2022
WATER MASTER PLAN

DECEMBER 2022

Adopted by the South San Joaquin Irrigation District Board of Directors on December 13, 2022

SOUTH SAN JOAQUIN IRRIGATION DISTRICT

Jacobs

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Acronyms and Abbreviations

%	percent
>	more than
°C	degrees Celsius
AFY	acre-foot per year
AWMP	Agricultural Water Management Plan
Bay-Delta Plan	San Francisco Bay-Sacramento San Joaquin Delta Estuary
BO	Biological Opinion
Board	South San Joaquin Irrigation District Board of Directors
Cal Poly	California Polytechnic State University
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIP	capital improvement plan
CIPP	cast-in-place pipe (concrete)
CMP	corrugated metal pipe
COVID-19	coronavirus disease 2019
CSJWCD	Central San Joaquin Water Conservation District
CVP	Central Valley Project
Davids	Davids Engineering, Inc.
District	South San Joaquin Irrigation District
DO	dissolved oxygen
DSA	distribution service area
DWR	California Department of Water Resources
ESJGWA	Eastern San Joaquin Groundwater Authority
ET	evapotranspiration
ETAW	evapotranspiration of applied water
ETc	standard evapotranspiration rate
FCOC	French Camp Outlet Canal
GAC	Grower Advisory Committee
gpm/acre	gallons per minute per acre
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IDC	integrated demand calculator
ITRC	California Polytechnic State University Irrigation Training and Research Center
JMC	Joint Main Canal
LSJR	Lower San Joaquin River

LTO	Long-term Operation
MDC	Main Distribution Canal
mg/L	milligram(s) per liter
MSC	Main Supply Canal
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMI	New Melones Index
NMOM	New Melones Operations Model
NMR	New Melones Reservoir
O&M	operations and maintenance
OID	Oakdale Irrigation District
ppm	part(s) per million
PVC	polyvinylchloride
Reclamation	U.S. Department of the Interior Bureau of Reclamation
RGRCP	rubber gasket (joints) reinforced concrete pipe
RPA	Reasonable and Prudent Alternative
SB x7-7	Senate Bill x7-7, The Water Conservation Act of 2009
SB	Senate Bill
SCWSP	South County Water Supply Program
SEWD	Stockton East Water District
SGMA	Sustainable Groundwater Management Act or 2014
SJCOG	San Joaquin Council of Governments
SR	service ratio
SRP	Stepped Release Plan
SSJID	South San Joaquin Irrigation District
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TAF	thousand acre-feet
TDS	total dissolved solids
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Plan
WMP	Water Master Plan
WTP	water treatment plant

1. Introduction

South San Joaquin Irrigation District (SSJID or District) was formed in 1909 to deliver water for agricultural production in southern San Joaquin County. While the District's initial mission to deliver reliable high-quality water from the Stanislaus River to its customers at affordable rates has remained unchanged, the compounding effects of evolving customer needs, increased regulatory requirements, highly variable hydrologic conditions, an aging water delivery system, and an ever-changing economic climate necessitated a long-term planning process that was initiated in 2018. This section provides foundational information and context for the multi-year planning process of the Water Master Plan (WMP), and a summary of the remaining sections.

1.1 General Background

1.1.1 Study Area

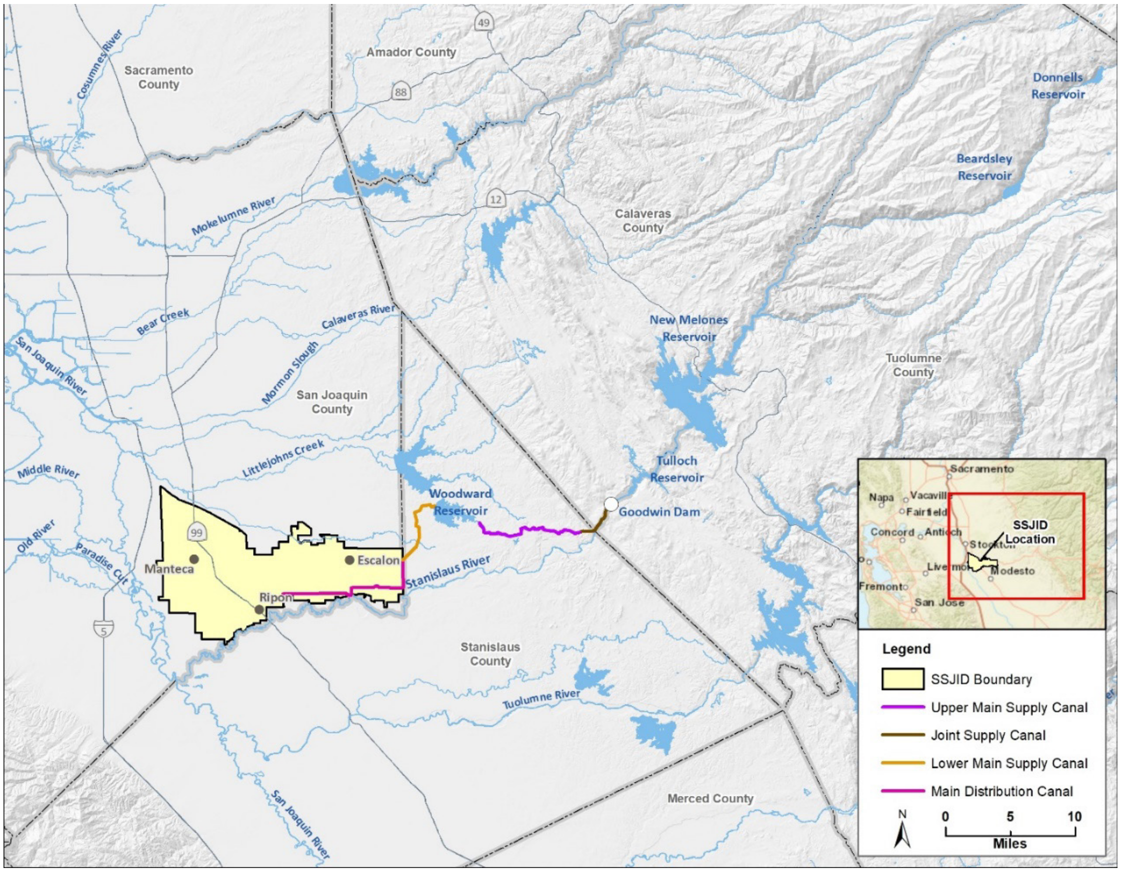
SSJID is located in southeastern San Joaquin County in California's San Joaquin Valley. The District boundary encompasses urban and agricultural areas in and surrounding the Cities of Manteca, Ripon, and Escalon with a southern boundary paralleling the Stanislaus River. The District boundary and its approximate 72,000-acre service area are shown on the vicinity map on Figure 1-1. Approximately 66% of the irrigated acres in the District are currently almond orchards. The other crops grown include corn, pasture, grapes, walnuts, peaches, alfalfa, and other crops. SSJID started delivery of municipal water in 2005 in conjunction with city partners Manteca, Tracy and Lathrop, and Escalon, through the development of the South County Water Supply Program.

1.1.2 Water Rights and Resources

The principal source of water supply for the District is its pre-1914 water rights on the Stanislaus River. These water rights are shared with neighboring Oakdale Irrigation District (OID). Water is diverted downstream of the New Melones Reservoir (NMR) at Goodwin Dam and conveyed through a system of canals, ditches, and pipelines to serve customers. These water rights are exercised through an operations agreement with the U.S. Department of the Interior Bureau of Reclamation (Reclamation), developed to resolve water rights concerns between OID, the District and Reclamation during development and construction of the NMR (shown on Photograph 1-1). The District also conjunctively uses groundwater through District well pumping and through private pumping by District customers.

In addition to sharing water rights, SSJID and OID partnered to develop the Tri-Dam Project, a system of dams, reservoirs, and hydropower facilities that increases the water storage in the basin and generates hydropower. The revenue from hydropower generation provides SSJID with a strong financial foundation, which allows the District to provide reliable, low-cost services to the communities it serves.

Figure 1-1. Map of SSJID Boundary and Vicinity



Photograph 1-1. New Melones Reservoir

Source: California Department of Water Resources

1.1.3 2017 Strategic Plan

In 2016, the District initiated strategic planning efforts to identify the critical issues facing the District, and identify actionable solutions to resolve these issues. Through this process, the District developed new mission and vision statements. The *South San Joaquin Irrigation District Strategic Plan 2017–2021* (2017 Strategic Plan) (SSJID 2017) provided specific goals, strategies, and objectives intended to further strengthen the District's foundation for long-range planning.

Culminating with the completion of the 2017 Strategic Plan, this effort identified specific goals for the District's water supply, operation, distribution, customer service, and finance activities. These goals created the motivation to embark on development of the WMP in 2018.

MISSION STATEMENT

SSJID provides the utmost value for its agricultural, urban, and business community by protecting and delivering vital resources with exceptional service.

VISION STATEMENT

As a premier organization, South San Joaquin Irrigation District is passionately focused on delivering high quality water and power that are integral to the communities we serve, while leading in innovation and sustaining a deep respect for our history, our employees, and our environment.

1.2 Water Master Plan Overview

1.2.1 Purpose and Scope

The WMP is a 30-year plan for the District's agricultural irrigation service and related water distribution facilities. The WMP is designed to meet the evolving needs of customers, and to address numerous resource management challenges facing the District. The WMP planning process enabled the SSJID Board of Directors (Board) to evaluate recommendations and make informed decisions for the future, while considering policies and actions that will help assure the long-term financial viability of the District. Development of the WMP was approached in a way that provided alignment among Board members, SSJID staff, and customers regarding the District's future.

SSJID WATER FACTS

- *Number of parcels irrigated: 1943 as of 2022*
- *Total acreage: Approximately 72,000 acres*
- *Irrigated acreage: Approximately 50,000 acres in 2022*
- *Principal water supply: Stanislaus River*
- *Primary storage on the Stanislaus River: New Melones Reservoir, 2.4 million acre-feet*
- *Tri-Dam Project Storage: 200 thousand acre-feet (TAF)*
- *Woodward Reservoir Storage: 33 TAF*
- *Point of Diversion: Goodwin Dam on the Stanislaus River, just upstream from Knights Ferry*
- *Joint Main Supply Canal: 3.5 miles*
- *Main Distribution Canal and laterals: 362 miles*
- *Pipelines: 315 miles*
- *District owned groundwater wells: 32*

The WMP scope was focused, through stakeholder engagement and feedback, to guide decisions and future investments particularly with regard to aging infrastructure and system modernization. The WMP presents costs of implementation and financial strategies to meet the District's future needs. To develop the WMP, SSJID carried out detailed technical studies to evaluate options and make informed decisions. Technical components included water resources, on-farm practices, current and forecasted changes in land use, comprehensive current and future water needs, water supply reliability, water conveyance system inventory and hydraulic capacity analysis, and development of financial strategies for future sustainability. These technical studies informed the Board, staff, customers, and the broader SSJID community about the challenges, opportunities, and solutions.

In addition, technical tools and models were created to facilitate the various studies within the WMP. These tools and models were used to understand current water supply use and trends, anticipate future land use and water supply needs, evaluate and prioritize capital improvement projects, and define and study financial impacts of CIP alternatives. These models and tools created through this WMP are meant to be preserved and updated periodically, which will allow new information, technologies, challenges, opportunities, and priorities to be evaluated on an ongoing basis, so the District's direction and planning can be refined to meet future customer and business needs.

1.2.2 Water Master Plan Phases

The WMP was scoped as a phased approach to ensure efficient technical studies that aligned with stakeholder needs, to form a foundation on which to make critical long-term decisions by the District. Table 1-1 describes the phased approach.

Table 1-1. Water Master Plan Phased Approach

Phase	Timing	Activities
PHASE I Initial Assessment	2018 through 2019	▪ Gather information ▪ Engage stakeholders (customers, industry, community leaders) ▪ Refine WMP scope ▪ Set goals
PHASE II Plan Development	2019 through 2022	▪ Provide continued stakeholder engagement ▪ Develop analytical tools (water resources modeling, financial modeling) ▪ Conduct technical studies (land use, on-farm systems, infrastructure, water resources, financial) ▪ Develop and evaluate infrastructure and financial scenarios ▪ Agree on the recommended plan ▪ Provide WMP documentation ▪ Adoption of the WMP by the Board
PHASE III Implementation	2023 through the future	▪ Ensure compliance with California Environmental Quality Act (CEQA) ▪ Monitor the District's financial wellbeing while maintaining cash reserves. ▪ Fund and construct projects in capital improvement plan (CIP) ▪ Review adaptive management: revisit CIP spending on 5-year cycles as conditions change (for example, funding projections, infrastructure priorities)

1.2.3 Water Master Plan Goals

Establishing WMP goals at the onset of the planning process with full Board, staff, and customer alignment was a critical step to ensure the WMP development was properly scoped and completed. Goals were vetted in Phase I through Board workshops and multiple customer meetings. Technical analysis and decision-making during the planning process were performed with WMP goals providing guidance.

1.3 Report Organization

The complete WMP documentation includes this Summary Report and accompanying appendices. The Summary Report compiles technical analysis, outreach, decision-making process, and the recommended plan. The appendices provide the detailed information of technical analyses, supplement the content of the Summary Report, and support the overall WMP decision-making process. The following is a brief overview of section content:

- **Section 2, Public Outreach**, summarizes the public outreach approach and engagements with stakeholders and customers, and input that was considered as part of the WMP planning process.
- **Section 3, Water Resources Inventory**, describes the current state of water resources for the District in terms of supply and overview of SSJID demand for water. In addition, relevant issues affecting water resources are described, including related regulation and regulatory processes.
- **Section 4, On-farm System Assessment**, presents a summary of water management at the field level, which informs infrastructure needs, water balance, and water use efficiency concerns.

- **Section 5, Land Use Trends and Forecasting**, summarizes historical and current land uses, and forecasts future land use as the basis for current and future water demands for water balance analysis.
- **Section 6, Infrastructure**, provides information on the process and analysis for the infrastructure recommendations including the time-phased CIP.
- **Section 7, Water Resources Analysis**, presents long-term water supply reliability analysis, the District's current and future water demand analysis, and a system-wide water balance study.
- **Section 8, Financial Analysis**, presents the planning-level financial tool and provides an analysis of the current business model, provides recommendations to address sustainability of current financial practices, and presents an analysis to fund the long-term CIP, while maintaining the long-term financial sustainability of the District.
- **Section 9, Recommendations**, presents the final recommended plan that resulted from the WMP planning process including the CIP with implementation schedule and financial plan.
- **Section 10, References**, is a compiled list of all works cited in this WMP and other works used to develop its content.

WATER MASTER PLAN GOALS

- *Protect and preserve SSJID's water rights.*
- *Ensure long-term viability of SSJID's water delivery system and enhance flexibility, reliability, and operational efficiency.*
- *Promote the use of available surface water and protect the sustainable use of groundwater within the District.*
- *Promote efficient and effective on-farm water use.*
- *Provide an affordable water supply to SSJID customers.*
- *Ensure SSJID remains financially sound.*
- *Promote SSJID's stewardship of the water resource and its contributions to the economy and the environment.*

The following appendices contain more detailed information that used to develop the WMP.

- Appendix A, *Water Resources Inventory*
- Appendix B, *On-farm Systems Evaluation*
- Appendix C, *Historical and Forecasted Land Use*
  - Attachment 1: Sphere of Influence Map
  - Attachment 2: General Plan Land Use Maps
- Appendix D, *Water Resources Analysis*
- Appendix E, *Infrastructure Plan*
  - Attachment 1: SSJID Flow Management Strategies
  - Attachment 2: Unit Costs and Descriptions
  - Attachment 3: Supervisory Control and Data Acquisition Assessment Technical Memorandum
  - Attachment 4: Critical Infrastructure Map
  - Attachment 5: South San Joaquin Irrigation District Main Distribution Canal Reconnaissance
  - Attachment 6: Infrastructure Alternatives Maps
  - Attachment 7: Intermediate Infrastructure Screening Analysis
  - Attachment 8: Capacity Analysis Project Descriptions
  - Attachment 9: Capital Improvement Plan
- Appendix F, *Capacity Analysis*
- Appendix G, *Public Outreach Materials*

2. Public Outreach

SSJID has conducted an open and transparent, multi-year public outreach process to inform constituents of the need for a comprehensive plan and explain how it will benefit the District. This WMP presents a 30-year vision based on current conditions and will be implemented using a flexible approach, updated and guided by spending plans evaluated over 5-year intervals. As SSJID implements the WMP, SSJID will continue to seek active stakeholder involvement. This section provides an overview of the public process since the start of the WMP in 2018, and summarizes outreach activities and key stakeholder input.

2.1 Stakeholder Outreach Approach

The purpose of the public outreach effort is to engage stakeholders to solicit their input throughout the development of the WMP, build consensus for its successful future implementation, document the process in support of future project development, including CEQA, and ensure WMP efforts are consistent with SSJID's adopted mission and vision. The WMP team strived to provide consistent messaging and offered multiple opportunities to identify potential issues that may impact public response and actively elicit ongoing stakeholder opinion and actions.

The stakeholder outreach approach was implemented to engage stakeholders throughout the WMP development process. The WMP Phase 1 process was informally introduced with District growers and stakeholders at SSJID's annual Field Day in October 2018 (refer to Photographs 2-1 and 2-2). While the Field Day was focused on the successful implementation and dedication of new Division 9 facilities, stakeholders were informed of the purpose and process expected for the long-term planning effort of the WMP. In Phase 1 (May 2019), a Strategic Communications Plan was developed to guide messaging, as well as the process for communicating and documenting feedback among stakeholders and SSJID during the latter two phases. During this period, SSJID staff continued to provide the Board of Directors updates and information that arose from these outreach efforts.

Photograph 2-1. SSJID Field Day (October 2018)

Source: Jacobs

2.2 Key Findings in Phase 1

To provide context, the following are key findings from Phase 1 that form the basis of the Strategic Communications Plan. Initial public outreach included a Board workshop and a series of key stakeholder interviews. For the Board workshop, the WMP team reviewed the overall WMP process and solicited Board input regarding the WMP goals. For the interviews, the WMP team solicited input from stakeholder groups regarding their perception, attitude, and awareness of key water issues facing SSJID and their own water operations. Feedback was also sought on the proposed WMP goals presented at the Board workshop. Stakeholder groups included SSJID Board members, customers, municipalities within the District, industry groups, and other water agencies in the basin. To create a consistent source of feedback, SSJID established a Grower Advisory Committee (GAC), which included a cross-section of growers that were representative of the District.

The summary of issue importance across all Phase 1 meetings is depicted on Figure 2-1. Based on the frequency of discussion of various topics across numerous stakeholders, the summary of discussion comments depicts a fairly even distribution of issue importance across topics of surface water, groundwater, infrastructure, irrigation service and operations, and financial concerns. Less frequent discussion was observed for the issues of water quality, communications, and regulations. The path forward for District-wide modernization dominated many of the discussions, which is the intersection of financial, irrigation service, and infrastructure issues (as reflected on Figure 2-1). Table 2-1 provides a summary of stakeholder perceptions and feedback as a result of Phase 1 engagements.

Figure 2-1. Summary of Issue Importance across All Phase 1 Meetings

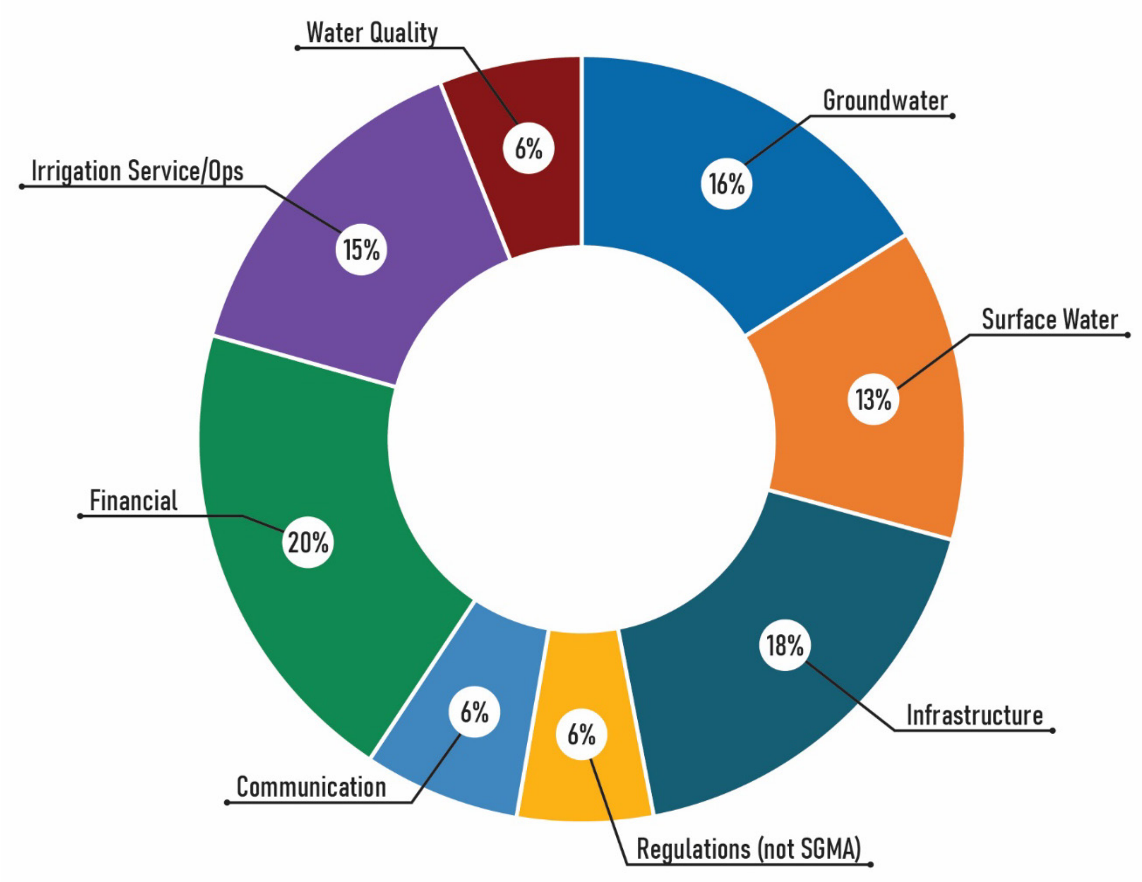


Table 2-1. Summary of Stakeholder Perceptions and Feedback during Phase 1

Perceptions on Which to Build
▪ SSJID is seen as a leader in regional water resources. ▪ Significant awareness exists about the complexity and severity of current water issues, particularly increasing concern about the California State Water Resources Control Board (SWRCB) unimpaired flow standard as well as compliance with the Sustainable Groundwater Management Act (SGMA). ▪ Stakeholders positively acknowledged recent SSJID communications efforts and improved responsiveness to their requests. ▪ SSJID surface water has an increased value, especially considering groundwater basin status and SGMA compliance. ▪ The Division 9 pressurization pilot project is widely perceived as successful. ▪ Stakeholders are financially aware with regard to infrastructure modernization and appreciate the current low cost of SSJID water. ▪ Stakeholders are interested in staying informed and participating in the WMP.
Feedback to Address in WMP Development
▪ The WMP must result in an implementable plan. ▪ Modernization efforts must look beyond irrigation deliveries and consider the upstream conveyance system. ▪ The Division 9 pilot project was successful and should be expanded to more customers if feasible. ▪ Pressurized irrigation service, whether District provided or on-farm, should be the standard; the continued capability to flood irrigate should be considered. ▪ Irrigation rotations must be reduced and operations shifted to shorter rotation or on-demand delivery; growers want flexibility in their irrigation service. ▪ Agricultural rate increases are acceptable if growers get real, improved service for the investment. ▪ SSJID needs to share its highly valuable public relations story more aggressively; SSJID has a long history of successful water resources stewardship and is important to the regional economy and environment.

2.2.1 Refined Goals Based on Phase 1 Stakeholder Input

After the Board workshop in November 2018, interviews were held with key stakeholders in December 2018, which included industry organizations, municipalities, and other agencies (summarized as follows). Numerous perspectives were discussed in the meetings regarding the key water resource issues facing stakeholders and SSJID. Key issues identified included: improved service to agricultural customers (for example, frequency of rotations, pressurized service), groundwater and SGMA compliance, water rights protection, and addressing aging or inadequate conveyance infrastructure. The draft goals generally aligned with and/or addressed key issues and drivers noted by stakeholders, but goal changes were discussed with general consensus. One goal was amended to recognize the importance of promoting surface water use over groundwater. One new goal was added to recognize the importance of public relations (including local, regional, and statewide) promoting SSJID's long history as a successful steward of water resources. The following goals were confirmed by the Board in April 2019, at the conclusion of Phase 1.

The following WMP goals provided guidance throughout all technical and planning activities as well as alternatives development and evaluation during Phase 2 of the WMP:

- Protect and preserve SSJID's water rights.
- Ensure long-term viability of SSJID's water delivery system and enhance flexibility, reliability, and operational efficiency.
- Promote the use of available surface water and protect the sustainable use of groundwater within the District.
- Promote efficient and effective on-farm water use.
- Provide an affordable water supply to SSJID customers.
- Ensure SSJID remains financially sound.
- Promote SSJID's successful stewardship of its water resources and its contributions to the economy and the environment.

Photograph 2-2. SSJID Field Day (October 2018)

Source: Jacobs

2.3 Public Outreach Activities

Public outreach activities during Phase 2 of the WMP generally followed the process outlined in the Strategic Communications Plan developed at the conclusion of Phase 1. Despite the challenges of public outreach during the coronavirus (COVID-19) pandemic, the District maintained open communication channels with customers and stakeholders through WMP development, soliciting input and providing progress updates. Figure 2-2 provides an overview and general timeline of Phase 1 and 2 engagements. Table 2-2 summarizes formal outreach engagements during WMP Phases 1 and 2. Refer to Appendix G, *Public Outreach Materials* for an inventory of presentations and documents used to facilitate stakeholder communications in Phases 1 and 2.

Figure 2-2. Overview of Phase 1 and 2 Outreach Engagements

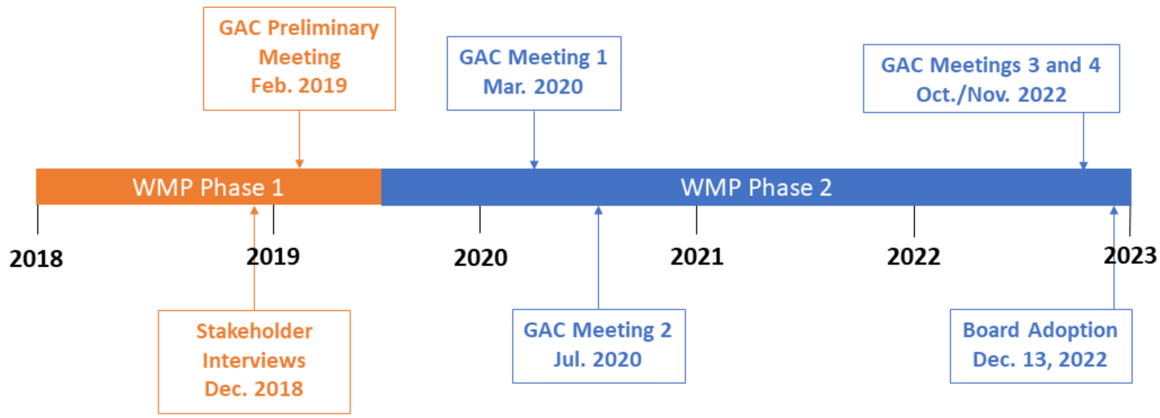


Table 2-2. Formal Outreach Engagements (Water Master Plan Phases 1 and 2)

Phase/Date	Forum	Topics	Key Feedback
Phase 1/ December 2018	Stakeholder interviews with industry and community leaders [a] (8 interviews plus 1 workshop with all 5 District Board Members)	▪ Information sharing regarding ongoing planning processes ▪ Stakeholder concerns ▪ Top issues to be addressed in WMP ▪ WMP goals	Feedback from industry and community leaders encompassed a wide range of views and topics, including groundwater, surface water, infrastructure, regulations, communications, financial, irrigation service/farm operations, and water quality. Based on a compilation of interview responses, the primary areas of concern were irrigation service and operations, infrastructure reliability and modernization, and financial considerations.
Phase 1/ February 2019	GAC Meeting (two meetings; February 11 and 13)	▪ WMP and planned process introduction ▪ Draft goals ▪ GAC establishment ▪ Open discussion	Generally, growers view the role and performance of SSJID positively. General recognition that water rates are low relative to other districts. Growers outside of Division 9 want improved service. Growers recognize the importance of SGMA implications. Growers are concerned about municipal interests overshadowing agricultural interests, but also recognize the importance of their influence having municipal interests on the District's side on common issues (such as SWRCB Substitute Environmental Document). Growers responded positively to the draft WMP goals and agreed that protecting the water rights should be the #1 goal. A new WMP goal was proposed encompassing the theme of "long-term water resource stewardship."
Phase 2/ March 2020	GAC Meeting 1	▪ General WMP process review ▪ Land use forecast results ▪ Water balance results	The District's water use efficiency and conservation efforts need to be publicized. Conservation will come from District-scale delivery system improvements.

Phase/Date	Forum	Topics	Key Feedback
		▪ Infrastructure planning update ▪ Schedule update	Growers will want to see cost estimates for infrastructure alternatives.
Phase 2/ July 2020	GAC Meeting 2	▪ Infrastructure alternatives update ▪ District's financial baseline	Acknowledgment of significant cost of District-wide pressurization. Growers expressed the need to see irrigation rate impacts to fully consider all alternatives; however, the WMP is not at this stage yet. The current SSJID business model is not financially sustainable.
Phase 2/ October and November 2022	GAC Meetings 3 and 4 (refer to Photographs 2-3 and 2-4 for the October and November GAC Meetings, respectively)	▪ WMP progress-to-date review ▪ Recommended CIP ▪ Financial modeling results	The CIP will be flexible and is intended to be revisited every 5 years. Projects will be considered based on regulatory requirements and funding availability. Growers commended SSJID for WMP and CIP development thus far, especially given COVID-19 circumstances. Growers agreed with SSJID's pursuit of the new trenchless pipelining technology. Financial modeling results are for planning purposes only. A formal Proposition 218 process will follow the WMP to consider irrigation rate increases. Growers stated that current irrigation rates are low compared to neighboring districts. Growers understand the need for irrigation rate increases but want to know the scheduled plan of increases which will be developed in the Proposition 218 process. Growers appreciated SSJID's commitment to seek out water transfers and grant opportunities to reduce rate increases and/or fund highly beneficial projects that did not make the final recommended plan.
Phase 2/ December 2022	Board Meeting	Board Adoption of the WMP	The SSJID District Board of Directors adopted the WMP with a unanimous vote at the December 13, 2022 board meeting.

