Chapter 4
Management Plan

This chapter begins by listing the foundational assumptions, or drivers, that underpin the *Salinas River Long-Term Management Plan* (LTMP) and which were developed though significant discussion and collaboration with stakeholders and the public. These drivers have helped guide the direction, scope, and development of the LTMP and have created the basis for its management objectives and associated actions, as identified in this chapter (Tables 4-1 and 4-2).

Comprising the management strategy, the LTMP's objectives and actions are the next step in the process of establishing comprehensive solutions to the complex water resource management challenges along the Salinas River. Accordingly, they were designed to be flexible and may be adapted over time. Management objectives and actions are identified for six categories: general (applying to all of the Salinas River), the Salinas River Lagoon, stream maintenance, water resource management (surface and ground water), habitat and connectivity, and South-Central California Coast steelhead (steelhead).

Developing these objectives and actions required considering the important constraints, limitations, key issues, and needs that determine what can and should be achieved—these planning considerations are described in detail and help illustrate the unique environmental, engineering, and economic circumstances of the Salinas River system.

4.1 Management Plan Drivers

LTMP development was directed by the program goals established at the start of the development process (Section 1.2, *Purpose and Goals*). The stakeholder engagement process was also a critical component of LTMP development. Discussions and issues raised at the planning group and working group meetings helped form management objectives and actions, illuminating planning considerations and overarching needs for river management. These discussions raised various issues that set foundational assumptions—or drivers—underpinning the LTMP, as listed below.

- The LTMP should propose an approach to protect species viability and habitat while supporting a strong economy and the people that make it so.
- LTMP success is contingent on the participation of those who own portions of the river; accordingly, it is critical that these individuals be involved in developing solutions.
- Compliance with state and federal laws and regulations requires certain needs to be met, including actions which support recovery of steelhead in the study area.
- Management actions (projects and activities) must not put other listed species at risk.
- The LTMP will focus on management of small to moderate flood flows.
- The LTMP will focus on management to provide multiple benefits.

- Future planning efforts will utilize and build on the information developed for the LTMP, ensuring alignment of all river planning efforts.
- Funding opportunities will be sought to update the LTMP in the future as management needs and priorities change.

It is important to consider these drivers when considering the recommended management actions below. These drivers also help inform LTMP implementation, discussed in Chapter 5, *Implementation Recommendations*.

4.2 Management Objectives and Actions

This section describes the process by which the LTMP management objectives and actions were developed, assigns definitions to terminology established to describe the management actions, and how the management objectives and actions are organized.

4.2.1 Approach

Several management focus areas were identified through the stakeholder engagement process: lagoon management, stream maintenance, integration with the groundwater sustainability planning, implementation, stormwater management, and special-status species conservation. Of these, working group meetings were held to discuss the first four focus areas, and draft lists of management objectives and actions. For the lagoon working group, the draft list integrated lagoon management measures developed during management planning efforts conducted in the 1990s if still applicable. Objectives and actions for stormwater management were included in the LTMP primarily through collaboration with Central Coast Wetlands Group, which is actively involved in stormwater planning efforts in the county (Section 2.4.2.6, *Greater Monterey County Integrated Regional Water Management Plan* and Section 2.4.2.7, *Greater Monterey County Storm Water Resources Plan*). The planning group reviewed these draft lists and recommended revisions.

While a working group meeting was not held for listed species, or for steelhead specifically, the planning group did recommend that objectives and actions be developed for targeted listed species that are likely to be affected by Salinas River management (Table 3-18). Listed species management objectives and actions were developed based primarily on recovery plans, if available, with additional input from existing permitting efforts, the objectives and actions developed for lagoon management, and from the LTMP consulting team.

In addition to the management actions identified through the stakeholder engagement process, a small number of data gaps were identified through the literature review process, described in Appendix G, *Data Collection and Data Gap Assessment*, and based on technical team recommendations. These data gaps (listed in Appendix G, Section G.2 *Data Gap Assessment*) were not explicitly discussed with the planning group and thus are not included in the recommended management actions. However, there may be value in considering these data gaps as potential management actions during LTMP implementation.

4.2.2 Definitions of Key Terms

The following terms and definitions are defined specific to the LTMP to help characterize the different types of management objectives and actions proposed. (A complete LTMP glossary is included in Appendix A.)

Management objective. Targets that will be sought to achieve a given goal. Objectives are typically quantitative or at least measurable. Objectives describe a specific desired outcome.

Management action. Tasks proposed to meet an associated objective. Actions describe how objectives can be achieved, and a single action can support multiple objectives. For the purposes of the LTMP, actions are divided into one of four subcategories: research and analysis, planning tasks, projects, and activities.

Research and Analyses. For the purposes of the LTMP, research and analyses constitute a type of management action that calls for new research or new analysis of existing data.

Planning tasks. For the purposes of the LTMP, planning tasks are a type of management action that call for additional planning efforts to identify projects or activities. Planning efforts generally result in development of a document that may require environmental analysis (CEQA) or regulatory permits prior to implementation.

Projects. For the purposes of the LTMP, projects are a type of management action that require substantial capital or construction. Examples of projects include construction or replacement of water management infrastructure, implementation of large-scale restoration, or land acquisition by willing parties.

Activities. For the purposes of the LTMP, activities are a type of management action that have some direct effect on one or more natural resource, but that do not rise to the level of being a project. Examples include field monitoring, moderate vegetation management, facility maintenance, and implementation of best management practices.

4.2.3 Organization

All management objectives and actions were compiled and organized into Table 4-1, *Salinas River LTMP Management Objectives and Actions*, and Table 4-2, *Salinas River LTMP Listed Species Objectives and Actions*. Management objectives and actions for steelhead are included in Table 4-1, as steelhead management is a key driver for the LTMP.

Table 4-1 is divided into categories roughly corresponding to the overarching LTMP goals. The categories are listed and briefly summarized below.

- **General.** This category includes those objectives and actions that apply across multiple management focus areas.
- **Lagoon management.** These objectives and actions apply primarily to lagoon management. Objectives and actions that were developed as part of the lagoon management working group discussions may be reassigned to other categories. This is primarily true of steelhead-related objectives and actions.
- **Stream maintenance.** These objectives and actions apply primarily to stream maintenance.

- **Water resource management.** These objectives and actions were developed as an outcome of the groundwater sustainability planning working group and subsequent planning group discussion. The category is titled to reflect language used in the LTMP goals.
- **Habitat and connectivity.** This category includes the objectives and actions focused most directly on improvements for habitat quality and connectivity, and these objectives and actions were compiled based on several working group and planning group meetings.
- **South-Central California Coast steelhead.** This category is focused on management objectives and actions specific to steelhead.

Objectives and actions were assigned to the category under which they primarily apply, although some apply to other categories as well. Within each category, objectives and actions are further organized into four subcategories: research and analysis, planning tasks, projects, and activities (definitions are in Section 4.2.2, *Definitions of Key Terms*). The implementation of research and analyses management actions is intended to resolve outstanding questions about river management. Because of their importance to inform future actions, these research and analysis actions should generally be prioritized in LTMP implementation.

Each management action in Table 4-1 is tied back to the LTMP goals in the column titled *LTMP Goals Addressed*. Shorthand abbreviations were developed to address all LTMP goals (Section 1.2, *Purpose and Goals*), or components of goals, with the exception of goals for documenting and describing the historical and existing condition in the Salinas River watershed, which are addressed by Chapter 3, *Historical and Existing Conditions*. The shorthand abbreviations, together with excerpted text from the goal, are provided below.

- FLOOD = "Identify long-term solutions for management of the Salinas River that include flood reduction…" and "Investigate the Salinas River Lagoon for the potential of reducing flooding…."
- SUPPLY = "Identify long-term solutions for management of the Salinas River that include… water resource management…."
- MAINT = "Identify long-term solutions for management of the Salinas River that include… stream maintenance…."
- HAB = "Identify long-term solutions for management of the Salinas River that include… habitat management for threatened and endangered species…" and "Investigate the Salinas River Lagoon for the potential of… improving habitat conditions."
- SPECIES = "Identify long-term solutions for management of the Salinas River that include… habitat management for threatened and endangered species…" and "Identify potential improvements to steelhead migration issues in the Salinas River…."
- SCCCS = "Identify potential improvements to steelhead migration issues in the Salinas River…."
- WQ = "Identify long-term solutions for management of the Salinas River that include… habitat management for threatened and endangered species…" "Investigate the Salinas River Lagoon for the potential of… improving habitat conditions," and "Identify potential improvements to steelhead migration issues in the Salinas River…."
- IMP = "Develop the framework for implementing the LTMP that meets a variety of multi-benefit management goals…," and "Inform development of a future MCWRA habitat conservation plan (HCP) and other planning documents"

- PARTNER = "Build upon and incorporate public/private partnerships, compatible with existing land, water rights and uses."

Finally, Table 4-1 includes a column titled *Responsible Party(ies)*. This column indicates one or more entities or organizations that are expected to be involved in implementation of the management action. If the responsible party is unknown, the cell is assigned a value of *TBD* to indicate that the responsible party will be identified during LTMP implementation.

Table 4-2 is organized by species. A column is not included for *LTMP Goals Addressed*, as all proposed species management objectives and actions meet the LTMP goal of, "[i]dentify long-term solutions for management of the Salinas River that include… habitat management for threatened and endangered species." Similarly, a column is not included for *Responsible Party(ies)* because it is expected that these management actions will primarily be implemented as part of a permitting process. These may also be implemented by a yet-to-be identified conservation-oriented organization. It is also important to note that while these management actions were developed primarily based on recovery plans, it is likely that they will be revised in the future as more specific needs for certain species are identified (i.e., through an adaptive management process).

4.2.4 Recommended Management Objectives and Actions

The recommended management actions in Table 4-1 and Table 4-2 are designed to form a collective approach to river management. It is a goal of the LTMP to, "[d]evelop the framework for implementing the LTMP that meets a variety of multi-benefit management goals…." As such, while a single objective or action may have a relatively limited scope, the intent for LTMP implementation is that suites of management actions be considered and implemented together to meet "a variety of multi-benefit management goals." For example, Lagoon management action A-LAG-3 calls for an evaluation of new engineered solutions for flood management, while A-LAG-11 calls for development of a sandbar management approach that is considerate of listed species habitat. Neither of these actions is proposed to take priority over the other, but rather be implemented in concert to consider multiple approaches to addressing multiple needs.

