations and agricultural field drainage pumps.

Monterey County Regional Stormwater Management Projects

Monterey County is currently engaged in the planning and development of a number stormwater management projects as part of the Monterey County Regional Stormwater Resource Management Plan (Regional Plan), which was developed by the Greater Monterey Integrated Regional Water Management (IRWM) stakeholders. The Regional Plan is a comprehensive stormwater management strategy for the greater Monterey Region, which encompasses the Gabilan Creek watershed. These projects have been developed on order to meet a variety of TMDLs applicable to Monterey County. While not designed to address the proposed TMDL, nor attributable are their costs attributable to the proposed TMDL, the stormwater management projects will contribute to water quality improvements within the watershed and may be of interest to the reader. Summary information on Monterey County Regional Stormwater Management projects is included in Appendix C.

3. Proposed TMDL Requirements

This section describes the turbidity control levels and associated requirements in the proposed TMDL.

Allocations

In accordance with the Basin Plan, sources shall be managed to meet the water quality objectives as well as the waste load allocations and load allocations contained in the proposed TMDL.

The TMDL is a numerical calculation of the loading capacity of a water body to assimilate a certain pollutant—in this case, turbidity—and still attain all water quality standards. The sum of the individual wasteload allocations for point sources (e.g., urban, industrial, and construction stormwater, and low threat wastewater), load allocations for nonpoint sources (e.g., agricultural dischargers and cannabis growers), natural background, and a margin of safety.

Table 2 summarizes the allocations proposed in the Gabilan Creek TMDL. Compliance with the assigned allocations is designed to return local waterbodies to attainment with their beneficial uses lost due to turbidity impairment.

Table 2. Allocations assigned in the Gabilan Creek TMDL.

Allocations	Location	Year-Round (NTU	Dry Season (NTU)	Wet Season (NTU)
Load Allocation	Headwater streams in the upper Gabilan Creek watershed (COLD and WARM)[1]	2.5	2.2	3.3
Wasteload Allocations and Load Allocations	Streams in the lower Gabilan Creek watershed (COLD and WARM)[2]	8	6	11
Wasteload Allocations and Load Allocations	Brackish Sloughs (EST)	--	--	--

1. To determine attainment of the load allocations for the upper Gabilan Creek watershed, compare the 75th percentile of the upper Gabilan Creek data to the appropriate seasonal allocation compliance level.
2. Determine attainment of the wasteload allocation and load allocation for the lower Gabilan Creek watershed, compare the median of the lower Gabilan Creek data to the appropriate seasonal allocation compliance level.

NPDES stormwater and wastewater permittees described in Section 2 of this Report are subject to wasteload allocations in Table 2. Regulated non-point sources and other non-point sources described in Section 2 of the Report are subject to load allocations in Table 2.

Implementation Procedures

This section documents reasonable means and methods to achieve compliance with the requirements of the proposed TMDL. Reasonable compliance activities were identified based on the implementation recommendations of the Gabilan Creek TDML staff report (Central Coast Regional Water Quality Control Board, 2021; see Section 9). Additionally, likely permitting outcomes based on standard practices for implementation of TMDL wasteload allocations in NPDES permits based on California's NPDES permitting standards and procedures: *The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Water Resources Quality Control Board, 2005; hereafter, the SIP).

NPDES Stormwater Permittees

Section 9 of the Gabilan Creek TMDL staff report (Central Coast Regional Water Quality Control Board, 2021) identifies the following activities as likely to be implemented in MS4 permits in order to meet applicable WLAs.

The City of Salinas MS4

Water quality-based effluent limitations necessary to implement the proposed wasteload allocations are likely to be included in any future or re-opened permit for the MS4. Under the existing permit, the City of Salinas is required to develop a Pollutant Load Reduction Plan to comply with all active TMDLs. Consequently, the MS4 will be required to update their plan to identify actions and timelines for complying with interim and final WLAs in the proposed TMDL. In addition, the Gabilan Creek TMDL staff report recommends increasing background and receiving water monitoring for turbidity to a monthly frequency for the term of the permit.

Monterey County MS4

Under the Phase II General Stormwater Permit, the MS4 is required to develop a Wasteload Allocation Program that identifies actions the MS4 will take to achieve compliance with wasteload allocations from all active TMDLs. To comply with the wasteload allocations in the proposed TMDL, Monterey County will need to update its program. A brief summary of some of the key program update tasks include, but are not limited to, the following: identify sources of turbidity within the MS4 service area, identify BMPs which will result in meeting the wasteload allocation, develop a project schedule, and include documentation verifying that the proposed Program is adequate to meet the wasteload allocation. After approval of the proposed Wasteload Allocation Program, the MS4 must implement the program.

Caltrans MS4

The Caltrans MS4 will be required to meet the wasteload allocations through the provisions of their existing NPDES permit. Under the permit, Caltrans must develop an assessment and implementation plan to meet the wasteload allocations within 1 year of

the adoption of the proposed TMDL. The assessment shall identify sources, Caltrans' contribution to turbidity loading, and the effectiveness of existing BMPs in addressing sedimentation and hydromodification. The implementation plan shall include implementation measures, monitoring, and a time schedule to achieve their waste load allocations.

Construction Stormwater

Permittees under the Construction Stormwater General NPDES Permit will be required to comply with the existing permit. According to the TMDL staff report (2021), it is anticipated the permittees will be able to comply with wasteload allocations through current practices including the development and implementation of a SWPP and BMPs designed to control turbidity. Permittees discharging to the Gabilan Creek impaired waters are already required to implement a monitoring plan for sediment.

Industrial Stormwater

Permittees under the General Industrial Stormwater Permit will meet wasteload allocations through TMDL implementation requirements contained in the general permit, potentially including monitoring for turbidity, updates to SWPPPs, and establishment of BMPs. Industrial stormwater permittees will likely need to perform monitoring for turbidity and further remedial measures (e.g., improvements to SWPPP or applying new BMPs) if monitoring demonstrates the appliable wasteload allocation is not being met.

NPDES Wastewater Permittees

Municipal and Industrial Wastewater

Wasteload allocations assigned to industrial wastewater sources (note: there are no permitted municipal wastewater sources in the watershed) will result in the establishment of water-quality based effluent limitations in individual NPDES permits, consistent with the procedures established in the SIP (2005). In addition, the Central Coast Board will establish routine effluent monitoring for turbidity to establish compliance with the effluent limitations. Permittees unable to immediately comply with effluent limitations may implement additional control strategies (e.g., source reduction, new treatment technologies) in order to meet effluent limitations and comply with the assigned wasteload allocation.

Low Threat

Permittees under the low threat general permits will meet wasteload allocations through implementation of existing permit conditions. Wasteload allocations will be implemented as water quality-based effluent limitations and/or receiving water limitations. These permits currently require turbidity monitoring.

Regulated Non-Point Sources

Irrigated Lands Program

Under the existing Agricultural Order, permittees are required to participate in a cooperative monitoring program to evaluate long-term trends in water quality throughout region. In general, the Central Coast Water Board anticipates implementation of the requirements of the existing Agricultural Order will be sufficient to attain compliance with load allocations under the proposed TMDL. If there are operators where existing pollution control practices are insufficient to meet load allocations, implementation of additional BMPs may be necessary.

In Section 10.6 of the Gabilan Creek TMDL staff report (2021), Central Coast Water Board staff recommend the cooperative monitoring program implemented under the Agricultural Order be augmented with additional monitoring within the Gabilan Creek watershed. Staff recommend receiving water site monitoring be increased from monthly to weekly frequencies and additional long-term monitoring sites be established. In addition, the staff report recommends conducting benthic monitoring at a site once every three to five years.

Cannabis Growers

Under the proposed TMDL, all cannabis cultivators in the Gabilan Creek watershed must develop a sitewide Sediment Discharge Monitoring and Reporting Plan which includes, but is not limited to, the following elements:

- Development of a Sitewide Stormwater Management Plan which lists the location and condition of all stormwater conveyance channels on the site and a time schedule for rehabilitating all erodible areas with stormwater conveyances.
- Monthly stormwater runoff monitoring for turbidity and pH, and reporting on site-maintenance activities.
- Receiving water turbidity monitoring for sites that are adjacent to surface waters and have any amount of unstable ground present on site or are undergoing land disturbing activities. Samples must be collected on all days in which flow is present in the receiving water and land disturbing activities are taking place or ground conditions are unstable. Monitoring must include three sampling activities: (1) baseline monitoring prior to initiating site disturbing activities, (2) upstream and (3) downstream monitoring during land disturbing activities.

The effectiveness of erosion prevention and sedimentation control measures will be determined by comparing discharge events and instream receiving water monitoring to established watershed discharge goals for turbidity in the Basin Plan.

Flood Control Pump Stations and Agriculture Field Drainage Pumps

According to the proposed TMDL staff report, the operators of the pump stations and drainage pumps must develop and implement plans to achieve compliance with load allocations from the proposed TMDL. According to provisional data collected from four of the pump stations in 2020 and 2021, operation of the pump stations result in increased turbidity levels within the receiving water downstream of the stations (as summarized in Table 3) and are likely to require development of additional controls in order to meet load allocations.