[a] Stakeholder/industry organization interviews were held with Almond Board of California, Blue Diamond, City of Escalon, City of Manteca, City of Ripon, Stockton East Water District, San Joaquin County, San Joaquin Farm Bureau.

In addition to the formal engagements throughout the development of the WMP, other means of outreach were undertaken by District staff members, including newsletter updates, email blasts, and regular summary WMP updates at public Board meetings.

Photograph 2-3. Grower Advisory Committee Meeting 3 (October 2022)

Source: South San Joaquin Irrigation District

Photograph 2-4. Grower Advisory Committee Meeting 4 (November 2022)

Source: South San Joaquin Irrigation District

3. Water Resources Inventory

Water resources management is at the core of SSJID's existence and success for more than 110 years. Continuation of its deliberate, forward-looking water management approaches will be necessary for SSJID to successfully serve its customer base long into the future. Understanding the current status of the District's water resources is essential to the long-term WMP planning process. This water resource inventory describes SSJID's general surface water supply and groundwater resources. Key relevant operations agreements and regulatory requirements that affect the management of water supplies are also acknowledged. Further detail on the information presented in this summary is provided in Appendix A, *Water Resources Inventory*.

3.1 Surface Water Supply

Factors affecting the ability of the District's Stanislaus River water supply to meet the demands of existing baseline uses, include water rights for storage and diversion, NMR operational agreements, and state and federal environmental regulations. These factors are discussed in this section.

3.1.1 Water Rights for Storage and Diversion

SSJID and OID share the primary surface water rights on the Stanislaus River. Since their formation, the two Districts have obtained adjudicated pre-1914 appropriative rights and additional storage rights in the Stanislaus River Basin to supplement their supplies. Goodwin Dam, the Districts' primary diversion dam, was completed in 1913, and has a storage right for approximately 3.6 TAF. SSJID constructed Woodward Reservoir, an off-stream impoundment near Oakdale, CA, in 1916, to store approximately 36 TAF. Old Melones Dam and Reservoir were developed as the original shared water storage facilities for the Districts in 1927, impounding 112.5 TAF. The two Districts then combined efforts to complete construction of the Tri-Dam Project in 1957, which included additional water storage of approximately 230.4 TAF in Donnells, Beardsley, and Tulloch Reservoirs. The Districts also hold significant senior water rights for hydropower generation.

With the construction of the New Melones Dam and Reservoir, the Districts various storage and diversion rights were recognized and coordinated through operating agreements between the Districts and the United States Bureau of Reclamation, as discussed in the next section. Figure 3-1 shows surface water facilities and SSJID's service area.

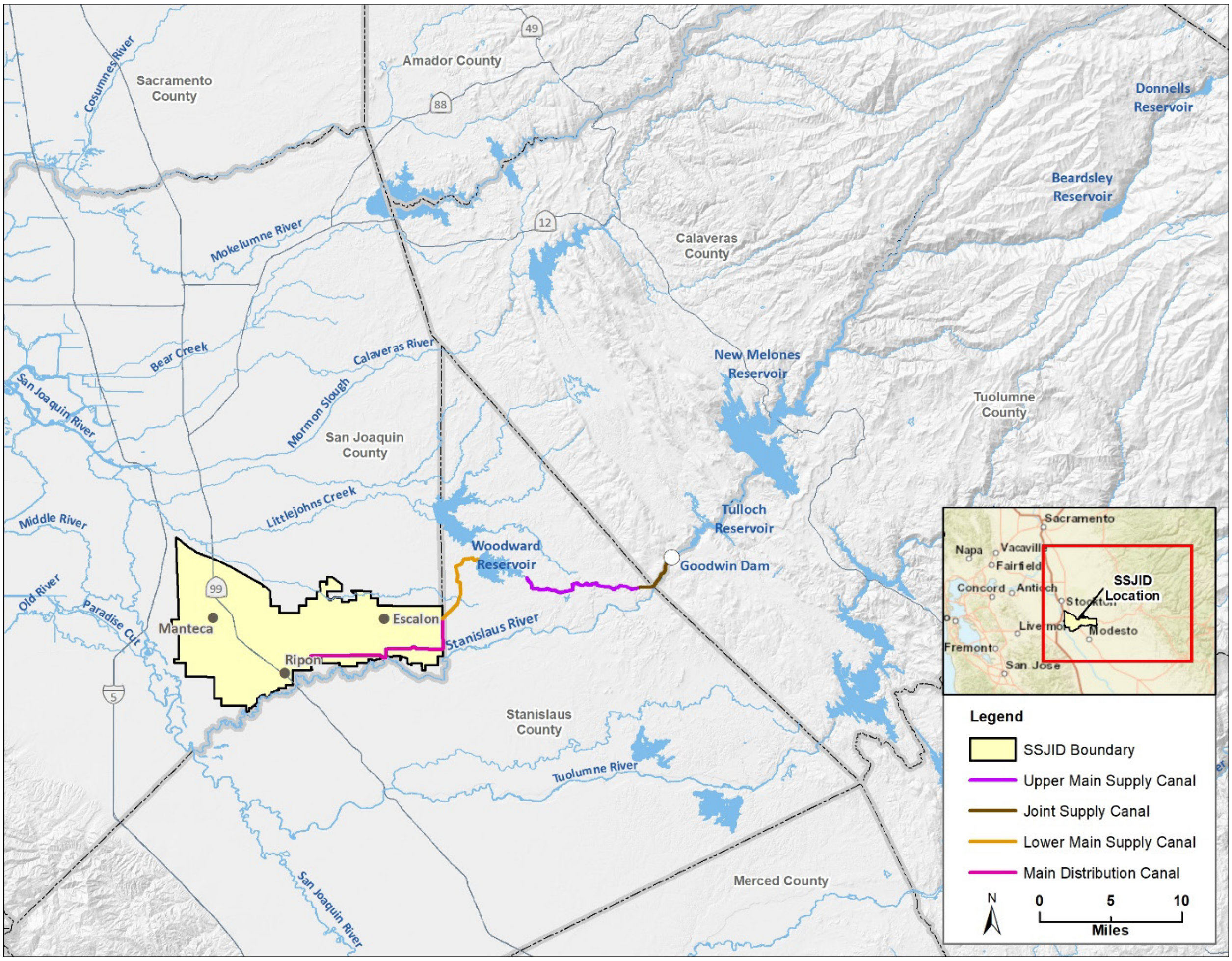
3.1.2 New Melones Operating Agreements

3.1.2.1 1988 Agreement and Stipulation

Reclamation began operations of NMR in 1980. The obligations to the Districts' senior water rights, including pre-1914 rights, were memorialized in the 1972 Agreement and Stipulation between Reclamation, SSJID, and OID (Reclamation 1972). In 1988, the Agreement and Stipulation among Reclamation, SSJID, and OID was superseded by a new agreement (1988 Agreement) (Reclamation 1988) that provided for conservation storage in NMR by SSJID and OID. The 1988 Agreement required Reclamation to release NMR inflows of up to 600 TAF each year for diversion at Goodwin Dam by SSJID and OID. In years when annual inflows to NMR are less than 600 TAF, the Districts' entitlements are derived using the following formula:

$$Annual\ SSJID\ \&\ OID\ Supply = Inflow + (600\ TAF - Inflow)/3$$

Figure 3-1. Vicinity Map of Surface Water Facilities and SSJID Boundary



The 1988 Agreement also created a conservation account in which the difference between the entitled quantity and the actual quantity diverted by OID and SSJID in a year may be stored in NMR for use in subsequent years. This conservation account has a maximum storage limit of 200 TAF, and is constrained by a number of criteria in the 1988 Agreement. In addition to releases for diversion by OID and SSJID, water is released from NMR, currently incidental to other operations, to satisfy riparian water rights totaling approximately 48 TAF annually downstream of Goodwin Dam.

3.1.2.2 Revised Plan of Operation

Recent years of extreme drought conditions and regulatory requirements placed on NMR operation have inhibited Reclamation's ability to fulfill its obligations to the Districts. In response, a New Melones Revised Plan of Operation was developed. A key element of the plan is a proposed instream flow requirement included in the *Reinitiation of Consultation on the Coordinated Long-term Operation of the Central Valley Project and State Water Project* (Reclamation 2020). Reclamation issued a Record of Decision concerning the Proposed Action, which was signed on February 18, 2020, implementing the new instream flow requirement.

3.1.3 State Regulations

Lower Stanislaus River flows provide water supply for riparian water right holders, fishery management objectives, and dissolved oxygen (DO) requirements. In addition, Stanislaus River outflow contributes to the San Joaquin River flow, which improves water quality and flow on the San Joaquin River at Vernalis, where minimum flow and water quality is measured against set objectives.

SWRCB established flow and quality requirements, which impact Stanislaus River operation (Reclamation 2008). SWRCB requirements include Decision (D-)1422 (SWRCB 1973), D-1641 (SWRCB 2000), and the 2006 and 2018 updates of the *Water Quality Control Plan for the San Francisco Bay-Sacramento San Joaquin Delta Estuary* (Bay-Delta Plan) (SWRCB 2006, 2018).

3.1.3.1.1 Instream Flow Requirements

D-1422 requires Reclamation release 98 TAF per year from NMR into the Stanislaus River for fish and wildlife purposes, with the exception of critical water years during which the requirement is reduced to 69 TAF per year. For all water year types, water must be released following a distribution pattern for fish and wildlife objectives. The California Department of Fish and Wildlife releases the distribution pattern annually.

3.1.3.1.2 Dissolved Oxygen Requirements

D-1422 requires that NMR releases comply with DO requirements in the Stanislaus River. The 1995 Bay-Delta Plan specified a minimum DO concentration of 7 milligrams per liter (mg/L) in the Stanislaus River measured near the City of Ripon (SWRCB 1973; Reclamation 2008).

3.1.3.1.3 Vernalis Water Quality Requirements

D-1422 specifies that NMR must operate to not exceed an average monthly total dissolved solids (TDS) concentration of 500 parts per million (ppm) at Vernalis before entering the Delta. TDS is commonly measured as electrical conductivity and converted to ppm concentration. Historically, NMR releases complied with these requirements; however, during the 1987–1992 drought, the standard was not always met due to water shortages and high TDS upstream of the Stanislaus River confluence.

Reclamation has always met the D-1641 standards since 1995 (Reclamation 2008). SWRCB requirements are subject to revision through future updates of the Bay-Delta Plan, including the 2018 update, which modified the objective to 1.0 milliSiemens per centimeter year-round at Vernalis and at three interior South Delta locations.

3.1.3.1.4 Vernalis Flow Requirements

Flow requirements specified at Vernalis were established in 2006 under the Bay-Delta Plan and have been modified by the 2018 update.

2006 Bay-Delta Plan

Prior to the adoption of the 2018 Bay-Delta Plan update, D-1641 and the 2006 Bay-Delta Plan established flow criteria at Vernalis for the February through June period and for the fall. These criteria are shown in Appendix A, *Water Resources Inventory*.

The implementation program for the flow objectives during the April through May period was amended in the 2006 Plan to allow for staged implementation of the objectives by conducting the Vernalis Adaptive Management Plan (VAMP) until 2011 (San Joaquin River Group Authority 2013). The VAMP provided contributions by the San Joaquin River Group Authority members that in effect increase the flows at Vernalis above the flow level that would otherwise occur during a 31-day period in April and May.

2018 Bay-Delta Plan

The 2018 Bay-Delta Plan updated flow criteria at Vernalis for the months of February through June. The February through June Vernalis flow criteria is supplanted by flow criteria in each of the three tributaries and is applied to the Stanislaus at the Koetitz location (SWRCB 2018b). These criteria are shown in Appendix A, *Water Resources Inventory*.

3.1.3.1.5 Water Quality Control Plan for the San Francisco Bay-Sacramento San Joaquin Delta Estuary

The 2018 Bay-Delta Plan updated Lower San Joaquin River (LSJR) flow requirements to protect fish and wildlife and southern Delta salinity objectives to protect agriculture. The objectives will be carried out by programs of implementation with specific action items. SWRCB also encourages entities to enter voluntary settlement agreements to support LSJR flow objectives. For the February through June compliance period, SWRCB aimed to fully implement the requirements in 2022. SSJID and OID have joined dozens of other local government agencies, business organizations, and irrigation districts from the eastern San Joaquin Valley in opposing and legally challenging the 2018 updated Bay-Delta Plan.

3.1.4 Federal Environmental Regulations and Studies

Several federal environmental regulations and studies are in effect that influence Stanislaus River operations. Key prior and current regulations and studies are summarized in this section.

3.1.4.1 2009 Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project and State Water Project

The National Marine Fisheries Service's (NMFS') 2009 *Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project* (2009 BO) (NMFS 2009) defined several actions that affected New Melones operations. The goals of the actions were to: adequately define East Side Division operations to support the Stanislaus River steelhead population including freshwater migration to and from the Delta; and stop or reduce adverse impacts to critical steelhead habitat.

The 2009 BO's Reasonable and Prudent Alternatives (RPAs) required Reclamation to adaptively manage available flows to meet minimum instream flow, ramping flow, pulse flow, floodplain inundation, and geomorphic and function flow patterns.

Annually, the volume of water provided by Appendix 2-E varied by year type between 185.3 TAF and 589.5 TAF. These criteria are shown in Appendix A, *Water Resources Inventory*.

3.1.4.2 2019 Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project

NMFS' *Biological Opinion on Long-Term Operation of the Central Valley Project and State Water Project* (NMFS 2019) implements a long-term operation (LTO) plan beginning with issuance of a Record of Decision on February 18, 2020.

The LTO plan provides that Reclamation operates NMR releases to satisfy minimum flow requirements at Goodwin Dam. NMR releases would follow a stepped release plan (SRP), which is a function of water year type. Previously, the water year type was determined from the New Melones Index (inflow and storage based); however, the water year type is now determined from the San Joaquin Valley (602020) Index (basin runoff based). These criteria are shown in Appendix A, *Water Resources Inventory*, and are summarized by annual flow in Table 3-1.

Table 3-1. San Joaquin Valley Index Criteria by Annual Flow

Water Year Type	Annual Release (TAF)
Critical	184.3
Dry	233.3
Below Normal	344.6
Above Normal	344.6
Wet	476.3

3.2 Groundwater Supply

SSJID conjunctively uses surface water supplies from the Stanislaus River and groundwater through District well pumping and through private pumping by District customers. SSJID's ability to use groundwater supplies has a direct impact on the District's need to use its water rights on the Stanislaus River. In this section, factors affecting groundwater supplies are discussed.

The District owns and operates 28 deep wells in the western portion of the service area. Wells are primarily used to lower groundwater levels in areas of shallow groundwater and promote drainage of crop root zones; these wells also provide a source of supplemental water supply. At the time of the WMP analysis, District and private groundwater pumping use was estimated at about 40 TAF per year (SSJID 2015). As per the *SSJID 2020 Agricultural Water Management Plan* (AWMP), District and private groundwater pumping use increased to about 65 TAF per year (SSJID 2021).

Deep percolation of applied surface water and seepage from District canals provides a significant benefit to local and regional groundwater users. Previous analyses have shown that recharge resulting from SSJID's surface water supply serves as a primary source of recharge to the Eastern San Joaquin Groundwater Subbasin. According to the *SSJID 2015 Agricultural Water Management Plan* (SSJID 2015) and time of WMP analysis, net recharge within the District was approximately 79 TAF per year on average from 2005 through 2014. As per the 2020 AWMP, net recharge within the District has decreased to about 69 TAF per year on average from 2005 through 2019 (SSJID 2021). SSJID is currently refining its ability to estimate and calculate private groundwater pumping on an annual basis.

Although the District provides a significant source of recharge to the subbasin, a large cone of depression formed north of SSJID where surface water supplies are limited. As a result, groundwater flow under SSJID now flows in a northerly direction rather than to the west (SSJID 2015). During drought years when surface water availability is reduced, the lowering of groundwater levels adjacent to the District is likely to be exacerbated. The ability of SSJID to ensure continued access to groundwater supplies to its customers is primarily supported by the historical use of Stanislaus River water. As SSJID becomes more efficient in its use of surface water, additional water may be available for conjunctive water management actions.

SSJID, in conjunction with OID, is pursuing the ability to perform long-term water transfers to Stockton East Water District (SEWD) and Central San Joaquin Water Conservation District (CSJWCD), which will supplement water demands during below normal and dry water years (Eastern San Joaquin Groundwater Authority [ESJGWA] 2019). Water transfers will allow SEWD and CSJWCD to have increased surface water availability, reducing the need to supplement supplies with groundwater. In addition, SSJID is enhancing local groundwater supplies by providing treated surface water to the Cities of Manteca, Escalon, Lathrop, and Tracy.

3.3 South San Joaquin Irrigation District Baseline Water Demand

Section 7, *Water Resources Analysis* and Appendix A, *Water Resources Inventory* contain details regarding the SSJID baseline water demand.

3.4 Municipal Water Agreements

SSJID is currently providing municipal water supply to three municipalities as part of the South County Water Supply Program (SCWSP). The SCWSP was developed through a collaborative effort between SSJID and the Cities of Manteca, Escalon, Lathrop, and Tracy to provide treated drinking water and supplement the City's existing groundwater supplies. Contractual water allotments for each of the municipal partners to the SCWSP are presented in Table 3-2.

Table 3-2. South County Water Supply Program Water Allotments by City (acre-foot per year)

Phase	City				Total
	Escalon	Lathrop	Manteca	Tracy	
I	2,015	8,007	11,500	10,000	31,522
II	2,799	11,791	18,500	10,000	43,090

Note: Only Phase I water allotments are included in existing water service agreements

Over the 10-year period, 2009 through 2018, the total diversion of raw water to the water treatment plant (WTP) for the SCWSP partners has averaged 18,527 acre-foot per year (AFY) with a maximum of 21,046 AFY in 2018. WTP demands are rising with SSJID delivering 24,043 acre-feet in the 2021 water year. SSJID plans to continue the development of the SCWSP up to existing obligations.

3.5 Existing Water Transfers

Existing water transfers include: (1) irrigated lands adjacent to SSJID and OID that have benefited from annual contracts for water delivery through the Districts; and (2) water transfers made by SSJID and OID to others. These water transfers are outlined briefly in this section.

OID historical water transfers are presented in this section along with SSJID historical water transfers; the two Districts share a water right and commonly engage in joint transfer agreements.

3.5.1 Annual Contracts to Lands Adjacent to the Districts

Historically, OID has made water available to adjacent lands on a discretionary basis through annual contracts when water supplies were sufficient. These annual contracts have typically served lands adjacent to OID where water could be delivered through OID's existing water delivery infrastructure to a point of connection that outside water users could access water for their uses. During the 2005 through 2016 period, annual contracts ranged from 220 to 8,380 AFY and averaged 4,230 AFY. Historically, SSJID has not made water available on an annual contract basis to adjacent lands. However, like OID, SSJID could make water available for these uses on a discretionary basis, when sufficient water supply and distribution capacity is available to meet other District commitments.

3.5.2 Water Transfers by the Districts

SSJID and OID have made water available to other water districts and state and federal entities on a discretionary basis through water transfers, when water supplies were sufficient. Transfers made to SEWD and CSJWCD provided supplemental water to these water districts that could not be otherwise satisfied through the CVP contracts with Reclamation. During the 2005 through 2014 period where a complete record for SSJID and OID was available, annual water transfers ranged from lows of 130 and 325 AFY in 2012 and 2014 respectively, up to a high of 100,390 AFY in 2009, averaging 50,060 AFY throughout the period.

Water transfers have been a part of SSJID's past water management decisions. While the ability to effectuate future water transfers is currently uncertain and unreliable for financial planning, SSJID will continue seeking transfer opportunities in the future to make full beneficial use of SSJID's water rights, bolster groundwater sustainability within the local groundwater subbasin, and supplement fisheries pulse flows for the benefit of environment and water users.

3.6 Other Basin Water Demands

3.6.1 Central Valley Project Contractor Deliveries

Reclamation holds CVP water contracts with SEWD and CSJWCD. The contracted water is released from NMR to Goodwin Dam, transported through Goodwin Tunnel to be delivered to the contractors. Reclamation has three long-term service contracts: one contract specifying that Reclamation provide up to 49 TAF per year (given a firm water supply) and two contracts specifying that Reclamation provide 106 TAF per year (given an interim water supply) (Reclamation 2008). Currently, Reclamation is providing the water to the CVP contractors through the procedures of an operating plan currently deployed to incorporate the *Reinitiation of Consultation on the Coordinated Long-term Operation of the Central Valley Project and State Water Project* (Reclamation 2020).

For purposes of modeling the New Melones Project in baseline conditions, CVP contractors are assumed to divert 102,000 AFY, subject to current water allocation protocols used by Reclamation. While 102,000 AFY exceeds the historical maximum annual CVP diversion over the last 25 years by 6,000 AFY, this value approximates the annual diversion to CVP contractors, assuming each entity receives up to their respective maximum monthly historical diversions through CVP contract deliveries and water transfers. For the year 2040 time horizon, it will be assumed the CVP contractors will divert 155,000 AFY, subject to current water allocation protocols.

3.6.2 Other Demands

Other demands for diversion of Stanislaus River water besides the SSJID, OID, and CVP contractor demands, include the following: (1) several small diversions in the upper basin above NMR, and (2) diversions by riparian water users along the Stanislaus River below New Melones for irrigation purposes. While these demands are relatively small compared with other demands on the system, they are quantified and considered in the NMR Operations Model as part of the District's water supply reliability analysis.

3.7 Compliance with the Water Conservation Act of 2009

The Water Conservation Act of 2009, also known as Senate Bill (SB) x7-7, required all agricultural water suppliers greater than 25,000 acres in size to prepare and adopt an AWMP by December 31, 2015 and update the plan every 5 years thereafter.

Required elements of the AWMP are set forth in the California Water Code, the California Code of Regulations, and in an AWMP guidebook prepared by DWR. General requirements include the following:

- Prepare and adopt an SB x7-7-compliant AWMP.
- Implement efficient water management practices.
- Submit documentation for Agricultural Water Measurement Regulation compliance.
- Submit an Aggregated Farm-Gate Delivery Report.

SSJID's Board adopted AWMPs, in compliance with SB x7-7, in 2015 and 2021 (SSJID 2015, 2021). SSJID has also complied with the requirements set forth in SB x7-7 by completing an assessment of flow measurement accuracy, measuring and reporting the volumes of water delivered to customers, adopting a pricing structure for water customers based in part on the quantity of water delivered, and implementing a number of other efficient water management practices.

3.8 Compliance with the Sustainable Groundwater Management Act

3.8.1 Sustainable Groundwater Management Act of 2014

In 2014, SGMA was signed into State law. SGMA requires Groundwater Sustainability Agencies (GSAs) with critically overdrafted basins or subbasins to develop Groundwater Sustainability Plans (GSPs). GSAs with critically overdrafted basins were required to begin implementing their GSPs in 2020 to achieve sustainable, local groundwater management by 2040. SSJID partnered with the cities of Escalon and Ripon to form the South San Joaquin GSA.

The California Department of Water Resources (DWR) identified the Eastern San Joaquin Groundwater Subbasin as one of the state's 21 critically overdrafted subbasins. The ESJGWA, comprised of 16 member agencies, developed a single GSP for the subbasin with a goal for approval, adoption, and implementation in 2020. The GSP was revised re-submitted to the DWR in July 2022. The Eastern San Joaquin Subbasin boundaries are shown on Figure 3-2.

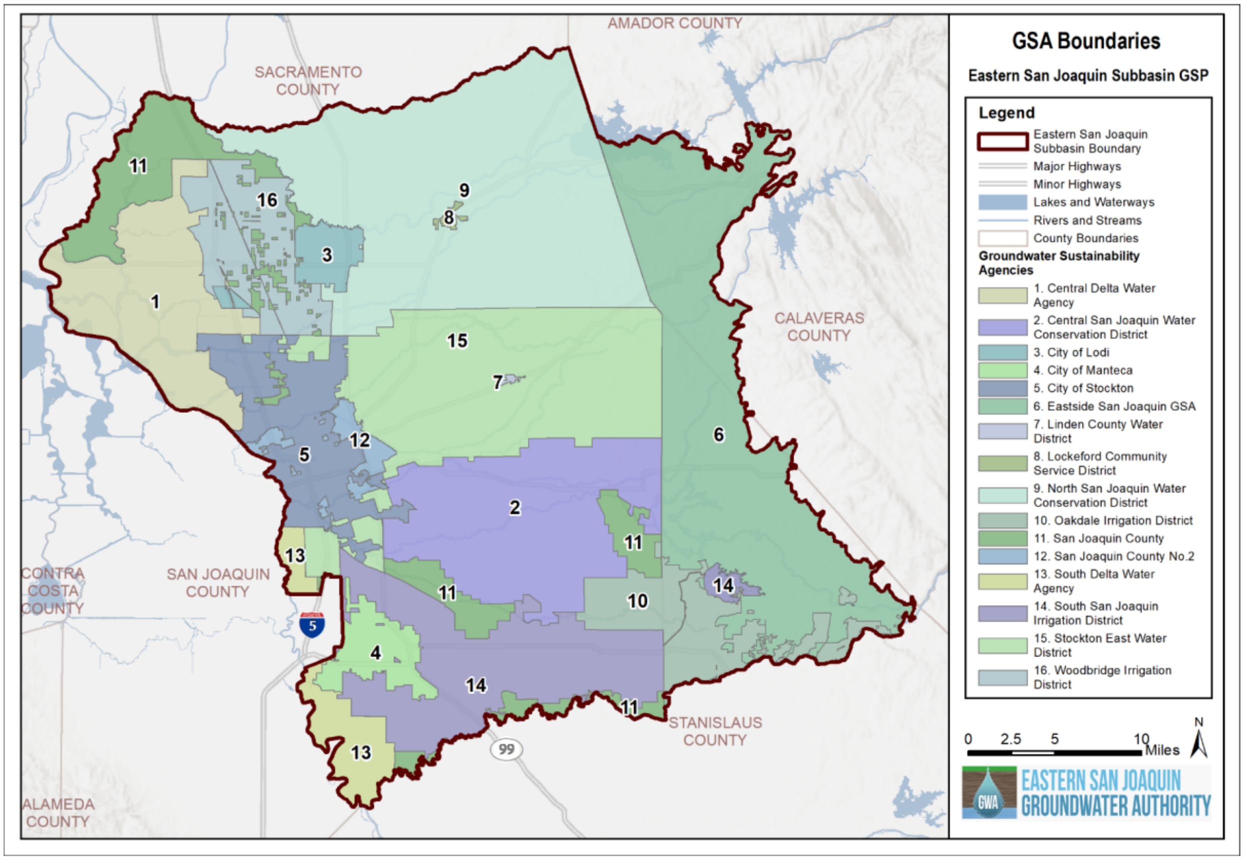
3.8.2 Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan

The Eastern San Joaquin Groundwater Subbasin has been designated by DWR to be in critical groundwater overdraft. In compliance with SGMA, the ESJGWA published the Eastern San Joaquin Groundwater Subbasin GSP in November 2019 (ESJGWA 2019) and was adopted before the January 2020 deadline by all 16 GSAs. Subsequently, the GSP was revised and readopted by all 16 GSAs in July 2022 and re-submitted to DWR. The ESJGWA jurisdiction is defined by the boundaries of the Eastern San Joaquin Groundwater Subbasin (Figure 3-2).

Groundwater sustainability will be achieved by implementing water supply projects that either replace groundwater use, or supplement groundwater supplies to attain the estimated pumping offset and/or additional recharge identified in the GSP. A list of 23 projects is provided in the GSP, including direct and in-lieu recharge, intra-basin water transfers, demand conservation, water recycling, and stormwater reuse projects. The projects are classified into two categories based on project status: (A) likely to be implemented in the next five years; and (B) longer-term/conceptual projects. Funding is needed to support the implementation of all projects identified in the GSP.

Currently, pumping restrictions have not been proposed for the subbasin. However, member GSAs maintain the flexibility to implement such demand-side management actions in the future, if needed. If projects are not implemented, or if monitoring efforts demonstrate that the projects are ineffective in achieving the recharge and/or offset targets, the ESJGWA will convene a working group to evaluate supply-side and demand-side management actions such as groundwater pumping curtailments and land fallowing.

Figure 3-2. Eastern San Joaquin Groundwater Subbasin Boundaries



Source: Eastern San Joaquin Groundwater Authority 2019

3.9 Climate Change Considerations

Climate change is projected to impact California with increased temperatures, fewer wet days, increased precipitation on the wettest days, wetter winters, and drier spring and autumn seasons by the end of the century. While significant uncertainty remains regarding the timing and magnitude of the future impacts, it is important to acknowledge the potential for climate change in the WMP, which includes a 30-year strategic vision for SSJID water management.

Annual average maximum temperature of San Joaquin County is projected to increase by 2.6 degrees Celsius (°C) under a medium emission scenario and 4.5°C under a high emission scenario by the end of the century. Annual average minimum temperatures are projected to increase by 2.4°C under a medium emission scenario and 4.2°C under a high emission scenario by the end of the century. (California Natural Resources Agency 2021). Annual average precipitation of San Joaquin County is projected to change by -0.1% under a medium emission scenario and +0.1% under a high emission scenario by the end of the century. (California Natural Resources Agency 2021) For the San Joaquin Valley, projected changes show more than 50% decline on snowpack, 13% more precipitation coming in extreme events, more frequent very dry (+4 to 10%) and very wet years (+34 to 57%) toward the end of the century (California Natural Resources Agency 2021).

In terms of water resources management, climate change could impact the demand and supply of SSJID, and Tri-Dam hydropower operations in the future. A summary of potential impacts follows.

Agricultural Demand. The rise in temperature potentially increases crop evapotranspiration (ET) by 3% by 2050. However, increasing atmospheric carbon dioxide can reduce ET, thereby partially offsetting some of the effects of increasing temperature. In addition, changing temperature effects on crop growth patterns may affect crop development, yields, and cultural practices, which in turn affect irrigation water demands.

Supply. Stanislaus Basin runoff is expected to experience significant shifts in seasonal timing but not significant changes in average annual runoff under median climate change scenarios. The projected change in average annual unregulated inflow to NMR is a reduction of 2.2% by 2040. These changes in runoff and NMR inflow timing result from earlier snowmelt and with more precipitation falling in the form of rain compared to snow due to elevated temperatures (California Energy Commission 2018). Given the large capacity of NMR relative to average annual basin runoff, NMR will generally dampen the changes in reservoir inflow timing and potential water supply impacts on downstream water rights holders (including SSJID and OID).