Similarly, it is important to acknowledge that most management actions will have implications for other actions or future management needs. For example, changes to the flow prescription in support of steelhead connectivity will affect, and have been affecting, management of riparian vegetation and sediment. Construction of new facilities to support flood management are likely to affect listed species and native vegetation communities. Management projects and activities that touch land or water will have potential effects requiring environmental review (CEQA or NEPA) and regulatory permits (Appendix H provides an overview of regulations and permitting requirements likely to be triggered by stream management actions).

Table 4-1. Salinas River LTMP Recommended Management Objectives and Actions[1]

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
General			
Research and Analysis			
O-GEN-1. Conduct research and analyses to gain a better understanding of the details surrounding flood flow management.	A-GEN-1. Investigate the potential for flood flow attenuation through reservoir management and by retaining flood flows upstream of the Lagoon during storm events greater than a 5-year return interval. Investigation should consider establishment or enhancement of on- or off-channel groundwater percolation zones for percolation of floodwater into the groundwater basin, and the reintroduction of floodplains along the length of the river. For off-channel sites, investigation should also consider the potential adverse effects of retaining surface flows, such as introduction of weed seed to new sites, degradation or loss of topsoil, restrictions on producing food crops following flooding, and changing the chemistry of flooded soils.	FLOOD	MCWRA; others (TNC did previous work)
	A-GEN-2. Conduct a study to better understand the relationship between retention of sand in the reservoirs and replenishment of the sand dunes at the mouth of the Salinas River. Based on the results of the study, consider adaptive management approaches to reduce the adverse effects of reduced sediment in the Salinas River system.	HAB	TBD
Planning Tasks			
O-GEN-2. Establish a geographic planning framework within which river management planning and implementation will be organized, including—but not limited to—groundwater management, stream maintenance, control of nonnative species, and conservation actions.	A-GEN-3. Expand the geographic extent of the RMU designations (developed for the Salinas River Stream Maintenance Program) to provide a planning framework for the entire management area. RMU designations will reflect the different management and/or conservation considerations of given reaches throughout the Salinas River watershed.	All	MCWRA

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
O-GEN-3. Ensure the LTMP is a driver in the development of future programs and projects (e.g., HCP, GSPs).	A-GEN-4. Participate in stakeholder processes or programs that will have an effect on, or be affected by, the management of the Salinas River and ensure that the management objectives and actions of the LTMP are considered.	PARTNER; IMP	TBD
O-GEN-4. Develop a floodwater management program focused on reducing erosion and reducing flooding frequency, extent, and duration.	A-GEN-5. Inform development of the floodwater management program using the results of research conducted under A-GEN-1 and O-LAG-1.	FLOOD; MAINT	MCWRA; others
	A-GEN-6. Develop guidance on managing debris, both natural (e.g., fallen trees) and human-made (e.g., shopping carts, telephone poles, tires), to enhance in-channel habitat conditions and improve flow capacity.	FLOOD; MAINT; HAB; WQ	MCWRA; others
	A-GEN-7. Develop a suite of voluntary bioengineered bank stabilization designs and accompanying guidance on the appropriate use of each design that considers site conditions and constraints. Guidance will include information as to whether hydraulic analysis is necessary for each design. Designs will be applicable to a range of conditions encountered within the management area.	FLOOD; MAINT; HAB; WQ	MCWRA; others
O-GEN-5. Develop programs to support implementation of the Lagoon floodwater management program.	A-GEN-8. Investigate the potential for establishing flood easements (payment to landowners in exchange for the ability to flood lands under certain conditions) or land exchanges on targeted agricultural lands. Assess the implications of flooding agricultural lands including issues related to food safety standards.	FLOOD; IMP; PARTNER	TBD
	A-GEN-9. Based on analyses identifying areas most vulnerable to flooding, conduct outreach to landowners to investigate willingness of landowners to sell, rent, or swap lands for short-term flooding or restoration.	FLOOD; HAB; IMP; PARTNER	TBD

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
O-GEN-6. Develop a recreation management plan.	A-GEN-10. Develop a public use and access plan on public properties, including measures to avoid and minimize potential effects on sensitive habitats and wildlife. (Source: Adapted from Salinas River Lagoon MEP, adapted from Measure 13 and 24.) Consider restrictions on motorized boats on the Lagoon.	HAB; SPECIES; PARTNER	TBD
Projects			
[None identified]			
Activities			
O-GEN-7. Implement the recreation management plan.	A-GEN-11. Better manage public recreational use, and illegal trespass, to avoid impacting wildlife.	HAB; SPECIES; PARTNER	USFWS; State Parks; others
Lagoon Management			
Research and Analysis			
O-LAG-1. Conduct research and analyses to better define and evaluate the trade-offs of Lagoon management options.	A-LAG-1. Conduct an assessment of different Lagoon management elevations drawing from available data sources that consider the implications for natural resources and surrounding agriculture. Based on the assessment, establish a Lagoon elevation management approach.	FLOOD; HAB	CCWG
	A-LAG-2. Evaluate the condition of current infrastructure, including if it is in good operating condition and if the infrastructure is providing the service for which is was designed. Consider infrastructure adjustments that could help better manage water levels or salinity in the Lagoon and OSR, and allow fish passage. (Source: Partially adapted from Salinas River Lagoon MEP, Measure 26.)	FLOOD; MAINT; HAB; SPECIES; WQ	MCWRA; CCWG
	A-LAG-3. Explore the viability of new engineered solutions for flood management (e.g., levees, deeper/wider OSR, secondary channel along the OSR). Include an assessment of existing infrastructure affected by flooding (e.g., Twin Bridges).	FLOOD	MCWRA; CCWG

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-LAG-4. Evaluate the effects of downstream flooding related to impermeable surface run-off, including plastic tarps used for agricultural purposes. Consider relative contribution of different runoff sources and the associated effects of higher peak flows and velocities. Identify approaches to reduce the effects of increased surface runoff.	FLOOD; WQ	CCWG
	A-LAG-5. Conduct a comprehensive study of Lagoon and OSR bathymetry and changes to the bathymetry over the period of the study to better understand how the sediment levels of the Lagoon and OSR shift over time. Identify if there are opportunities to increase the capacity of the Lagoon and OSR. Assess how much capacity could be gained from dredging (deepening) or widening the OSR. Compare with survey data for water quality and target species to understand better how Lagoon bathymetry affects water quality and how species use the Lagoon.	FLOOD; MAINT; HAB; SPECIES;	MCWRA; CCWG; others
	A-LAG-6. Review the water quality monitoring programs currently being implemented by MCWRA and other agencies, and consider if changes are needed. Adapt, as needed, the current monitoring plan to include an assessment of how water quality in the Lagoon changes over the course of a breaching event (before, during, and after). Continue monitoring water quality in the Lagoon based on the most current monitoring plan.	HAB; WQ	MCWRA; CCWG; others
	A-LAG-7. Identify areas most vulnerable to flooding based on current conditions and under various sea level rise scenarios.	FLOOD	In process by CCWG
	A-LAG-8. Conduct an assessment of inflows to the OSR from both the Lagoon and Tembladero Slough to better understand where flooding occurs under different scenarios.	FLOOD	In process by CCWG

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-LAG-9. Conduct an assessment of inter-annual variability in Lagoon conditions, including changes in water quality and bathometry.	FLOOD; HAB	MCWRA; CCWG; others
O-LAG-2. Investigate and identify locations for potential restoration projects that would achieve a diversity of habitat types while also supporting management of flood flows.	A-LAG-10. Investigate potential wetland restoration for flood attenuation in the Lagoon.	FLOOD; HAB; SPECIES	CCWG; others
Planning Tasks			
O-LAG-3. Develop a feasible and implementable (i.e., can be permitted by regulatory agencies) floodwater management program for the Lagoon that reduces flooding while allowing MCWRA to meet all of its jurisdictional and regulatory obligations.	A-LAG-11. Develop a sandbar management approach that provides clear guidelines and triggers for implementing a breach that is considerate of listed species habitat needs. Include the potential to conduct periodic breaches at times that are most favorable to natural resources including sediment flushing, water quality, and species migration. Evaluate the most favorable conditions under which breaching could occur.	FLOOD; SPECIES; PARTNER	MCWRA; USFWS; State Parks; NMFS; CCWG; others
O-LAG-4. Develop programs to support implementation of the Lagoon floodwater management program.	A-LAG-12. Investigate the potential for establishing flood easements (payment to landowners in exchange for the ability to flood lands under certain conditions) or land exchanges on targeted agricultural lands. Assess the implications of flooding agricultural lands including issues related to food safety standards.	FLOOD; MAINT; IMP; PARTNER	CCWG; others
	A-LAG-13. Based on analyses identifying areas most vulnerable to flooding, conduct outreach to landowners to investigate willingness of landowners to sell, rent, or swap lands for the purpose of restoration.	FLOOD; HAB; IMP; PARTNER	CCWG; others
O-LAG-5. Identify approaches to reduce pollutant sources.	A-LAG-14. Based on the results of analyses conducted under A-LAG-6, identify best management practices that could help better manage pollutants in the Lagoon.	HAB; SPECIES; WQ	CCWG; others
O-LAG-6. Establish a process for coordination among stakeholders.	A-LAG-15. Engage property owners regarding necessary permitted improvements. (Source: Salinas River Lagoon MEP, Measure 25.)	FLOOD; IMP; PARTNER	TBD

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-LAG-16. Consider the establishment of a Salinas River Lagoon management committee. (Source: Salinas River Lagoon MEP, adapted from Measure 27.)	IMP; PARTNER	TBD
	A-LAG-17. Encourage participation in the Water Quality Protection Program, which is run by the Monterey Bay National Marine Sanctuary. (Source: Salinas River Lagoon MEP, Measure 23.)	WQ; IMP; PARTNER	MCWRA (currently participating); others
Projects			
O-LAG-7. Implement restoration projects in the Lagoon to achieve a diversity of habitat types while also supporting management of flood flows.	A-LAG-18. Establish marsh plain and backwater refugia habitat for steelhead and tidewater goby that provide foraging habitat for juvenile steelhead and freshwater refugia habitat for tidewater goby.	FLOOD; HAB; SPECIES	USFWS; State Parks; CCWG; others
Activities			
O-LAG-8. Manage the Lagoon to provide suitable habitat for multiple species, including tidewater goby and rearing steelhead.	A-LAG-19. Establish baseline salinity levels in the OSR and enhance freshwater fisheries habitat in the Lagoon. (Source: adapted Salinas River Lagoon MEP, Measure 19.)	HAB; SPECIES	MCWRA; CCWG; ESNERR
O-LAG-9. Improve aquatic and upland habitat in and surrounding the Lagoon.	A-LAG-20. Enhance riparian habitat around the Lagoon, including by the Highway 1 bridge. (Source: Salinas River Lagoon MEP, Measures 5 and 6 combined.) Consider ways to encourage floodwaters to inundate areas of marsh habitat in the Lagoon that historically flooded, and if there are physical impediments to flooding of marshland.	HAB; SPECIES	TBD
	A-LAG-21. Enhance fore dunes and dune scrub to improve ecosystem function.	HAB; SPECIES	CCWG; State Parks; USFWS; others
O-LAG-10. Manage USFWS National Wildlife Refuge to support sensitive habitats and wildlife.	A-LAG-22. Implement habitat enhancement on a portion of the USFWS refuge. (Source: Salinas River Lagoon MEP, Measure 10.)	HAB; SPECIES	USFWS
	A-LAG-23. Manage hunting activity within sensitive areas on USFWS property. (Source: Salinas River Lagoon MEP, Measure 11.)	HAB	USFWS