Table 3. Turbidity measurements upstream and downstream of select pump stations.

Pump Station[1,2]	**Mean Upstream Concentration (NTU)**	**Mean Downstream Concentration with Pumps Off (NTU)**	**Mean Downstream Concentration with Pumps Running (NTU)**
Year-Round Mean Measurements			
Espinosa Station	108	78	189
Lower Merritt Station	61	83	136
Santa Rita Station	119	215	213
Upper Merritt Station	48	46	91
Dry Season Mean Measurements			
Espinosa Station	64	78	185
Lower Merritt Station	23	42	73
Santa Rita Station	39	45	87
Upper Merritt Station	7.2	6.7	55
Wet Season Measurements			
Espinosa Station	195	[3]	195
Lower Merritt Station	138	165	260
Santa Rita Station	278	555	465
Upper Merritt Station	130	120	185

1. Averages based on a total of six samples per monitoring station.
2. Note the data contained in this table is considered provisional. Data were collected in a simulated exercise designed to determine what, if any, effect the pump stations had on in-stream turbidity levels. These data may not reflect normal operational conditions.
3. Data not available.

4. Compliance and Incremental Costs Analysis

This section describes the analysis for evaluating compliance with the proposed TMDL requirements and for estimating incremental cost impacts.

Methods for Estimating Incremental Costs

As discussed in Section 1 of this report, this analysis identifies a range of reasonable methods of compliance with the requirements of the proposed TMDL, and estimates the incremental costs with these methods. Incremental costs are the difference between the total direct costs of environmental regulation already in place (i.e., the baseline cost) and the total direct costs after a new regulation has been adopted (i.e., the proposed TMDL cost).

Direct costs are estimated by identifying the entities within the Gabilan Creek watershed likely to be directly impacted by the regulation and computing the costs of turbidity pollution control activities under the baseline scenario and under the proposed TMDL. The costs associated with pollution control activities (e.g., turbidity monitoring, developing and implementing pollution control plans, and BMPs) are tallied under each scenario and compared to identify the total incremental costs under the baseline and proposed TMDL scenarios. In instances where one or more pollution control activities do not vary between the baseline and proposed TMDL scenarios (e.g., a plant will perform monthly turbidity monitoring under both scenarios), the incremental cost associated with the activity is assumed to be zero.

All costs reported in the main body of this report are annual costs unless otherwise indicated. When compliance activities incur a capital or one-time cost (e.g., development of a new SWPPP or construction of a stormwater BMP), the cost is converted to an annual cost using a 5% annual interest rate and a 20 year amortization period according to the following equation:

$$Annual\ Value = \frac{Present\ \ Value}{(1.05^{20}-1)\Big/_{0.05\ x\ (1.05)^{20}}}$$

Appendix A contains a summary of unit costs and other programmatic cost information which were used to estimate total direct costs under the baseline and proposed TMDL scenarios. In addition, other cost information which may be of interest to regulated entities within the watershed have been included in Appendix A as a reference resource. All costs presented in the main body of this report have been adjusted for inflation and are presented in March 2021 dollars (Consumer Price Index for All Urban Consumers: All Items in U.S. City Average, Index 1982-1984=100, Annual, Seasonally Adjusted; March 2021 value of 264.8). The cost information in Appendix A has not been inflation adjusted and is presented as found in its original source, unless otherwise noted.

Appendix B contains descriptions and cost estimates of several turbidity control and minimization alternatives applicable to the flood control pump stations and agricultural drainage pumps located throughout the watershed.

Appendix C contains summary description and cost information for stormwater resource management projects being implemented throughout Monterey County, including portions of the Gabilan Creek watershed. While these projects and costs are not directly attributable to the proposed TMDL, this information has been included since it may be of interest to readers of this report.

NPDES Stormwater Permittees

Identifying the Affected Community

The watershed includes the following MS4s which are subject to the proposed TMDL:

- City of Salinas MS4
- Monterey County MS4
- Caltrans MS4

In addition, permittees subject to the General Industrial Stormwater Permit and the Construction General Permit are subject to the wasteload allocations in the proposed TMDL.

Incremental Cost Estimate

Insufficient information is available to directly estimate the full baseline costs associated with implementation of the existing turbidity water quality criteria for the NPDES stormwater permittees operating within the Gabilan Creek watershed. Instead, programmatic monitoring costs for the City of Salinas, and unit costs associated with turbidity monitoring and stormwater pollution control BMPs are presented in Appendix A.

Incremental costs associated with watershed planning and monitoring within the MS4s have been estimated based on the incremental changes in monitoring and planning activities described in Section 3 of this report and in the TMDL staff report. Watershed planning activities were estimated based on a range of likely costs which encompass updating existing plans to accommodate the turbidity wasteload allocation (i.e., low range cost) to development of a new plan designed to meet the wasteload allocation (i.e., high range cost).

The City of Salinas MS4 is the only MS4 in the watershed likely to be subject to a change in monitoring activities due to the proposed TMDL. The current monitoring frequency, the recommended monitoring frequency under the proposed TMDL, and the average annual incremental change for the City of Salinas MS4 are summarized in Table 4.

Table 4. City of Salinas MS4 Background and Receiving Water Monitoring

Monitoring Location	Existing Monitoring Frequency	Proposed Monitoring Frequency	Average Annual Incremental Increase
Receiving Water Station	Monthly (October – April, July, and September) during first year of permit term	Monthly throughout permit term	10.2 events/year
Background Station	None.	Monthly throughout permit term	12 events/year
		Total	22.2 events/year

Incremental costs associated with watershed planning and monitoring were estimated using the unit cost information summarized in Appendix A. Table 5 summarizes the incremental costs associated with monitoring and watershed planning by the MS4s necessary to comply with the TMDL.

Table 5. MS4 Incremental Monitoring and Watershed Planning Activities Necessary to Comply with Proposed TMDL.

MS4	Incremental Control Activity	Unit Cost	Estimated Incremental Cost
City of Salinas MS4	22.2 additional sampling events per year	$99/sample[1]	$2,198 per year
City of Salinas MS4	Pollutant Load Reduction Plan Development/Update	$16,000 - $93,000 per plan	$1,280 - $7,480 per year[2]
Monterey County MS4	Pollutant Load Reduction Plan Development/Update	$16,000 - $93,000 per plan	$1,280 - $7,480 per year[2]
Caltrans MS4	Pollutant Load Reduction Plan Development/Update	$16,000 - $93,000 per plan	$1,280 - $7,480 per year[2]
		Total	**$6,050 - $24,600 per year**

1. The per sample costs includes 1.12 hours of labor at $39 per hour to collect a sample, and $55 per sample in measurement costs. Refer to Appendix A for additional information on unit costs.
2. Unit costs have been annualized over a 20 year period at a 5% interest rate.

MS4s permittees may need to design and implement BMPs to achieve a level of turbidity control consistent with the wasteload allocations. Evaluating the need for BMPs, the number and type of BMPs required, and their total cost is highly site-specific. Site-specific information sufficient to estimate BMP design and implementation necessary to meet wasteload allocations is unavailable and collecting such information is beyond the scope of this analysis. Appendix A includes unit cost information for a

variety of stormwater BMPs which may provide permittees with context and helpful information in assessing potential BMP costs under the proposed TMDL.

As discussed in Section 3 of this report, it is unlikely permittees under the Construction Stormwater general permit will need to implement monitoring or pollution control activities to meet the wasteload allocation beyond those required under their existing permit.

Permittees under the General Industrial Stormwater Permit will meet wasteload allocations through TMDL implementation including updates to SWPPPs and establishment of BMPs. The need for compliance activities will be assessed through turbidity monitoring of industrial stormwater discharges. Visual inspection and monitoring for turbidity is required under the existing general permit and no incremental cost is anticipated. At this time, insufficient information regarding discharges of turbidity from permittees is available to identify facilities which may be unable to immediately comply with the applicable wasteload allocation. For this reason, and because stormwater BMP design and costing is highly specific to the on-site conditions and the nature of the industrial stormwater discharge, it is infeasible to estimate incremental costs associated with BMP-based pollution controls for industrial stormwater general permittees.

NPDES Municipal and Industrial Wastewater Permittees

The Gabilan Creek watershed does not contain NPDES-permitted facilities which discharge municipal or industrial wastewater. However, as discussed in the previous section, there are a number of industrial facilities which are authorized under the NPDES program to discharge stormwater.

Permittees to the NPDES Low Threat and Other General Permits

Permittees under the low threat general permits will meet wasteload allocations through implementation of existing permit conditions. As such, the expected costs under the baseline conditions and under conditions of the proposed TMDL are the same, and the estimated incremental cost for these permittees is zero.

Irrigated Lands Program

Identifying the Affected Community

PG Environmental identified the affected community of growers and farmland operators under the Central Coast Board's existing irrigated lands program Agricultural Order by a review of 2019 Notice of Intent (NOI) information. PG Environmental utilized geographic information (i.e., operation latitude and longitude coordinates) in the 2019 NOI information to identify the proportion of operations located within the Gabilan Creek watershed and subject to the proposed TMDL. According to the 2019 NOI data, there

are 4,129 operations enrolled under the existing Order and 4.5% of these (i.e., 189 operations) are located within the Gabilan Creek watershed.

