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Draft Adaptive Management Plan for the College Lake Integrated Resources Management Project

September 2021

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Acronyms and Abbreviations

AF, AFY	acre feet, acre feet per year
AMP	adaptive management plan
BA	biological assessment
BO	biological opinion
CDFW	California Department of Fish and Wildlife
CDS	Coastal Distribution System
CHRIS	California Historical Resources Information System
Committee	Ad Hoc Adaptive Management Plan Committee
EIR	environmental impact report
MAVC	Mosquito Abatement and Vector Control
MMRP	mitigation monitoring and reporting program
NAVD	North American Vertical Datum
NMFS	National Marine Fisheries Service
NWIC	Northwest Information Center
O&M	operations and maintenance
PEIR	programmatic environmental impact report
Project	College Lake Integrated Resources Management Plan
PV Water	Pajaro Valley Water Agency
RD	Reclamation District
RWQCB	Regional Water Quality Control Board
USFWS	U.S. Fish and Wildlife Service

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WRP	water right permit
WSE	water surface elevation
WTP	water treatment plant
USFWS	U.S. Fish and Wildlife Service

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Species Names

Alder	*Alnus* spp.
American peregrine falcon	*Falco peregrinus*
arroyo willow	*Salix lasiolepis*
bald eagle	*Haliaeetus leucocephalus*
black cottonwood	*Populus trichocarpa*
box elder	*Acer negundo* var. *californicum*
bristly ox-tongue	*Helminthotheca echioides*
Bryant's savannah sparrow	*Passerculus sandwichensis alaudinus*
California blackberry	*Rubus ursinus*
California red-legged frog	*Rana draytonii*
coast live oak	*Quercus agrifolia*
cocklebur	*Xanthium strumarium*
coyote brush	*Baccharis pilularis*
curly dock	*Rumex crispus*
dogwood	*Cornus* sp.
fat-hen	*Atriplex prostrata*
golden eagle	*Aquila chrysaetos*
Himalayan blackberry	*Rubus armeniacus*
nettle	*Urtica* sp.
red willow	*Salix laevigata*
rushes	*Juncus* spp.

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San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*
shining willow	*Salix lasiandra* var. *lasiandra*
short-eared owl	*Asio flammeus*
smartweeds	*Persicaria* spp.
Steelhead	*Oncorhynchus mykiss*
swamp pricklegrass	*Crypsis schoenoides, C. vaginiflora*
tricolored blackbird	*Agelaius tricolor*
western burrowing owl	*Athene cunicularia*
western pond turtle	*Actinemys marmorata*
western red bat	*Lasiurus blossevillii*
western sycamore	*Platanus racemosa*
white-tailed kite	*Elanus leucurus*
yellow warbler	*Setophaga petechial*

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CHAPTER 1

Overview

This chapter states the purpose of the Adaptive Management Plan (AMP), describes its development process, and outlines the document's organization.

1.1 Purpose of the Adaptive Management Plan

Adaptive management is a structured process that allows for taking action under uncertain conditions based on the best available science and information, closely monitoring and evaluating outcomes, and then re-evaluating and adjusting decisions as more information is learned.[1]

Implementation of the College Lake Integrated Resources Management Project (Project) will be adaptively managed. The purpose of this AMP is to provide an adaptive management framework, including metrics, triggers, and management actions, to guide operations and maintenance (O&M) of the Project, and in particular to mitigate negative impacts to the College Lake ecosystem.

1.2 Adaptive Management Plan Development

This AMP has been developed to fulfill a mitigation measure of the 2014 Basin Management Plan Update Programmatic Environmental Impact Report (PEIR; Pajaro Valley Water Management Agency [PV Water] 2014) and related mitigation measures of the 2019 College Lake Integrated Resources Management Project Draft Environmental Impact Report (EIR; PV Water 2019). It has been developed consistent with the Project's objectives, regulatory requirements, and related plans, and with input from an Ad Hoc AMP Committee. The following sections describe the EIR and regulatory requirements, other related plans, and the involvement of the Ad Hoc AMP Committee.

1.2.1 EIR Requirements

This AMP fulfills Mitigation Measure BIO-2i.1 (Develop Adaptive Management Plan for College Lake Waterfowl Management and Multi-Species Mitigation) that was included in the mitigation monitoring and reporting program (MMRP) adopted by PV Water's Board of Directors for the

[1] A relevant definition of adaptive management is provided in the Delta Reform Act: "a framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives" (Water Code Section 85052).

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2014 Basin Management Plan Update Programmatic Environmental Impact Report (PV Water 2014). This AMP:

- Was developed in collaboration with state and federal resource agencies and College Lake stakeholders through formation of an Ad Hoc Adaptive Management Plan Committee (Committee)
- Applies multi-year baseline waterfowl population and habitat use data developed to inform management
- Applies multi-year baseline steelhead surveys developed to inform management
- Integrates the results of ongoing College Lake hydrology and hydraulic analyses, as well as consultations with state and federal agencies on fish flows and fish bypass criteria
- Includes terms and conditions from applicable permits and agreements as appropriate, and defines provisions for monitoring assignments, scheduling, and responsibility
- Includes habitat replacement and revegetation, protection during ground-disturbing activities, performance standards, maintenance criteria, and monitoring requirements for temporary and permanent impacts consistent with mitigation in the 2019 College Lake Integrated Resources Management Project Draft Environmental Impact Report (2019 Draft EIR)[2] and regulatory requirements during project-specific review
- Is in conformance with the mitigation measures from the 2019 Draft EIR, and includes terms and conditions consistent with regulatory requirements as applicable from permits

Table 1-1 provides the text of Mitigation Measure BIO-2.i-1 and two other mitigation measures (HYD-2a and BR-2) of the 2019 Draft EIR that reference the AMP. Both Mitigation Measures HYD-2a and BR-2 require monitoring that is part of management plans closely related to both the initial framework to support adaptive management planning and the anticipated AMP, and which are described in the following section.

TABLE 1-1
ADAPTIVE-MANAGEMENT-RELATED MITIGATION MEASURES OF BASIN MANAGEMENT PLAN PEIR AND COLLEGE LAKE INTEGRATED RESOURCES MANAGEMENT PROJECT EIR

BIO-2i.1: Develop Adaptive Management Plan for College Lake Waterfowl Management and Multi-Species Mitigation.
To mitigate impacts to existing waterfowl or waterfowl habitat at College Lake, an Adaptive Management Plan for waterfowl management and multi-species mitigation will be developed with the consultation of the state and federal resource agencies and College Lake stakeholders. The Adaptive Management Plan for waterfowl management and multi-species mitigation at College Lake will develop multi-year baseline waterfowl population and habitat use data for future project design, environmental permitting and CEQA impact analysis of project-level alternatives. To the extent practical, it will integrate the results of ongoing College Lake hydrology and hydraulic analyses, as well as future consultations with state and federal agencies on fish flows and fish bypass criteria.
The Management Plan will be specific to the level of impact and mitigations under site-specific and project implementation conditions. However, the following standards will apply as defined during project-level design,

[22] PV Water. 2019. College Lake Integrated Resources Management Project Environmental Impact Report. SCH# 2017112063

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regulatory review and CEQA analysis: The Management Plan should include terms and conditions from applicable permits and agreements as appropriate and define provisions for monitoring assignments, scheduling, and responsibility. The Management Plan should also include habitat replacement and revegetation, protection during ground-disturbing activities, performance standards, maintenance criteria, and monitoring requirements for temporary and permanent impacts consistent with mitigation in this EIR and regulatory requirements during project- specific review. The Management Plan will be in conformance with the biology mitigation measures from this EIR, and will also include terms and conditions consistent regulatory requirements as applicable from the U. S. Fish and Wildlife Service (USFWS), National Marine Fisheries Services (NMFS), U. S. Army Corps of Engineers (USACE), California State Water Resources Control Board, (SWRCB), Central Coast Regional Water Quality Control Board (RWQCB), and California Department of Fish and Wildlife (CDFW) permits during project design and permitting as applicable. The Management Plan will be prepared for project level project implementation as determined needed through future CEQA review and consultation with agencies as required under the California Endangered Species Act (CESA) and federal Endangered Species Act (ESA).
Mitigation Measure BR-2: Invasive Fish Species Control Plan. PV Water shall develop an Invasive Fish Species Control Plan. PV Water would submit the plan to the appropriate resource agencies (CDFW, USFWS, and NMFS) for approval within one year of Project implementation. The Fish Species Control Plan shall be implemented at College Lake within two years of Project implementation. The Fish Species Control Plan shall include, at a minimum: 1. Measures describing PV Water's methods of draining College Lake to the greatest extent feasible; 2. Measures describing PV Water's methods, equipment, and timing of invasive species eradication efforts to be conducted in association with lake drawdown efforts; 3. Measures describing the frequency at which invasive species control efforts are to be implemented.
HYD-2a: Water Quality Adaptive Management for College Lake. To learn about potential impacts of the Project on College Lake water quality and the quality of downstream water bodies, PV Water shall monitor College Lake water for indications of Cyanobacteria blooms. When the proposed weir crest is elevated to 62.5 feet NAVD88, PV Water shall monitor College Lake water temperature within the water column to establish whether a thermocline develops. PV Water shall use results of this monitoring to support the development of the Adaptive Management Plan (refer to Section 2.7) that establishes management actions to minimize the conditions that can contribute to algal blooms, including cyanobacteria blooms, such that this impact is mitigated.