Hydropower. The timing of runoff in the upper Stanislaus Basin will likely shift in future climate change scenario. The seasonality of the flow will be impacted by projected increases in flow from September through May and reductions in flow from June through August. An operations model that simulates reservoir operations and hydropower generation is not available for use in the WMP. The operators of Tri-Dam are expected to adapt operations over time with hydrologic trends and continue to maximize power generation (avoid spills) with a shift in timing of power generation resulting from changes in runoff timing.

3.10 Other Regulatory and Planning Issues

As outlined in the previous section on surface water supply and subsections on state regulations and federal regulations, ongoing regulatory developments continue to have the potential to impact SSJID's operations. These issues involve multiple different state and federal agencies, water users, nongovernmental agencies, and other stakeholders and are dynamic in nature. SSJID continues to work with state and federal agencies and key stakeholders in ongoing regulatory processes to better understand potential impacts, while advocating for SSJID's water rights, facilities, and the communities served.

3.11 Summary

Several factors affect the ability of the Stanislaus River water supply and local groundwater supplies to meet the demands of existing baseline uses, including water rights for storage and diversion, NMR operational agreements, and state and federal environmental regulations. Each of these factors are outlined and described in this document. Information from Appendix A, *Water Resources Inventory* and Section 7, *Water Resources Analysis* was integrated into the baseline water supply and demand assumptions used for the baseline water supply reliability assessment.

Baseline Stanislaus River water supply conditions to meet SSJID demands were based on applicable requirements for the operation of NMR as of early 2020. Baseline groundwater supply conditions to meet SSJID demands were based on current groundwater regulation as of early 2020. While regulation under SGMA has the potential to restrict groundwater use within SSJID's water service area in the future, the adopted Eastern San Joaquin Groundwater Subbasin GSP does not currently limit groundwater pumping within the SSJID water service area.

SSJID is currently supplying water to three municipalities as part of the South County SCWSP. The SCWSP was developed through a collaborative effort between SSJID and the Cities of Manteca, Escalon, Lathrop, and Tracy to provide treated drinking water and supplement the City's existing groundwater supplies. SSJID currently has commitments to supply up to 32 TAF under Phase 1 and up to 43 TAF under Phase 2 of the SCWSP. SSJID plans to continue the development of the SCWSP up to existing obligations.

Water transfers have been a part of SSJID's past water management actions. While the ability to effectuate future water transfers is currently uncertain and unreliable for financial planning, SSJID will continue seeking transfer opportunities in the future to make full beneficial use of SSJID's water rights, bolster groundwater sustainability within the local groundwater subbasin, and supplement fisheries pulse flows for the benefit of environment and water users.

SSJID's Board adopted AWMPs, in compliance with SB x7-7, in 2015 and 2021. SSJID has also complied with the requirements set forth in SB x7-7 by completing an assessment of flow measurement accuracy, measuring and reporting the volumes of water delivered to customers, adopting a pricing structure for water customers based in part on the quantity of water delivered, and implementing a number of other efficient water management practices. SSJID has met its current obligations under SB x7-7, will continue to prepare AWMPs and assess efficient water management practices, and has included projects in the CIP to satisfy future obligations for on-farm metering.

SSJID is an active member of the ESJGWA and will continue to track its contributions to the groundwater basin to maintain positive balance and to implement groundwater projects that benefit the basin as SSJID has the opportunity. Continued use of Stanislaus River water for SSJID's agricultural and municipal customers is a key cornerstone to ensuring sustainable groundwater future as required by the SGMA. SSJID deliveries of Stanislaus River water and the associated recharge from Woodward Reservoir and the Main Distribution Canal enables SSJID to be a net contributor to the underlying groundwater basin. SSJID continues to engage state and federal agencies and key stakeholders in ongoing regulatory processes to better understand potential impacts and advocate for the protection of SSJID's water rights, facilities, and the communities served.

4. On-farm System Assessment

The purpose of evaluating on-farm systems is to understand and document current water management practices at the field level across the District, including current irrigation practices, trends in on-farm water management, and grower preferences for water sources and water delivery schedules. This information helps to inform the development of infrastructure alternatives, water balance projections of future water savings, levels of surface water subscription, and policy considerations for the WMP.

4.1 Methodology

The on-farm systems evaluation synthesizes information gathered primarily from the following past studies and reports as listed in Section 10, *References*. In addition to information from these references, input from stakeholder outreach documented during Phase 1 of the WMP was incorporated, and additional refinement of water user characterization data was performed by SSJID staff members during Phase 2.

4.2 Cropping Patterns and Irrigation Methods

As described in the *Draft Historical and Forecasted Land Use Technical Memorandum* (SSJID 2019) and presented in Section 5, *Land Use Trends and Forecasting* crops and other land uses were grouped into nine representative land use categories, which include the predominant uses of irrigated lands. These classifications generally follow the same classifications used in the 2015 AWMP. The predominant crop category within SSJID is almonds, which represents 66% of the District irrigated acres as of 2018. In combination with other tree crops, such as walnuts and peaches, the total orchard tree crop acreage represents 72% of the District's irrigated area. Other field crops, such as corn (11%), pasture (6%), and alfalfa (2%), comprise 19% of the District's irrigated acres. Grapes comprise 4% of the irrigated area with the remaining 5% being in other crops and idle lands.

Typically, the corn, pasture, and alfalfa acreage are flood irrigated, while the tree crops have a mixture of pressurized systems (such as drip, micro, or sprinkler) and flood irrigation systems (depending on orchard age, parcel size, soil differences), and grower preference. In addition, many tree crops are irrigated using a mixture of pressurized and flood irrigation systems throughout the year for various purposes, depending on water source availability and agronomic needs (for example, frost protection, salinity control, soil moisture management). Soil type differences within the District may impact irrigation methods to some extent. However, soils across SSJID are generally deep and well drained to somewhat excessively drained, with soil textures mostly within loamy sand to sandy loam textural classes.

In 2018, California Polytechnic State University (Cal Poly) at San Luis Obispo's Irrigation Training and Research Center (ITRC) collected on-farm irrigation method data by conducting field site visits as part of the *SSJID Water Delivery Infrastructure Modernization Plan* effort (ITRC 2018). During the current WMP Phase 2 work, SSJID staff members also performed a comprehensive review and update of the dataset to reflect current conditions including on-farm irrigation methods, water delivery source information, and status of SSJID water service to parcels. Irrigation customer parcels within SSJID were classified into one of the following categories, as shown in Table 4-1. Figure 4-1 presents the data spatially across the District.

Table 4-1. On-farm Irrigation Methods and Water Sources Information for South San Joaquin Irrigation District Irrigated Parcels (2018)

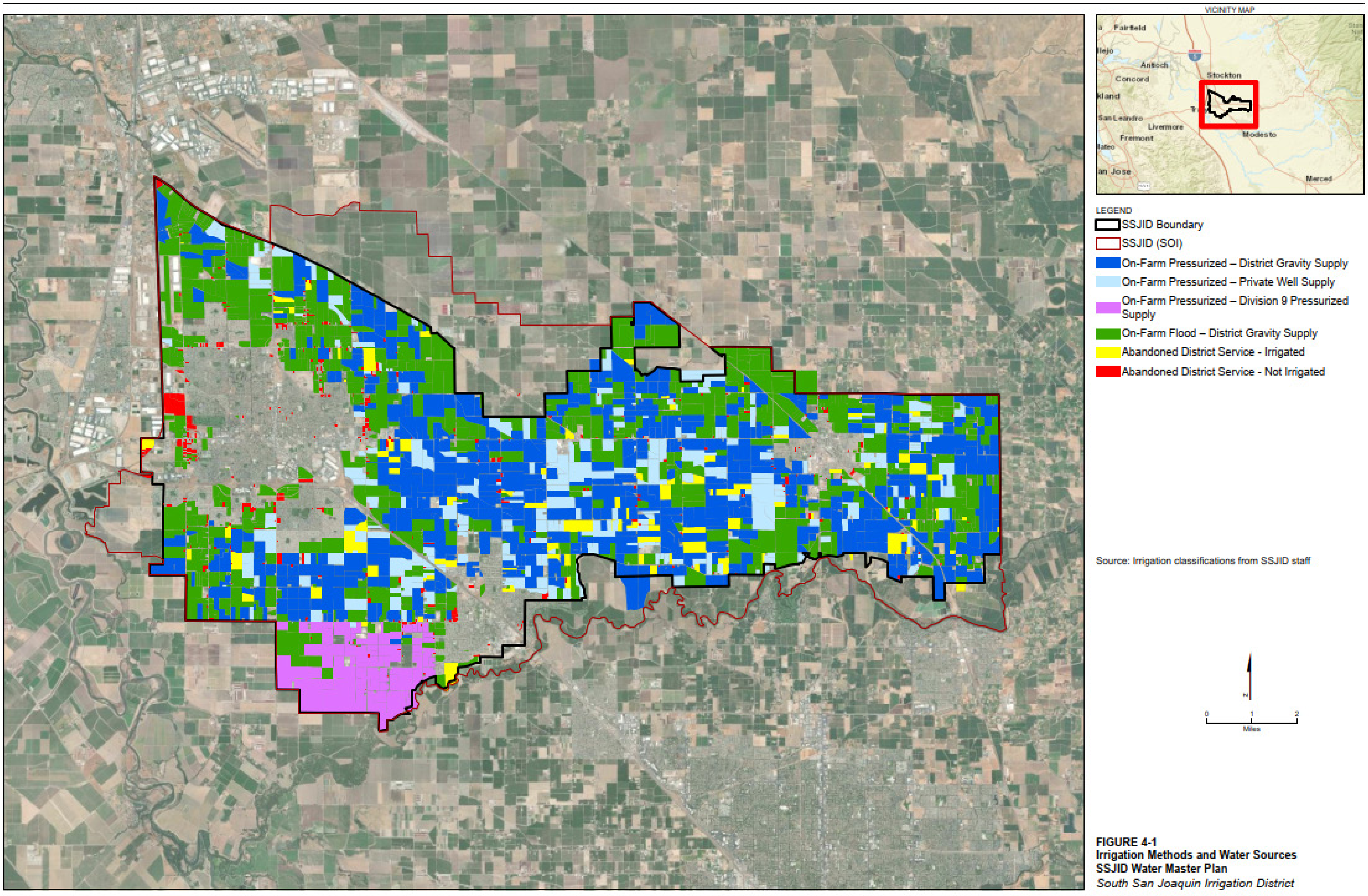
Irrigation Method and Water Source Category	Total acres	% of Total acres within SSJID
On-farm Pressurized—District Gravity Supply—These are parcels with pressurized primary on-farm irrigation systems and are supplied primarily by District water through a gravity delivery. These parcels may also have private wells that they rely upon for a backup water supply.	22,020	39%
On-farm Pressurized—Private Well Supply—These are parcels with pressurized primary on-farm irrigation systems and are supplied primarily by a private well supply. These parcels have rights for full District water service but are currently electing to rely on private wells for irrigation water supply.	6,830	12%
On-farm Pressurized—Division 9 Pressurized Supply—These are parcels with pressurized primary on-farm irrigation systems and are supplied by District water through the Division 9 pressurized delivery system. These parcels may also have private wells that they rely upon for a backup water supply.	3,162	6%
On-farm Flood—District Gravity Supply—These are parcels with flood irrigation as the primary on-farm irrigation system and are supplied primarily by District water through a gravity delivery. These parcels may also have private wells that they rely on for a backup water supply, but generally do not.	20,767	37%
Abandoned District Service—Irrigated—These are parcels with service abandonment agreements that are irrigated using private wells.	2,153	4%
Abandoned District Service—Not Irrigated—These are parcels with service abandonment agreements and are no longer irrigated (excludes residential, commercial, and industrial parcels).	1,038	2%
Total	55,971	100%

Notes:

1) Parcels with pressurized primary on-farm irrigation systems may also use flood irrigation as a secondary backup irrigation method.

2) A service abandonment agreement is an agreement with the District, and a parcel owner that revokes the Districts obligation to supply water to the parcel and in turn reduces or eliminates the annual fees. Parcel owners who enter an abandonment agreement but continue to irrigate with private well facilities are charged a “recharge fee” amounting to half (50%) of the District’s standard annual acreage fee. Parcel owners who enter an abandonment agreement, change land use, and no longer intend to irrigate can have their fee eliminated. Parcel owners can go through a process with these agreements to amend the service abandonment agreement and restore District service at a later date.

Figure 4-1. Irrigation Methods and Water Sources

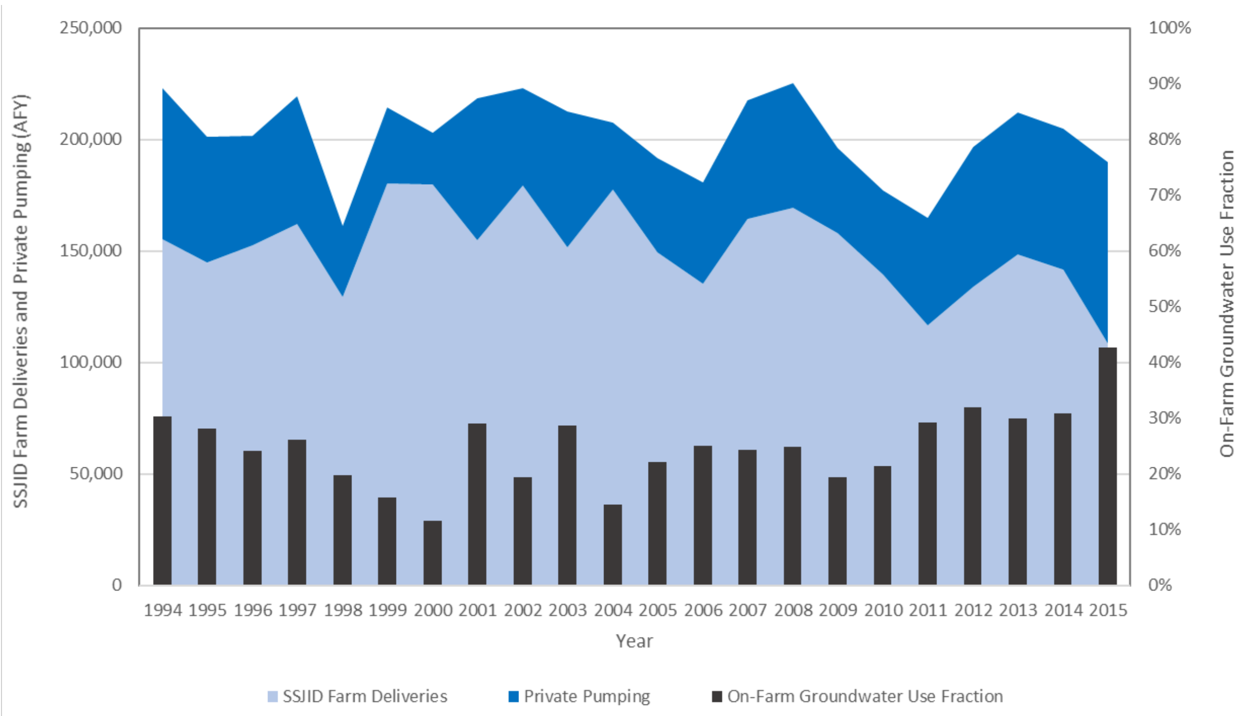


4.3 On-farm Water Supply Sources

SSJID irrigated lands with a primary District gravity supply account for 76% of total irrigated acres in the District. While these lands may also use private wells for backup groundwater supply, District deliveries comprise the primary water source for irrigation.

To evaluate the magnitude of groundwater usage through private pumping by SSJID irrigation customers, water use summaries from the 2015 AWMP were evaluated (SSJID 2015). Figure 4-2 summarizes private pumping groundwater use relative to District deliveries and total on-farm water use for the 1994 through 2015 irrigation seasons. Prior to 2015, the fraction of total on-farm water supply met by private pumping ranged from 12 to 32% and averaged 24%. Due to reduced District water availability due to drought in 2015, private pumping increased to 43% of the on-farm water supply in 2015.

Figure 4-2. Historical Patterns of On-farm Water Supply Source Usage



4.4 On-farm Metering and Measurement

SB x7-7 requires delivered water volumes to be measured with "sufficient accuracy" along with documentation of metering accuracy in the water supplier's AWMP. As presented in the 2015 AWMP, SSJID's *2012 Agricultural Water Measurement Corrective Action Plan* outlined efforts to advance District-wide metering and measurement compliance. As part of the compliance process, SSJID developed a 3-year schedule and identified the following tasks: (1) install acoustic Doppler sensors at specified measurement locations, (2) install magnetic flow meters at pump deliveries, and (3) include new flow measurements into the delivery volume calculation database. The total budgeted cost for this effort was $4.8 million.

Since development of the *2012 Agricultural Water Measurement Corrective Action Plan*, SSJID improved District-wide metering and measuring efforts with on-farm meter installation. Magnetic flowmeters were installed during the Division 9 pressurization pilot project and throughout the District with all new drip/sprinkler irrigation systems through SSJID's On-farm Water Conservation Program. Active from 2011 through 2014, the On-farm Water Conservation Program offered an 80% cost share to growers for meter purchase and installation. Throughout the 2011 through 2015 period, the combined Division 9 and On-farm Water Conservation Program efforts resulted in 194 magnetic meter installations to measure water deliveries to 8,731 acres (SSJID 2015). Since 2013, District policies require that new pressurized systems proposed to be served by the District include magnetic meters as part of the installation.

Additional details of District metering and measurement efforts can be found in the 2020 AWMP. As of 2020, more than 310 magnetic flow meters were installed throughout the District. Continued installation of magnetic flow meters is required for all new drip/sprinkler irrigation systems and system modifications requiring District permitting and oversight.

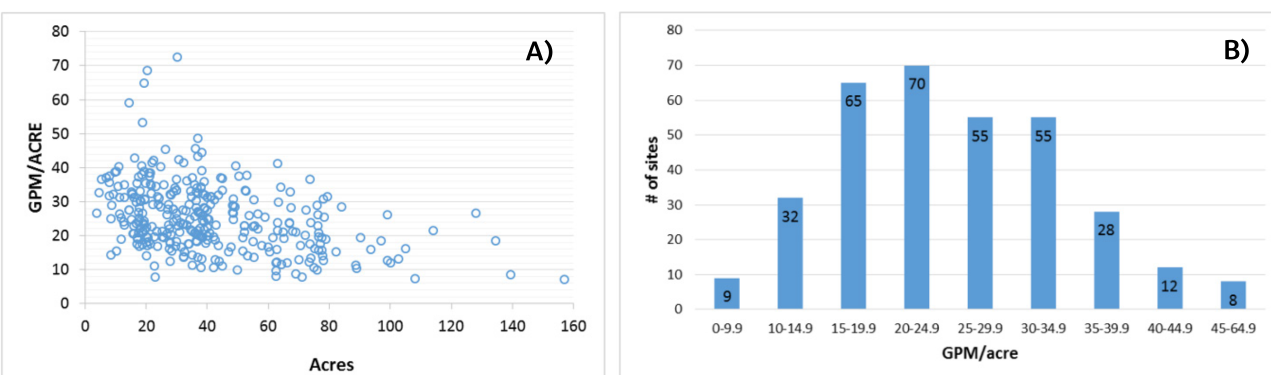
4.5 Scheduling, Frequency, and Duration of Irrigation Events

SSJID's water delivery infrastructure was originally developed to serve irrigation customers that were almost exclusively using flood irrigation to irrigate their crops on a 10-day rotation, which is less optimal for pressurized irrigation systems (such as drip, micro, and sprinkler). The difference in optimal irrigation intervals, unit flow rates per acre served when irrigating, and schedule flexibility between flood and pressurized systems can be explained by the different fundamental design principles used for those irrigation systems.

Flood systems require a specified flow for a minimum amount of time to cover a field fully and uniformly over the course of many hours before they start infiltrating water uniformly; they rely on flood wave advance and recession across the field surface. They are typically designed for a standard combination of flow x minimum time equals volume (and depth) to achieve a design distribution uniformity and application efficiency. With sprinkler systems, the delivery systems are charged quickly, begin uniform irrigation within minutes, and apply a uniform depth of water across a wide range of irrigation run times and associated applied irrigation water depths. As a result, users have significantly more flexibility to vary irrigation depth and intervals between irrigation events to adjust to the ET demands than with flood irrigation, but are currently limited by District policies for the 10-day irrigation rotation.

As part of the work to develop the 2018 SSJID Water Delivery Infrastructure Modernization Plan, ITRC conducted a survey of SSJID customers' on-farm irrigation systems. As part of the survey, ITRC staff members collected information on the on-farm pumping rates and field sizes for on-farm pressurized systems to evaluate the design unit water delivery rates (gallons per minute per acre [gpm/acre]) for pressurized systems across the District. Figure 4-3, reproduced from the ITRC report, presents a summary of the survey results.

Figure 4-3. District On-farm Unit Water Delivery Rate Survey Results



Source: Cal Poly San Luis Obispo ITRC 2018

The results show a wide range in unit delivery rates ranging from 7 to more than 70 gpm/acre with the majority of systems sized within the 20 to 25 gpm/acre range. Large fields tended to be sized at lower unit delivery rates due to the fields generally being broken up into multiple irrigation sets. For pressurized irrigation systems in California that do not have water supply schedule limitations, systems are typically designed for unit delivery rates of less than 10 gpm/acre. For reference, an irrigation system sized for 24/7 operations during the peak annual standard ETc[1] period would typically be sized at 6.5 to 7.0 gpm/acre.

Balancing water deliveries across water users with widely varying unit flow rate and irrigation scheduling needs and goals is one of the challenges experienced by District staff members scheduling water deliveries. In addition, SSJID irrigation customers with pressurized on-farm systems are increasingly looking for more schedule flexibility to receive water on shorter rotations. This is one of the key issues that is being evaluated within the WMP infrastructure planning efforts of the WMP.

4.6 Tailwater and Drainwater Management

While the shift in on-farm irrigation water management has reduced the amount of on-farm-tailwater generated and discharged into District drains, operational spills have slowly increased due to water management inefficiencies that occur when providing service to pressurized systems. The District's distribution infrastructure was designed to provide flood service, which allows more forgiveness in flow rate delivery compared to pressurized systems. Existing flow control infrastructure does not allow for operators to manually refine system flows to match the precise demands of pressurized systems and the variations in flow rates that occur when multiple systems irrigate simultaneously. As a result, District drains will continue to need maintenance to not only handle on-farm discharges, but to also convey operational spills and urban stormwater discharges where covered under existing drainage agreements. The continued maintenance of these drainage facilities, along with enhanced flow management strategies, needs to be considered in future operations and maintenance planning under the WMP.

Operational spills outside the SSJID water service area that result from on-farm tailwater and canal operations can be reduced through projects that improve internal balancing of calls and cuts in canal deliveries (regulation reservoirs) and through projects that capture and redistribute drainage water near the operational spill points. These types of projects represent some of the better opportunities for in-District water conservation being evaluated within the WMP.

4.7 Conclusions

SSJID was originally developed for flood irrigation service, but 57% of District irrigated lands are now irrigated with a primary pressurized on-farm irrigation system. Given the high percentage of orchard crops (72%), the fraction of irrigated lands using pressurized on-farm systems is likely to grow in the future. At the same time, flood irrigation will continue to be the primary irrigation method for some crops and will continue to be used as a secondary method of water delivery to orchard crops using primary pressurized on-farm systems. SSJID has developed projects to improve the level of service to some portions of the District, but other portions require additional work to improve the level of service in particular for irrigation customers with pressurized on-farm systems.

The majority of SSJID irrigated lands (82%) rely primarily on SSJID irrigation water deliveries as their primary irrigation water supply. This includes 76% of SSJID irrigated lands served by a primary District gravity delivery and 6% that are served by the Division 9 pressurized delivery system.

While the WMP infrastructure alternatives are being developed to improve level of service and water delivery flexibility to promote preferred use of District supplied water, impacts to water rates must also be considered along with policy decisions that mitigate increases in private pumping by SSJID customers. As the SGMA regulations are phased in over time, the management of SSJID customer water supply sources will be important to meet the GSP compliance metrics.

[1] ETc = standard evapotranspiration rate

5. Land Use Trends and Forecasting

This section assesses historical agricultural and urban land use changes and forecasts significant future trends within SSJID. The agricultural and urban land use forecasts were used to inform the development of infrastructure plans and long-term water resources management alternatives to serve future projected in-District water demands. More information is provided in Appendix C, *Historical and Forecasted Land Use*.

5.1 Current Land Use Evaluation

5.1.1 Data Sources

The land use trends and forecasting effort included an assessment of DWR crop surveys, City of Manteca, City of Ripon, City of Escalon, and San Joaquin County land use mapping data, City and County planning documents, and SSJID irrigation customer data. This data, in combination with input from SSJID Water Operations staff members, were used to compare and contrast data sources, evaluate historical trends, and project future land use changes to the planning horizon of 2040.

5.1.2 Current Land Use Summary

The current SSJID service boundary includes a total of 72,290 acres, and the SSJID sphere of influence for irrigation service approved by the San Joaquin County Local Agency Formation Commission covers an additional 13,970 acres. SSJID boundaries also overlap with the incorporated areas of Escalon, Manteca, and Ripon.

Crops and other land uses were grouped into representative land use categories to evaluate historical land use trends and to forecast future land use within the SSJID service area. This breakdown of land use covers the predominant uses of irrigated lands, and generally follows the same classifications used in the 2015 AWMP. A brief description of each category, along with the relative area represented in the 2018 SSJID cropping report, is presented in Table 5-1.

Table 5-1. Description of South San Joaquin Irrigation District Irrigated Land Use Categories

Land Use Category	2018 SSJID Land Use Survey Irrigated acres [a]	% of Total Irrigated acres within SSJID	Description
Almonds	35,104	66%	This category primarily includes almonds (97% in 2015) but can include small percentages of other minor tree crops, such as apples, cherries, olives, and pistachios.
Corn	5,640	11%	This category is predominantly corn and oats that are double-cropped with a summer corn and winter oats crop. Both crops are commonly harvested as green-chop silage used for animal feed in local dairies.
Pasture	3,207	6%	This category is primarily permanent irrigated pasture use. However, a small amount of landscape and golf course turf grass and sudan grass are also included.
Grapes	2,387	4%	This category is primarily wine grapes.
Walnuts	1,945	4%	This category is walnut orchards.
Peaches	1,135	2%	This category is peach orchards.

Land Use Category	2018 SSJID Land Use Survey Irrigated acres [a]	% of Total Irrigated acres within SSJID	Description
Other crops	1,013	2%	This category includes small acreages of miscellaneous row crops, field crops, and nurseries.
Alfalfa	876	2%	This category includes alfalfa and clover.
Water	10	0%	This category is ponds for onsite irrigation water regulation.
Idle	1,903	4%	This category covers lands in transition between crops and are reported as idle for the year.
Total	53,222	100%	

[a] Irrigated acres are estimated from gross parcel acres by multiplying 0.94 against gross acres. A total of 56,619 gross acres were SSJID irrigation water customer accounts in 2018.

Overall, 56,619 gross acres were SSJID irrigation water customer accounts in 2018, which covers 78% of the SSJID water service area. The remaining lands within the service boundary are primarily urban lands.

For the urban land use analysis, urban areas were broken down into the following primary centers of urban activity: (1) City of Manteca, (2) City of Ripon, (3) City of Escalon, and (4) Other unincorporated communities within SSJID.

Figures showing the in-District agricultural and urban lands are presented in Appendix C, *Historical and Forecasted Land Use*.

5.2 Forecasted Land Use

5.2.1 Land Use Forecasting Methods for Urban Lands

The land use forecasting effort started with projecting urbanization due to the conversion of agriculture to urban land uses out to the 2040 planning horizon. These increases in the urban land uses within SSJID are projected using the following three separate methods: (1) Population-based projections, (2) General Plan development area projections, and (3) historical SSJID irrigated area trend projections.

5.2.2 Urban Lands Forecast

5.2.2.1 Population Projections

Per the San Joaquin Council of Governments (SJCOG), the population of San Joaquin County is projected to increase from 728,644 in 2015 to 1,020,862 in 2040. Urbanization and the conversion of agriculture to urban land uses will fuel population growth (SJCOG 2018). The SJCOG population projections, by relevant local jurisdiction and county-wide, are shown in Table 5-2. These population projections are also consistent with the California Department of Finance (DOF) projections.

Table 5-2. San Joaquin Council of Governments 2040 Population Forecast by Local Jurisdiction

City	2015	2020	2025	2030	2035	2040	2015 to 2040 Increase	
Manteca	71,831	77,018	82,912	88,855	95,930	103,958	32,127	45%
Ripon	15,359	16,525	17,850	19,186	20,777	22,582	7,223	47%
Escalon	7,369	7,612	7,889	8,168	8,501	8,878	1,509	20%
San Joaquin County	728,644	775,819	829,426	883,484	947,835	1,020,862	292,218	40%

Source: SJCOG 2018

5.2.2.2 Urban Conversion of Agricultural Lands Results and Summary

Table 5-3 summarizes the results of the three separate estimation methods applied across the SSJID water service area. The resulting urban conversion estimates range from a high of 10,090 acres for the general plan development area projections, to 6,296 acres from the population-based projections, to a low of 5,266 acres based on historical trends in SSJID irrigated area.

Table 5-3. Comparison of Projected Urban Conversion of Agricultural Lands in the District's Water Service Area between 2014 and 2040

Urban Area	General Plan Development Area Projections (acres)	Population-based Projections (acres)	Historical SSJID Irrigated Area Trend Projections (acres)
Manteca	5,324	4,516	N/A
Ripon	3,258	1,536	N/A
Escalon	1,405	244	N/A
Non-agricultural planning areas within unincorporated San Joaquin County	104	N/A	N/A
Total	10,090	6,296	5,266

The historical SSJID irrigated area trend projection results were selected for use in the WMP for reasons outlined in Appendix C, *Historical and Forecasted Land Use*. While the estimated land conversion estimates were evaluated between 2014 (the year of SSJID spatial cropping data from DWR) and 2040 (the planning horizon of the WMP), the baseline land use year used for the WMP is 2018. In 2018, SSJID was serving 53,222 irrigated acres and 56,619 gross acres. Using the historical trend projections, the SSJID irrigated area to be served in 2040 is estimated to be 47,635 irrigated acres and 50,676 gross acres. **This translates into an estimated reduction of 5,587 irrigated acres and 5,944 gross acres due to agricultural to urban land conversion between 2018 and 2040.**

While the general plan projections likely overestimate the total urban conversion that will occur by 2040, the identification of agricultural lands at risk to development (Figure 5-1) are helpful for infrastructure planning. When planning for SSJID infrastructure projects that require land acquisition of easements and long-term operations and maintenance (O&M), siting new facilities outside of areas planned for development may help decrease capital and O&M costs and reduce the potential for assets that are eventually surrounded by urban development.