Incremental Cost Estimate

Under the proposed TMDL, operators in the Gabilan Creek watershed are required to participate in a cooperative monitoring program to assess long-term water quality trends. The TDML staff report recommends increasing the monitoring frequency from monthly to weekly sampling frequencies, and to add additional monitoring sites. According to the TMDL staff report, there are currently 13 monitoring sites in the watershed under the irrigated lands cooperative monitoring program. In estimating incremental monitoring costs under the proposed TMDL, PG Environmental assumed two additional sites would be established within the watershed and monitoring at all sites would proceed at a weekly frequency. In addition, the new routine monitoring would be limited to measurement of turbidity and other physical parameters (color, temperature, odor) at $99 per sample[4].

The staff report recommends performing benthic monitoring at one site every three to five years within the watershed. PG Environmental assumes benthic monitoring will cost approximately $584 per sampling event[5].

Table 6 summarizes the cost estimate for TMDL monitoring activities under the irrigated lands program.

[4] The per sample costs includes 1.12 hours of labor at $39 per hour to collect a sample, and $55 per sample in measurement costs. Refer to Appendix A for additional information on unit costs.

[5] The per sample cost include 6 person hours of labor at $39 per hour to collect samples and $350 in analysis costs (Aquatic Biology Associates, 2021).

Table 6. Routine and Benthic Irrigated Lands Monitoring Costs.

Monitoring Site Category	Site Count	Baseline Monitoring Frequency (Sampling Events per Year)	TMDL Monitoring Frequency (Sampling Events per Year)	Baseline Cost	TMDL Cost	Incremental Cost
Existing Routine Monitoring Sites	13	12	52	$15,444	$66,924	$51,480
New Routine Monitoring Sites	2	0	52	$0	$10,296	$10,296
Benthic Monitoring	1	0	0.33[1]	$0	$195	$195
			Total	$15,444	$77,415	$61,971

1. The TMDL staff report recommends benthic monitoring occur once every three to five years. A monitoring frequency of once every three years has been conservatively assumed.

In addition to the incremental cost analysis for the proposed TMDL, EPA and the Central Coast Water Board requested that PG Environmental estimate the total costs of implementing the Agricultural Order after adoption of the proposed TMDL. According to the report, *Economic Considerations of Proposed Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands* (PG Environmental, 2019), the total estimated cost associated with implementation of Agricultural Order 4.0 is between $3.6 million per year to $4.6 million per year.

Assuming the total implementation cost for operations in the Gabilan Creek watershed are proportional the fraction of permittees present in the area (i.e., 4.5% of all permittees regulated by the Agricultural Order are located in the Gabilan Creek watershed), the total implementation cost of the Order in the Gabilan Creek watershed is approximately 4.5% of total implementation cost—i.e., ranging from approximately $163,000 to $205,000 per year for all operations in the Gabilan Creek watershed and $860 to $1,090 per year per operation. Adding in the incremental costs associated with the proposed TMDL results in a total implementation cost, of $225,000 to $267,000 per year.

Cannabis Growers

Identifying the Affected Community

There are currently 28 commercial cannabis cultivators in the Gabilan Creek watershed enrolled in the Cannabis General Order. As described in Sections 2 and 3 of this report, under both the baseline condition and under the proposed TMDL cannabis growers must develop and implement a site-wide sediment and stormwater management plan,

and monitor turbidity in their stormwater discharges once per month. In addition, the Gabilan Creek TMDL staff report (2021) recommends establishing new receiving water monitoring at cannabis operations that are located near receiving waters.

Incremental Cost Estimate

To estimate incremental control costs under the proposed TMDL, PG Environmental estimated costs for the turbidity control activities described above. Insufficient information is available to estimate how many grow operations would engage in site disturbing activities each year. Central Coast Water Board staff indicated that most or all the growers are greenhouse operations which are unlikely to engage in site disturbing activities in any given year. Therefore, PG Environmental conservatively assumed 5 of the 28 operations would engage in site disturbing activities each year and these activities would last an average of 2 days. This assumption is likely to overestimate costs as not all operations are located in close proximity to receiving waters and subject to new receiving water monitoring regardless of site disturbances. In addition, PG assumed the typical operation would have a single stormwater monitoring location and a single receiving water to monitor. Table 7 summarizes the incremental planning and monitoring costs for cannabis operations under the proposed TMDL.

Table 7. Incremental Costs for Site Planning and Routine Monitoring at Cannabis Operations.

Monitoring Site Category	Number of Operations	Baseline Monitoring Frequency (Sampling Events per Year)	TMDL Monitoring Frequency (Sampling Events per Year)	Baseline Cost (per Year)	TMDL Cost (per Year)	Incremental Cost (per Year)
Sitewide Stormwater Management Plan[1]	28	--	--	$5,842	$5,842	$0
Routine Stormwater Monitoring[2]	28	12/year	12/year	$33,264	$33,264	$0
Receiving Water Monitoring[3]	5	0	2/year[4]	$0	$2,970	$2,970
			Total	$39,106	$42,076	$2,970

1. Unit cost is $209 per site per year based on a total present value cost of $2,600 per plan annualized over 20 years at a 5% interest rate.
2. Unit cost is $99 per sampling event for routine stormwater monitoring.
3. Unit cost is $297 per sampling event (three receiving water samples—background, upstream, and downstream receiving water samples—at $99 per sample).

4. Assumes 2 days of site disturbing activities per year necessitating receiving water monitoring.

Insufficient information is available at this time to evaluate what number of cannabis operations in the watershed will be able to meet load allocations based on existing BMPs and use of a stormwater management plan. Should any operations require additional stormwater controls to meet the turbidity load allocation, Appendix A summarizes unit costs associated with common BMPs at cannabis and other agricultural operations used to control turbidity in stormwater discharges.

Flood Control Pump Stations and Agriculture Field Drainage Pumps

Identifying the Affected Community

The proposed TMDL staff report identifies at least six pump stations currently in operation with the Gabilan Creek watershed. Based on turbidity monitoring data collected during pump station operations, discussed in Section 2 of this report, PG Environmental identified the following stations as sources likely to require additional controls in order to comply with the applicable TMDL load allocations.

- Espinoza Station
- Lower Merritt Station
- Santa Rita Station
- Upper Merritt Station

PG identified three alternative options to reduce turbidity in the receiving water due to pump operations and comply with the proposed load allocations. These alternatives reduce receiving water turbidity by (1) armoring receiving water banks and channel beds to prevent erosion, and/or (2) upgrading or replacing pumps to reduce turbulence generated by pump operations. Specifically, these alternatives are:

- **Riprap armoring of the channel and installation of gabion baffling:** Riprap armoring will reduce the resuspension of sediment due to turbulence in the receiving water, and gabion baffles diffuse the energy of the discharge and reduce turbulence-driven bank erosion.
- **Installation of Variable Speed Drives:** This alternative allows the pumps in each station to operate at lower capacities when feasible. This reduces the erosive capacity of discharge and will minimize the resuspension of sediment.
- **Full Replacement of Pump Stations:** This alternative involves replacing the existing pump stations with entirely new pump stations that have a larger number of smaller pumps. The new pump stations would allow the pump stations to operate at lower flow rates more frequently and would have similar benefits to the variable speed pumps.

Appendix B summarizes the details of these control alternatives. The costs of these alternatives are summarized in the following table.

Table 8. Summary of Pump Station Alternative Costs

Alternative No.	Pump Station	Capital Costs ($)	O&M Costs ($/year)	Annualized Total Cost ($/year)[1,2]
1 (Armoring)	Upper Merritt	$319,073	$12,725	$38,328
1 (Armoring)	Lower Merritt	$291,708	$11,876	$35,284
1 (Armoring)	Santa Rita	$90,642	$3,535	$10,808
1 (Armoring)	Espinosa	$90,642	$3,535	$10,808
			Alternative No 1. Total	**$95,227**
2 (Variable Drives)	Upper Merritt	$288,745	[3]	$23,170
2 (Variable Drives)	Lower Merritt	--	--	--
2 (Variable Drives)	Santa Rita	--	--	--
2 (Variable Drives)	Espinosa	$130,924	[3]	$10,506
			Alternative No. 2 Total	**$33,675**
3 (Full Replacement)	Upper Merritt	$3,263,341	[3]	$246,818
3 (Full Replacement)	Lower Merritt	$2,870,759	[3]	$217,125
3 (Full Replacement)	Santa Rita	$1,906,478	[3]	$144,193
3 (Full Replacement)	Espinosa	$2,092,955	[3]	$158,297
			Alternative No. 3 Total	$766,433
			Range of Cost Alternatives	**$33,700 - $766,000**

1. Annualized total costs ($/year) are the sum of annualized capital costs ($/year; see footnote 2 for present worth-to-annual cost conversion assumptions) and O&M costs ($/year).
2. Capital costs were annualized based on a 5% interest rate and a 20 year project life.
3. O&M costs for these alternatives are expected to be similar or slightly less than the existing pump stations.