Source: PV Water 2014, 2019

1.2.2 Regulatory Compliance and Related Plans

Consistent with adopted Mitigation Measure BIO-2i.1, PV Water first engaged with state and federal resources agencies (National Marine Fisheries Service [NMFS], U.S. Fish and Wildlife Service [USFWS], Regional Water Quality Control Board [RWQCB], and California Department of Fish and Wildlife [CDFW]) to refine concepts for specific AMP objectives, and to make minor modifications to the proposed operations and maintenance described in 2019 Draft EIR Section 2.7.2 to conform with anticipated conditions in permits and other agreements. Through initial coordination with regulatory stakeholders, PV Water gained a more detailed understanding of the obligations of permits and other approvals that will govern Project O&M and be incorporated into the AMP. These requirements include avoidance and minimization measures and related monitoring and management plans that are described in the following sections.

1.2.2.1 Avoidance and Minimization Measures

Multiple measures required to avoid and minimize impacts to the environment will be implemented in conjunction with maintenance and operations. These measures are included in the Project's MMRP, water right permit (WRP), or are proposed as conservation measures in the biological assessments prepared for NMFS and USFWS. These measures are listed in **Table 1-2** and provided in full in **Appendix 1**. Conservation measures proposed in the biological assessments (BAs) will be superseded by the conservation measures included in the biological opinions (BOs).

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TABLE 1-2
LIST OF MEASURES TO AVOID AND MINIMIZE IMPACTS OF MAINTENANCE ACTIVITIES

Measure Title	Source
Nesting Bird Surveys	MMRP: BIO-2i
California Red-legged Frog Qualified Biologists	MMRP (and USFWS BA): BIO-2j, CRF-1
California Red-legged Frog Survey	MMRP (and USFWS BA): BIO-2j, CRF-2
California Red-legged Frog Training	MMRP (and USFWS BA): BIO-2j, CRF-3
California Red-legged Frog Monitoring	MMRP and USFWS BA: BIO-2j, CRF-4
Staging and Access Routes	MMRP (and USFWS BA): BIO-2j, CRF-5, WPT - 5
California Red-legged Frog Seasonal Restrictions	MMRP (and USFWS BA): BIO-2j, CRF-6
Dewatering Procedures	MMRP (and USFWS BA): BIO-2j, CRF-7
Amphibian Pathogen and Parasite Prevention	MMRP (and USFWS BA): BIO-2j, CRF-8
Water Quality Protection	MMRP: BIO-2j, CRF-9
Western Pond Turtle Qualified Biologists	MMRP: BIO-2k, WPT-1
Western Pond Turtle Survey	MMRP: BIO-2k, WPT-2
Western Pond Turtle Training	MMRP: BIO-2k, WPT-3
Western Pond Turtle Monitoring	MMRP: BIO-2k, WPT-4
Standard measures to maintain water quality and to control erosion and sedimentation	BA for USFWS: Conservation Measure (CM) 1 (California Red-legged Frog) MMRP: BIO-1b
Open Water and Wetland Revegetation and Restoration	BA for USFWS: CM 1 (California Red-legged Frog) MMRP: BIO-1d
Delineate Work Area	BA for USFWS: CM 1 (California Red-legged Frog) MMRP: BIO-2e
Special-Status Species Clearance Surveys	BA for USFWS: CM 1 (California Red-legged Frog) MMRP: BIO-2f
Exotic Species Removal	BA for USFWS: CM 1 (California Red-legged Frog) MMRP: BIO-2g
Notification of Dead or Injured Individuals of Special-Status Species	BA for USFWS: CM 1 (California Red-legged Frog) MMRP: BIO-2h
Steep-walled Holes and Trenches	BA for USFWS: CM 1 (California Red-legged Frog)
Inspect Pipes for Special-Status Species	BA for USFWS: CM 1 (California Red-legged Frog)
Stockpile Storage	BA for USFWS: CM 1 (California Red-legged Frog)
Amphibian Friendly Erosion Control Materials	BA for USFWS: CM 1 (California Red-legged Frog)
Speed Limit	BA for USFWS: CM 1 (California Red-legged Frog)
Avoid Disturbance of Emergent Vegetation	BA for USFWS: CM 1 (California Red-legged Frog)
Invasive Plant Disposal	BA for USFWS: CM 1 California Red-legged Frog
Vegetation Removal	BA for USFWS: CM 1 (California Red-legged Frog)
Steelhead Monitoring	BA for NMFS: Steelhead CMs MMRP: BIO-2l FISH-1
Coffer Dam Monitoring	BA for NMFS: Steelhead CMs MMRP BIO-2l FISH-2
Coffer Dam Dewatering	BA for NMFS: Steelhead CMs

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TABLE 1-2 LIST OF MEASURES TO AVOID AND MINIMIZE IMPACTS OF MAINTENANCE ACTIVITIES	
Measure Title	**Source**
	MMRP: BIO-2l FISH-3
Dewatering Procedures	BA for NMFS: Steelhead CMs MMRP: BIO-2l FISH-4
Coffer Dam Removal	BA for NMFS: Steelhead CMs MMRP: BIO-2l FISH-5
Implement Water Quality BMPs	BA for NMFS: Steelhead CMs MMRP: BIO-2l FISH-6
Water Diversion Seasonal Restrictions	MMRP: BIO-2m
Protection of Steelhead Migratory Habitat: Seasonal Restrictions	BA for NMFS: Steelhead CMs MMRP: BIO-2n
Protection of Steelhead Migratory Habitat: Bypass Flow Requirements	BA for NMFS: Steelhead CMs MMRP: BIO-2o
Streamflow Gauging Stations	BA for NMFS: Steelhead CMs MMRP: BIO-2p
Water Quality Permits	BA for NMFS: Steelhead CMs MMRP: HWQ-1
Avoid Rapid Water Level Fluctuations	MMRP: HWQ-2
Well Production and Pumping Rates	MMRP: HWQ-3
Fish Relocations	BA for NMFS: Steelhead CMs MMRP: BR-1a
Invasive Fish Species Control Plan	BA for NMFS: Steelhead CMs MMRP: BR-2
Implement Dewatering Best Management Practices for In-Water Construction	BA for NMFS: Steelhead CMs MMRP: HYD-1
Water Quality Adaptive Management for College Lake	MMRP: HYD-2a
Avoid Flooding at Pajaro Dunes During Pumped Flow	MMRP: HYD-3

Sources: PV Water, *College Lake Integrated Resources Management Project Environmental Impact Report*, Final Mitigation Monitoring and Reporting Program, October 2019; BA prepared for USFWS and BA and Essential Fish Habitat Assessment prepared for NMFS for the College Lake Integrated Resource Management Project

1.2.2.2 Related Management Plans

The Project will develop and implement several related monitoring and management plans required by the Project's EIR mitigation measures or its WRP, which are described in refer to **Table 1-3**. These related plans include a Water Quality Monitoring Plan, Steelhead Monitoring Plan, Invasive Species Management Plan, Compliance Plan, and Operations and Maintenance Plan. All of these plans have a role in implementation of the Project and will be considered in its adaptive management. The AMP serves as an umbrella document for all of these plans so that management can be evaluated holistically.

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Table 1-3 Monitoring and Management Plans Related to the Adaptive Management Plan			
Plan	**Origin**	**Scope**	**Status**
Water Quality Monitoring Plan	Mitigation Measure HYD-2a, (Prevention of Cyanobacteria Formation), CDFW requested as condition to dismiss Water Right protest	Addresses monitoring of ecologically important water quality constituents (e.g., dissolved oxygen, temperature)	Drafted and submitted to regulatory agencies
Steelhead Monitoring Plan	2014 commitment by PV Water, NMFS requested as condition to dismiss Water Right protest	Addresses effectiveness of fish passage at the weir, and effectiveness of the bypass flows through Salsipuedes Creek.	Completion planned for November 2021
Invasive Species Management Plan	CEQA requirement, dismissal of Water Rights protest	Addresses management of invasive species, including bullfrogs and non-native piscivorous fishes, in College Lake during Project operations and maintenance.	Drafted and submitted to regulatory agencies
Compliance Plan	SWRCB requirement	Addresses how compliance with each term of the WRP will be determined	In preparation; to be finalized after receipt of the WRP.
Operations and Maintenance Plan	Need for guidance for operations including timing of annual weir raising.	Addresses timing of weir raising, timing and size of diversions, operation of fish passageway structure, and maintenance of fish passageway passage structure; during consultations, regulatory agencies may request additional content.	To be developed after all permits secured

1.2.3 Ad Hoc Adaptive Management Plan Committee

Following initial engagement with regulatory agencies, the AMP was developed in conjunction with a series of meetings of the Ad Hoc Adaptive Management Plan Committee (Committee) formed by PV Water to solicit stakeholder input through a transparent and inclusive process. During these meetings, which occurred in 2021, key AMP content was discussed and Committee members provided input and made recommendations. The Committee was supported by PV Water staff and consultants, including technical experts in fisheries, terrestrial wildlife, botany and wetlands, and hydrology.

Specifically, Committee members were asked to review and provide recommendations to the PV Water Board of Directors on the following content of the AMP:

- Objectives
- Monitoring parameters
- Monitoring-based thresholds that when crossed, trigger adaptive management actions
- Management actions that could potentially be implemented when thresholds are crossed

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- Reporting and plan update procedures

Committee recommendations and feedback aided development of the draft AMP and are summarized below in Section 1.2.3.2, "Ad Hoc Committee Recommendations."