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-LAG-24. Maintain the quality of Smith's Blue Butterfly habitat on public property. (Source: Salinas River Lagoon MEP, Measure 12.)	HAB	USFWS
	A-LAG-25. Manage the pond on the USFWS refuge to maintain wildlife habitat. (Source: Salinas River Lagoon MEP, Measure 14.)	HAB	USFWS
Stream Maintenance			
Research and Analysis			
O-MAINT-1. Conduct research and analyses to gain a better understanding of issues related to stream maintenance.	A-MAINT-1. Conduct additional research into the historic ecology of the Salinas River to inform what is the "natural" state of the river, particularly after removal of extensive stands of invasive vegetation, including how sandbars shift during high flows. Use the results of the research to inform adaptive management under the vegetation management program.	FLOOD; SUPPLY; MAINT; HAB; SPECIES	TBD[2]
Planning Tasks			
O-MAINT-2. Establish an equitable funding mechanism for implementing stream maintenance activities that allocates cost of maintenance and associated mitigation across all beneficiaries.	A-MAINT-2. Collaborate with programs with funding mechanisms (e.g., the Salinas Valley Basin GSA in development of the Salinas Valley Basin GSP) to consider stream maintenance needs and, where appropriate, incorporate stream maintenance objectives and actions.	SUPPLY; MAINT; PARTNER	TBD
O-MAINT-3. Develop a practical and implementable (i.e., able to be permitted by the regulatory agencies) vegetation management program for the entire Salinas River main stem and select tributaries within the LTMP management area.	A-MAINT-3. Work with the regulatory agencies to confirm information required to develop a vegetation management program that meets regulatory requirements. Once confirmed, identify funding opportunities to develop identified information.	FLOOD; SUPPLY; MAINT; HAB; PARTNER	MCWRA; RMU Association; RCDMC; regulators

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-MAINT-4. Conduct a site visit with members of each regulatory agency, discussing the key vegetation management needs, identifying differences between each RMU, and how the river is a dynamic system, with changing vegetation characteristics reflecting the amount of water in the basin (either as a result of reservoir operation or by water year type).	PARTNER	MCWRA; RMU Association; RCDMC; regulators
	A-MAINT-5. Collaborate with organizations and agencies conducting vegetation management throughout the Salinas River watershed (including in San Luis Obispo County) on a cohesive approach to vegetation management, focused on invasive plant management.	FLOOD; SUPPLY; MAINT; HAB; PARTNER	MCWRA; RMU Association; RCDMC; Las Tablas RCD
	A-MAINT-6. Compile and organize information on vegetation management into a program document. Include an analysis of how the vegetation management program will affect regulated natural resources and water quality.	FLOOD; SUPPLY; MAINT; HAB; SPECIES; PARTNER	MCWRA; RMU Association; RCDMC
	A-MAINT-7. Develop a mitigation strategy that minimizes the short-term adverse impacts of a management action and takes into account the long-term benefits of those actions on regulated resources, ecological processes, and flood risk reduction. Continue the current option of coordinated mitigation led by one or more agencies on behalf of multiple landowners.	FLOOD; SUPPLY; MAINT; HAB; PARTNER	MCWRA; RMU Association; RCDMC; regulators
	A-MAINT-8. Use the information learned regarding the "natural" state of the Salinas River (A-MAINT-1) to inform adaptive management for the vegetation management program.	FLOOD; SUPPLY; MAINT; HAB; PARTNER	MCWRA; RMU Association; RCDMC; regulators
	A-MAINT-9. Conduct outreach to landowners along the Salinas River mainstem and select tributaries to educate them on the benefits of the vegetation management program and increase participation.	FLOOD; SUPPLY; MAINT; HAB; PARTNER; IMP	MCWRA; RMU Association; RCDMC

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-MAINT-10. Develop and make available of a suite of best management practices that would help avoid and minimize impacts on sensitive resources, and in some cases, provide guidance on appropriate mitigation.	FLOOD; SUPPLY; MAINT; HAB	MCWRA; RMU Association; RCDMC
	A-MAINT-11. Incorporate results of Long-Term Effectiveness Assessment of current stream maintenance activities when available.	FLOOD; SUPPLY; MAINT; HAB; IMP	MCWRA
O-MAINT-4. Develop a practical and implementable (i.e., able to be permitted by the regulatory agencies) invasive species (plant and animal) management program for the entire Salinas River main stem and select tributaries within the LTMP management area.	A-MAINT-12. Conduct a comprehensive assessment of the current status of invasive species.	FLOOD; SUPPLY; MAINT; HAB; SPECIES	TBD
	A-MAINT-13. Coordinate with land management agencies and private landowners in the study area in development of the invasive species management program to guide consistency with existing programs and approaches.	FLOOD; SUPPLY; MAINT; HAB; SPECIES; PARTNER	TBD
Projects or Activities			
[None identified]			
Water Resource Management			
Research and Analysis			
O-WAT-1. Conduct analyses to gain a better understanding of how flows travel through the Salinas River basin (i.e., the interaction of surface and groundwater).	A-WAT-1. Model different scenarios for re-operating (flow management) the river and reservoirs to evaluate how a more natural flow regime can be established, and the associated costs and benefits. Consider interactions of groundwater and surface water. Include scenarios that evaluate flow regimes under different vegetation and sediment management regimes.	SUPPLY; MAINT; HAB; SPECIES	MCWRA; GSAs; NMFS

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-WAT-2. Identify the required flows and the right time of year for salmonids at key points in the system that, if met, will provide sufficient passage flows for steelhead during wet, normal, dry, and consecutive dry years.	SPECIES	MCWRA; NMFS
Planning Tasks			
O-WAT-2. Operate the Salinas River and reservoirs in the study area to achieve a balance between environmental and economic needs, while ensuring regulatory requirements for fish and water rights are met.	A-WAT-3. Identify potential activities, the implementation of which could help achieve a balanced approach to river management.	SUPPLY; MAINT; HAB; SPECIES	MCWRA
	A-WAT-4. Develop a portfolio of projects, where the purpose and need, complete cost (e.g., design, permitting, construction, mitigation, operation), and benefits are clearly described such that one or more projects can be put on the ballot for voter approval as required by Proposition 218. Cost and benefit analysis must, at a minimum, be quantitative.	SUPPLY; MAINT; HAB; SPECIES; IMP	MCWRA; GSAs; others
	A-WAT-5. Identify funding sources—in addition to voter-approved funding—for GSP projects that have multiple benefits including, but not limited to, Proposition 68 (approved in June 2018), the California State Revolving Fund, and California Department of Water Resources.	SUPPLY; MAINT; HAB; SPECIES; IMP	GSAs
O-WAT-3. Achieve sustainable groundwater management as defined by SGMA in the Salinas Valley Basin.	A-WAT-6. Use the GSPs as a mechanism for meeting some, if not all, water management needs in a manner that is financially equitable.	SUPPLY; MAINT; HAB; SPECIES; IMP	GSAs
	A-WAT-7. Projects developed under the GSPs should utilize information provided in the LTMP to inform and guide the goals and parameters of the project.	SUPPLY; MAINT; HAB; SPECIES	GSAs
	A-WAT-8. Develop the GSPs based on best available data to be consistent and compatible with a future potential HCP. Identify projects in the GSPs that could become covered activities under an HCP.	SUPPLY; MAINT; HAB; SPECIES	GSAs

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
Projects or Activities			
[None identified]			
Ecosystem Health and Habitat Connectivity			
Research and Analyses			
O-HAB-1. Conduct research to gain a better understanding of various ecosystem health issues in the Salinas River watershed.	A-HAB-1. Assess the potential benefits of releasing managed pulse flows from the reservoirs to support stream channel and stream bank habitat restoration, and to push sediment through the Lagoon to the dunes and into the bay.	HAB	MCWRA
	A-HAB-2. Evaluate the potential to reintroduce native freshwater species. (Source: adapted from Salinas River Lagoon MEP, Measure 20.)	HAB	TBD
	A-HAB-3. Conduct research on the life history of naturalized populations of nonnative species such as striped bass to identify approaches to eliminate, reduce, or control nonnative and/or invasive species.	HAB; SPECIES	TBD
	A-HAB-4. Survey and monitor the distribution and abundance of nonnative species plants and animals that degrade natural habitats or compete with native species, and reduce and/or control such nonnative invasive species.	HAB; SPECIES	CCWG
	A-HAB-5. Utilize current technology to conduct a complete wetland and stream inventory, including an assessment of overall health and condition of these resources, in the study area.		CCWG
Planning Tasks			
O-HAB-2. Develop programs to support habitat conservation.	A-HAB-6. Develop a public education program addressing watershed health issues including, but not limited to, species habitat, pollutant reduction, and responsible recreation.	HAB	CSUMB; CCWG
	A-HAB-7. Consider aquatic and terrestrial habitat connectivity when identifying potential restoration sites.	HAB; SPECIES	All