In addition, the Central Coast Water Board anticipates MCWRA, the agency which owns and operates the pump stations, will agree to conduct new routine turbidity monitoring at the pump stations to evaluate progress towards meeting load allocations. The Central Coast Water Board anticipates 2 - 4 monitoring events will be conducted per year (one in the dry season and one in the wet season) at each of the four stations. Each event will include collection of three turbidity samples (one upstream, two downstream before

and during pump operation). No monitoring occurs under the existing policy status quo so there are no baseline turbidity monitoring costs. The unit cost for conducting a monitoring event at one station is $354[6]. The total cost for conducing 2 – 4 monitoring events per year at four stations is $2,833 - $5,666 per year. Because the baseline monitoring cost is zero, the total annual incremental cost for turbidity monitoring at all four stations will range from $2,833 - $5,666 per year.

The total range of potential incremental costs for the flood control pump stations and agricultural field drainage pumps is anticipated to range from $36,500 - $772,000 per year.

[6] Unit monitoring cost information provided by MCWRA (personal communication with Central Coast Water Board staff, 2021).

5. Conclusion

Summary of Incremental Cost Analysis Results

This section of the report summarizes the total incremental costs which were estimated for the regulated community in Section 4 of this report. As discussed in Section 4 of this report, PG Environmental estimated potential incremental compliance costs for monitoring and watershed planning activities under the proposed TMDL. These costs are summarized in Table 9.

Table 9. Summary of Estimated Incremental Compliance Costs Due to Monitoring and Watershed Planning under the Gabilan Creek TMDL

Category	Incremental Cost ($/year)
NPDES Stormwater Permittees	$6,050 - $24,600
NPDES Municipal and Industrial Wastewater Permittees	$0
NPDES Low Threat Wastewater General Permittees	$0
Irrigated Land Program	$62,000
Cannabis Growers	$2,970
Flood Control Pump Stations and Agricultural Field Drainage Pumps	$36,500 - $772,000
Total	**$107,000 - $862,000 per year**

Compliance costs for additional control activities (e.g., implementation of additional stormwater control BMPs) which may be necessary to comply with wasteload allocations and load allocations under the proposed TMDL were not feasible to estimate due to data limitations. However, Appendix A provides unit cost information associated with a wide variety of control activities—including BMP implementation, turbidity monitoring, and pollution control planning activities—which are applicable to the community of entities regulated under the proposed TMDL. Members of the regulated community may refer to Appendix A information to develop estimates of possible compliance costs under the proposed TMDL which are more narrowly tailored to their specific individual circumstances.

Uncertainties and Limitations of the Analysis

There are a number of uncertainties associated with the analysis of potential compliance activities under the proposed TMDL and associated costs due to data limitations. In general, the estimated incremental costs in this report were for watershed and site planning activities, and for pollutant monitoring activities. Data and information necessary to forecast the ability of NPDES stormwater and agricultural discharges to

meet the applicable turbidity wasteload allocations and load allocations is not available. In addition, the level of site-specific information necessary to estimate costs for most urban and agricultural stormwater BMPs is substantial and the collection of such information is beyond the scope of this analysis. Therefore, it was infeasible to account for these potential activities in the cost analysis.

Table 10 summarizes the these and other key uncertainties and their potential effects on estimated costs.

Table 10. Key Limitations and Uncertainties in the Analysis of Compliance Costs

Assumption or Issue	Impact on Estimated Incremental Costs[1]	Comments
No assessment if additional BMPs are necessary for TMDL compliance	–	Insufficient data is available to estimate which regulated point sources and non-point sources will be able to immediately comply with the TMDL, and which entities may need to undertake additional actions. Because costs for sources which may need to take additional actions to achieve compliance are infeasible to include, total incremental costs for the TMDL are likely to be underestimated.
Assumed five cannabis grow operations would need to conduct receiving water monitoring per year	?	Insufficient information was available to determine which cannabis grow operations are located in proximity to receiving water and would need to conduct receiving water monitoring during land-disturbing activities. PG Environmental has assumed a value which is meant to be conservative (and likely an overestimate of costs); however, insufficient information is available to assess the reasonableness of the assumption.

1. A plus sign (+) indicates costs are likely overestimated. A minus sign (–) indicates costs are likely underestimated. A question mark (?) indicates the effect of the assumption is uncertain.

6. References

Aquatic Biology Associates. 2021. Benthic Monitoring Price Guidelines. https://www.aquaticbio.com/services/price-guidelines/

Central Coast Regional Water Quality Control Board. 2019. The Water Quality Control Plan for the Central Coast Basin.

Central Coast Regional Water Quality Control Board. 2021. Draft Staff Report for the Total Maximum Daily Load for Turbidity in the Gabilan Creek Watershed, Monterey County California.

Personal Communications with Central Coast Water Board Staff. September 22, 2021.

PG Environmental. 2019. Economic Considerations of Proposed Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands.

State Water Resources Quality Control Board. (2005). Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.

Appendix A. Unit Cost Information

Approach for Collecting Cost Information

This appendix summarizes unit cost information and programmatic costs collected to estimate compliance costs with existing turbidity regulations in the watershed, and reasonably foreseeable methods of compliance with proposed wasteload allocations and load allocations in the Gabilan Creek Turbidity TMDL.

PG utilized turbidity surface water quality monitoring cost data collected under a previous work assignment (Cost Analysis for Ag Order 4.0), wherein PG contacted laboratories located in Monterey County. Additionally, PG reviewed the Central Coast Cooperative Monitoring program (CMP) website and Central Coast Ambient Monitoring program (CCAMP) website to evaluate the permittee participation fees and monitoring costs for surface water monitoring and bioassessment monitoring.

PG also reviewed the relevant literature and cost data associated with conducting remedial measures and best management practices for erosion control, stormwater management, and agricultural discharge. PG reviewed guidance documents, permit cost analyses, and TMDL technical reports as follows:

- Agricultural Order 4.0 Economic Analysis
- City of Salinas Phase I MS4 Stormwater Permit Cost Analysis
- Turbidity California Environmental Quality Assessment (CEQA) Checklist and Analysis Report
- Draft TMDL Staff Report

Cost data included in this appendix are presented as dollar values consistent with their source documentation and have not been adjusted for inflation. Where costs documented in this appendix have been used to estimate incremental costs in this report, reported costs have been adjusted for inflation in the main body of the report.

Cost Data

NPDES Stormwater Data

Estimated unit costs associated with the common pollutant control measures associated with specific MS4 permits and other forms of NPDES-permitted stormwater are summarized below (Tables A-1 to A-3).

Table A-1. Applicable Monitoring Costs.

Monitoring Type	Unit Cost	Notes	Source
City of Salinas Phase I MS4 Stormwater Permit	Annual overall monitoring cost: $469,981 in FY 2017/18.	Annual Monitoring cost was presented between FY2013-18 in Table G-1	CRWQCB (2019)

Monitoring Type	Unit Cost	Notes	Source
– Overall monitoring		(pdf page 9).Includes overall cost for urban catchment, receiving water, and downstream monitoring.	
Water Sample Analysis	$10-$40/sample (only turbidity) $45-$65/sample (full scan of physical parameters: color, odor, and turbidity)	Unit cost for Turbidity lab analysis for a water sample	TES (2021), OCEUSA (2021), ACA (2021), MBAS (2021)
Water Sample Analysis	LaMotte 2020e Turbidimeter: $1,199 Hach portable turbidimeter $1,360	Unit price for a portable turbidimeter	Granger (2021), Hach (2021a)
Water Sample Analysis	YSI ProDSS Water Quality Meter: $1,618.85	Unit price for a continuous monitoring sonde	YSI (2021)
Water Sample Collection and Analysis	$99/event	PG estimates an average of 1.12 labor hours for sample collection includes travel and sampling. The average hourly wage (including employer benefits) for wastewater system operators in Salinas, CA is $39. Analytical analysis cost is approximately $55/sample for physical parameters (i.e., turbidity, color, and odor)	BLS (2020) TES (2021), OCEUSA (2021), ACA (2021), MBAS (2021)

Table A-2. Applicable Best Management Practices (BMPs) Cost.