Figure 5-1. City General Plan Planning Areas in SSJID and Potential Agricultural to Urban Conversion Locations

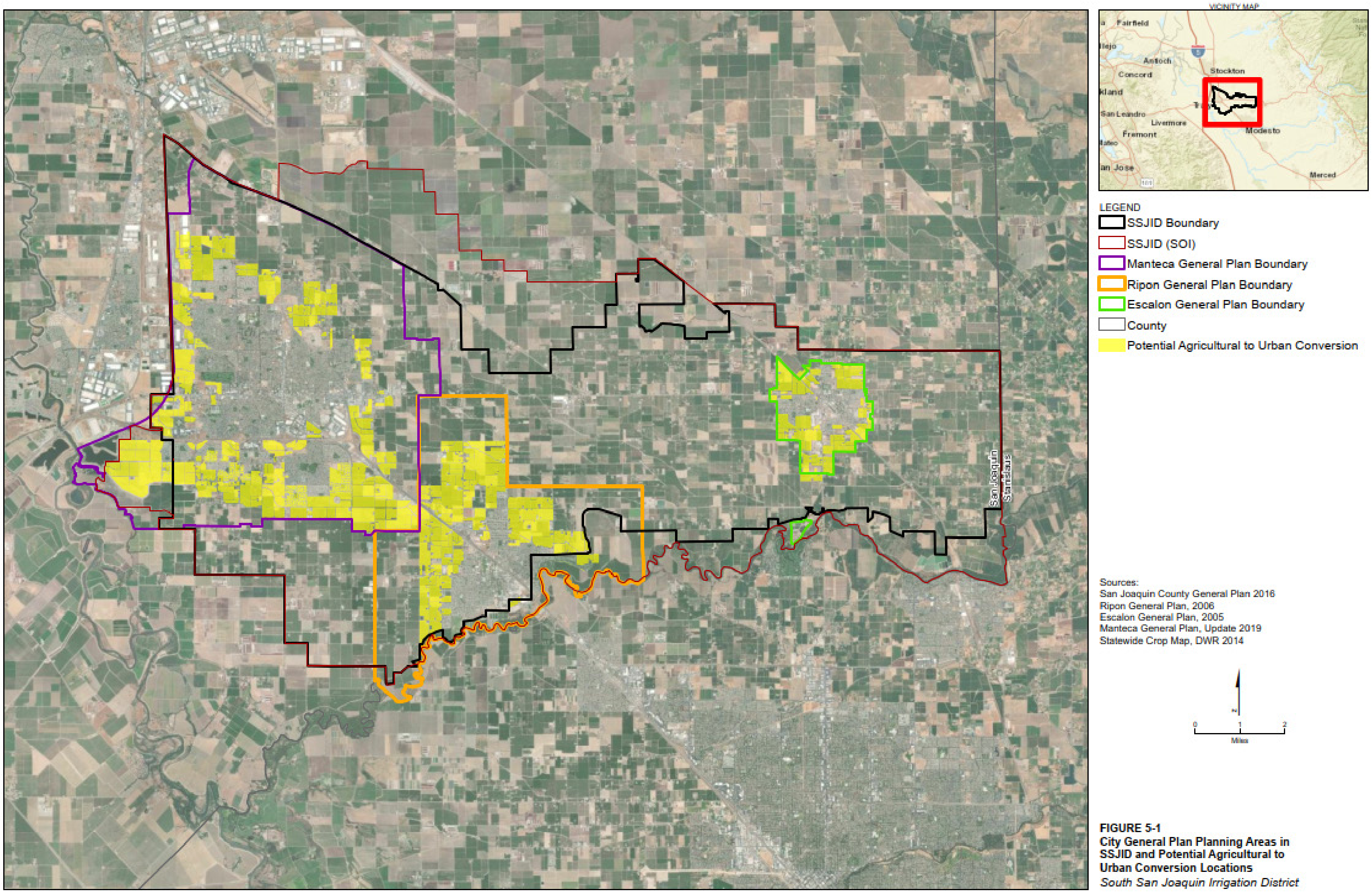


FIGURE 5-1
City General Plan Planning Areas in SSJID and Potential Agricultural to Urban Conversion Locations
South San Joaquin Irrigation District

5.2.3 Land Use Forecasting Methods for Agricultural Lands

Historical land use trends for SSJID irrigated lands were primarily analyzed by comparison of the SSJID crop survey data over time. In addition, the DWR and SSJID crop survey data were compared and contrasted to understand differences in land use classification between the two data sources and evaluate spatial trends in cropping throughout the District. Land use forecasts were obtained by combining the information presented in the historical land use trends analysis with information from City and County planning documents and knowledge of regional trends in agricultural cropping.

5.2.4 Agricultural Lands Forecast

Projections in agricultural to urban lands conversion presented in Section 5.2.2.2, *Urban Lands Forecast* are used in this section to estimate the total reduction in irrigated lands; the distribution of crops within the total area is estimated based on cropping trends and market conditions.

While the overall trends in SSJID irrigated acreage used the period of record to 1988, trends in individual crop areas were assessed based on more recent data to better reflect recent cropping trends. Generally, cropping trends were evaluated for the past 18 years including 2000 through 2018. Grapes were the exception and were evaluated from 2005 to 2018 to exclude short-term changes during 2000 to 2004. Historical and projected future crop acres are presented in Table 5-4.

Table 5-4. Projected Changes in South San Joaquin Irrigation District Crop Areas to 2040

Crop	2018		2020	2025	2030	2035	2040	
	(acres)	(%)	(acres)	(acres)	(acres)	(acres)	(acres)	(%)
Alfalfa	876	2%	852	792	732	671	611	1%
Almonds	35,104	66%	35,104	35,104	35,104	35,104	35,104	74%
Corn	5,640	11%	5,485	5,097	4,709	4,321	3,933	8%
Grapes	2,387	4%	2,255	1,927	1,598	1,270	941	2%
Other Crops	1,013	2%	999	964	929	893	858	2%
Pasture	3,207	6%	3,119	2,899	2,678	2,457	2,237	5%
Peaches	1,135	2%	1,069	904	739	574	409	1%
Walnuts	1,945	4%	1,934	1,904	1,874	1,844	1,814	4%
Water	10	0.02%	12	15	19	23	26	0.06%
Idle	1,903	4%	1,885	1,839	1,793	1,747	1,701	4%
Total	53,222	100%	52,714	51,444	50,174	48,904	47,635	100%

Note: For gross acreage, divide irrigated acreage by 0.94.

5.3 Land Use Conclusions

The land use trends analysis and forecasting of future land use conditions presented in this section are used to form a basis for future water demand estimates, and to inform planning of future infrastructure projects by identifying agricultural lands at risk for development. Relevant City and County general plans were reviewed along with historical crop acreage to inform the assessment of historical and future land use changes.

Notable trends and projections out to the 2040 planning horizon are summarized as follows:

- In 2018, SSJID was serving 53,222 irrigated acres and 56,619 gross acres. By 2040, SSJID is projected to serve 47,635 irrigated acres and 50,676 gross acres, which translates into an estimated reduction of 5,587 irrigated acres and 5,944 gross acres due to agricultural to urban land conversion between 2018 and 2040.
- While the City and County general plan projections likely overestimate the total urban conversion that will occur by 2040, maps were prepared to identify agricultural lands at risk to development. These maps will be helpful for infrastructure planning and siting of new facilities outside of areas planned for development.
- With the estimated reduction of 5,587 irrigated acres by 2040, the majority of this reduction is estimated to be from alfalfa, corn, and pasture (2,943-acre reduction) and grapes (1,445-acre reduction). The almond area is projected to hold constant in area but increase from 66 to 74% of SSJID's total irrigated area.

These projections will be used to provide the basis for estimating future changes in SSJID customer water demands.

6. Infrastructure

The District owns and maintains hundreds of miles of tunnels, canals, pipelines, and similar facilities that allow for water conveyance and irrigation deliveries. This section presents recommended infrastructure projects and investments allowing for reliable irrigation deliveries to customers to continue for decades to come. This section includes the following information:

- **Existing Infrastructure—**provides a brief history of SSJID infrastructure development and a quantitative inventory of infrastructure components. This section also discusses aging infrastructure, evolving irrigation demands, and issues and challenges with existing infrastructure.
- **Water Delivery Customer Service—**includes a synopsis of the 10-day rotation irrigation delivery schedule, how cropping patterns and the shift to more pressurized on-farm irrigation systems impact candidate infrastructure maintenance and improvement projects, and details the development of SSJID's quantitative capacity analysis tool.
- **Capital Improvement Plan—**summarizes the approach that was used to develop and evaluate candidate projects, and presents the recommended CIP with implementation recommendations.

Refer to Appendix E, *Infrastructure Plan* for additional infrastructure information, methodology, and infrastructure alternatives analysis.

6.1 Existing Infrastructure

The District's original irrigation distribution system included a series of unlined canals and lateral ditches that were constructed at the turn of the 20th century to provide flood irrigation service to the areas of Escalon, Ripon, and Manteca. In the 1950s and 1960s, the District enclosed approximately 310 miles of unlined, open-channel lateral ditches with 36- to 48-inch pipelines. Each pipeline lateral was typically sized to deliver between 15 and 25 cfs (referred to as one "head") of water to each customer, depending on the specific lateral. During pipeline construction, the original open ditch "weirs" (that is, vertical walls constructed in pipes or ditches, intended to elevate upstream water levels) were replaced with concrete control boxes, including an interior concrete weir wall (also known as a "pour over wall"), used to generate upstream pipeline pressures above the ground surface to enable delivery of flood irrigation to customers. The quantity and length of piped laterals make SSJID unique compared to other California irrigation districts, who typically have far less underground infrastructure. As of 2021, approximately 314 miles of the District's laterals are pipelines and 38 miles are open, concrete-lined ditches. The only predominantly unlined open channel is the Main Distribution Canal (MDC), totaling 18 miles in length (SSJID 2021). The existing lateral pipelines are categorized by diameter and pipe material for urban and rural areas, in Tables 6-1 and 6-2, respectively.

Each lateral pipeline is supplied by the District's MDC, which originates at Woodward Reservoir and provides water to six geographic service areas, known as "Divisions," within the distribution area. Each Division is managed by Division Managers (or ditch tenders). Daily flows into the MDC are adjusted remotely by an operator, based on a manual calculation that is dependent on forecasted water demand as established by the Division Managers.

SSJID acknowledges that the rate of infrastructure maintenance and rehabilitation over the last few decades is not sustainable and must be addressed in the near term to preserve system reliability. Challenges to existing key infrastructure facilities are identified in Table 6-3.

With challenges of threatened water conveyance reliability, aging pipelines, and an ever-increasing demand for maintenance, the level of service provided to irrigation delivery customers may become increasingly compromised.

Table 6-1. Existing Urban Pipeline Laterals by Diameter and Material

Nominal Diameter (inches)	Lateral Pipe Length (miles)				Total
	CIPP	CMP	PVC	RGRCP	
6	0	0	0	0.02	**0.02**
12	0	0	0.02	0	**0.02**
18	0	0	0	0.33	**0.33**
30	0.01	0	0	0.04	**0.06**
36	4.18	0.01	0	4.21	**8.41**
42	8.66	0.04	0	8.64	**17.34**
48	6.90	0	0	10.80	**17.70**
54	0	0	0	0.13	**0.13**
60	0.13	0	0	1.04	**1.17**
78	0	0	0	0.35	**0.35**
Total	**19.88**	**0.05**	**0.02**	**25.58**	**45.53**

Note: There is approximately 160LF of welded steel pipe in the existing pipeline network, this quantity is not included in the totals above.

CIPP = cast-in-place pipe (concrete)
CMP = corrugated metal pipe
PVC = polyvinylchloride pipe
RGRCP = rubber gasket (joints) reinforced concrete pipe

Table 6-2. Existing Rural Pipeline Laterals by Diameter and Material

Nominal Diameter (in)	Lateral Pipe Length (miles)				Division 9 (miles)	Total
	CIPP	CMP	PVC	RGRCP		
6	0	0	0	0	0.17	**0.17**
10	0	0	0	0	0.19	**0.19**
12	0	0	0	0	0.19	**0.19**
16	0	0	0	0	1.95	**1.95**
18	0	0	0.19	0	1.12	**1.31**
20	0	0	0	0	0.59	**0.59**
24	0.49	0	0	0	12.29	**12.78**
30	7.01	0	0	0	0	**7.01**
36	85.59	0.01	0	10.65	0	**96.24**
38	3.99	0	0	0	0	**3.99**
42	65.27	0.06	0	14.49	0	**79.82**
48	67.51	0.05	0	9.01	0	**76.56**
60	0	0	0	2.54	0	**2.54**
72	0	0	0	0.62	0	**0.62**
78	0	0	0	0.45	0	**0.45**
Total	**229.86**	**0.11**	**0.19**	**37.75**	**17.09**	**285**

Note: Approximately 98% and 2% (by length) of Division 9 lateral pipes are PVC and ductile iron, respectively.

Table 6-3. Existing Infrastructure Challenges

Facility	Challenges
Upstream infrastructure	Almost all of SSJID's water supply is conveyed from upstream supply canals. Infrastructure conditions and geologic risks threaten water supply reliability of facilities including the Joint Supply Canal, Upper Main Supply Canal, and Woodward Reservoir. Improvement projects, such as the "Canyon Tunnel", are necessary to improve supply reliability and operational flexibility.
MDC	Several geotechnical deficiencies have been identified along the MDC related to seepage and bank erosion, threatening delivery reliability.
Lateral distribution system	Most of SSJID's existing water lateral distribution system have surpassed its original design life, leading to deteriorating pipelines, which threaten the District's long-term service stability for irrigation deliveries. Pipeline replacement is very expensive. Efficiently managing flows throughout the distribution system has become increasingly difficult; preferred irrigation methods for certain crops and fields have evolved from flood to drip/sprinkler irrigation over the last 30 to 40 years. System operators have been challenged to meet the variations in demand flows and irrigation frequency that are required by on-farm pressurized systems, especially on the many "dead-end" laterals (that is, laterals without spill outlets) throughout the District. Combined with a historical lack of adequate maintenance and infrastructure investments, the aging pipeline network also has capacity limitations as a result of conveyance bottlenecks. These issues have compromised service equity across the District depending on turnout location.
SCADA	Per the *Infrastructure Plan Supervisory Control and Data Acquisition Assessment Technical Memorandum*, (SSJID 2020a) four challenges were identified in SSJID's current SCADA system that negatively impact short-term reliability and long-term usefulness: ▪ Remote site equipment replacement program, based on lifecycle analysis ▪ Remote site hardware and software product consolidation ▪ Network architecture obsolescence ▪ Water management services data integration Development of a SCADA Master Plan is recommended to address these challenges.
Institutional capacity	With an increasing backlog of maintenance and infrastructure improvement projects, SSJID acknowledges the increased institutional capacity (that is, administrative, staff members, equipment) needed to address these challenges.

SCADA = supervisory control and data acquisition

6.2 Water Delivery Customer Service

With current and future changes to land use, cropping patterns, and customer irrigation methods, SSJID needed an analytical tool to quantify level of service throughout the District, which would aid in project development and evaluation for the CIP. SSJID conducted a detailed capacity analysis of the water distribution system and capacity-limited segments that impair the current level of service. This tool provides an analytical approach for quantifying level of service (building on past anecdotal information) to assess service equity and identify proposed capacity enhancement projects.

The capacity analysis began with an evaluation of the capacity of the District's existing water distribution system to meet the current irrigation demands served by each lateral system. The analysis was then conducted using several scenarios of potential infrastructure improvement projects with current and future projected land use conditions. Outputs from the analysis included acreage summaries and maps of the SSJID water service area identifying the service ratios provided to each irrigated parcel within the District.

To evaluate current system performance, the distribution system was segmented into many small subareas and the development of a simple and quantifiable index that could be used to assess the level of service to each parcel based on available information. The analysis began with a process of breaking the SSJID distribution system up into distribution service areas (DSAs). A DSA encompasses irrigated parcels served by a specific lateral supply pipeline or canal/ditch. The average DSA size was approximately

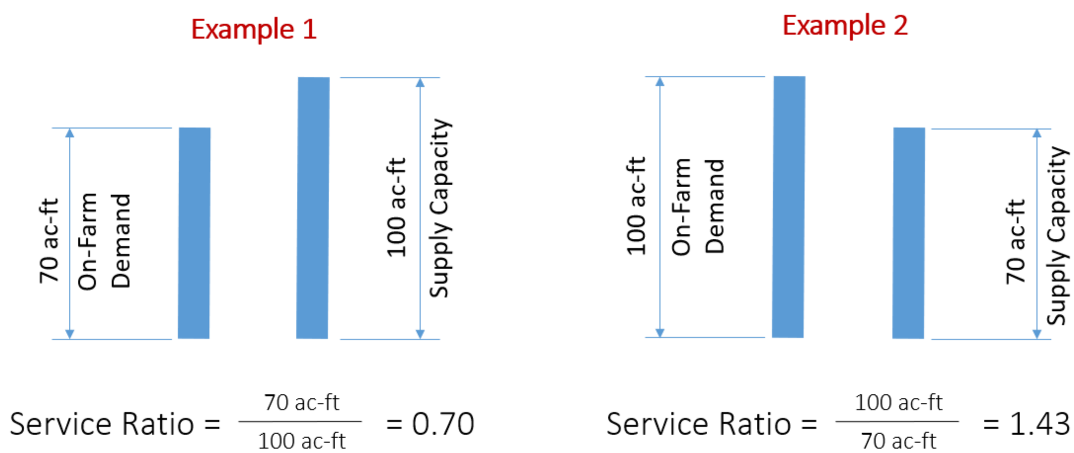
200 acres; the largest 10% of DSAs exceeded 600 acres with the largest DSA at 1,900 acres. Within each DSA, the hydraulic capacity of the lateral was assessed, and the water supply and demand characteristics of each parcel was evaluated.

The information collected within each DSA was then distilled into a single numeric index assigned to the parcels served within a DSA. The index developed for this analysis is called the service ratio and is defined as follows:

$$\text{Service Ratio} = \frac{\text{On} - \text{Farm Demand}}{\text{Distribution System Supply Capacity}}$$

This ratio is simply defined as the amount of on-farm demand that a lateral must service in relation to the lateral's hydraulic capacity over a typical irrigation cycle at the peak crop evapotranspiration (ET) demand period of the year. As the ratio increases, the level of service typically decreases because of reduced available downtime between irrigation deliveries and the resulting reduced operational flexibility. An example of the service ratio for a hypothetical lateral is provided on Figure 6-1. As shown in the examples, when the supply capacity exceeds the on-farm demand, the ratio is less than 1.0 (Example 1); when the on-farm demand exceeds the supply capacity, the ratio is greater than 1.0 (Example 2).

Figure 6-1. Examples of Service Ratios

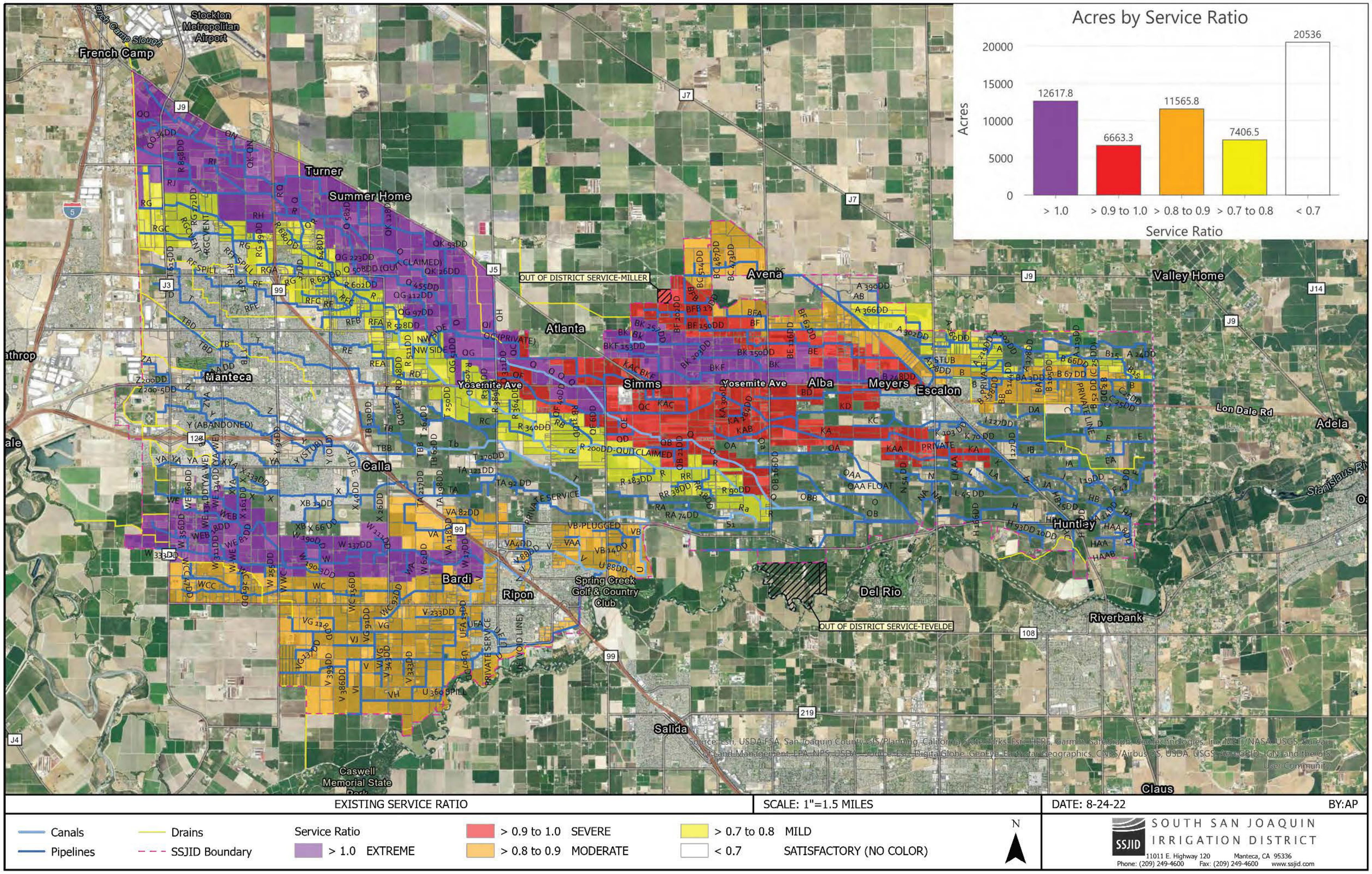


Another way to conceptualize the service ratio is as the percentage of time over an irrigation cycle that the distribution system would need to be flowing at capacity to meet the on-farm demand. For a system with service ratio of 0.7, the system would need to be flowing at full capacity for 7 days out of a 10-day irrigation cycle to meet the on-farm demand, leaving 3 remaining days in which the system could be idle. Each DSA usually serves many fields of different sizes with various flow demands that need to be scheduled and coordinated over each irrigation cycle; therefore, the actual flows typically fluctuate below the supply capacity over the entire irrigation cycle without extended down periods during the peak ET season. With a lower service ratio, more flexibility is allowed to operators to meet all the on-farm demands within the irrigation cycle.

The evaluation of existing service ratios across SSJID indicated that parcels served by distribution systems that were operating with a service ratio of 0.7 or less generally have great service. Areas of known level of service issues generally had service ratios exceeding 0.7. Reference to details on the calculation procedures, assumptions, and identified capacity enhancement projects are presented in Appendix E, *Infrastructure Plan*, and Appendix F, *Capacity Analysis*.

Figure 6-2 shows service ratios throughout the District for the existing distribution system.

Figure 6-2. Service Ratios for Existing Distribution System



After conducting the capacity analysis, SSJID engineering staff shared results with SSJID operational staff, who then confirmed the analytical results with field observations. The current distribution system scenario (and another current distribution system with potential annexation scenario) had the greatest acreage in the "Extreme" category out of all scenarios. These Extreme-categorized areas are concentrated in Divisions 1, 3, and 5 and around Laterals Bk, Q, and W.

6.3 Capital Improvement Plan

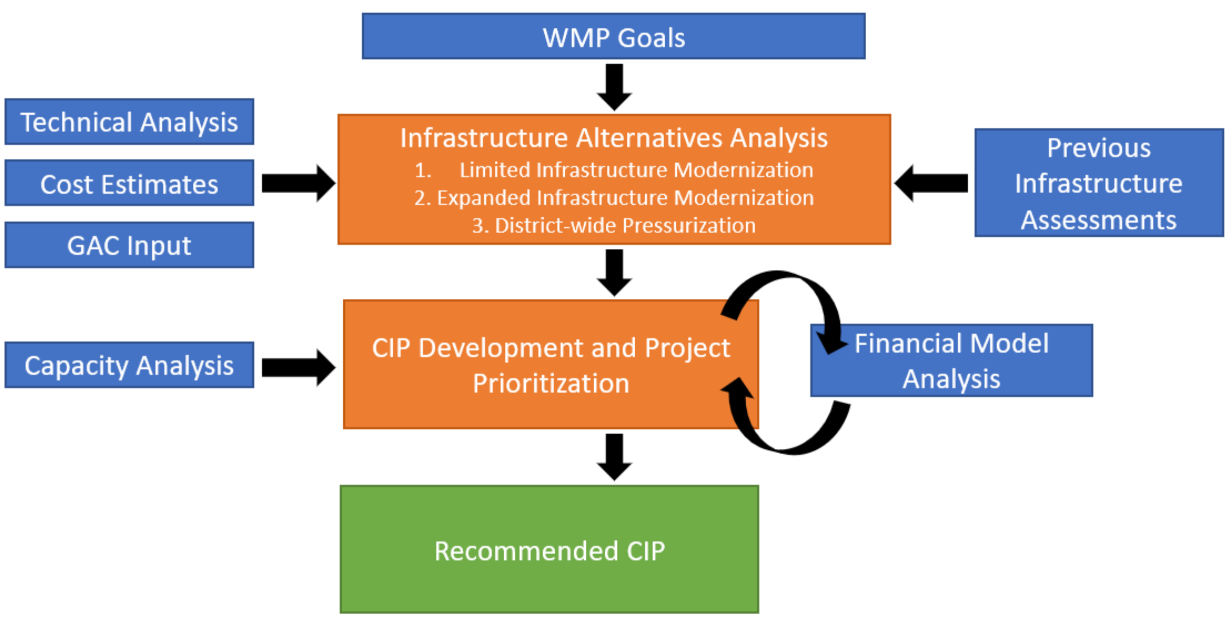
The 30-year CIP is based on current assessments and forecasts but is intended to be a flexible plan that will be adjusted in the future in 5-year increments, based on changes in system performance, water user needs, regulations, funding availability, and implementation capacity.

A list of candidate projects for potential inclusion in the CIP were either informed by previous studies (SSJID 2016; Cal Poly San Luis Obispo ITRC 2018; SSJID 2018) or identified by SSJID engineering and operations staff during their comprehensive review of all infrastructure facilities for potential improvement or rehabilitation projects. SSJID also identified critical existing infrastructure that must be maintained regardless of alternative. Project costs were developed using cost data from established cost databases, historical SSJID construction costs and bids, and planned or ongoing upstream infrastructure projects.

With an initial list of potential projects and the WMP goals in mind, SSJID developed tools and analyses (such as infrastructure alternative analysis, capacity analysis, CIP project prioritization) to develop a CIP which would address District infrastructure challenges (such as long-term O&M, aging infrastructure, and similar).

Figure 6-3 shows a conceptual process graphic of infrastructure planning to develop SSJID's CIP with a 30-year planning period. Key processing milestones including infrastructure alternatives, CIP development, and the various technical, stakeholder, and financial inputs that contributed to these processes are fully described in Appendix E, *Infrastructure Plan*.

Figure 6-3. Capital Improvement Plan Development Process



The infrastructure alternatives analysis, which eliminated the District-wide Pressurization alternative as financially infeasible, and GAC feedback helped SSJID identify key challenges and subsequently formulate key solutions, shown in Table 6-4. The identification and development of these challenges and solutions prompted the transition from the alternatives analysis to CIP development.

Table 6-4. Key Infrastructure Challenges and Solutions

Challenge	Solution
Identify a cost-effective long-term pipeline rehabilitation plan.	Implement trenchless pipe rehabilitation self-performed by SSJID crews. Refer to Appendix E, *Infrastructure Plan* Section 1.5.3.1 for more detailed information.
Identify how to stabilize service.	Invest in extending the useful life of existing infrastructure. Prioritize comparatively low-cost improvement projects enhancing water conveyance and hydraulic controls for reliable deliveries serving flood and sprinkler irrigators (e.g., automated gates, float valves, and cut down pour-over walls). Refer to Appendix E, *Infrastructure Plan* Attachment 1 for more detailed information.
Identify how to measure and enhance service.	Conduct a District-wide capacity analysis, which informed the identification, selection, and prioritization of CIP projects and quantified associated benefits of constructing and implementing projects. Refer to Appendix E, *Infrastructure Plan* for more detailed information.

6.3.1 Project Development and Prioritization

The CIP contains projects, grouped by project programs/categories and classified by a capital expenditures scenario. The CIP can be filtered by a capital expenditures scenario to yield a project list and time-phased distribution of project costs. The CIP is organized in a Microsoft Excel spreadsheet with an individual sheet for each project. Two summary sheets consolidate key project details and display a time-phased distribution of project costs, respectively.

CIP projects originated from various efforts including the initial infrastructure alternatives analysis, other SSJID feasibility studies and projects, and the capacity analysis.

From the onset of plan development, the Canyon Tunnel Project and an annual Joint Supply and Main Supply Canal maintenance program were determined to be necessary under any infrastructure investment scenario to addresses the risk and reliability of the District's most important and vulnerable components of the upstream conveyance system.

As previously described, SSJID conducted a detailed capacity analysis of the water distribution system and capacity-limited segments that impair the current level of service. This analysis aided in the refinement and selection of capacity improvement projects in the CIP.

The following categories were considered when selecting and prioritizing CIP projects when compared to cost and funding availability:

- **Project need and regulatory compliance**—projects that help the District achieve regulatory compliance in alignment with governing WMP goals were prioritized in selection and implementation timing compared to other projects.
- **Project benefit and risk mitigation**—projects alleviating conveyance bottlenecks or that mitigate risks of excessive seepage loss and infrastructure failure were prioritized over other candidate projects.
- **Operational assessment**—the most cost-effective projects that enhance the ability to serve flood and sprinkler irrigators or that improve service in 'problem areas' are scheduled to be implemented earlier than other projects.
- **Service ratio and equity**—projects benefiting laterals with unfavorable service ratios and positively impacting multiple flood and sprinkler users were prioritized over projects having more limited, localized benefits.