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-HAB-8. Develop a plan for watershed-scale restoration with the intent of minimizing loss of, and restoring where feasible, riparian habitats.		CCWG
Projects			
[None identified]			
Activities			
O-HAB-3. Protect and restore sensitive habitats.	A-HAB-9. Work with landowners to minimize loss of channel and riparian areas.	FLOOD; HAB	TBD
	A-HAB-10. Implement a public education program addressing watershed health issues including, but not limited to, species habitat, pollutant reduction, and responsible recreation.	HAB	TBD
South-Central California Coast Steelhead			
Research and Analysis			
O-SCCCS-1. Conduct or support necessary research to monitor the population on the Salinas River and its tributaries, and to develop a better understanding of the habitat requirements and population responses of the species related to management actions.	A-SCCCS-1. Support implementation of the California Coastal Salmonid Population Monitoring Plan on the Salinas River and its tributaries.	SPECIES	TBD
O-SCCCS-2. Conduct or support necessary research to evaluate existing or potential habitat connectivity for steelhead during all life stages.	A-SCCCS-2. Evaluate alternative steelhead migration corridors, including through the OSR, when the sandbar is closed.	SPECIES	MCWRA; CCWG; others
	A-SCCCS-3. Determine if there are water quality barriers to fish migration (i.e., reaches where there may be flow connectivity, but where water quality conditions would deter fish from passing).	SPECIES	MCWRA; CCWG; others
Planning Tasks			
O-SCCCS-3. Stabilize and increase abundance of steelhead to viable population levels, including the expression of all life-history forms and strategies and maintenance of current distribution in the watershed.	A-SCCCS-4. Collaborate with U.S. Forest Service and CalFire to ensure that fire-suppression and post-fire suppression activities are conducted in a manner which is protective of steelhead and steelhead habitats.	SPECIES; PARTNER	TBD

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-SCCCS-5. Collaborate with local, state, and federal agencies on local flood control and management programs to ensure projects and activities that affect steelhead incorporate appropriate steelhead habitat protection and restoration provisions.	SPECIES; PARTNER	TBD
Projects			
O-SCCCS-4. Protect lands for steelhead conservation and recovery.	A-SCCCS-6. Collaborate with local, state, and federal agencies, as well as non-governmental organizations, in the acquisition (fee-title or easement) of lands or long-term management agreements to protect steelhead migratory, spawning, and rearing habitats.	SPECIES; PARTNER	TBD
O-SCCCS-5. Restore suitable habitat conditions and characteristics for all life-history stages, thereby preserving the diversity of life-history stages that allow for adaptation to a highly variable environment.	A-SCCCS-7. Assess the condition of and restore estuarine habitats through the control of fill, waste discharges, and establishment of buffers.	SPECIES	MCWRA; others
O-SCCCS-6. Restore the species to historically occupied areas.	A-SCCCS-8. Based on the result of habitat connectivity studies (O-SCCCS-2), physically modify fish passage impediments, including concrete road crossing and diversion structure, to allow steelhead natural rates of migration to upstream spawning and rearing habitat, and passage of smolts and kelts downstream to the estuary and ocean. Focus passage improvements on the Arroyo Seco and the Salinas mainstem downstream of the Arroyo Seco.	SPECIES	MCWRA; others
Activities			
O-SCCCS-7. Maintain flows and habitat conditions, taking into consideration the timing of steelhead migration, in the Salinas River sufficient to maintain connectivity for steelhead between the Lagoon and areas in the upper watershed suitable for spawning.	A-SCCCS-9. Reduce the need for artificial breaching by minimizing Lagoon level fluctuation through prolonged low-volume discharge through the OSR. (Source: Salinas River Lagoon MEP, Measure 4.)	SPECIES	MCWRA

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)
	A-SCCCS-10. Evaluate the existing reservoir flow prescription and propose changes when monitoring and adaptive management indicate that desired results are not being achieved.	SPECIES	MCWRA; NMFS
	A-SCCCS-11. Manage instream mining to minimize impacts to migration, spawning, and rearing habitat, and protect spawning and rearing habitat in major tributaries, including the Arroyo Seco. Identify, protect, and where necessary, restore estuarine rearing habitats, include management of artificial breaching of the sandbar at the river's mouth.	SPECIES	TBD
	A-SCCCS-12. Enhance protection of natural in-channel and riparian habitats, including appropriate management of flood-control activities, off-road vehicle use, and in-river sand and gravel mining practices.	SPECIES	TBD
	A-SCCCS-13. Collaborate with riparian landowners to minimize and manage withdrawals from wells in the riparian zone.	SPECIES	TBD
O-SCCCS-8. Maintain suitable habitat conditions and characteristics for all life-history strategies, thereby preserving the diversity of life-history strategies that allow for adaptation to a highly variable environment.	A-SCCCS-14. Reduce water pollutants such as fine sediments, pesticides, herbicides, and other non-point source waste discharges.	SPECIES	TBD

Management Objectives	Management Actions	LTMP Goal(s) Addressed	Responsible Party(ies)

[1] Abbreviations

LTMP Goals

FLOOD = flood management
HAB = improved habitat conditions
IMP = implementation (framework and approaches)
MAINT = stream maintenance
PARTNER = public/private partnerships
SCCCS = steelhead conservation (including migration)
SPECIES = listed species
SUPPLY = water resource management (surface water and groundwater management)
WQ = water quality

Other

CalFire = California Department of Forestry and Fire Protection
CCWG = Central Coast Wetlands Group
CSUMB = California State University, Monterey Bay
ESNERR = Elkhorn Slough National Estuarine Research Reserve
GSA = groundwater sustainability agency
GSP = groundwater sustainability plan
HCP = habitat conservation plan
Lagoon = Salinas River Lagoon
MCWRA = Monterey County Water Resources Agency
MEP = Management and Enhancement Plan
NMFS = National Marine Fisheries Service
OSR = Old Salinas River
RCDMC = Resource Conservation District of Monterey County
RMU = River Management Unit
RMU Association = Salinas River Stream Maintenance Program River Management Unit Association
SFEI = San Francisco Estuary Institute
State Parks = California Department of State Parks
TBD = to be determined during implementation
TNC = The Nature Conservancy
USFWS = U.S. Fish and Wildlife Service

[2] SFEI developed the report *Historical Ecology Reconnaissance for the Lower Salinas River*, addressing the portion of the Salinas River from the confluence with Arroyo Seco to the Monterey Bay. With funding, SFEI has expressed interest in expanding this analysis.

Table 4-2. Salinas River LTMP Listed Species Objectives and Actions

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
Tidewater Goby					
O-TIGO-1. Protect and enhance currently occupied tidewater goby habitat.	A-TIGO-1. Assess and monitor the current status of extant tidewater goby populations and their habitats.	X			
	A-TIGO-2. Develop and implement water facility management (surface and groundwater) strategies to minimize habitat degradation and, if feasible, to enhance habitat.		X		X
	A-TIGO-3. Develop and implement strategies to breach the Lagoon in ways that optimize habitat for tidewater goby, or at least minimize adverse effects.		X		X
	A-TIGO-4. Develop and implement strategies for managing water quality within current or improved parameters for tidewater goby.		X		X
	A-TIGO-5. Develop and implement strategies to manage deleterious exotic fish at current or reduced levels.		X		X
California Red-Legged Frog					
O-CRLF-1. Confirm extant populations of California red-legged frog and identify areas for potential population expansion.	A-CRLF-1. Assess the locations of known occurrences of California red-legged frog and evaluate suitable habitat near occupied areas.	X			
	A-CRLF-2. Conduct surveys at sites with previously known occurrences of California red-legged frog and in other areas supporting suitable habitat to confirm extant populations of California red-legged frog.	X			
O-CRLF-2. Protect existing populations, suitable habitat, and habitat connectivity.	A-CRLF-3. Acquire lands in fee title or conservation easements from willing sellers or develop and fund long-term management agreements with willing landowners where these actions may protect existing populations.			X	

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
	A-CRLF-4. Acquire lands in fee title or conservation easements from willing sellers or develop and fund long-term management agreements with willing landowners where these actions may protect suitable breeding and nonbreeding aquatic habitat to allow for the expansion of metapopulations within the range of the species.			X	
O-CRLF-3. Manage and enhance occupied habitat or suitable habitat near occupied areas.	A-CRLF-5. Evaluate the management needs of California red-legged frog on protected lands and develop site-specific management strategies to address identified needs.	X	X		
	A-CRLF-6. Implement site-specific management strategies developed under A-CRLF-5.				X
California Tiger Salamander					
O-CTS-1. Confirm extant populations of California tiger salamander and identify areas for potential population expansion.	A-CTS-1. Assess the locations of known occurrences of California tiger salamander and evaluate suitable habitat near occupied areas.	X			
	A-CTS-2. Conduct surveys at sites with previously known occurrences of California tiger salamander and in other areas supporting suitable habitat to confirm extant populations of California tiger salamander.	X			
O-CTS-2. Protect existing populations, suitable habitat, and habitat connectivity.	A-CTS-3. Acquire lands in fee title or conservation easements from willing sellers or develop and fund long-term management agreements with willing landowners where these actions may protect existing populations.			X	
	A-CTS-4. Acquire lands in fee title or conservation easements from willing sellers or develop and fund long-term management agreements with willing landowners where these actions may protect suitable breeding and nonbreeding habitat to allow for the expansion of metapopulations within the range of the species. Ensure connectivity between managed occupied areas to promote cross-breeding.			X	

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
O-CTS-3. Manage and enhance occupied or suitable habitat near occupied areas.	A-CTS-5. Plant native emergent vegetation around the perimeter of ponds and wetlands that have little to no vegetation to provide aquatic cover and substrate for attaching eggs. Pond vegetation should be managed to maintain suitable habitat quality (U.S. Fish and Wildlife 2017).				X
	A-CTS-6. Improve the hydroperiod and water quality of natural ponds and stock ponds for California tiger salamander by clearing dense stands of nonnative vegetation, repairing eroding dams and spillways, and removing sediment, where appropriate (Ford et al. 2013).				X
	A-CTS-7. Improve upland habitat through the reduction of invasive plant growth and by promoting land management practices that will benefit California ground squirrels and other fossorial mammals that create burrows used by California tiger salamander.				X
	A-CTS-8. Remove exotic wildlife species such as bullfrogs, mosquitofish, other nonnative predatory fish, and nonnative turtles and salamanders from managed breeding sites.				X
	A-CTS-9. Monitor ponds to assess the presence of hybrid tiger salamanders. If found, identify and implement management approaches appropriate to the level of hybridization present.	X	X		X
O-CTS-4. Reduce or eliminate the current threats to the species to conserve a healthy ecosystem supportive of California tiger salamander populations.	A-CTS-10. Identify potential threats to California tiger salamander on protected lands and management approaches to reduce or eliminate the threats.	X	X		
	A-CTS-11. Reduce potential that ranaviruses, chytrid, or other pathogens are introduced to existing populations of the management area. Ensure early detection of pathogens if they are introduced to California tiger salamander populations in the future.				X

