City of Santa Rosa

Regional Water Reuse System

Master Plan

February 2018

Regional Water Reuse System

MASTER PLAN

Project No. 8411395

Prepared for:

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February 2018

Acknowledgments

The project team acknowledges the contributions from City staff in providing direction, contributing time, and sharing resources for preparing the Regional Water Reuse System Master Plan. In particular, we would like to recognize the following team members:

- Mike Prinz, Deputy Director – Regional Operations
- Rita Miller, Deputy Director – Environmental Services
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- Terry Schimmel, Mechanical Superintendent
- Zach Kay, Biosolids Coordinator
- Mike Sherman, Geysers Operations Manager
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Executive Summary

This Master Plan serves to document the current state of the Santa Rosa Regional Water Reuse System (WRS), identify key service levels for ongoing management of the enterprise, evaluate potential opportunities and risks through the year 2035, and identify investment needs for managing the WRS in a manner that:

- optimizes resource recovery;
- achieves regulatory compliance at a cost that is respectful of ratepayer resources; and
- provides the greatest protection of public health and environmental benefit to the region.

On behalf of the Regional Partners, the City of Santa Rosa (the City) owns and operates the Laguna Treatment Plant (LTP) receiving and treating wastewater from the Regional Partners and providing treatment, disposal, and reuse of the water and its residual by-products in accordance with regulatory requirements.

This Master Plan builds on previous planning efforts initiated by the City including the *Incremental Recycled Water Program (IRWP) Recycled Water Master Plan* (Santa Rosa, 2004), the *Laguna Treatment Plant Condition Assessment Project* (Santa Rosa, 2012), the *Biosolids Management Strategic Plan* (Santa Rosa, 2014) and the *Energy Optimization Plan (EOP) – Phase 1* project (Santa Rosa, 2014). This planning effort serves to confirm previous recommendations in light of current needs and drivers, identify new investments that address anticipated opportunities and risks, and consolidate the recommendations into a single document for operational, financial and regulatory planning purposes.

Regional Water Reuse System Levels of Service

Service levels provide the basis for establishing performance benchmarks, planning for long-term infrastructure needs, and establishing decision criteria for management of the enterprise. The City works to achieve numerous service levels generally falling into the categories of regulatory compliance (permits), contracts and agreements, Environmental Impact Reports (EIRs), and stakeholder expectations. Table ES-1 provides a summary of service levels that provide a framework within which the City operates and manages the WRS.

Table ES-1 Summary of Service Levels Driving WRS Operations

Category	Description	Key Examples
Compliance	Sets limits to allowable pollutant levels in all discharges to receiving waters, land and the atmosphere, and prescribes inspection monitoring and reporting requirements to confirm compliance. Compliance requires investment in treatment technology, redundancy for critical facilities, and a maintaining a highly trained staff.	• National Pollutant Discharge Elimination System (NPDES) Discharge Permit and Waste Discharge Requirements (WDRs) • Industrial Storm Water General Permit • EPA 503 Regulations • Air Permits • Hazardous Materials and Waste Management/Certified Unified Program Agencies (CUPA) Program

Category	Description	Key Examples
Contracts and Agreements	The City has entered into numerous contracts and agreements with customers interested in receiving recycled water and biosolids that help to ensure compliance with regulatory requirements for discharge. Although the agreements have some flexibility built into them, in times of drought customer demands at times exceed resource availability.	• Regional Partners Agreement • GPC (Calpine) Agreement • Producer-Distributor Agreement with City of Rohnert Park • Recycled Water Pricing Policy with City of Santa Rosa • City of Santa Rosa Recycled Water Ordinance • Agricultural Irrigation User Agreements • Agricultural Biosolids Application User Agreements • Open Space District Agreements
Environmental Impact Reports (EIRs)	Programmatic and project level EIRs establish the need, mitigation measures and limits for projects. The Incremental Recycled Water Program (IRWP) EIR establishes the current limit for planned growth at an Average Dry Weather Flow (ADWF) of 25.89 mgd at the treatment plant.	• Long-Term EIR • IRWP EIR • Compost EIR • Agricultural Reuse EIR
Stakeholder Expectations	Regional Partners expect the City to operate and manage the WRS in a manner that balances levels of service with cost of service at an acceptable level of risk. Regional stakeholders expect that the WRS will be operated and managed in a manner that is consistent with other regional goals. Meeting these expectations requires access to remote facilities, access to the discharge valves, and electrical service redundancy for critical facilities such as the Delta Pond Pump Station (add UPS).	• Reliable Performance • Lowest Cost of Ownership • Watershed Protection and Public Outreach

Current State of Regional Water Reuse System Facilities

Driven by increasingly restrictive regulations protective of the Laguna de Santa Rosa and Russian River watersheds, an improved public perception of water reuse by regulators and the public, and planned growth for the Regional Partners, the City has made significant investments in the resilience of the WRS infrastructure to meet desired levels of service. Representative investments over the past 25 years include completion of the Geysers Recharge Project to provide weather-independent, reliable, recycled water demand; preparation of the *IRWP Recycled Water Master Plan* to accommodate planned growth; and completion of the Combined Heat and Power project (CHP) to optimize energy recovery and provide emergency power generation capability at the Laguna Treatment Plant (LTP). The confluence of these drivers and responses has shifted the role of WRS operations from one of wastewater treatment and disposal to one of resources recovery serving the needs of the region. Essentially, recycled water disposal concerns have shifted to recycled water supply optimization.

With few exceptions, the WRS is meeting desired service levels. The City continues to invest in preventative maintenance and renewal/replacement projects to address aging assets and in capital projects that enhance resources recovery. The City is currently addressing a few known issues that will improve service level performance and mitigate risks, including:

- Replacement of aging ultraviolet disinfection facilities and restoration of peak day treatment capacity to 67 mgd, and construction of emergency flow bypass facilities to return non-compliant water from the effluent channel upstream to the Flow Equalization Basins;
- Construction of berms/floodwalls around critical LTP facilities to protect assets from a 100-year flood;
- Recent purchase of land for biosolids applications, which increase the reliability of disposal options over lease agreements; and
- Investment in a new laboratory information management database to improve data accuracy, reporting, and security.

Looking forward the City will need to continue its assessment and renewal/replacement of aging assets, and relieve capacity constraints to accommodate increased flows from planned growth.

Regional Water Reuse System Opportunities and Risks

The City has actively sought to achieve service levels through long term planning efforts and implementation of major projects and programs, including the Geysers pipeline, IRWP program, and CHP project. Regulatory compliance, resources recovery, accommodation of planned growth and stakeholder engagement form the foundation of current management practices and there are limited opportunities to make large advancements in any of these areas. Potential risks that could cause a decline in service level performance over the next 20 years include aging assets, climate variability, natural disasters, more stringent regulations, and capacity limitations. Table ES-2 provides a summary of the opportunities and risks evaluated in this Master Plan.

Table ES-2 Summary of Opportunities and Risks Evaluated in WRS Master Plan

Category	Description	Potential Opportunity/Risk
Opportunity	Compliance Strategies – Alternative strategies to enhanced treatment operations / infrastructure.	• Water quality credit trading • Regulatory advocacy • Collaborative partnerships
Opportunity	Cost Efficiencies – Opportunities to maximize utility of existing assets at a lower cost of ownership.	• Energy efficiency • Optimize built capacity
Opportunity	Resources Recovery – Opportunities to maximize resources recovery.	• Energy recovery • Recycled Water reuse • Potable reuse • Biosolids reuse • Nutrient recovery

Category	Description	Potential Opportunity/Risk
Opportunity	Mitigation Bank at Kelly Farm – To reduce cost of environmental mitigation credits.	• Reduced cost • Immediate credit availability
Risk	Aging Infrastructure – Reduced performance and potential failure; potential for major renewal and replacement costs.	• Buried pipes • Mechanical and electrical equipment • Structures • Spills
Risk	Climate Variability and Natural Disasters – Loss of critical facilities due to a catastrophic event.	• Floods and severe weather events • Drought • Fires • Earthquakes • Ecosystems and Habitat
Risk	New Regulations – More restrictive regulations triggering need for major investment or shift in operational strategy.	• Discharge • Biosolids • Recycled Water reuse • Laboratory standards
Risk	Failure of Critical Facilities – Reduced service level performance from failure of critical facilities.	• Treatment facilities • Seasonal storage • Geysers conveyance • Recycled water distribution • Compost facilities • Air conditioning • Discharge system
Risk	Loss of Disposal Options – External drivers causing loss in disposal or reuse options, such as non-renewal of a contract or lease.	• Class B biosolids • Class A biosolids • Recycled water
Risk	Shortage of Recycled Water – Increased regional demands for recycled water to supplement surface water or groundwater supplies.	• Surface water supply restrictions and increased urban demands • Groundwater pumping limitations and increased agricultural operation needs
Risk	Capacity Limitations – Inability to accommodate increased flows from planned growth due to capacity restrictions in existing facilities.	• UV disinfection • Seasonal biosolids storage • Geysers pump stations
Risk	Loss of institutional knowledge / staff expertise	• Succession planning • Cross training

Regional Water Reuse System Investment Needs

WRS investment needs are comprised of recommended capital projects and ongoing renewal and replacement of existing assets. When expressed in a 20-year timeline by priority and estimated time of need, these investment needs inform the financial planning requirements to achieve desired service levels for the enterprise.

Recommended Capital Improvement Projects

Recommended investments for capital projects, including assessments, infrastructure improvements, and strategic initiatives, create opportunities to achieve greater energy efficiencies and lower cost of operations, and serve to mitigate identified risks to achieving desired levels of service. These capital projects include CIP projects previously identified by the City, recommendations from previous studies not yet implemented, and new projects identified through this master planning effort.

Table ES-3 provides a summary of the estimated capital project costs by WRS functional area and by relative level of priority.

Table ES-3 Recommended Capital Project Needs by Functional Area and Priority

Functional Area	Priority Class	Estimated Cost
LTP and Environmental Laboratory	A – Immediate Need	$80,294,008
	B – Near-future Need	$41,489,251
	C – Future Need	$11,218,400
	Functional Area Total:	**$133,001,659**
Biosolids Facilities	A – Immediate Need	$30,000
	B – Near-future Need	$3,100,000
	C – Future Need	$16,100,000
	Functional Area Total:	**$19,230,000**
Reclamation Facilities	A – Immediate Need	$1,020,000
	B – Near-future Need	$3,000,000
	C – Future Need	$110,850,000
	Functional Area Total:	**$114,870,000**
Geysers Facilities	A – Immediate Need	$405,000
	B – Near-future Need	$770,000
	C – Future Need	$7,600,000
	Functional Area Total:	**$8,775,000**
All WRS Functional Areas Combined	**WRS Total:**	**$275,876,659**

Asset Renewal and Replacement Needs Analysis

Although this Master Plan focuses on recommended capital projects, the City will need to have in place a financial plan that accommodates annual asset renewal and replacement needs. The timing of the capital projects and the overall average investment costs, including renewal and replacement, are important factors in developing the long-term financial picture of the WRS enterprise. During the budget planning period for the 2018/19 budget year the City performed an assessment of annual asset renewal and replacement needs to develop a preliminary picture of total spending needs.

The anticipated annual renewal and replacement costs are based on industry standard preventative maintenance schedules and industry standard service life by asset type. The timing and value of actual expenditures could differ based on the judgement of City personnel who are monitoring WRS asset conditions in real time. The renewal and replacement costs summarized in Table ES-4 provide a realistic representation of the average investment needs over time to renew and replace existing WRS assets.

Table ES-4 Projected Annual Asset Renewal and Replacement Costs

Asset Grouping	5-Year Average	10-Year Average	15-Year Average	20-Year Average
LTP and Laboratory	$4,435,646	$6,689,446	$5,311,993	$4,745,119
Biosolids Facilities	$470,367	$422,574	$411,715	$495,158
Reclamation Facilities	$384,252	$7,716,333	$5,650,082	$4,321,983
Geysers Facilities	$181,510	$379,209	$1,130,127	$1,125,636
All WRS Facilities	**$5,471,775**	**$15,207,563**	**$12,503,917**	**$10,687,896**

Note: All costs are in 2017 dollars.

20-Year Financial Investment Profile

Viewing the recommended financial investments along a 20-year timeline is helpful to highlight investment spikes and average annual budget needs across the full planning horizon. Figure ES-1 provides a 20-year capital investment profile for the WRS. These capital investments are necessary to address planned growth within the service area, maintain operability and reliability of aging assets, and anticipate evolving drivers that could change the levels of service expected from the Regional System.

The City has approved a bond program to pay for the near term investment spike for several large capital projects that will restore LTP capacity to a peak day flow of 67 mgd, protect the LTP from floods, and address aging infrastructure concerns, some of which are urgent. A second investment spike is predicted in another 15 to 20 years, primarily due to the need for additional seasonal storage. The investment profile shown includes half of the needed investment for seasonal storage ($55 million) under the assumption that the two additional ponds could be constructed in phases. The City should begin planning for how to pay for that inevitable investment now.

This Master Plan and the 20-year investment profile should be updated every 5 years to ensure that long-term funding needs are monitored and necessary improvements are made to operate the WRS in a sustainable manner, balancing levels of service with cost of service and acceptable risk. This will allow the Regional Partners to continue their historical practice of managing the WRS at the lowest cost of ownership without sacrificing desired levels of service for stakeholders.

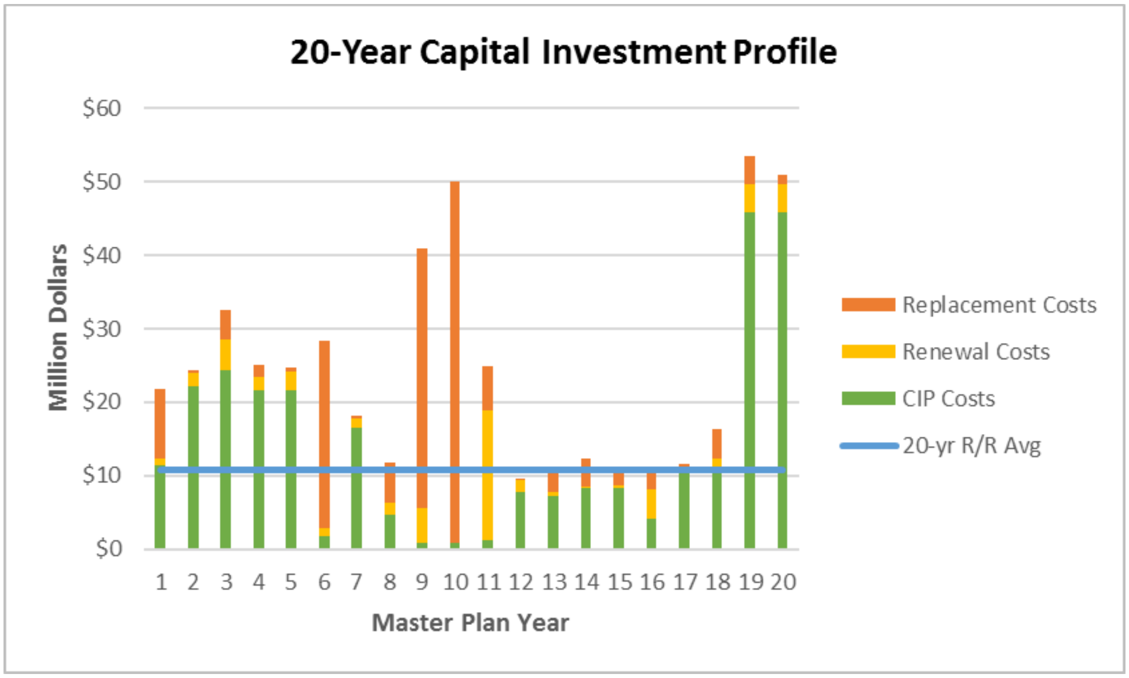


Figure ES-1 20-Year Profile of Recommended WRS Investments

1. Introduction

1.1 Background and Purpose

The Santa Rosa Regional Water Reuse System (WRS) is a resilient infrastructure system providing public health, water quality, environmental protection and resource recovery benefits to the region. Regional Partners, shown in Figure 1-1, include the cities of Santa Rosa, Rohnert Park, Cotati and Sebastopol and the South Park County Sanitation District. As managing partner, the City of Santa Rosa (the City) seeks to operate these facilities at a high level of service and in a sustainable manner. The City is managing the WRS to optimize operations, maintain regulatory compliance, maximize resource recovery, and anticipate the drivers that will shape the evolution of the system over the next 20 years.

In 1993 the City initiated the Santa Rosa Regional Long-Term Wastewater Project to address the North Coast Regional Water Quality Control Board's (Regional Board's) requirement that the City put in place a recycled water disposal solution that met the Regional Board's reliability requirements for existing and future flows, no matter what weather conditions occur. The innovative solution for this mandate was construction of the Geysers Recharge Project, a 40-mile conveyance pipeline delivering recycled water to Calpine at the Geysers steamfields in northeast Sonoma County. The Geysers pipeline, a nationally recognized award-winning project, began operation in 2004. The Geysers project significantly changed the focus of the WRS from recycled water disposal concerns to optimizing recycled water use.

The Incremental Recycled Water Program (IRWP) was a substantial planning effort initiated by the City in 2001 to address increased wastewater flows from planned growth in the WRS service area and comply with anticipated regulatory requirements for discharge, particularly the California Toxics Rule. Program objectives included, among others, maximizing water reuse opportunities, adopting potable water demand management policies, and maintaining weather independence as substantially provided by the Geysers Recharge Project. The City has successfully implemented recommended improvements and practices from the IRWP and the discharge of treated effluent is managed carefully and limited to few occasions in extremely wet winters. Except for infrequent discharges during wet years, 100 percent of the recycled water is reused for generation of green power (Geysers Recharge), potable water offsets (urban irrigation), and conservation of groundwater supplies (agriculture irrigation). As of the writing of this document, anticipated flows predicted by the IRWP have not materialized to their full extent.

Over the past ten years the City has also initiated several studies that evaluate opportunities to improve energy efficiency and recover heat and energy from treatment processes at the Laguna Treatment Plant (LTP). Completion of the Combined Heat and Power Project (CHP) in 2013 provides the City with increased capacity to recover methane gas for co-generation of heat and power for use at the LTP, and the addition of high strength waste receiving facilities will increase the amount of energy recovery achieved at the LTP. The Geysers Recharge Project, IRWP and the CHP are examples of the City's long-term commitment to operating the WRS at a high level of service and in a sustainable manner.

With the successful implementation of these landmark projects and programs the City is in need of a comprehensive and forward-looking master plan that reflects current conditions, anticipates new drivers, and provides a road map for future operational practices and investments. A planning horizon of 20 years is used because it represents a timeframe in which the City can reasonably anticipate opportunities and risks, and identify long-term investment needs for financial planning.

Specific Master Plan objectives include:

- Consolidate existing background information into a single document to serve as a reference for City staff;
- Identify current and future drivers and propose strategies to address them;
- Evaluate alternatives for achieving the identified strategies with a goal of optimizing operations, maximizing resource recovery, and managing risk;
- Develop a prioritized capital improvements plan of recommended projects; and
- Prepare a master plan report documenting current conditions, articulating current and future drivers and strategies to address them, and identifying financial investment needs for the next 20 years.

1.2 Scope

The project scope has been refined as the work progressed to focus attention where the Master Plan can provide the greatest value for managing the WRS at this time. Scope revisions included expanding the discussion of the existing facilities, resources, and service levels, and reducing the number of consultant-led workshops. Condition assessments of some assets and further development of the Santa Rosa Water asset management program are included in this Master Plan as recommended investments. The intent of these changes was to create a single document that will serve as a useful reference for staff. A summary of the project tasks is provided in Table 1-1.

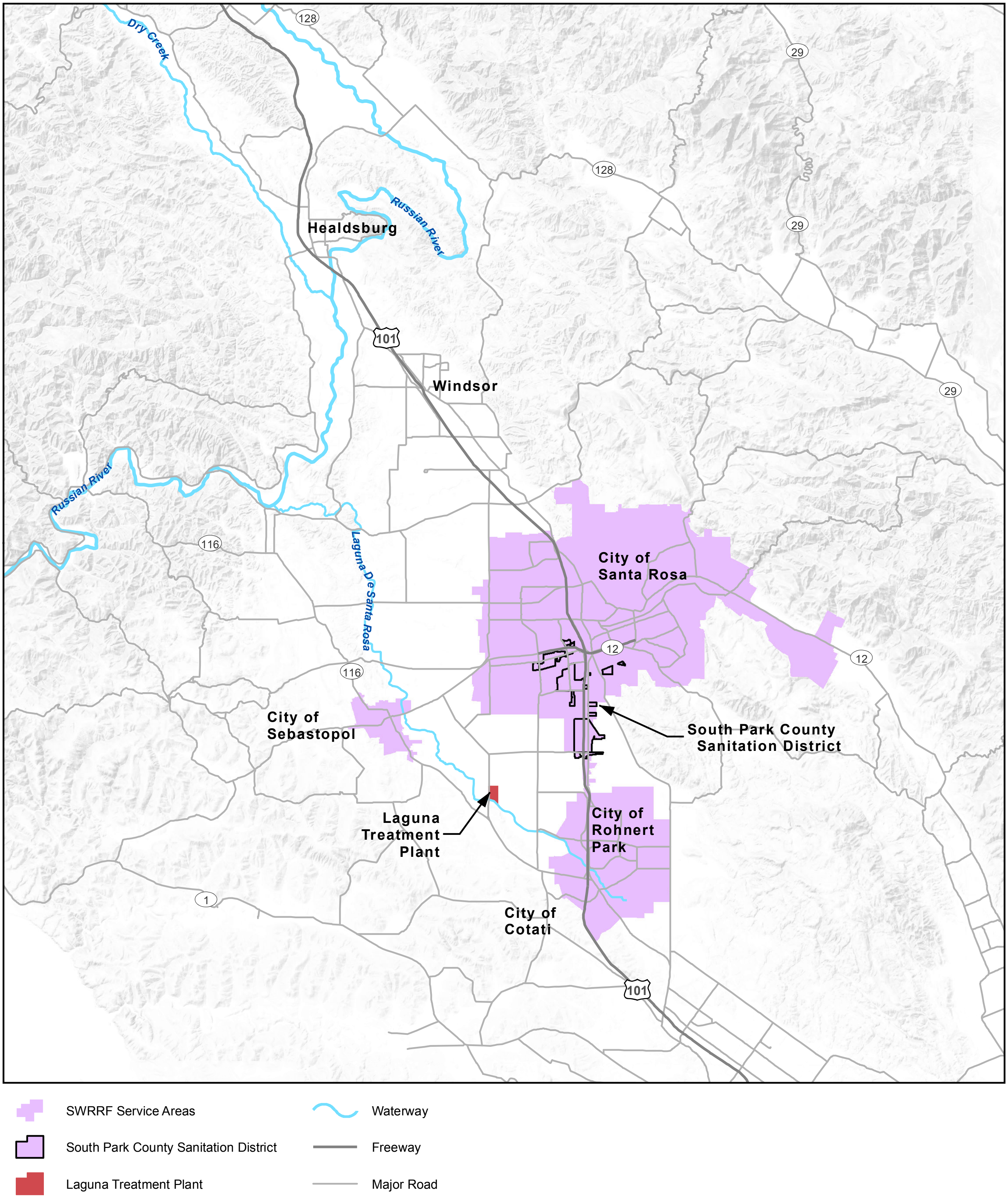
Table 1-1 WRS Master Plan Scope of Work

Task Name	Description of Services
1. Data Collection	Tour WRS facilities, interview management, operations, and maintenance staff, and review background documents.
2. Document Existing Conditions and Data Gaps	Describe existing facilities for the Laguna Treatment Plant, biosolids facilities, reclamation and discharge facilities and WRS lands. Identify data gaps that should be addressed with additional studies.
3. Alternative Development	Identify alternatives to exploit opportunities and mitigate risks for the strategies generated in the workshop with the City (Task 5).
4. Evaluation of Alternatives	Evaluate identified alternatives and recommend the preferred alternatives.
5. Workshops	Convene a workshop with City staff to identify potential opportunities and risks over the next 20 years, and identify potential strategies to address them.
6. CIP Development	Develop a prioritized CIP that includes recommended studies from the data gap analysis (Task 2) and the alternatives evaluations (Task 4). Identify financial investment needs for renewal and replacement of existing assets and for capital projects over the next 20 years.
7. Master Plan Report	Prepare draft and final master plan reports.
8. Project Management	Project team coordination and monthly progress reports.

Content organization for the WRS Master Plan is summarized in Table 1-2.

Table 1-2 WRS Master Plan Content Organization

Section Title	Content Summary
Executive Summary	Summarizes current situation, identifies new drivers looking forward, highlights strategies to optimize opportunities and mitigate risks, and presents the recommended 20-year financial investment plan for the WRS.
1. Introduction	Describes project background and purpose, scope, and key assumptions made during the analyses.
2. Existing Facilities	Describes the existing WRS including the LTP, biosolids facilities, reclamation and discharge facilities, and WRS lands.
3. Resource Analysis	Describes current and projected future resource flow streams including LTP influent flows, biosolids production, recycled water flows, and biogas production.
4. Service Levels	Summarizes key service levels for operating the WRS including regulatory compliance, contracts and agreements, Environmental Impact Report (EIR) requirements, and stakeholder expectations.
5. Opportunity and Risk Assessments	Identifies opportunities for compliance strategies, cost efficiency and resources recovery. Identifies risks from aging assets, climate variability and natural disasters, new regulations, failure of critical facilities, loss of disposal options and recycled water demands exceeding availability.
6. Recommended Strategic Initiatives	Recommends optimization strategies that exploit opportunities, and risk management strategies that mitigate high risk factors.
7. Recommended Financial Investments	Recommends a prioritized financial investment program including additional studies, capital improvements, and renewal/replacement of existing assets.
Appendices	Provides references for source documents and CIP project descriptions and budgets.



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SWRRF Master Plan

Job Number | 8411395
Revision | D
Date | 03 Aug 2018

SWRRF Service Area

Figure 1-1

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Data source: Santa Rosa, GIS: Sphere of Influence/Service Areas; ESRI Street Map. Created by:jkjellsson

2. Existing Facilities

The WRS is comprised of:

- LTP providing wastewater treatment;
- Environmental laboratory providing analytical testing for compliance reporting and operational controls;
- Biosolids management facilities storing and processing treated biosolids and producing Class A compost for beneficial reuse; and
- Recycled water distribution system managing seasonal storage, permitted discharges, and conveyance of recycled water to urban and agricultural users as well as to the Geysers steamfield owned by Calpine.

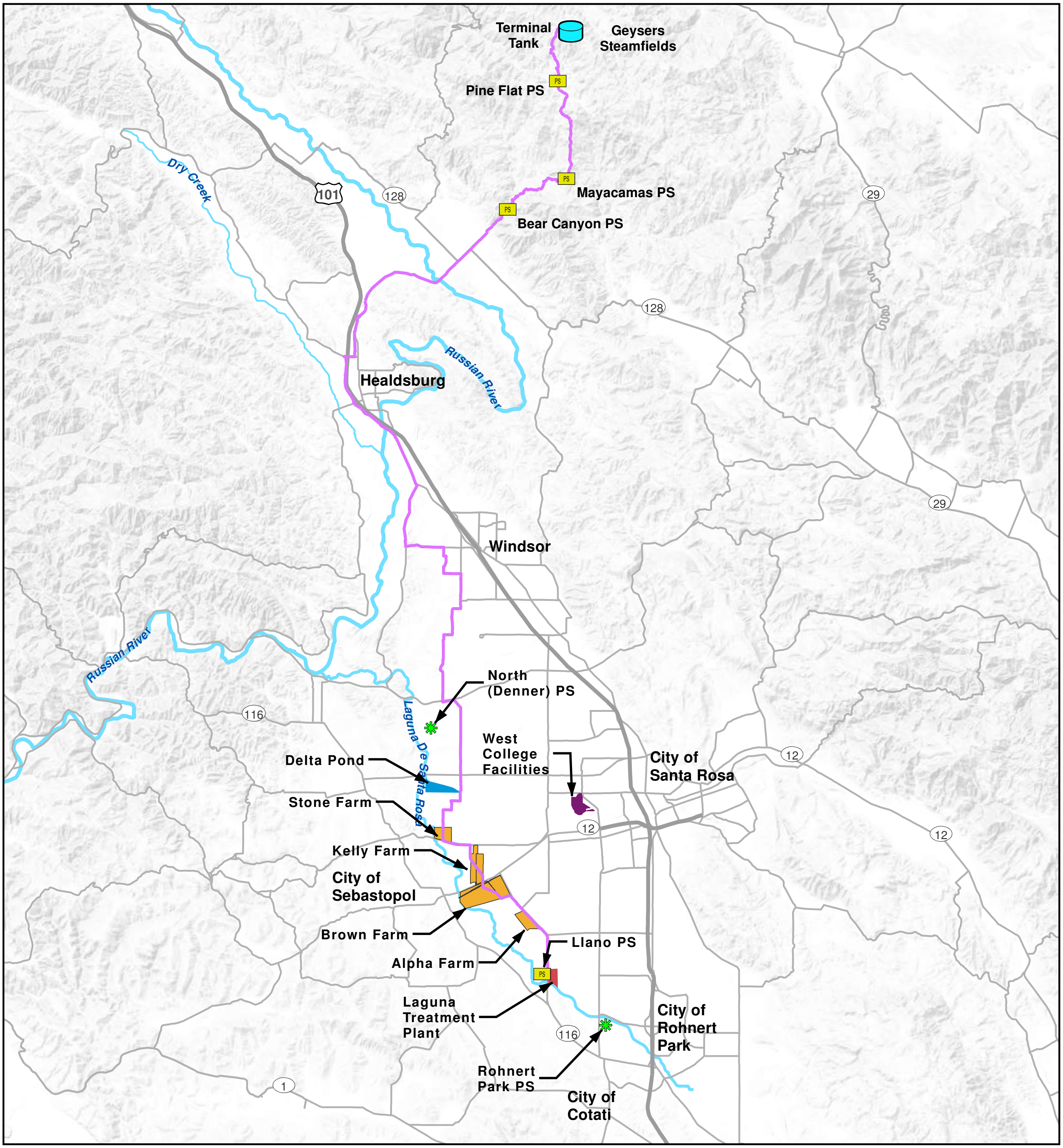
In addition, the WRS include properties throughout Sonoma County where key facilities are sited and recycled water and biosolids are stored and/or applied for beneficial reuse and disposal. City farms also support wetlands and riparian areas, ecosystem enhancements and restoration activities. Each of the Regional Partners owns and operates their own sewage collection systems delivering wastewater to the LTP, and therefore they are not considered as part of this Master Plan. Figures 2-1 and 2-2 identify locations of key WRS facilities and the City farms.