Stormwater Management Practices	Unit Cost	Notes	Source
Bioretention	Retention basins: $0.80-1.60/ cubic foot of runoff Bioretention: $8.47/cubic foot of runoff	Typical unit costs are presented in dollars per cubic foot of treated water volume	USEPA (1999b), CRWQCB (2019)
Buffer Strips	Urban forest buffer: $2,860/acre Urban grass buffers: $2,053/acre	Stormwater Cost estimates per impervious acre treated. Combined annual operating,	MDE (2011)

Stormwater Management Practices	Unit Cost	Notes	Source
		implementation, and maintenance costs	
Filter Strips	Filter strip: $0-2.08/cubic foot of runoff	Based on cost/sq. ft & 6 in. storage in strip	USEPA (1999b), CRWQCB (2019)
Vegetated Swales	Grass swales: $0.80/cubic foot of runoff	Based on cost/sq. ft &, 6 in. of storage in filter)	USEPA (1999b), CRWQCB (2019)
Straw Wattles	$1.38 per linear foot of wattle	Represents cost for 9-inch diameter, application Rate:60 foot spacing for 3% slope recommended	Chagrin River Watershed (2012)
Rain Gardens	$3-$40/square feet	Cost varies depending on the complexity, size, and infrastructure such as underdrains or outlet structures of the garden	USEPA (2015b)
Green Roofs	$9.60-$40/square feet	Cost depends on the media depth and plantings (extensive vs. intensive)	USEPA (2015b)
Detention Ponds	Detention basins: $3.20 - $231.67/cubic foot of runoff	Lower cost represents lower treatment capacity of the basin while the higher price represents the basin with higher treatment capacity	Minnesota Pollution Control Agency (2011), CRWQCB (2019)
Infiltration	Infiltration basins: $33.55 per cubic foot	None.	Minnesota Pollution Control Agency (2011), CRWQCB (2019)
Low-Impact Development (LID)	Green streets: $52.35-$66.14/sq foot Green infrastructure:$32.16-$66.53	Green Streets: infiltration and filtration BMPs located in public right-of-way along transportation corridors Green Infrastructure: small-scale infiltration on publicly-owned parcels, e.g., rain gardens, permeable parking lots	Table I-3 in San Diego Bacteria TMDL Cost-Benefit Analysis, CRWQCB (2019)

Stormwater Management Practices	Unit Cost	Notes	Source
Media/Sand Filtration	Sand filter: $4.79-9.59/ cubic foot of runoff	None.	USEPA (1999b), CRWQCB (2019)
Local Infiltration Systems	$50,000-$4.7 million	Includes installation and O&M cost. Low cost represents an infiltration paver system serving the small urban mixed-use residential and commercial scenario (0.14 acre, 2,800-gallon Design Capture Volume) while the higher cost represents the cistern and green roof combination serving the 12.4-acre big-box commercial project.	CRWQCB (2019)

Table A-3. Other cost components.

Other Cost items	Unit Cost	Notes	Source
Develop and implement City of Salinas' existing wasteload allocation attainment plan (WAAP)	$50K for plan development and $40K to complete assessment	Development and implementation cost: Consultant fees: $50K for plan development and $40K to complete assessment (not including equipment and analytical costs). Estimate was developed for pesticide wasteload allocations.	CRWQCB (2019)
Updating City of Salinas' existing pollutant load reduction plan	$16,000	PG assumes the development of a plan update will take approximately 100 hours of labor from a civil engineer. The average wage (including employer benefits) is $54/hour in Salinas, CA. A multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit.	BLS (2020)
Updating Monterey County's wasteload allocation attainment program to include turbidity wasteload allocations.	$32,000	PG assumes the development of a plan to meet new wasteload allocations will take approximately 200 hours of labor from a civil engineer. The average wage (including employer benefits) is $54/hour in Salinas, CA. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit.	BLS (2020)

Other Cost items	Unit Cost	Notes	Source
Existing volume reduction control strategies	Cisterns: Capital costs – $26,680,000; Operation and Maintenance Costs – $72,000 per year	volume capture approach focused exclusively on deploying and maintaining 10,000-gallon cisterns over 20 percent of the Permittee's area	CRWQCB (2019)

Irrigated Agriculture Data

The costs associated with the existing provisions of the Agricultural Order and related proposed requirements of the TMDL are summarized below (Tables A-4 to A-8).

Table A-4. Applicable Monitoring Cost.

Monitoring Action	Total Cost	Assumptions/Notes	Source
Surface Receiving Water Trend Monitoring - cooperative	$8,847,000	Projected total cost under Agricultural Order 4.0. A project period of 2021–2025 was used	CRWQCB (2021a)
Surface Receiving Water Trend Monitoring - Individual	$4,667,000	Projected total cost under Agricultural Order 4.0. A project period of 2021–2025 was used	CRWQCB (2021a)
Follow-up surface water monitoring	$1,525,000	Projected total cost under Agricultural Order 4.0. A project period of 2021–2025 was used	CRWQCB (2021a)
Preparation and submittal of turbidity monitoring report (occurs twice yearly)	$1,040/report	PG assumes each report will take approximately 20 hours to prepare and submit by a farm manager. The average wage (including employer benefits) is $52/hour in Salinas, CA.	BLS (2020)
BMP effectiveness monitoring - TSS or SSC monitoring	TSS monitoring cost: $8/sample Sediment grain size analysis: $10/sample	None.	CRWQCB (2021c)
Bioassessment monitoring - Benthic invertebrate monitoring every 3 to 5 years	$1,004/sample, $50,200/event CMP fee: as per the fee schedule.	CMP already conducts but not addressed in ag order cost analysis	CRWQCB (2021b)
Periodic CRAM monitoring	$200-$500/assessment area (assuming each assessment area is 200 m along the stream reach)	Proposed monitoring requirement under the TMDL is every 3 to 5 years	CRWQCB (2021b)

Monitoring Action	Total Cost	Assumptions/Notes	Source
	$1,500-$2,500/half day assessment		

Table A-5. Irrigated agricultural management practice for the Central Coast Region.

Management Practices	Total Cost	Assumptions/Notes	Source
Develop a Sediment and Erosion Management Plan (SEMP) as part of the Agricultural Order's Farm Plan	$2,600/plan Develop SEMP for Ag. Order permittees with impermeable surfaces: $472,000 to $878,000 ($1.11 to $1.84 per acre)	Assuming, a large farm site, a civil engineering firm with AutoCAD 3D (or similar) would develop SEMPs, and no additional civil engineering plan is required (such as stormwater management, site plans, or other zoning plans). An average of 12-16 hours is required for a qualified professional to develop a SEMP. The average wage (including employer benefits) is $54/hour in Salinas, CA. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit. Estimated regional cost for five years. The cost of operation in Gabilan creek will be proportionally low.	PG (2019), USEPA (2020) CCRWCB (2021)
Used soil amendments to protect soil structure.	Soil amendment costs: Hay: $192/acre Compost: $84/acre	None.	On Pasture (2019)
Alignment of rows for proper drainage and to reduce erosion	Costs are highly site-specific and infeasible to estimate given the available information.	None.	--
Controlled concentrated drainage on roads by grading to reduce erosion or installing culverts, rolling dips,	Culverts: Rolling dips: UG outlet pipes. Curb or gutter: $20 - $50/linear feet	None.	RDPW (2010)

Management Practices	Total Cost	Assumptions/Notes	Source
underground outlet pipe(s).			
Installed sediment basin(s), pond(s), reservoir(s) or other sediment trapping structures to remove sediments from discharge.	Sediment basin: Catch basin: $50 - $13,000/unit Sand filters: $75.00/cubic yard	None.	GI (2020), RDPW (2010)
Application of Polyacrylamide (PAM) in irrigation water.	$2.86/acre (applied at a rate of 1 l/acre for each irrigation, and an added labor or purchased applicator cost of $1.00 an acre for PAM application)	None.	OSU (2001)
Walked the perimeter of the property to verify erosion controls and that sediment does not leave the ranch/farm during irrigation events and/or storm events.	$25/hour	Total cost is infeasible to estimate because insufficient information is available identify the quantity of effort required. Costs are likely to be highly site-specific. The unit cost is the total compensation rate (wage plus benefits) for a supervisory farm laborer to inspect erosion controls in Salinas, CA.	BLS (2020)
Conducted laboratory analysis, field quick tests or used handheld meters to measure Turbidity in irrigation runoff.	Field quick test: Turbidimeter: $164/unit	None.	Hach (2021b)
Conducted photo monitoring before and after practice implementation.	Equipment cost: Digital Camera: $62/each	None.	Amazon (2021a)
Consulted with a qualified professional to assess practice implementation (e.g., CCA, PCA, UCCE Specialist, NRCS, RCD, agronomist, or other).	Crop consultant/agronomist: $8.43/acre (Full service — prescriptions with 7+ visits/year plus report)	None.	Asbridge (2004)

Table A-6. Representative costs of selected erosion control practices

Practice	Description[1]	Unit	Range of capital costs ($)[2]
Diversions	A channel constructed across the slope with a supporting ridge on the lower side	Feet	$1.97 - $5.51
Terraces	A system consisting of multiple continuous lines of earth embankments constructed across a field slope at a line spacing that reduces sheet and rill erosion and gully erosion to tolerable soil loss limits under the most intense cropping system planned for the field.[3]	Feet	$3.32 - $14.79
Waterways	A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.	Feet	$5.88 - $8.87
Permanent vegetative cover	Living vegetative cover (e.g., grasses) on the soil surface protect against detachment by intercepting and/or dissipating the energy of falling raindrops. A layer of plant material also creates a thick layer of still air next to the soil to buffer against wind erosion.	Acre	$69 - $270
Conservation tillage	Disturbing the entire soil surface using tillage operations such as chisel plowing, field cultivating, tandem disking, or vertical tillage.[4] This practice preserves or increases organic matter and soil structure, resulting in improved water infiltration and surface stability.	Acre	$9.50 - $63.35

[1] Practice descriptions extracted from the National Management Measures for the Control of Nonpoint Pollution from Agriculture, Chapter 4C: Erosion and Sediment Control (EPA, 2003), unless otherwise noted.

[2] Reflects the range of capital costs per unit of management practice installation, in 1998 dollars. This cost is paid by the farmers.

[3] Source: USDA (2011).

[4] Source: USDA (2016).