1.2.3.1 Ad Hoc Adaptive Management Plan Committee Membership

PV Water sought to represent all critical parties on a committee of a manageable size. The resulting Committee consisted of the following members:

- Tom Broz – PV Water Director
- Bob Culbertson – PV Water Director
- Stephen Rider – PV Water Director
- Joel Casagrande – NMFS
- Jessie Maxfield – CDFW
- Adam French – Amah Mutsun Land Trust (Tribal representative)
- Jonathan Pilch – Watsonville Wetlands Watch (non-governmental organization representative)
- Jerry Busch – Representative-Ventana Chapter Sierra Club (non-governmental organization representative)
- John Diffenbaugh – Neighboring landowner
- Dawn Reis – Neighboring landowner
- Christi Suchil – Disadvantaged community representative
- Frank Shields – Local environmental scientist
- John Pritchard – At-large community member

1.2.3.2 Ad Hoc Adaptive Management Plan Committee Recommendations

[*Forthcoming—to be drafted on the basis of meeting notes, reviewed by committee members, and revised on the basis of that review.*]

1.2.3.3 AMP Adoption

This AMP was adopted by the PV Water Board of Directors on XXX.

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1.3 Organization of This Document

This document is organized as follows:

- Preceding the main document text is a list of acronyms, abbreviations, and list of species names.
- **Chapter 1, Overview.** This chapter states the purpose of the AMP, describes its development process, and outlines the document's organization.
- **Chapter 2, College Lake Setting.** This chapter provides regional and local background information about the College Lake setting related to land cover, biological resources, cultural resources, and existing management activities.
- **Chapter 3, College Lake Project.** This chapter describes the Project's components and design as well as operations and maintenance activities.
- **Chapter 4, Adaptive Management Framework.** This chapter describes the framework for adaptive management, which consists of objectives, metrics, action triggers, and potential management actions.
- **Chapter 5, Monitoring and Targeted Studies.** This chapter describes the monitoring that will be conducted to inform O&M of the College Lake IRMP and identifies topics for targeted studies (research or community science) that could reduce key uncertainties
- **Chapter 6, Reporting and Plan Updates.** This chapter describes the evaluations by PV Water staff, reporting, and updating of the plan that will be components of adaptive management of O&M of the College Lake IRMP
- **Chapter 7, References.** This chapter provides information on literature and other sources cited in the text.
- Appendix A, **Avoidance and Minimization Measures.** This appendix provides the text of adopted and anticipated measures to avoid and minimize the impacts of maintenance activities.
- Appendix B, "XXX," XXX.
- Appendix C, "XXX," XXX.
- Appendix D, "XXX" XXX.

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CHAPTER 2

College Lake Setting

This chapter summarizes regional and local background information about the College Lake setting related to land cover, biological resources, cultural resources, and existing management activities.

2.1 Regional Setting

The Project area, shown on **Figure 1**, is located within the Pajaro Valley. Historically, the Pajaro Valley supported a variety of vegetation communities, including extensive riparian forests along waterways, oak savanna intermixed with grasslands in the lowland areas, mixed hardwood forests on hillsides, coastal dunes near the ocean, and coastal scrub on rocky sites. Currently, the Pajaro Valley is mostly agricultural with isolated patches of remnant natural vegetation communities. The valley is drained by the Pajaro River and its major tributary, Salsipuedes Creek, as well as by the Watsonville Slough system and Carneros Creek.

College Lake is a naturally occurring seasonally wet depression that receives water inflows from the Green Valley, Casserly, and Hughes Creek subwatersheds. The College Lake watershed, consists of approximately 11,000 acres of range, rural residential, and crop lands (PV Water 2014). Outflows from College Lake enter Salsipuedes Creek. Reclamation District 2049 (RD 2049), established in 1920, typically pumps the lake dry beginning in mid-March to allow agricultural use of the lakebed until measureable rain in the fall.

2.2 Land Cover

College Lake and portions of Salsipuedes Creek within the Project's maintenance areas support the following general habitat types as shown on **Figure 2**: riparian scrub, riparian forest, freshwater emergent wetland, coyote brush scrub, seasonal wetland, agriculture, farmed wetlands, annual grassland, urban/developed and upland tree groves, perennial stream, and ditch. The most common habitat types in College Lake and Salsipuedes Creek in the Project area are described below:

Figure 2-1. Project Location Map

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Riparian Forest: Riparian forest occurs as a large stand in the northeast quadrant of College Lake and is also present within other portions of College Lake and its tributaries. This broadleaf deciduous forest is dominated by native riparian species including arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), black cottonwood (*Populus trichocarpa*), alder (*Alnus* spp.), western sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), box elder (*Acer negundo* var. *californicum*), shining willow (*Salix lasiandra* var. *lasiandra*), and dogwood (*Cornus* sp.). Associated understory species include California blackberry (*Rubus ursinus*), nettle (*Urtica* sp.), curly dock (*Rumex crispus*), and coyote brush (*Baccharis pilularis*). These understory species are also the dominants of riparian scrub (i.e., shrub and perennial-dominated riparian vegetation).

Seasonal Wetland: Seasonal wetlands are found along the margins of College Lake and in the northwestern and eastern extensions of the lake. These areas support a wide variety of annual and perennial herbaceous species. Some dominant species include smartweed (*Persicaria* spp.), cocklebur (*Xanthium strumarium*), and rushes (*Juncus* spp.). California blackberry and Himalayan blackberry (*Rubus armeniacus*) are also prevalent in some areas that are transitional to riparian scrub.

Agriculture: Agricultural fields located at elevations above approximately 62.5 feet North American Vertical Datum of 1988 (NAVD88) can be planted with berries and orchards (i.e., crops requiring a longer growing season) while agricultural fields below 65.2 feet NAVD88 are typically planted with annual vegetable row crops. Agricultural habitats are routinely disked, planted, harvested, and subject to the application of herbicides, pesticides, and fertilizers, which prevents the establishment of non-crop perennial plant species and natural habitats.

Agricultural fields on the lakebed of College Lake are periodically fallowed, at the discretion of the farmer. In fallow years, these fields support weedy plant species, including: bristly ox-tongue (*Helminthotheca echioides*), cocklebur; swamp pricklegrass (*Crypsis schoenoides, C. vaginiflora*), fat-hen (*Atriplex prostrata*), smartweeds, and, curly dock.

Farmed Wetlands: Farmed wetlands include agricultural areas within College Lake that support hydrological conditions of wetlands. This highly managed system presents a unique situation where farm fields provide aquatic habitat during the winter and early spring, seasonal wetland habitat for a brief period as College Lake is drawn down, arable farmland in the summer, and fallow fields in the fall and early winter.

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2.3 Biological Resources

Several biological resources are particularly important for Project O&M either because of their potential sensitivity to management actions or their potential to affect sensitive biological resources or Project O&M. These resources include:

- Cyanobacteria
- Invasive animal species
- Invasive plant species
- Riparian forest
- Seasonal wetlands
- South-central California coast steelhead
- Special-Status wildlife species
- Waterfowl

The following sections briefly describe each of these resources and their relation to O&M of the Project.

2.3.1 Cyanobacteria

[*Forthcoming*]

2.3.2 Invasive Animal Species

[*Forthcoming*]

2.3.3 Invasive Plants

[*Forthcoming*]

2.3.4 Riparian Forest

[*Forthcoming*]

2.3.5 Seasonal Wetlands

[*Forthcoming*]

2.3.6 South-Central California Coast Steelhead

South-central California coast (S-CCC) steelhead (*Oncorhynchus mykiss*) occur in College Lake. Based on a 2011 study, it is likely that at least some juvenile steelhead from the upper

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watershed spend time rearing in College Lake during winter and early spring prior to migrating out to the ocean (Podlech 2014).

[*Additional text describing relationship to O&M forthcoming*]

2.3.7 Special-Status Wildlife Species

There are a number of special-status wildlife species that are either known to occur, or have potential to occur within the Project area. California red-legged frog (*Rana draytonii*) and western pond turtle (*Actinemys marmorata*) have not been observed within the Project Area, but have potential to occur in suitable aquatic and riparian habitat.

A variety of special-status birds have potential to forage and/or nest within the Project area including tricolored blackbird (*Agelaius tricolor*), short-eared owl (*Asio flammeus*), western burrowing owl (*Athene cunicularia*), Golden eagle (*Aquila chrysaetos*), white-tailed kite (*Elanus leucurus*), American peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), yellow warbler (*Setophaga petechia*), and Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*).

Also, in the Project area's riparian habitats, two special-status western red bat (*Lasiurus blossevillii*) and San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*) could occur.

[*Additional text describing relationship to O&M forthcoming*]

2.3.8 Waterfowl

A diverse assemblage and large number of wading birds, waterfowls, and raptors use habitats at College Lake, which is a well-known winter bird stopover location. Because of its value as waterfowl habitat, PV Water has funded annual winter-spring waterfowl surveys at College Lake since the winter–spring of 2014, and in 2017 began to incorporate summer–fall surveys as well. The purpose of this effort is to develop a baseline of waterfowl use of College Lake's storage area and adjacent wetland, upland, and riparian habitats. During the past eight years of PV Water-funded waterfowl surveys (2014–2021), between 82 and 140 species have been documented at College Lake each study season.