2.1 Laguna Treatment Plant and Environmental Laboratory

The LTP was originally constructed in 1968, then providing 2 million gallons per day (mgd) of treatment capacity to residential, commercial, and industrial customers in the Santa Rosa area. The facility has been expanded over time to increase capacity and add sophisticated treatment processes that provide reliable resources recovery. The existing site plan of the LTP is shown in Figure 2-3.

2.1.1 Description

The LTP provides disinfected tertiary treatment for an average dry weather flow (ADWF) that has been in the range of 14-15 mgd over the past five years, and can treat peak weekly flows up to 67 mgd, except for the UV disinfection facilities which were recently de-rated to a capacity of 48.5 mgd due to a lower UV transmittance. The LTP underwent major expansions in 1977 (to 15 mgd) and 1986 (to 18 mgd). With the Sodium Hypochlorite and UV Disinfection Facilities expansion in 1998, the design capacity of the plant was increased to 22 mgd on an annual average basis, and 67 mgd peak. A Report of Waste Discharge submitted to the Regional Board in 1999 resulted in an authorized increase of the permitted dry weather flow to 21.34 mgd, with a portion of the tertiary treated flow discharged to the Geysers steamfield.



Laguna Treatment Plant

City Farm

West College Facilities

Delta Pond

Geysers Conveyance Pipeline

Geysers Conveyance Pump Stations

Recycled Water Pump Stations

Terminal Tank

Waterway

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Revision B
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Key Subregional Facilities

Figure 2-1

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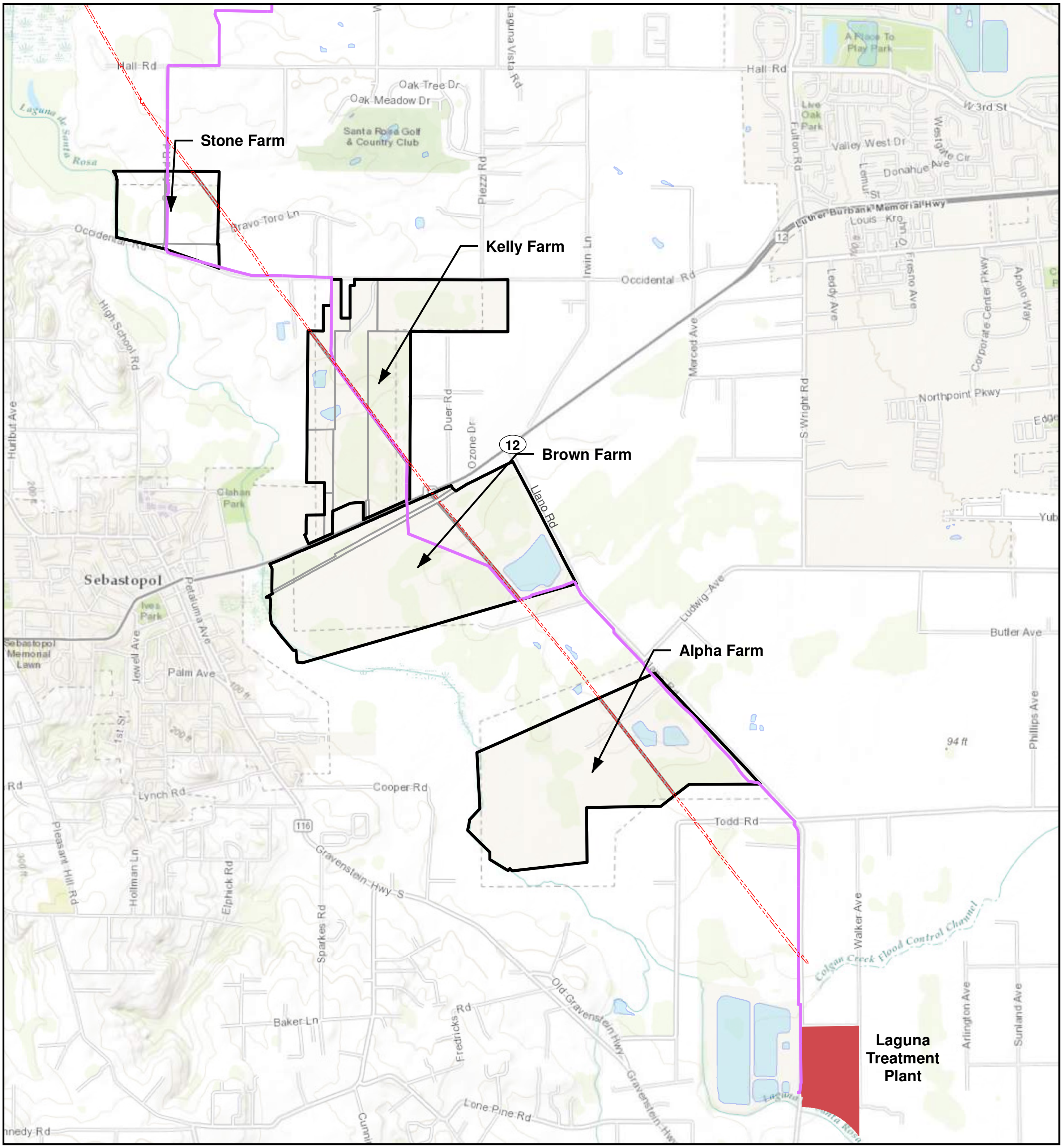

SCWA Aqueduct ROW

Geysers Conveyance Pipeline

City Farms

Laguna Treatment Plant

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SWRRF Subregional Master Plan

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Revision C
Date 12 Dec 2016

City Farms

Figure 2-2

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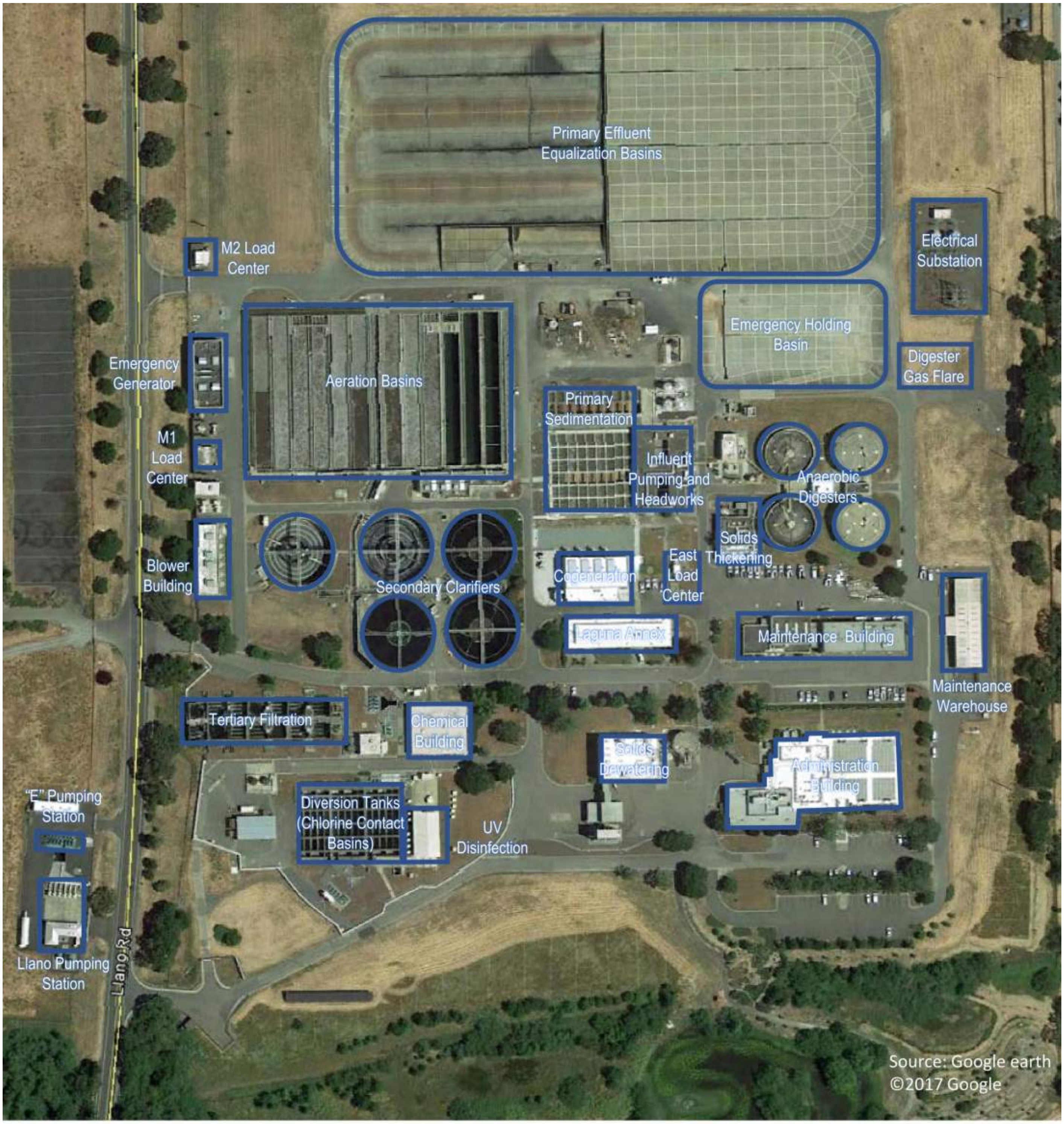

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Laguna Treatment Plant

Job Number 0764001
Revision
Date Sep. 2017

Figure 2-3

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The LTP was recently upgraded to include the CHP facility with four 1.1 megawatt (MW) cogeneration engines. The new CHP facility will allow the LTP to produce energy from additional digester gas generated as a result of the addition of high strength waste (HSW). Additional upgrades have been identified to enhance the treatment and resource recovery capabilities at the LTP. Modifications to the primary treatment system were proposed to support chemically-enhanced primary treatment (CEPT) for enhanced settling, biochemical oxygen demand (BOD) removal, and phosphorus removal, though these improvements have not been implemented.

All water is treated to “disinfected tertiary” as defined under Title 22 of the California Code of Regulations and also to comply with National Pollutant Discharge Elimination System (NPDES) discharge requirements, regardless of the actual end use of the water. Treated water is stored in a series of seasonal storage ponds located at the LTP, City farms and customer sites for later reuse or discharge.

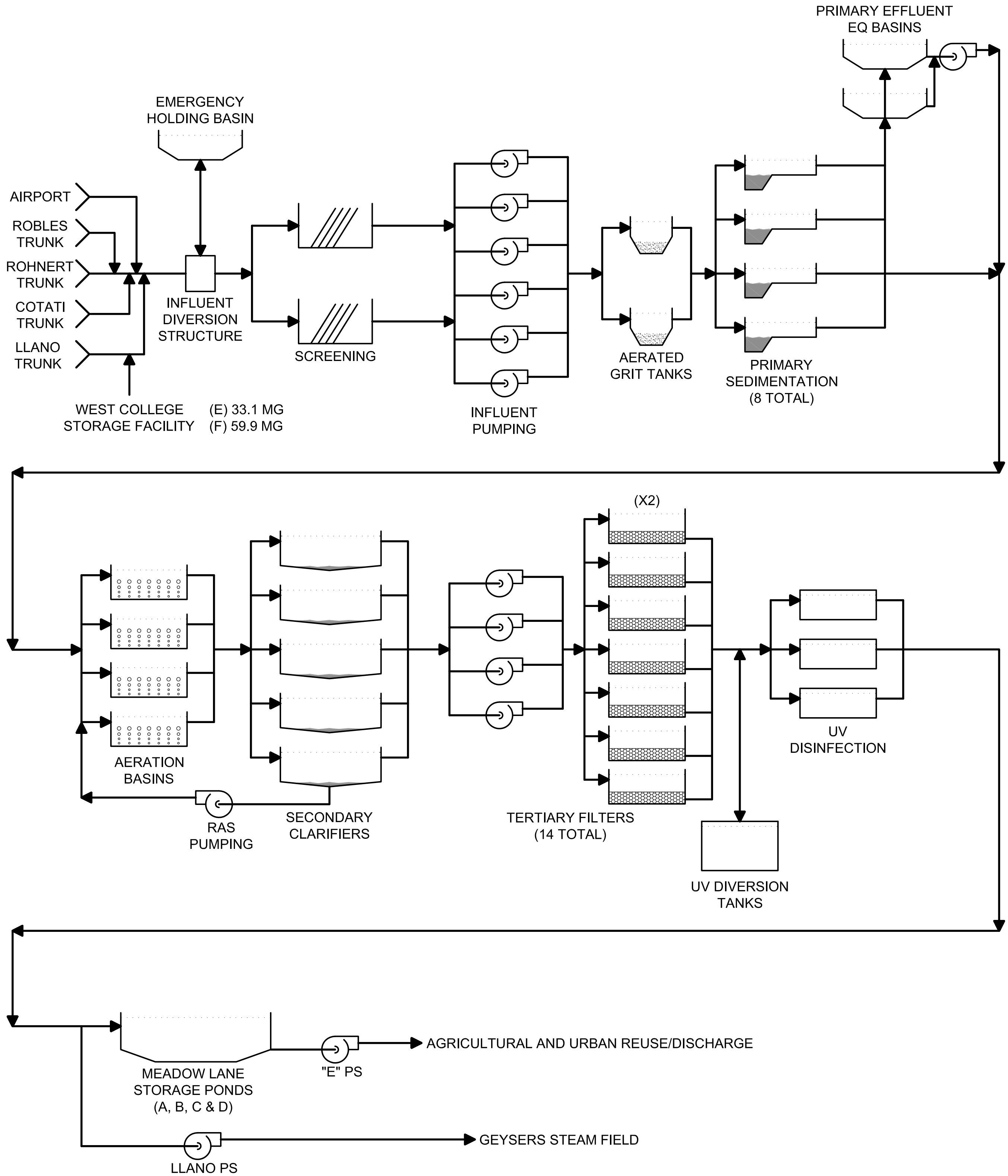
Laboratory functions also occur at the LTP. The laboratory provides analytical sampling and testing services for compliance reporting as well as to support operational process control. The laboratory is State certified by the Environmental Laboratory Accreditation Program (ELAP) to analyze wastewater, drinking water, biosolids, compost, soils, and plants for a wide variety of chemical and biological constituents. The laboratory facilities include two spaces – one built as part of the initial plant construction, and another included in a later plant expansion. The laboratory is capable of providing highly sophisticated analytical testing, and can be modified to create a class 100 cleanroom if needed to support future activities The lab space is currently at capacity for the staffing levels and types of testing required.

2.1.1 Schematics

Figure 2-4 shows a schematic of the treatment process at the LTP, and Figure 2-5 shows the hydraulic profile of the facility. Influent flow entering the plant receives mechanical screening in two identical screening structures, each containing two perforated plate screens. Screened influent is conveyed to the influent pump station, and then to grit removal. Under high flow conditions, screened influent can also be conveyed to an emergency holding basin prior to be returned to the plant influent. Primary clarification occurs in eight rectangular clarifiers, and primary effluent flows to four aeration basins incorporating anoxic and aerobic treatment. Aeration is provided primarily by two 600-hp blowers, with four 900-hp blowers available for backup. Secondary clarification is provided by five clarifiers incorporating draft tube sludge withdrawal. Secondary effluent is filtered in 14 granular media filters, and disinfection is provided by ultraviolet (UV) light. Filter effluent that does not meet reclamation requirements established in the NPDES permit is currently sent to the unused chlorine contact basins for return to the headworks.

2.1.2 Capacity

The LTP is constrained by built capacity and permit restrictions highlighted in Table 2-1. The UV disinfection facilities are the only bottleneck under certain flow scenarios and the City is working to upgrade the disinfection facilities as a priority.



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Laguna Wastewater Treatment Plant

Liquid Stream Processes

Job Number	0764001
Revision	
Date	Nov. 2016

Figure 2-4

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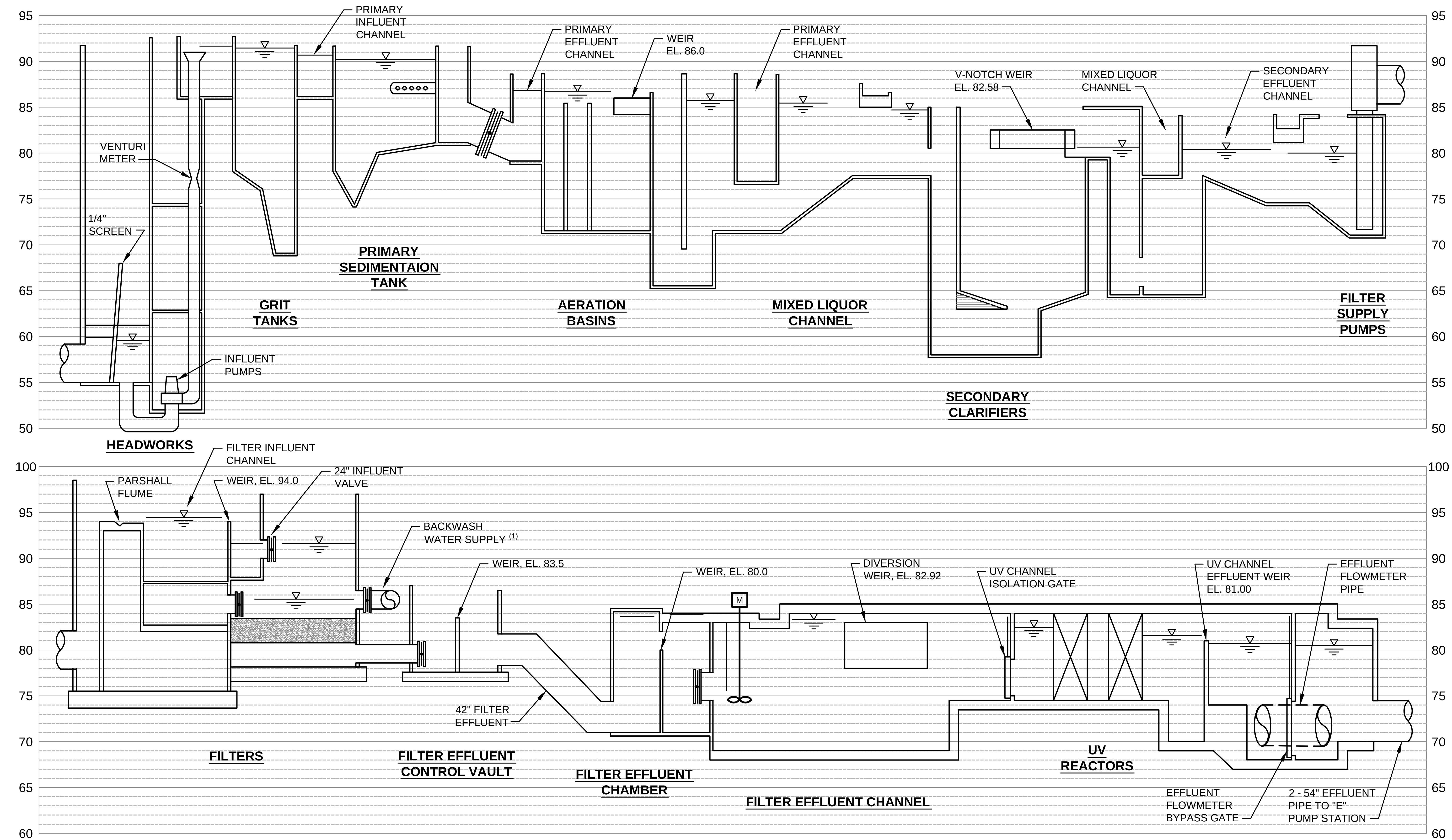

Source: CH2M Hill, May 1994; CH2M Hill, Mar 1997
(1): Location as shown in Record Drawings.
Actual supply located below filter media.

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City of Santa Rosa

SWRRF Master Plan
Laguna Wastewater Treatment Plant
Hydraulic Profile

Job Number	0764001
Revision	
Date	Nov. 2016

Figure 2-5

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Plot Date: 5 September 2017 - 11:09 AM CAD File No: C:\Users\SundeepKaur\Desktop\1468051-FIG 2-5.dwg

Table 2-1 LTP Facility Needs, Built Capacity and Permit Restrictions

Facility	2014 Need	Built Capacity	Permit Restrictions
Headworks	79 mgd	90 mgd	
Flow Equalization Basins (FEBs)	12.8 mg	12.8 mg	
Primary	67 mgd	67 mgd	
Secondary	67 mgd	67 mgd	
Filtration	67 mgd	62 mgd [a.]	
Disinfection	67 mgd	48.5 mgd [b.]	
Average Dry Weather Flow (ADWF)	15.5 mgd	21.3 mgd	21.34 mgd (Order R1-2013-0001)
Peak Month	43 mgd	47.3 mgd	47.3 mgd (Order R1-2013-0001)
Peak Week	55 mgd	48.5 mgd [b.]	64 mgd (Order R1-2013-0001)
Peak Day	67 mgd	48.5 mgd [b.]	
Peak Hour	79 mgd	48.5 mgd [b.]	

a. Filter capacity is 84.2 mgd but Filter Pump Station peak capacity is 80 mgd peak, 60 mgd firm.
b. Hydraulic capacity is 90 mgd peak hour, 67 mgd peak day and 55 mgd peak week; capacity re-rated to 48.5 mgd due to results of bioassay testing.
c. According to Order R1-2013-0001 Section IVc.3, the design ADWF "permitted to be discharged may be modified provided the Permittee demonstrates the agreements, modifications, and capacity are adequate to ensure surface water discharge volumes remain unchanged."

The IRWP EIR and *Recycled Water Master Plan* (Santa Rosa, 2004), including amendments through 2007, provide a framework of alternatives to address the incremental increase in flow from planned growth from the Regional Partners. Table 2-2 summarizes the program, project and implemented capacities for each alternative under the IRWP.

Table 2-2 IRWP EIR Alternatives and Master Plan Annual Capacity Limitations[a]

Alternative	Program Limit	Project Limit	Implemented Capacity
Indoor Water Conservation (above 2003 levels)	300 mg	n/a	220 mg[b.]
Urban Reuse (above 2003 levels)	2,200 mg	500 mg	43 mg
Agricultural Reuse (above 2003 levels)	2,200 mg	n/a	0 mg
Geysers Expansion (above 11 mgd)	3,209 mg	3,209 mg	3,209 mg
Discharge	4,500 mg	2,900 mg	2,900 mg
LTP ADWF	25.9 mgd	0 mg	21.3 mgd
Seasonal Storage (above 2003 levels)	1,200 mg	500 mg	0 mg

a. Current water conservation capacity analysis may vary. Updating Partner Agencies' water conservation capacity analyses was not included in the scope of the Master Plan.
b. Implemented conservation measures as of 2007 and does not reflect measures associated with drought related conservation in 2011 – 2014 which were greater.

2.1.3 Condition

The City conducted a condition assessment of the LTP in 2012 (Santa Rosa, 2012). The condition assessment was focused on developing an inventory of assets to be assessed, and conducting preliminary seismic evaluations. A prior Power Master Plan (Santa Rosa, 2006) documented condition issues in the electrical power system at the LTP. Additional information was gained from site visits and staff interviews conducted in March 2015, and through continued correspondence with City staff. Condition deficiencies noted by the City and in previous condition assessments are documented in Table 2-3.

Table 2-3 LTP Condition Observations

Process	Potential Condition Deficiencies
Headworks	• Condition Assessment noted advance corrosion of emergency bypass gate, pump deflector covers, and stop log • Condition Assessment identified corrosion on surface of concrete and recommended repairs and coating • Original influent pumps were installed in 1976. These pumps may be reaching the end of their useful lives and should be monitored. • Pump suction pipes require re-coating and re-lining to extend service life.
Primary Clarifiers	• 42-inch Equalization Basin Supply (EBS) pipe has never been inspected. Contract provisions for emergency pumping need to be maintained.
Aeration System	• Routine maintenance of aeration equipment (clarifier drives, etc.) is provided by LTP staff. No potential condition deficiencies noted.
Effluent Filters	• 50% valve and actuators were recently rebuilt/replaced. No other condition deficiencies noted.
Disinfection	• Disinfection system replacement is currently underway.
Sludge Thickening	• No condition deficiencies noted
Sludge Digestion	• Several issues with the anaerobic digesters were identified in the Condition Assessment. Roofing material for the two prestressed concrete digesters is in poor condition, and exterior gas piping corroded.
Sludge Dewatering	• No condition deficiencies noted
Cogeneration	• No condition deficiencies noted
Electrical System	• Many electrical components are nearing the end of their useful life, including switchgear M1 and many load centers from the 1976 plant expansion.
Yard Piping and Buried Duct banks	• Not included in previous condition assessments; condition unknown
Laboratory	• Exterior, uncovered location of deionized water tank leads to brittle condition in plastic valves and piping. • Future instruments may require a facility that can control bench vibrations to prevent excess noise and enable ability to detect very low levels of analytes. • Laboratory spaces may need to be converted to clean rooms for better contamination control to meet future regulatory reporting limits. • Some laboratory fume hoods are corroded because they are made from materials that are incompatible with chemicals and they are over 20 years old and nearing the end of life.

2.2 Biosolids Management Facilities

Management of biosolids produced at the LTP includes a variety of beneficial reuse programs. This diverse biosolids management program provides a resilient biosolids management strategy providing a range of products targeted to the resource needs of the region.

2.2.1 Description

Anaerobically digested and dewatered biosolids produced at LTP are stored at Alpha Farm and used for Class B land application, processed at the compost facility, or sent to a landfill for disposal. In a typical year roughly two thirds of the biosolids produced at LTP are land-applied and one third is treated at the compost facility. In 2016 roughly 1.2 percent of biosolids produced at LTP were sent to a landfill.

Land application of Class B biosolids takes place on one City owned farm, one City leased farm, and five farms on which the City has agreements allowing beneficial reuse of biosolids. The biosolids are applied at agronomic rates based on crop production. According to City staff, application rates have historically ranged from about 12 to 20 wet tons per acre. The City has 1-year leases with the private farms that have been renewed annually. At the City farms, the crops consist of hay and pasture, and biosolids are applied once per year in the fall. On the private farms, crops consist of hay and oats, with biosolids applied once per year.

Biosolids are typically applied from May through October each year. During the winter months when biosolids cannot be land applied, they are either composted or stored in an open sided pole barn at Alpha Farm that can hold up to approximately 7,000 wet tons. Biosolids stored at Alpha Farm are applied to both North and South County farms. Biosolids can be stored on the land at the South County farms between May and October, but not on land at the City Farms. The North County farms are regulated by the North Coast Regional Water Quality Control Board, while the South County farms are regulated by the San Francisco Bay Regional Water Quality Control Board.

The compost facility converts anaerobically digested biosolids to a Class A biosolids compost product. Compost produced at the facility is sold to local landscaping companies, golf courses, and vineyards. Lesser amounts are sold to individuals or donated to local community gardens and schools.

Compost production occurs at the fully-enclosed Compost Facility with emissions captured and treated as required by the LTP's Bay Area Air Quality Management District-Title V Air Quality Permit. Following construction of the facility in 1995, compost facility staff has made adjustments to increase process throughput and minimize operational costs. Most recently these efforts have included adjusting the compost recipe in terms of the amount of biosolids used, and closely monitoring the moisture content of the material as it moves through the composting process. Compost is produced using a bulking agent that consists of organic waste from a local curbside pickup program provided by Total Waste Systems.

A small percentage of the Class B biosolids are transported to landfills for disposal. Options available include the Redwood Landfill located in Novato 26 miles to the south of the LTP and the Hay Road Landfill located in Vacaville located about 75 miles to the east. Both facilities limit the amount of solids that can be disposed, with Redwood Landfill being limited to 23 wet tons per day and Hay Road Landfill to 350 wet tons per year. One percent of biosolids are sent to the Lystek Organic Material Recovery Center at the Fairfield Suisun Sewer District.

2.2.2 Schematics

Waste activated sludge produced at the LTP is thickened on three gravity belt thickeners, then combined with primary sludge and anaerobically digested in four digesters. Digested sludge is dewatered on four belt filter presses, and stored for land application or transferred to the Compost

Facility for treatment. The Compost Facility is an aerated, agitated in-vessel composting system that uses four compost turners (agitators) that turn the material in the bins each day. A schematic of the solids system is show in Figure 2-6, and the site plan of the Compost Facility is shown in Figure 2-7.