The cost estimates for control of erosion and sediment transport from agricultural lands in Table A-7 are based on experiences in the Chesapeake Bay Program (USEPA, 2015b).

Table A-7. Annualized cost estimates and life spans for selected management practices from Chesapeake Bay installations[1]

Practice	Description[2]	Practice Life-span (Years)	Median Annual Cost[3] ($/acre/yr)[4]
Strip-cropping	Growing planned rotations of erosion-resistant and erosion-susceptible crops or fallow in a systematic arrangement of strips across a field.	5	$11.60
Terraces	A system consisting of multiple continuous lines of earth embankments constructed across a field slope at a line spacing that reduces sheet and rill erosion and gully erosion to tolerable soil loss limits under the most intense cropping system planned for the field.[5]	10	$84.53
Diversions	A channel constructed across the slope with a supporting ridge on the lower side.[6]	10	$52.09
Sediment retention water control structures	An earth embankment or a combination ridge and channel constructed across the slope of a minor drainageway.	10	$89.22
Grassed filter strips	A strip or area of herbaceous vegetation that removes contaminants from overland flow.	5	$7.31
Cover crops	Crops including grasses, legumes, and forbs for seasonal cover and other conservation purposes.	1	$10.00
Permanent vegetative cover on critical areas	Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal seeding/planting methods.	5	$70.70
Conservation tillage[7]	Disturbing the entire soil surface using tillage operations such as chisel plowing, field cultivating, tandem disking, or vertical tillage.[8] This practice preserves or increases organic matter and soil structure, resulting in improved water infiltration and surface stability.	1	$17.34
Reforestation of crop and pasture[7]	The reestablishment of forest cover either naturally (by natural seeding, coppice, or root suckers) or artificially (by direct seeding or planting).[9]	10	$46.66
Grassed waterways[10]	A natural or constructed channel that is shaped or graded to required dimensions and established in suitable	10	$1.00

Practice	Description[2]	Practice Life-span (Years)	Median Annual Cost[3] ($/acre/yr)[4]
	vegetation for the stable conveyance of runoff.[6]		

1 Median costs (1990 dollars) obtained from the Chesapeake Bay Program Office (CBPO) best management practices (BMP) tracking data base and Chesapeake Bay Agreement Jurisdictions' unit data cost. Costs per acre are for acres benefited by the practice.
2 Practice descriptions extracted from USDA NRCS Conservation Practice Standards found in the Field Office Technical Guide for California (https://efotg.sc.egov.usda.gov/#/details), unless otherwise noted.
3 Annualized BMP total cost including O&M, planning, and technical assistance costs. BMP costs are per acre of practice area per year of practice lifespan.
4 These costs are expressed as "Equivalent annual cost" (EAC) for the lifespan of the targeted practice in 10% discount rate. For an example, the EAC of a standard diversion is $52.09, which means the annual cost (considering discounted price over time) of a standard diversion practice is $52.09 per acre in its overall life span of 10 years. For financial decision making between two options, lower EAC of a practice indicates more cost-effectiveness of the option.
5 Source: USDA (2014a).
6 Source: National Management Measures for the Control of Nonpoint Pollution from Agriculture, Chapter 4C: Erosion and Sediment Control (EPA, 2003).
7 Government incentive costs.
8 Source: USDA (2016).
9 Source: USDA (2014b).
10 Annualized unit cost per linear foot of constructed waterway.

In addition to the management practices reported in the annual compliance forms, the Agricultural Order CEQA document identifies additional reasonably foreseeable management practices as determined from available literature. The following are identified as practices to retain sediment onsite:

Table A-8. Table of irrigated agricultural management practice for the Central Coast Region.

Management Practices	Total Cost	Assumptions/Notes	Source
Plant cover crops; use them and manage them appropriately	Seed cost: $9-$36 per acre (depending on the seed) $28.40 per acre for cereal rye and $58.25 per acre for the rye/vetch blend.(establishment cost) $37/acre cost of seed and seeding	None.	NRCS (2014), Swanson (2018), SARE (2019)
Rotate crops	$14.90/acre	Conservation crop rotation	USDA (2014i)
Manage irrigation, examples include: - Irrigation distribution uniformity - Reduce irrigation water applied - Use micro-irrigation	Small systems for small area (manual labor, gravity flow): $50	None.	NRCS (2009a), NRCS (2009b)

Management Practices	Total Cost	Assumptions/Notes	Source
- Maintain irrigation system; check for leaks and broken emitters, and fix/replace as needed	Larger systems requiring pumps and permanent piping can cost from $1,800 to $2500 an acre Drip system: $2,000-$4,000/acre Hand move system: $2,000-$3,000/acre Subsurface: $3,000-$6,000/acre		
Install buffer strip, vegetated filter strip, or swale	Swale: $10.86/gal	None.	UNH (2011)
Install constructed wetlands or other vegetated treatment system	$785	Annualized per acre costs over 40 year lifespan	Tyndall & Bowman (2016)
Minimize bare soil	Line the area with crushed rock or gravel (porous material) to promote infiltration and minimize discharge Crushed stone or gravel: $1 - $3/square feet	The cost collected from crushed stone and gravel supplier's website. The cost does not include construction cost.	Homeguide (2021)
Minimize tillage	Reduced tillage options: Deep-zone tillage: $2.29/acre Strip-tillage $17.90/acre No-till zero cost Ridge tillage $37.25/acre	Assuming deep tillage less than 20 inches, and only the total machinery costs for strip-till operations	Nevegetable (2021), NRCS (2019), NRCS (2021), USDA (2013)
Install and maintain sediment trapping measures	$513 (1,800 CF) $1,669 (5,400 CF) $2,671 (9,000 CF)	Cost is developed based on the BMPs Used for 27 model construction sites. Sediment traps appear on study sites with steep sites and clay soils.	USEPA (1999a)
Conservation tillage	$73-$78/acre	None.	FAO (2001)
Critical area planting	$20-$369 (year 1) $121-$903 (year 2 and 5)	None.	UCANR (2003)
Mulching	$0.21/ Square Yard	None.	UCANR (2003)

Management Practices	Total Cost	Assumptions/Notes	Source
Contour farming or strip-cropping	Contour farming: $7.44/acre Strip-cropping: $4.47/acre	None.	USDA (2014a), USDA (2014b)
Contour buffer strips	$307.18/acre	None.	USDA (2014h)
Grassed waterway	$3,745 $28 - $2,250 (year 1) $27 - $767 (year 2 and 5)	None.	USDA (2014c), AWQA (2003)
Terrace	$2,300/unit	None.	Lenhart (2017)
Out-slope roads	Outsloping is performed along road segments where concentrated flow can cause adverse effects. Recent watershed contracts cited a cost of $2 per linear foot	None.	USDA Forest Service (2007)

State Highways and Rural Roads

Table A-9 summarizes unit costs and programmatic costs applicable turbidity management on state highways and rural roads.

Table A-9: Applicable Best Management Practices (BMPs) Cost.

Management Practice	Total Cost	Assumptions/Notes	Source
Paving or graveling unpaved roads	Paving: $3,422 (Chip Seal-Double Surface Treatment) - $6,048 (cold mix) (cost/mile per year), Gravel road maintenance cost $18,065 (total for 6 years)	None.	USEPA (2015)
Dust and erosion controls on unpaved roads or trails	Apply liquid/solid dust control: $2.61/square yard,	Petroleum-Based Road Oil Application - Once per Year	USDA (2014g)
Improved/expanded street sweeping	Street sweepers $69,000 - $127,000/unit	The higher end of the cost reflects costs of vacuum-assisted and regenerative air sweepers.	CDM (1993)

Management Practice	Total Cost	Assumptions/Notes	Source
Development and submission of an assessment and implementation plan to meet TMDL WLA	$32,000/plan	PG assumes the development of a plan to meet new wasteload allocations will take approximately 200 hours of labor from a civil engineer. The average wage (including employer benefits) is $54/hour in Salinas, CA. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit.	BLS (2020)
Development of a nonpoint source implementation program that complies with the NPS Implementation and Enforcement Policy	$101,340 /year	PG assumes the development of a new nonpoint source implementation program will require retaining an environmental scientist on a full-time basis by the agency to develop and implement the program on an ongoing basis. The annual mean wage in Salinas, CA, for an environmental scientist is $101,340 per year.	BLS (2020)

Cannabis Operations

Tables A-10 and A-11 summarize unit and programmatic costs identified as applicable to cannabis operations.

Table A-10. Management practice and monitoring actions for the Central Coast Region.