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
	A-CTS-12. Ensure that other threats from predation, contaminants, and road mortality are controlled, reduced, or eliminated, if feasible.				X
Least Bell's Vireo					
O-LBV-1. Identify if populations of least Bell's vireo occur in the management area.	A-LBV-1. Implement a monitoring program, in coordination with local conservation groups such as the Monterey Audubon Society, to survey for least Bell's vireo nesting populations in accessible areas most likely to be occupied (i.e., best breeding and foraging habitat in the management area), to detect occupancy and inform management actions.	X			
O-LBV-2. If found, protect and manage least Bell's vireo occupied habitat in the management area.	A-LBV-2. Acquire lands in fee title or conservation easements from willing sellers or develop management agreements with willing landowners where these actions may protect existing populations of least Bell's vireo.			X	
	A-LBV-3. Assess the management needs of the occupied habitat and develop a management plan to support the continued occupancy of the site.		X		
	A-LBV-4. If least Bell's vireos are nesting, establish a brown-headed cowbird control program if needed to help maintain the breeding population and to encourage its expansion.				X
O-LBV-3. If not found, protect and manage least Bell's vireo suitable habitat in the management area to support the repopulation of the management area by this species.	A-LBV-5. Incentivize private landowners to promote riparian land management practices that will maintain and, if possible, improve least Bell's vireo suitable breeding and foraging habitat in the management area.				X
	A-LBV-6. Participate the weed abatement program led by Monterey County Resource Conservation District including the removal of giant reed and tamarisk to restore suitable nesting habitat for least Bell's vireo.				X

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
Western Snowy Plover					
O-LAG-4. Work with private and public landowners to protect and manage snowy plover habitat (Source: adapted from Salinas River Lagoon MEP, Measure 17) to reduce or eliminate threats and maximize survival and productivity of the regional population in the management area (U.S. Fish and Wildlife Service 2007).	A-WSP-1. Develop and implement a management plan for public access of to protect western snowy plover during its nesting period, typically March–September.		X		X
	A-WSP-2. Evaluate the need to manage predatory species (e.g., red fox, skunk) populations to reduce predation of snowy plover and, if needed, implement predator control program. (Source: adapted from Salinas River Lagoon MEP, Measure 16.)				
	A-WSP-3. Coordinate with an existing monitoring program to survey for western snowy plover nesting populations in suitable breeding and foraging habitat in the management area to inform habitat protection, enhancement, restoration, and management, as well as to determine progress of recovery actions to maximize survival and productivity.	X			X
	A-WSP-4. Incentivize private landowners to promote coastal land management practices that will improve western snowy plover breeding habitat and maintain foraging habitat in the management area.				X
	A-WSP-5. Develop a weed abatement plan including the removal of European beachgrass to restore suitable nesting habitat for western snowy plover.		X		X
	A-WSP-6. Develop and implement strategies to breach the Lagoon in ways that optimize habitat for western snowy plover, or at least minimize adverse effects.		X		X

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
San Joaquin Kit Fox					
O-SJKF-1. Determine if San Joaquin kit fox occurs in the management area and if so, where.	A-SJKF-1. Implement a monitoring program to detect San Joaquin kit fox in suitable habitat.	X			
O-SJKF-2. Protect, manage, and enhance San Joaquin kit fox movement habitat and important regional linkages for the species in the management area.	A-SJKF-2. Incentivize private landowners in the southern portion of the management area to maintain or enhance connectivity for San Joaquin kit fox across their property.				X
	A-SJKF-3. Continue to restore the Salinas River corridor by Arundo removal and other actions that will enhance connectivity for San Joaquin kit fox within the floodplain.			X	X
	A-SJKF-4. Design and implement a cost-effective monitoring program with remote wildlife cameras to determine most likely movement routes for San Joaquin kit fox and other species in suitable habitat in the southern portion of the management area, to inform habitat protection, enhancement, restoration, and management.	X			
Monterey Spineflower					
Objective-MOSP-1. Preserve and maintain or enhance Monterey spineflower populations within the management area.	A-MOSP-1. Protect and maintain or increase the distribution of Monterey spineflower within the management area.			X	X
	A-MOSP-2. Maintain or increase the abundance of Monterey spineflower within the management area.				X
	A-MOSP-3. Protect populations from anthropogenic factors which negatively impact Monterey spineflower, including exotic plants, unnatural disturbances, and erosion.				X

Listed Species Objectives	Listed Species Actions	Action Type			
		Research	Planning	Project	Activity
	A-MOSP-4. Through targeted research, increase our understanding of the ecological factors influencing the distribution, abundance, and population persistence of the Monterey spineflower within the management area in order to improve the effectiveness of management actions.	X			
Sand Gilia					
O-SAGI-1. Preserve and maintain or enhance sand gilia populations within the management area.	A-SAGI-1. Protect and maintain or increase the distribution of sand gilia within the management area.			X	X
	A-SAGI-2. Maintain or increase the abundance of sand gilia within the management area.				X
	A-SAGI-3. Protect populations from anthropogenic factors which negatively impact sand gilia, including exotic plants and erosion.				X
	A-SAIG-4. Monitor the sand gilia population on public property (source: Salinas River Lagoon MEP, Measure 9) and identify habitat enhancement needs.	X			
	A-SAGI-5. Through targeted research, increase our understanding of the ecological factors influencing the distribution, abundance, and population persistence of the sand gilia within the management area in order to improve the effectiveness of management actions.	X			

4.3 Planning Considerations

Development of the management objectives and actions was driven by a variety of important constraints, limitations, key issues, and needs regarding what should be achieved and what is feasible. These *planning considerations* are described below and help illustrate the unique circumstances of the Salinas River system. Planning considerations are not management objectives or actions in and of themselves, but they do greatly inform the management objectives and actions, as well as other aspects of the LTMP, including the implementation framework. In some cases, the recommended management objectives and actions seek to help solve the problems stated in the planning considerations. In other cases, the planning considerations articulate constraints beyond the scope of the LTMP.

Many planning considerations were raised by MCWRA, stakeholders, and consultants throughout the LTMP development process. Planning considerations described below were drawn from discussions held at four planning group meetings, five working group meetings, one public meeting, various written comments on meeting materials provided by stakeholders following the meetings, and by the LTMP consulting team.

4.3.1 Opportunities Exist for LTMP Development

Planning and coordination efforts over the last several decades have brought the stakeholders of the Salinas River to a point in time where there is a collective understanding of the need to collaborate on management of the Salinas River. Listening exercises conducted by MCWRA in 2013 and the Issues Assessment developed by Consensus Building Institute (Appendix B) show that most stakeholders believe a comprehensive management solution for the Salinas River is needed. Perhaps not surprising then is that the stakeholder and public outreach meetings for LTMP development have been well-attended. Approximately 40 people attended the June 20, 2018, public meeting, and over 30 organizations and individuals have collectively participated in 11 LTMP development meetings.

There is also a lot known about the management needs of the Salinas River basin. Data from a strong and growing body of research, permits, and management plans is available from which to draw guidance and recommendations. Additionally, MCWRA must develop an HCP to comply with the federal Endangered Species Act, and MCWRA has time to develop a thoughtful conservation strategy for species that meets regulatory needs while also supporting the needs of landowners/growers. Development of the LTMP is the next step in a process to establish a comprehensive solution to management on the Salinas River and the Salinas River Lagoon.

4.3.2 Regulations May Drive Management Actions

Appendix A includes an overview of various regulations that are likely to affect design and implementation of LTMP management actions that require ground or vegetation disturbance. These regulations provide for the protection of streams, floodplains, wetland and riparian vegetation, special-status species, and water quality. As identified in the LTMP goals, and described in Section 2.4.1.3, *Salinas Valley Water Project*, steelhead conservation is a central focus of the LTMP. The interim biological opinion for steelhead is expected to result in management requirements not yet identified in this LTMP.

Similarly, the Central Coast Regional Water Quality Control Board (Regional Water Board) is in the process of developing the region's next Agricultural Order (4.0)[1], with a targeted adoption date of March 2020. Based on an analyses of surface water and groundwater data and trends in water quality status, Regional Water Board staff have concluded that, overall, water quality objectives are not being achieved and beneficial uses are not being protected in many agricultural areas of the Central Coast, primarily due to the impacts from agricultural discharges (Central Coast Regional Water Quality Control Board 2018 [Staff Report]).

The groundwater sustainability plan (GSP) development process has also identified groundwater quality as a concern. The Seaside, 180/400 Foot Aquifer, and Eastside subbasins are affected by seawater intrusion; the 180/400 Foot Aquifer and Eastside subbasins are affected by elevated nitrate and organic compounds from agricultural runoff, and the Upper Valley subbasin is affected by large dissolved solids (sulfate). Water quality is one of the sustainability criteria required to be addressed in GSPs.

Management actions implemented in support of the LTMP will be subject to these regulatory requirements.

4.3.3 The Time is Ripe for Collaborative Implementation

The land use authorities of the Salinas Valley include multiple cities, County of Monterey, and state and federal agencies. The Salinas River channel and floodplain is owned by hundreds of private parties. Accordingly, no single entity currently has the authority to implement, or simply oversee, all the different types of management actions identified in the LTMP.

The Monterey County Water Resources Agency Act (Agency Act) establishes MCWRA as a flood control and water agency, and defines the authorities of MCWRA. These authorities are listed in Section 2.2, *Jurisdiction and Funding Mechanisms*. While MCWRA has broad authority under the Agency Act, it has not historically exercised all of its authorities. MCWRA may have to develop new sources of funding if certain additional authorities were to be exercised for implementation of the LTMP. Additionally, exercising these authorities would require the support and cooperation of the community.

Under the forthcoming GSPs, the associated Groundwater Sustainability Agencies (GSAs) will have broad authority and flexibility in approach to ensure the Salinas Valley Basin achieves sustainable groundwater management. While the primary focus of GSPs is groundwater, there could (and should) be coordination with long-term basin management. As such, GSPs may be a good tool to incorporate aspects of the LTMP.

Stakeholders expressed interest in establishing a coalition of agencies, a new a non-profit, or other impartial agency to lead implementation of the LTMP. These approaches are further explored in Chapter 5, *Implementation*.

[1] A Conditional Waiver of Waste Discharge Requirement regulating discharges from irrigated agricultural lands to protect surface water and groundwater, which applies to owners and operators of irrigated land used for commercial crop production (Central Coast Regional Water Quality Control Board 2019).

4.3.4 Management Funding Sources are Needed

New funding sources will be needed for LTMP implementation. Several new funding mechanisms are currently becoming available that could be used to fund infrastructure projects, particularly those with components benefiting the environment (including Proposition 68, passed in June 2018). Implementation of the GSPs is also expected to provide a program through which many actions directly or indirectly proposed by this LTMP can be implemented. Funding of these projects is anticipated to require a Proposition 218 vote. The Salinas Valley, often called "the Salad Bowl of the World," supports a $9 billion agricultural industry. Growers have indicated their willingness to vote in favor of a package of actions to support improved water resource management, so long as the package contains a clear connection to the benefits for the greater community.