- **System responsiveness and water delivery flexibility—**projects resulting in operational efficiency and having potential labor savings or similar benefits to Division Managers were prioritized.
- **Project urgency—**CIP costs were compared to anticipated funding availability and the timing of project implementation was phased accordingly. Comparatively low-cost projects and those having the highest benefit to cost per acre ratio were selected and are scheduled for earlier implementation.
- **Water conservation and operational spill reduction—**Benefits of water conservation (including seepage reduction, operational spill reduction, flow and water level control for effective flood and sprinkler runs) were considered. Projects having a positive impact on groundwater/SGMA or help the District with drought resiliency were given higher priority compared to other projects.

6.3.2 Capital Improvement Plan Project Scenarios

Six capital expenditure scenarios, each a collection of projects, were identified as potential CIPs. Each capital expenditure scenario accomplishes particular objectives while considering engineering feasibility (scheduling, labor, sequencing). The scenarios are described as the following:

- **Bare Minimum Projects—**includes projects required to keep the District operational and are primarily rehabilitation and maintenance projects
- **Maintain Existing Service—**includes Bare Minimum Projects and projects required to stabilize service (that is, no degradation or improvement in service)
- **Tier 1—**includes all projects from prior scenarios (that is, bare minimum projects, maintain existing service) and limited additional projects to improve service and enhance District operations, including a subset of projects identified by the capacity analysis (one pipeline upsizing, two pipeline interconnections, one regulating reservoir)
- **Tier 1+—**includes Tier 1 projects and two additional projects identified by the capacity analysis (two more regulating reservoirs)
- **Tier 2—**includes Tier 1+ projects and additional improvement projects
- **Tier 3—**includes Tier 2 projects and additional improvement projects

The development of these categories was foundational to the evaluation of refined CIP alternatives which allowed for the development and selection of Tier 1+ as the recommended CIP.

6.3.3 Evaluation of Capital Improvement Plan Project Scenarios

CIP project scenarios with a full range of projects were defined and evaluated. This was an iterative evaluation process that included analysis of costs and benefits and considered the criteria listed in Section 6.3.1, *Project Development and Prioritization*, all of which were governed by the WMP goals. Definition and refinement of project evaluations for each scenario were informed by input from District staff, the GAC, and the District's Finance Committee (refer to Section 8, *Financial Analysis*). Findings from the evaluation process for each project category are summarized below.

- **Bare Minimum Projects—**Only investing in essential rehabilitation and maintenance projects would expose the District to ongoing risk of conveyance and water delivery inefficiencies, inhibit the ability to respond to evolving irrigation demands associated with 10-day flood rotations compared to more frequent sprinkler irrigation demands without addressing service equity challenges at downstream lateral reaches, and result in declining level of service. Through the evaluation process it was evident that this was not the preferred scenario; however, it defined a baseline list of CIP projects and investments necessary to keep the District operational at the lowest possible level.

- **Maintain Existing Service**—Through an iterative process, a list of CIP investments required to stabilize and maintain the existing level of service (year 2021) were defined by developing a detailed inventory and general condition assessment of laterals and water delivery infrastructure. Estimated project costs and anticipated implementation timing were inputs to the financial model. Projects in this scenario were not explicitly defined to address service inequities. It was concluded that the incremental benefits outweighed the incremental investment required to implement additional projects included in Tiers 1 and/or 2 (see below). This scenario was not selected as the preferred CIP approach but provided useful financial information aiding comparison and evaluation of other CIP tiers.
- **Tier 1**—This scenario included the most cost-effective improvement and modernization projects with the greatest benefit to cost ratio. These projects would yield the following: 1) begin to increase service equity by alleviating locations that have historically experienced water delivery challenges; 2) extend the useful life of existing infrastructure through localized rehabilitation and improvement projects; and 3) provide strategic enhancements to District operations. Tier 1 was cost effective compared to Tiers 2 and 3 but did not alleviate some of the localized service inequities, conveyance capacity restrictions, and existing water delivery challenges.
- **Tier 2**—This scenario included Tier 1 projects and additional capacity improvements, regulating reservoirs, water conservation projects, and other modernization projects throughout the District. A preliminary financial analysis indicated that Tier 2 may be too costly. However, through the evaluation and financial modeling process, the District identified several projects having significant benefits to water delivery service. It was concluded that Tier 2 was not recommended as originally defined, but certain cost-effective projects would be reevaluated and prioritized if new opportunities to expand project implementation become available.
- **Tier 3**—This scenario included a comprehensive list of projects that would allow customers to receive water more frequently at varying flow rates with less notice throughout the District. Also, additional water conservation and reliability projects were identified in Tier 3. Preliminary analysis indicated that 2040 irrigation rates for Tier 3 would likely be at least double those for Tier 1. It was concluded that Tier 3 was too costly, particularly considering uncertainties associated with revenue (refer to Section 8, *Financial Analysis*) and urban sprawl/forecasted land use trends (see Section 5, *Land Use Trends and Forecasting*).

As presented above, by conducting a preliminary evaluation of CIP scenarios and obtaining feedback from the GAC, the following CIP scenarios were not recommended: Bare Minimum Projects, Maintain Existing Service, Tier 2, and Tier 3. The remaining scenario was Tier 1 and select Tier 2 capacity enhancement projects, most of which were identified in the capacity analysis. Tier 1 was more cost effective but could not fully provide desired long-term benefits and service improvements. Therefore, Tier 1+ was established which included projects identified in Tier 1 and two additional capacity enhancement projects initially presented in Tier 2.

6.3.4 Results and Recommendations

Tier 1+ is the Recommended CIP. The Recommended CIP provides the desired balance between investments required to maintain and rehabilitate an aging system plus strategic projects focused on modernization and improvements resulting in District-wide benefits. The Recommended CIP is a responsible investment strategy with reasonable projected water rates supported by the financial analysis.

Through the CIP project prioritization and development process, SSJID concluded the following:

- The CIP has been developed to address and balance WMP goals, including a focus on addressing infrastructure condition, limited capacity improvements, operational enhancements, and improved level of service within acceptable levels of investment.
- Without increasing the rate of condition assessment, inspection, and rehabilitation of aging pipes within the water distribution system, the current level of service to SSJID water customers will deteriorate.
- SSJID evaluated options for full pipe replacement versus pipeline rehabilitation to address aging pipelines and determined that pipeline rehabilitation through pipe lining was a more financially feasible strategy.
- Maintaining and rehabilitating the existing water distribution system through condition assessment, inspection, and rehabilitation of aging pipes is a significant component of the CIP accounting for approximately 15% of planned CIP expenditures.
- Projects identified through the capacity analysis, included in the CIP, address capacity limitations, level of service, and water conservation in the District.
- CIP investments will help to improve water distribution system reliability, improve level of service to growers, and provide more equitable level of service across the District.

Table 6-5 summarizes projects and costs included in the Recommended CIP for the 30-year planning horizon. For the full list of projects, costs, and timelines, refer to Appendix E, *Infrastructure Plan*.

Figure 6-4 shows the service ratios resulting from proposed capacity enhancement projects, identified in the capacity analysis, and potential annexations which are both included in the Recommended CIP. These service ratio results include acreage with Moderate and Mild levels of service deficiencies. The inclusion of the FCOC Recirculation Reservoir improvement project is largely responsible for a decrease in service ratio (increase in level of service), as compared to scenarios with less proposed improvements. In previous scenarios, Division 3 along Lateral Q was repeatedly an area of service degradation. However, with the inclusion of the FCOC Recirculation Reservoir project, the level of service significantly increases.

Figure 6-5 shows the service ratios from proposed capacity enhancement projects and potential annexations included in the Recommended CIP with the addition of projected 2040 agricultural to urban land use conversion. Since these service ratio results consider agricultural to urban conversion, service ratios decrease (level of service increases) in general due to decreased demand compared to the previous scenario. Compared to Figure 6-4, there is no longer acreage with Moderate or Mild levels of service discrepancies. In conclusion, anticipated urban sprawl will inherently increase water availability and irrigation delivery flexibility.

Table 6-5. Recommend Capital Improvement Plan Project Summary

Program/Category	Key Projects	Description	Present Value Cost [a]
Baseline Capital Expenditures	Baseline capital expenditures	Includes capital expenses that the District has historically experienced, that are expected to continue into the future, and that are not associated with specific CIP projects.	$21.3
Capacity Enhancement	New parallel pipes, lateral capacity enhancements, new connection pipes	Includes pipeline capacity enhancement projects identified in the capacity analysis. Projects located along laterals (R, Bc, Q, Qc, Be, Bk, Bkf, FCOC) and lateral connections (X-W). Tentatively scheduled for 2023–2031.	$5.76
Distribution Modernization Program	Float valves, level instrumentation, automated gates, cut down pour-over walls, new control boxes, Division 9 instrumentation replacement	Includes approximately 97 float valves, 32 level sensors, 35 automated gates, 109 cut down pour-over walls, 34 control boxes (new and modification to existing), control box replacement program (2 boxes per year), 6 trash screens, and additional concrete control structures over the 30-year period.	$16.6
District Administration Facilities	Headquarter facility improvements	Project includes site improvements to existing District Headquarters including: ▪ Parking lot pavement resurfacing/replacement ▪ New electric vehicle charging stations for future electric vehicle fleet ▪ Solar panel installation ▪ Building modifications to support additional staff as needed ▪ Other miscellaneous site improvements (such as drainage improvements, accessory building modifications, landscaping modifications) Project may require architectural, geotechnical, structural, and landscaping consulting services. Budgetary numbers are provided as a general placeholder and will require refinement. Project will likely occur in phases over an extended period. For the WMP, spending is assumed to be evenly distributed over a 10-year period. Extent of improvement will likely be influenced by the outcome of the District's pursuit to provide retail electric service.	$1.73
MDC Bank Stabilization	MDC bank lining, Van Groningen Control Wall, annual O&M program	Includes cast-in-place concrete relining with fibrous reinforcing including excavation of existing deteriorating concrete lining, and site grading and compaction. Approximately 10 reaches of the MDC (19,600 LF) identified for bank stabilization over the 30-year period.	$13.5
MDC Modernization	MDC drop rehabilitation and upgrades	Construct upgrades to gates, actuators and instruments at existing 12 MDC drop structures.	$0.75

Program/Category	Key Projects	Description	Present Value Cost [a]
Open Channel Lateral Improvements	Canal shotcrete lining, annual open channel lateral O&M program	Includes three ditch lining projects tentatively scheduled within the next 5 years and an annual improvement program for all 38 miles of open channel laterals over the next 30 years. Annual improvement program will require liner replacement/resurfacing of approximately 2,675 feet per year to maintain facilities within expected lifespan.	$7.76
Pipe Replacement	CIPP pipeline replacement, drainage, and culvert improvements	500 linear feet of pipe replacement per year over the next 30 years. Assumes average cost of pipe replacement (sizes ranging from 36 to 48 inches) is $300 per linear feet. Pipe replacement will be constructed with District crews.	$3.45
Regulation Reservoirs	New reservoirs	Includes Lateral Bk/Bkf Regulation and Tailwater Recovery Reservoir and Be to Bk Connection Project and two additional reservoirs identified in the capacity analysis (FCOC Recirculation Reservoir and Q/Qc Regulation Reservoir).	$26.9
SCADA	SCADA rehabilitation and improvements	Includes development of a SCADA Master Plan and rehabilitation and improvements program. Program will include: ▪ Remote site hardware rehabilitation (replacement of PLCs, flow meters, pressure transducers, actuators, and similar SCADA components) ▪ New remote sites (average of 5 per year) ▪ On-Farm Meter Program (existing and new meters) ▪ Communications Network Projects ▪ Control Center Hardware ▪ Two additional staff members: one Programming/Data Acquisition Controller and one Technician	$14.2
Studies, Analyses, Pilot Projects	Unidentified future capital projects	Includes evaluation of the Woodward/Turlock Irrigation District Reservoir Operations Agreement and placeholder for implementation of future CIP projects not previously identified.	$7.44
Trenchless Lining Program	Equipment procurement, District-performed pipeline rehabilitation and lining	Includes equipment procurement and future replacement and District-performed pipeline rehabilitation and lining program. Assume 20,830 linear feet annually of centrifugally applied fiber-reinforced cementitious lining performed by District crews. Rate of resurfacing assumes that all eligible pipe is resurfaced in 50–60 years.	$27.7
Tunnels	Canyon Tunnel Project, UMSC Tunnels	Approximate 2-mile-long Joint Supply Canal Bypass Tunnel Project originating from Goodwin Dam down to the vehicular bridge/access ramp. Cost estimates are based on budgetary efforts made in October of 2021 as the 60% design phase was concluding. Also includes general	$37.6

Program/Category	Key Projects	Description	Present Value Cost [a]
		maintenance and rehabilitation of existing tunnels located along the Joint Supply Canal and UMSC.	
Water Ordering System	SSJID digital app	Design, integration, and implementation of an SSJID digital communication application.	$0.15
Water Supply	Joint Supply Canal improvements and maintenance	Includes maintenance and improvement program to Joint Supply and Main Supply Canals, including liner repair and replacement, slope protection, additional condition surveys, and reestablishment of property documentation and easements. Immediate maintenance and improvement projects scheduled for next 10 years. General maintenance and improvement program scheduled for the next 30 years.	$2.59
Woodward Reservoir	Flow control improvements, Dam Safety retrofit	Currently, specific projects are not required. However, for planning purposes a placeholder for a future Woodward Spillway, which may ultimately be required by the Department of Safety of Dams, is included in CIP. Woodward Reservoir Excavation Expansion is included as a potential project for future study and evaluation.	$3.45
		Total:	$190.9

[a] Cost is in millions of 2021 dollars.

Figure 6-4. Service Ratios Resulting from Capacity Enhancements and Annexations included in the Recommended Capital Improvement Plan

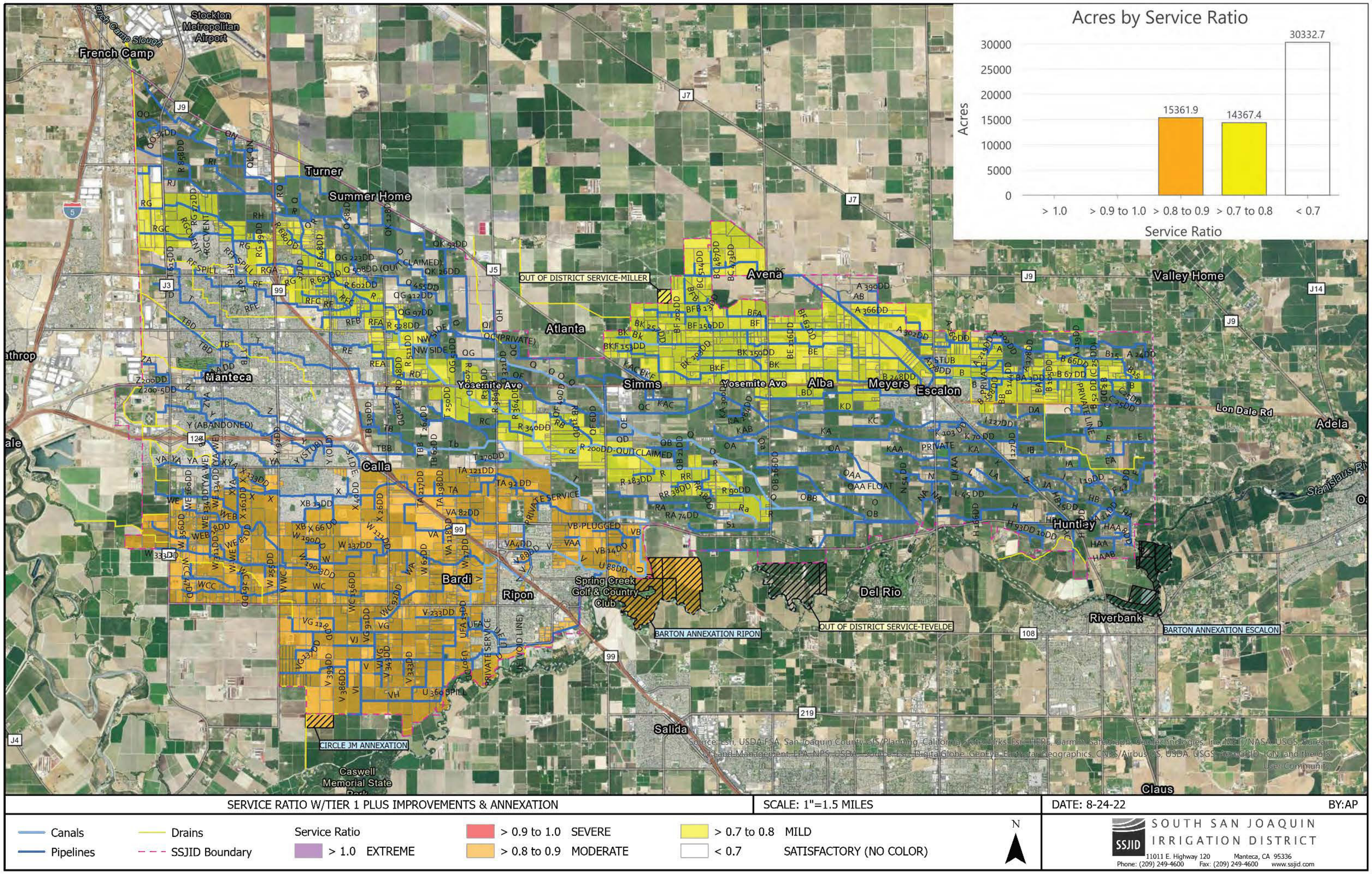
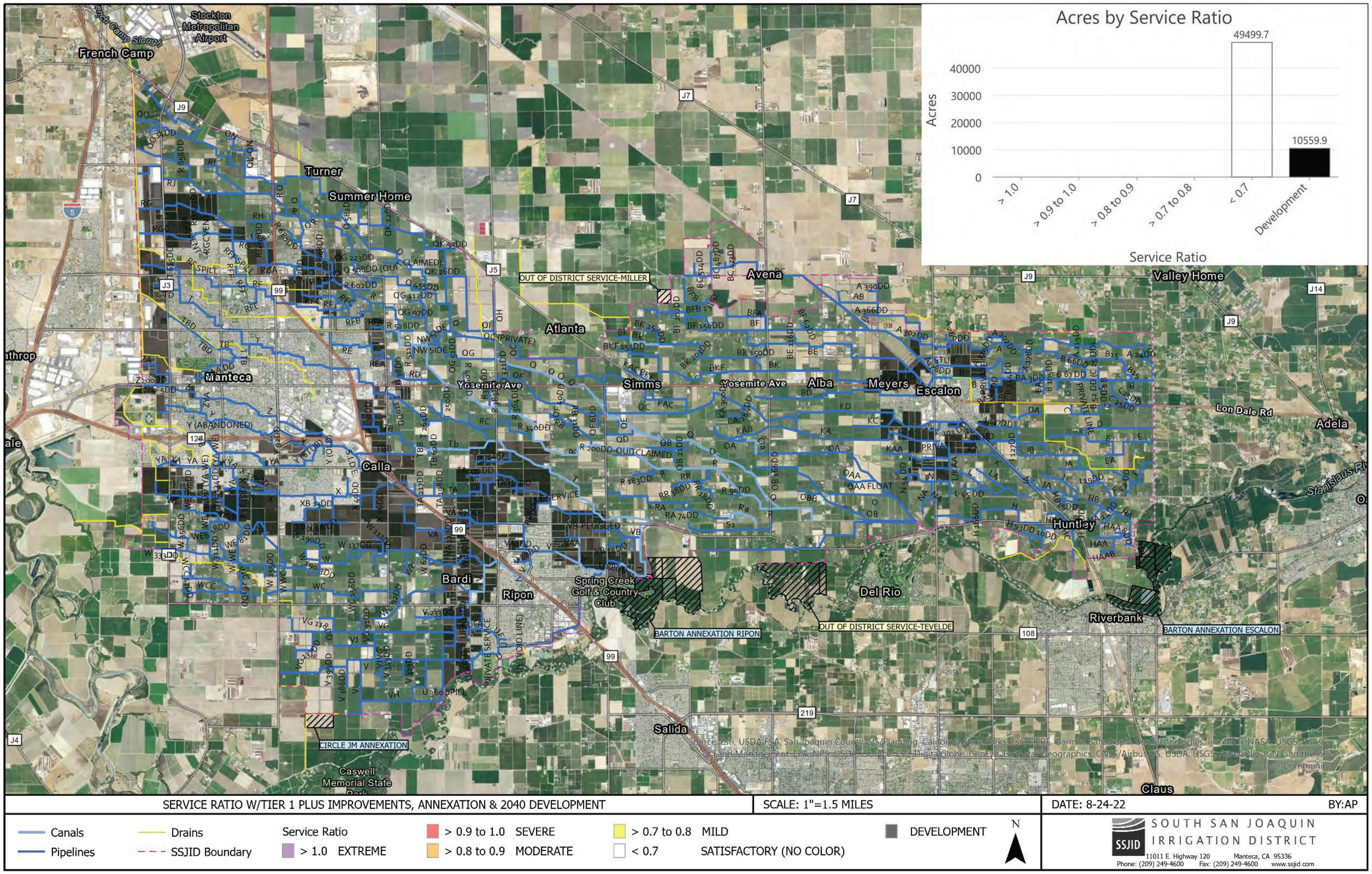


Figure 6-5. Service Ratios Resulting from Capacity Enhancements and Annexations included in the Recommended Capital Improvement Plan with 2040 Land Use Projections



As described previously, the 30-year CIP is based on current assessments and forecasts but is intended to be a flexible plan that will be adjusted in the future in 5-year increments based on changes in system performance, water user needs, regulations, funding availability, and implementation capacity. Proposed projects are conceptual, each project will need engineering, design, and implementation planning. In addition, the dividing line between projects included in the Recommended CIP and omitted projects will be evolving and will be modified and shifted at regular intervals. This gives SSJID flexibility to adapt in the future based on needs, regulatory requirements, and funding availability.

7. Water Resources Analysis

The purpose of the Water Resources Analysis is to quantify SSJID's water demands and water supplies under existing baseline conditions and for future conditions at the WMP planning horizon. More information can be found in Appendix D, *Water Resources Analysis*. This effort is important to define water supply reliability for SSJID water users, and identify water surplus and deficit conditions of water availability for assessment of additional future commitments.

7.1 Overall Analytical Process

The New Melones Operations Model (NMOM) was developed for SSJID and OID to model hydrologic simulations of the joint management of the District's shared Stanislaus River water supplies. One of the key objectives of this Water Resources Analysis is to document the updates to SSJID water demands used within the NMOM for assessing water supply and demand conditions as well as the water supply reliability of the Districts' Stanislaus River supply.

For the District, historical water demands and land uses were first evaluated to characterize water use trends. Current water delivery operations and the land use in 2018 were then considered in the development of a baseline water balance using major components of the District demands (such as on-farm deliveries, canal system losses, municipal demands, and similar) offset by their internal supplies (such as District groundwater pumping, reuse of drainwater and tailwater).

For future water demands, forecasted land use trends within the District were evaluated first. This analysis considered expected urbanization of agricultural lands and expected shifts in cropping over the planning horizon. On-farm irrigation water demands were updated using these future land use and cropping projections. In addition, planned infrastructure projects, operational changes, and committed water deliveries that are expected to change District water demands over the planning horizon were included to project demand terms into the future.

Demands were integrated into an updated version of the NMOM, and the set of baseline water demands was evaluated over a 96-year hydrologic period (1922 through 2018 water years) within the NMOM.

7.2 SSJID Water Balance

SSJID maintains a number of gauges to record flows through the water distribution system and the water service area, to account for all major inflows and outflows. These inflows and outflows are tabulated on a monthly and annual basis for each irrigation season and are reported on 5-year intervals in SSJID's AWMP, which is required by SB x7-7. To develop a complete water balance analysis of SSJID's operations, measured inflows and outflows are supplemented with estimated terms. A schematic depicting SSJID's AWMP water balance structure (SSJID 2015) and the interaction between the AWMP water balance terms is shown in Appendix D, *Water Resources Analysis*.

The AWMP water balance analysis provides a historical accounting of water inflows and outflows from the SSJID water service area and is constructed in a fashion that suits this purpose. However, for future water supply and demand planning that addresses water supply reliability across a range of hydrologic conditions, a different water balance structure is required to define water demands based on a given set of land use and water operations assumptions. The NMOM is the tool that SSJID has historically used for this purpose; NMOM is described in more detail in the following section.

For the WMP, the SSJID canal demand terms within the NMOM were reconstructed and updated to align more closely with key AWMP water balance terms. The historical water balance datasets used for this operation included the 1994 through 2014 water balances presented in SSJID's 2015 AWMP (SSJID 2015) along with updates to the water balances through 2015 and SSJID irrigated land uses through 2018. Due to the timing of the WMP water resources analysis, the 2020 SSJID AWMP was not yet available for use.

7.3 New Melones Operations Model

For the purposes of the WMP, the NMOM is used to assess water supply and demand conditions and the water supply reliability of SSJID's Stanislaus River supply. The conditions assumed to govern the baseline water supply include the factors presented in the New Melones Operation Agreements described in Appendix A, *Water Resources Inventory* and the current state of regulations and agreements at the beginning of year 2020.

The remainder of this section summarizes the NMOM framework as well as key inputs and assumptions used in the model.

7.3.1 New Melones Operations Model Framework

NMOM was developed to perform simulations of the New Melones Project operations under varying assumptions for Stanislaus River water allocations and alternative boundary conditions within the San Joaquin River Basin. The model is a Microsoft Excel workbook with a single model worksheet and several ancillary worksheets that provide input and reporting functions. The model provides a simulation of operations over a 96-year hydrologic period (1922 through 2018 water years) on a monthly basis.

A schematic representation of key hydrologic accounting centers within the NMOM is presented in Appendix D, *Water Resources Analysis*. In relation to geography and facilities, the model is separated into four sections: (1) NMR, (2) Tulloch Reservoir, (3) Goodwin Reservoir, and (4) the Lower Stanislaus River and San Joaquin River.

Flows to SSJID are diverted out of Goodwin Reservoir into the Joint Main Canal (JMC) that is jointly owned and operated by SSJID and OID. After the bifurcation of the JMC to downstream SSJID and OID water service areas, SSJIDs water is conveyed through the Main Supply Canal (MSC) to SSJID's Woodward Reservoir, and subsequently into the MDC for flow out of Woodward Reservoir to serve downstream water customers.

The demands of SSJID for diversion out of Goodwin Reservoir into the JMC are defined by monthly time series datasets and are described in more detail in Section 7.5, *Future Water Demand* and Section 7.6, *Baseline Water Supply Reliability Results*.

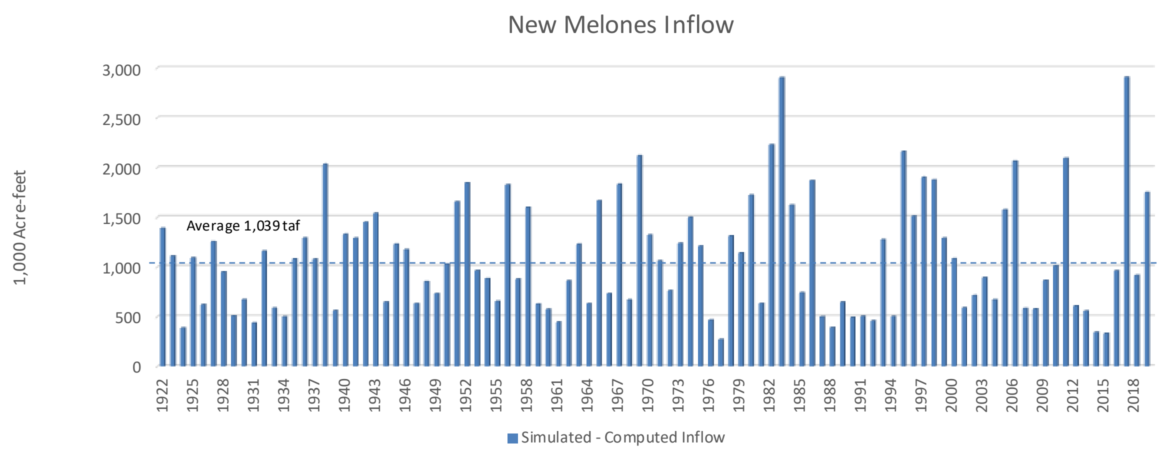
7.3.2 Stanislaus River Runoff

The Upper Stanislaus River watershed covers approximately 895 square miles upstream of NMR. The watershed has an average annual runoff of approximately 1,130 TAF from years 1922 through 2019, ranging from 155 TAF (1977) to 3,078 TAF (2017).

Numerous projects in the Upper Stanislaus River watershed alter the quantity and timing of runoff into the NMR, including diversion and reservoir works owned by Calaveras County Water District, Northern California Power Agency, Utica Power Authority, Pacific Gas & Electric Company, and the Tri-Dam Project (OID and SSJID). Collectively, these projects divert a relatively small amount of water for consumptive use within and outside of the watershed. In addition, consumptive use within and diversions out of the watershed are relatively small.

Runoff impairments alter the runoff of the basin seasonally and annually, and result in the inflow that occurs to the NMR. The historical annual inflow to New Melones used in the analysis is shown on Figure 7-1. Average NMR inflow is 1,039 TAF per year ranging from a low 271 TAF to more than 2,905 TAF.

Figure 7-1. New Melones Inflow



7.3.3 New Melones Operations

Numerous regulations, requirements, obligations, and agreements affect the operation of the New Melones Project. Refer to Appendix D, *Water Resources Analysis* for more information.

7.3.4 Groundwater Supplies

Continued use of Stanislaus River water for SSJID's agricultural and municipal customers is a key cornerstone to ensuring sustainable groundwater future as required by SGMA. While regulation under SGMA has the potential to restrict groundwater use within the District's water service area in the future, the adopted ESJGWA GSP does not currently limit groundwater pumping within the SSJID water service area (ESJGWA 2019). For baseline assumptions of groundwater supplies available to offset water demands within the District, it is assumed that recent levels of District and private groundwater pumping by District customers, at the time of WMP analysis, will continue. Assumptions for SSJID district groundwater pumping and minimum private groundwater pumping is discussed in Section 7.5.2, *SSJID Internal Water Supplies*. As the implementation of SGMA matures, the District recognizes that groundwater recharged or saved due to increased surface water deliveries will become an increasingly important metric in demonstrating progress to the state toward groundwater sustainability.

7.4 Baseline Water Demand

SSJID's baseline water demands for the 2018 baseline year are summarized in Table 7-1. These demands represent an average climate year demand condition with sufficient Stanislaus River water supply to meet in-District water demands.