Management Practice/ Monitoring Action	Total Cost	Assumptions/Notes	Source
Turbidity and pH monitoring	See Table A-1	None.	--
Apply for Lake and Streambed Alteration Agreement (LSA Agreement) or consult with CDFW to determine if an LSA Agreement is needed	Fees for standard agreement: $596 - $5,313	Fee varies with the project cost and the validity of the agreement	CDFW (2019)
Supervision of all land disturbing activities during the winter period by a qualified professional	Using an hourly labor rate of $179.04 for professional engineers	None.	USEPA (2020)
Implementation of erosion control requirements	See Table 6	None.	--

Management Practice/ Monitoring Action	Total Cost	Assumptions/Notes	Source
Development and submission of a site erosion and sediment control plan/stormwater management plan	$2,600/plan	An average of 12-16 hours is required for a qualified professional to develop a SEMP. The average wage (including employer benefits) is $54/hour in Salinas, CA for an engineer. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit. PG assumed 16 hours to develop the plan.	BLS (2020)
Development and submission of a disturbed area stabilization plan	$3,200/plan	PG assumes approximately 20 hours will be required by a professional engineer to develop and submit a disturbed area stabilization plan. The average wage (including employer benefits) is $54/hour in Salinas, CA. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit. PG assumed 20 hours to develop the plan.	BLS (2020)
Earthmoving	Excavation: $1.99/ cu yard Grading and shaping: $933.91/acre Soil spreading: $1.07/ft	None.	USDA (2018)
Soil and bulk amendment storage	Soil container: $48 each	Rubbermaid® Square Brute®	Uline (2021)

Management Practice/ Monitoring Action	Total Cost	Assumptions/Notes	Source
		Trash Can - 28 Gallon, Gray	
Access road development and maintenance	$1,090/mile assuming 10% side slope	Basic Temporary Road Costs by Mile for Idaho	USDA (2020)
Land drainage	$75 or $150/drainage acre	Custom rate costs associated with controlled drainage	Tyndall & Bowman (2016)
Drainage culverts and stream crossings	Culvert installation: $3.60/inch-foot, low water crossing (riprap): $118.60/cubic yard	None.	USDA (2014f)
Soil disposal and management	Municipal disposal fees: $47.03/ton, radioactive waste transport and disposal fees: $265/ton	Cost estimates for off-site disposal facility, Arizona	USDA (2017a, 2017b)

Table A-11. Management practice and monitoring actions for the Central Coast Region.

Management Practices	Total Cost	Assumptions/Notes	Source
Development of sitewide Sediment Discharge Monitoring and Reporting Plan	$2,600/plan	An average of 12-16 hours is required for a qualified professional to develop a sediment monitoring plan. The average wage (including employer benefits) is $54/hour in Salinas, CA. A labor multiplier of 2.97 was applied to the labor rate to account for consultant's overhead, administrative costs, and profit. PG assumed 16 hours to develop the plan.	BLS (2020)
Instream receiving water and stormwater monitoring for Turbidity	Lab analysis Turbidimeter	See Table A-1	--

Management Practices	Total Cost	Assumptions/Notes	Source
Development of sitewide stormwater management plan	$772.25/site	Estimated cost for per Phase II construction site (1998 dollars)	USEPA (1999a)

Regional Stormwater Management and Stream Restoration Projects

Tables A-12 through A-14 summarize regional stormwater management and stream restoration projects planned within the watershed.

Table A-12. Summary of Regional Stormwater Management Projects in the Gabilan Creek Watershed.

Project Title	Project Applicant	Project Cost	Estimated Completion Date
Castroville and Moss Landing Storm Water Enhancement Project:	Central Coast Wetland Group	$1,800,000	2024
Espinosa Lake Flood Retention Project	Central Coast Wetland Group	$1,750,000	2024
Old Salinas River Treatment Wetland	Central Coast Wetland Group	$1,120,000	2025
Salinas Water Quality and Agricultural Reuse Efficiency Project	Monterey One, Central Coast Wetland Group, and City of Salinas	$1,610,000	2023

Table A-13. Summary of Watershed Restoration Projects in the Gabilan Creek Watershed.

Project Title	Project Applicant	Total Project Cost	Year of Project Completion
Carr Lake Project	Big Sur Land Trust	$4,870,000	2027
Salinas to the Sea Storm Water Management, Community Development, and Habitat Enhancement Project	Central Coast Wetland Group	$12,595,000	2032
Gabilan Floodplain Enhancement Project	Central Coast Wetland Group	$450,000	2025
Acosta Plaza Urban Drainage Restoration	City of Salinas	$1,500,000	2023
Lincoln Green/Complete Street	City of Salinas	$1,430,000	2023
Storm Water Management, Collection, and Infiltration on Private and Public Lands	Resource Conservation Districts	$2,200,000	2022

CRWQCB (2022) identifies additional reasonably foreseeable management practices for regional stormwater management as follows (*Table A-14*):

Table A-14. Management practice and monitoring actions for the Central Coast Region.

Management Practice	Total Cost	Assumptions/Notes	Cost Data Source References
Constructing managed wetlands	$785	Annualized per acre costs over 40 year lifespan	Tyndall & Bowman (2016)
Restoring wetlands	$200 to over $3,300 per acre	Expected upfront costs of restoring and preserving new wetlands within the Prairie Pothole Region	USDA (2015)
Armoring and vegetating stream channels	Streambank and shoreline protection: Vegetative $0.80/ square foot, bioengineered $2.24/ square foot, structural riprap $47.35/ton	None.	USDA (2014e)
Restoring riparian areas	$593 million - $1.2 billion	Cost estimates are based on restoring 96,000 acres of riparian land Willamette basin	ODEQ (2010)

Rangeland and Natural Areas

Currently on a voluntary basis, ranchers in the Gabilan Creek watershed implement management practices to protect water quality and riparian areas. The costs associated with these existing practices and related proposed management practices of the TMDL are summarized in Table A-15.

Table 15. Management practice and monitoring actions for the Central Coast Region.

Management Practice	Total Cost	Assumptions/Notes	Cost Data Source References
Rotational grazing	$10-$70/acre	Cost varies with the size of the rangeland	Wang (2020)

Management Practice	Total Cost	Assumptions/Notes	Cost Data Source References
Using troughs as the main water source for livestock and not natural waterbodies	$59.15/unit	Heavy Duty Feeding & Watering Trough for Livestock (15 Gallon)	Amazon (2021b)
Keeping livestock away from the waterbodies when providing hay for feeding.	Filter strip: $0-2.08/cubic foot of runoff	Based on cost/sq. ft & 6 in. storage in strip	USEPA (1999a), USEPA (1999b), CRWQCB (2019)
Develop a rangeland management plan or a rangeland certification program	$50,670 /year	PG assumes the development of a new rangeland management or certification program will require retaining an environmental scientist on a half-time basis by the agency to develop and implement the program on an ongoing basis. The annual mean wage in Salinas, CA, for an environmental scientist is $101,340 per year.	BLS (2020)
Fencing for livestock	$1.18/acre (mobile electric fencing with fiberglass posts) - $18.37/acre (high-tensile electric fencing)	None.	NRCS (2002)
Structural practices including improvements to unpaved access roads, grade stabilizers, sediment ponds, troughs and tanks, and streambank protection	Streambank and shoreline protection: Vegetative $0.80/ square foot, bioengineered $2.24/ square foot, structural riprap $47.35/ton	None.	USDA (2014e)
constructing animal trails to provide movement of livestock through difficult or ecologically sensitive terrain	$0.25/square foot	None.	USDA (2014d)

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Appendix B. Flood Control Pump Station Alternatives

Pump Station Alternatives Analysis

This appendix documents the alternatives developed by PG Environmental for minimizing the entrainment of sediment and colloidal material resulting from the operation of the flood control pump stations in the Gabilan Creek watershed. The cost estimates focused on the following four pump stations:

1. Upper Merritt
2. Lower Merritt
3. Santa Rita
4. Espinoza

Based on turbidity data collected during pump station operations, PG Environmental identified these stations as sources likely to require additional controls in order to comply with the applicable TMDL load allocations. Data was not available for all flood control pump stations in the watershed—in particular, data was unavailable for pump stations in the eastern, higher elevation portions of the watershed. PG was unable to determine if these stations would require upgrades to meet the proposed load allocations.

Opinions of probable cost were prepared for three project alternatives. PG Environmental anticipates these alternatives will reduce turbidity in the receiving water by minimizing bank erosion and resuspension of sediment by (1) armoring the banks and beds of the channels, (2) upgrading certain pumps with variable speed drives, or (3) by replacing pumping equipment to reduce the turbulence of the discharge.

The project alternatives that were evaluated include:

1. **Riprap armoring and gabion baffling.**
   This alternative involves installing armoring (riprap) on the banks and channel bed, both upstream and downstream of the pump station to prevent erosion, and installing gabion baffles downstream of the pump stations to dissipate energy in the high velocity discharges from the pump station pipe outlets.

   Rip rap armoring of areas upstream and downstream of the pump stations.
   The riprap average stone diameter (D_{50}) and armoring thickness were estimated using the State of Michigan's Stabilized Outlet guidance (Michigan Department of Environment, Great Lakes, and Energy, 2012). The estimated length of rip-rap section downstream of each pump station exceed the minimum recommended apron length in order to protect channel contractions which are observable in the receiving waters in satellite imagery. The length of the upstream section of rip rap was assumed to be half the length of the downstream section. The width of both upstream and downstream rip rap sections were determined using satellite

imagery.