A number of grant programs exist to support design and implementation of environmental enhancement activities. While these programs are typically competitive, projects included in a comprehensive management plan are often more competitive because they support implementation of a thorough and stakeholder-supported process.

4.3.5 Re-Think Water Management Facility Needs

MCWRA owns and/or manages many facilities to help move water through the management area. Key facilities include the Nacimiento and San Antonio Dams, the Salinas River Diversion Facility (SRDF), the Castroville Seawater Intrusion Project, the Old Salinas River (OSR) Slidegate, and various pumping facilities along the Reclamation Ditch system. Much of the infrastructure owned and operated by the MCWRA is aging and in need of costly repair and maintenance. Additionally, the existing infrastructure was not contemplated to be used for comprehensive management of the basin and needs to be adapted and/or improved to be useful for implementation of the LTMP. In particular, there are relatively few canals or pipelines in the management area with which to move surface water around. As such, the Salinas River acts as the primary "trunk line" for the entire system. If the goals of the LTMP are to be met, infrastructure needs to be re-evaluated for maintenance, retrofit, or replacement.

4.3.6 Share the Costs and Benefits of River Management

The costs of management projects and activities are typically born by the agency or individual responsible for implementing the action without consideration of larger benefit to the community. This is particularly true for the private landowners who are members of the Salinas River Stream Maintenance Program River Management Unit Association and participants in the Salinas River Stream Maintenance Program. The costs of implementing stream maintenance actions includes not only conducting the work, but also reporting on the work conducted and, for some activities, funding mitigation projects. These private individuals are not only preventing flooding and erosion on their own lands and adjacent lands, but they are creating channel capacity to accommodate floodwaters. These actions have significant benefits for flood management and groundwater recharge throughout the watershed, yet the cost of implementing these actions fall on a limited group of individuals and agencies.

New permits or permitting programs are needed (e.g., long-term biological opinions for reservoir operation and sandbar breaching) to remain in compliance with existing laws and regulations. Implementation of the LTMP should include identification of mechanisms for equitable cost distribution that align the cost of management actions across those that benefit from the work. This

should be done in concert with identification of new funding mechanisms as discussed in Section 4.4.4, *Management Funding Sources are Needed*.

4.3.7 Flooding Affects the Community

Addressing flooding is one of the primary goals of the LTMP. As such, it is important to understand all the issues surrounding flooding, as well as existing programs that are designed to address flooding. Various forms of flooding from extreme events (such as those experienced in 1995 and 1997), to smaller 5- and 10-year storms coupled with drought conditions, require the community to rethink how it approaches stormwater management, including capture and recharge.

The location of flooding is highly variable—it is driven by where precipitation falls, tides, available capacity of local watercourses, infrastructure built along or into the channel, and quantity of debris moving through the system—and can present location-specific consequences. When flooding occurs on agricultural lands, it can destroy or degrade crops such that they cannot be sold. It can also wash away topsoil and/or change the chemical composition of the soil. Food safety standards (e.g., California Leafy Green Products Handler Marketing Agreement [LGMA], buyer's agreements) may prohibit replanting for a given amount of time after flooding, reducing a farmer's ability to recover economic losses in a single growing season.

During large storm events, flooding can also inundate homes and threaten infrastructure including roads and bridges, which affects the livelihood and transportation needs of the community. Storms can further damage infrastructure by increasing the volume of debris moving through the system. During times of drought, vegetation dies back and is washed down the river creating flood hazards (e.g., tree trunks or large branches catch on bridges or tide gates and back up the channel).

A considerable amount of stormwater runoff could be captured—if projects designed to do so were implemented—instead of flowing out to the ocean. Others acknowledge the ecological benefits of letting water flow to the ocean. These benefits include repelling saltwater that could back up into the lagoon and transporting sediment (i.e., fine sediments and sand) out of the lagoon into the ocean and thus maintaining flood management capacity in the lagoon.

Consideration should be given to redesigning flow pathways so that progress in reducing flooding and improving water quality is realized. It is recommended that the known and likely future flood zones (water pathways) be evaluated, and that this information is used to inform where flood management projects can be installed. A storm water resource plan (SWRP) for the Greater Monterey County Integrated Regional Water Management (IRWM) Region is under development with an expected completion date in June 2019 (Section 2.4.2.7). As required by regulations, the SWRP will include approaches for diverting runoff from existing storm drains, channels, or conveyance structures to sites (particularly publicly owned sites) that can clean, store, infiltrate and/or use the runoff. This SWRP will identify specific projects to address flooding.

Additionally, when planning for the future, it is important to acknowledge current weather projections, which anticipate prolonged periods of drought and increased intensities of storms. Projections also indicate that average mean sea level is increasing; together with increased intensity of storms, this may result in flooding beyond that caused by precipitation alone.

4.3.8 Wildlife Needs Well-Connected Habitat in Good Condition

4.3.8.1 Connecting the Ocean and the River

Steelhead are anadromous fish, having a lifecycle that begins in freshwater streams, transitioning to the ocean then returning to freshwater. Steelhead entering the Salinas River from Monterey Bay can use one of two routes: direct access from the ocean to the Salinas River if the sandbar at the mouth of the river is open; or through Moss Landing Harbor, south to the Potrero Road tide gates, up the OSR channel , and finally through the OSR Slidegate opening to the lagoon. The mouth of the Salinas River is often separated from the sea by a sandbar, which requires flows high enough to naturally breach the sandbar, or manual efforts to open it. Natural breaches generally do not occur until the water level is sufficiently high to also flood the neighboring agricultural lands (see Section 4.4.9.1, *Lagoon Elevation, Sandbar Management, and Flooding*, for details). Neither the Potrero Road tide gates nor the Old Salinas River Slidegate were designed to support fish passage, although fish passage is likely possible under certain conditions. However, the use of this pathway as a migration corridor for steelhead deserves further study.

As such, the timing of sandbar breach affects successful migration into the river and is a key focus of ongoing steelhead management discussions. If the sandbar is not breached until later in the winter or spring season, this can delay adult steelhead migration, which primarily occurs from the end of December through April. Similarly, if the sandbar closes early in the spring, the number of out-migrating juveniles that reach the ocean will be limited. In dry years, river flow events may not be large enough to trigger sandbar breaching (natural or artificial), leaving the sandbar in place for a year or more. This most recently occurred when the sandbar was closed between January 2013 to January 2017.

Sandbar management during the late spring or early summer may affect tidewater goby recruitment due to the low tolerance of juvenile tidewater goby to drastic changes in salinity that may result from a breaching event. In addition, tidewater goby overwintering survival is highly dependent on a large population going into the fall and winter; because large flood events may sweep individuals out to the ocean, a large population increases the potential for some individuals to survive winter events (U.S. Fish and Wildlife Service 2005). These survivors comprise the initial breeding population the following summer.

The management of the Old Salinas River Slidegate has likely helped to bolster the population of tidewater goby by providing a colonization pathway to the lagoon, providing refuge or permanent habitat in the OSR, and by establishing and maintaining a salinity gradient in the lagoon that allows tidewater gobies to distribute along the gradient according to their physiological preference. A less saline lagoon would likely increase local abundance of nonnative predators such as largemouth bass and bluegill in the downstream areas of the lagoon, and a more saline lagoon would likely increase the abundance of competitors such as arrow goby and yellowfin goby (FISHBIO 2018).

Tidewater goby has been consistently found near the Old Salinas River Slidegate and in the OSR since 2014 (FISHBIO 2018). Any attempts to utilize the OSR for steelhead migration, including widening the channel or updating infrastructure, may alter the habitat quality for tidewater goby by altering water velocities in the channel—tidewater goby are very poor swimmers—or altering salinity levels.

As lagoon management actions extend into the future, it will be important to attempt to identify approaches to improve steelhead connectivity while minimizing the effects on other listed species. Additionally, the implications for sea level rise and how it might affect lagoon management (and associated issues of flooding and sandbar breaching) needs to be understood.

Future management of the lagoon and sandbar will need to balance habitat needs (e.g., migrating fish), flood control options and infrastructure, and community concerns related to flooding and salinity intrusion.

4.3.8.2 Connecting the Lagoon to Headwaters

Once in the Salinas River, steelhead must also be able to migrate to headwater streams (particularly the Arroyo Seco) which support the only spawning habitat in the river (i.e., habitat with gravel substrate, well-oxygenated flows, cold water, and cover). Steelhead generally migrate inland December–March annually and out-migrate February–April. Consequently, they need surface flow connectivity during the winter months in order to travel between the ocean and headwaters.

Starting in 2010, as part of the Salinas Valley Water Project (SVWP) permitting process, San Antonio and Nacimiento Dams have been operated according to the *Salinas Valley Water Project Flow Prescription for Steelhead Trout* (MCWRA 2005) to meet multiple goals, including adult migration passage for steelhead. The flow prescription defines the steelhead upstream migration season as beginning on January 1 and continuing through March 31 of each year, during which time passage flow requirements are defined as "five or more consecutive days of a mean daily stream flow of at least 260 cubic feet per second (cfs) as measured at the [U.S. Geological Survey] stream flow gage Salinas River near Chualar, when the Salinas River Mouth at the Salinas River Lagoon is open to the ocean." The MCWRA submits annual reports summarizing operational and fish flow data relevant to implementation of the flow prescription to the National Marine Fisheries Service (NMFS). However, connectivity challenges for steelhead persist and are a key focus of the interim biological opinion (Section 2.4.1.3, *Salinas Valley Water Project*).

Other factors may affect connectivity for steelhead as well. In 2005, the National Oceanic and Atmospheric Administration (NOAA) conducted a fish passage study that analyzed the extent, frequency, and morphological characteristics of Salinas River sand dune formations (Cluer and McKeon 2005). The study found in-channel sand dunes to be a prominent feature occurring over the majority of the Salinas River in the study area, which likely presented sequential and repetitive fish passage impediments for migratory steelhead during low flow conditions. The study concluded with flow regime recommendations to create and maintain a passable migratory low-flow channel through the dunes. Additionally, stakeholders noted that the increased presence of vegetation supported by summer-time flows might also be affecting connectivity for steelhead.