Table 7-1. SSJID Average Baseline (2018) in-District Water Demands

Water Supply/Demand Component	Subcomponents	SSJID Total (AFY)	Notes
On-farm demand for applied water	--	198,880	a,c
Canal and lateral system losses	SSJID JMC loss	1,995	c
	Upper MSC seepage	455	c
	MDC/MSC seepage	25,550	c
	MDC/MSC evaporation	520	c
	Lateral seepage	5,300	c
	Lateral evaporation	690	c

Water Supply/Demand Component	Subcomponents	SSJID Total (AFY)	Notes
	Lateral operational spills	24,770	b,c
Reservoir losses	Woodward Reservoir evaporation	7,460	d
	Woodward Reservoir seepage	21,050	d
Municipal deliveries	Municipal deliveries to WTP	22,500	b,d
Other demands	U3 Ranch delivery	4,410	c
Total SSJID in-District water demands	--	313,580	--
District groundwater pumping	--	4,380	b,c
Minimum private groundwater pumping	--	56,000	c
Intercepted flow used as supply	OID spills to SSJID	6,790	b,c
	Woodward Reservoir precipitation	1,360	d
	Woodward Reservoir local inflow	690	d
Total SSJID internal water supplies	--	69,220	--
SSJID's Stanislaus River diversion demand for in-District use	--	244,360	--

Notes:

General—1994 through 2015 data were used for developing SSJID water balance components aside from on-farm demand. On-farm demands use 2018 cropping and irrigation efficiencies and 1922 through 2018 climate data.

[a] While average year conditions are presented, on-farm demand for applied water varies in response to climate annually with up to 88,000 AFY between high and low demand years.

[b] Operational spills, District groundwater pumping, OID spills to SSJID, and municipal deliveries can vary in response to shortages during years of impaired Stanislaus River diversion availability but are presented as typical annual values.

[c] Covers irrigation season months of March through October.

[d] Terms associated with Woodward Reservoir and municipal deliveries cover the entire year.

Table 7-1 shows the total SSJID in-District water demand at 314,000 AFY exceeding the 300,000 AFY maximum allocation available to SSJID from Stanislaus River diversions. SSJID has managed to meet the in-District water demands through the implementation of projects that have reduced their canal and lateral system losses, water conservation projects to capture and reuse OID spills, and the conjunctive use of groundwater supplies through District and private wells.

Simulation of baseline water demands is integrated through the NMOM on a monthly basis. A summary of the simulated baseline water demands without impairment of Stanislaus River water supply compared to actual diversions during 2005 through 2015 is presented in Appendix D, *Water Resources Analysis*, both on a monthly basis and on an annual basis, in units of TAF.

7.4.1 SSJID Water Demand Components

Discussion of baseline water demands by demand component are presented in this section.

7.4.1.1 On-farm Demand for Applied Water

The on-farm demand for applied water is calculated using the following primary data sources: (1) SSJID irrigated acreage by crop, (2) evapotranspiration of applied water (ET_{AW}) using the integrated demand calculator (IDC) based on historical climate and consumptive use patterns by crop, and (3) average District-wide on-farm irrigation efficiency values.

The on-farm demand for applied water is the largest component of the SSJID demand and is closely tied to land use and cropping. Cropping patterns within SSJID are presented in Section 4, *On-farm System Assessment*. Overall, irrigated acreage within SSJID remained relatively constant from 2006 through 2018 and the 2018 conditions of 53,222 irrigated acres are used for baseline conditions.

Following the evaluation of crop specific water balances using the IDC model to determine ET_{AW}, District level on-farm irrigation efficiency values were assessed on a monthly and annual basis within the recent historical water balances. Although monthly efficiency values are used to estimate monthly on-farm demands for applied water, the annual average field level efficiency was 67% throughout the 2005 through 2015 recent period of record.

Applying the ET_{AW} and monthly field level efficiency values, estimates of on-farm demand for applied water were assessed over the hydrologic period of record for 1922 through 2019, resulting in the distribution of demands presented in Appendix D, *Water Resources Analysis*.

7.4.1.2 Canal System Losses

Canal system losses include losses to canal seepage, evaporation, and operational spills. Historical average seepage and evaporation losses for SSJID add up to 34,510 AFY. For noncritical water year types in which deliveries are not limited, lateral operational spills average 24,770 AFY. The combined canal system losses in noncritical water year types is 59,280 AFY or about 23% of the net diversion demand, and 31,305 AFY or approximately half of this loss contributes to groundwater recharge.

In critical water year types, operational spills are reduced through tightened District operations, and operational spills are reduced on average by 6,260 AFY to 18,510 AFY.

7.4.1.3 Reservoir Losses

Reservoir losses include losses to seepage and evaporation in Woodward Reservoir. Historical average seepage and evaporation losses add up to 28,510 AFY with 74% of this loss contributing to groundwater recharge.

7.4.1.4 Municipal Deliveries

SSJID began delivering water for municipal use in 2005, and demands have steadily increased since that time up to 21,710 AFY in 2018 (refer to Figure D-10 in Appendix D, *Water Resources Analysis*). Current water delivery agreements between SSJID and the partner cities in the SCWSP commit SSJID to delivery of up to 31,522 AFY under Phase 1 of the SCWSP. Actual deliveries are adjusted each year based on water demand projections provided by the partner cities annually and based on adjustments in demands communicated throughout the year. For the baseline (2018) condition, municipal demands are assumed to be 22,500 AFY, set slightly above actual 2018 deliveries.

7.4.1.5 Other Demands

The only other demands category for SSJID are deliveries made to the U3 Ranch for irrigation purposes. These deliveries are sourced from the Upper MSC above Woodward Reservoir outside of the SSJID service area; they are not accounted for in the on-farm demand for applied water within SSJID. Average annual deliveries to the U3 Ranch are 4,410 AFY.

7.4.2 SSJID Internal Water Supplies

Internal water supplies within the SSJID system are used to offset the demand for diversion of Stanislaus River water. Internal water supplies include a combination of groundwater resources, local inflows, and water recycled from other irrigation uses.

7.4.2.1 District Groundwater Pumping

SSJID's groundwater pumping of District wells ranged from 2,600 to 6,100 AFY from 2005 through 2015. Excluding dry and critical water year types, the average SSJID District well pumping was 4,380 AFY, which is assumed for baseline conditions.

7.4.2.2 Minimum Private Groundwater Pumping

Private pumping within SSJID ranged from 38,000 to 81,000 AFY and averaged 54,000 AFY during 2005 through 2015 (refer to Figure D-11 in Appendix D, *Water Resources Analysis*). With recent trends in groundwater development, however, groundwater use in the latter half of this period excluding diversion impaired water supply years is likely most representative of baseline current private pumping practices. For this reason, the average private pumping during the pre-drought years of 2011 and 2012 was used to represent baseline conditions with an annual pumping of 56,000 AFY. Private pumping estimates published in the 2020 AWMP (SSJID 2020) reported private pumping of 58,232 AFY in 2019 (a wet year type), which confirms the baseline annual private pumping estimate is reasonable.

7.4.2.3 Intercepted Flow Used as Supply

Intercepted flows used as supply include SSJID capture of operational spills from OID as well as direct precipitation and local inflow to Woodward Reservoir. The combination of these terms totals 8,840 AFY.

7.5 Future Water Demand

SSJID's baseline water demands for the future condition at a planning horizon of year 2040 are summarized in Table 7-2. These demands represent an average climate year demand condition with sufficient Stanislaus River water supply to meet in-District water demands.

Table 7-2. SSJID Average Future (2040) Forecasted in-District Water Demands

Water Supply/Demand Component	Subcomponents	SSJID Total	Notes
On-farm demand for applied water		170,690 AFY	a,c
Canal system losses	SSJID JMC loss	1,995 AFY	c
	Upper MSC seepage	455 AFY	c
	MDC/MSC seepage	25,550 AFY	c
	MDC/MSC evaporation	520 AFY	c
	Lateral seepage	5,300 AFY	c
	Lateral evaporation	690 AFY	c
	Lateral operational spills	15,620 AFY	b,c
Reservoir losses	Woodward Reservoir evaporation	7,460 AFY	d
	Woodward Reservoir Seepage	21,050 AFY	d
Municipal deliveries	Municipal deliveries to WTP	43,090 AFY	b,d
Other demands	U3 Ranch delivery	4,410 AFY	c
Total SSJID in-District water demands		296,830 AFY	
District groundwater pumping		4,380 AFY	b,c
Minimum private groundwater pumping		45,270 AFY	c
Intercepted flow used as supply	OID spills to SSJID	4,060 AFY	b,c
	Woodward Reservoir precipitation	1,360 AFY	d
	Woodward Reservoir local inflow	690 AFY	d

Water Supply/Demand Component	Subcomponents	SSJID Total	Notes
Total SSJID internal water supplies		55,760 AFY	
SSJID's Stanislaus River diversion demand for in-District use		241,070 AFY	

Notes:

General—1994 through 2015 data were used for developing SSJID water balance components aside from on-farm demand. On-farm demands use 2018 cropping and irrigation efficiencies and 1922 through 2018 climate data.

[a] While average year conditions are presented, on-farm demand for applied water varies annually in response to climate with up to 76,000 AFY between high and low demand years.

[b] Operational spills, District groundwater pumping, OID spills to SSJID, and municipal deliveries can vary in response to shortages during years of impaired Stanislaus River diversion availability but are presented as typical annual values.

[c] Covers irrigation season months of March through October.

[d] Terms associated with Woodward Reservoir and municipal deliveries cover the entire year.

As shown in Table 7-1 and Table 7-2, SSJID's total Stanislaus River diversion demand is expected to only reduce slightly by 3,290 AFY from baseline (2018) to future (2040) conditions. However, anticipated changes in demands and internal supplies between baseline and future conditions are as follows:

- 28,190 AFY reduction in on-farm demand for applied water due to urbanization, a reduction in irrigated acreage inside SSJID, changing crop distribution, and increased on-farm irrigation efficiency.
- 9,150 AFY reduction in lateral operational spills resulting from the Recommended CIP regulation reservoirs.
- 20,590 AFY increase in municipal water deliveries up to Phase II planning volumes under the SCWSP.
- 2,730 AFY reduction in flows captured from OID operational spills due to continued modernization of OID's water delivery system.
- 5,700 AFY reduction in minimum private groundwater pumping due to a reduction in irrigated acreage.
- 5,030 AFY decrease in minimum private groundwater pumping due to a larger fraction of District irrigation demands being met by increased surface water deliveries resulting from the implementation of WMP projects.

It is anticipated that implementation of the recommended CIP program will improve service across the District's distribution system, making an incremental increase in the amount of water available to customers. Such improvements, coupled with increasing groundwater regulation, are likely to result in reduced in-District groundwater use. Furthermore, future groundwater regulations and other regulatory threats could force the District to conjunctively manage groundwater by maximizing its surface water entitlements.

Changes from SSJID baseline to future conditions are discussed in more detail in the following sections.

7.5.1 SSJID Water Demand Components

Discussion of future water demands by demand component are presented in this section.

7.5.1.1 On-farm Demand for Applied Water

The on-farm demand for applied water is a function of climate and weather conditions, total irrigated acreage by crop, and on-farm irrigation efficiency. For the purposes of the baseline and future water demand comparisons, the climate conditions defined by the hydrologic period of record from 1922 through 2019 are used for both planning periods.

SSJID's historical and forecasted changes in land use were evaluated under SSJID's Water Master Planning effort and are summarized in Table D-3 of Appendix D, *Water Resources Analysis*. The largest changes in land use include an approximately 5,600-acre reduction in irrigated acreage inside SSJID due to continued urbanization inside the District service area and changes in crop distributions in response to these land use pressures and market conditions.

Increases in on-farm irrigation efficiency are expected over the planning horizon in response to an increase in tree and vine acreage and the continued conversion from flood to drip, micro, and sprinkler irrigation as older orchards are taken out and replanted. With an increase in the estimated tree and vine average irrigation efficiency from 70 to 75%, the SSJID average on-farm irrigation efficiency is assumed to increase from 68 to 72% for the future condition.

The future on-farm demand for applied water was projected using anticipated future land use and cropping and irrigation efficiency, resulting in the distribution of demands presented in Appendix D, *Water Resources Analysis*.

7.5.1.2 Canal System Losses

In the Recommended CIP presented in Appendix E, *Infrastructure Plan* three in-system regulating reservoirs are planned for implementation as funding becomes available. Each of these projects will improve the operational efficiency of SSJID water deliveries within the affected lateral service areas of the reservoirs, resulting in a reduction in lateral operational spills. As detailed in Appendix E, *Infrastructure Plan* the three facilities and the projected annual reductions in lateral operational spills associated with each project are as follows:

- FCOC Recirculation Reservoir—7,000 AFY
- Q/Qc Regulation Reservoir—650 AFY
- Bk/Bkf Regulation Reservoir—1,500 AFY

Within the water balance, the combined effect of constructing and operating these three projects is a 9,150 AFY reduction in estimated future canal operational spills.

7.5.1.3 Reservoir Losses

There are no proposed infrastructure projects or planned changes to reservoir operations that are anticipated to change the water losses from Woodward Reservoir. Reservoir losses are projected to be the same in the future as under baseline conditions.

7.5.1.4 Municipal Deliveries

For the purposes of the WMP, it will be assumed that the City partners will increase their water demands from current baseline conditions of 22,500 AFY up to the Phase II water allocation limit of 43,090 AFY by the WMP planning horizon of 2040, increasing SSJID's municipal water demands by 20,590 AFY compared to baseline. Additional information can be found in Section 1.6.1.4 of Appendix D, *Water Resources Analysis*.

7.5.1.5 Other Demands

Other demands are projected to be the same in the future as under baseline conditions.

7.5.2 SSJID Internal Water Supplies

7.5.2.1 District Groundwater Pumping

District groundwater pumping is projected to be the same in the future as under baseline conditions.

7.5.2.2 Minimum Private Groundwater Pumping

Overall, SSJID is a net positive contributor to the ESJGWA Subbasin so future regulation of groundwater use under the GSP for this subbasin is not expected to significantly change in-District private groundwater use patterns. Assuming private groundwater use patterns do not change substantially on a District average per unit area basis but accounting for a 10% reduction in overall irrigated acreage within the District, the minimum private groundwater pumping is also projected to decrease by 10% or 5,700 AFY.

An additional 10% reduction in minimum private groundwater pumping (decrease of 5,030 AFY) is also projected for the future demand scenario. This reduction is in response to a larger fraction of District irrigation demands being met by surface water deliveries resulting from the implementation of WMP projects.

7.5.2.3 Intercepted Flow Used as Supply

The primary difference in intercepted flow used as supply in the future is a reduction in captured spills from OID to SSJID. As OID continues to implement its modernization plan, OID's operational spills are projected to be reduced by 40% from baseline conditions. As a result, OID spills to SSJID are projected to be reduced by 2,730 AFY on average compared to baseline conditions.

7.6 Baseline Water Supply Reliability Results

SSJID's baseline water supply reliability is described by the results of a simulation of river system operations for the New Melones Project and SSJID and OID's Tulloch Reservoir, Goodwin Dam, and canal systems. The model simulates the operation of the river and reservoir system with the assumptions described in Section 7.4, *Baseline Water Demand* regarding underlying regulations, requirements and obligations. The Districts' baseline water supply reliability from the Stanislaus River is the magnitude of water available for diversion and the frequency of that availability. Subsequently, the Districts' overall water supply water reliability is the comparison of the Districts' water demand inclusive of their assumed system operation efficiencies and other resources, such as groundwater and reuse, and the supply available from the Stanislaus River.

7.6.1 Baseline Water Supply from the Stanislaus River

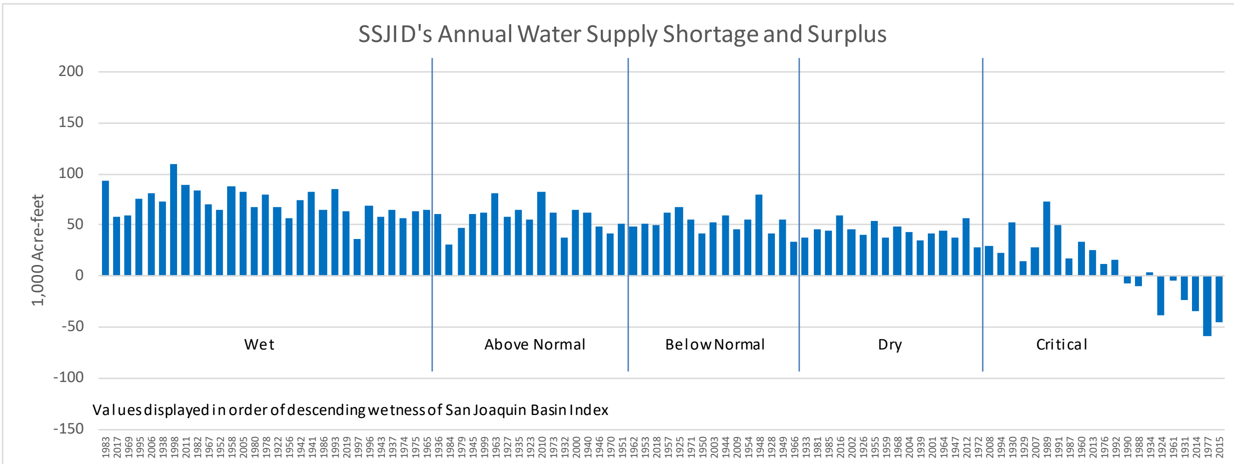
For the baseline condition, the Districts' water supply reliability is defined by the amount of water available within the 1988 Agreement, up to 600 TAF per year as may be limited during years when inflow into the NMR is less than 600 TAF. Within the historical hydrologic analysis performed for the baseline condition that supply will range from a low of 388 TAF to a high of 600 TAF, which is the maximum entitlement under the 1988 Agreement. The average entitlement is 582 TAF.

7.6.2 SSJID Water Supply Reliability

SSJID's overall water supply reliability is the comparison of SSJID's water demand inclusive of their assumed system operation efficiencies and other resources, such as groundwater and reuse, and the supply available from the Stanislaus River. Deficits or surpluses can occur depending on the coincident water demands and available supplies in any given water year. Deficits generally occur during years when meteorological conditions of low precipitation cause higher applied water needs combined with lower runoff and a reduction to full entitlements under the 1988 Agreement.

Put in terms of surpluses and deficits by hydrologic conditions, Figure 7-2 illustrates the state of SSJID's overall water supply reliability as contrasted against Stanislaus River and area water conditions.

Figure 7-2. SSJID's Annual Water Supply Shortage and Surplus by Year Type Under Baseline Conditions



In most years, SSJID has sufficient or surplus water supplies to meet its requirements. In drier years when demands are higher and its surface supplies are less than full, entitlement deficits could occur. These deficits can be mitigated with additional District water system and farming practice efficiency improvements, additional groundwater pumping or cropping changes, and fallowing. Overall, it is projected that SSJID water supplies are sufficient to cover all of SSJID water demands in 88 out of 96 years or more than 9 out of 10 years on average.

7.7 Future Water Supply Reliability Results

Although the regulatory climate affecting SSJID's surface water supplies is dynamic, the current projection of future water supply conditions to the WMP planning horizon of 2040 is that Stanislaus River water supplies to SSJID will remain the same as under baseline conditions.

As presented in previous sections, SSJID's diversion demand for Stanislaus River water is expected to only reduce slightly by 3,290 AFY from 244,360 to 241,070 AFY from baseline to future conditions.

The resulting effects of changes to water supply and diversion demand is that future water supply reliability should be similar to or improve slightly from baseline conditions.

7.8 Groundwater Recharge

Groundwater recharge resulting from canal and reservoir seepage, drain seepage, and deep percolation of applied water are accounted for as recharge terms and are considered in combination with both District and private groundwater pumping to estimate SSJID's net groundwater recharge.

As reported in the 2020 AWMP, the resulting SSJID net groundwater recharge has been positive in years 2005 through 2019, ranging from a low of 14,800 AFY in the drought and surface water cutback year of 2015 to a high of 109,796 in the 2005 wet year type. The average net groundwater recharge in the recent 2015 through 2019 years was 51,600 AFY, which is considered the net recharge for current baseline conditions. Projected future net recharge conditions at the 2040 WMP planning horizon are expected to maintain a positive net groundwater recharge contribution to the subbasin.

7.9 Summary and Conclusions

For the baseline condition, Stanislaus River diversion demands are estimated at 244,000 AFY for SSJID on an average year basis. During a low precipitation, high ET year, when on-farm demands peak, SSJID's demand can be 34,000 AFY higher than the average diversion demand; this increases diversion demands to 278,000 AFY in a peak on-farm demand year. SSJID relies on additional internal water supplies to reduce demands for Stanislaus River diversions. The internal supplies included conjunctive use groundwater pumping (District and private), District and private reuse of drainwater and tailwater, capture and reuse of operational spills, recycled water from industrial sources, and precipitation and local inflows captured in the distribution system. These internal supplies add up to 69,000 AFY for SSJID on an average year. Without the benefit of these internal supplies, SSJID's demand for Stanislaus River diversions would be 314,000 AFY in an average year and as much as 348,000 AFY in a peak on-farm demand year, which both exceed SSJID's maximum allocation of 300,000 AFY.

For the future (2040) condition, Stanislaus River diversion demands are estimated at 241,000 AFY for SSJID on an average year basis. Therefore, over the next 20 years, considering agricultural to urban land use development, increased municipal deliveries, groundwater regulations, irrigation efficiency improvements, resulting future SSJID surface water demands remain about the same (3,000 AFY reduction from the 244,000 AFY average annual baseline District demand). During a low precipitation, high ET year, when on-farm demands peak, SSJID's demand can be 29,000 AFY higher than the average diversion demand. This increases diversion demands to 270,000 AFY in a peak on-farm demand year. SSJID relies on additional internal water supplies to reduce demands for Stanislaus River diversions. These internal supplies add up to 56,000 AFY for SSJID on an average year. Without the benefit of these internal supplies, SSJID's demand for Stanislaus River diversions would be 297,000 AFY in an average year and as much as 326,000 AFY in a peak on-farm demand year.

A detailed assessment of the District's water supply reliability was conducted for the baseline current conditions using the NMOM. Considering historical hydrology and the Districts' 1988 Agreement, the Districts' water supply is highly reliable resulting from inflow to NMR being near 600 TAF or greater about 85% of the time. This percentage signifies that water supply reliability remains relatively high compared to other irrigation districts. In addition, considering the baseline District demands, which incorporates SSJID's water conservation and conjunctive use operations compared against the Stanislaus River water supplies available under the 1988 Agreement, SSJID experiences shortages only in the driest years during critical water year types under baseline conditions. Specifically, SSJID water supplies are sufficient to cover all of SSJID water demands in more than 9 out of 10 years on average.

Over the next 20 years, considering agricultural to urban land use development, increased municipal deliveries, groundwater regulations, irrigation efficiency improvements, resulting future surface water demand remains about the same. With projected consistent water supply conditions, the future forecast is for water supply reliability to remain high and be similar to or improve slightly from baseline conditions.

One of the reasons for SSJID's high water supply reliability are the District water conservation efforts, which include District and private reuse of drainwater and tailwater, capture and reuse of operational spills, and precipitation and local inflows captured in the distribution system. In addition, SSJID's groundwater conjunctive use practices include pumping of District-operated and District customer-operated private groundwater wells to supplement surface water supplies.

SSJID's recharge contributions to the East San Joaquin Groundwater Basin more than offset District and customer groundwater pumping on average under current conditions. SSJID will continue supporting conjunctive use operations by maintaining a positive District net recharge to the groundwater basin providing District customers coverage for groundwater pumping through periods of reduced water availability.

Historically, additional water demands have included deliveries to irrigated lands adjacent to SSJID through annual contracts and water transfers made by OID and SSJID to others. For the baseline and future water demands, annual contracts and water transfers were not included. These uses are considered as part of the discretionary uses that Districts may exercise when water supply is sufficient to meet other District commitments.

Excess surface water availability in some years presents an opportunity for SSJID to expand agricultural or municipal water service, provide out-of-District water sales, transfer water within their basin, or transfer water out of the basin to meet demands of others. These activities are important to improving groundwater management with the basins receiving water while generating revenue for infrastructure modernization within the District, which allows SSJID to use their combined water supplies more efficiently. Although not included as part of the actions under this WMP, SSJID will continue to explore opportunities to make full beneficial use of supplies through transfers or other water management actions.

8. Financial Analysis

The WMP presents a 30-year vision for District finances and CIP investments in the context of long-term water resources management. SSJID applied its financial projection model (FPM) to ensure that recommendations resulting from the WMP were holistic in scope and would consider not only system performance and technical feasibility of CIP implementation, but financial reality as well. It is imperative that current and future capital infrastructure plans are developed in tandem with a financing strategy capable of delivering them.

Throughout the WMP planning process and financial analysis, the District considered challenges to the current business model as well as the long-term financial approach for implementing the WMP.

The financial analysis presented here covers many future scenarios. Under each scenario, a unique financial strategy, or financial plan, was developed based on inputs of that scenario and refers to the combination of revenue sources, debt issuances, and pulls to other financial levers that may be required to reach long-term financial sustainability and fund the CIP under the specified scenario.

The financial analysis presented in this section is intended to guide future decision-making such as changes to customer rates and debt issuances. The District's financial strategy, and the FPM itself, must also be updated at regular intervals to reflect changing conditions, including updated infrastructure plans, policy priorities and other variables affecting the District's financial outlook.

After adoption of the WMP, the District will engage with an outside consultant to perform a rate study; the purpose of which is to develop the needed rate structure and schedule required to reach the financial goals of the WMP. Upon completing the rate study, the District will embark on the Proposition 218 process to adopt and implement the resulting rate structure.

8.1 Purpose and Approach

The financial analysis component of the WMP is intended to set the District on a path for long-term financial sustainability and to ensure that the WMP's recommended capital improvement plan (CIP) will be financially feasible.

Throughout the WMP financial analysis process, including iterations with infrastructure planning, SSJID strived to align with the following WMP goals: (1) provide an affordable water supply to SSJID customers and (2) ensure SSJID remains financially sound.

8.2 Background

A financial screening tool (FST) developed by Jacobs was used to determine the financial feasibility of implementing the initial infrastructure alternatives developed during the early stages of the WMP. Figure 6-3 outlines these alternatives as: (1) limited infrastructure modernization, (2) expanded infrastructure modernization, and (3) District-wide pressurization. The FST was designed to analyze infrastructure alternatives at a high level and helped narrow the scope of capital projects that may be financially feasible over the 30-year planning horizon.

Based on FST results, District-wide conversion to pressurization was deemed financially infeasible due to the extraordinary cost. Coupled with infrastructure analysis and feedback from the GAC, the focus of the CIP shifted to Alternatives 1 and 2. Attachment 7, *Intermediate Infrastructure Screening Analysis* in Appendix E, *Infrastructure Plan* further describes the decision to abandon District-wide pressurization as a potential CIP for the WMP.

SSJID first developed an in-house financial model, the FPM, in 2010 to review and consider financial implications of potential changes to District operations. SSJID modified the FPM to perform analysis specifically for the WMP planning process. The robust functionality of the FPM allows the District to paint a complete financial forecast under various future scenarios expanding beyond the impacts of the CIP.

Early modeling through the FPM revealed an impending vulnerability in SSJID's business model: irrigation expenses have grown while irrigation revenues have remained stagnant for nearly three decades. Despite ongoing operating losses, SSJID remains financially solvent due to revenues received from other sources outside of its irrigation customer base. However, reliance on those sources in perpetuity presents a risk to the District. The top priority of any financial plan had to be to adjust SSJID's business model to reduce the irrigation component's reliance on revenue sources other than irrigation-based rates, fees, and charges.

After using the FST to screen initial CIP alternatives, the FPM replaced the FST as the financial analysis tool and was used to evaluate the six capital expenditure scenarios, or CIPs, defined in Section 6.3.3, *Evaluation of Capital Improvement Plan Project Scenarios* as Bare Minimum projects, Maintain Existing Service, Tier 1, Tier 1+, Tier 2 and Tier 3.

Between GAC meetings and SSJID Board presentations, staff met with the ad hoc Finance Committee of the Board to share WMP progress including trends identified from the FPM and receive feedback on developments. Since Finance Committee members are also District customers, their feedback helped guide direction of the WMP to ensure the resulting WMP would receive greater customer acceptance.

8.3 Current Business Model and Financial Position

Based on findings from the FPM, the District determined that the current business model is not feasible for long-term viability. The base irrigation rate has remained unchanged at $24 per acre since 2000, up from $22 per acre set in 1993. Frozen operating revenues has led to an annual operating loss that continues to grow. SSJID has been afforded the ability to operate at a loss yet remain financially solvent because of its non-operating revenues and, to some extent, water transfers. Over 50% of the District's annual non-operating revenues come from distributions from the Tri-Dam Project. Other non-operating sources include allocations of local property tax revenues and investment earnings on cash reserves.

Per FPM results, assuming the District continues the trajectory it is on and does not adopt any changes in irrigation customer rates, there will come a point in which operating expenses exceed all sources of revenues, including Tri-Dam Project distributions. At that point, the District will experience ongoing negative cash flows starting in 2039 and become financially insolvent (negative cash reserves) in 2050 (refer to Figure 8-5). While non-operating revenues have been sufficient to cover operating costs and should continue to be so during the short-term, they will eventually become insufficient to deliver essential infrastructure improvements and implement the recommended CIP.

The District's reliance on non-operating revenues and water transfers presents a risk as these sources are subject to volatilities outside of the District's control. Tri-Dam Project distributions are subject to contract negotiations, the energy market, and hydrology. Water transfers are reliant upon available water resources, the needs of other agencies, hydrology, and coordination with other agencies, including state and federal agencies. Local property tax revenues fluctuate with property valuation and the housing market, whereas investment earnings are greatly influenced by the bond market.

Fortunately, SSJID's current financial position is strong with over $80 million in cash reserves, no debt and relatively stable revenues giving the District time to adjust its course. However, despite being strong, its reserves are not as significant as they seem, as more than 50% are designated by the District's reserve policy for purposes other than capital improvement of irrigation infrastructure, and are therefore not available for implementation of the recommended WMP CIP.

The following key observations were made during the financial analysis of the current business model and are reflected in Figure 8-1.

- SSJID operates at a loss.
- Operating revenues are primarily from the sale of treated water to the District's municipal partners, providing irrigation service to customers and occasional water transfers to outside agencies. Irrigation operating revenues account for approximately $2 million per year in Figure 8-1.
- High operating expenses are required to provide services. In 2021, irrigation operating expenses were $18.5 million.
- SSJID has remained financially solvent due to non-operating revenues, mostly from Tri-Dam Project distributions. Non-operating revenues reduce, and in most years eliminate, operating losses, producing a positive net income for the District. However, in years with low distributions from Tri-Dam Project and no significant out-of-district water transfers, a net loss results (refer to years 2020 and 2021 on Figure 8-1). As these revenue sources are generally out of SSJID's control, the District should not rely on these revenue sources to cover growing operating expenses and District needs.