[*Additional text describing relationship to O&M forthcoming*]

2.4 Cultural Resources

2.4.1 Archaeological Resources

Records searches, a cultural resources survey, and geoarcheaological assessment conducted for the Project identified two known archaeological sites within the water storage area of College Lake and at least a moderate probability of undocumented, significant archaeological resources being present.

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Records searches conducted through the California Historical Resources Information System (CHRIS) Northwest Information Center (NWIC) revealed that 138 cultural resources studies have been conducted within a one-half-mile radius of the Project, 22 of which overlap the project area[3]. As a result of these surveys, the majority of the land within one-half mile of the project site has been included in previous cultural resources surveys.

These previous cultural resource studies recorded seven archaeological resources recorded within a one-half-mile radius of the project sites. In addition, two resources within the one-half-mile radius but not on file at NWIC include one prehistoric archaeological site and one historical-period archaeological site. Of the nine resources, two overlap the water storage area at College Lake resulting from the Project.

No archaeological resources were identified as a result of the cultural resources survey, which is described in the following section.

The geoarchaeological assessment indicated that the majority of the project area has a high sensitivity for prehistoric archaeological resources and that these resources could be shallowly or deeply buried[4]. Areas that have the highest probability of containing significant resources are within 200 meters (656 feet) of the high water mark of the College Lake water storage area. The lower elevation floodplain area has a moderate probability of containing significant resources include the low-lying floodplain area.

2.4.2 Historical Resources

A 2018 cultural resources survey of the project area did not identify any historical resources eligible for listing in the National Register or California Register. Approximately 40 percent of the project area was surveyed systematically or opportunistically on foot, or through a "windshield" survey. Other areas were not surveyed because of access limitations, no visible native ground surface, or inundation. All resources meeting the California Office of Historic Preservation's 45-year-old age threshold for consideration as historical resources were documented on California Department of Parks and Recreation 523 series forms.

A total of five newly identified historic architectural resources meeting the California Office of Historic Preservation's 45-year-old age threshold were documented during the 2018 survey: ESA-Built-001 (pump intake house and weir), ESA-Built-002 (76 Holohan Road – residence), ESA-Built-003 (38 Holohan Road – agricultural buildings), ESA-Built-004 (canal segment), and ESA-Built-005 (railroad spur). These resources were evaluated for listing in the National Register and California Register and found ineligible.

[3] Records searches for the Project were conducted through the California Historical Resources Information System (CHRIS) Northwest Information Center (NWIC) housed at Sonoma State University on June 22, 2017 (File No. 16-2078) and August 4, 2017 (File No. 17-0246) and updated on September 19, 2017 (File No. 17-0246) and April 25, 2018 (File No. 17-2410).

[4] The geoarchaeological study was based on a review of previously recorded archaeological sites obtained through records searches at the CHRIS-NWIC, a literature review, and a review of geologic maps, soils maps, and historical aerial photos and maps covering the project area.

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2.5 Existing Management of College Lake

2.5.1 Water Management

The majority of the water in College Lake enters from the north side of the lake through Casserly Creek, and is supplemented by inflows from the Green Valley and Hughes Creek subwatersheds (Resource Conservation District Santa Cruz County 2014). During wet weather, flow direction in the reach of Salsipuedes Creek between College Lake and Corralitos Creek can reverse due to high flows in Corralitos Creek, and surface water enters the lake as backflow from Salsipuedes Creek. During other periods, outflow from College Lake drains into Salsipuedes Creek, which is a tributary to the Pajaro River. RD 2049 pumps College Lake dry in the spring to accommodate summer farming of the lakebed. Pumping usually begins in mid-March, depending on the amount of spring rain.[5] Pumping the lake dry generally takes 30 to 40 days, typically resulting in a dry lakebed by May 1st to May 10th.[6] Intermittent pumping into Salsipuedes Creek continues after this date as needed to maintain a dry lakebed.

An existing weir with crest at elevation 60.1 feet NAVD88 associated with the pumps spans the Salsipuedes Creek channel and, under certain conditions, controls the water level in College Lake.[7] When the lake water surface elevation (WSE) is at the existing weir crest elevation, approximately 228 acres of the lake basin is inundated, storing about 1,150 acre-feet of water (Resource Conservation District of Santa Cruz County 2014). Subsurface tile drains are present within the College Lake basin; during the summer farming period, flow from these drains is collected and pumped into a channel at the center of the College Lake basin. Water in the channel flows to the weir and pumps.

2.5.2 Farming

Once the lake has been pumped and agricultural land within the lakebed is dry enough to accommodate heavy machinery (typically around May 30th), tractors turn the soil; it then takes about one month to prepare the land for planting. Most of the crops in College Lake require at least 60 to 90 days to reach maturity; depending on the water year, two crops can be grown. Growers aim to complete harvesting and other agricultural operations in the lake basin before the fall–winter rains, generally by the end of October, although farming can and has occurred later in the year. Vegetable row crops (including varieties of kale, lettuces, and onions) comprised the largest area under cultivation from 2014 to 2018. Tree and vine crops (e.g.,

5 RD 2049 was formed in 1920 and was granted express legal authority under State law (California Water Code Section 50000 et. seq.) to pump water from College Lake to reclaim the land for agricultural production.

6 Peixoto, Dick, Lakeside Organic Gardens, LLC, Letter to Mary Bannister, May 12, 2014.

7 The primary purpose of the existing weir is to prevent pumped water from flowing from Salsipuedes Creek into College Lake.

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apples, raspberries and blackberries), comprising about 3 acres in total, are grown at higher elevations and extend to just below 64 feet NAVD88.

Farmed lands are periodically disked, planted, harvested, treated with herbicides, pesticides, and fertilizers, and periodically left fallow at the discretion of the farmer.

2.5.3 Mosquito Abatement

The College Lake area has a long history of seasonal floodwater mosquito production.[8] The Santa Cruz County Mosquito Abatement and Vector Control (MAVC) implements mosquito control measures in the creek adjacent to the fairgrounds to limit hatching of floodwater mosquitos and the eastern section of Casserly Creek also has issues with mosquitoes. Access to these locations on foot has been difficult.[9]

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8 Binding, Paul. Santa Cruz County Mosquito and Vector Control CSA 53. Comments on the Notice of Preparation for Proposed College Lake Integrated Resources Management Project. January 4, 2017

9 Conversation with Steve Driscoll, Vector Control Specialist, Santa Cruz County Mosquito and Vector Control

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CHAPTER 3

College Lake Integrated Resources Management Project

This chapter describes the multiple components of the Project, as well a proposed operations and maintenance activities.

Throughout the Pajaro Valley Groundwater Basin, overdraft conditions[10] have caused groundwater levels to drop below sea level, creating a landward pressure gradient that causes seawater to move inland. Seawater intrusion has elevated the chloride concentrations in groundwater up to approximately three miles inland from the coast, in some areas contaminating the groundwater to the point that it is unsuitable for agricultural irrigation and domestic (potable) uses without treatment.

The purpose of the Project is to help balance the groundwater basin, by decreasing demands on groundwater, preventing further seawater intrusion, and meet water supply needs within PV Water's Coastal Distribution System (CDS) service area by developing College Lake as a water storage and supply source for agricultural irrigation, while accommodating the release of fish bypass flows and facilitating fish passage between Salsipuedes Creek and College Lake.

3.1 Project Design

The essential function of the Project is to store water in and divert water from College Lake for treatment, transmission, and distribution for agricultural irrigation. The Project includes the following components:

Weir Structure and Intake Pump Station. The Project includes a weir structure with an adjustable crest, and a diversion and intake pump station to divert surface water from College Lake. The diversion weir will have an adjustable weir crest that will be operational through a range of 60.1 to 62.5 feet NAVD 88. The proposed weir crest elevation could be adjusted with one or more pneumatically actuated gates (e.g., Obermeyer Spillway Gates). The intake pump station will pump raw (untreated) water

10 Overdraft occurs when the amount of groundwater withdrawn from a basin exceeds the volume of freshwater replenishing the basin.

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from an intake just upstream of the weir to the proposed College Lake water treatment plant (WTP) via a 30-inch diameter intake pipeline.

A fish passage structure will be located on the west side of the weir and will route fish around the diversion weir during periods when passage over the weir is not possible.

The proposed adjustable weir will be capable of raising the College Lake water level by up to 2.4 feet above the elevation of the existing weir to a water surface elevation of 62.5 feet NAVD88. The storage capacity of College Lake is approximately 1,150 acre feet (AF) at a water surface elevation of 60.1 feet NAVD88 and approximately 1,800 AF at a water surface elevation of 62.5 feet NAVD88.

Water Treatment Plant. The WTP will remove sediment, filter, and disinfect the water diverted from College Lake. The WTP will contain sedimentation basins and solids drying beds, filtration and disinfection systems, and an treated water pump station.

College Lake Pipeline. The Project will include an approximately 6-mile-long, 24-inch-diameter pipeline from the proposed WTP to the CDS.

3.2 Project Operations

This section describes the Project's operations: fish passage flows, weir operations, and water supply diversions.

3.2.1 Fish Passage Flows

The proposed weir structure will be designed to accommodate release of fish bypass flows and to facilitate fish passage between Salsipuedes Creek and College Lake. **Table 2-1** lists proposed minimum lake levels and minimum flows for fish passage for adult steelhead migration (December 15th through April 30th) and smolt outmigration (May 1st through May 31st).