Water quality conditions should also be considered as a potential impediment to steelhead passage. The water quality of a stream is controlled by multiple factors including the chemical and physical nature of the streambed material, groundwater quality, and upstream runoff from adjacent lands. Portions of the Salinas River watershed are listed as impaired for boron, fecal indicator bacteria, nutrients, PCBs, and pesticides. These contaminants are transported from their agricultural and urban points of origin to the Salinas River by way of surface runoff (e.g., storm sewers, agricultural drainage systems, small tributaries) and shallow sub-surface flow (e.g., leaks from sanitary sewer systems). However, the degree to which these contaminants affect steelhead passage is unknown.

Steelhead passage is likely more affected by additional water quality parameters such as temperature, dissolved oxygen pH, salinity, and turbidity (Section 3.1.9 provides additional detail). As flows subside in the spring, temperatures and dissolved oxygen concentrations may approach lethal thresholds (24-27°C, and 1.5–2.0 mg/L, respectively; Moyle 2002; Mathews and Berg 1997). High salinity and turbidity levels may affect fish passage as well, although it is not clear to what extent these factors limit fish passage opportunities in the watershed.

4.3.8.3 Restoring Riparian Habitat

Areas along the Salinas River are believed to have once supported wooded riparian areas thousands of feet wide, and in some places as much as a mile wide (San Francisco Estuary Institute 2009). Today, however, much of the historical riparian areas have been converted to agricultural fields (and continue to be converted), and the river is affected by an extensive invasive plant management problem. *Arundo donax* (Arundo) is one of the worst plant invaders of California's riparian and wetland communities. As of 2011, the Salinas River supported 23% of known Arundo stands in all of coastal California (California Invasive Plant Council 2011). Thick stands of Arundo are impenetrable for many wildlife species and prevent movement across the Salinas River corridor.

While some riparian vegetation remains, there are opportunities for restoration. LTMP stakeholders noted that riparian restoration, focused on removal of Arundo and replanting or natural recruitment of native species, provides an excellent opportunity to meet the multi-objective goals of the LTMP. Along with re-establishment of native vegetation, removal of Arundo creates additional flood flow capacity in the channel, reduces the amount of vegetative debris that is moved downstream during floods, and may reduce the amount of water used by vegetation.

Riparian restoration will also support regional objectives to improve habitat connectivity. The Salinas River was included as a "potential riparian connection" to important habitat regions throughout the Central Coast in the *California Essential Habitat Connectivity Project Plan* (2010), and the upper valley areas are designated "essential connectivity areas." The Resource Conservation District of Monterey County has begun preliminary studies (working with Pathways for Wildlife) to collect wildlife use data as part of the *Long-Term Effectiveness Plan for the Salinas River Stream Maintenance Program*. It is expected that the data will reveal that the Salinas River riparian zone is an important corridor for wildlife movement between the Gabilan Range and the Santa Lucia Mountains, using Salinas River tributaries (pers. comm. E. Zefferman).

Restoration of riparian habitat may support a return of listed species rarely seen today, including least Bell's vireo. Restoration, particularly removal of large, dense Arundo stands, may allow for enhanced wildlife movement, and could also lead to an increase in surface water presence in off-stream and backwater areas. Allowing water to persist on the landscape during and following high-flow events, in a planned for and management approach, could provide habitat for amphibians and a water source for terrestrial wildlife.

4.3.9 Ensure Lagoon Sandbar Management is Multi-Benefit

MCWRA has been managing the lagoon consistent with the *Salinas River Lagoon Management and Enhancement Plan*, the 2007 USFWS biological opinion, and the draft 2009 NMFS biological opinion. However, key management issues persist. The sections below detail current considerations for lagoon management.

Discussions with the LTMP stakeholders have concluded that future management of the lagoon and sandbar will need to balance habitat needs (e.g., for steelhead and tidewater goby), flood control options and infrastructure, and community concerns related to flooding and salinity intrusion.

4.3.9.1 Lagoon Elevation, Sandbar Management, and Flooding

When the sandbar is in place, lagoon elevation is managed between 3.0 and 3.5 feet above sea level; flooding of adjacent lands begins when elevation reaches approximately 5.5 feet National Geodetic Vertical Datum of 1929 (NGVD 29). Lagoon elevation is primarily controlled by the Old Salinas River Slidegate and Potrero Road tide gates. An adjacent waterway, the Tembladero Slough, drains a significant watershed and outlets into the OSR upstream of the Potrero tide gates. This can limit outflow from the lagoon, causing lagoon elevations to rise with limited inflow from the Salinas River. Currently, when water elevation reaches 5 feet NGVD 29 and inflows to the lagoon are predicted to increase (as a result of a storm event), MCWRA begins preparations for an emergency breach of the lagoon. During preparations for sandbar breaching, lagoon elevation can reach 7 or 8 feet NGVD 29.

Flooding primarily affects agricultural lands to the north of the lagoon. As noted previously, when agricultural lands are flooded, it destroys or degrades crops such that they cannot be sold, and it washes away topsoil and can change the chemical composition of the soil. Food safety regulations also prohibit replanting for a period of 60 days or more for certain crop types. During large storm events, flooding can also inundate homes and threaten infrastructure including roads and bridges.

Breaching of the sandbar is performed during a storm event as high flows increase the scour potential at the mouth; if the flows are not high enough to scour the sand out of the river mouth, the sandbar has increased potential to form again soon after the breach. As discussed previously, the timing of sandbar breach is also an important consideration for steelhead as their life history requires ocean connectivity. If the sandbar is not breached until later in the winter or spring season, this can delay adult steelhead migration, which primarily occurs from the end of December through April. Similarly, if the sandbar closes early in the spring, the number of out-migrating juveniles that reach the ocean will be limited. In dry years, river flow events may not be large enough to trigger sandbar breaching (natural or artificial), leaving the sandbar in place for a year or more. This most recently occurred when the sandbar was closed between January 2013 to January 2017.

There may be some potential for steelhead migration to occur through the OSR when the sandbar is closed; however, there is no evidence that this occurs. Given the Potrero Road flap gates are closed during high tide events, if migration is occurring in the OSR, it is most likely juvenile outmigration (rather than adults migrating to the river from the ocean). This is because the Potrero Road flap gates are closed at high tide when the optimal connectivity between the OSR and the Moss Landing Harbor would exist.

The timing and location of an artificial sandbar breach must also consider the western snowy plover nesting season. Plovers nest on the beach near the mouth of the Salinas River between March 1 and September 30. If artificial sandbar breaching occurs during this time, the presence of people and construction equipment may cause plovers to either not nest or abandon their nests, or it may result in destruction of nests if they are washed away as the breach occurs.

Tidewater gobies benefit from a relatively stable surface water elevation provided when the sandbar is in place and have a tolerance for a wide range of salinities and oxygen concentrations. However, if there is a need for sandbar management during the late spring or early summer, or the lagoon stays open for most or all of the summer, this could disrupt the goby breeding season, which

begins in late spring and continues through to early fall. Because goby live an average of one year, the loss of one breeding season could limit overall survival potential in the Salinas River Lagoon.

4.3.9.2 Infrastructure

Water management infrastructure around the lagoon affects how the lagoon is managed. The Old Salinas River Slidegate separates the Salinas River Lagoon from the OSR, and the OSR drains to Moss Landing Harbor through the Potrero Road tide gates. The Old Salinas River Slidegate is used to maintain surface water elevations in the lagoon. The slidegate is opened when the sandbar closes. The slidegate allows water from the Salinas River to "spill out" when it reaches approximately 3 feet. The slidegate is not ideal for surface water management because it allows the fresh, oxygenated surface water to exit the lagoon. Allowing freshwater to exit the lagoon slows or stops the conversion of the lagoon from a salinity stratified system with poor bottom water quality to a more uniformly freshwater system; allowing the freshwater to remain within the lagoon could slowly convert the lagoon to a freshwater system and thus maximize habitat quantity and quality for rearing steelhead. Tidewater gobies have a wide range of salinity tolerance and are generally able to reproduce so long as the lagoon is formed and relatively stable in elevation.

The Potrero Road tidegates are a series of flap gates that are located at the northern end of the OSR. Water exits the channel and enters the harbor through these gates. The purpose of these gates is to reduce the amount of saltwater that can enter the OSR, because salinity and inundation from high tides can degrade the quality of surrounding agricultural lands. The Potrero Road tidegates limit the volume of water that can exit the lagoon because the function of the gates is subject to tidal levels: at high tides, the surface water elevation is raised and the pressure from the water flow caused by the rising tide keeps the flapgates closed. Thus, the function of the OSR as a mechanism for controlling surface water elevations is limited during high tides.

The size of the OSR channel, together with the diameter of the culverts at the Old Salinas River Slidegate and the Potrero Road tidegates, limit the volume of water that can be transported out of the lagoon. Consequently, MCWRA's ability to manage surface water elevations during large storm events is limited; water cannot be carried out of the lagoon quickly enough to keep pace with inflow, and the water elevation rises. To compound this management issue, Tembladero Slough also contributes water to the OSR. During dry weather, most of this discharge is in the form of agricultural runoff returns. However, during storm events, the flows from Tembladero Slough increase dramatically. It has even been observed that with low inflow from the Salinas River, flows from the Tembladero Slough are capable of causing flooding.

4.3.9.3 Water Quality

Water quality conditions vary with water year and the status of the sandbar; when the sandbar is open and when freshwater inflows are high, water quality is good. When the sandbar is closed and freshwater inflows are low or absent, water quality can be poor.

Water quality degradation occurs, primarily as the result of water column stratification, particularly in the summer. The water column stratifies with the more dense saline water on the bottom becoming isolated from the fresh surface water layer. As a result of no mixing between layers in the water column, bottom water becomes hypoxic (<2 mg/L) or anoxic (0 mg/L) and surface waters experience diurnal (daily) fluctuations in dissolved oxygen concentrations. These diurnal fluctuations are a result of oxygen levels becoming "super saturated" (>15 mg/L) during the day as a

result plant respiration and then dropping at night when microbial and animal respiration continue without the oxygen input from plants.

Warm temperatures and stagnant water fosters "blooms" of rooted and floating vegetation which is exacerbated by nutrient inputs from agricultural and urban sources. Prior to 2010, freshwater inflows from the upper watershed were typically low or non-existent in the summer and fall. Since 2010 and the operation of the SRDF, freshwater inflows to the lagoon are a requirement of the SVWP permits, conditions allowing.