Figure 8-1. Current Business Model (2018 through 2021)

	2021	2020	2019	2018	
Operating Revenues	$ 12,600,000	$ 11,900,000	$ 10,700,000	$ 16,400,000	Water Transfer $6.3 million
Operating Expenses	32,300,000	33,000,000	31,100,000	29,000,000	
Operating Income (Loss)	(19,700,000)	(21,100,000)	(20,400,000)	(12,600,000)	
Non-operating Revenues	16,800,000	20,300,000	26,600,000	16,800,000	
Net Income (Loss)	$ (2,900,000)	$ (800,000)	$ 6,200,000	$ 4,200,000	
	Tri-Dam $9 million	Tri-Dam $11 million	Tri-Dam $18 million	Tri-Dam $9 million	

As a key conclusion of the WMP, SSJID must address the current business model issues as a priority that is equally important as implementing a long-term infrastructure program. SSJID identified the following essential components of a financial plan to remedy the current business model for the District's long-term financial viability:

- **Control the growth of irrigation operating losses.** SSJID prides itself on providing affordable water to its customers, and is hopeful that it will continue to do so many years into the future. While it is not the District's intention to fully eliminate the irrigation operating loss at this time, action must be taken to reduce and stabilize the loss for the continued success of the District and communities it serves. Irrigation rates have not increased substantively in nearly three decades. As long as the District continues to receive sufficient non-operating revenues, the irrigation operation can operate at a slight loss. However, to ensure that adequate cash reserves are maintained, such losses cannot be allowed to grow too quickly or to continue in perpetuity.
- **Become less reliant on non-operating revenues.** Reliance on non-operating revenue sources exposes the District to outside risks such as market changes, which creates vulnerabilities for SSJID in light of the fact that its irrigation revenues have not kept pace with the irrigation operational expenses. The FPM revealed sensitivity to fluctuations in SSJID's distributions from the Tri-Dam Project, which are dependent on Tri-Dam's hydropower sales contract and annual hydrology. The Tri-Dam hydropower contract will be renegotiated in 2023, and will likely be up for renewal or renegotiation every 5 to 10 years thereafter. Each new contract price will be dependent of market factors present at that time. Changes in the hydropower contract correlate to substantial changes in SSJID's forecasted revenue as discussed in the sensitivity analysis in Section 8.5.7, *Sensitivity Analysis*.

8.4 Scenarios

As described in Appendix E, *Infrastructure Plan,* a comprehensive list of capital improvement projects was developed and categorized into different candidate capital improvement plans; bare minimum projects, maintain existing service, Tier 1, Tier 1+, Tier 2 and Tier 3. SSJID performed several iterations in the FPM among the candidate capital improvement plans, seeking a reasonable balance between infrastructure needs and financial considerations. However, through the preliminary financial analysis, Tier 2 and Tier 3 scenarios were deemed financially infeasible with projected 2040 irrigation rates doubling that of the ultimately recommended CIP (Tier 1+).

After the preliminary analysis was complete and the CIP and revenue needs were better understood, the focus shifted to three scenarios for comparison and presentation purposes with a larger audience including the SSJID Board and the GAC. Each scenario had a specific analytic focus highlighting level of service, CIP and the associated financial plan of that scenario. The scenarios are summarized as follows.

1. **Current business model.** This scenario simulated the District extending its current business operations into the future without increasing irrigation rates and not implementing a capital improvement plan beyond current and recent investment levels.
2. **Maintain existing service.** This scenario reflects implementing a set of capital improvement projects required to maintain current service levels to irrigation customers.
3. **Recommended CIP (Tier 1+).** This scenario represents implementing a CIP that takes an incremental step toward improving service and addressing service equity issues across the District.

8.5 Financial Projection Model

The FPM is a planning-level tool designed to model how various factors or events might financially impact the District over the next 30 years. It was used to evaluate the financial feasibility of implementing various capital expenditure scenarios and guided the development of financial strategies used in the WMP.

To evaluate the financial vitality of the District under various future scenarios, inputs were made to the District's FPM. Based on inputs, the FPM forecasts key financial performance indicators over the next 30 years, referred to as the FPM results or outputs. The results provided evaluation criteria in which the District could use to compare different scenarios, mainly different CIPs.

8.5.1 Design

The design principle SSJID followed for the FPM is that it should produce projections of the three basic financial statements: (1) the statement of net position; (2) the statement of revenues, expenses and changes in net position; and (3) the statement of cash flows. The three basic financial statements provide all the financial information typically needed for financial analysis, and in the conventional form that accountants, financial managers, and analysts expect. The District's audited financial statements serve as the model's starting point, or "year 0" of the 30-year planning horizon.

The second design principle was flexibility. The FPM was designed so it can be updated and modified as needed for use in future financial planning exercises so that it may remain a useful tool years into the future. SSJID intends to revisit its financial position every five years, and use the FPM to revisit rate requirements, and adjust the District's financial plan to reflect changes in priorities, pace of CIP implementation or other changes in assumptions. The District will also incorporate actual financial results into the model on an annual basis.

8.5.2 Inputs

The FPM includes several inputs which can be adjusted independently under each scenario. All revenue sources, operating expenses, and capital improvement plans are treated as inputs to the FPM. Table 8-1 describes the parameters of the most impactful inputs. Based on inputs, the model projects financial performance on an annual basis over a 30-year period and produces the outputs (results) discussed in Section 8.5.6, *Model Results*.

Table 8-1. Financial Projection Model Inputs

Parameter	Description
Hydrology	The FPM can simulate various hydrology patterns based on recorded history. The hydrology input can replicate segments of recorded history to simulate the timing and severity of dry or wet conditions or the input can be based on the historical annual average.
Tri-Dam hydropower contract price	Input is in terms of dollars per megawatt hour (MWh).
Water transfers	Includes timing, volume and pricing of transfer(s).
Infrastructure plan, or CIP	Includes cost and timing of capital improvement projects identified in the activated CIP. CIP schedules, or capital expenditure scenarios, were developed by the engineering team and fed into the FPM. The FPM has the ability to store up to 20 different CIP schedules. Modeling is based on which of those schedules is activated by the user. The activated CIP becomes the input for that scenario.
Debt issuance	Includes year, borrowed amount, interest rate and repayment period of debt issuance(s). The debt input was used to fund significant projects identified in the activated CIP.
Irrigation customer rates	FPM can consider changes to the land-based, per-acre charge and volumetric charge independently of one another in terms of timing and magnitude of changes. Changes to irrigation charges were made to correct the business model and to fund the CIP whether it be through cash flow or repayment of debt obligations.

8.5.3 Assumptions

To measure the financial impact of different capital expenditure scenarios, all other model inputs need to remain constant. Therefore, the District had to make assumptions for inputs whose futures were unknown at the time of WMP development.

Table 8-2 summarizes the key assumptions that potentially will have the largest impact to the District’s finances. SSJID acknowledges that assumptions used in the financial analysis are based on best available information and forecasts to ensure applicability for long-term strategic planning. These assumptions will need to be continually revisited in the future with WMP implementation decisions adjusted accordingly.

Table 8-2. Financial Projection Model Assumptions

Parameter	Description
Hydrology	Historical average. SSJID understands there will continue to be dry and wet periods into the future. However, since the specific timing of drought and wet years cannot be accurately forecasted for the next 30 years, an average hydrology pattern was assumed.
Tri-Dam hydropower contract price	Contract renewal of $80 per MWh in year 2024, escalating 1.5% annually thereafter. The 1.5% is reflective of the current contract which expires at end of year 2023. In early WMP stages, the unit purchase price was projected to renew at $69/MWh in year 2024, down $11/MWh from the current contract price of $80. That assumption has since been refined by newer forecasts due to more favorable power market conditions. In the past 5 years, the energy market declined to levels at half of the current contract price. The current hydropower contract is based on set pricing levels pre-determined at time of signing. Due to the structure of the contract, Tri-Dam, and in turn, SSJID, was protected from negative market fluctuations.
Out-of-district water sales	None. SSJID is unable to predict the timing or quantity of water transfers due to the current regulatory climate and unpredictable conditions; therefore, water transfers are not included in final WMP financial strategy as to remain conservative.
Grant funding	None. SSJID is committed to seeking grant funding opportunities and is hopeful that some level of grant funding will be received for future capital projects but did not include grant funding in the final WMP financial strategy as to remain conservative.
Debt service coverage ratio (DSCR)	Annual DSCR of 125%. A ratio of 125% was a requirement under the District's prior debt issuance and falls within the range of typically required DSCRs.
Operating expenses	Unique inflationary indexes were applied to income statement line items dependent upon the historical behavior and assumed future of the line item. Additionally, an annual inflationary adjustment of 3% was applied.

8.5.4 Financial Strategies, Trends and Significant Findings

Based on the activated CIP scenario, evaluation of the financial results guided development of the financial strategy needed to implement the CIP.

To compare the CIP scenarios identified in Section 8.4, *Scenarios,* all other inputs aside from CIP, debt service, and irrigation rates were held constant across all scenarios. All inputs were entered in the FPM according to the assumptions outlined in Table 8-2 and the applicable CIP scenario was activated. Based on the resulting financial projection, the need for debt service was evaluated and customer rates were adjusted as needed to ensure the District would be financially sustainable for the 30-year period. The resulting combination of inputs, mainly debt and rates, is the financial strategy. Table 8-3 outlines the primary FPM outputs used for evaluating whether District financial needs would be met.

When developing financial strategies, the District remained sensitive to increasing its service costs to customers, based on initial GAC feedback, and an understanding of costs associated with alternative water sources such as groundwater. In its modeling, the District favored small consistent increases over large infrequent jumps when possible. These changes are typically preferable to customer groups as well.

In years of projected significant capital spending, debt issuances were inserted to the FPM if sufficient revenue could not be raised from rates. Over the long-term, financing capital projects is more costly to the District and in turn its customers. However, the associated impact to rates is less severe under a debt issuance since the debt service is spread out over time as opposed to cash flowing a project from customer rates. The former is in alignment with the goal of small, consistent increases. Under the latter, rates would sharply increase, potentially to impossible heights, in only one or a few years then, likely, sharply decrease once the project is complete and paid for. The sharp jumps correlated to cash flowing capital expenditures could be avoided if the expenditure (capital improvement) was delayed until adequate funding could be raised from rates; in essence saving up to fund a large expenditure rather than borrowing for it.

An important trend identified in the financial modeling was the significance of timing. The impact of a change to rates is not immediately seen, but rather is most impactful years after implementation. Early increases yielded more favorable impacts to later year reserves and average customer costs than late increases. It is because of this reason that SSJID must implement increases to rates now, instead of waiting for reserve balances to fall to minimum thresholds if we are to fix the business model in the 30-year planning horizon. This strategy also better positions the District to react to an unforeseen negative financial impact in later years due to the increased reserves raised under this strategy over a strategy that delays rate increases. This strategy also provides opportunity to help fund later year capital improvements via cash flow instead of relying upon debt service.

Modeling also revealed that aggressive increases needed to remedy short-term financial needs can have unintended long-term impacts. In some instances, reserves grew to unnecessary heights in the later model years due to rate increases implemented in early years, causing the District to refine its financial strategy. SSJID's intention for raising rates is not to grow reserves above reasonable levels, but to only raise them to levels necessary to ensure long-term financial sustainability.

Equally as important is the timing of capital improvement projects. Delaying an improvement, allowing the impact of early rate increases to be realized, reduces the need for debt thus reducing the overall cost of the project. However, the financial component must be balanced with infrastructure needs.

Timing of the most impactful FPM inputs proved significant. For example, altering the timing of hydrology (dry vs. wet periods) or any other forecasted event or assumption greatly affected the FPM outputs. Sensitivity analysis of the hydrology, water transfers and Tri-Dam Project hydropower contract inputs are documented in Section 8.5.7, *Sensitivity Analysis*.

8.5.5 Evaluation Criteria (Model Outputs)

The financial analysis of each scenario focused on key metrics serving as evaluation criteria used for comparing the financial model results of different scenarios. Those metrics and evaluation criteria are discussed in Table 8-3.

Table 8-3. Financial Projection Model Outputs

Parameter	Purpose
Irrigation operating loss	Financial analysis considered the trend in the annual operating loss. The primary goal of any financial strategy was to correct the business model. This meant that the annual growth of the operating loss needed to slow substantially in comparison to the current business model results shown in Figure 8-3.
Cash flow	To maintain financial sustainability, average annual cash flow over the projection period must be positive. The District may experience negative cash flows in some years, but must be at or above $0 on average.
Reserves balance	To maintain financial sustainability, District reserves consisting of cash and invested cash must meet or exceed the minimum threshold for reserve requirements as set by the District's Reserves Policy. The projected minimum reserve requirement is based on FPM inputs and assumptions and therefore fluctuates under each changing scenario. The minimum reserve requirement is based on overall District needs and considers the irrigation capital infrastructure plan, a contingency for low non-operating revenues (for example, on-going, low distributions from Tri-Dam Project due to changing contract terms, hydrology, infrastructure problems leading to low production, or any other reason), funds received from specific customer groups that are to be used only for that customer group (water treatment plant infrastructure, the District's "Division 9" pressurized service system), unfunded pension liability, and electric utility startup and litigation.
Debt service coverage ratio	The financial strategy of some CIP scenarios included the issuance of debt. To ensure the District would meet its annual debt obligations and potential bond covenants under those scenarios, financial analysis ensured projected DSC ratios met or exceeded 125% annually.
Irrigation customer rates	Changes were shown as an annual percentage change from year to year. Financial strategies with smooth percentage increases were favored.
Average customer cost per acre	The average customer cost per acre is the combination of the land-based, per-acre charge and the volumetric charge. This metric was developed to understand and convey the impact to customers resulting from the projected changes in rates.

For GAC and Board presentation purposes, the financial analysis was limited to the key financial metrics of the irrigation operating loss, consolidated net income, cash flow, reserves and average customer cost per acre.

8.5.6 Model Results

Figures 8-2 through 8-6 compare the key financial results of the scenarios identified in Section 8.4, *Scenarios*, and were presented at the October and November 2022 GAC meetings.

Figure 8-2. Comparison of Average Customer Cost Per acre by Scenario

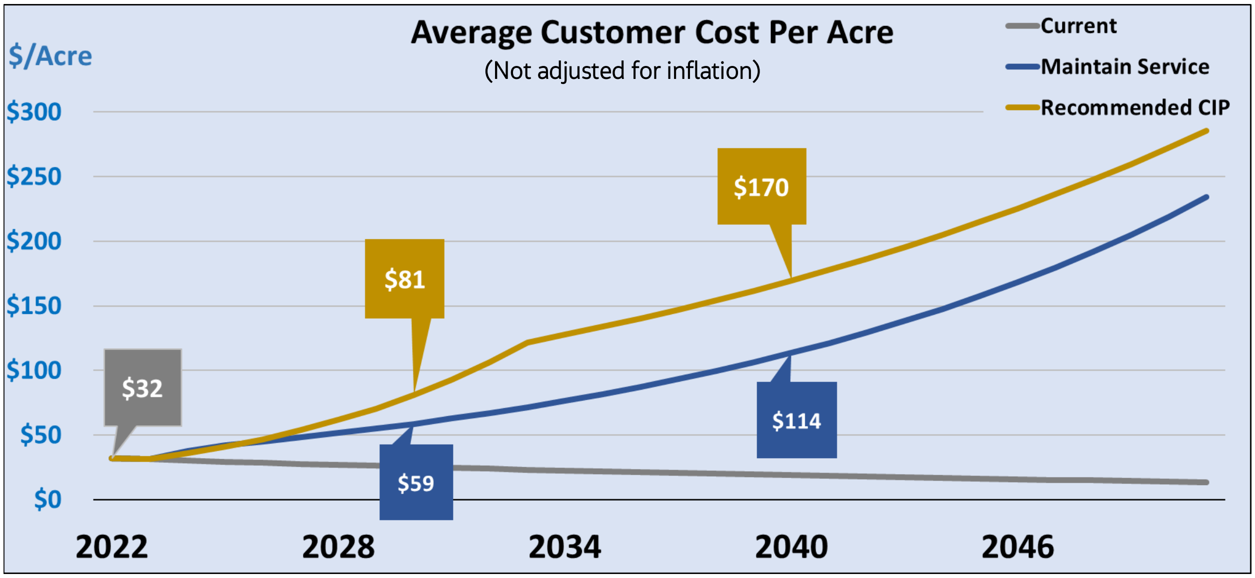


Figure 8-3. Comparison of Irrigation Operating Loss by Scenario

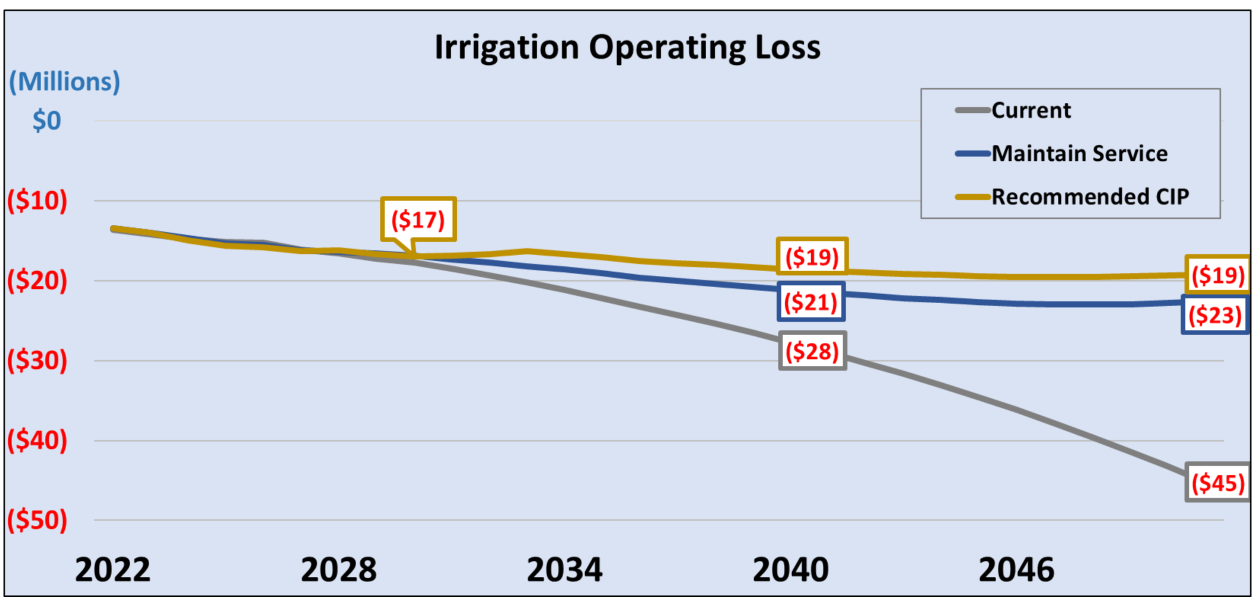


Figure 8-4. Comparison of Cash Flow by Scenario

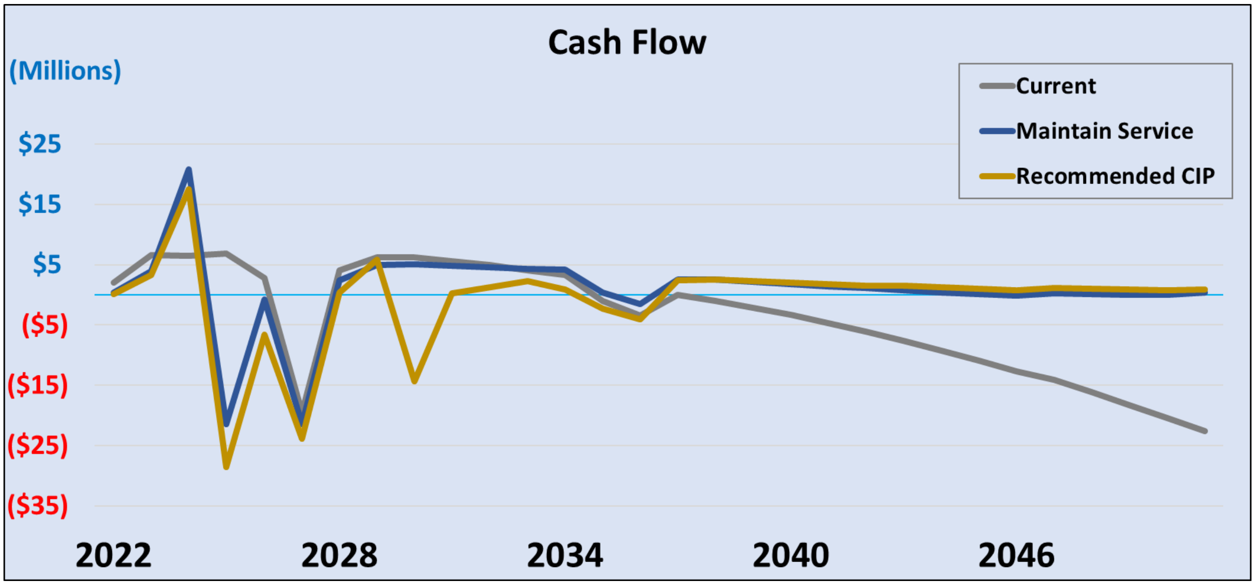


Figure 8-5. Comparison of Reserves by Scenario

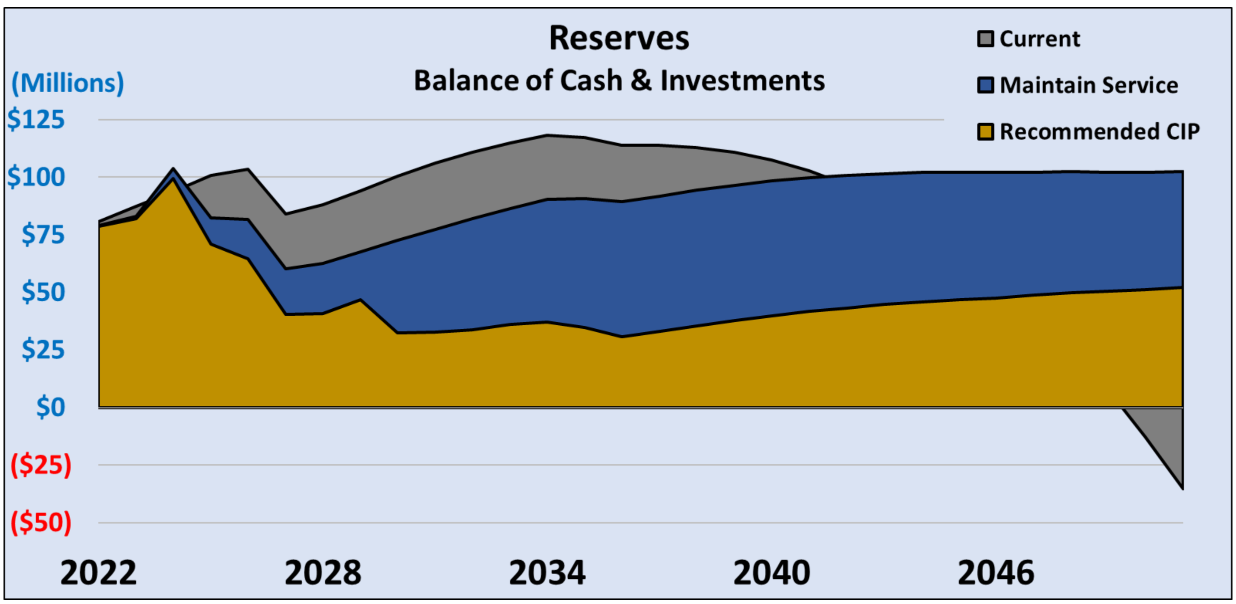


Figure 8-6. Comparison of Reserves to Minimum Reserve Requirements by Scenario

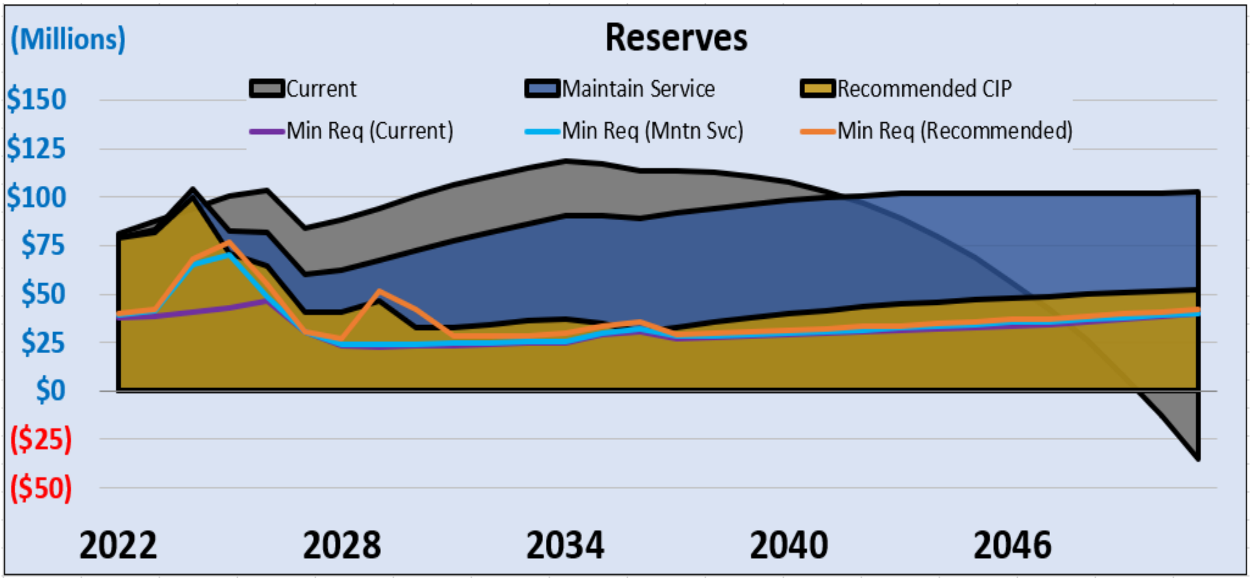


Figure 8-2 compares the average customer cost per acre over the 30-year planning period with identification of projected customer costs in years 2030 and 2040. The current business model scenario maintains the current $32 per acre rate throughout the entire period. Since the chart is shown in 2022 dollars, the value of $32 declines over time. The importance of this metric is to show that much of the rate increases are needed to meet minimum WMP goals under the "maintain existing service" scenario.

Figure 8-3 compares the irrigation operating loss for each scenario. The current business model projects a continually increasing loss while the "maintain existing service" and "recommended CIP" scenarios show suppression after 2030, and after 2047 the loss begins to reverse and trend upward. This trend after 2030 is attributed to the impact of rate changes implemented in the early model years and reflect the initiative to fix the business model.

Figure 8-4 compares the cash flow for each scenario. The current business model scenario shows a sharp and continuing decline after 2039 as irrigation losses consume all sources of revenue. The "maintain existing service" and "recommended CIP" scenarios show a $40 million dollar debt issuance in 2024, followed by significant capital spending in 2025 for the Canyon Tunnel Project. These events result in spikes and valleys in cash flow. An additional $30 million dollar debt issuance in 2029 is needed under the "recommended CIP" scenario to implement other priority capital projects. The negative spike in year 2027 under all three scenarios is reflective of the retail electric assumption.

The financial approaches of the "maintain existing service" and "recommended CIP" scenarios keep a mostly positive cash flow through the duration of the planning horizon, avoiding the sharp decline present in the current business model. Again, these results are reflective of the impacts of rate increases implemented in early model years targeted at fixing the business model. While the near zero cash flow in the later modeling years is not ideal if they were to continue long-term, as that means reserves will not grow, SSJID has time to adjust its financial plan and strategy before then. For modeling purposes, these results are ideal.

Figure 8-5 compares District reserves for each scenario, while Figure 8-6 provides the minimum reserve balance of each scenario. In the current business model scenario, without changes to rates, reserves continue to grow, but then begin to irreparably decline. The "maintain existing service" scenario builds reserves well above the minimum requirement, because this scenario corrects the business model and curbs operating losses, but does not use reserves to invest in capital infrastructure at the same level as the "recommended CIP" scenario. Though reserves exceed the minimum requirement under this scenario, they do not climb to excessive heights, instead they peak and stabilize near the $100,000 mark which is just above where SSJID has been in recent years. Therefore, this level of reserves seemed reasonable.

The financial strategy under the “recommended CIP” scenario barely meets the projected reserve requirements of that scenario and falls below the required threshold in years when the minimum requirement spikes due to correlated capital planning. While these reserve balances are not ideal, they are acceptable for modeling purposes as reserves increase to the minimum requirement immediately after years of significant capital spending. Also, reserves meet and grow with the required minimum in the later years of the model which is ideal.

As shown on Figures 8-2 through 8-6, the “maintain existing service” scenario includes the required capital improvement projects to maintain the District’s current level of service and the financial plan required to implement those projects. The majority of infrastructure investment and resulting financial adjustments required for the “recommended CIP” scenario is attributable to the maintaining existing service scenario.

8.5.7 Sensitivity Analysis

The financial plan required to implement the “recommended CIP” scenario was based on best available information and assumptions on numerous potential variables. SSJID acknowledges the uncertainty of many aspects of the analysis, but the results helped identify the recommended program and will strategically guide SSJID investments into the future. To better understand which variables have significant influence on long-term financial forecasts or potentially could impact year-to-year decision-making, SSJID performed a limited sensitivity analysis on the recommended program. The variables included the following:

- **Hydrologic variability—**The current financial analysis is based on historically average hydrologic conditions year after year for the 30-year planning horizon. The FPM can replicate hydrology patterns from segments of history. An analysis repeating the hydrology period of 1987–2015, a historically dry period that begins and ends in significant drought, was performed.

  Analyses concluded that the timing of dry, or wet, periods produce wider fluctuations in cash flow as compared to scenarios using historical average hydrology which smooths cash flow over the projection period. As a result, periods with mostly dry hydrology will result in negative impacts to cash reserves which will lead to pressure on customer rates if other revenue sources cannot be found.
- **Water transfer revenue—**Revenue generated from water transfers would greatly improve the financial standing of the District and reduce the need for increased service rates and/or bond funding. A sensitivity analysis including a modest level of water transfers was performed and reinforced the need to continue to pursue transfers when market conditions and regulatory hurdles allow.