TABLE 2-1
PROPOSED FISH PASSAGE FLOWS

Proposed Fish Passage, Bypass of Casserly Creek Flows[a]	Adult Steelhead Migration		Smolt Outmigration
	Dec. 15 – Mar. 31	Apr. 1 – Apr. 30	May 1 – May 31[c]
Bypass flow between Corralitos-Salsipuedes Confluence and Pajaro River	21 cfs	8 cfs when natural flows are < 18 cfs; or 21 cfs when natural flows are ≥ 18 cfs	8 cfs
Bypass flow at weir[b] and in Salsipuedes Creek between weir and Corralitos Creek	1.8 cfs	1.8 cfs	1.0 cfs
Minimum lake level	59.5 feet NAVD88	59.5 feet NAVD88	59.3 feet NAVD88

Source: State Water Resources Control Board (2021) Right to Divert and Use Water, Draft Permit Application AO32881

NOTES:

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cfs = cubic feet per second

NAVD88 = North American Vertical Datum of 1988

[a] Instream flow requirements based on critical riffle surveys conducted in 2017 and 2018. Each minimum flow requirement will be the number specified in this table or the flow resulting from bypassing the total inflow into College Lake, whichever is less. Minimum flow between the Corralitos Creek-Salsipuedes Creek confluence and Pajaro River is for the combined flow from Corralitos Creek and College Lake. Refinements to fish passage assumptions and modeling may occur during permitting based on agency consultations.

[b] The minimum flows may be refined during design phase of the proposed weir and fish passage structure.

[c] The smolt outmigration season begins in March, but instream flow requirements for adult steelhead prior to May 1 meet or exceed the smolt requirement and are therefore protective of smolt instream flow needs.

Fish bypass releases will begin only when the water surface elevation in College Lake increases to the minimum level at which passable conditions for fish will have occurred without the existing weir in place and with flows being regulated only by the existing channel topography in Salsipuedes Creek. Based on a critical riffle analysis, these water surface elevations are 59.6 feet NAVD88 for the adult season, which corresponds to a depth of 0.6 feet at the critical riffle, and 59.3 feet NAVD88 for the smolt season, which corresponds to a depth of 0.4 feet at the critical riffle. Releases for fish passage will not exceed total inflows into College Lake during any time interval.

In addition, PV Water anticipates that other future conditions may warrant pumping flows from College Lake into Salsipuedes Creek during the summer and fall. The Project design includes a 30-inch bypass pipeline from the pump station to the downstream side of the proposed weir structure for this purpose. This bypass pipeline could be used to drain College Lake for equipment maintenance or equipment repair, to ensure the lake bottom is able to dry out for purposes of predator control, or to prevent water quality issues such as low dissolved oxygen, algal blooms, or other unforeseen issues from developing within the lake. Although PV Water is not presently able to anticipate the frequency of such operations, the bypass pipeline will be operated in compliance with all applicable regulatory permit conditions.

3.2.2 Proposed Weir Operations

PV Water will manage the proposed adjustable weir[11] to avoid exacerbating flood risk while retaining water from late season precipitation events for subsequent treatment and distribution to irrigators in the Pajaro Valley. The proposed weir will be raised to 62.5 feet NAVD88 following the last anticipated significant storm event of the season. Factors that would affect the timing of the weir adjustment include water surface elevation and corresponding duration of drawdown, short- and long-term meteorological forecasts, and downstream channel conditions. In the event a significant storm is predicted to occur after the weir has been raised to 62.5 feet NAVD88, PV Water would initiate a pre-storm lowering of the weir from an elevation of 62.5 to 60.1

11 The weir crest could be adjusted from 60.1 feet NAVD88 (the height of the existing weir) to 62.5 feet NAVD88.

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feet. cbec eco engineering conducted analyses to estimate the rate at which College Lake would drain over the proposed weir to meet pre-event drawdown criteria to prevent exacerbating existing downstream flood risks.[12] Based on the results of these analyses, lowering of the weir from 62.5 feet to 60.1 feet under existing downstream channel conditions would result in an initial draining rate at the weir of approximately 75 cfs, and this rate would decline quickly (i.e., within one hour) as Salsipuedes Creek below the weir reaches capacity.[13] Additional information on estimated drawdown times is provided in College Lake Integrated Resources Management Project Hydrologic and Hydraulic Modeling Technical Memorandum (cbec, inc. 2018, provided as Appendix HYD-1 of PV Water 2019)

3.2.3 Water Supply Diversions

Anticipated typical annual water diversion rates for the Project range between 1,800 and 2,300 AF per year (AFY) and the maximum would be 3,000 AFY. PV Water has estimated monthly demands based on existing conditions for irrigation water for four modeled water year types (i.e., ranging from very wet to extremely dry). Operational criteria used in the water budget model to determine the extent to which projected monthly demand could be met included the following restrictions:

- Water supply diversions s could not begin until College Lake achieves the water levels for adult steelhead migration and smolt outmigration shown in **Table 2-1**; and
- For the period December 15 to May 31, only College Lake inflows exceeding the proposed minimum fish bypass flows in **Table 2-1** could be diverted to the treatment plant for irrigation supply.

Depending on water year type, and time of year, monthly demand has been estimated at from a minimum 14 AF to maximum of 470 AF (cbec, inc. 2018).

3.3 Project Maintenance

This section describes maintenance of the Project's facilities and of the water storage area. **Table 2-2** summarizes these maintenance activities. Measures to avoid and minimize environmental impacts would be implemented in conjunction with these activities. The adopted and anticipated measures are provided in **Appendix A**.

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12 cbec, inc. eco engineering, College Lake Integrated Resources Management Project Hydrologic and Hydraulic Modeling Technical Memorandum, prepared for Environmental Science Associates by cbec, inc., November 8, 2018.

13 cbec, inc. eco engineering, unpublished data provided to M. Podlech on February 12, 2020.

TABLE 2-2
SUMMARY DESCRIPTION OF ANTICIPATED MAINTENANCE ACTIVITIES

Activity	Frequency	Anticipated Annual Quantity	Seasonal Timing	Description
Weir, pipeline, pump station Inspections	Weekly	—	Year-round	—
Weir, pipeline, pump station repair	As needed	1	Year-round	Typically, an unscheduled activity conducted when facilities are damaged. Standard equipment would include light duty trucks, small winches, crane, front end loader, haul truck, chainsaw, and hand tools.
Weir repair or maintenance requiring dewatering	As needed	0.2 (1 in 5 years)	Summer – fall	Channel adjoining weir dewatered for weir maintenance and repair.
Weir maintenance	Annually	3	Late summer – early fall	Typical weir maintenance activities would include debris/sediment removal, cleaning, minor erosion control measures (including replacement of fill in eroded areas), and replacement of the weir gate. Standard equipment would be the same as for weir repair.
Sediment and debris removal	Annually	Up to 11,700 cubic yards of sediment	Late summer – early fall	Sediment deposited in channels would be removed every 1–2 years (from 0–100 % of channel length/year), typically by using excavators and bulldozers to load material onto haul trucks for transport to landfill or other upland location. Sediment deposits outside of channels would also be removed in some years.
Channel reshaping	Periodic	1 site	Late summer – early fall	Channel banks "laid back" (bank angle decreased) or other modifications are made to reduce erosion or encourage deposition in away from weir and pumps.
Vegetation management —channels	Annually	1.4 acres[1]	Late summer – early fall	Aquatic vegetation in channels is removed in association with sediment and debris removal. Removal is mechanical using a drag-line and excavator bucket. Removed aquatic vegetation is loaded into haul trucks and deposited in a landfill or upland location.
Vegetation management —lakebed	Annually	75 acres[2]	Late summer – early fall	Uncultivated areas of the lakebed that are not already in woody riparian vegetation are disked, tilled, ripped or mowed every 1–2 years to prevent new establishment of woody plants that could trap sediment, or restrict flow or drainage.

Source: Table content adapted from Draft College Lake Integrated Resources Management Project Environmental Impact Report (PV Water 2019) and draft permit applications for the Project.

Notes:

[1] Corresponds to acreage of entire existing ditch system

[2] Corresponds to the existing acreage of farmed wetland below an elevation of 59 feet NAVD 88 and potentially uncultivated in most years after Project implementation.

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3.3.1 Weir Structure, Pump Station, Water Treatment Plant, and College Lake Pipeline

Once the Project is fully operational, PV Water staff will periodically conduct routine inspections (e.g., for visual signs of wear and tear, obstructions or leakage) and perform scheduled maintenance of the weir structure, pump station, WTP, and pipelines. Should damage to facilities occur, PV Water would dispatch a crew to conduct the necessary repairs. Typical weir maintenance activities would include debris removal, cleaning, minor erosion control measures (including replacement of fill in eroded areas), and replacement of the weir gate. Standard equipment includes light duty trucks, small winches, crane, front end loader, haul truck, chainsaw, and hand tools. An excavator, backhoe, or crane could be required to lift metal parts from the gate or adjustable weir for maintenance or if sediment removal is required.

To the greatest extent feasible, inspections, maintenance, and repairs to the weir and intake structure will be conducted during periods of low water surface elevations in the lake (i.e., late summer and early fall). However, dewatering of the channel surrounding these structures may be necessary at times. The anticipated frequency of dewatering activities is not expected to exceed once every five years and would occur at a time of year when water surface elevations are low.