2.2.3 Capacity

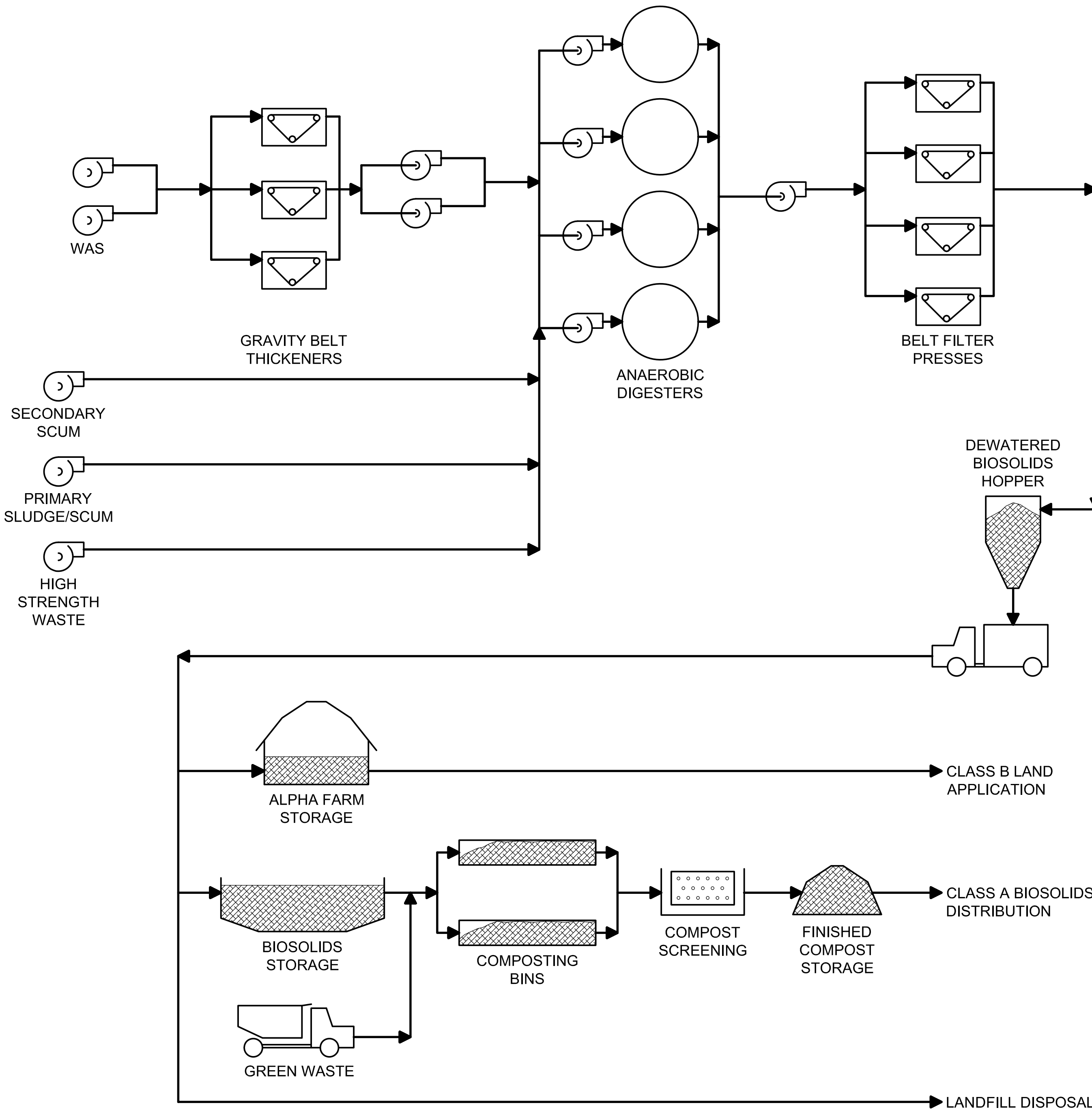
The biosolids management system includes the Alpha Farm storage, Compost Facility and land application sites. The capacity of the overall system and the individual program elements are shown in Table 2-4.

Table 2-4 Biosolids Management System Facility Needs and Built Capacity

Facility	Current Need[a]	Built Capacity
Biosolids:		
Biosolids	28,500 wt	n/a
Land Application	10,200 wt	n/a
Compost	9,100 wt	8,800 wt
Landfill	360 wt	n/a[b]
Lystek	260 wt	150,000 wt[c]
Compost Facility:		
Sludge Feed Rate	n/a	50.6 wt/d
Total Bin Volume	n/a	4,390 wt
Storage Facilities:		
Alpha Storage	7,000 wt	7,000 wt
Compost Facility Storage	3,500 wt	3,500 wt

a. Based on reported biosolids volumes for 2016
b. Redwood Landfill is limited to 23 wt/day limit and Hay Road landfill is limited to 350 wt/year
c. Lystek's Organic Material Recovery Center has a capacity to treat 150,000 wt/year from Fairfield Suisun Sewer District and other organics producers in the region.

As Table 2-4 shows, the existing storage capacity is equal to the current need in the biosolids program. The Biosolids Management Strategic Plan (Santa Rosa, 2014d) recommended maximizing land application in the near-term, prior to implementing a full Class A treatment process that precludes the need for additional storage. The most cost-effective approach to maximize land application is to secure additional sites in the North County area. Adding storage near the South County properties would also make it easier for the City to fully utilize private land application sites in the South County.



City of Santa Rosa

SWRRF Master Plan

Laguna Wastewater Treatment Plant
Solids Treatment Stream

Job Number | 0764001
Revision
Date | Nov. 2016

Figure 2-6

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City of Santa Rosa

SWRRF Master Plan
Laguna Subregional
Compost Facility

Job Number 0764001
Revision
Date Nov. 2016

Figure 2-7

2235 Mercury Way Suite 150 Santa Rosa California 95407 USA T 1 707 523 1010 F 1 707 527 8679 W www.ghd.com

Plot Date: 12 December 2016 - 9:31 AM CAD File No: Z:\1468051.00-SWRRF-Master_Plan\1468051-FIG 2-7.dwg

2.2.4 Condition

The Compost Facility, built in 1995, currently has notable mechanical and structural system deterioration. The City completed a structural evaluation of the facility in 2016 that included analysis of failing mechanical and structural systems (Santa Rosa, 2016e). Additional condition deficiencies were identified during meetings and field visits with facility staff.

Worker Access and Safety. Several worker access and safety related needs were identified. They include the following:

- *Catwalks*. Two additional catwalks are needed to provide access from both sides of the compost bins. Currently each group of six compost bins can only be accessed from one side causing staff to climb over bin walls.

Roof System. The existing roof purlins in the compost facility have varying degrees of deterioration ranging from no damage to major holes from corrosion.

Conveyor. Composting staff identified two immediate needs associated with the existing conveyor.

- *Screen Location*. Facility operators prefer to move the compost screen underneath the conveyor discharge to eliminate use of a front-end loader to move compost from the conveyor discharge to the screen. However, the existing push wall must be removed to provide adequate space for screen maintenance.
- *Conveyor Supports*. The corrosive atmosphere within the composting facility has damaged the conveyor support structure. Although repairs have been made, additional work is needed.

Walking Floor and Pit Area. The Compost Facility has been in operation nearly 20 years, and the Walking Floor is showing signs of wear and deterioration. The area immediately to the north and below the walking floor is also prone to flooding and was identified as having the following immediate needs.

- *Walking Floor*. The walking floor design lends itself to solids and moisture intrusion, leading to corrosion and deterioration of drive elements.
- *Electrical Panel and Hydraulic Drive*. The walking floors electrical panel and hydraulic drive unit are both located in the pit area. Because of the area's high humidity and potential for flooding, staff wish to relocate this equipment either to the working area directly above or outside.
- *Floor Repair*. Ground water pressure beneath the pit floor has damaged the floor slab causing the upper high strength concrete layer to delaminate. Staff would like to add pressure relief valves in the slab to reduce ground water pressure and slope the floor to improve drainage.

Site Utilities. Several site improvements were noted by composting staff as being immediate needs.

- *Truck Wash*. Existing truck wash facilities are inadequate; requiring drivers to take too much time. Because of the effort needed, staff believe drivers may not adequately clean their vehicles which has resulted in trucks carrying material out onto Llano Road.
- *Truck Scales*. The truck scales have limited access requiring confined space entry to clean, and existing drains are undersized.

2.3 Reuse Distribution and Discharge

Water reuse was originally intended as an alternative means to dispose of water when discharge to the Laguna is prohibited or limited. As regulatory requirements relating to discharge became more and more restrictive, reuse options were expanded culminating with construction of the Geysers Pipeline system to deliver water to Calpine at the Geysers steamfields. Recycled water is now viewed as a valuable resource, providing critical water supply for agricultural reuse, urban reuse, and green power generation.

2.3.1 Description

The water reuse facilities consist of a low-pressure distribution and storage system serving agriculture, golf course irrigation customers, A Place to Play, and Countryside Estates. A high pressure urban reuse distribution system serves customers in Rohnert Park and Santa Rosa, and a separate high-pressure delivery system conveys water to the Geysers. In 2016, the LTP treated about 6.7 billion gallons of water, of which 2.3 billion gallons were delivered to irrigation customers (agricultural and urban) and 4.2 billion gallons were delivered to Calpine. The total working storage volume in the seasonal storage ponds is about 1.5 billion gallons. In addition to the WRS storage facilities, customer ponds provide an additional 150 million gallons of working storage that can be used to manage water during the wet season to minimize discharges to surface water.

The primary point of effluent discharge is from Delta Pond at the confluence of the Laguna de Santa Rosa (Laguna) and Santa Rosa Creek. Discharge is also permitted from the Meadow Lane Pond into the Laguna at the confluence with Colgan Creek, although this discharge point is rarely used. The last discharge from Meadow Lane Pond was during 2016. From 2009 through 2016 discharge was only required from Delta Pond during a single calendar year. A complete list of permitted discharge points is as follows:

1. 001 Alpha Pond (Advanced-treated water to Roseland Creek, tributary to the Laguna de Santa Rosa)
2. 002 Arlington Pond (Advanced-treated water to Colgan Creek, tributary to the Laguna de Santa Rosa)
3. 003 Brown Pond (Advanced-treated water to an unnamed ditch, tributary to the Laguna de Santa Rosa)
4. 004 Kelly Pond (Advanced-treated water to the Kelly Demonstration Wetland to an unnamed ditch, tributary to the Laguna de Santa Rosa)
5. 005 LaFranconi Pond (Advanced-treated water to an unnamed ditch, tributary to the Laguna de Santa Rosa)
6. 006A Meadow Lane Pond D (Advanced-treated water to the Laguna de Santa Rosa)
7. 006B Meadow Lane Pond D (Advanced-treated water to the Laguna de Santa Rosa)
8. 007 Poncia Pond (Advanced-treated water to the Laguna de Santa Rosa)
9. 008 West College Pond 1C (Advanced-treated water to Santa Rosa Creek)
10. 009 Ambrosini Pond (Advanced-treated water to Santa Rosa Creek)
11. 012A Delta Pond (Advanced-treated water to Santa Rosa Creek)
12. 012B Delta Pond (Advanced-treated water to Santa Rosa Creek)
13. 014 Meadow Lane A Pond (Advanced-treated water to Laguna de Santa Rosa)

14. 015 Laguna Treatment Plant (Advanced-treated water to the Regional System or Laguna de Santa Rosa)
15. 016 Laguna Joint Wetlands (Advanced-treated water to an unnamed ditch, tributary to the Laguna de Santa Rosa)

The LTP's NPDES permit restricts timing of discharges to October 1 to May 14 (discharge season) of each year. Furthermore, these discharges of advanced treated wastewater must be less than five percent of the flow in the Russian River, as measured by USGS Gage No. 11467000).

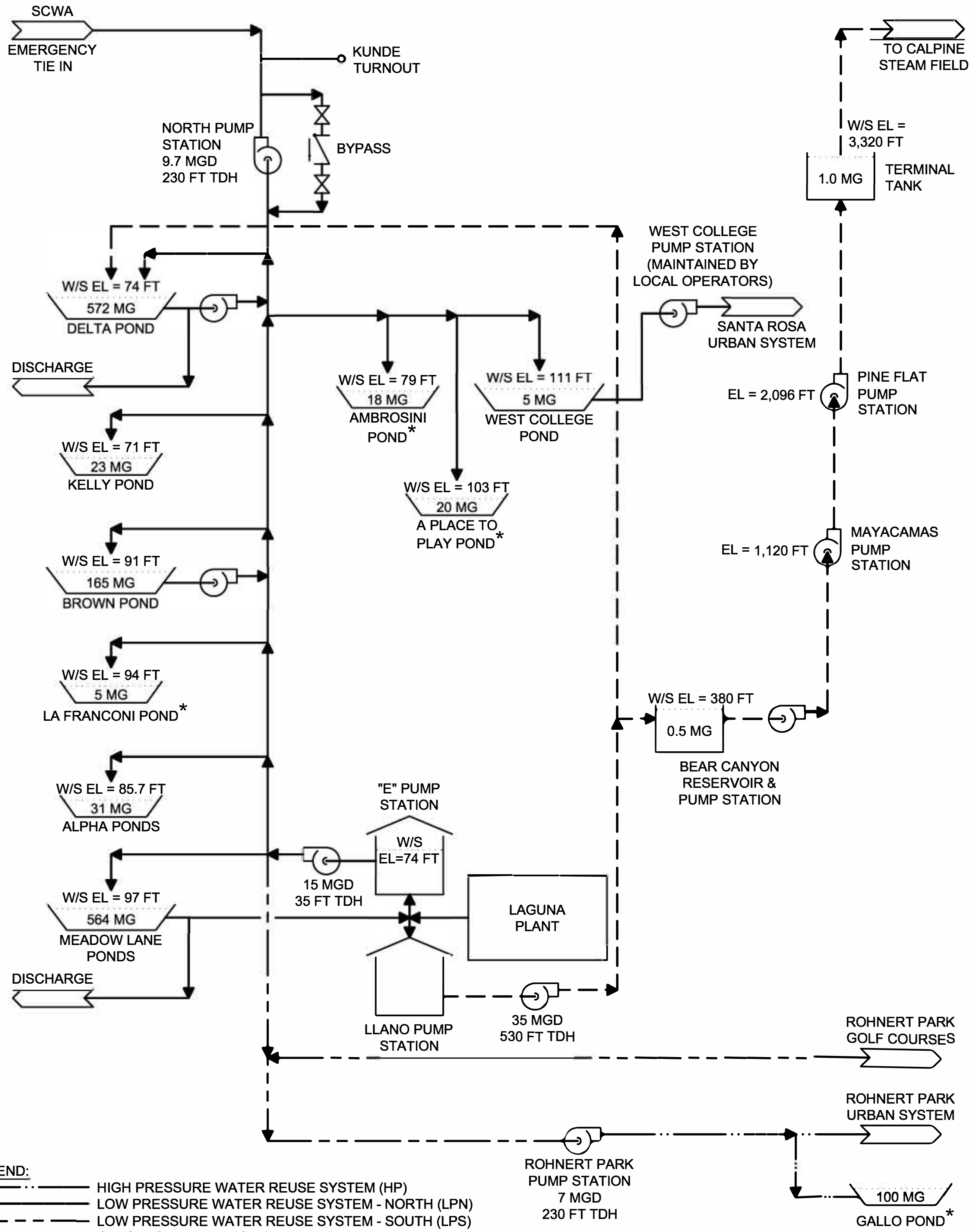
Urban customers sign up for reuse water with an expectation that they will have a reliable water supply and have invested in onsite retrofits of their irrigation systems accordingly. Demand from agriculture has historically been curtailed when total reuse water demand exceeds supply. However, at farms where biosolids are used as soil amendment, reducing reuse water for irrigation of crops also reduces the amount of biosolids application. Operation of the reuse facilities in wet years is limited by available storage volume, and in dry years it is limited by water supply.

The City, on behalf of the Regional Partners, and Rohnert Park have executed an agreement that transferred ownership of the urban reuse infrastructure within Rohnert Park's boundaries to the City of Rohnert Park. The Regional Partners maintain the right to use the Rohnert Park network to move water through the system to other Regional Partners as necessary in the future. This agreement went into effect on August 1, 2015.

A two-way connection exists with the Sonoma County Water Agency's Airport water reclamation system located at the north end of the low-pressure distribution system. The connection can be used to transfer recycled water from Santa Rosa's water reuse system to Sonoma County Water Agency's (SCWA) reclamation system, and vice versa. In practice, the connection is rarely used because during most years both agencies utilize all the recycled water that they generate, therefore in these situations there is no need to transfer water from one agency to another. While the connection is rarely used during normal years, it is still a valuable asset and Santa Rosa could also potentially need it for transferring recycled water eliminated the need to discharge.

2.3.2 Schematics

Figure 2-8 provides a schematic of the WRS water reuse facilities. The low-pressure distribution system and some seasonal storage ponds were originally constructed in the 1970s, Rohnert Park's high pressure urban reuse distribution system and additional seasonal storage ponds were constructed in the mid-1990s, and the infrastructure has operated reliably with minimal maintenance requirements. The Geysers pipeline went into operation in 2004 and the City of Santa Rosa has added urban reuse customers over the last 10 years.



LEGEND:

- HIGH PRESSURE WATER REUSE SYSTEM (HP)
- LOW PRESSURE WATER REUSE SYSTEM - NORTH (LPN)
- LOW PRESSURE WATER REUSE SYSTEM - SOUTH (LPS)
- GEYSERS PIPELINE (GPL)
- * CUSTOMER PONDS

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City of Santa Rosa

SWRRF Master Plan

Existing Reuse Conveyance Storage Schematic

Job Number	0764001
Revision	
Date	Nov. 2016

Figure 2-8

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Plot Date: 21 July 2017 - 9:00 AM CAD File No: \\Eug\cad\CAD\2014\1468051.00-SWRRF-Master_Plan\1468051-FIG 2-8.dwg

2.3.1 Capacity

The capacities of the key reuse facility assets are summarized in Table 2-5.

Table 2-5 Reclamation System Facility Needs, Built Capacity and Permit Requirements

Facility	2014 Need	Built Capacity	Permit Requirements
Seasonal Storage:	1,500 mg	1,500 mg [a]	1,650 mg [b.] (Order R1-2013-0001)
Delta Pond	572 mg	572 mg	
Meadow Lane Ponds	564 mg	564 mg	
Brown Pond	165 mg	165 mg	
Alpha Ponds	31 mg	31 mg	
Kelly Pond	23 mg	23 mg	
West College Pond	5 mg	5 mg	
Geysers Conveyance:			> 4,015 mgy (Order R1-2013-0001)
Llano Pump Station	18 mgd [c.]	35 mgd	
Bear Canyon Pump Station	18 mgd [c.]	16.9 mgd	
Mayacamas Pump Station	18 mgd [c.]	16.9 mgd	
Pine Flat Pump Station	18 mgd [c.]	16.9 mgd	
Irrigation and Discharge:			> 2,590 mgy (Order R1-2013-0001)
"E" Pump Station	15 mgd	15 mgd	
Rohnert Park Pump Station	7 mgd	7 mgd	
West College Pump Station	2 mgd	2 mgd	
North Pump Station	9.7 mgd	9.7 mgd	
Discharge	0 mgy	n/a	< 5% Russian River Flow (Order R1-2013-0001)

a. Total working volume of seasonal storage includes 143 mg from customer ponds.
b. Minimum storage referred to in Order R1-2013-0001 is total storage, including "dead" storage, and does not account for loss of 70 mg of storage at West College.
c. Geysers pump stations have capacity of 19 mgd with spare pump in operation.

2.3.2 Condition

The low-pressure distribution system, Rohnert Park high pressure urban reuse distribution system, and the majority of the seasonal storage ponds were constructed in the 1970s and have operated reliably with minimal maintenance requirements. The Geysers pipeline went into operation in 2004 and the City of Santa Rosa has added urban reuse customers over the last 10 years.

The City has not conducted a condition assessment of the original (1977) reclamation piping system since it was placed into operation. An initial assessment and ongoing inspection program is needed to manage the buried assets in the reclamation system. Inspection of the Geysers pipeline should also be conducted regularly, especially in areas where flow restrictions have been observed.

2.4 Regional Lands

The City owns and leases numerous properties in Sonoma County that are used for WRS facilities, provide agriculture land for irrigation with recycled water and/or application of Class B biosolids, support wetlands and riparian area enhancements and restoration activities, and provide buffer around the LTP. These parcels are critical to WRS operations and a brief description of the various uses for the parcels is provided in this section. Figure 2-9 shows the approximate locations of the WRS lands within Sonoma County.

2.4.1 Descriptions

The WRS lands support the following operations:

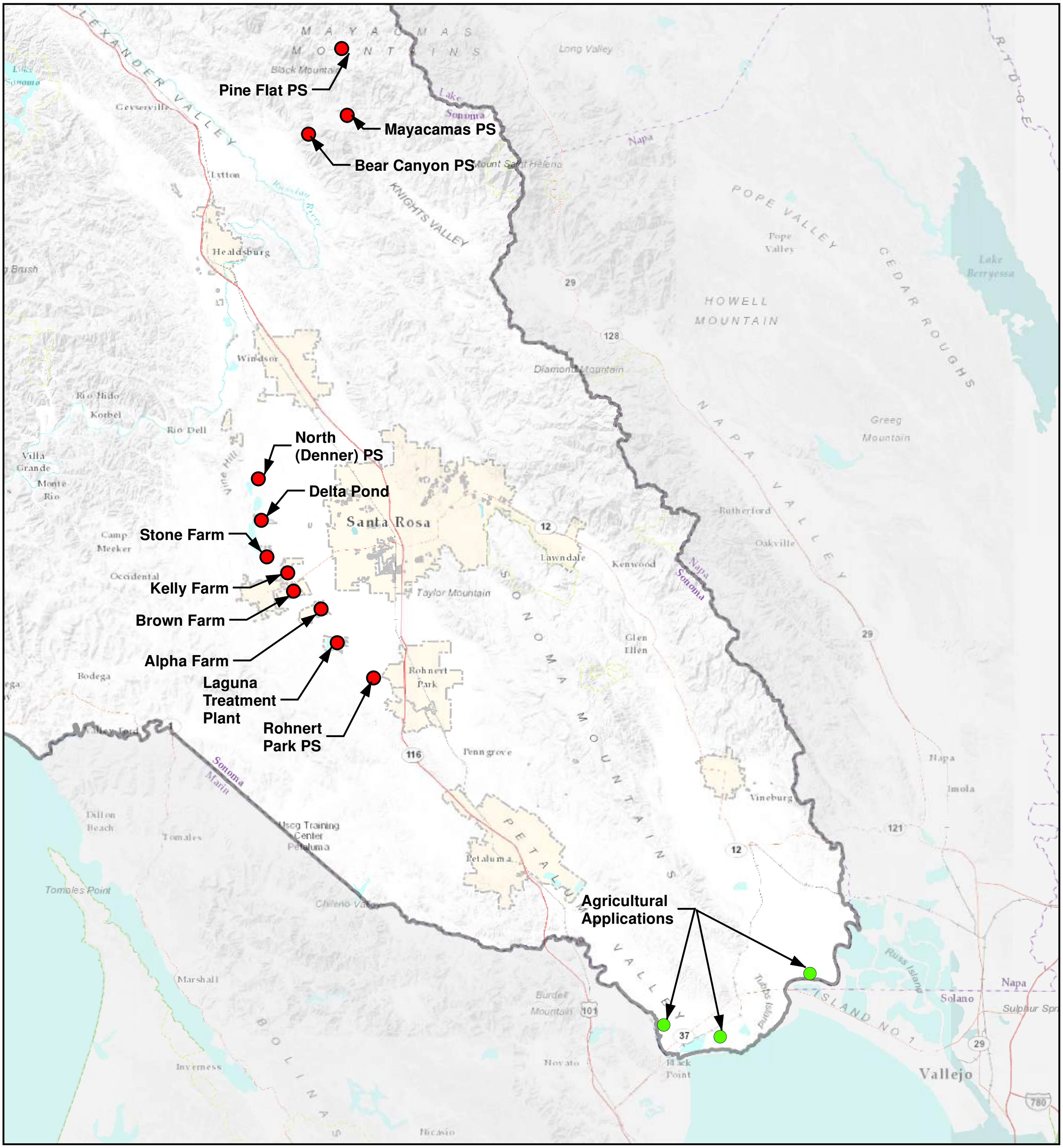
- LTP treatment and compost facilities
- Seasonal storage sites (recycled water and biosolids)
- Recycled water pump stations
- Geysers pump stations
- Agricultural applications

The LTP is located on the north side of the Laguna de Santa Rosa – Mainstem Channel, and along both sides of Llano Road. The wastewater treatment facilities are located on the east side of Llano Road, and on the west side are the biosolids compost facilities, Meadow Lane Ponds, and the Llano Pump Station. The City has also purchased several neighboring parcels to the east of the LTP to serve as buffer lands. Portions of these parcels lie within the 100-year flood plain as mapped by Federal Emergency Management Agency (FEMA) and the LTP has experienced occasional flooding during larger storm events. The City has recently completed a feasibility study for constructing berms/floodwalls around critical facilities to protect the LTP site from future flood events.

In addition to the Geysers Pump Station located at the LTP, the Geysers conveyance facilities include the Bear Canyon, Mayacama and Pine Flat Pump Stations located to the northeast of Healdsburg. The City also owns and maintains the Terminal Tank located at the steamfields where water is received by Calpine for steamfield injection. These parcels house conveyance facilities and are not used for other purposes.

Seasonal storage of recycled water is provided at several properties including the LTP (Meadow Lane Ponds), the City farms (Alpha, Brown and Kelly), Delta Pond and the West College storage facilities. Delta Pond is a key storage facility in that it is the largest surface storage facility in the WRS system (572 mg), it is a two-way pond that can supply water for reuse in the summer months, and it also is the location of the primary discharge site for when the City elects to discharge under permitted conditions. Storage at the West College site is primarily a terminal storage site for the low-pressure recycled water distribution system, keeping the low-pressure system pressurized for serving users between the LTP and this storage facility. There are additional point-of-use storage ponds located on private property that are owned and maintained by the recycled water customers, and therefore are not considered WRS lands for the purpose of this Master Plan.

The Rohnert Park Pump Station receives recycled water from the low-pressure system and delivers water to the Gallo point-of-use pond in Cotati and the City of Rohnert Park urban reuse distribution system. The North Pump Station receives water from the low-pressure system and provides delivery of recycled water to the Kunde turnout. This facility also serves as a two-way inter-connection with the SCWA recycled water system from their airport treatment facility. The City of Santa Rosa owns a pump station located at the West College Facilities serving City of Santa Rosa urban reuse customers, but this is not considered a WRS facility.



Properties Owned

Properties Leased

City Limits

Sonoma County

Paper Size 8.5" x 11" (ANSI A)

0 2 4 6 8

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of Santa Rosa
SWRRF Subregional Master Plan

Job Number 8411395
Revision B
Date 12 Dec 2016

Subregional Lands

Figure 2-9

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Data source: Basemap: ESRI; Sonoma County GIS: Roads, Site data. Created by:alovell

Agriculture parcels (other than the City farms) are leased by the City for application of Class B biosolids for soil augmentation and support of crop production (hay, fodder and pasture). The City is also in the process of purchasing property in south Sonoma County for biosolids applications, which will improve reliability of disposal options over leased properties.

2.4.2 City Farms

The City Farms are a key component of the WRS facilities and play an important role in permit compliance. Operation of the City Farms is described in the *Ranch Plans* (Santa Rosa, 1999) prepared by the City in October 1999. These properties were originally annexed by the City in 1977 (Stone Farm later in 1984) with the purpose of reducing discharges to the Laguna by providing reuse opportunities through agricultural irrigation of recycled water. The purpose of the *Ranch Plans* is to guide management of the lands to support compliance with the Clean Water Act and Non-Point Source Pollution (NPSP) requirements, including soil erosion and nutrient runoff, through continued maintenance and enhancement of wetlands and riparian areas, regular maintenance of ranch roads and stream crossings, and implementation of Best Management Practices (BMPs) for application of biosolids. Stated goals presented in the *Ranch Plans* include:

- Agricultural irrigation with recycled water to minimize discharges, and provide a buffer when recycled water availability is limited;
- Restoration and maintenance of wetlands and riparian areas;
- Maintenance of existing wildlife habitat areas and further development of habitat as appropriate;
- Optimization of agricultural yields through the use of best management practices;
- Identification of marginally productive agricultural areas that may be better suited to other uses;
- Identification of poor production areas and implementation of management practices to increase agricultural productivity; and
- Minimization of non-point source pollutants (NPSP) including sedimentation and siltation through the use of recovery ponds or wetlands.

Use of the City Farms lessens the City’s dependence on surface water discharge, and supports agriculture by providing a reliable source of irrigation water while offsetting historical use of groundwater resources. Additionally, land application of biosolids at City Farms reduces the reliance on landfill deposition. The land application of biosolids on City Farms represents 36 percent of the total biosolids production and 2 percent of the water reuse. Table 2-6 provides a breakdown of resource recovery on City Farms.

Optimization of agricultural yields, and identification of poor production areas is a means of conserving irrigation water supplies to provide maximum benefit, Maintenance of the existing wildlife habitat areas helps the City to comply with environmental mitigation requirements.

The land application of biosolids on City Farms represents 36 percent of the total biosolids production and 2 percent of the water reuse.

Table 2-6 City Farms Land Application of Biosolids and Recycled Water

Property	Acres Applied	Specific Volume Biosolids Applied (dry metric tons/acre)	Volume Biosolids Applied (dry metric tons)	Recycled Water Applied (AFY)	Recycled Water Applied (MGY)
Alpha	49	2.1	102.9	136.2	44.4
Brown	123	2.4	295.2	146.1	47.6
Kelly	NA	NA	NA	99.3	32.4
Stone	21	2.3	48.3	55.0	17.9
Total	193	6.8	446.4	436.6	142

Notes:

- Data obtained from the City of Santa Rosa Laguna Regional Water Reclamation System Waste Discharge Requirements and Master Reclamation Permit 2016 Annual Report
- 1,233 dry metric tons of biosolids was produced in 2016
- 5,502 MG of recycled water was beneficially reused in 2016 (Table 5-4)

The City farms as described within the *Ranch Plans* are shown in Figures 2-10 through 2-13.

Restrictions

The City farms are laid out in grids (with the exception of Stone Farm), and the *Ranch Plans* describe allowable activities and restrictions using the grid system as a reference. Some grids are designated for protection and enhancement as wetlands, riparian corridors, woodlands, or mitigation areas. Other grids are designated for pasture, crops and ranching/livestock activities. Application of recycled water and biosolids must be done at agronomic rates to meet NPSP requirements, and is restricted to designated grids according to the plans.

In 2001 the City and the Sonoma County Agricultural Preservation & Open Space District (OSD) entered into a deed and agreement for the acquisition of conservation easements on the City farms. The purpose of the agreement is to preserve open space, scenic and biotic values of the properties, and prevent any uses of the property that will "significantly" impair or interfere with those values. Also in 2001 the City provided an offer of dedication to the County of Sonoma for a public recreational trail easement on certain City-owned properties, including Alpha, Brown, Stone, and Kelly Farms. The OSD has developed a draft master plan of trails along the Laguna; some or a portion of these trails are located on City farms.