Gabion baffling downstream of the pump stations. For each pump station, an opinion of probable costs was prepared for a series of overlapping sections of baffles perpendicular to the channel with the following parameters:

a. Combined length of baffles = Maximum channel width (estimated using satellite imagery)
b. Height = 6 feet
c. Width = 3 feet

2. **Upgrading pump station pumps with variable speed drives.** This alternative involves upgrading the pumps in the existing pump stations with variable speed drives to allow the station to operate more frequently at a reduced capacity. Opinions of probable costs were prepared for variable speed drives at two pump stations (Upper Merritt and Espinoza), where installing a variable speed drive would allow the pump station to operate continuously at the average flow rate for each month of the year. Opinions of probable costs were not developed for the other two pump stations (Lower Merritt and Santa Rita) because they are equipped with pumps that are too large to operate during months with lower average flow rates, even with variable speed drives. Operating the pumps at lower capacity reduces the shear stress on the upstream and downstream banks. Additionally, operating the pumps more frequently would reduce the residence time of flows in the well, which reduces settling of solids that are then resuspended when the pumps are turned on.

3. **Fully replacing the pump stations.** This alternative involves replacing the existing pump stations with entirely new pump stations that have a larger number of smaller pumps. The new pump stations would allow the pump stations to operate at lower flow rates more frequently and would have similar benefits to the variable speed pumps. The pump stations were designed to have a firm capacity of four times the highest average monthly flow rate based on flow data from 2007-2019 provided by Monterey County to handle peak flow conditions.

These alternatives represent a range of potential costs that could be incurred in order to comply with the TMDL load allocations. These alternatives were developed with limited data and represent the best available estimate at a Class V level of accuracy in accordance with the AACE International Recommended Practice No. 17R-97 (AACE International 2020). Class V estimate accuracy can range from +40%/-20% to +200%/-100%. The accuracy goal of these estimates is +50%/-25%, meaning the actual construction costs may range from 50% higher than the estimated costs to 25% lower.

These opinions of probable costs were developed using cost curves, RS Means 2021 Heavy Construction Cost Index, CAPDET Software, satellite imagery, and State of Michigan's Stabilized Outlet guidance (Michigan Department of Environment, Great Lakes, and Energy, 2012).

All cost estimates were multiplied by a location factor of 1.15 for Salinas, California (RSMeans, 2021). All costs reflect the cost in dollars as of March 2021, which is represented by an Engineering News-Record (ENR) Construction Cost Index value of 11,749. The construction cost of each project was multiplied by a factor of 1.4 to account for engineering and administrative costs to account for project engineering and owner administration costs. That total was multiplied by a general contingency factor of 1.2 to account for unanticipated construction costs.

The annual O&M costs of the rip rap armoring were estimated by assuming 10% of the riprap would need to be replaced annually. The gabion baffles were assumed to have negligible O&M costs. The annual O&M costs of the variable speed pumps and the new pump stations were assumed to remain constant with the current O&M costs and, therefore, have no incremental cost. It was assumed the annual flow volume and dynamic head of the pump stations would not change. However, installing the variable speed drive or constructing the new pump station may reduce the O&M costs by improve the pumping efficiency and reduce maintenance requirements.

Table B-1 summarizes the range of pump station design alternatives proposed to minimize turbidity in the receiving waters.

Table B-1. Summary of Pump Station Turbidity Control Alternatives

Pump Station	Alternative No. 1: Riprap Armoring & Gabion Baffles	Alternative No. 2: Variable Speed Drives	Alternative No. 3: Pump Station Replacement
Upper Merritt	<u>Riprap Armoring</u> Length=100 ft Downstream and 50 ft Upstream Average width=30 ft D_{50}=12 in <u>Gabion Baffles</u> Length=35 ft (total material used) Width=3 ft Height= 6 ft	Replace the 18,000 gpm pump with a new 30,000 gpm variable speed centrifugal pump.	8 Pumps all fixed speed centrifugal, 4 cfs x4, 10 cfs x2, 30 cfs x 2
Lower Merritt	<u>Riprap Armoring</u> Length=100 ft Downstream and 50 ft	Not Applicable (Current pumps are too large to benefit from	7 Pumps all fixed speed centrifugal, 2

Pump Station	Alternative No. 1: Riprap Armoring & Gabion Baffles	Alternative No. 2: Variable Speed Drives	Alternative No. 3: Pump Station Replacement
	Upstream Average width=28 ft D_{50}=12 in <u>Gabion Baffling</u> Length=40 ft (total material used) Width=3 ft Height= 6 ft	installation of variable speed drives.)	cfs x2, 5 cfs x3, 30 cfs x 2
Santa Rita	<u>Riprap Armoring</u> Length=50 ft Downstream and 25 ft Upstream Average width=25 ft D_{50}=8 in <u>Gabion Baffles</u> Length=25 ft (total material used) Width=3 ft Height= 6 ft	Not Applicable (Current pumps are too large to benefit from installation of variable speed drives.)	7 Pumps all fixed speed centrifugal, 1 cfs x2, 3 cfs x3, 10 cfs x 2
Espinosa	<u>Riprap Armoring</u> Length=50 ft Downstream and 25 ft Upstream Average width=25 ft D_{50}=8 in <u>Gabion Baffles</u> Length=25 ft (total material used) Width=3 ft Height= 6 ft	Replace the 18,000 gpm pump with a new 30,000 gpm variable speed centrifugal pump.	6 Pumps all fixed speed centrifugal, 2 cfs x3, 5 cfs x3

Table B-2 summarizes the capital, operation and maintenance, and equivalent annualized total costs for each of the alternatives. All costs are presented in March 2021 dollars.

Table B-2. Summary of Pump Station Alternative Costs

Alternative No.	Pump Station	Capital Costs ($)	O&M Costs ($/year)	Annualized Total Cost ($/year)[1,2]
1 (Armoring)	Upper Merritt	$319,073	$12,725	$38,328
1 (Armoring)	Lower Merritt	$291,708	$11,876	$35,284
1 (Armoring)	Santa Rita	$90,642	$3,535	$10,808
1 (Armoring)	Espinosa	$90,642	$3,535	$10,808
			Alternative No 1. Total	**$95,227**
2 (Variable Drives)	Upper Merritt	$288,745	[3]	$23,170
2 (Variable Drives)	Lower Merritt	--	--	--
2 (Variable Drives)	Santa Rita	--	--	--
2 (Variable Drives)	Espinosa	$130,924	[3]	$10,506
			Alternative No. 2 Total	**$33,675**
3 (Full Replacement)	Upper Merritt	$3,263,341	[3]	$246,818
3 (Full Replacement)	Lower Merritt	$2,870,759	[3]	$217,125
3 (Full Replacement)	Santa Rita	$1,906,478	[3]	$144,193
3 (Full Replacement)	Espinosa	$2,092,955	[3]	$158,297
			Alternative No. 3 Total	$766,433
			Range of Cost Alternatives	**$33,700 - $766,000**

Appendix B References

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Appendix C. Monterey County Stormwater Resource Management Plan Projects

The Monterey County Stormwater Regional Resource Management Plan (Regional Plan) is a comprehensive stormwater management strategy for the greater Monterey Region, which encompasses the Gabilan Creek watershed. The Regional Plan is an integrated approach implemented by collaborating stormwater management agencies and stakeholders to optimize their stormwater planning and implementation efforts. The IRWM planning group represents government agencies, nonprofit organizations, educational organizations, water service districts, private water companies, and organizations representing agricultural, environmental, and community interests. Some signature members to the Regional Plan including the City of Salinas, MCWRA, and the County of Monterey Resource Management Agency have allocations and are responsible for attaining the TMDLs.

The Regional Plan includes estimated costs and completion dates for the design and concept proposals. The estimates are summarized in Table C-1 and Table C-2. There are four projects with completed design plans that are ready for implementation. The estimated total cost for implementation these four projects is $6,280,000 and the estimated completion dates range from 2023 to 2025. There are five concept proposals that need implementation plans and the estimated total cost for their implementation is $23,045,000. The total cost of all proposed projects in the Regional Plan is $29,325,000 and the completion dates range from 2020 to 2032.

Table C-1. Summary of projects with completed designs and ready for implementation.

Project Title	Project Applicant	Project Cost	Completion Date
Castroville and Moss Landing Storm Water Enhancement Project:	Central Coast Wetland Group	$1,800,000	2024
Espinosa Lake Flood Retention Project	Central Coast Wetland Group	$1,750,000	2024
Old Salinas River Treatment Wetland	Central Coast Wetland Group	$1,120,000	2025
Salinas Water Quality and Agricultural Reuse Efficiency Project	Monterey One, Central Coast Wetland Group, and City of Salinas	$1,610,000	2023

Table C-2. Summary of projects at the conceptual design phase of the project.

Project Title	Project Applicant	Total Project Cost	Year of Project Completion
Carr Lake Project	Big Sur Land Trust	$4,870,000	2027
Salinas to the Sea Storm Water Management, Community Development, and Habitat Enhancement Project	Central Coast Wetland Group	$12,595,000	2032
Gabilan Floodplain Enhancement Project	Central Coast Wetland Group	$450,000	2025
Acosta Plaza Urban Drainage Restoration	City of Salinas	$1,500,000	2023
Lincoln Green/Complete Street	City of Salinas	$1,430,000	2023
Storm Water Management, Collection, and Infiltration on Private and Public Lands	Resource Conservation Districts	$2,200,000	2022