Dewatering of surface water could occur by isolating the work area through the use of sheet-pile coffer dams and bypassing flows around the construction site. A passive gravity bypass system could be used if feasible. If not feasible due to site conditions, water may be actively pumped around the work area using pumps. Bypass pumps will be screened in accordance with current NMFS and CDFW guidelines.

If subsurface water is encountered, the water would be discharged to agricultural lands, storm drains, or other waterways, and would be discharged in accordance with applicable regulatory requirements. The contractor would treat water from excavated areas as necessary prior to discharge. The treatment could include settling tanks or filter bags to allow sediment to settle out.

3.3.2 College Lake Water Storage Area

PV Water will conduct routine (annual or semi-annual) vegetation management and sediment and debris removal activities within College Lake to:

- Preserve water storage capacity

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- Avoid exacerbating existing flood hazards[14]

- Manage habitat in a manner consistent with requirements established in permits and approvals and in accordance with the AMP.

These maintenance activities may occur in the lake's existing ditches and channels, on portions of the lake bed, and upstream of the weir structure. The amount of these activities needed in any given year will depend on weather and hydrologic conditions, and frequency and extent of past maintenance activities. Additional details regarding methods and timing of maintenance activities will be determined once the Project has been implemented.

3.3.2.1 Vegetation Management

Figure 3 depicts areas proposed for vegetation management; these are areas that are farmed under baseline conditions and that are expected to support seasonal wetland vegetation with implementation of the Project. Vegetation management will not reduce the current extent of riparian forest but aims to limit new establishment of woody riparian plants that could trap sediment and restrict flow or drainage. PV Water is not proposing any specific vegetation management activities within the existing riparian forest habitat on land currently owned by PV Water.

In general, areas below 59 feet NAVD88 in elevation will be managed as open water habitat during the wet season. Vegetation management in this area during the dry season will sustain open water habitat during the wet season. Vegetation management methods will include disking, tilling, and ripping. Vegetation may also be trimmed or mowed if necessary. These activities may occur in most or all years. Removal of flow-constricting vegetation within channels and around Project components and equipment may also occur annually. Aquatic vegetation in channels may also be removed mechanically using a drag-line and excavator bucket, and in association with sediment and debris removal described below. Debris from vegetation management will be loaded into haul trucks and deposited in a landfill or upland location.

The Project's MMRP includes measures to avoid and minimize impacts to existing habitat features in College Lake and additional measures are being determined in consultation with regulatory agencies with approval authority over the Project. See

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14 The Santa Cruz County Flood Control and Water Conservation District Zone 7 (Zone 7) is responsible for the provision of drainage improvements in the project area. Zone 7 was formed for the primary purpose of improving the flood carrying capacity of the Pajaro River, Salsipuedes, Creek and Corralitos Creek systems within the Pajaro Valley floodplain. This is achieved through funding the maintenance of and minor capital improvements to existing drainage facilities within the zone's boundaries. Santa Cruz County Flood Control and Water Conservation District Zone 7 does not currently have an existing stream maintenance plan or other adopted sediment management plan for the College Lake area. (County of Santa Cruz Department of Public Works, Flood Control and Water Conservation District: Zone No. 7, 2019. Available online at http://www.dpw.co.santa-cruz.ca.us/Home/FloodControlStormwater/FCWCZone7.aspx. Accessed on April 10, 2019.)

Appendix A for adopted and proposed measures for avoiding and minimizing impacts of maintenance activities.

3.3.2.2 Sediment and Debris Removal

PV Water will remove excess sediment and debris from certain areas of College Lake and upstream of the weir structure. The need for sediment removal will be evaluated annually during routine facility monitoring.

Sediment removal is the act of mechanically removing sediment that has deposited within a channel or on the lakebed, typically using excavators and bulldozers, loading material onto haul trucks. Sediment and debris removal will be conducted during the dry season, and could be implemented if sediment accumulations (for example) impede fish passage, significantly compromise channel capacity, or impair operation of the proposed weir and intake structure. Channels within the lakebed may also be reshaped to minimize bank erosion (e.g., laying back banks) or help minimize stranding of fish as water levels recede.

Removed sediment and debris will be hauled to the Buena Vista Landfill or other upland location for disposal.

3.4 Anticipated Inundation and Land Cover Changes Resulting from Operations and Maintenance

Operations would alter the duration and timing of inundation at College Lake, requiring changes in existing land use activities. Associated changes in land cover are also anticipated. **Table 2-3** summarizes these anticipated changes. The primary effect is anticipated to be on the extent of farmed wetlands below an elevation of 59 feet NAVD88. These farmed wetlands are frequently submerged or in seasonal wetland vegetation for part of the year and also in agricultural production for part of the year. With operation of the Project, these farmed wetlands would be more frequently inundated for longer periods of time, which would preclude or substantially reduce the frequency of their cultivation.

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TABLE 2-3
ANTICIPATED CHANGES TO INUNDATION PERIODS AND LAND COVER AT COLLEGE LAKE

Maintenance Area	Water Surface Elevation (feet NAVD88)	Existing Inundation Period[a]	With Project Inundation Period (62.5 foot weir)[b]	Land Cover (Wetland/Water/Upland)	With Project Land Cover, Anticipated Change
Routine Vegetation Maintenance (mowing/disking) (< 59 feet NAVD88)	50 up to 57	4-7 months	7-11 months	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland) Consists of: 1. Open water (November 1 to March 31) 2. Seasonal wetland vegetation (April 1 to May 31) 3. Agriculture[c] (June 1 to October 31)	Farmed wetland would convert to managed seasonal wetland which would consist of: 1. Open water (November 1 to July or August) 2. Mudflat with sparse seasonal wetland vegetation (July or August to October 31) No farming would occur at this elevation with the Project. Vegetation management (mowing, disking) would occur annually to maintain open water and mudflat and prevent woody plant encroachment.
				Riparian Forest (Wetland)	No land cover type change. Riparian Forest present below 57 feet NAVD88 is expected to persist with its current riparian species composition and abundance in the short term but may shift in species composition and abundance in the future with a dominance of inundation-tolerant species such as Pacific willow (*Salix lasiandra*), and possibly a sparser overstory canopy with freshwater emergent plants in the understory. A small 0.7-acre area of freshwater emergent wetland occurs within the larger riparian forest and would not be actively maintained.
				Seasonal Wetland (Wetland)	No land cover type change, though seasonal wetlands that are not currently managed annually through mowing and tilling would be subject to these management practices in the future to prevent woody plant encroachment. The increase in management frequency, combined with the longer inundation period in this elevation range would likely result in sparser vegetation, dominated by annual species.
	57 up to 59	4 months	6-7 months	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland) Consists of: 1. Open water (December 1 to March 31) 2. Seasonal wetland vegetation (April 1 to May 31) 3. Agriculture[c] (June 1 to November 30)	Farmed wetland would convert to managed seasonal wetland, similar to 50 to 57 feet NAVD88. No farming would occur at this elevation with the Project. Vegetation management (mowing, disking) would occur annually to maintain open water, mudflat, and seasonal wetland and prevent woody plant encroachment.
				Riparian Forest (Wetland)	No land cover type change, though species composition may change as this forest matures and older trees senesce. A small 0.2 acre area of freshwater emergent wetland occurs within the larger riparian forest and would not be actively maintained.
				Seasonal Wetland (Wetland)	No land cover type change. This area would be managed as seasonal open water and wetland through mowing and disking, to prevent woody plant encroachment, similar to existing conditions.
Routine Vegetation Maintenance and Farming (59-63 feet NAVD88)	59 up to 62	1-4 months	2-6 months	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland) Consists of: 1. Open water (January 1 to March 31) 2. Seasonal wetland vegetation (April 1 to May 31) 3. Agriculture[c] (June 1 to December 30)	No land cover type change. Although this elevation range would be inundated for longer durations (especially at the lower end of the range) these areas would continue to be used for seasonal crops in years and locations where at least one crop rotation is feasible. Areas that are not farmed would be managed as seasonal open water and wetland through mowing and disking, to prevent woody plant encroachment, similar to existing conditions.
				Riparian Forest (Wetland)	No land cover type change.
				Seasonal Wetland (Wetland)	No land cover type change.
	62 up to 63	1-6 weeks, not continuous	2-8 weeks, not continuous	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland)	No land cover type change. Although this elevation range would be inundated for longer durations these areas would continue to be used for seasonal crops in years and locations

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TABLE 2-3
ANTICIPATED CHANGES TO INUNDATION PERIODS AND LAND COVER AT COLLEGE LAKE