Figures 8-7 and 8-8 present sensitivity analyses results reflective of changes to the hydrology and water transfer inputs under the recommended CIP scenario as mentioned in the proceeding paragraphs. Both sensitivity analyses held the same inputs as the recommended CIP. However, under the dry hydro analysis, the hydrology input was changed to replicate the hydrology period of 1987-2015 while the water transfer input remained at 0. Likewise, under the water transfer analysis, the water transfer input was changed to an assumption of 12,500 acre-feet transferred at $150 per acre-foot annually while the hydrology input was set to historical average. The sensitivity analyses were performed to demonstrate the potential impact of future uncertainties and acknowledge the sensitivity of output parameters. These results highlight the need for SSJID to proactively adjust variables in the FPM based on changing conditions and to continuously adapt its financial strategy to accommodate future trends to maintain financial stability. If changing conditions are not addressed in the future, these figures show the significance of financial impacts.

Figure 8-7. Sensitivity Analyses of Cash Flow Considering Water Transfers and Hydrology

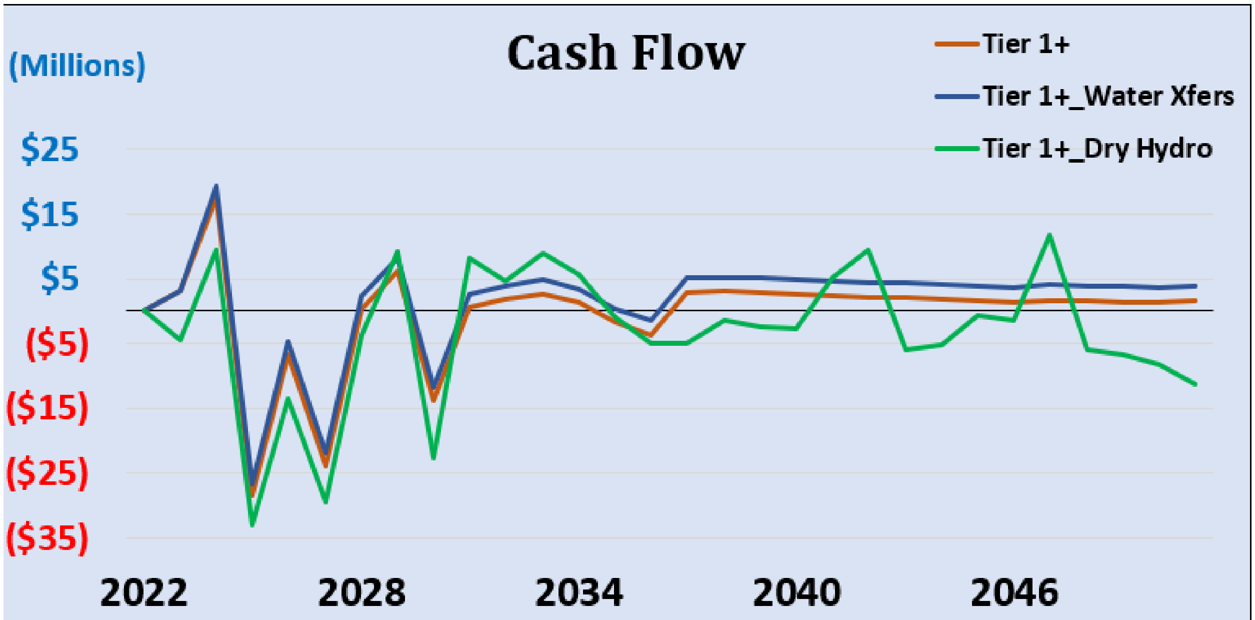
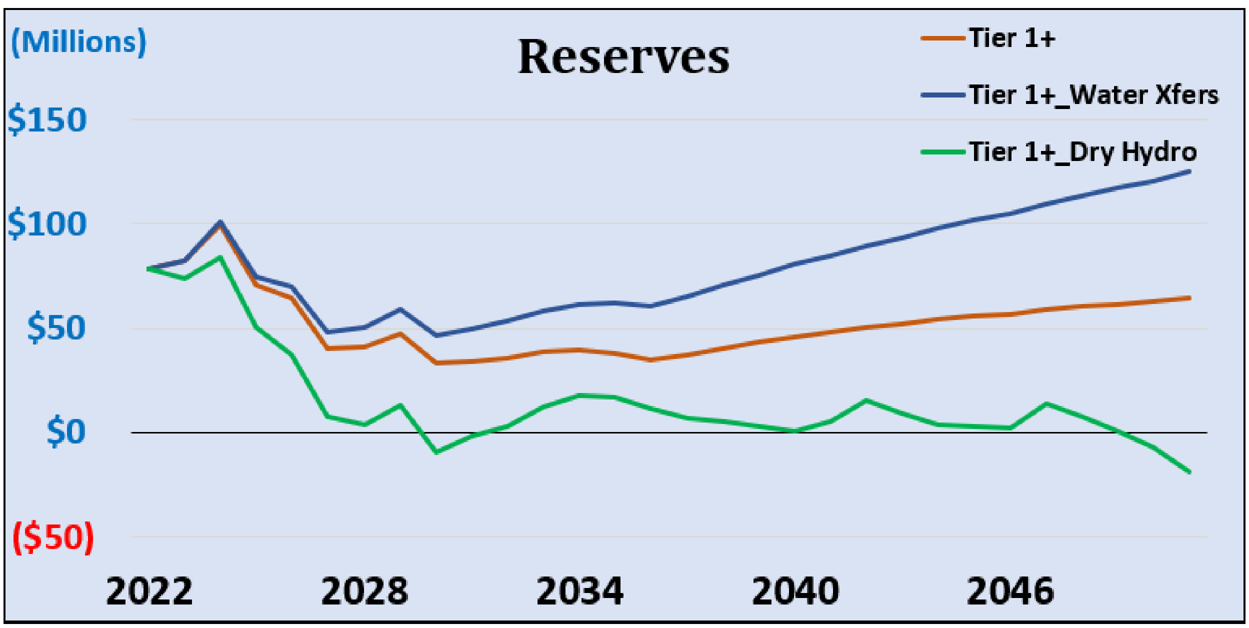


Figure 8-8. Sensitivity Analyses of Reserves Considering Water Transfers and Hydrology



- **Tri-Dam hydropower contract price**—Revenue from Tri-Dam Project distributions is the largest source of non-operating revenue and the overall financial plan is highly dependent on this variable. In early WMP planning stages, Tri-Dam hydropower contract was forecasted to renew at $69 per MWh. Under the current business model scenario, the assumption of a $69 renewal price led to on-going negative cash flows starting in the immediate early years of the planning horizon that progressively declined every year and cash reserves were gone by year 2032. Moving the assumption to $80, informed by current power market trends, delayed the plummet of cash flows until year 2029 (year 8) and extended reserves to year 2050.
- **Climate change**—As discussed in Section 3.9, *Climate Change Considerations,* long-term effects of climate change have the potential to impact water demand, supply, and hydropower generation. It was

determined that an intensive analysis of agricultural demands changes was not needed for financial analysis given the minimal impact of demands on the overall financial plan. Supply reliability due to climate change is not expected to be a major factor for financial planning at this time. There is potential for hydropower impacts due to the changes in timing of basin runoff and the potential for Tri-Dam facilities to spill more water than historical amounts resulting in less power generation than historical levels. Given that a reservoir operations model is not available to simulate the Tri-Dam reservoirs' abilities to handle the changes in basin runoff, representative financial analysis depicting a -2% change in hydropower generation was performed as a simplified approach to understanding potential impacts. The analysis concluded that a -2% change did not make a substantive impact on projected financial results and therefore supported the findings in Section 3.9, *Climate Change Considerations* that further analysis and inclusion in the financial strategy was not deemed necessary at this time. The District will continue to monitor evolving science in this area and factor potential climate change impacts into future District operations.

8.6 Key Takeaways

To align with the financial WMP goals, robust modeling was necessary to address the current business model and prepare for CIP implementation. SSJID identified the following are key takeaways from the WMP financial analysis process:

- **A financial plan has been developed to implement the 30-year recommended CIP.** The plan was crafted through careful integration with infrastructure planning, review of financial assumptions, forecast of District-controlled financial factors, and outreach with SSJID customers. The financial plan aligns with the following WMP goals: (1) provide an affordable water supply to SSJID customers and (2) ensure SSJID remains financially sound.
- **Irrigation rate increases are needed, regardless of the capital infrastructure plan.** Rate increases are necessary in the near term under any feasible WMP scenario to address the current business model.
- **SSJID will seek other opportunities to increase revenues, reduce expenses, and reduce reliance upon existing non-operating revenues**. Sensitivity analysis revealed the District's heavy reliance upon Tri-Dam Project distributions. To shield itself from negative impacts of reduced distributions due to poor hydropower contract prices, change in hydrology or any other reason, the District needs to correct its business model to become less reliant upon Tri-Dam. The District will not only turn to irrigation customers to increase future revenues, but will continue to seek other revenue sources and reduce expenses as opportunities arise. This includes continuing to seek water transfer opportunities when feasible, and proactively pursue grant funding opportunities.
- **The future will not align with what has been projected.** The FPM is built on assumptions of future conditions. SSJID will revisit the FPM and assumptions every 5 years, updating the model to reflect then current conditions, and will revise the financial plan to reflect changing assumptions and adjustments to the priorities or pace of implementation of the recommended CIP.
- **Customer rates and the associated average customer costs per acre shown in this document are for modeling and long-term strategic planning purposes only.** After adoption of the WMP, a rate study will be performed to develop the irrigation rates needed to achieve WMP goals. After which, SSJID will return to customers with a proposed rate schedule and will seek customer support as part of a transparent and public Proposition 218 process.

Finance Plan Highlights

- ✓ *Full alignment with WMP goals*
- ✓ *$191 million CIP implemented over 30 years*
- ✓ *Reasonable rate increases for irrigation customers*
- ✓ *$70M in bond funding*
- ✓ *Irrigation operating losses stabilized*
- ✓ *District cash reserves maintained*
- ✓ *Seek out opportunities for grant funding and water transfers, but do not rely on these revenue sources*
- ✓ *Assume likely revenue from Tri-Dam and revisit with new power contract*
- ✓ *Update model every 5 years and refine WMP implementation accordingly*
- ✓ *Starting point for rate study and Proposition 218 process*

9. Recommendations

SSJID's multi-year WMP planning process that included integrated technical analysis, stakeholder outreach, and Board engagement and endorsement, has culminated into a recommended program. The development process is summarized, the recommend program is presented, and additional supporting information and recommendations are presented in this section.

9.1 Program Development Process

As part of the outreach activities and technical analysis presented in Section 2, *Public Outreach* through Section 7, *Water Resources Analysis,* several issues were identified to help scope the planning process and shape the recommended program. SSJID identified several opportunities to potentially address these issues and completed an integrated, technical analysis to evaluate the opportunities for inclusion in the WMP. By vetting with SSJID staff members, Board members, and stakeholders, the opportunities were revised, refined, or eliminated for inclusion in the WMP based on customer needs, engineering, regulatory, and financial feasibility. Table 9-1 presents the primary issues considered in the WMP process as well as the accompanying opportunities considered for inclusion in the WMP. Through this process, SSJID developed a recommended WMP.

Table 9-1. Issues and Opportunities Considered in WMP Process

Category	Issues Identified and Considered in WMP Process	Opportunities Considered for Inclusion in WMP
Customer needs	▪ Reliable irrigation deliveries ▪ Reasonable irrigation rates (such as cost per acre) ▪ Improved level of service	▪ Stakeholder engagement and input ▪ Financial analysis (refer to the Finance category) ▪ Level of service and capacity analysis ▪ Strategic investments to improve level of service by carefully assessing potential project benefits and costs
Water resources management	▪ Long-range protection of surface water supply and water rights ▪ Changing land use (such as agricultural to urban conversion) ▪ Evolving grower irrigation methods ▪ Municipal water commitments ▪ SWRCB and other potential regulatory actions to reduce water supply reliability ▪ Uncertain climate change forecasts ▪ Groundwater protection ▪ Surface water service abandonment	▪ Water transfers (in-basin or out-of-basin) ▪ District annexations ▪ Municipal service expansion ▪ Water conservation and spill reduction ▪ Sustainable groundwater management (SGMA)
Infrastructure	▪ Aging conveyance infrastructure, particularly with vast pipeline system and tunnels ▪ Extending useful life of existing infrastructure ▪ Inadequate and unsustainable historical baseline infrastructure expenditures ▪ Desire for District-wide pressurized service, following Division 9 pilot project success ▪ Secure water supply and delivery reliability (for example, avoid catastrophic failure)	▪ Improved water supply conveyance reliability through focused investment ▪ Improved level of service to meet evolving on-farm irrigation needs (flood conversion to sprinkler and drip/micro methods) ▪ Feasibility of full- or partial- pressurization, incremental infrastructure modernization ▪ Canyon Tunnel and other upstream water supply improvements ▪ Variable rates of pipeline replacement and/or rehabilitation ▪ Trenchless pipeline rehabilitation program

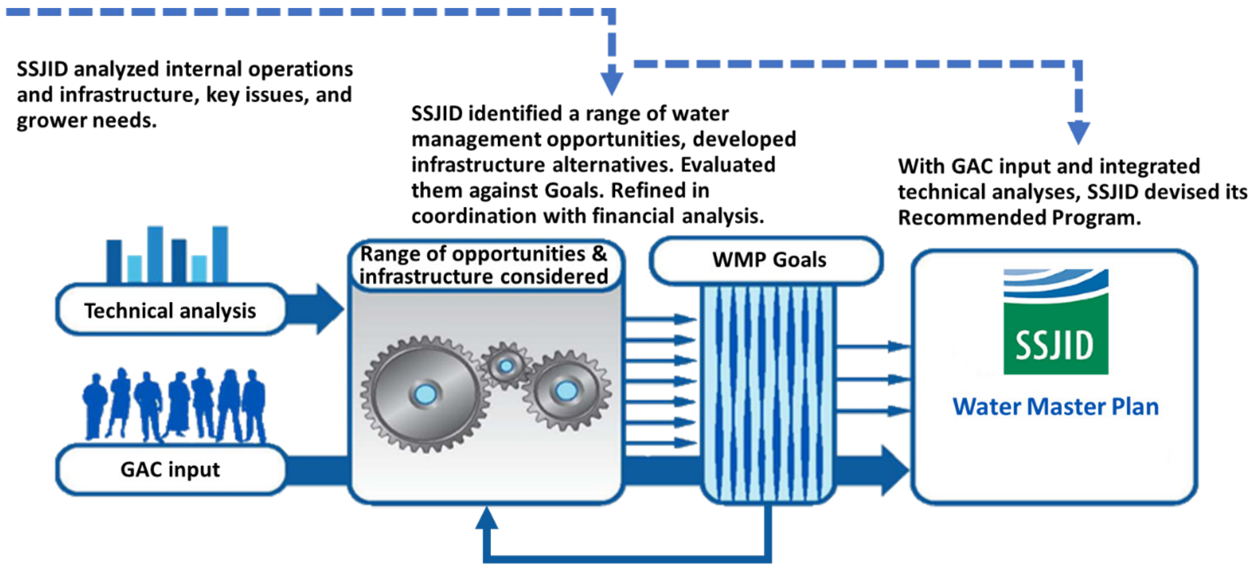
Category	Issues Identified and Considered in WMP Process	Opportunities Considered for Inclusion in WMP
	▪ Managing flows with precision and control	▪ In-system reservoirs to reduce operational spills ▪ Customer service equity: analytical tool to quantify existing delivery capacity and level of service
Finance	▪ Unsustainable current business model ▪ Lack of historical irrigation rate increases to match inflation and operation and maintenance costs ▪ Hydropower contract negotiations and revenue uncertainty ▪ Increase in nonoperating expenses	▪ Acceptable rate increases ▪ Maintain target cash reserves ▪ Water transfer revenue ▪ Grant funding ▪ Debt issuance ▪ Tri-Dam hydropower projections

The planning process included extensive technical work and robust modeling by the WMP team, evaluated and refined in coordination with the Board and stakeholders to inform a defensible decision-making process. The following activities were foundational to the WMP development:

- Detailed outreach program to engage SSJID staff, Board members, and stakeholders (Section 2, *Public Outreach*).
- Identified water resources regulatory requirements, water demand changes (such as land use, irrigation methods) (Section 3, *Water Resources Inventory*, Section 4, *On-farm System Assessment*, and Section 5, *Land Use Trends and Forecasting*).
- CIP planning (such as incorporating GAC/Board input and financial model integration), capacity analysis (Section 6, *Infrastructure*).
- Water supply reliability modeling (Section 7, *Water Resources Analysis*).
- Current business model analysis, and financial modeling of proposed CIP and many iterations of the CIP (Section 8, *Financial Analysis*).

The following Figure 9-1 conceptually depicts the planning process and recommended program development. As depicted in the figure, GAC input was solicited and considered throughout the process. Decision-making was based on thorough technical analyses based on best available information. All opportunities and infrastructure alternatives were evaluated against the WMP goals in an iterative approach. Iterations between the financial analysis and program element refinement led to the identification of the recommended program.

Figure 9-1. Conceptual WMP Recommended Program Process



9.2 The Proposed Plan

This WMP represents a 30-year vision for SSJID's infrastructure, finance, and water management to ensure the long-term sustainability of SSJID carrying out its mission. The WMP is a flexible plan intended to incorporate an adaptive approach. Over the next 30 years, the District plans to implement the following actions guided by this plan:

- Implement a $191 million CIP inclusive of projects to stabilize and improve equity in level of service to growers, achieve incremental modernization, extend the useful life of existing water conveyance infrastructure, and avoid catastrophic failure of critical infrastructure.
- Address threats to SSJID's water rights with continual engagement with state and/or federal regulatory processes.
- Revise the current business model by enacting reasonable customer irrigation rate increases, issuing bonds to fund large CIP projects, and maintaining the Board's existing cash reserve.
- Pursue opportunities for grant funding and water transfers to potentially accelerate CIP implementation and/or implement projects identified but not included in the WMP CIP, and reduce the need for debt financing or rate increases.
- Provide adaptive management by continually revisiting WMP analysis assumptions and variables (for example, financial, land use, customer needs, financial, regulatory, hydrologic) to determine if priorities, funding sources, or District needs have changed.

The Recommended WMP Program

- ✓ *Achieves WMP goals*
- ✓ *$191 million CIP implemented over 30 years to address infrastructure risks and improve service*
- ✓ *Continued engagement with regulatory processes impacting supply and potential water transfers*
- ✓ *Corrections to the current business model*
- ✓ *Reasonable rate increases for irrigation customers, combined with bond funding*
- ✓ *Commitment to seek out grant funding and water transfers, without relying on these revenue sources*
- ✓ *Adaptive approach for implementation*

This recommended WMP was developed and evaluated with careful consideration of the WMP goals. Table 9-2 revisits the WMP goals that were established at the beginning of the planning process and summarizes the expected performance of the WMP relative to the goals, once the WMP is implemented.

Table 9-2. Assessment of the Recommended Plan's Expected Outcomes Relative to the WMP Goals

WMP Goal	Goal Met?	Notes
Protect and preserve SSJID's water rights.	✓	Maintaining and enhancing level of service to irrigation customers and expanding municipal service enable SSJID to continue making beneficial use of its water supplies.
Ensure long-term viability of SSJID's water delivery system, and enhance flexibility, reliability, and operational efficiency.	✓	The CIP was designed to keep the water running for the long-term and reduces operational risks. Incremental system modernization allows SSJID to maintain level of service for all types of irrigators. Service equity across the District was analyzed and addressed in CIP.
Promote the use of available surface water, and protect the sustainable use of groundwater within the District.	✓	Improving service and supply reliability keeps SSJID customers on surface water and could encourage private groundwater pumpers to come back to surface water. Continuing to expand municipal water deliveries helps to reduce municipal use of groundwater.
Promote efficient and effective on-farm water use.	✓	The incremental modernization projects in the CIP directly respond to grower needs and assist growers in effective on-farm water use.
Provide an affordable water supply to SSJID customers.	✓	The financial plan to implement the CIP fixes the business model. Proposed rate increases were carefully analyzed for reasonableness.
Ensure SSJID remains financially sound.	✓	The Recommended Program maintains cash reserves and ensures the District is in good standing for debt issuance.
Promote SSJID's stewardship of the water resource and its contributions to the economy and the environment.	✓	SSJID's WMP process is a proactive means to chart its own course, demonstrating value of the water now and for future generations to benefit the regional economy.

9.3 Additional Supporting WMP Recommendations

The following sections provide specific supporting recommendations for each WMP element to further the District's alignment with WMP goals.

9.3.1 Public Outreach Recommendations

Public outreach recommendations include the following:

- Continue conducting open and transparent public outreach engagement during WMP implementation.
- Provide regular newsletter updates on CIP implementation progress.
- Provide early notification and transparency in notifying landowners of project construction.
- Continue GAC engagement.
- Comply with CEQA requirements for public noticing.
- Seek customer input on a regular basis for adaptive management approach.

9.3.2 Water Resources Recommendations

Water resources recommendations include the following:

- Continue to actively defend and address threats to water rights, plan for future water demands, and comply with regulatory requirements.
- Continue to coordinate with partner water right agency (OID) to maintain a united front of senior water rights holders in the Stanislaus River Basin.
- Continue to engage state and federal agencies and key stakeholders in ongoing regulatory processes to better understand potential impacts and advocate for the protection of SSJID's water rights, facilities, and the communities served.
- Monitor regulatory processes and further develop and implement water resources projects based on funding availability and future needs.
- Water transfers have been a part of SSJID's past water management decisions. While the ability to secure water transfers is currently uncertain and unreliable for financial planning, SSJID will continue seeking transfer opportunities to make full beneficial use of SSJID's water rights, bolster groundwater sustainability within the local groundwater subbasin, and supplement fisheries pulse flows for the benefit of the environment and water users.
- Continue active involvement as a member of the ESJGWA and continue to track its contributions to the groundwater basin to maintain positive balance and implement groundwater projects that benefit the basin on an opportunistic basis.
- Continue supporting conjunctive use operations by maintaining a positive District net recharge to the groundwater basin providing District customers coverage for groundwater pumping through periods of reduced water availability.
- Continue the development of the South County Water Supply Program up to existing obligations.
- The District has met its current obligations under SBx7-7, and will continue to prepare AWMPs and assess efficient water management practices, and has included projects in the CIP to satisfy future obligations for on-farm metering.

9.3.3 Infrastructure Recommendations

The District should implement a CIP allowing for long-term, reliable irrigation deliveries to protect the District's water rights and stabilize overall service providing localized improvements for more equitable District-wide irrigation deliveries. The recommended CIP (as summarized in Section 8, *Financial Analysis* and detailed in Appendix E, *Infrastructure Plan*) includes a $191 million investment over the next 30 years and should be revisited every 5 years to reevaluate project prioritization, including implementation planning and scheduling.

As a basis for CIP planning, it was concluded that without increasing the rate of condition assessment, inspection, and rehabilitation of aging infrastructure within the water distribution system, the current level of service to SSJID water customers will deteriorate. The CIP has been developed to address and balance WMP goals, including a focus on addressing infrastructure condition, limited capacity improvements, operational enhancements, and improved level of service within acceptable levels of investment. Recommended projects included in the CIP are strategic, were selected by evaluating benefits and costs, and align with the following recommendations:

Maximize the benefits of the existing water supply and distribution system. There are no fundamental changes to how water is conveyed from upstream surface supply sources through the distribution system to grower turnouts, but the District will implement improvements and cost-effective modernization projects to serve flood and sprinkler irrigators.

- Preserve critical conveyance infrastructure that is aging and deteriorating in some locations; specifically, invest in protecting tunnels, canals, and structures where a failure could have catastrophic implications. The Canyon Tunnel Project is necessary to address the risk and reliability of the District's most important and vulnerable component of the upstream conveyance system. Additional projects, such as MDC drop structure rehabilitation, MDC bank stabilization, and seepage reduction projects, are included in the CIP. Maintaining and rehabilitating the existing water distribution system through condition assessment, inspection, and rehabilitation of aging pipes is a significant component of the CIP accounting for approximately 15% of planned CIP expenditures.

- The conversion from the existing gravity water distribution system to a fully pressurized system is not financially viable. Replacing existing pipelines District-wide is expensive and cost prohibitive. SSJID evaluated options for full pipe replacement compared to pipeline rehabilitation to address aging pipelines and determined that pipeline rehabilitation through pipe lining was a more financially feasible strategy. As such, the District will implement and self-perform a comprehensive lateral pipeline rehabilitation program implemented annually over 30 years to extend the useful life of existing pipelines while providing reliable water conveyance and irrigation deliveries.

Continue to provide irrigation deliveries on a 10-day rotation for flood irrigators while providing water delivery reliability for sprinkler irrigators. Implement projects that promote enhanced water delivery service equity across the District.

- The baseline program for infrastructure maintenance and improvements is not sustainable and must be addressed in the near term to preserve system reliability.
- Selected CIP projects include comparatively low-cost water level and flow control structure improvement projects that provide significant benefit to laterals and localized reaches benefiting both flood and sprinkler irrigators.
- CIP recommendations include investment in components and projects needed to maintain service in Division 9.
- SSJID conducted a detailed capacity analysis of the water distribution system and capacity-limited segments that impair the current level of service. This tool provides an analytical approach for quantifying level of service (building upon past anecdotal information) to assess service equity and identify selected capacity enhancement projects. This approach helped identify focused, strategic projects that when implemented will help alleviate conveyance bottlenecks and localized service areas that have historically been problematic.

Protect long-range water supply by planning for and selectively implementing water conservation and infrastructure modernization projects that provide enhanced water delivery flexibility. This includes sustainable groundwater management and spill reduction projects. The implementation of significant modernization and improvement projects may be reprioritized and accelerated should additional revenue become available from items, such as water transfers and grants.

- Projects identified through the capacity analysis, included in the CIP, address capacity limitations, level of service, and water conservation in the District.
- CIP investments will help improve water distribution system reliability, improve level of service to growers, and provide more equitable level of service across the District. The 30-year CIP is based on current assessments and forecasts, but is intended to be a flexible plan that will be adjusted in the future in 5-year increments based on changes in system performance, water user needs, regulations, funding availability, and implementation capacity.

Implement the CIP with an adaptive approach. The prioritized list of projects and timing of implementation over 30 years was carefully crafted considering the urgency of a project for continued reliable delivery of water, financial considerations (such as timing of rate increases or debt issuance or other revenue sources), and the reasonable capacity of the District for project construction whether using in-house staff members or contractors. The time-phased CIP presented as part of the WMP Recommended Program is based on a number of assumptions and current conditions, all of which can change in the future. The WMP recommends revisiting key assumptions and conditions on a regular basis (no longer than 5-year increments) and updating the CIP and updating the CIP project list and pace of implementation accordingly.

9.3.4 Financial Recommendations

As presented in Section 8, *Financial Analysis*, SSJID has developed a financial plan that revises its current business model and allows for funding implementation of the WMP over 30 years while meeting the WMP financial goals. In addition to the financial plan, the following financial recommendations are identified as part of the WMP.

- **The public process for irrigation rate increases should be initiated immediately following adoption of the WMP.** As described in Section 8, *Financial Analysis*, the proposed rate increases presented are for illustrative purposes and for long-term financial forecasting. The rates presented are not a formal rate increase proposal. SSJID will initiate the Proposition 218 process with the assistance of a specialty consultant and involve the customers in each step of the process.
- **Any major capital project, especially those that may require bond funding, should be initiated after Tri-Dam's hydropower contract (Power Purchase Agreement) is renegotiated in 2023.** This gives District a clear understanding of near-term revenue expectation from Tri-Dam and allows the District to make investment plans accordingly.
- **The District will continue to seek water transfer opportunities when feasible and analyze financial implications.** As described in previous sections, revenue generated from water transfers has been unreliable due to challenges in obtaining regulatory approvals. The WMP financial plan cannot rely on this revenue source; as opportunities arise, SSJID will pursue transfers and revenue generated could reduce the need for issuing bonds or reducing rate increases and/or could accelerate elements of the CIP.
- **The District will aggressively pursue grant funding opportunities to assist in CIP implementation.** Funding sources, both state and federal, are available for project implementation related to water conservation, environmental enhancement, groundwater sustainability, and aging infrastructure. Opportunities will be researched to fully understand qualifications, timing, award potential, and administrative requirements. When applicable, the District will apply for grant funding and keep customers informed of successes.
- **The District will continue to seek other opportunities to increase revenues in other funds, and decrease growth of expenses.**
- **SSJID should embrace a flexible approach in funding and implementing CIP projects to account for the many variables that will change in the future.** While the WMP presents a 30-year vision for CIP investments and District finances, new information and financial or water resources assumptions should be revisited on 5-year intervals with spending and rate plans adjusted accordingly.

9.3.5 Other Policy Recommendations

As part of the WMP process, several policy-level conceptual ideas surfaced and were considered, but were not further developed as a component of the recommended program. These policies are documented here for future consideration and evaluation by SSJID staff members and the Board, if applicable and beneficial to SSJID in terms of implementing the WMP.

- Explore a funding mechanism that reflects the benefit to groundwater users in the Eastern San Joaquin Groundwater Subbasin, from the application of surface water by SSJID growers.
- Explore future annexations as a means of maximizing beneficial use of the District’s water supplies and as a mechanism to address concerns in basin-wide compliance with SGMA, while balancing against resulting impacts to water supply reliability for existing water customers.
- Revisit SSJID’s Service Abandonments Agreement policies, and update the Agreement as needed.

9.3.6 Environmental Documentation Recommendations

The WMP contains a broad range of recommendations, which are expected to be implemented using an adaptive approach over 30 years. Included in the WMP are infrastructure recommendations that would result in physical changes to the environment (that is, a footprint). Discretionary actions that may result in an environmental impact are subject to review under the California Environmental Quality Act (CEQA) when ripe for consideration. At this time, most of the WMP infrastructure recommendations have not been designed to any level of certainty. As each infrastructure recommendation is further developed, it will be considered for the following CEQA review in a similar manner as all District projects:

- **Review for Exemption.** Some infrastructure projects may fall under an existing CEQA statutory or categorical exemption, meaning the project is not required to prepare an environmental document as long as the exemption requirements are met.
- **Negative Declaration.** Projects with a potential to have a significant environmental impact cannot be exempt but can prepare a Negative Declaration or Mitigated Negative Declaration if it can be demonstrated that the impact would not be significant or could be reduced to a less-than-significant level with the adoption of mitigation measures. The determination is made after preparing an Initial Study following a template provided in the CEQA Guidelines.
- **Environmental Impact Report**. Larger projects with significant environmental impacts are required to be evaluated in an Environmental Impact Report.

Projects with a federal nexus may also require evaluation under the National Environmental Policy Act (NEPA). NEPA review is usually streamlined at the federal level for most permit and funding purposes, but each federal agency has considerable discretion to apply NEPA on a case-by-case basis.

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