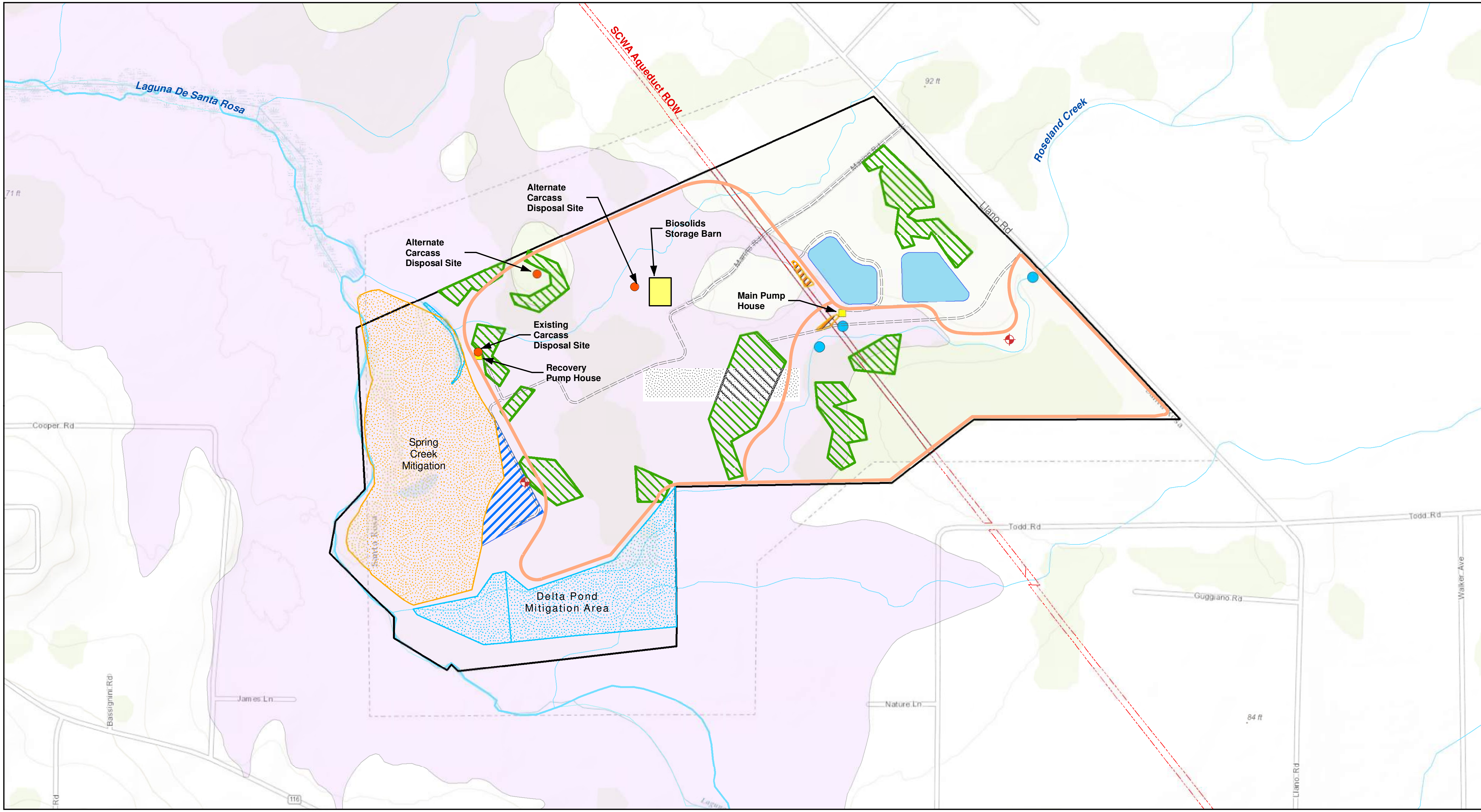
All of the City farms are located in areas known to contain habitat for the endangered California Tiger Salamander (CTS); furthermore, seasonal wetland habitat includes extant or extirpated populations of Sebastopol meadow foam (Limnathes vinculus). Any new activities or projects being considered on the City Farms must first be screened for potential impacts to CTS and Sebastopol meadow foam habitat, with appropriate mitigation measures considered for any impacts identified.

Land Uses

Land uses at the City farms are fairly restricted to current operations, and any proposed improvements in the future will be subject to the requirements described in the *Ranch Plans* and the OSD Conversation Easement. As part of the IRWP program the City investigated potential sites for constructing up to 500 mg of additional seasonal storage, with recommended pond locations sited at City farms as described in the *IRWP Seasonal Storage Project – Draft EIR* (Santa Rosa, March 2008). The final EIR was adopted by the City in October 2008 and the additional storage could be constructed if the City deems the investment is beneficial. The benefits of using available land to construct additional storage will be weighed against the reduction in the land area available for other uses including agricultural irrigation with recycled water, land application of biosolids, and further ecological enhancements.

Monitoring

Monitoring programs at the City farms are described in the *Ranch Plans* (Santa Rosa, 2014), which were developed to comply with the Clean Water Act and meeting NPSP requirements. The Ranch Plans lay out planned actions such as maintenance and enhancement of wetlands and riparian areas, maintenance of roads and stream crossings, and Best Management Practices (BMPs) for fertilizer and manure applications (City of Santa Rosa, 2015). Monitoring and generally consist of water quality monitoring (groundwater and surface water) to ensure that nutrient and NPSP requirements are being met, photographic monitoring to create a permanent record of property conditions, vegetation monitoring to ensure health of natural habitat and control of invasive species, and wildlife monitoring to establish presence of naturally occurring species and especially listed species.



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Map Projection: Lambert Conformal Conic
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N

- Farm Boundary
- Mitigation Areas
- Water Development
- Wetlands
- Seasonal Storage Pond
- 100-year Flood plain
- Brush and Forest or Woodland Plants
- Monitoring Well
- Surface Water Sample Location
- Carcass Disposal
- Buildings and Structures
- Livestock Area
- SCWA Aqueduct ROW
- Proposed OSD Trails
- Ranch Roads
- Waterway

GHD

City of Santa Rosa

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City of Santa Rosa
SWRRF Subregional Master Plan

Job Number 84-111395
Revision B
Date 12 Dec 2016

Alpha Farm

Figure 2-10

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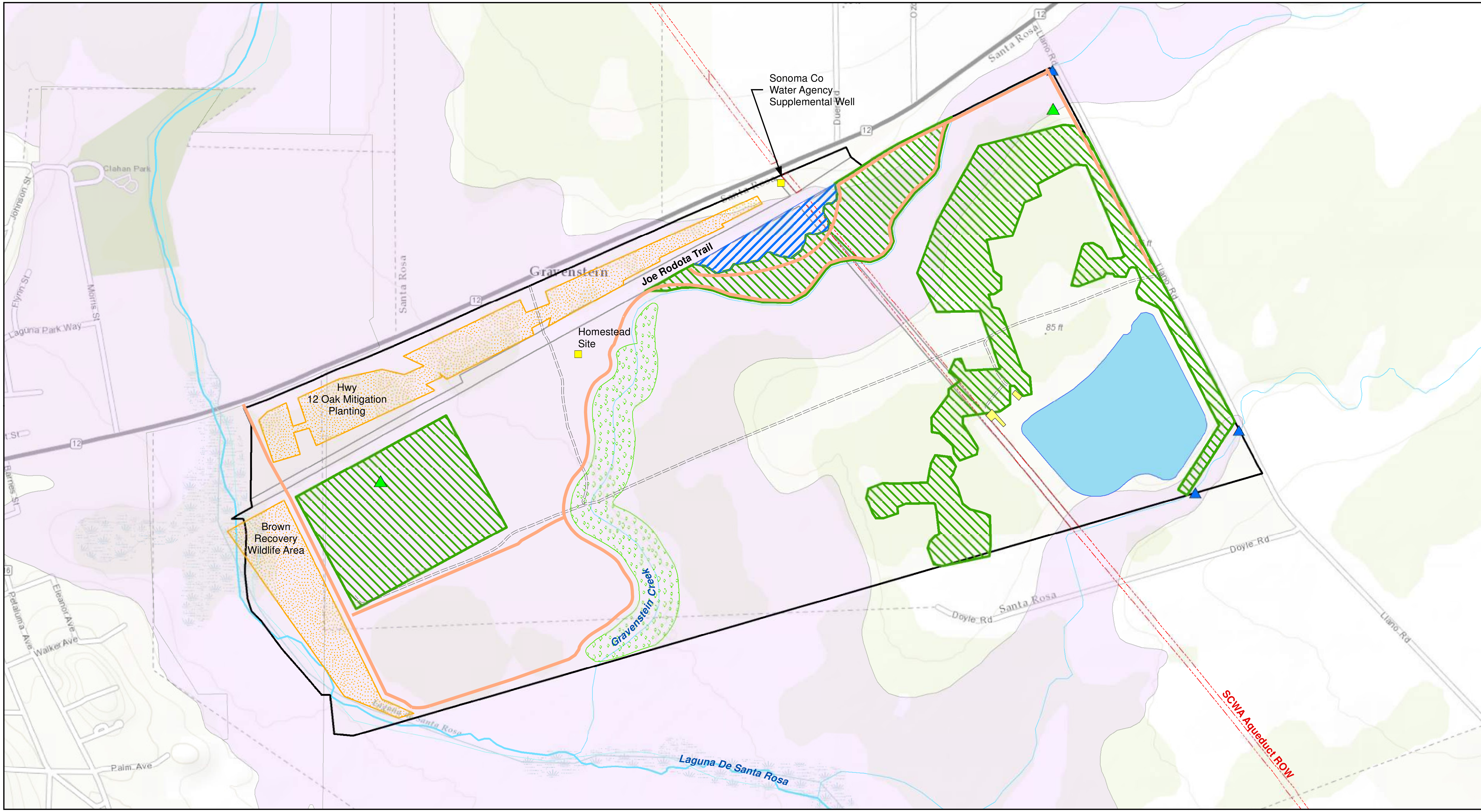
Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community Created by:alovell



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Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

N

- Farm Boundary
- Mitigation Areas
- Gravenstein Creek Riparian Area
- Wetlands
- Seasonal Storage Pond
- 100-year Flood plain
- Brush and Forest or Woodland Plants
- Wildlife Population
- Water Intersection Points
- Buildings and Structures
- SCWA Aqueduct ROW
- Proposed OSD Trails
- Ranch Roads
- Waterway

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Revision B
Date 12 Dec 2016

Brown Farm

Figure 2-11

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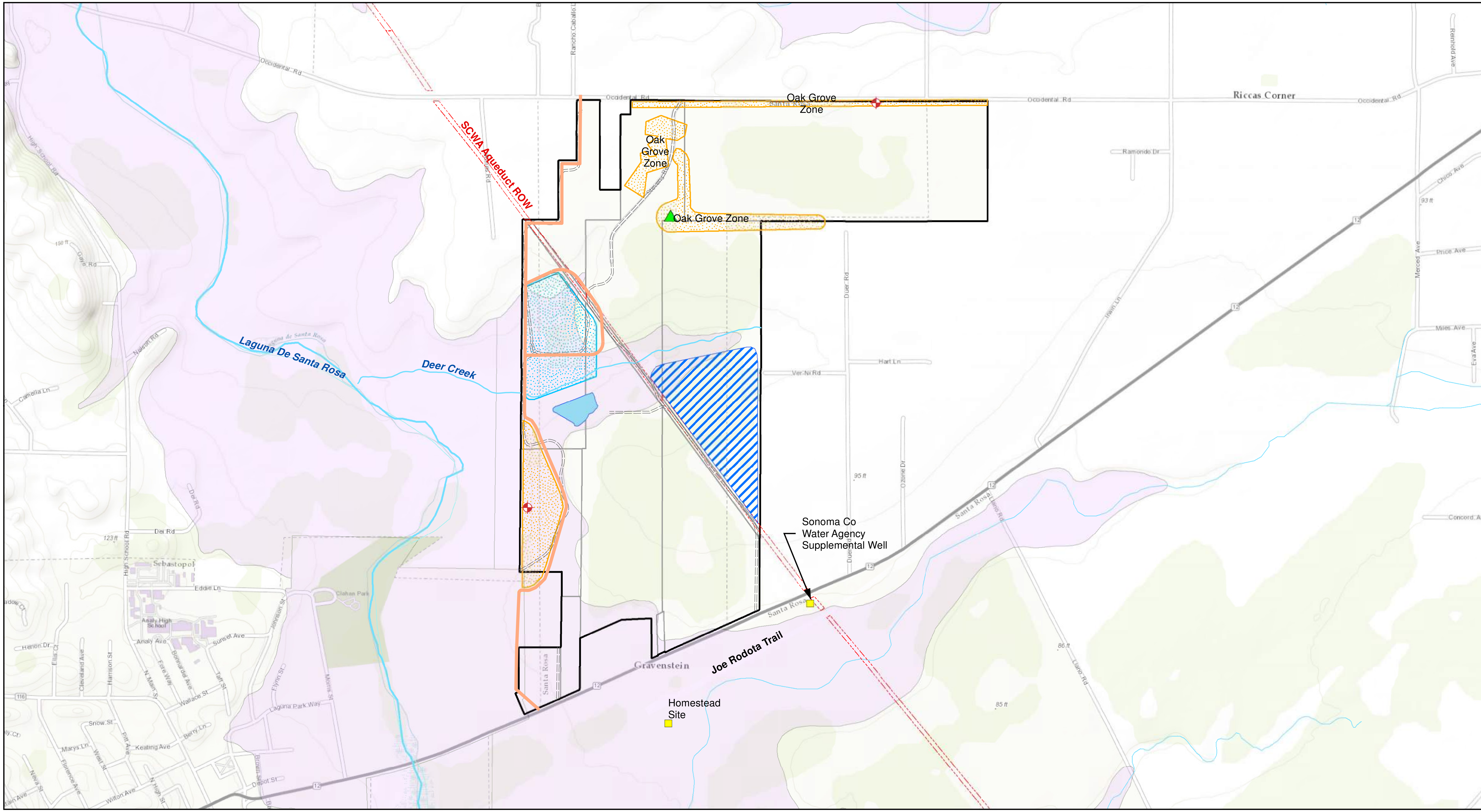
Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community Created by:alovell



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Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

N

- Farm Boundary
- Mitigation Areas
- Water Development
- Wetlands
- Seasonal Storage Pond
- 100-year Flood plain
- Monitoring Well
- Wildlife Population
- Buildings and Structures
- SCWA Aqueduct ROW
- Proposed OSD Trails
- Ranch Roads
- Waterway

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City of Santa Rosa
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Job Number	84-111395
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Date	12 Dec 2016

Kelly Farm

Figure 2-12

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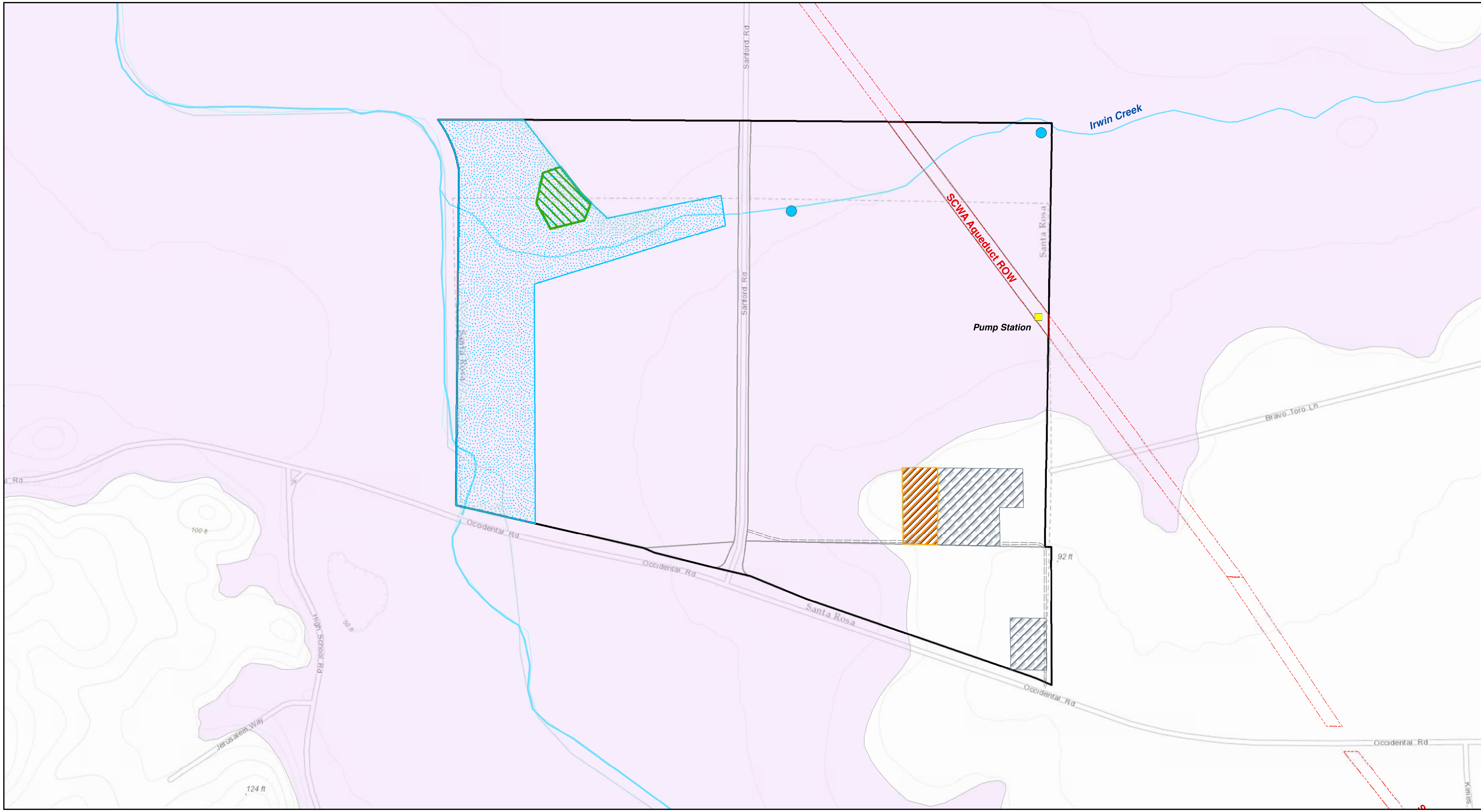
Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community Created by:alovell



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Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

N

- Farm Boundary
- Water Development
- 100-year Flood plain
- Brush and Forest or Woodland Plants
- Surface Water Sample Location
- Buildings and Structures
- Historic Facilities
- Livestock Area
- SCWA Aqueduct ROW
- Ranch Roads
- Waterway

GHD

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SWRRF Subregional Master Plan

Job Number 84-111395
Revision B
Date 12 Dec 2016

Stone Farm

Figure 2-13

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Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community Created by:alovell

3. Resource Analysis

The Regional system was originally designed to receive raw wastewater, treat it to levels determined by regulatory permits, and then discharge the treated effluent to the Laguna and incorporate the treated biosolids into soil on farmlands. Over time, and as regulatory permit requirements became stricter with respect to minimum treatment levels and disposal constraints pertaining to effluent and receiving water limitations, the Regional system has evolved into resource recovery facilities that convert untreated wastewater into resources that can be reused with ancillary benefits to the Regional partners and the region as a whole. This chapter describes the initial, intermediate and final resource streams that are processed through the WRS.

3.1 Influent Sources

Influent sources are the untreated waste streams conveyed to the LTP via the Regional Partners' sewer collection systems, or delivered by waste haulers to the facility by other entities. The waste streams are a combination of water, biological matter, chemicals and inert solids that must be processed further to create recoverable resources. Influent sources received at the LTP include wastewater, high strength waste, landfill leachate and transfer facility runoff, and storm water.

3.1.1 Wastewater

Wastewater received from the Regional partners represents the highest volume waste stream received at the LTP and the majority of the facilities are designed to handle the particular characteristics and volume of this flow. The volume of wastewater received varies diurnally, seasonally, and annually. Regional trends in growth and per capita potable water usage influence wastewater flows over longer periods of time.

Current and Projected Future Base Wastewater Flows

Influent wastewater flows received at the LTP have historically trended upward corresponding to population growth within the service area as would typically be expected. As indicated in Figure 3-1, this historical trend reversed in 2004 and influent wastewater flows began to decrease year over year, a trend that has generally continued through 2015. There are two primary factors that likely caused this trend reversal. Development was curtailed by environmental constraints in the Santa Rosa Plain, including mapping of CTS habitat, and then the recession in 2008, which curtailed population growth. Also, the public's response to voluntary and then mandatory water conservation measures further reduced per capita water usage during the most recent droughts.

This trend reversed again and returned to an upward slope in 2016 and 2017 as development activity returned and the current drought cycle ended. However, the rate of increase may not return to historical levels due to local water conservation programs and public attitudes that have shifted towards a new way of life in this water sensitive state and region.

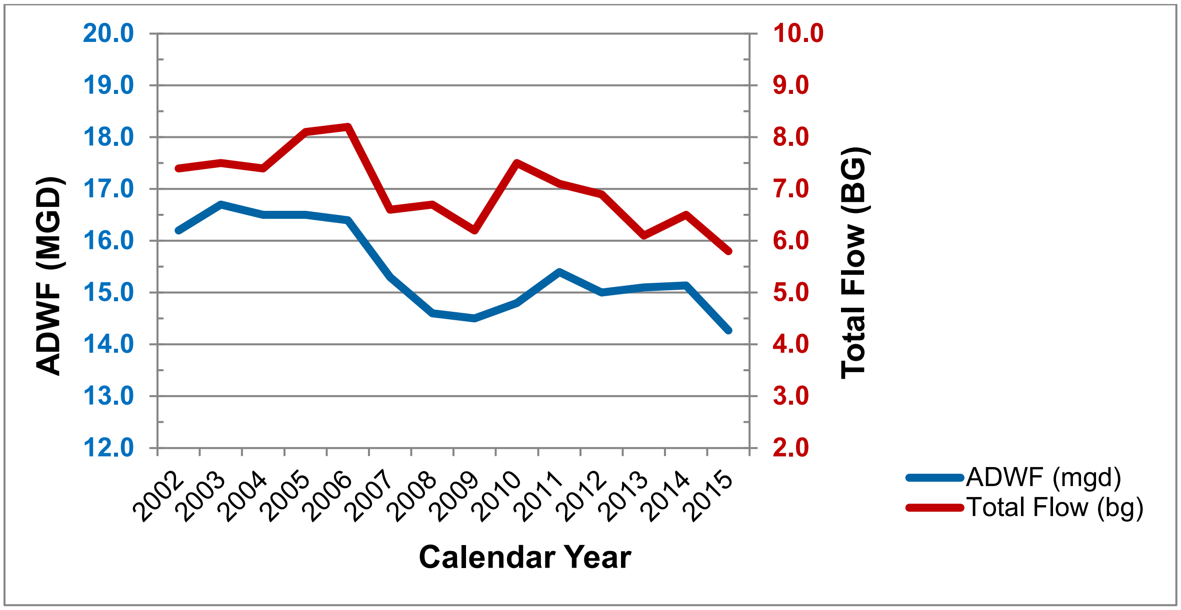


Figure 3-1 Influent Wastewater Flows at LTP 2002 - 2015

Projected future flows are based on approved growth within the WRS service area. The *Incremental Recycled Water Program (IRWP) Recycled Water Master Plan* was completed in 2004, and at that time future flow projections were estimated to be 25.89 mgd average dry weather flow (ADWF) through buildout of the General Plans of the Regional Partners. The *IRWP Recycled Water Master Plan* included the estimated future flow shown in Table 3-1 (Santa Rosa, Table 1, p. 1-9, 2004). The *IRWP Program EIR* evaluated treatment and disposal for these projected flows to the LTP.

Table 3-1 IRWP Recycled Water Master Plan ADWF Projections

Regional Partner	Incremental Increase in Flow due to Buildout (mgd)
Rohnert Park	5.15
Santa Rosa	19.14
Sebastopol	0.84
Cotati	0.76
Total	**25.89**

The Santa Rosa flow projections in Table 3-1 include flows from the South Park County Sanitation District. Because the District is entirely within the City's Sphere of Influence, District flow projections are determined by City of Santa Rosa General Plan buildout projections. No separate flow projections have been made for the District. The County contributes funds to the WRS for treatment and disposal of flows from the District service area, as well as operation and maintenance of the collection system.

In 2014, the City undertook a review of these wastewater flow projections to determine if they had increased due to changes in the General Plans of the Regional Partners (Santa Rosa, 2014b). A number of General Plan updates and amendments have been approved by the Regional Partners since the IRWP projections were prepared. The 2014 IRWP flow review evaluated General Plan updates and amendments through October 2013. The review included, for example, Rohnert Park's approval of several Specific Plans and the construction of the Federated Indians of Graton Rancheria casino.

The wastewater flow review concluded that changes to the General Plans of the Regional Partners have increased buildout conditions, but that these increases have been more than offset by decreased per capita and/or per employee flows, and therefore the flow projections in the IRWP Master Plan were still reliable and appropriate through October 2013.

As an additional check of the IRWP ADWF projections, the potable water demand projections for Santa Rosa and Rohnert Park through 2035 were reviewed and correlated to typical wastewater flows. Projected potable water demands were taken from the *City of Santa Rosa 2015 Urban Water Management Plan* (Santa Rosa, Tables 4-3 and 4-4, 2016) and the *City of Rohnert Park Urban Water Management Plan 2015* (Rohnert Park, Tables 4-1 and 4-2, 2016). The methodology of correlating the potable water demand projections from the Urban Water Management Plans (UWMPs) to wastewater flow received at the LTP is outlined below:

Water demand projections were taken from the UWMPs for the period 2015 through 2035 in five year increments. Water demands for landscape and losses were not included since these demands would not translate to sewer flows. According to the City of Santa Rosa Sanitary Sewer System Master Plan Update (Santa Rosa, Tables 3-2 and 3-3, 2014) approximately 96 percent of the wastewater flow received at the LTP is from Santa Rosa and Rohnert Park. Therefore, the potable water demand projections for Santa Rosa and Rohnert Park were factored up to account for the additional 4 percent that would be received at the LTP. Based on recorded potable water demands (excluding landscape and losses) and wastewater flows for 2015, the wastewater flows received at the LTP are about 86 percent of the potable water demands. Therefore, the adjusted potable water demands were factored down to correlate with wastewater flows received at the LTP. The resulting flow correlation is presented in Table 3-2.

Table 3-2 UWMP Potable Water Demands Correlated to Wastewater Flows (ADWF) at LTP

Flow Description	2015	2020	2025	2030	2035
SR 2015 UWMP (afy) [a.]	13,854	19,909	21,110	22,104	23,177
RP 2015 UWMP (afy) [b.]	3,959	4,573	4,684	4,759	4,884
SR+RP 2015 UWMP (afy) [c.]	17,813	24,482	25,794	26,863	28,061
Adjusted 2015 UWMP (afy) [d.]	18,555	25,502	26,869	27,982	29,230
Correlated ADWF at LTP (mgd) [e.]	**14.27**	**19.57**	**20.62**	**21.47**	**22.43**

a. 2015 UWMP reported potable water demand in Santa Rosa in 2015 and projected demands for 2020 - 2035, excluding losses and water for landscape, in acre-feet per year.
b. 2015 UWMP reported potable water demand in Rohnert Park in 2015 and projected demands for 2020 - 2035, excluding losses and water for landscape, in acre-feet per year.
c. Sum of potable water demands for Santa Rosa and Rohnert Park, excluding losses and water for landscape.
d. Sum of potable water demands for Santa Rosa and Rohnert Park, excluding losses and water for landscape, divided by 0.96 to adjust for total Regional service area.
e. Adjusted potable water demand for Regional service area times 0.84 to correlate to ADWF at LTP in million gallons per day.

The correlation of projected potable water demands from the 2015 UWMPs to wastewater flow at the LTP supports the use of the IRWP ADWF projections as a "buildout" condition, and that current projections suggest that this condition would not occur during the 20-year planning horizon for this Master Plan. According to the *West College and Laguna Treatment Plant Storage Optimization Memorandum* (Arcadis 2016), emergency storage at the West College Storage Facility (WCSF) is sufficient to limit peak flows at LTP capacities below 67 mgd if revised storage control strategies are adopted and if temporary pumping of 10 mgd from North Trunk Sewer directly into the WCSF is provided to maintain system protection during a 10-year return frequency, 12-hour duration storm event. Therefore, using the revised storage control strategies, in conjunction with the temporary pumping (for LTP capacities below 67 MGD) removes the need for any additional connections to WCSF.

Characteristics

As reported in the *Laguna Regional Water Reclamation System 2015 Annual Report*, influent wastewater received at the LTP primarily consists of domestic sewage with only about 3 to 4 percent of the flow coming from industrial dischargers (Santa Rosa, p.35, 2016). Typical composition of the wastewater is presented in Table 3-3.

Table 3-3 Composition of Influent Wastewater to LTP in 2017

Description	Results Range (mg/l)	Average Result (mg/l)
BOD_5	110-570	356
TSS	130-1000	417
Total Kjeldahl Nitrogen (TKN)	15-74	53
Ammonia	8.6-50	32.3
Total Phosphorus	2.7-14	7.0

The City of Santa Rosa's Environmental Compliance Section is responsible for managing the WRS Industrial Pretreatment Program on behalf of all of the Regional Partners. As stated in the *Laguna Regional Water Reclamation System 2015 Annual Report* (Santa Rosa, pp. 38-43, 2016), there were a total of 1,075 Environmental Compliance Permits held in 2015 of which 74 percent were within the City of Santa Rosa. The majority of these permits (1,044) are for commercial establishments having Non-Residential User Permits for their discharges; 60 percent of the commercial establishments are food service businesses. City inspectors perform routine site inspections and sampling on a pre-determined schedule, frequency varying by permit type, to ensure that dischargers are in compliance. When non-compliance is detected inspectors utilize a progressive enforcement policy to get the discharger back into compliance.