Maintenance Area	Water Surface Elevation (feet NAVD88)	Existing Inundation Period[a]	With Project Inundation Period (62.5 foot weir)[b]	Land Cover (Wetland/Water/Upland)	With Project Land Cover, Anticipated Change
					where at least one crop rotation is feasible. Areas that are not farmed would be managed as seasonal open water and wetland through mowing and disking, to prevent woody plant encroachment, similar to existing conditions.
				Riparian Forest (Wetland)	No land cover type change.
				Seasonal Wetland (Wetland)	No land cover type change.
				Agriculture (Upland)	Farmed wetland. This is not likely to change the land use practices or habitat value[d]
				Annual Grassland (Upland)	Seasonal Wetland.
None/No Maintenance Action (>63 feet NAVD88)	63 up to 64	1-6 weeks, not continuous	2-8 weeks, not continuous	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland)	No land cover type change. Although this elevation range would be inundated for longer durations these areas would continue to be used for seasonal crops in years and locations where at least one crop rotation is feasible. Farmers may continue to manage farmed wetlands for agricultural purposes.
				Riparian Forest (Wetland)	No land cover type change.
				Seasonal Wetland (Wetland)	No land cover type change.
				Agriculture (Upland)	Farmed wetland. This is not likely to change the land use practices or habitat value.[d]
				Annual Grassland (Upland)	Seasonal Wetland.
				Riparian Scrub (Upland)	No land cover type change
	64 up to 70	Periodic inundation of one week or less	Periodic inundation of one week or less	Ditch (Other Water)	No land cover type change. Ditches would be continued to be managed for water conveyance and fish passage.
				Farmed Wetland (Wetland)	No land cover type change. These farmed wetlands are currently supported by seeps and not by inundation of the College Lake Basin. So changes in the College Lake basin hydrology would not likely change these farmed wetlands. Farmers may continue to manage farmed wetlands for agricultural purposes.
				Riparian Forest (Wetland)	No land cover type change.
				Seasonal Wetland (Wetland)	No land cover type change. These seasonal wetlands are currently supported by seeps and not by inundation of the College Lake Basin. So changes in the College Lake basin hydrology would not likely change these farmed wetlands
				Agriculture (Upland)	No land cover type change.
				Annual Grassland (Upland)	No land cover type change.
				Coyote Brush Scrub (Upland)	No land cover type change.
				Riparian Scrub (Upland)	No land cover type change.
				Developed (Upland)	No land cover type change.

NOTES:

[a] Based on observed water surface elevation during 2016.

[b] Based on the modeled above-average rainfall year (2016). See Appendix HYD and Figures 3.3-7a through 3.3-7d in Section 3.3, Surface Water, Groundwater, and Water Quality in College Lake EIR.

[c] Agriculture includes a fallow period after harvest during which time fields are bare, tilled soil.

[d] The anticipated change of agricultural land to farmed wetland would not affect the agricultural land use of this area.

SOURCES: cbec, inc. eco engineering, Inundation Statistics and Monthly Flows, December 18, 2018; Draft College Lake Integrated Resources Management Project Environmental Impact Report (PV Water 2019)

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CHAPTER 4

Adaptive Management Framework

Adaptive management is a framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives[15]. This structured process for making decisions informed by monitoring is well suited to situations with clear objectives, some ability to modify actions, and a moderate level of uncertainty. Such situations are common in natural resource management, and include implementation of the College Lake IRMP.

This chapter describes the framework for adaptively managing implementation of the IRMP, as described in the Consolidated Final Environmental Impact Report for the College Lake Integrated Resources Project (PV Water 2019). The framework consists of:

- Objectives (desired outcomes)
- Metrics (monitored variables)
- Action triggers (thresholds, decision criteria)
- Potential management actions

Table 4-1 presents this framework, which is described further in the following sections.

Note to PV Water Reviewers and Committee Members: *Table 4-1 is the table that was distributed for the second committee meeting, but with additional content: examples of potential management actions have been added, and some revisions (in underline and strike out) have been made in response to comments made during the second committee meeting.*

[15] The Delta Reform Act provides a relevant definition of adaptive management: "a framework and flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives" (Water Code section 85052)

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Table 4-1
Summary of Proposed Management Objectives, Metrics, and Triggers

Objective	Metric	Management Action Trigger	Potential Management Actions **[Examples]**
Flooding—Avoid exacerbating existing flood hazards outside the proposed water storage area.	April–May precipitation	Occurrence of major precipitation event (> 1 inch rainfall) when weir is raised above 60.1 feet NAVD88	Evaluate flooding effects from storm event, and likely effects of College Lake water surface and weir elevations on flooding. Revise procedure for defining last major storm of year, criteria for raising weir, or response to storm events after weir has been raised.
Fish Passage—Facilitate fish passage between the Pajaro River and College Lake between December 15th and May 31st.	Tagged smolts (number detected)	Significant difference between upstream and downstream sides of weir	Inspect monitoring equipment to confirm no bias resulting from instrumentation. Review operational guidance and records, to confirm compliant bypass flows have been released. Evaluate potential structural and hydraulic issues affecting passage at the weir, and rectify identified issues. Reassess flow requirements for passage at critical riffle, and associated fish passage flows as necessary. Evaluate fish passage needs at potentially critical riffles in Salsipuedes and Corralitos Creeks to verify continued adequacy of bypass flow requirements
	Relative abundance of Age 0 steelhead (% of juveniles) in Casserly Creek and College Lake	Relative abundance in Casserly Creek/College Lake significantly less than in nearby stream systems	
Water Storage—Preserve water storage capacity within College Lake.	Sediment/debris in ditches—Flow obstructions (presence and location) and ditch depth	Presence of a flow obstruction or depth decrease of 25% or more.	Evaluate need for sediment removal. Remove sediment deposits that are reducing storage capacity. Identify watershed factors contributing to sediment production, transport, and deposition, and coordinate with upstream landowners and Resource Conservation District of Santa Cruz County to reduce sediment deposition in College Lake.
	Sediment/debris on lakebed—elevation	Elevation increase > 2 inches <u>by sediment/debris deposited on > 1,000 square feet (> 9 cubic yards).</u>	
Water Quality—Minimize conditions that can contribute to algal blooms, including cyanobacteria blooms.	Temperature profile (°C)	Water column temperature gradient > 5 °C[a]	Review monitoring data and consult technical experts and regulatory stakeholders regarding potential responses. Reassess temperature gradient and constituent concentrations used as triggers for management actions Identify watershed factors contributing to phosphorus availability in concentrations in College Lake, and coordinate with upstream landowners and Resource Conservation District of Santa Cruz County to reduce sediment deposition in College Lake. Treat College Lake with aluminum sulfate Lower water level in or drain College Lake
	Total phosphorus (mg/L)	Concentrations > 0.17 mg/L[a]	
	Chlorophyll-a (µg/L)	Concentrations > 25 µg/L[a]	
	Microcystins, total (µg/L)	Concentrations > 0.8 µg/L[a]	
Farming—Promote farming within the College Lake basin	Acreage cultivated between 59 feet and 63 feet elevation	Acreage cultivated in a below normal, dry, or critical water year below pre-project (2014–2021)	Conduct landowner outreach to identify factors limiting area of cultivation Develop revised terms for use in future leases.

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Table 4-1
Summary of Proposed Management Objectives, Metrics, and Triggers

Objective	Metric	Management Action Trigger	Potential Management Actions **[Examples]**
between 59 feet and 63 feet elevation NAVD88.	NAVD88 in below normal, dry, or critical water years	range of cultivated acreages during below normal, dry, or critical water years.	Adjust rate or timing of water diversions. Adjust timing, frequency, or methods of sediment and debris removal. Maintain, improve, or expand tile drain system.
Vegetation— Sustain seasonal wetland and native vegetation	Seasonal wetland vegetation—acreage	Acreage less than 2017–2022 range of acreage	Evaluate potential relationships of change in vegetation to operations and maintenance activities, particularly vegetation management Modify timing or techniques of vegetation management. Modify weir operations or water supply diversions. Implement woody riparian plant control measures: disking, or localized hand removal. Monitor treated areas and retreat or revegetate as needed. Reassess practices for limiting introduction and spread of invasive plants, and revise as appropriate. Implement invasive plant control measures: hand removal of new/smaller infestations, other mechanical treatments if effective for species, or chemical treatment of larger areas. Monitor treated areas and retreat or revegetate as needed.
	[*Additional metric forthcoming*]	[*Additional trigger forthcoming*]	
	Woody riparian plants—location, estimated area, abundance, and height)	1 location > 0.1 acres in area with >0.5% cover of seedlings of woody riparian plants > 3 inches in height	
	Prioritized Invasive Plants—Infestation coordinates, area, and species	1 new invasive plant infestation or >25% increase in area of existing infestation.	
~~**Water Quality—**Confirm conditions are unsuitable for steelhead rearing in College Lake during June–September.~~	~~Temperature (°C)~~	~~June–September maximum weekly average temperature (MWAT) < 20°C or maximum weekly maximum temperature (MWMT) < 25°C~~	~~[Forthcoming]~~
Waterfowl—Sustain waterfowl habitat quality in the proposed water storage area.	Median daily abundance of waterfowl guilds during December–March	Annual median of abundance below range of pre-project (2015–2021) medians	Evaluate College Lake monitoring data, regional data, and other information sources (including technical experts) to identify potential causes of low abundance. Adjust timing or frequency of vegetation management to enhance habitat quality Take additional vegetation management actions to enhance habitat quality Adjust rate or timing of water diversions
Invasive Animal Species—Control invasive animal species pursuant to a plan approved by the appropriate regulatory agencies.	Species—Presence	Additional species detected	Determine source of invasive species and develop and implement measures to control spread from identified sources Adjust frequency, extent (partial or complete), or timing of lake draining Physically capture and remove invasive animals Revaluate invasive species control methods
	Species—# Individuals / unit area or sampling effort	Increasing trend in abundance	

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Table 4-1
Summary of Proposed Management Objectives, Metrics, and Triggers

Objective	Metric	Management Action Trigger	Potential Management Actions **[Examples]**
Cultural Resources—Preserve significant archaeological and historical resources and support tribal use of College Lake	Inspections for erosion or other impacts to Sites CA-SCR-44/H and CA-SCR-150.	Visible evidence of erosion or other damage.	Work with qualified archaeologist to develop and implement a plan to protect the site(s) from further damage. Work with a qualified archaeologist to recover archaeological resources from the affected portion(s) of the site(s) if protective measures are infeasible.
Research—Support research and ~~citizen~~ community science focused on key uncertainties affecting management.	Studies addressing key prioritized data gaps (number)	0 studies initiated at College Lake in first 3 years of implementation	Identify opportunities to improve suitability of College Lake as a research site (e.g., improvements to access, safety of researchers and equipment, or availability of supporting site and Project information) and make these improvements. Conduct additional targeted outreach to potential researchers at local universities, colleges, and environmental non-governmental organizations.