4.3.10 What Happens to Flood Flows and Reservoir Releases?

Understanding how water moves throughout the study area (aboveground and belowground) is critical to meet the goals of the LTMP. At the most basic level, the relationship between the Salinas River and the Salinas Valley groundwater basin is controlled by annual cycles of precipitation and groundwater pumping. Rain falling within the Salinas Valley watershed can enter and recharge underlying aquifers through direct rainfall on the land surface and subsequent infiltration/ percolation, or through infiltration once the runoff reaches the streambed of the Salinas River and its tributaries. When groundwater levels in the aquifers are high enough, groundwater can contribute to surface streamflow. Groundwater is lost from aquifers when it is pumped for municipal or agricultural uses, particularly during the summer irrigation season. In general, the subbasins are pumped during the dry season when the agricultural water supply demand is greatest, and they are recharged in the wet season—although the amount of recharge varies depending on the amount and timing of precipitation and how low the subbasin water levels are at the start of the wet season.

In years of plentiful rainfall, the abundance contributes to groundwater recharge and helps maintain surface flows in the Salinas River. During dry years, there is not always sufficient runoff to recharge aquifers and maintain stream flows. San Antonio and Nacimiento Reservoirs store runoff that can be used to both augment flows in the Salinas River and recharge the aquifers. How effective this management approach is at maintaining streamflow depends primarily on how these reservoirs are operated (timing and volume of releases) and the level of depletion in the aquifers (which varies with season and pumping activity). The greater the depletion of the aquifers, the more flow will be required in the Salinas River to maintain surface flow connectivity to the Monterey Bay. If the reservoirs do not have sufficient storage and/or if the aquifers are depleted such that any surface flows readily percolate into the ground, then stream flows may not be maintained. As such, under existing conditions, the successful management of the Salinas River within the study area is dependent, in part, on how groundwater is managed. Figure 4-1 provides a conceptual model depicting these interactions.

Managing water resources along the Salinas River is challenging due to differences in when water is naturally plentiful (typically during the winter) and when it is generally needed for irrigation (during the dry season). Compounding this challenge is the lack of data regarding flow along the Salinas River and inflow from its tributaries. There are only four gages on the mainstem of the Salinas River. Of the Salinas River's undammed tributaries in the study area, only the Arroyo Seco and San Lorenzo are gaged.

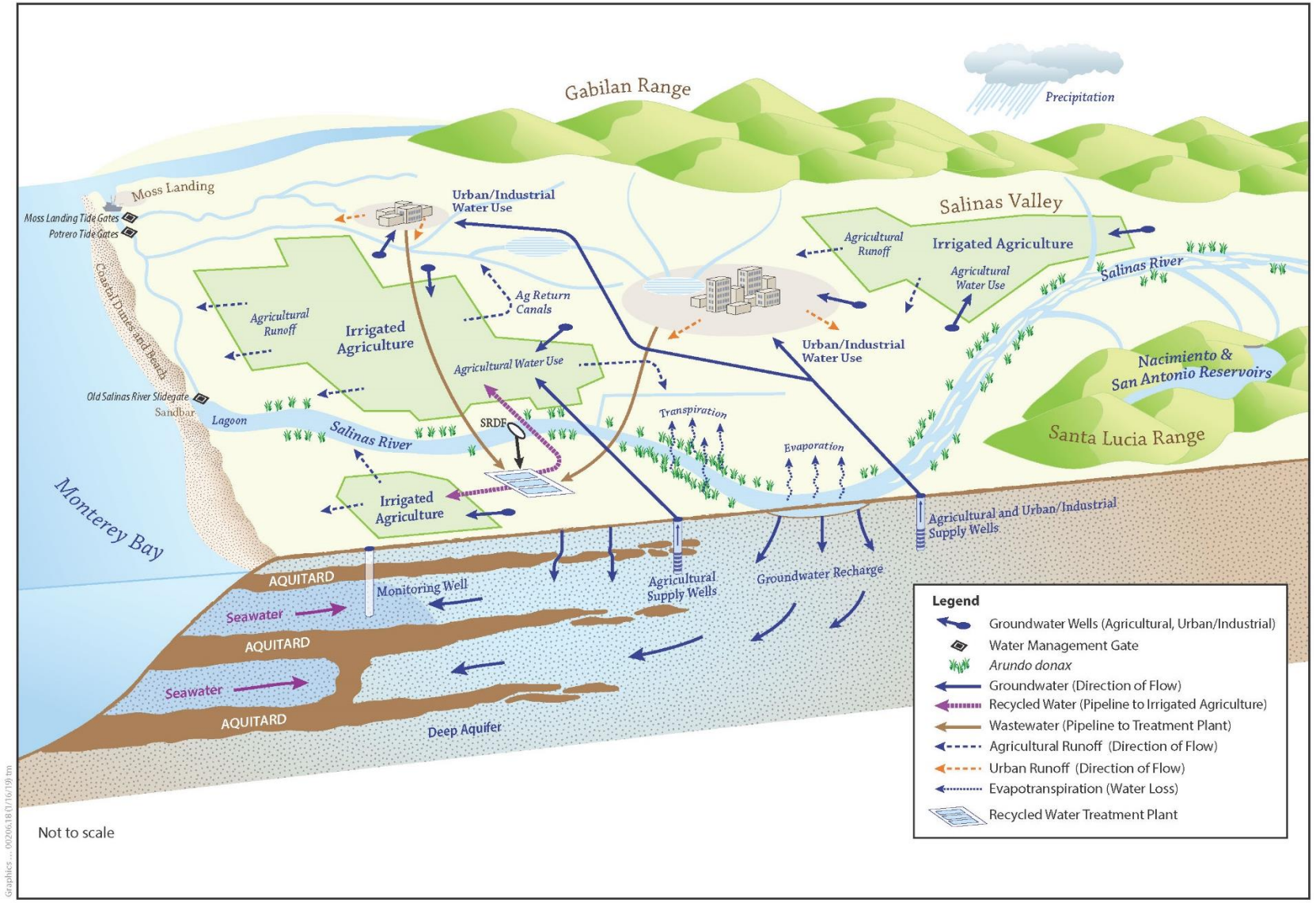

Figure 4-1. Salinas Valley Water Management System Conceptual Model

Groundwater is a valuable resource to the agriculture-based economy of the Salinas Valley. Although the Salinas River is ultimately the primary water supply for the valley, most of the water used first infiltrates from the Salinas River into the underlying sediments before being extracted for use through groundwater pumping. The Salinas Valley groundwater subbasins serve as critical reservoirs for seasonal water storage between the wet and dry seasons, providing an estimated 16.4 million acre-feet of storage as compared to 0.7 million acre-feet in Nacimiento and San Antonio Reservoirs combined. The groundwater reservoir also provides critical storage over multiple-year climatic cycles with groundwater levels in the Salinas Valley Basin being drawn down during drought periods and replenished during wet periods.

While the general mechanics of surface and groundwater interaction are known, the details along the Salinas River are not fully understood. For example, the level at which aquifers must be maintained in order to maintain surface flow along the length of the Salinas River is not known. To address this uncertainty, MCWRA is working with the U.S. Geological Survey to develop the Salinas Valley Integrated Hydrological Model. This model combines a rainfall-runoff model (simulating the generation of runoff from input climate data) with a groundwater-surface water model (simulating the movement of water in the groundwater and surface water systems, as well as the dynamic operation of the linked reservoirs) to attempt to quantify the interaction of surface water and groundwater in the Salinas Valley.

With passage of the Sustainable Groundwater Act, which requires GSPs for each basin, information will be developed that will support groundwater basin management for the first time. It is expected that GSPs will be informed by the Salinas Valley Integrated Hydrological Model.

4.3.11 The River Changes Over Time

Many stakeholders expressed an interest in returning the river to a more “natural” state.

Over the past 150 years, the Salinas River has gone through many changes that have affected its hydrology and geomorphology. These changes began with the development of the Salinas Valley as a major agricultural region, including construction of the first railroad connecting the Salinas Valley to Monterey and the incorporation of the City of Salinas. Around the turn of the century, the use of groundwater pumping for irrigation expanded quickly. As the amount of irrigated crops increased, the amount of freshwater removed from the groundwater basin exceeded the amount replenished through natural hydrologic processes. By the late 1930s, wells in the Salinas Basin near Monterey Bay had been abandoned due to excess salinity (California Department of Water Resources 1946). Accelerated encroachment of salinity into the groundwater basin was observed in 1943, which led to an investigation of the Salinas Basin (California Department of Water Resources 1946) and ultimately to the construction of the Nacimiento Dam in 1957, followed by the San Antonio Dam in 1965. These reservoirs have been primarily operated to capture winter flows and release them at a low enough rate throughout the year to maximize groundwater recharge in the Salinas Valley aquifer (CALFED 1976) so that groundwater wells for irrigation continue to function.

Prior to the construction of major reservoirs and diversion, the Salinas River experienced a dynamic system where seasonal high flows regularly scoured the sandy bars and channel bottom, transporting sediment and creating a wide and largely bare channel bed (San Francisco Estuary Institute 2009). Anecdotal records cited by San Francisco Estuary Institute (2009) from the 1700s and 1800s indicate that the Salinas River had an extensive riparian corridor along the active channel, as well as in the overbank floodplains, surrounding a broad and sandy river bed. The

earliest available aerial photography from 1937 (by which time the agricultural industry was well developed) shows a wide riverbed and very little-to-scattered vegetation growing on large sand bars within the channel, and with pockets of more dense vegetation growing towards the outside margin of the riverbed (Monterey County Water Resource Agency 2014). Today, the operations of the Nacimiento Reservoir and the San Antonio Reservoir have reduced flow peaks and increased summer flows, allowing vegetation growth to expand onto the bars and channel bottom by reducing scouring events and maintaining water supplies throughout the study area during the summer. This vegetation growth has tended to "armor" sandbars, reduce or eliminate multi-channel braiding, and create the typically heavily vegetated, single-threaded channel form in the lower Salinas River.

Balancing the operation of the river and reservoirs with the existing need and desire for the river to operate more naturally must be considered. Returning to this "natural" state of the 1700 and 1800s is no longer possible due to conversion of riparian corridors to agricultural fields and population growth that has driven a need to manage the river for flood control. However, a "naturalized" management approach, particularly regarding reservoir releases, could help reestablish some of the historical Salinas River characteristics while still meeting flood control, irrigation, groundwater recharge, and fish migration needs.

4.3.12 There is Support for Recreation

LTMP stakeholders have expressed a desire to maintain access for recreation on public lands, including the Salinas River Lagoon and in the Nacimiento and San Antonio Reservoirs. Where recreation opportunities overlap with natural lands, access must be carefully managed to ensure that it does not result in adverse effects on sensitive plant or animal species. To address this issue, projects implemented in support of the LTMP should consider potential interactions with recreation.