Environmental Compliance also manages a proactive pollution prevention program to reduce the discharge of unwanted substances and products to wastewater entering the collection system and ultimately discharging to the LTP. This source control program includes several elements including:

- Fats, Oil and Grease (FOG) Source Control Program
- Public Education Program on What Not to Flush (e.g. disposable wipes)
- Mercury Thermometer Exchange Program
- Safe Medicine Disposal Program

- Although the source control program has successfully reduced unwanted substances and products from entering the wastewater stream, there will always be more opportunities to invest more in the program to achieve further reduction of unwanted and detrimental substances from entering the LTP.

3.1.2 High Strength Waste

The City completed construction of a High Strength Waste receiving facility in 2016 to receive fats, oils and grease (FOG) and other commercial organic wastes at the LTP. The facility includes four 12,000-gallon tanks, with a total firm storage capacity of 36,000 gallons. This volume is more than adequate to handle waste streams from local commercial and industrial producers and even producers outside of Sonoma County. The High Strength Waste facilities will allow the City to produce more biogas from the existing anaerobic digesters for energy recovery, provided operation of the energy recovery system continues to meet conditions of the City's air permit and uses no more than 10% natural gas by volume.

3.1.3 Leachate and Transfer Station Gray Water

Leachate from the Central Landfill located at 500 Mecham Road in Petaluma is collected into a central holding basin and then pumped into the Cotati conveyance line for discharge to the LTP in accordance with the leachate discharge permit SR-SIU08209 (City of Santa Rosa, 2015) and the City's sewer code and/or ordinance. The flow rate is somewhat dependent on rainfall and in a typical year about 17 to 18 mg of leachate is received at the LTP, with flow rates ranging from 7,000 gpd up to 125,000 gpd seasonally. In addition to the Central Landfill, leachate generated from five closed landfills in Sonoma County is trucked to the LTP for disposal. The hauled leachate totals about 4.4 mg annually with monthly flows ranging from 100,000 to 1,000,000 gals. The City has determined that the leachate has lowered the ultraviolet transmittance of the treated water entering the UV disinfection facilities at the LTP during peak flow events, effectively reducing the disinfection capacity of these critical facilities. The leachate discharge permit stipulates the monitoring and reporting requirements and gives the City of Santa Rosa the ability to terminate leachate discharge at any time.

The transfer station located at the Central Landfill collects storm water runoff in a tank, and then periodically the County transfers this gray water to the LTP by truck. The gray water is rainfall dependent and the quantity and quality of the water does not introduce any treatment issues for the operators at the LTP. In a typical year the LTP could receive 500,000 gals of gray water, with monthly totals ranging from 0 to 125,000 gals.

3.1.4 Storm Water

Regional partners have been working on reducing infiltration and inflow (I/I) entering their collection systems for more than 15 years, and with ongoing renewal and replacement of sewer mains the I/I is not expected to increase further. The City can utilize emergency storage at the WCSF to limit peak flows at the LTP to 48.5 mgd during a 10-year return frequency, 12-hour duration storm event if a temporary 10 mgd pump drawing water directly from the North Trunk sewer into WCSF is provided. By itself, the existing connection to WCSF cannot divert enough flow off the Llano to maintain the LOS and prevent overfilling at the LTP while the LTP is at reduced treatment capacity of less than 67 mgd (Arcadis 2016).

The City is planning to construct a flood protection berm/wall around the LTP within the next few years. This could allow the City to capture storm water runoff from the LTP site and return the flows to the headworks for treatment, and thereby eliminate the need for an Industrial Storm Water Discharge Permit. According to the *Flood Protection at the Laguna Treatment Plant Feasibility Study* (Santa Rosa, Table 11, 2016) rainfall accumulations at the LTP for the 100-year, 24-hour storm could total 7.5 inches and for the 55-acre LTP site this could generate as much as 10 million gallons of storm water to store and then process after peak flows have subsided.

3.2 Biosolids

All of the biosolids generated at the LTP are Class B, and a portion of this flow stream is converted to Class A at the Compost Facility. The City can vary the solids content of the biosolids and currently targets 16 percent solids based on ideal conditions for the biosolids management operations.

3.2.1 Class B Biosolids

In recent years the LTP generated about 4,320 dry tons annually of Class B biosolids (27,000 wet tons at 16 percent solids) from an ADWF of about 15 mgd. At this same ratio the LTP would generate about 7,450 dry tons of Class B biosolids (46,600 wet tons at 16 percent solids) at the buildout ADWF of 25.89 mgd. This assumption is likely conservative since the period used as a basis for the ratio was during a significant drought cycle.

In 2016, the City constructed facilities at the LTP for receiving high strength wastes from commercial and industrial producers in the Regional service area and beyond. The high strength waste receiving facilities provide a total capacity of 46,000 gpd of waste material, with a design operating volume of up to 41,000 gpd. Depending on the source and characteristics of this new waste stream the amount of Class B biosolids produced at the LTP could increase by as much as 640 dry tons annually at full capacity.

Because of these and other factors that could alter the biosolids production rate, this Master Plan assumes that the buildout biosolids production from an ADWF of 25.89 mgd would be 7,450 dry tons annually under buildout conditions. Using the wastewater flow correlation to the UWMP potable water demand projections, in 2035 the biosolids production from the LTP would be about 6,400 dry tons annually at an ADWF of 22.43 mgd.

3.2.2 Class A Compost

Class A compost is produced from a portion of the Class B biosolids flow stream generated at the LTP. The amount of Class A compost produced is limited by the capacity of the Compost Facilities (8,800 wet tons annually) and seasonal storage for the Class B biosolids (7,000 wet tons). The Compost Facilities are bordered by the Meadow Lane Ponds, Geysers Pump Station and Llano road and space is very limited for increasing capacity at the current location. Unless new composting capacity is constructed or the treatment process modified to reduce the volume of solids produced, the projected increase in biosolids generation from the LTP at buildout will need to be managed in other ways and locations (e.g. land application, landfill, etc.).

3.3 Recycled Water

The amount of recycled water generated at the LTP is directly correlated to the influent wastewater stream received at the headworks, and it varies annually based on the amount of rainfall in the service area during the wet season (October through May). In normal to wet years flows increase due to I/I entering the collection systems of the Regional partners. In the period from 2002 through 2015 the total annual amount of recycled water generated from the LTP averaged 7.0 billion gallons (bg) on an average ADWF of 15.3 mgd, and varied by as much as 20 percent ranging from 5.6 to 8.2 bg.

The I/I rate within the service area is not expected to increase over the 20 year planning horizon of this Master Plan due to positive impacts from prioritized renewal and replacement of sewer mains by Regional partners. Therefore, assuming that the I/I rate and weather variability would be similar to the period from 2002 through 2015, the City could anticipate that the recycled water generation rate at buildout would average 10.9 bg and range from 9.5 to 12.3 bg. Using the wastewater correlation to the UWMP potable water projections, in 2035 the annual recycled water generation rate would average about 9.6 bg and range from 8.2 to 11.0 bg.

All water treated at the LTP meets the criteria for “disinfected tertiary” as defined by Title 22 and also complies with NPDES discharge requirements, regardless of the ultimate disposition of the water. Having a uniform water quality for all uses provides the greatest amount of operational flexibility for the City for managing seasonal storage and meeting contractual agreements with end users.

3.4 Digester Gas

Anaerobic digestion of volatile solids in the City’s digesters produces methane gas that is used for energy recovery in the CHP system. Figure 3-2 shows the volatile solids reduction and digester gas production at the LTP from May 2014 through May 2015 (prior to startup of the High Strength Waste facility). During this period, the plant produced approximately 15 cubic feet (cf) of digester gas per pound of volatile solids (VS) reduced, resulting in daily gas production averaging 351,000 cubic feet per day (cfd).

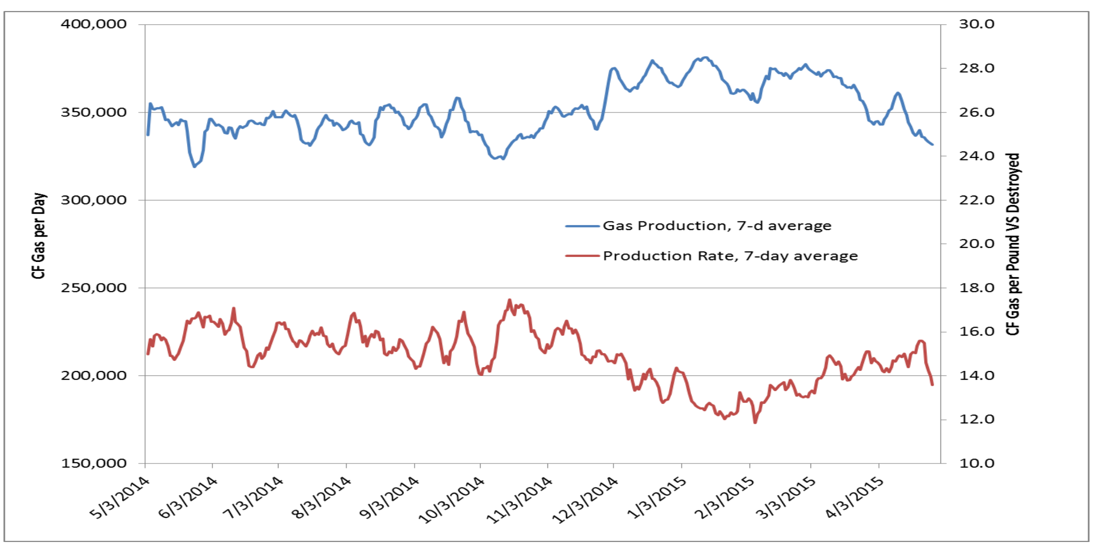


Figure 3-2 Digester Gas Production

Digester gas production will increase with additional VS loading to the digesters through growth in the service area and introduction of high strength waste. Gas production can also increase with additional VS reduction in the digesters.

Future Digester Gas Production

Digester gas production can increase as a result in buildout of the service area, improvements in digester mixing, and addition of high strength waste. The Mechanical Digester Mixing Investigation completed as part of the Energy Optimization Project (Santa Rosa, 2016) estimated that volatile solids reduction could increase from the current 49% to 58-65% by upgrading digester mixing to a pump mixed system. Based on 2016 monitoring data the facility has accepted up to an average of 23,000 gpd of high strength waste, with a peak receiving rate of 46,000 gpd. At the maximum capacity of the high strength waste facility, the gas production capacity is 247,000 cfd. Projected future gas production resulting from these three factors is shown in Table 3-4.

Table 3-4 Estimated Future Digester Gas Production

Future Condition	Potential Digester Gas Production
Service Area Buildout	518,000 cfd
Buildout with Mixing Improvement	613,000 – 687,000 cfd
High Strength Waste Addition	222,000 – 247,000 cfd

4. Service Levels

Service levels provide the basis for establishing performance benchmarks, planning for long-term infrastructure needs, and establishing decision criteria for management of the enterprise. The City has numerous service levels generally falling into the categories of regulatory compliance (permits), contracts and agreements, Environmental Impact Reports (EIRs), and stakeholder expectations. A summary of key service levels impacting planning and management for the WRS are summarized in this section.

4.1 Regulatory Compliance (Permits)

While the WRS are subject to numerous permits that drive operation and management decisions on an ongoing basis, the City strives to minimize the impacts of WRS operations on the natural environment. Non-compliance typically has escalating consequences depending on the severity and frequency of violation, and can be significant in terms of cost to make repairs and clean up spills, environmental damage, fines, and erosion of the public's confidence in the City's ability to meet basic service levels. A summary of key permits governing the operation of the WRS are provided below.

4.1.1 NPDES – Laguna de Santa Rosa Discharge

The North Coast Regional Water Quality Control Board (NCRWQCB) issued the City its current wastewater discharge and reclamation requirements through the National Pollutant Discharge Elimination System (NPDES) in accordance with the Clean Water Act and California Water Code under Order R1-2013-0001. WRS operations must comply with all applicable regulations in order to meet the minimum level of service required under this order and the associated Waste Discharge Requirements and Master Reclamation Permit CA0022764.

The LTP effluent limitations and discharge requirements are based on effluent quality as compared to Santa Rosa Creek and flow rate as compared to that of the Russian River. The NPDES permit limits potential effluent discharge to specific outfalls identified in the permit and only during a specified discharge season, October 1 to May 14, when surface flow rates within the watersheds are higher and more capable of assimilating system discharge. Advanced treated wastewater discharged to the Laguna de Santa Rosa or any tributaries of the Russian River is limited to a rate that exceeds 5 percent of the Russian River's flow rate. Effluent quality limitations apply to all discharges as detailed in the permit.

In particular, the NPDES permit includes approval of a Nutrient Offset Program to assist the City with conformance with the permit's zero phosphorus limit. The Nutrient Offset Program will also support future TMDLs for nitrogen and phosphorus. The Nutrient Offset Program provides for a reduction in nutrient loads elsewhere in the Laguna watershed by an amount at least bioequivalent to the amount discharged. The City strives to obtain and maintain sufficient nutrient offset credits to allow for future discharges. Compliance to the no net loading of phosphorus limitation is calculated with a three year averaging period. The first compliance determination will occur in 2017, after conclusion of 2016 – 2017 discharge season.

The NPDES Permit also currently serves as the Regional System's Master Reclamation Permit and regulates the distribution of recycled water to both User Agencies and the Geysers Recharge Project in accordance with federal Water Code and the Water Recycling Criteria issued by the California Department of Public Health in Title 22 of the California Code of Regulations (CCR). The Geysers Recharge Area was included as an acceptable use area for recycled water by the State Water Resources Control Board by Water Rights Order WW-33.

WRS operations must maintain, at a minimum, a total reclamation capacity of 4,015 million gallons for the Geysers Recharge Project and the capability to distribute 2,590 million gallons per year at 21.34 MGD ADWF to permitted recycled water users specified in the NPDES permit. This capacity must be demonstrated in an engineering report issued to NCRWQCB. Future system capacity requirements are discussed in the Incremental Recycled Water Program (IRWP) developed by the City of Santa Rosa (Santa Rosa, 2003) as well as the IRWP Master Plan (Santa Rosa, 2004).

4.1.2 General Order – Recycled Water Distribution System

Currently, the City of Santa Rosa is filing a Notice of Intent with the North Coast Regional Water Quality Control Board for enrollment under the State's General Order for Recycled Water Use WQ 016-0068-DDW (General Order). The city intends to rescind the distribution program from the NPDES permit and replace it with coverage under the General Order. The NPDES Permit will otherwise remain in place for the treatment plant operations, recycled water production, and discharge to surface waters. The City intends for enrollment in the General Order to cover all recycled water deliveries currently covered by the NPDES Permit; including, diversion of partially treated wastewater to City-owned land provided that all diversions of partially-treated waste comply with the LTP emergency response procedure and are consistent with title 22 requirements.

Monitoring and reporting of use areas will be conducted according to the guidelines in the General Order. Upon enrollment under the General Order, the City will continue its current monitoring practices for total coliform, turbidity, UV dosage, and filter loading rates as specified in the NPDES permit. The city will conduct California Toxic Rule (CTR) Priority Pollutant monitoring as required by the General Order. Along with use area monitoring summaries, the recycled water program annual report submitted for compliance with the General Order will include monthly water usage for each site, total irrigated acreage and application rate, and discussion and copies of any enforcement actions. (Woodard & Curran 2018)

4.1.3 EPA 503 Regulations

Disposal of biosolids produced by the LTP includes land application to several City-owned and contracted farms where biosolids are beneficially used as a carbon and nutrient source. The farms used as land application sites are separated into two regions: the North County and the South County.

Farms located in the North County (Alpha, Brown, and Stone farms) are City-owned and subject to the EPA's regulations regarding land application of biosolids (40 CFR Part 503) as issued by the State Water Board's Water Quality Order 2004-0012-DWQ, which sets biosolids-specific Waste Discharge Requirements. Planning considerations for the North County sites include the generally smaller parcels, the presence of environmental constraints, and the restrictions of the State's general order.

A number of farms in the South County, which are privately contracted lands, are regulated at the federal level under 40 CFR.503 instead of the State's general order. Planning considerations in the South County include the restrictions of the EPA's 40 CFR 503 regulations, the longer hauling distance and the lack of covered storage, which restricts storage at the site to the dry season and subsequently requires the dewatered biosolids to be hauled twice, once to Alpha Farm where it can be stored during the wet season and then a second time to its land application site during the dry season (Santa Rosa, 2014d).

4.1.4 Air Permits

The Bay Area Air Quality Management District (BAAQMD) enforces regional, state and federal air quality requirements on behalf of the California Air Resources Board (CARB) and the federal EPA. BAAQMD requires WRS operations to self-report air quality compliance based on the requirements set forth in the documents referenced below.

Bay Area Air Quality Management District Permit

Applicable environmental regulations corresponding to air emissions and regulated by the California Air Resources Board (CARB) and the EPA are issued to the WRS under the Title V permit process in accordance with Clean Air Act. The Bay Area Air Quality Management District (BAAQMD), as the enforcement agency, has issued the Santa Rosa Wastewater Treatment Plant (Facility ID A1403) a Title V Major Facility Review Permit valid for 5 years, next requiring renewal by May 19, 2018, that covers regulatory requirements enforceable by both the regional air District and the federal EPA. An application was submitted in November of 2017 to renew the permit. In the permit, BAAQMD maintains a list of facility equipment and systems that are required to be individually permitted as they do or have the potential to contribute to nuisance or harmful air emissions. One of the more significant systems which are regulated is the water treatment plant itself. The BAAQMD permit limits the total wastewater flow into the plant to 21.3 or 42 mgd on a calendar month average during dry and wet weather periods respectively.

CARB Registrations (Portable Engine Reporting Program (PERP)

CARB mandates under the Portable Engine Airborne Toxic Control Measure (ATCM) that all large portable engines be registered with CARB and assigned a Tier designation by the manufacturer. Each Tier is based on CARB determined efficiency standards and is regulated in accordance with CARB's emissions goals. WRS facilities include several engines which must maintain their registration with CARB in order to maintain compliance. Additionally, engine use must be documented and reported to CARB annually.

Greenhouse Gas (GHG) Emissions Reporting

CARB requires annual reporting of GHG emissions under the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (Title 17, CA Code of Regulations, Section 95100 – 95158). Facilities need to monitor all GHG emissions annually and file a report with CARB for total emissions exceeding the 10,000 MTCO2e threshold. In 2014, Yorke Engineering completed a review of the CARB GHG Mandatory Reporting Regulation requirements for LTP and determined that the facility GHG emissions were less than the CARB GHG reporting thresholds for 2013 and thus reports were not required. In 2016, staff contacted Yorke again to inquire if LTP was still under the threshold. Yorke informed staff that LTP GHG emissions would need to double (and that has not happened) in order to trigger the reporting requirements. Due to the fact that the HSW system has come on line, staff is preparing to work with Yorke to review the 2018 LTP GHG emissions data to determine if reporting requirements have been triggered.

4.1.5 Hazardous Materials and Waste Management/CUPA Program

The WRS are part of the Santa Rosa Fire Department's (SRFD) Hazardous Materials Program which oversees the storage and handling of hazardous materials used or produced by the WRS operations. SRFD has authority as the Certified Unified Program Agency (CUPA) under the California Environmental Protection Agency and requires facilities to utilize the California Environmental Reporting System (CERS) to generate a hazardous materials inventory as well as submit a regularly updated Spill Prevention Control and Countermeasure Plan (SPCC).

Hazardous wastes leaving the LTP or other WRS properties must be tracked and reported to Department of Toxic Substances Control (DTSC) using waste manifests.

4.1.6 Local Agency and Resource Agency Compliance Needs

The WRS are subject to various local, regional, state, and federal regulatory requirements, beyond the specific permit limitations listed elsewhere in this section. These requirements cover a variety of resources which are regulated through laws, regulations, plans, and policies. This section lists the primary relevant regulations, but many more are applicable to the operation of the WRS.

City and County General Plans, Zoning, and Building Ordinances. In general, cities are exempt from County General Plan, zoning, and building regulations; however, the City complies with these regulations as applicable. For example, the City has obtained County Use Permits for biosolids land application and the Geysers terminal tank.

Climate Action Plans. Climate Actions Plans for the Regional Partners and Sonoma County have policies that may apply to SWRFF operations. For example, the Santa Rosa Climate Action Plan (2012) contains policies to maintain recycled water deliveries to the Geysers and to promote urban reuse.

Wetlands, Waters, Streams, and Riparian Areas. The U.S. Army Corps of Engineers and the Regional Water Quality Control Board implement regulations to protect wetlands and surface waters. In addition, the State Department of Fish and Wildlife controls development within streams and riparian areas. Many SWRFF have wetlands, surface waters, streams, and riparian vegetation where permits must be obtained if disturbance of these resources cannot be avoided.

Endangered and Special-status Species Habitat. The U.S. Fish and Wildlife Service and National Marine Fisheries Service implement the federal Endangered Species Act. The California State Department of Fish and Wildlife implements the state Endangered Species Act. Each agency also designates a variety of special categories of species which require some level of protection. Being situated in the Laguna de Santa Rosa, an ecologically sensitive wetland, many SWRFF contain critical habitat for endangered species (e.g., CTS) and/or potential habitat (e.g., coho salmon and vernal pool rare plants).

Groundwater. The State Department of Water Resources implements the 2014 Sustainable Groundwater Management Act (SGMA). The State has designated the Santa Rosa Plain and Petaluma Valley Groundwater Basins as "medium priority", a category which requires that a Groundwater Sustainability Agency be formed by 2017 and Groundwater Sustainability Plan be developed by 2022. SWRFF primarily overlie the Santa Rosa Plain Basin, but some facilities overlie the Petaluma Valley Basin as well. Impacts to WRS to be determined.

Energy use. The Santa Rosa Water's *Energy & Sustainability Team Strategic Plan 2014/15 to 2019/20* (August 2014) includes a goal for increasing energy independence (Goal 1). To advance this goal the plan includes a strategy for the City to complete and implement an Energy Optimization Plan (EOP) for the WRS. The preliminary goal of the WRS EOP is to identify a least-cost strategy to achieve 50 percent energy independence and accomplish the greenhouse gas (GHG) reduction target of 20 percent below 2000 levels by 2020. The EOP has been completed and the list of projects have been identified (Santa Rosa, 2014c; Santa Rosa, 2016e). Due to the fire and the resulting impact to staff's workloads and priorities, the EOP presentation to the Santa Rosa Board of Public Utilities (BPU) has temporarily been put on hold but we hope to pick this back up by the fall.

4.2 Contracts

On behalf of the Regional Partners the City has entered into numerous contracts that are intended to secure long term solutions to what would otherwise be disposal challenges for treated effluent and biosolids generated from the LTP. These agreements take different forms depending on the conditions and needs at the time they were negotiated, and impact current and future operations to a varying degree. A summary of the key agreements is provided below.

4.2.1 General Agreements

Regional Agreement

Initially signed in 1975, the Regional Agreement is a contract between the City of Santa Rosa (Managing Partner) and the User Agencies (together the Regional Partners) for use of the Regional System by setting the terms, provisions and compensation model with which the Regional System will be managed. The agreement has been amended 5 times, most recently in 2008, and includes the City of Rohnert Park, the City of Sebastopol, the South Park County Sanitation District and the City of Cotati all as User Agencies.

Included in the agreement is the mandate for the creation of a Technical Advisory Committee composed of a single representative from each User Agency, who are charged with managing mutual problems and future development of the Regional System which impact the Regional Partners.

Each Regional Partner is responsible for collecting and transporting its sewage to the LTP and for ensuring its collection system is properly maintained and managed. Once the sewage has been treated each Partner has a right to an amount of recycled water equal to its percentage of wastewater treated at the LTP. If the User Agency should choose to exercise its right to claim its share of recycled water, it will be responsible for the recycled water's reuse/disposal. Amendment #4 of the Regional Agreement set the most recent treatment plant capacity and Partner capacity shares as tabulated below.

Table 4-1 LTP Flow Capacity and Regional Partner Shares as set by Amendment #4

Entity	Share of 21.34 MGD Capacity	
	MGD	Percentage
City of Santa Rosa	15.610	73.15
City of Rohnert Park	3.430	16.07
City of Sebastopol	0.840	3.94
City of Cotati	0.760	3.56
South Park County Sanitation District	0.700	3.28
Total	21.340	100.00

The 5th Amendment to the Regional Agreement, developed by the Technical Advisory Committee and approved by each of the User Agencies, has set the framework for both the Geysers Expansion Project and increasing the treatment capacity of the LTP to 25.89 mgd. (Santa Rosa, 2008)

4.2.2 Recycled Water Agreements

Geysers Power Company Agreement

The City of Santa Rosa has entered into an agreement with the Geysers Power Company (GPC), which operates a geothermal power plant in northern Sonoma County, to supply a guaranteed minimum amount of water annually for the plant's use in generating electricity. In the agreement, the "Annual Amount" of guaranteed water supply is currently set at the Schedule I rate of 4,607 million gallons. If the City determines that it would like to increase the amount of water guaranteed to GPC it can do so once notifying GPC at least 24 months prior to setting the new rates. The maximum rate currently available is Schedule V, or 5,543 million gallons annually.

The City must deliver at least 90 percent of the scheduled water delivery each year or pay penalties if they cannot make up the water in the subsequent four years. There are similar penalties if Calpine cannot accept 90 percent of the scheduled water deliveries. Calpine has first rights to the "best effort" water after the City has met its other recycling commitments up to 1,250 million gallons annually. Both parties rely heavily on the scheduled water deliveries and there has been cooperation in the past when flexibility has been required. Calpine provides power to the Bear Canyon, Mayacamas and Pine Flat Pump Stations, and pays the City $300,000 annually to cover power costs at the Llano Pump Station. The current GPC agreement is in effect through 2037 with financial penalties for early termination by either party.

Rohnert Park Producer-Distributor Agreement

The City of Rohnert Park (Rohnert Park) uses recycled water to supply approximately 20 percent of its water needs, offsetting the use of potable water for irrigation. In the mid-1980s and 1990s, WRS constructed what is now known as the Rohnert Park Reuse System to convey recycled water to customers in Rohnert Park. In 2015, as part of the producer-distributor agreement, Rohnert Park entered into a "wholesaler-retailer" agreement with Santa Rosa where WRS provides recycled water to Rohnert Park who then distributes it to customers. The existing Rohnert Park Reuse System was transferred to the City of Rohnert Park from WRS at no cost.

The agreement reached between WRS and Rohnert Park sets wholesale pricing models based on interruptible (lower pricing) and uninterruptible (higher pricing) service. In addition, it provides that

WRS will supply at least 450 million gallons annually with the option to increase this minimum level of service in the future based on additional wastewater contributions to the LTP.

Santa Rosa Wholesale Agreement

The City of Santa Rosa also has a wholesaler-retailer pricing model with WRS. Santa Rosa buys recycled water at wholesale prices from WRS and conveys it to customers through the Santa Rosa Urban Reuse Project (SRURP), which is operated by the Santa Rosa Water Utility.

Town of Windsor Agreements

In November 2008 the City of Santa Rosa entered into an agreement with the Town of Windsor (Town) allowing the Town to discharge recycled water into the Geysers Pipeline for reuse. The Town's minimum recycled water delivery is 0.53 mgd annual average and the Town, with notice, can increase deliveries to as much as 1.25 mgd annual average. The recycled water must meet the minimum water quality requirements stipulated in the City's Geysers Operating Agreement. Windsor pays the City for the right to discharge beginning when the Town first started discharging water in 2011 and continuing through the 2037, when the agreement is scheduled to terminate coincident with the City's GPC Agreement.

Agriculture Reuse Agreements

According to the *Laguna Regional Water Reclamation System 2015 Annual Report* (Santa Rosa, 2015, Table 4), recycled water is provided to agricultural customers. Each agricultural customer has entered into their own User Agreement with the City of Santa Rosa. The individual agreements were negotiated independently over the past 30+ years and terms and conditions of each agreement were negotiated based on the WRS's interests at the time that the agreements were executed. Recycled water is also applied to seven City-owned properties and the City has entered into lease agreements with agricultural operators to farm those properties using recycled water provided by the WRS.

4.2.3 Biosolids Agreements

Biosolids Land Application Agreements

Similar to the agreements for agricultural uses of recycled water, the City has several biosolids land application agreements with private users who utilize the carbon and nutrient value of the biosolids for soil amendment and crop production. The City is currently providing biosolids to two agricultural users in North County, and to three agricultural users in South County. Agricultural operators who farm the City farms also have the benefit of biosolids application on Alpha, Brown and Stone farms.

The City of Santa Rosa also has an agreement with the Town of Windsor to assist with their Industrial Pretreatment/ Pollution Prevention (Source Control) Program.

4.2.4 City Farm Agreements

Open Space District Agreements

In 2001 the City and the Sonoma County Agricultural Preservation & Open Space District (OSD) entered into a deed and agreement for the acquisition by the OSD of a conservation easement on the City farms. The purpose of the agreement is to preserve open space, scenic and biotic values of the properties, and prevent any uses of the property that will "significantly" impair or interfere with those values. Also in 2001 the City provided an offer of dedication to the County of Sonoma for a public recreational trail easement on certain City-owned properties, including Alpha, Brown and Kelly Farms. The OSD has developed a master plan of trails along the Laguna; some or a portion of these trails are located on City farms.

In a joint agreement with OSD and the Laguna de Santa Rosa Foundation (Laguna Foundation), the City of Santa Rosa in 2012 agreed to pursue grant funding to implement a riparian restoration project along Irwin Creek on the City's Stone Farm. The grant application was successful and in 2014 the City authorized the Laguna Foundation to proceed with the restoration project, which is consistent with the City's Ranch Plan for Stone Farm.