Notes

a Based on Total Maximum Daily Load (TMDL) established for Pinto Lake and supporting assessments; intended to reduce likelihood of cyanobacteria blooms impairing water uses (State of California Regional Water Quality Control Board Central Coast Region Resolution No. R3-2020-0034; R. Ketley, A. Retinger, and M. Los Huertos [2013] Pinto Lake Total Maximum Daily Load (TMDL) Planning and Assessment, State Water Resources Control Board, Sacramento, California.

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4.1 Objectives

Objectives are desired outcomes or performance measures that serve to guide decision making and evaluations of success in fulfilling the Project's purpose. Important attributes of objectives include being:

- Specific
- Measurable
- Attainable
- Relevant
- Time-bound

The project's objectives also must not conflict with permit requirements or other constraints, and must not conflict with each other.

4.2 Metrics

Metrics are monitored variables used to evaluate project outcomes (e.g., progress towards a measurable objective, success). Important attributes or metrics include:

- Relevance: Metrics are related to the Project's objectives and have implications for management activities.
- Responsiveness: Metrics are capable of exhibiting changes in response to actions taken in the time frame required for adaptive management (e.g., within 0–5 years).
- Cost-effectiveness: Individually and collectively, measuring the metrics will involve a reasonable expenditure relative to other metrics that could effectively assess progress and inform management decisions.
- Reliability of interpretation: Changes in the metrics will reliably and clearly document the results of management actions (as opposed to other causes, such as environmental fluctuations) and will highlight the types of changes that are needed in the Project's implementation.
- Transparency/ease of communication: As a set, the metrics will tell a clear and concise story to a broad cross section of the interested public about the results of implementing the Project.

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Table 4-1 presents the metrics for each of the project's objectives, and Section 5.1, "Monitoring Framework," describes how these metrics will be monitored.

Monitoring of other variables may improve management by increasing understanding of the College Lake ecosystem. Studies that would address key uncertainties are discussed in Section 5.2, "Targeted Studies."

4.3 Triggers and Management Actions

Triggers are limiting values of metrics that trigger management actions (e.g., thresholds, decision criteria). The key attributes of an action trigger are its relationship to the objective and its relationship to potential management actions. Action triggers need to indicate risk of an undesirable outcome when there are still potential actions that could be taken to avoid or rectify the undesirable outcome. Natural variability complicates the selection of action triggers, and management responses when they are exceeded. **Table 4-1** presents the action triggers selected for each metric.

For most objectives, there are several different types of management actions that could be implemented, including:

- Evaluation
- Coordination/consultation
- Adjustments to operations and maintenance practices
- Remedial actions
- Collaboration on off-site actions (e.g., actions up or downstream of College Lake)

For each action trigger, **Table 4-1** presents potential management actions that may be implemented in response to the trigger being exceeded. These lists represent the range of potential management actions but do not necessarily include all potential actions. Although no sequencing of actions is indicated in **Table 4-1**, the initial action typically would be an evaluation or assessment of the situation which would inform the selection of subsequent actions.

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CHAPTER 5

Monitoring and Targeted Studies

This chapter describes the monitoring that will be conducted to inform O&M of the Project and topics for targeted studies (research or community science) that could support management by reducing key uncertainties.

5.1 Monitoring Framework

For each objective of the AMP, the following sections concisely describe how O&M activities will be documented and how metrics will be monitored for each objective of this AMP.

5.1.1 Monitoring of Metrics for Objectives

5.1.1.1 Flooding

[*Forthcoming*]

5.1.1.2 Fish passage

[*Forthcoming*]

5.1.1.3 Water Storage

[*Forthcoming*]

5.1.1.4 Water Quality

[*Forthcoming*]

5.1.1.5 Farming

[*Forthcoming*]

5.1.1.6 Vegetation

[*Forthcoming*]

5.1.1.7 Waterfowl

[*Forthcoming*]

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5.1.1.8 Invasive Animal Species

[*Forthcoming*]

5.1.1.9 Cultural Resources

[*Forthcoming*]

5.1.1.10 Research

[*Forthcoming*]

5.1.2 Documenting Management Actions

Records will be kept documenting all O&M conducted by PV Water at College Lake. Documenting O&M activities is an important component of monitoring. These records will be summarized annually to support decision making.

5.2 Targeted Studies

Data on College Lake's habitats, ecosystems processes (e.g., hydraulics), and species have been sufficient for the planning and analyses conducted for the Basin Management Plan Update Programmatic Environmental Impact Report and College Lake Integrated Resources Management Project Draft Environmental Impact Report (PV Water 2014, 2017), project permitting, and this AMP. However, some information that would assist future management is not available or not well understood. Therefore, focused studies will be encouraged and supported to fill high-priority data gaps or reduce key uncertainties.

Several of these data gaps or key uncertainties have been identified during development of this AMP, including:

[*Additional text forthcoming*]

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CHAPTER 6

Reporting and Plan Updates

This chapter describes the evaluations by PV Water staff, reporting, and updating of the plan that will be components of adaptive management of O&M of the Project.

6.1 PV Water Evaluations

PV Water staff will annually review summaries of monitoring data, PV Water O&M activities, and evaluate practices. Based on this review, monitoring and management practices will be discussed, and decisions to change practices for the subsequent year will be made if necessary. This evaluation may be supported by technical experts, regulatory agencies, land owners, or other stakeholders.

6.2 Reporting

6.2.1 Adaptive Management Reporting

Each year a memorandum will be produced that summarizes monitoring and O&M conducted by PV Water, notes if action triggers were exceeded, and if so, describes the management actions taken or planned in response. This memorandum also will document any changes in monitoring and O&M practices implemented for other reasons (e.g., changes in regulations or technology), new information that may affect O&M, and revisions to the AMP, if any. Annual memoranda will be publically available.

6.2.2 Other Reporting

In addition to monitoring and reporting to support and document operations, maintenance, and other management actions, PV Water will conduct monitoring and provide annual compliance reporting as required by the Project's permits and other authorizations.

6.3 Plan Updates

All planning documents eventually become dated and require revision so they can continue to provide practical direction for management. A common and unfortunate situation is that the revision of planning documents is neglected because the revision process is too involved and too cumbersome. To address this problem, this AMP incorporates simple procedures for making revisions to the plan.

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Revisions to the AMP in response to new information may be made annually by PV Water with input from the Ad Hoc AMP Committee. New information necessitating revisions to keep the AMP current may include:

- Feedback generated by adaptive management
- Scientific research that directs improved techniques for resource management
- Changes in land use or management of adjacent lands
- New regulatory requirements

Beginning in the first year of project operations, this information will be summarized annually in the adaptive management memorandum described in 6.2.1, "Adaptive Management Reporting." A draft of this memorandum will be shared with the Ad Hoc AMP Committee and will contain any proposed changes to the AMP. Proposed changes will be discussed with the Ad Hoc AMP Committee and the input of committee members solicited prior to the memorandum, and any changes to the AMP it contains, being finalized.

At five-year intervals, changes to the AMP made in the five annual adaptive management memoranda will be compiled in an updated version of AMP document for ease of reference.

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CHAPTER 7

References

7.1 Chapter 1, "Overview"

Pajaro Valley Water Agency (PV Water). 2014. Basin Management Plan Update Programmatic Environmental Impact Report. State Clearinghouse Number 2000062030. Watsonville, California.

———. 2019. College Lake Integrated Resources Management Project Draft Environmental Impact Report. State Clearinghouse Number 2017112063. Watsonville, California.

7.2 Chapter 2, "College Lake Setting"

Resource Conservation District of Santa Cruz County. 2014. College Lake Multi-Objective Management Project Final Report. November. Prepared by cbec, Inc., with assistance from Mike Podlech and Gary Kittleson. Santa Cruz, California.

Podlech, M. 2011. College Lake Smolt Outmigrant Study–Spring 2011. Prepared for Resource Conservation District of Santa Cruz County. Santa Cruz, California.

7.3 Chapter 3, "College Lake Project"

cbec, inc. 2018. College Lake Integrated Resources Management Project Hydrologic and Hydraulic Modeling Technical Memoranduum. Prepared for Environmental Sciences Associates. Santa Cruz, California.

Pajaro Valley Water Agency (PV Water). 2019. College Lake Integrated Resources Management Project Draft Environmental Impact Report. State Clearinghouse Number 2017112063. Watsonville, California.

7.4 Chapter 4, "Adaptive Management Framework"

R. Ketley, A. Retinger, and M. Los Huertos [2013] Pinto Lake Total Maximum Daily Load (TMDL) Planning and Assessment, State Water Resources Control Board, Sacramento, California.

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Pajaro Valley Water Agency (PV Water). 2014. Basin Management Plan Update Programmatic Environmental Impact Report. State Clearinghouse Number 2000062030. Watsonville, California.

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