LTP Joint Mitigation Wetlands

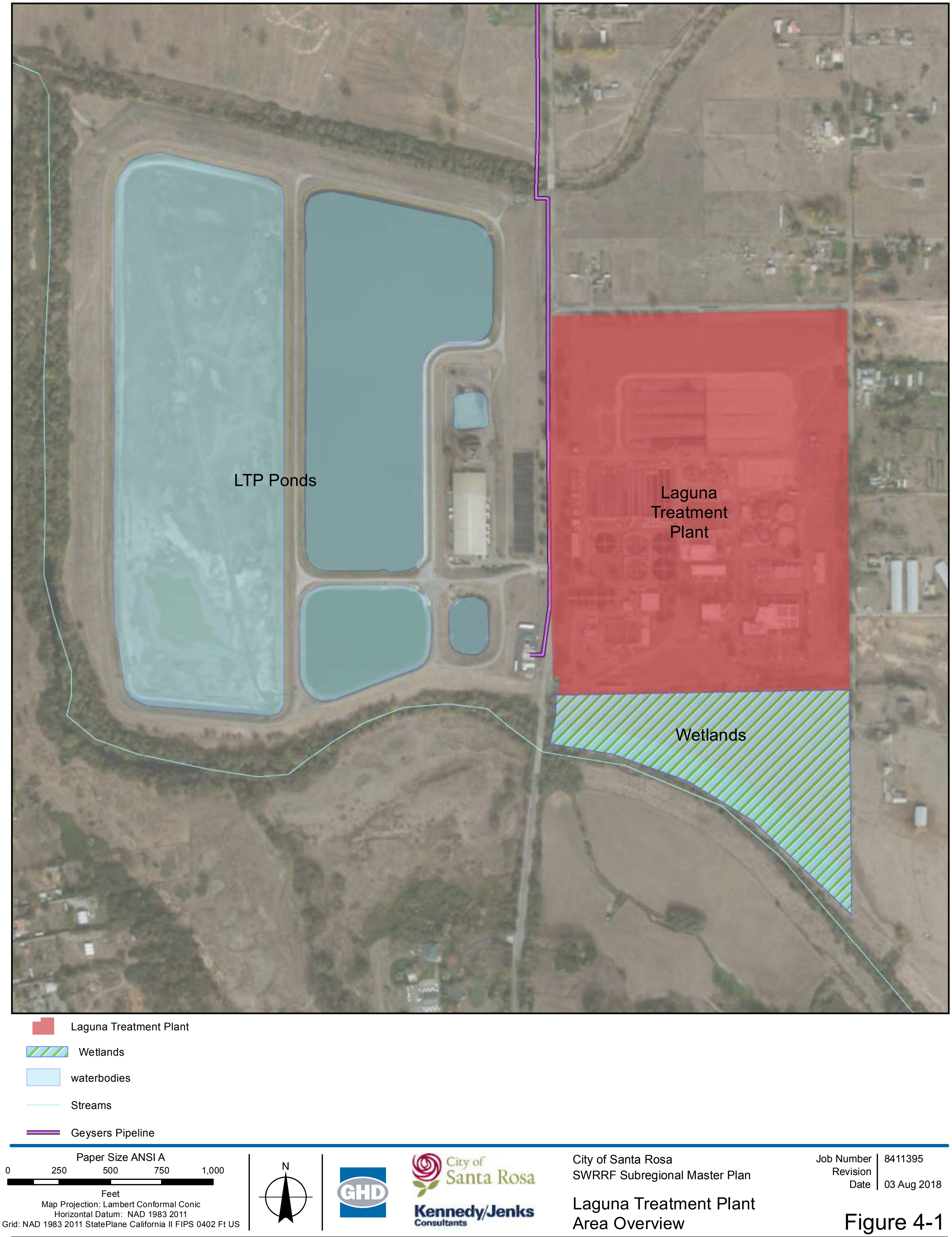
The Joint Wetlands Project is a 12-acre wetlands mitigation site and native habitat visitor area on the southern end of the Plant site adjacent to the Laguna de Santa Rosa, as shown in Figure 4-1. The Joint Wetlands Project includes 2.7 acres of seasonal wetlands that were created in 1994 jointly by the City of Santa Rosa and the County of Sonoma as mitigation for the Corps of Engineers wetlands permit requirements for the Stony Point Road widening project. The County was responsible for creating and monitoring the wetlands; the City is responsible for operations and maintenance of the wetlands, including permanent protection; and there is no conservation easement over the wetlands. The wetlands were originally planned to receive recycled water, but recycled water is no longer provided. (City of Santa Rosa 1992)

4.2.5 Laguna Foundation Lease of Stone Farm Historical Farm

In 2004 the City agreed to lease 4 acres encompassing the historical farm buildings at Stone Farm to the Laguna Foundation. The Foundation has restored the buildings, operates a learning center from the property, including docent-led tours, and will pursue restoration of the historic barn.

4.2.6 Sonoma County Airport Mitigation on Brown Farm

In early 2016 the City and Sonoma County approved a Memorandum of Understanding and entered an Endowment Agreement for the completion of a riparian habitat mitigation project along a section of Gravenstein Creek on the City's Brown Farm. The endowment will provide for long-term maintenance of the restoration project. The Laguna Foundation will implement the project on the County's behalf, and the project is consistent with the City's Ranch Plan's restoration objectives for Brown Farm.



City of Santa Rosa
SWRRF Subregional Master Plan

Job Number	8411395
Revision	
Date	03 Aug 2018

Laguna Treatment Plant Area Overview

Figure 4-1

"2235 Mercury Way, Suite 150, Santa Rosa, CA 95407" USA T 1 707 523 1010 F 1 707 527 8679 W www.ghd.com.au

N:\US\Santa Rosa\Projects\02059 - City of Santa Rosa\02059-8411395 Subregional Master Plan\08-GIS\Maps\Figures\NEW Figure 4-1 LTP Ponds.mxd

Data source: ESRI: basemap. Created by:jkjellsson

4.3 Regional System EIRs

The City has completed several EIRs over the past 45 years that were necessary to move forward with important WRS projects or programs that the City had determined were needed for regulatory compliance and planned growth within the service area. These EIRs describe the need for the project/program, evaluate impacts, recommend mitigation measures, and establish limits for the project. Four key EIRs for the WRS and their limitations are summarized below.

4.3.1 Long-Term EIR

The Santa Rosa Regional Long-Term Wastewater Project EIR, together with its Supplemental EIRs and Addenda (Long-Term EIR, 1997), is a project-level EIR that was used for approval of the Geysers Recharge Project. The Long-Term EIR limited Regional System capacity to 21.3 mgd ADWF and the Geysers Project to 11 mgd. The EIR is still being used for maintenance projects for the Geysers pipeline. The approval process for the Geysers Recharge Project accounted for a reduction in discharge flows to the Russian River and a reduction in acreage of agricultural reuse in the Laguna de Santa Rosa Watershed.

4.3.2 IRWP EIR

The Incremental Recycled Water Program (IRWP) EIR, together with its Addenda (IRWP EIR, 2004), is a Program-level EIR that was used for approval of the IRWP Master Plan. The IRWP EIR limits Regional System capacity to 25.89 mgd ADWF, but allows that capacity to be provided by any combination of five alternatives: Indoor Water Conservation, Urban Reuse (up to 1,200 mg), Agricultural Reuse (up to 6,400 mg), Geysers Expansion (up to 6,700 MG or 25 mgd), and Discharge to the Laguna or Russian River (up to 6,700 mg). In addition, the IRWP Master Plan included substantial upgrades at the LTP. Subsequent project-specific EIRs were prepared for the Discharge Compliance Project (including the Nutrient Offset Program) and the Seasonal Storage Project. As part of the implementation of the IRWP Master Plan, the IRWP EIR documents have been used for approval of the Delta Pond Improvements Project, the Geysers Expansion Project (to 19.8 mgd), the agreement with the Town of Windsor governing their use of the Geysers pipeline, the Santa Rosa Urban Reuse Policies and Phase I Project, and three Nutrient Offset Projects. The IRWP Mitigation Monitoring Program governs both construction and operation of the approved projects.

In 2014, the City undertook a review of the IRWP Master Plan which found that changes to the General Plans of the Regional Partners since 2004 have increased buildout conditions for future dwelling units and employment within the Regional System. However, these increases have been more than offset by decreased per capita and/or per employee flows, and therefore the demand projections in the IRWP Master Plan are still reliable and appropriate. The report recommended that the City review the projections again after Sebastopol and Cotati have completed their General Plan updates, or in approximately 2019, whichever is earlier.

4.3.3 Compost EIR

The Santa Rosa Regional Sludge Beneficial Reuse Project EIR (Compost EIR, 1991) is a project-level EIR that was used for approval of the Compost Facility and which covers composting, land application, and landfill disposal for biosolids. The Compost EIR limits biosolids management capacity to 21.5 dry tons per day; composting capacity to 8.5 dry tons per day or 42,000 cubic yards per year; land application capacity to 5.5 dry tons per day on 1,100 acres; and landfill disposal to 7.5 dry tons per day. In addition, the Management Plan for the Beneficial Reuse of Biosolids by Land Application Technical Report 2.2 (1993) provides project-specific CEQA coverage for land application on ten sites totaling 2,620 acres. The Biosolids Seasonal Storage Facility at Alpha Farm Mitigation Negative Declaration (MND) (2004) was used to approve a storage facility to house up to 9,400 cubic yards of biosolids.

In addition, Sonoma County approved the Residuals Processing (Hog Island) Use Permit and MND in 1997; the City uses several properties within this area for land application of biosolids. And, finally, the City obtained a County Use Permit for three land application sites when it prepared its South County Biosolids Reuse Project MND in 2006. Mitigation requirements for the land application sites mirror the EPA's 503 regulations, but require some site-specific limitations on construction and operation.

4.3.4 Agricultural Reuse EIR

The Alternative Wastewater Management Projects EIR and Addendum (Agricultural Reuse EIR, 1973) is a project-level EIR that governs the construction and operation of the recycled water conveyance and seasonal storage system as well as agricultural reuse on City farms and private agricultural properties. Subsequent environmental review in 1990 added specific properties for agricultural reuse. Mitigation requirements include avoidance or minimization and compensation for impacts to vernal pools and rare plants, and avoidance or minimization and mitigation of impacts to archaeological resources. MNDs were also prepared for expansion of the Brown Farm storage pond and the Cotati pipeline to the Gallo properties.

4.4 Stakeholder Expectations

Beyond regulatory permits and the contracts that stipulate specific performance measures there are stakeholder expectations by ratepayers, elected officials, and the residents and businesses within the region as a whole that create service levels that influence the management and operation of the WRS. Stakeholder considerations that are factored into management strategies and operational decisions are described in general terms below.

4.4.1 Reliable Performance

Stakeholders expect the WRS to be adequately funded and managed to provide reliable performance over time. Events such as spills, permit exceedances, breaches of contract, and/or significant unforeseen costs could erode the public's and regulators' confidence in the City's ability to manage the WRS. Also, the Regional Partners have an expectation that the WRS are being managed to accommodate planned growth within the service area and will not create limitations to planned growth. The City has regularly engaged in long term planning activities, such as the *IRWP Master Plan*, Santa Rosa Water's programmatic 5-year strategic plans, and this master planning effort, to remain in front of evolving opportunities and risks and thereby provide reliable performance for the long term.

4.4.2 Lowest Practical Cost of Ownership

Ratepayers expect their utility to manage assets for the lowest cost of ownership over time, in balance with achieving desired levels of service and managing risks. Lowest cost of ownership does not imply deferring all investments to the last possible moment to keep rates down in the near term. For example, deferred maintenance could reduce service life, reliability and performance of assets, ultimately increasing costs over time and putting the City at risk of permit violations and major asset failures. Likewise, deferred capital investments, especially for large asset classes that were installed at the same time (e.g. pipe networks), could lead to a large renewal/replacement need that is beyond the means of the utility to address in a short period of time, and thereby creating a scenario where risk of failure is higher than desired and where other investments must be delayed until the large and immediate asset replacement needs are met. A lowest cost of ownership approach would be to proactively maintain, renew and replace aging assets on an ongoing basis and avoid or mitigate investment spikes that are difficult to absorb over short periods of time.

In response to these concerns the City has completed several condition assessments of assets at the LTP and compost facilities over the last 10 years and is just now completing a planning tool to identify maintenance and renewal/replacement costs of its assets. This Master Plan identifies additional condition assessments that should be completed in the near term to develop strategies for renewal and replacement of aging assets, and results from these additional studies may be entered into the planning tool to project long-term funding levels required.

From a funding perspective, the City has routinely sought lowest cost funding options for capital investments and regularly monitors grant opportunities as a means to mitigate financial impacts to the Regional Partners.

4.4.3 Watershed Protection and Public Outreach

The City recognizes that the ecologically sensitive Laguna de Santa Rosa wetland complex has been designated as a Wetland of Importance under the Ramsar Convention and seeks to manage the WRS in a manner that supports environmental stewardship of this shared natural resource. In an effort to achieve this service level the City's Environmental Services Division performs a broad range of strategies in support of this effort including:

- Maintain and expand public outreach efforts
- Develop and maintain consistent sampling, analytical and monitoring programs
- Identify, maintain and improve collaboration with stakeholders
- Anticipate and develop programs to satisfy new regulatory requirements and mandates
- Maintain the natural resources management program
- Facilitate permit renewal and implementation
- Reduce regulatory risk
- Enhance compliance resiliency
- Maximize protection of public health and the natural environment

These efforts help to build trust with the public through transparency of actions taken to protect public health and the environment, proactive engagement with regulators and other stakeholders with a shared interest in the health of the Laguna de Santa Rosa, and educating the public about ways in which they can take part in protecting the environment.

5. Opportunity and Risk Assessments

The purpose of this section is to identify and characterize potential opportunities and risks that could impact WRS operations and inform management decisions over the next 20 years. This assessment will help identify and evaluate strategies that could be implemented over the planning horizon that take advantage of opportunities and mitigate risks to meet desired levels of service. The following opportunities and risks are discussed in this section:

- Opportunities
  - Compliance Strategies
  - Cost Efficiencies
  - Expanding Resource Recovery
- Risks
  - Aging Infrastructure
  - Climate Variability and Natural Disaster
  - New Regulations and Standards
  - Catastrophic Failure of Critical Facilities
  - Loss of Waste Disposal Options
  - Shortage of Recycled Water

5.1 Opportunities

The City has actively sought to achieve targeted service levels through long term planning efforts and implementation of major projects and programs, including the Geysers pipeline, IRWP program, and CHP project. Regulatory compliance, resources recovery, accommodation of planned growth and stakeholder engagement form the foundation of current management practices and there are limited opportunities to make large advancements in any of these areas.

Opportunities that were identified are based on discussions with City staff, visits to the Regional facilities, review of recommendations in existing studies and planning documents, and efforts being considered by similar utilities facing similar issues. Opportunities related to compliance strategies, cost efficiency, and expanded resource recovery are discussed below.

5.1.1 Compliance Strategies

In large part, the City utilizes built infrastructure to achieve regulatory compliance. In addition to physical assets the City employs a variety of compliance strategies that serve to meet regulatory requirements and reduce operating costs. These strategies need to be recognized for the value they deliver, and opportunities to increase or sustain value should be explored.

Water Quality Credit Trading

The current NPDES effluent limitations and discharge specifications mandate that “there shall be no net loading of total phosphorous to the water bodies of the greater Laguna de Santa Rosa watershed.” The City could implement chemical treatment at the LTP to reduce phosphorous levels to a minimal level but this would fall short of the no net loading requirement as it does not provide complete removal. This option is also costly and reduces the nutrient value of recycled water for irrigation. Given that there are only episodic needs to discharge to the Laguna, the City continues to seek alternative strategies to meet the phosphorous limitation stipulated in the NPDES permit.

Through extended negotiations with the Regional Board, the City has successfully established a nutrient offset program, soon to be enhanced as a water quality credit trading program that allows the City to implement ecologically beneficial projects within the watershed that offset the potential phosphorous loading from discharges from the LTP. These offset projects must be completed in advance of any discharge. Project are determined to have a specified project life and credits are granted a credit life. If not used to offset actual discharges, credits currently expire. The nutrient offset program approach has allowed the City to gain compliance “insurance” and maximize nutrient value of recycled water for irrigation purposes. The City is trying to align their riparian restoration projects on the City farms with this program, and is also discussing enhanced sediment removal projects within the Laguna with SCWA as another method of achieving water quality credits.

The water quality credit trading program does have limitations. As the City implements the most cost-effective offset projects first, the selection of available projects remaining may be reduced and these projects could become increasingly more costly. Two of the three approved offset projects implemented reduced phosphorous loading from agricultural operations. The City is working with the Freshwater Trust to establish a basis for developing nutrient credits through in stream restoration activities (The Freshwater Trust, 2016).

As the water quality credit trading program proceeds, the City will need to develop a long-term nutrient management strategy that addresses the loss or expansion of credit trading options, and compares them to treatment alternatives for the lowest overall cost.

Regulatory Advocacy

Active participation and leadership in industry advocacy groups represents an opportunity to have a voice in the shaping of new regulations impacting WRS operations. The California Association of Sanitation Agencies (CASA) is one such organization that provides advocacy on state and federal legislation impacting the industry. The National Association of Clean Water Agencies (NACWA) is another organization providing legislative advocacy, and also provides leadership on the future of clean water agencies through their Utility of the Future Today (UOTFT) program. The UOTFT program focuses on emerging issues such as climate change, the energy-water nexus, green infrastructure, watershed-based solutions and resources recovery. The City is an active member of these groups and WateReuse CA, providing feedback on pending legislation when draft regulations are circulated for review. The City is also a leader in many of the areas promoted through the UOTFT program, and received recognition under the program in June 2016.

Maintaining professional relations with local regulators is another opportunity to advocate for the Regional Partners. The City has found that through proactive negotiations with the Regional Board the parties have been able to arrive at solutions that help achieve overall watershed objectives in a manner that are easier and less costly to implement than traditional treatment methods (e.g. – water quality credit trading). Going forward the City should seek to maintain these relations with the Regional Board and other regulators to understand their long-term goals and offer input as to how the goals could reasonably be met by permit holders like the Regional Partners.

The City should continue to actively participate in advocacy groups and pursue, positive, mutually beneficial relations with regulators at the local and state level.

Collaborative Partnerships

Collaborative partnerships with other local organizations that have a shared interest in aspects of WRS operations and protection of the Laguna watershed represents another opportunity for the City to identify and implement compliance strategies beyond traditional means and methods. This could take the form of shared compliance strategies with neighboring permit holders, involving non-government organizations (NGOs) such as the Laguna de Santa Rosa Foundation to participate in mitigation projects that advance both parties' goals, and collaborating with SCWA to remove sediment from the Laguna channel to improve flood control and provide nutrient offsets for the LTP.

Stakeholders having potentially shared interests include:

- Public agencies with jurisdictions within the Laguna and Russian River watersheds
- NGOs with interests in the Laguna de Santa Rosa and its tributaries
- Local agricultural organizations
- Bay Area Clean Water Agencies
- Bay Area Biosolids to Energy Coalition
- Maintaining professional relationships with regional stakeholders that sometimes have aligned interests can help to surface and implement alternative solutions that address compliance and mitigation requirements at a lower cost than "going it alone".

5.1.2 Cost Efficiencies

Cost efficiencies can be achieved by implementing energy efficiency projects, and through optimization of existing facilities. The City has recently implemented projects to capture cost efficiencies in both areas. These projects and potential additional opportunities are described below.

Energy Efficiency

In 2014, four primary Regional systems were audited in Part 1 of the Energy Optimization Plan (Santa Rosa, 2014c):

1. Laguna Treatment Plant (LTP)
2. Biosolids Compost Facility
3. Reclamation System
4. Geysers Recharge System

The purpose of these audits was to identify and recommend cost-effective Energy Efficiency Measures (EEMs) either through equipment upgrades, retrofits, or changes in plant operations and processes. The audit for the reclamation system was updated in 2015 after gathering additional data to benchmark EEMs for the Delta Pond and B-Pond pump stations.

The bulk of the City's annual energy use (75%) is associated with operation of the LTP, followed by the Geysers recharge system at 18%. The reclamation and composting systems account for only 5% and 2%, respectively of the total energy use at the Regional facilities for 2012 and 2013.

The audits evaluated many EEMs; those that were deemed cost-effective were recommended for implementation. General findings for each of the Regional facilities are summarized as follows:

- **LTP:** Overall, the LTP audit found that it is well operated and maintained and is in the top-tier nationally in its performance and practices, and exceeds normal industry standards. Ten EEMs were recommended for implementation and seven process improvement suggestions were made.
- **Compost:** The current composting system provides for an effective means of producing a quality Class A biosolids compost product; however, there are alternative technologies available that would potentially save energy, reduce emissions, and significantly reduce overall operations and maintenance costs.
- **Reclamation:** This system is well run but modest energy savings could come from improvements at pump stations.
- **Geysers:** This system could benefit from reducing head loss in the pipeline and modifying the operations of the HVAC system.

The fifteen recommended EEMs from Part 1 are identified in Table 5-1.

Table 5-1 Summary of Recommended Energy Efficiency Opportunities at Regional Facilities Identified in the Energy Optimization Plan (EOP) – Part 1

Energy Efficiency Measure (EEM)	Potential Savings (NPV, $)	Energy Efficiency Measure (EEM)	Potential Savings (NPV, $)
Laguna Treatment Plant		**Compost Facility**	
Raise Tertiary Filter Wet Well Level	$230,000	Modify Exhaust Fan Operations	$183,500
Replace Ultraviolet (UV) Disinfection	$1,231,000	**Reclamation System**	
Raise Raw Wet Well Level	$96,000	Eliminate Pressure-Relief Bypass	$25,379
3W Water -Scum Spray Modifications and VFD	N/A	Reduce Delivery Pressures	$22,200
Reduce Air to MLSS & Primary Channel	$685,000	**Geysers System**	
Run Idle Engines on Natural Gas	$1,743,000	Restore Pipeline Capacity	$104,600
Return Activated Sludge (RAS) Optimization	$447,000	Limit Operation of the Air-Handling Unit	$47,400
Modified Digester Mixing	$262,000		
Install VFDs on Aerated Grit System	$43,000		
Building and Lighting EEMS	N/A		

N/A = insufficient information available at this time to calculate costs and savings.

Phase 2 of the Energy Optimization Plan included detailed investigations into five additional opportunities identified by City staff in a Workshop at the end of Part 1. The five areas investigated in Part 2 were:

1. Waste Heat
2. Energy Management Software (EMS)
3. Irrigation System Optimization
4. Comprehensive Solar Photovoltaic (Solar PV)

5. Mechanical Digester Mixing

The investigation evaluated numerous EEMs, and those that were calculated to be cost-effective were recommended for implementation. General findings for each of the investigation are summarized as follows:

- **Waste Heat**: There is a significant amount of waste heat available from the combined heat and power plant at LTP. While several option were analyzed to use the waste heat one was found to be cost-effective – Organic Rankine Cycle (ORC) electricity generation.
- **EMS**: Several EEMs were investigated but only one EEM and one Process Improvement (add SCADA screen and instruments to facilitate energy management) were recommended.
- **Irrigation**: Ten pumps were chosen by City staff to be analyzed, and three were found to be cost-effective to replace with higher efficiency pumps.
- **Solar PV**: Numerous ownership options (PPA, NEM, RES-BCT, and Pond Lease) and technologies (ground mounted PV and flotovoltaic) were analyzed. Lease of Delta Pond for a flotovoltaic project, a PPA for ground mounted system at site #1 4220 Walker, and a PPA for a flotovoltaics on Pond B were recommended for further investigation. The benefits from a PPA for a 1 MW ground mounted system are included here.
- **Digester Mixing**: Replacing the existing gas-style draft tube mixing mechanism for digesters 3 & 4 with an externally pumped mixing system would increase volatile solids reduction thereby creating additional digester gas, reduce biosolids disposal costs, and reduce formation of upper grease mat and lower solids deposition. While increasing electricity usage the change would still result in net savings to the City. Resulting savings comes primarily from the reduction of in biosolids disposal (~85%) and the remainder from increased digester gas production that offsets natural gas purchases.

The 7 recommended EEMs from Part 2 are summarized in Table 5-2.

Table 5-2 Summary of Recommended Energy Efficiency Opportunities at Regional Facilities Identified in the Energy Optimization Plan (EOP) – Part 2

Title	Energy Savings (kWh/Yr)	Cost Savings ($/Yr)	Net Present Value of Cumulative Savings ($)	Description
LTP Waste Heat				
Two Organic Rankine Cycle (ORC) Generator Units	744,600	$11,000	$105,000	Install two ORC 50 kW generating units for a total of 100 kW, without the SGIP incentive (with the SGIP incentive the NPV increases to $213,000).
Energy Management System				
Modify Pump Alternation at LTP	151,000	$17,000	$235,000	Instead of equalizing run time on pumps, operate the pumps to optimize energy savings.
Irrigation System				
Aggio Pump	20,300	$1,600	$21,200	Replace 60 HP pump to increase the low overall pumping efficiency (OPE) of 44% to 69%.
Hansen East Pump	10,700	$900	$11,700	Replace 30 HP pump to increase the low overall pumping efficiency (OPE) of 52% to 69%.
La Franconi Pump	6,600	$300	$4,300	Replace 25 HP pump to increase the low overall pumping efficiency (OPE) of 45% to 69%.
Solar PV				
1 MW Ground Mounted PPA	1,358,000	$52,000	$652,000	1 MW Ground Mounted PPA including: $1.25M development cost (CEQA, CTS and Interconnection), able to interconnect with LTP, $0.9/kWh PPA price quote from Solar City, 0% escalation rate, 25 year term, site #1 4220 Walker.
Digester Mixing				
Install Replacement Mechanical Mixing System	(261,000)	$90,000	$1,211,000	Replace existing gas mixing system with externally pumped mixing system.
Part-2 Subtotal	**2,030,200**	**$172,800**	**$2,240,200**	
TOTAL for EOP	**12,303,200**	**$669,800**	**$7,507,200**	

Overall the Regional EOP provides the opportunity to reduce electricity use by 12.3 million kWh, savings on average over 20 years nearly $670,000 per year, with a NPV of cumulative savings over 20 years of $7.5 million.

Optimizing Built Capacity

Optimizing the use of existing asset capacity could represent an opportunity to achieve cost efficiencies over time. The City has implemented several measures recently that optimize the use of existing assets and maximize value to ratepayers. Opportunities to optimize use of existing assets are evaluated below.

High Strength Waste Receiving

Co-digestion of high strength waste including FOG and industrial/ commercial organic waste can be an effective means of increasing methane production and energy recovery at facilities with excess anaerobic digestion capacity. A study conducted as part of the City's CHP project determined that the existing anaerobic digesters have excess capacity available for treatment, and FOG treatment was incorporated as an option in the alternatives considered in the *Biosolids Management Strategic Plan* (Santa Rosa, 2014d).

As described previously the City constructed a HSW receiving facility at the LTP. The facility consists of four 12,000-gallon tanks with a firm capacity of 36,000 gallons and total capacity of 48,000 gallons. HSW can be fed to the digesters at a maximum rate of 72,000 gpd, resulting in a total facility throughput that is significantly higher than the storage capacity, From startup of the HSW facility in August 2016 through the end of 2016, the City has consistently accepted HSW for 5-6 days per week, with an average daily rate of 23,200 gpd. During this time, the average digester gas production was 454,000 cfd, compared with an average gas production of 347,000 cfd in 2015 and 367,000 in 2016 prior to the introduction of HSW.

The City conducted a survey to estimate the type and quantity of waste available in the local area. Table 5-3 shows the results of this survey.

Table 5-3 High Strength Waste Market Survey

Hauler	Feed Stock Type	Source Company	Average Weekly Waste Production
Biagi Trucking	Winery Waste	Local Wineries	40,000 Gallons
Environmental Pump Services	Fats, Oil, and Grease (FOG)	Local Restaurants	20,000 Gallons
Joe's Farmers Septic	FOG	Local Restaurants	5,000 Gallons
Liquid Environmental Solutions	FOG	Local Restaurants	3,800 Gallons
North Bay Restaurant Services	FOG	Local Restaurants	15,000 Gallons
United Site Service	FOG	Local Restaurants	15,000 Gallons
Industrial Carting	Food Processing	Amy's Kitchen. Inc	15,000 Gallons
Industrial Carting	Brewery Waste	Bear Republic Brewing Co.	20,000 Gallons
Industrial Carting	Brewery Waste	Lagunitas Brewing Co.	50,000 Gallons
Industrial Carting	Dairy Waste-DAF & Whey	Petaluma Creamery	20,000 Gallons
Industrial Carting	Dairy Waste	Cowgirl Creamery	15,000 Gallons
TBD	Meat Processing	Petaluma Poultry	10,000 Gallons
		Total	228,800 Gallons

Source: Prinze personal communication, 2016

Table 5-2 shows that local sources produce more than 30,000 gal/day of FOG and liquid waste from restaurants, breweries, dairies, and other commercial and industrial facilities. The 48,000 gpd capacity of the HSW receiving system provides adequate capacity to serve the local community, and to extend service to new industries or industries outside the County.

Attracting additional dischargers to use the HSW facility will maximize methane production and power production from the CHP facility. The City recently completed an upgrade of the original cogeneration facility, providing four new 1.1-megawatt (MW) engine generators. The new cogeneration units are located in a new building, and run on biogas produced by the digesters. With the addition of SCR-selective catalytic reduction, the primary engine generators would also be able to operate on natural gas.

Based on interviews with plant staff in 2015, the digesters currently produce enough biogas to operate one engine generator nearly full-time. In addition to providing a greater percentage of the plant's power needs through renewable energy, the upgrade provides heat recovery that could be used to support the ORC power generation measure identified in Table 5-2.

Optimize Flow Equalization Basins

The flow equalization basins allow the City to temporarily divert peak flows to manage wet weather operations of the LTP. The existing flow diversion system is completely gravity-driven. To provide greater operational flexibility, the City has included Project ID (PID) 1957 in the 2016/2017 Capital Improvement Plan. This goal of this project as defined in the CIP is as follows: "To support compliance with effluent water quality specifications for partially treated wastewater flow diversions, an on-site, pumped diversion system is required". The City's LTP Onsite Diversion System provides operational flexibility and reduces the potential for effluent water quality excursions and associated permit violations. The diversion system includes automated slide gates, a passively fillable sump, and a high flow, low head pumping system to collect and route water to the existing flow equalization basins at the upstream end of the plant site" (City of Santa Rosa Capital Improvement Program Budget, Fiscal Year 2016-17).

West College Storage Facility

The WCSF allows the City to temporarily divert trunk flows into the existing concrete filtering basin and overflow basins to prevent backups into the Llano Trunk Sewer system and maintain targeted level of service. Modeling and analysis conducted in 2016 of control strategies for managing the collective storage at the LTP and WCSF showed that improvements to the WCSF could limit peak wet weather flows into the LTP to the maximum treatment capacity by diverting flows to the WCSF. Depending on the scope of implementation of the Master Plan recommended upgrades, the West College Storage Ponds could be used to divert as much as 35 to 44.5 mgd from the LTP and trunk sewer system and store as much as 33.1 MG in the three basins at the WCSF (Arcadis, 2016). To provide additional long-term capacity, the City has conducted a preliminary design of improvements to raise the embankment of the High Flow Storage Pond No. 1 to elevation 119, increasing the storage capacity from 22.8 MG to 49.6 MG. The current and future pond capacities at the WCSF are shown in Figure 5-1.

City of Santa Rosa

SWRRF Master Plan

GHD Kennedy/Jenks Consultants

Job Number 0764001
Revision
Date Aug, 2017

West College Storage Facility Capacity

Figure 5-1

2235 Mercury Way Suite 150 Santa Rosa California 95407 USA T 1 707 523 1010 F 1 707 527 8679 W www.ghd.com

Plot Date: 25 August 2017 - 3:46 PM CAD File No: \\eug\CAD\CAD\2014\1468051.00-SWRRF-Master_Plan\1468051-FIG 5-1.dwg

Geysers Pipeline

The Geyser pipeline is a 48-inch diameter pipeline that runs about 40 miles from the LTP across the Santa Rosa Plain and then Alexander Valley before travelling up through the Mayacamas Mountains to the Geysers steam field reservoirs. This pipeline was originally designed to carry a firm capacity of 40 mgd; 16 mgd to the Geysers, and additional capacity to deliver up to 24 mgd to agricultural customers from turnouts along the pipeline running up to and within the Alexander Valley. Four pump stations pressurize the pipeline to approximately 200 PSI and convey the recycled water from the LTP to the Geysers. The first pump station (Llano Pump Station) is located at the LTP and conveys the recycled water through the first 30 miles of pipeline through Alexander Valley. The remaining pump stations (Bear Canyon, Mayacamas, and Pine Flat Pump Stations) lift the recycled water up the mountain, to the Geysers terminus reservoir for injection at the steamfields. The Geysers pipeline also has a connection to return advanced treated recycled water to the Delta Pond storage in cases of Geysers outage, such as when the Valley Fire of 2015 damaged Geysers facilities.

The Geysers pipeline is currently not operating at its full capacity, and current firm capacity (largest pumping unit out of service) of the pump stations is estimated at 16.9 mgd. Since the construction of this pipeline and the beginning of recycled water deliveries to the Geysers in 2003, the pipeline has not been utilized for delivery of water to any other user except Calpine. It is estimated that the full capacity could be achieved if recycled water were to be delivered to farms for agricultural irrigation via the portion of the Geysers pipeline in Alexander Valley.

The potential market for recycled water in Alexander Valley consists of dozens of agricultural users, primarily vineyards. The estimated total water use for the Alexander Valley Groundwater Basin in 1999 was approximately 15,800 afy; about 13,500 afy of this amount was estimated to be for agricultural use, primarily vineyards (USGS, 2016).

Although the Geysers pipeline could be used to deliver reuse water to agricultural operations in Alexander Valley or other partners who need potable offsets, this option is limited by the availability of recycled water from the LTP. Except in wet years when discharge needs to occur, demand from existing customers accounts for all of the City's water. Thus, this option would only be viable as growth within the service area increases flows to the LTP and the City builds additional seasonal storage so water is captured in the winter for use during the irrigation season rather than being discharged during the wet season. In addition, this strategy is subject to finding customers who are willing to use the recycled water and pay for the infrastructure to connect to the Geysers pipeline.

Low Pressure Transmission Main Operation

Recycled water is conveyed through the low-pressure 30-inch diameter pipelines to serve agricultural customers, a City park and two golf courses, and to feed two pump stations serving urban customers. Agricultural users are served by more than 60 point-of-use booster pumps to increase the hydraulic grade line between the low-pressure delivery system and the irrigation systems.

Challenges associated with the operation of the low-pressure system originate with the lack of as-built and design documentation of the system or test pressures. Furthermore, the pipeline connects to the West College pipeline, which was originally a gravity sewer and lacks any pressure valving to control or relieve pressures in the pipeline. A better understanding of as-built conditions and the safe operating pressures would allow for greater operational flexibility, allowing the system to operate over a wider pressure range.

Three options are recommended to address the issues of the low-pressure system:

- Conduct a condition assessment to establish safe working pressures and identify improvements needed to operate the system more efficiently.
- Refurbish and improve the pipeline.
- Use alternative means to convey recycled water to the existing customers.

The third recommendation is based on using the Geysers pipeline to deliver recycled water to the existing low-pressure system customers. Although the Geysers system is more costly to operate than the current low-pressure system, the additional cost may be offset by the elimination of the need for the more than 60 low-pressure booster pumps. While the City would avoid costs of refurbishments to the low-pressure system, it would incur costs associated with providing new high pressure services to existing customers. A disadvantage of using the Geyser pipeline for distribution is that it creates more of a dependence on the Geyser system and reduces redundancy with respect to the reclamation infrastructure.

The City of Santa Rosa owns and operates all of the pump stations of the low-pressure pipeline. For the Geysers pipeline, Calpine pays the City $300,000 annually for the energy use of the Llano Pump Station, and Calpine provides power to the remaining pump stations in the Geysers conveyance system. Below is a comparison of the specific energies of the Llano Pump Station to the largest of the low-pressure pump stations, the EB Pump Station and the Delta Pond Pump Station.

- Llano Pump Station – 1,492 KWh/MG
- EB Pump Station – 278 KWh/MG
- Delta Pond Pump Station – 186 KWh/MG

Once the condition of the low-pressure transmission main is determined and capital improvements identified, the City can determine whether it is feasible or cost-effective to avoid low pressure transmission upgrades by serving customers directly from the Geysers pipeline.

Although it may be feasible to serve agriculture users from the high pressure Geyser pipelines, doing so would not eliminate the need to maintain the low pressure transmission system. The low pressure transmission mains are an essential part of the recycled water transmission system in as much as it allows conveyance of recycled water between storage ponds (e.g., between meadow land ponds and delta ponds). Further, the low pressure transmission mains are essential to conveying recycled water to the cities of Rohnert Park and Santa Rosa, the West College Facility and other urban reuse facilities. The low-pressure transmission system is necessary whether or not the City continues to serve agriculture users.

Flow Meter Addition

The pump stations conveying recycled water from the LTP to the low-pressure recycled water system cannot always operate in accordance with low-pressure operating rules. This condition often occurs during the irrigation off-season when demand is lowest. In conjunction with manual operation of the low-pressure system booster pumps, a pressure bypass valve automatically opens when it senses a high-pressure condition and bleeds off excess pressure, returning excess recycled water to the Meadow Lane Ponds at the LTP. It is unknown how much water passes through the pressure bypass and is returned to the LTP, and therefore it is unknown how much energy is wasted by conveying the recycled water through the bypass loop. In order to optimize the low-pressure system, the volume of water flowing through the bypass system needs to be minimized.

Adding flow meters to the recycled water distribution system could improve cost efficiency of the system. It is recommended that flowmeters be installed at every pump station, prioritized according to annual energy consumption. It is further recommended that the EA, EB and Delta Pond pump stations be equipped with flowmeters.

Challenges associated with retrofitting the recycled water system with flowmeters include reduced accuracy of the flowmeters due to sub-optimal piping (i.e. lack of upstream and downstream straight lengths of piping). Despite these challenges, the flow data collected can still be used to analyze the system's operation.

5.1.3 Resource Recovery

The WRS are currently operated to maximize resources recovery, and additional projects are currently in the implementation phases to further advance this goal. The following section identifies additional opportunities that could incrementally increase resources recovery from WRS operations over the next 20 years.

Energy Recovery

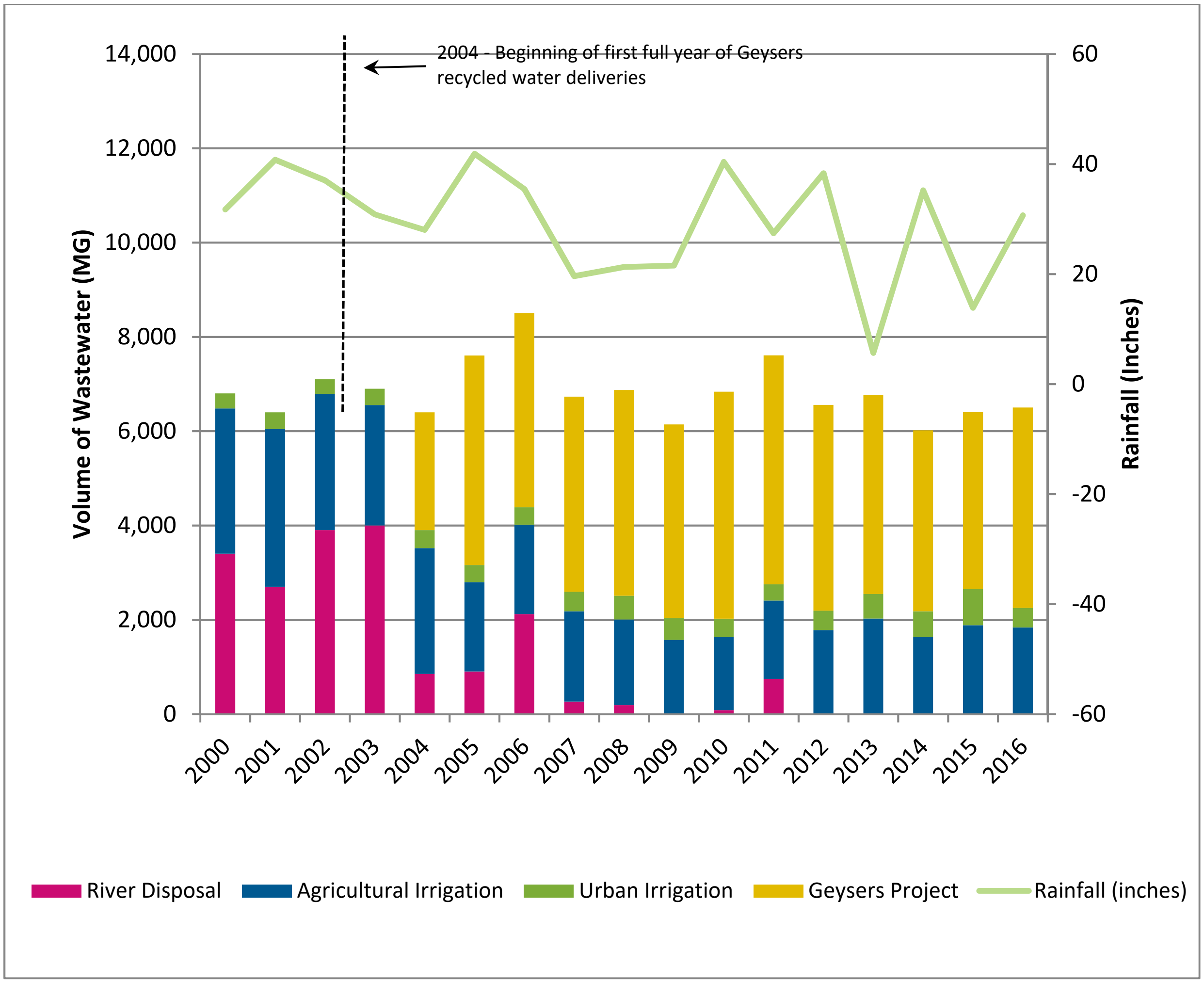
Technological advances and new regulatory requirements are increasing the number, variety, and cost-effectiveness of energy recovery opportunities for wastewater utilities. Table 5-2 described two energy recovery opportunities that were recommended through Phase 2 of the Energy Optimization Plan: solar photovoltaic power production, and use of waste heat to generate power using an ORC unit. The City is also participating in a California Energy Commission-funded project to develop an understanding of how microgrids can provide renewable energy at wastewater facilities. The project includes installation of a new 2-Mwh battery and microgrid controller, post-combustion exhaust treatment system, and a photovoltaic parking lot canopy system. Additional opportunities include the following:

- As of January 1, 2016, Assembly Bill (AB) 1826 prohibits landfill disposal of food/organic waste from businesses. Food waste co-digestion was considered in the Biosolids Management Strategic Plan, but not shortlisted for evaluation because it uses significant resources and was not considered a good fit with the existing facilities. However, the requirements imposed by AB1826 will change the market and potential revenue stream associated with food waste co-digestion. The City could further evaluate this potential market and assess the payback period associated with facility improvements given the new regulation.
- Backup generators located on site at the LTP can be used to produce electricity with digester gas if available. The electricity produced by the digester gas can offset purchases of natural gas. This opportunity was identified in the Energy Optimization Plan Phase 1 and captured in Table 5-1 along with other energy efficiency measures.

These opportunities should be evaluated further as potential opportunities to enhance resources recovery and lower the overall cost of operations for the WRS.

Recycled Water Reuse

Recycled water use has long been a core element of the City's resource recovery portfolio. Since the Geysers steamfield began receiving recycled water in 2003, total recycled water production has not varied dramatically and ranges from just below 6,000 mg to 8,500 mg produced per year. Historical recycled water use, effluent discharge, and annual rainfall are summarized in Figure 5-2 and Table 5-4. As indicated, the amount of water discharged has been reduced significantly and rarely occurs except in wet years. Discussion of opportunities to increase water reuse is really limited to the incremental increase in flows that will occur due to growth over the next 20 years.



Sources: Disposal and reuse data compiled from: Data provided by GHD; 2005 Rohnert Park UWMP, 2011-2013 Record of Disposal & Storage Reports, and 2012-2016 LTP Record Of Recycled Water Distribution

Figure 5-2 Historical Recycled Water Use

Table 5-4 Historical Recycled Water Use

Calendar Year	Discharge (MG)	Beneficial Use (MG)			Total Treated Wastewater (MG)	Annual Rainfall (inches)
		Agriculture	Urban Irrigation	Geysers Project		
2004	850	2,670	380	2,500	6,400	28
2005	903	1,896	361	4,445	7,605	42
2006	2,122	1,894	370	4,116	8,502	35
2007	263	1,916	417	4,136	6,732	20
2008	190	1,816	504	4,362	6,872	21
2009	0	1,574	466	4,104	6,144	22
2010	83	1,556	384	4,815	6,838	40
2011	744	1,663	345	4,856	7,608	27
2012	5	1,777	412	4,363	6,557	38
2013	0	2,024	521	4,227	6,772	6
2014	0	1,638	541	3,744	6,018	35
2015	0	1,883	774	4,249	6,401	14
Average	430	1,859	456	4,126	6,871	
Standard Deviation	612	283	115	585	681	

Sources: Disposal and reuse data compiled from: Data provided by GHD; LTP Record Of Recycled Water Distribution; 2015 Santa Rosa UWMP; and the 2015 LTP Annual Report. Rainfall data gathered from University of California Statewide Integrated Pest Management Program, Santa Rosa Station.

Future Demands

Demand for recycled water will grow in the future as existing customers expand, new customers come online, and newly enacted groundwater sustainability legislation continues to focus on groundwater resources in the area. This represents an opportunity to continue the already successful program and maximizing reuse while minimizing discharges in accordance with the NPDES permit.

Calpine has indicated that they would take as much water as could be delivered within the existing agreement, which allows for increasing deliveries from the current Schedule I rate of 4,607 mgy to the Schedule V rate of 5,543 mgy. They are investing in their power generation infrastructure and delivery of recycled water is essential to achieving a satisfactory return on their investment.

Existing agricultural customers would take more water now if it were available to them. Based on climate trends and recent legislation, it is expected that recycled water demand for agricultural operations will increase in the future. Demands for recycled water for agricultural irrigation exceed supply during drought years, which are expected to become more frequent and deeper in the future (NCIRWMP, 2014). In addition, the California Sustainable Groundwater Management Act of 2014 (SGMA) requires that a Groundwater Sustainability Agency be formed by 2017 and Groundwater Sustainability Plan be developed by 2022 for the Santa Rosa groundwater basin. The impacts of this legislation are unknown, but it is anticipated that as a result of SGMA, groundwater pumping will be limited in the future, therefore increasing pressure on farmers to maximize surface water and recycled water sources.

With a focus on water conservation, urban reuse has not reached the levels of delivery initially projected. The *2010 City of Santa Rosa Urban Water Management Plan* (Santa Rosa, 2010) projected recycled water use of 900 AF for 2015. However, due in part to the City of Santa Rosa's success in reducing potable water demands, actual recycled water use in 2015 was 140 AF. The projected continuation of water conservation practices and the financial investment to install additional pipelines, storage tanks, and pumps, and proximity to the production of the recycled water and the distribution system has resulted in Santa Rosa's determination that it is not cost effective to expand the recycled water distribution system at this time (Santa Rosa, 2016a). Similarly, the City of Rohnert Park *2015 Urban Water Management Plan* caps future recycled water expansion to an additional 300 AFY at buildout (Rohnert Park, 2016).

Regional Approach

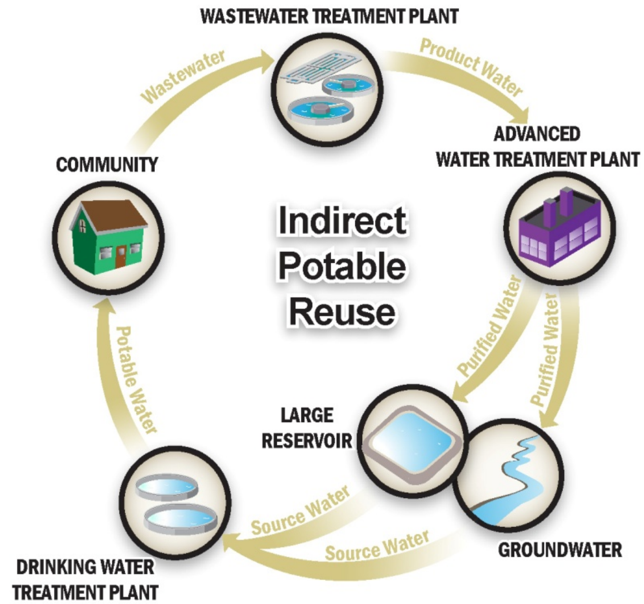
The Geysers pipeline can be utilized as a backbone to wheel recycled water throughout central Sonoma County to various users and locations with minimal upgrades to infrastructure and equipment and without impairing delivery to the Geysers steamfield. The Llano Pump Station is automated to modulate pump speeds to maintain constant level at the Bear Canyon Reservoir, the first and lowest elevation reservoir in the mountains on the way to Terminal Reservoir. The next two pump stations (Mayacamas and Pine Flat) operate in series and are similarly automated to maintain constant level in Terminal Reservoir by modulating pump speeds to move water from the Bear Canyon Reservoir. After Terminal Reservoir, the steamfields are plumbed and equipped to automatically adjust to preset delivery volumes. Therefore, the rate of flow through the pump stations within the mountains (Bear Canyon, Mayacama, and Pine Flat) match the rate of flow that is needed at the Geysers steamfields and flows through the Llano Pump Station are only those needed to maintain Bear Canyon reservoir levels.

In addition to utilizing the Geysers pipeline to deliver recycled water to agricultural customers throughout Alexander Valley, the pipeline can also be used to convey recycled water of a similar quality produced by others. This is possible given the Geysers existing infrastructure discussed above. For example, if additional recycled water were injected into the Geysers pipeline between the Llano Pump Station and the Bear Canyon Pump Station, the Llano Pump Station would automatically reduce output from the LTP to maintain a constant level at the Bear Canyon Reservoir. Similarly, if recycled water were extracted from the pipeline between the two pump stations, the Llano Pump Station would increase output from the LTP. In this way, the system would be able to increase recycled water output and the backpressure on Llano Pump Station is reduced, decreasing unit energy consumption, while still fulfilling the recycled water commitment to the Geysers steamfield.

The City is currently conducting a Regional Recycled Water Infrastructure Optimization Study (RRWIOS) to evaluate utilizing the Geysers pipeline to convey recycled water to the Sonoma County Water Agency (SCWA) storage facility at the County Airport. From a resources recovery perspective for WRS, however, water reuse is already being maximized and any incremental increase in flows from the LTP could be taken up by existing customers.

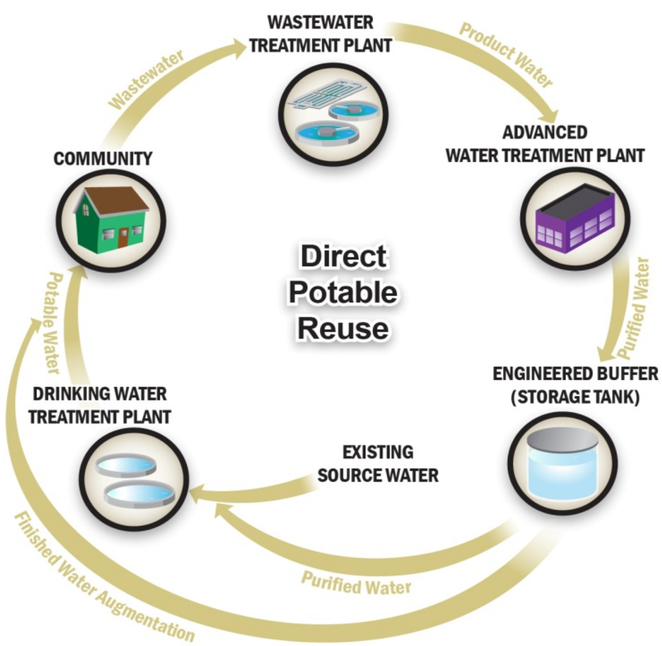
Potable Reuse

The California Water Code addresses the use of recycled water for potable reuse through Indirect Potable Reuse (IPR) and Direct Potable Reuse (DPR).



IPR is the purposeful introduction of highly purified recycled water into an untreated drinking water supply source, such as groundwater in an aquifer or surface water in a large reservoir. The recycled water is mixed with the untreated water source, and there is a specified blending ratio, travel time and distance between the point of addition and eventual extraction for treatment at a drinking water treatment plant. Regulations for groundwater replenishment using recycled water became effective on June 18, 2014 and have been incorporated into Recycled Water-Related Regulations in the Drinking Water Program's Law Book (DDW, 2014).

Direct potable reuse (DPR) is the purposeful introduction of highly purified recycled water into a drinking water supply, immediately upstream of a drinking water treatment plant or directly into the potable water supply distribution system downstream of a water treatment plant. DPR is currently under evaluation and is not yet included as an allowed use in Title 22. The California Water Code was modified by legislative statute to require the Division of Drinking Water (DDW), in consultation with the SWRCB, to investigate and report on the feasibility of developing uniform water recycling criteria for direct potable reuse by December 31, 2016. The Draft report was released on September 7, 2016 (SWRCB, 2016).



The potable reuse concepts within the Santa Rosa Region considered for the purposed of this Master Plan include groundwater recharge, surface water augmentation, streamflow augmentation and direct potable reuse. These concepts were explored at a high level to assess opportunities to beneficially reuse the recycled water for potable uses directly or indirectly. A list of general potential benefits and challenges associated with potable reuse in Santa Rosa are summarized in Table 5-5.

Table 5-5 Drivers and Obstacles for Implementing Potable Reuse in Santa Rosa

Drivers	Obstacles
• Develop a local and sustainable water supply. • Reduce reliance on SCWA supplies. • Provide climate resiliency to be better prepared to maintain water supply reliability in the face of external stresses imposed by climate change. • Use of available future excess recycled water flows to supplement potable supplies. • Contingency plan if Geysers contract is not renewed or if future flows to Geysers decrease. • Contingency plan for dealing with potential future, more stringent, Total Maximum Daily Loads (TMDLs) and nutrient waste load allocations during wet years when additional disposal capacity is needed. • Provide an integrated approach solving multiple issues, which could bring together a number of stakeholders in Santa Rosa and Sonoma County.	• Current lack of available supply after meeting existing non-potable recycled water demands for urban and agriculture customers and satisfying the Geysers contract requirements. • Need for advanced treatment comes at a higher cost with greater energy requirements and operational complexities than existing recycled water treatment. • Environmental issues and costs associated with brine disposal. • Additional infrastructure and increased energy requirements (add related GHG emissions). • Additional regulatory requirements (i.e. permitting, monitoring, and reporting) • Regulatory uncertainty related to SWA and DPR requirements • Development of partnerships and agreements • Public acceptance

Potable reuse is not likely to occur over the next 20 years, but it would have significant impacts on the operation of the WRS and the existing recycled water customers if it were to occur. A potable reuse scenario would mean that a significant portion of the recycled water generated would go to this use if it were to be cost effective, which means there would be less water available for other uses. A potable reuse option would take many years of planning before implementation would take place, and planning and analysis activities could realistically occur within the next 20 years.

Biosolids Reuse

The majority of anaerobically-digested biosolids produced at LTP are beneficially reused as soil amendment or compost for farms, vineyards, golf courses, and other customers in the region. In 2016, the LTP generated nearly 4,300 dry tons of biosolids and nearly 99% were beneficially reused or stored for future reuse. Class B biosolids are stored at Alpha Barn and used for Class B land application on about 193 acres of City farmland and seven private farms in South County (1,363 acres). Roughly 32 percent of the solids produced at LTP receive additional treatment at the Compost Facility. The resulting Class A biosolids are sold at a discounted price to local landscaping companies, vineyards and golf courses. Lesser amounts are sold to individuals or donated to local community gardens and schools. In addition, biosolids are sent to the Lystek Organic Material Recovery Center (Lystek) at the Fairfield Suisun Sewer District. Finally, a small fraction of LTP biosolids is sent to a landfill. Biosolids reuse during 2016 was described in the City's 2016 Annual Report and is summarized below.

Table 5-6 Biosolids Reuse and Disposal – 2017 [a.]

Reuse or Disposal Method	Dry Tons	Percentage
Land Application	2,050	41.63%
Composting	1,399	28.42%
Storage [b.]	1,105	22.44%
Landfill	287	5.82%
Lystek	83	1.69%
Total	4,924	100%

a. City of Santa Rosa Laguna Regional Water Reclamation System, 2017 Annual Report
b. Stored biosolids are typically composted and/or land applied in the following calendar year

To optimize beneficial reuse of biosolids, it is important that WRS continue to have a range of biosolids treatment options including a successful Class A biosolids program. Doing so will enable the City to more easily adjust its operations should market or regulatory changes occur.

Nutrient Recovery

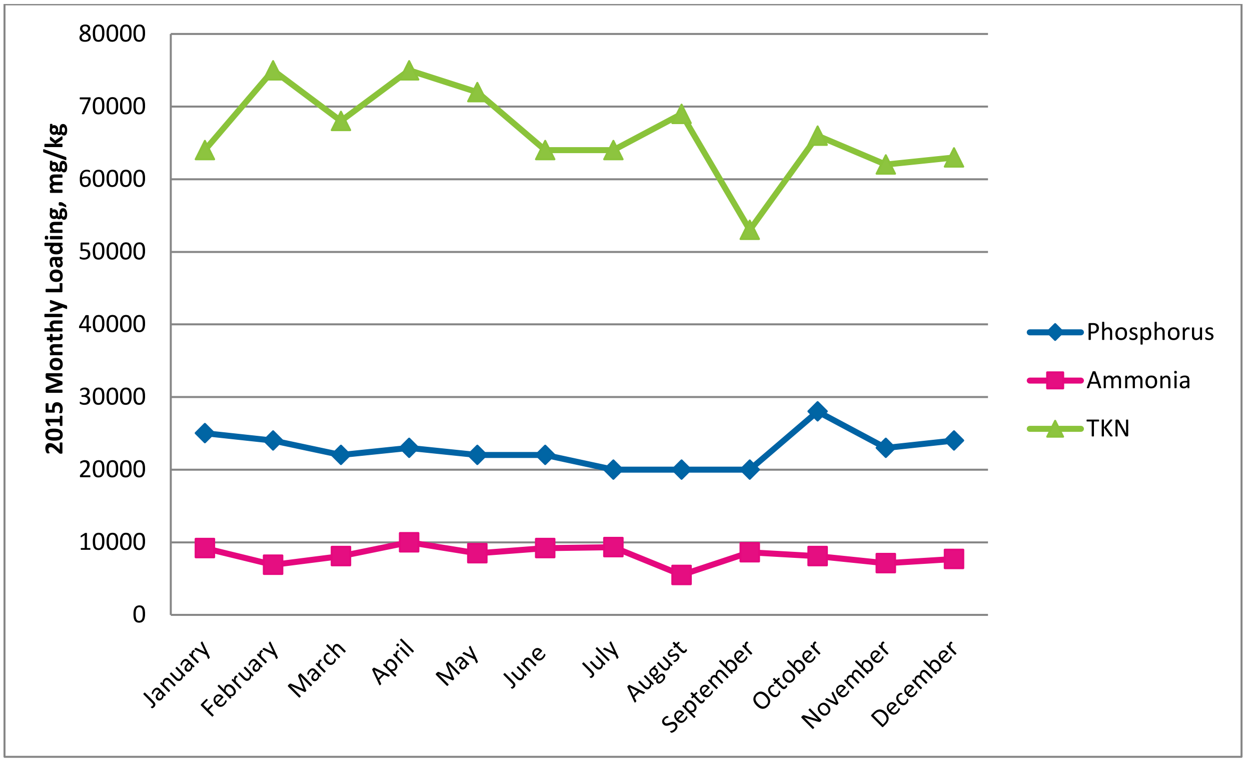
Nutrient discharge from wastewater treatment plants can have negative impacts on aquatic ecosystems, from ammonia toxicity to algal blooms and dissolved oxygen depletion. Nutrient removal at wastewater treatment plants is becoming more prevalent, both in response to water quality limitations and as a means of managing operating costs and resource recovery. The nutrients that are removed to achieve permit compliance become concentrated in sidestream flows, and can be converted to commercial fertilizer. Such nutrient recovery could provide a revenue stream to the City and a valuable product to local farmers.

Nutrient recovery is most beneficial when coupled with plants using biological phosphorus removal where biologically-bound phosphorus is released when waste activated sludge is exposed to anaerobic conditions, such as during anaerobic digestion. In these plants, ammonia and phosphorus often naturally crystallize in the formation of magnesium ammonium phosphate (MgNH4PO4), or struvite. Struvite is a hard material that adheres to the surfaces of pipes and equipment, resulting in loss of capacity and requiring maintenance effort. Magnesium is typically the limiting component in struvite formation in wastewater treatment plants, so adding magnesium in a controlled fashion can allow controlled struvite formation and maximize sidestream phosphorus and nitrogen removal.

Several vendors offer treatment systems for nutrient recovery. The most common system used in North America are manufactured by Ostara and Multiform Harvest. These processes use magnesium addition and pH adjustment to generate struvite crystals in a controlled reactor. The resulting products are slow-release fertilizers that can be sold commercially. Anaergia has also developed an ammonia stripping process targeted at removing ammonia from centrate sidestreams; the stripping process produces a concentrated ammonia salt solution that can be used as or blended with fertilizer. The Ostara and Multiform Harvest processes have full-scale facilities in operation in North America; while Anaergia's only full-scale installation is located in Asia.

Santa Rosa currently practices nutrient recovery to a large extent, through its urban and agricultural irrigation program (Santa Rosa, 2016). The *Laguna Regional Water Reclamation System 2015 Annual Report* reported results of water quality monitoring for nitrogen during 2015, with an average total nitrogen concentration of 17.5 mg/L. This nitrogen is primarily present as nitrate, and assumed to be 100% available to plants for uptake. Based on the data presented in the 2015 report, nitrogen applied through the City's recycled water program contributed 45% of the agronomic requirement for irrigated lands.

Nutrient recovery is also practiced through land application of biosolids. The 2015 values for phosphorus and nitrogen loading in biosolids (mg/kg dry weight) are shown in Figure 5-3.



Source: City of Santa Rosa Laguna Regional Water Reclamation System, 2015 Annual Report

Figure 5-3 Nutrient Reuse through Biosolids Land Application

Given the high degree of effluent and biosolids reuse, the bulk of nutrients generated at the LTP are currently reused beneficially. Nutrients in the reclaimed water sent to the Geysers steamfield are not beneficially reused; however, capturing this fraction of nutrients would require upgrading the LTP to provide biological phosphorus removal and adding a nutrient recovery process.

5.2 Risks

Risks to the utility are important drivers in determining future improvements and management strategies. Most risks come from factors outside of the City's control and they are always evolving. Understanding what the potential risks are, their probability and consequence of occurrence, and how they could impact the City's ability to meet level of service standards helps inform appropriate mitigation strategies.

5.2.1 Aging Infrastructure

Aging infrastructure poses a risk in that assets have finite service lives and, even with preventative maintenance, will need to be restored or replaced at some point in time. Critical facilities such as treatment, pumping and storage facilities will typically have built-in redundancy to mitigate risk from unplanned failures or scheduled maintenance that allows for work to be completed without loss of operability. Conveyance pipelines often do not have redundancy although, as a system, they are also critical to meeting service levels. Large asset groups (treatment structures, piping systems, etc.) that were constructed at the same time will reach the end of their service lives coincidentally creating a need for major investments in renewal and replacement of the assets. Performing condition assessments allows the City to assess the probability of failure of an asset or asset class, and with understanding of the consequence of failure for each asset or asset class, the City can prioritize investments for renewal and replacement projects.

The LTP was originally constructed in 1967 with major expansions in 1977 (to 15 mgd) and 1986 (to 18 mgd). The compost facility was constructed in 1995. The low pressure distribution system, Rohnert Park high pressure urban reuse distribution system, and the majority of the seasonal storage ponds were constructed in the 1970s and have operated reliably with minimal maintenance requirements. The Geysers pipeline went into operation in 2004 and the City of Santa Road has added urban reuse customers over the last 10 years.

The City has conducted condition assessment on some assets, primarily at the LTP and compost facilities, but does not currently have a formal asset management framework to track asset condition, assess consequence of failure, and prioritize renewal and replacement activities consistently for all WRS assets. The condition assessment activities that have taken place include the following:

- Laguna Treatment Plant Condition Assessment (Santa Rosa, 2012). This study provided an asset inventory, visual assessment, and desktop seismic assessment of the assets at the LTP and Compost facility. The Assessment consolidated plant piping schematics, but did not assess piping other than the influent trunk sewers. The Assessment also excluded electrical and instrumentation/controls (E&IC) assets at the LTP and Compost facility.
- Power Master Plan (Santa Rosa, 2006). Electrical facilities were evaluated in the Power Master Plan. At the time of the assessment, many electrical components were nearing the end of their useful life, including switchgear M1 and many load centers from the 1976 expansion. The M1 switchgear has not yet been replaced.

The City has not conducted a condition assessment of the original (1977) reclamation piping system. An initial assessment and ongoing inspection program is needed to manage the buried assets in the reclamation system. Inspection of the Geysers pipeline should also be conducted in areas where flow restrictions have been observed. A condition assessment of the seasonal storage ponds also has not been documented.

The LTP Condition Assessment identified numerous assets at both the treatment plant and Compost facility that have reached or exceeded their expected useful life, and exhibit condition that warrants either significant maintenance activities or replacement. The City's buried assets –including the reclamation system, Geysers pipeline, and buried pipelines at the LTP – are all in need of condition assessment. This program will support long-term capital and maintenance planning to maintain the value of the system assets.

5.2.2 Climate Variability and Natural Disasters

Climate vulnerability and natural disaster could significantly impact the City's ability to meet desired levels of service. The City prepared a Draft Local Hazard Mitigation Plan in 2016 to identify critical facilities, assess opportunities to reduce vulnerability to disasters, and implement measures to reduce disaster impacts. The Hazard Mitigation Plan addressed the City's vulnerability to following hazards:

- Dam inundation
- Drought

- Earthquake (including shaking, fault rupture and liquefaction)
- Flood
- Hazardous Materials
- Landslides
- Wildfire

The probability of seismic events, flood, drought, and wildfire were all characterized as high.

The City has also completed a Climate Action Plan (2012a) that helps address mitigation for climate change. The Climate Action Plan identifies potential climate change impacts in Santa Rosa, some of which – such as increased rate of wildfires – impact the WRS.

Other current efforts to address climate change within the region include:

- Sonoma County Water Agency Climate Vulnerability Assessment and Adaptation Work Plan (October 2015): This document lays out the development of a climate adaptation plan that will serve to guide SCWA in the prioritization and allocation of resources for the purposes of improving the resiliency of its operations and facilities to climate change (CH2M, 2015).
- Regional Climate Protection Authority (http://rcpa.ca.gov/): Coordinates efforts by cities and agencies within Sonoma County to reduce carbon emissions and address climate change impacts.
- North Bay Climate Adaptation Initiative (http://www.northbayclimate.org/): A coalition to develop and support local climate adaptation strategies that preserve natural resources.

The City's existing climate and hazard planning has not included detailed assessments of the WRS. Future plans should include evaluating the vulnerability of the LTP, Compost, Geysers, and reclaimed water systems to climate change and natural hazards.

Flood and Severe Weather Events

Assets that lie within the 200-year floodplain or are protected by aging or insufficient flood protection infrastructure are vulnerable to flooding and severe weather events (Van't Hof, et. al. 2016). During the 2006 New Year's Day Flood, exceptionally heavy rains flooded the LTP and its storage ponds, causing a release of partially treated wastewater (NOAA 2013). The City has constructed a nearly 950-foot temporary flood protection wall to protect critical areas of the plant from flooding, and is moving forward with design of a permanent berm/floodwall that would protect LTP and Compost facilities against a 500-year flood event.

Additional risks created by severe weather events include:

- Inundation of the Compost facility and Alpha Farm storage occurs during severe wet weather, requiring pumping to maintain proper operation of the facilities.
- Severe wet weather increases the volume of effluent and required storage, reduces available storage volume, and can limit the need for recycled water. All of these result in increased discharge and need for nutrient offset credits.
- Erosion increases landslide risk along the Geysers pipeline in the mountain reaches, increasing the risk of service interruption to Calpine, and creates the need to utilize seasonal storage to avoid discharges until repairs are completed.
- Flooding at Delta Pond can limit access to the discharge system.

Drought

Drought conditions increase the demand for recycled water from the LTP at periods of time when recycled water supply is reduced by decreased rainfall. Recycled water delivery commitments can be prioritized as follows:

- **Geysers Recharge Project**. The City's contractual obligation includes monetary damage clauses for noncompliance. Based on historical conditions, Geysers operations could continue with reduced supply (90 percent) to help balance limited recycled water resources
- **Urban Irrigation Demands**. Urban irrigation supply is governed by ordinance or agreement, with customers paying full price for reliable recycled water deliveries.
- **Agricultural Irrigation Demands**. Agricultural agreements for interruptible service provide flexibility to curtail deliveries during drought, though long-term or severe curtailment could make recycled water a less attractive source than other potential water sources.

Curtailments during drought have financial implications to the City and the long term impacts to the economy, and have the potential to erode the public trust in the reliability of recycled water as a source of supply. Mitigation measures that can be taken to address drought conditions include: closely monitoring storage/flow to predict shortages of supply, advance notification to potentially impacted customers, and outreach to irrigators to improve irrigation efficiency and conservation during drought years.

Fires

The following critical facilities are exposed to hazards from brush or forest fires:

- Calpine injection wells and power generation facilities;
- Geysers pump stations (mountain reach) and the Terminal tank;
- North Pump Station; and
- Individual point-of-use agricultural user pump stations.

The pump stations within the valley are easily accessible to emergency responders. However, the three Geysers pump stations in the mountain reach are located in steep mountainous areas where fire danger is higher and the ability to fight fires is compromised due to limited access on narrow mountain roads. These pump stations should be of critical concern for the City to protect and access.

Though not exposed to fire, the high-density polyethylene (HDPE) portion of the Geysers pipeline that was used for the connection near the Bear Canyon and Terminal reservoirs is vulnerable to the heat associated with fire. When HDPE is heated, the Modulus of Elasticity drops and the pipe is more susceptible to deformation from soil loads and surcharge loads. While the safe working pressure would be reduced at elevated temperatures, neither of these conditions are considered critical vulnerabilities (facilities still function). Moreover safe working pressure can drop by half because the required pressure needed for operation near the reservoirs is very low. The HDPE portion of the pipeline is unlikely to be compromised by fire provided at least 3 feet of cover is provided, which is typical.

Current levels of fire protection for the remote portions of the Geysers system are unknown. Measures that could be taken to mitigate fire risk include:

- Increased monitoring of fire hazards near critical facilities during high fire risk;
- Implement program of monitoring for fire hazards as part of preventative maintenance program;
- Provide defensible fire barriers around all critical facilities;

- Consult with local fire protection authority;
- Advise local authority of existence of critical facilities and collaborate to develop comprehensive mitigation and notification plan;
- Install fire detection instrumentation around critical facilities, i.e. light spectrum monitors;
- Incorporate routine testing of fire detection equipment at all facilities; and
- Provide fire hydrants at strategic locations along the Geysers pipeline, at reduced pressure required to meet fire district needs.

Earthquakes

The City of Santa Rosa is bisected by the Rodgers Creek Fault, making the area highly vulnerable to earthquakes. The City maintains a “catastrophic reserve” that would be available to address impacts of damage to the wastewater system (including LTP) following a Rodgers Creek fault event. The Draft Hazard Mitigation Plan examined seismic vulnerability scenarios, and Figure 5-4 shows a high to very high degree of ground motion associated with a magnitude 6.7 earthquake associated with a Rodgers Creek fault rupture.

Recommended mitigation measures from the Hazard Mitigation Plan include:

- Retrofit, replace, or relocate critical facilities that are shown to be vulnerable to damage in natural disasters (Action 1.5)
- Identify/analyze sanitary sewer trunk lines (Rohnert Park, Cotati, and Sebastopol force mains) that are determined to be structurally deficient where crossing fault zones. Retrofit/replace as necessary (Action 4.4)
- Develop a plan for expediting the repair and functional restoration of the wastewater system through stockpiling of shoring materials, temporary pumps, surface pipelines, portable hydrants, and other supplies (Action 7.4)
- The LTP Condition Assessment (Santa Rosa, 2012b) included a seismic structural assessment of occupied buildings, as well as a basic assessment of nonstructural facilities. The Assessment recommended further (Tier 2) seismic evaluation of the Chemical Building and Maintenance Building, which represent typical construction from the two major phases of plant construction. Retrofit priorities were also identified for each building area, as shown below in Table 5-7. Buildings rated “NA” were identified as benchmark buildings, indicating that they are expected to perform well during an earthquake.

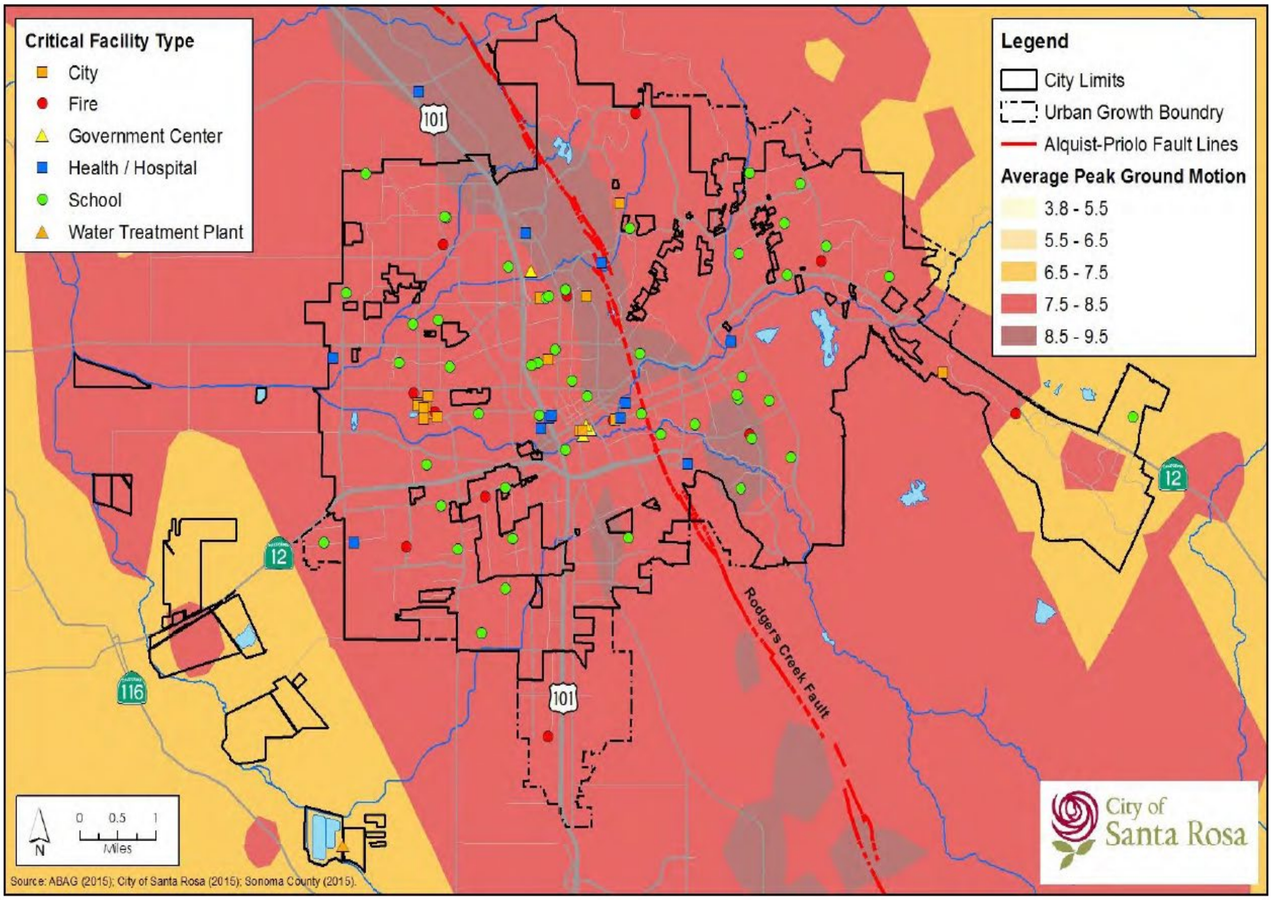


Figure 5-4 Worst-case Ground Shaking Scenario (source: Draft Hazard Mitigation Plan, 2016)

Table 5-7 Laguna Treatment Plant Structural Retrofit Priority

Building Name	Retrofit Priority Grouping
Primary Sedimentation Basins 1-6	High
Blower Electrical Building	NA
Blower Building	NA
Filter Control Building	High
Gravity Belt Thickener Building	Low
Digester 1 and 2 Equipment Building	High
Digester Control Building 12A	Medium
Digester Control Building 12D	Medium
Gas Booster Building	NA
Belt Filter Press Building	NA
Emergency Generator Building	NA
Chemical Building	Tier 2 Evaluation Recommended
Maintenance Building	Tier 2 Evaluation Recommended

Source: Laguna Treatment Plant Condition Assessment Project Summary Memorandum

The Geysers facilities were designed in accordance with building codes that were in force at the time. Given that those facilities were designed in the early 2000s, it is expected that those facilities would be safe from catastrophic damage from an earthquake. The two Russian River crossings are protected against accidental discharges from earthquakes by specially instrumented isolation valves on both side of the river at each crossing. Those valves were designed to automatically close and shut down Llano Pump Station if a significant seismic activity is detected near either valve. The City was compelled to provide this feature to address water quality concerns for the Russian River.

Damage to a seasonal storage pond due to a seismic event could result in a levee breach, causing potential damage to life and property in surrounding area. Mitigation measures to address this risk include:

- Perform periodic condition assessments of critical facilities
- Always check for obvious visual signs of damage or loss of integrity of any embankment/dam/levee. Can occur for other reasons such as rodent/erosion/vegetation. Mitigate as soon as observed.
- DSOD should be notified immediately if any problem with Regional storage reservoirs detected. The following reservoirs known to be under DSOD restriction: Delta Pond, Meadow Lane Ponds

Ecosystem and Habitat

Assets vulnerable to climate change may include those near habitats and wetlands vulnerable to erosion and sedimentation issues, estuarine habitats that rely on seasonal freshwater flow patterns, rivers and streams with environmental flow requirements, and areas with sensitive species (Van't Hof, et. al. 2016).

The LTP discharge permit allows treated effluent discharge from October 1 through May 14 of each year no greater than 5 percent of the flow in the River, whether deliberate or accidental. A reduction in flow in the river due to climate change can result in fines against the LTP if there is not sufficient flow to accept treated recycled water in excess of the available storage.

The City of Santa Rosa also owns large areas of land around the LTP and Regional System. During a survey of solar panel sites within these areas, many locations were excluded as possible sites due to the presence of sensitive species. According to the City of Santa Rosa General Plan Final Environmental Impact Report, the CTS, Burke's goldfields, Sonoma sunshine, Sebastopol meadowfoam, and many-flowered navarretia can be found in the lands in and around the City of Santa Rosa. Much of the lands purchased for the LTP serve as wildlife habitats, but climate change impacts such as droughts, floods, fires, and the increasing pressures of invasive species threaten to disrupt natural processes of the wetlands and waterways within the Regional System lands.

5.2.3 New Regulations

Regulatory requirements will continue to evolve over the next twenty years and with some foresight the City can account for anticipated changes and plan accordingly. Potential regulatory changes affecting discharge, land application of biosolids and water reuse practices could influence how the City elects to invest in its long-term operations.

Discharge

The City is permitted to discharge disinfected tertiary effluent to Santa Rosa Creek or the Laguna de Santa Rosa, and discharges preferentially to Santa Rosa Creek from Delta Pond. The City's discharge requirements are established in Order No. R1-2013-0001 and are intended to protect receiving waters. Discharge is prohibited from May 15 through September 30 each year, and must not exceed five percent of the Russian River flow during the allowable discharge period.

Since startup of the Geysers Expansion project, the majority of the City's recycled water has been delivered to the Geysers, urban irrigation, and agricultural reuse. There were no discharges during 2009, 2013, 2014, 2015, nor 2016 and minimal discharges occurred in 2010 and 2012. Annual discharge in millions of gallons is shown in Figure 5-5. Future regulatory changes that address nutrients and contaminants of emerging concern (CECs) will make discharge increasingly restrictive, and could require investment in additional treatment at the LTP.

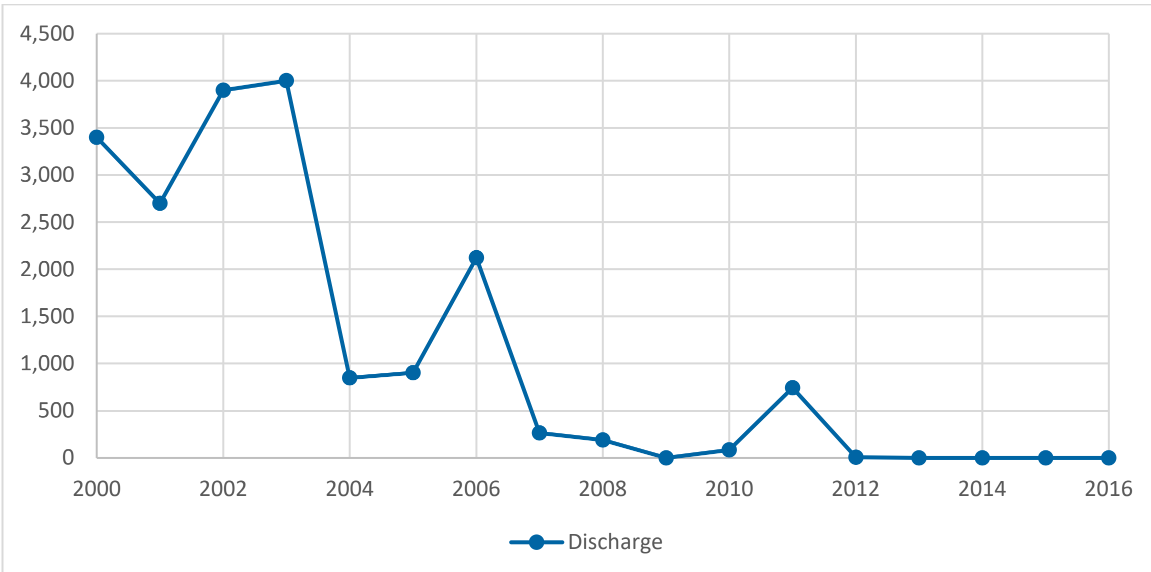


Figure 5-5 Annual Discharge

Nutrient Requirement and Nutrient Offset Program

Water quality impairments in the Laguna de Santa Rosa and Santa Rosa Creek have triggered the development of Total Maximum Daily Loads (TMDLs) for both water bodies. Both the Laguna and Santa Rosa Creek are impaired for nitrogen, phosphorus, dissolved oxygen, temperature, and sediment. Investigation and analysis by the Regional Board's TMDL Unit informed the effluent limits included in the City's 2013 permit. Evaluation by Regional Board staff indicated that phosphorus is the limiting nutrient in the Laguna de Santa Rosa watershed, the City's receiving water system. Water Board staff determined that data developed in support of the Laguna de Santa Rosa phosphorus TMDL indicated that any additional phosphorus load to the water body had the potential to negatively impact beneficial uses, and that "reductions in nitrogen loads beyond current levels are not expected to result in added protection of the beneficial uses, or significant water quality improvements in the water column" (Order No. R1-2013-0001, Appendix F). The Regional Board included a "no net loading" limit on phosphorus based on the lack of data to support development of a numeric nutrient criteria, consistent with the requirement in the City's previous Order. The City's ammonia discharge did not have a reasonable potential to produce acute or chronic impacts on aquatic life, therefore no ammonia limit was required.

The current permit also includes a performance-based limit of 10.6 mg/L total nitrogen on an average monthly basis. Water Board staff determined that the City's currently permitted discharge of nitrogen "is not believed to cause exceedances of the Basin Plan's narrative water quality objective for toxicity."

The Santa Rosa Nutrient Offset Program was developed and approved by the Regional Board in 2008, and included as a component of the City's 2013 permit. The Program is currently used as a basis for identifying, implementing, and certifying projects used to meet the City's zero net phosphorus limit, and it provides a framework for both nitrogen and phosphorus offsets. The Nutrient Offset Program is specifically designed to provide a framework for nutrient credit trading "during the interim period before the nutrient TMDL for the Laguna de Santa Rosa is implemented" (Order No. R1-2013-0001, Appendix H).

The Nutrient Offset Program is designed to allow the City to implement projects that reduce nonpoint source loading of nutrients to the Laguna, and compliance is determined based on a mass loading balance that shows less phosphorous was discharged than offset elsewhere in the watershed. Recognizing that habitat restoration is an important element of addressing impairments in the Laguna, The Freshwater Trust is working with the City of Santa Rosa to develop an instream crediting framework that would allow the City to also secure nutrient credits as a result of instream restoration activities (The Freshwater Trust, 2015).

Upon completion of the TMDL, the City expects to receive waste load allocations (WLAs) for nitrogen and phosphorus. The WLA for nitrogen may result in a lower effluent concentration limit. The City could further reduce effluent nitrogen discharges by:

- Implementing enhanced nitrogen removal through mainstream or sidestream treatment. The current limit of 10.6 mg/L is near the limit of what typical treatment plants can achieve without supplemental carbon addition, so treatment to reduce nitrogen loading may require additional carbon.
- Utilizing the Nutrient Offset Program to obtain credits to offset nitrogen discharged from the LTP.

CECs

Contaminants of emerging concern (CECs), including pharmaceutical and personal care products (PPCPs), are unregulated constituents that may be detected in water and for which little may be known about their potential risk to human health and the environment (USEPA, 2012). The United States Environmental Protection Agency (USEPA) gathers CEC occurrence data through the Unregulated Contaminant Monitoring Rule (UCMR), which requires utilities to monitor 30 EPA-selected CECs every 5 years. Some individual CECs may become regulated by USEPA after a long screening process that begins with their inclusion on a Contaminant Candidate List (CCL). The regulatory process is slow and meticulous – less than 100 drinking water contaminants have gone through a formal process over the last few decades involving review of detection methods, occurrence, and health effects and were eventually regulated by maximum contaminant levels (MCLs). A draft version of the most recent list (CCL4) contains 100 chemicals or chemical groups and 12 microbial contaminants. This draft was prepared by EPA in 2015, and reviewed by the Science Advisory Board (SAB) in early 2016.

The California State Water Resources Control Board (SWRCB) has also been evaluating the potential risk that CECs pose in both recycled water and discharged effluent. The Board established a CEC Advisory Panel in 2009 to provide guidance for developing monitoring programs that assess potential CEC threats from various water recycling practices (SWRCB, 2010). On December 15, 2010, the SWRCB established its intent to implement recommendations from the CEC Science Advisory Panel. In 2011, the SWRCB charged the Southern California Coastal Water Research Project (SCCWRP) with conducting further investigation into the assessment of CECs in recycled water.

Recent legislative efforts have focused on the control of CECs prior to entering the waste stream, rather than on regulating their occurrence in effluent discharge or recycled water. The 2015 Microbead-Free Waters Act and the FDA's rule banning the use of 19 antiseptic ingredients in the over the counter antimicrobial products (81 FR 61106) demonstrate the willingness of federal agencies to regulate CECs through product controls rather than discharge limitations. Sonoma and Mendocino County have also implemented a Safe Medicine Disposal Program to promote safe disposal of unwanted medications and prevent the pharmaceuticals from being discharged into the environment. Drop boxes are located throughout the region, including two in Santa Rosa.

Based on this recent focus on source control for CECs it may be best for the City to continue monitoring the EPA's and SWRCB's position relative to CECs and refrain from planning for any treatment-based approach to meeting new requirements, especially since the demand for recycled water is expected to increase and the frequency and amount of water discharged is decreasing.

Biosolids

Biosolids are classified into two general categories, Class A and Class B. Biosolids reuse and disposal is regulated under 40 Code of Federal Regulations (CFR) Part 503, and SWRCB adopted Water Quality Order 2004-12-DWQ, which establishes standards for biosolids consistent with EPA's regulations and California Water Code.

Class A biosolids contain insignificant levels of pathogens. To achieve Class A, biosolids must undergo heating, composting, digestion or lime addition that reduces pathogens to below detectable levels. Biosolids must also meet or exceed federal standards for nine regulated pollutants in accordance with 40 CFR Part 503.13(b)(1) or (3). If the biosolids achieve the low pollutant concentrations specified in 40 CFR Part 503.13(b)(3) and Class A with respect to pathogens they are deemed Class A Exceptional Quality (EQ). Class A EQ biosolids can be land applied without any pathogen-related restrictions at a site or bagged and marketed to the public for application to lawns, gardens and multiple other landscape uses.

Class B biosolids have less stringent standards for treatment and contain small amounts of pathogens. Class B regulatory requirements ensure pathogens in biosolids have been reduced to levels that protect public health and the environment and include certain restrictions for crop harvesting, grazing animals and public contact for all forms of Class B biosolids. As is true of their Class A counterpart, Class B biosolids are treated in a wastewater treatment facility and undergo heating, digestion or increased pH processes before leaving the wastewater treatment plant. Unlike Class A, Class B biosolids cannot be bagged or marketed to the public for application to gardens, landscapes or other public uses. Rather, Class B biosolids are typically land applied to agricultural sites under permits and with restricted public access. Site management practices must be in place to maintain appropriate setback distances to drinking water wells and streams, control public access, follow appropriate grazing or harvest restrictions, and apply biosolids at appropriate rates. When managed in this way, biosolids land application provides beneficial reuse or recycling of nutrients and organic matter."

As with effluent discharge and recycled water use, there is interest from the public and regulatory agencies regarding the presence of CECs and other organics in biosolids, and potential impacts related to land application of both Class B and Class A biosolids. The US Geological Survey (USGS) is conducting several studies to address this issue (USGS, 2016):

- A Source Characterization Study estimating the potential environmental contributions of select CECs in a range of waste sources (including municipal biosolids),
- Biosolids sampling of nine different biosolids for 87 organic chemicals including cleaners and PPCPs
- A study of the fate and occurrence of pharmaceuticals in wastewater effluent and biosolids, focused on targeted estrogenic compounds

- Investigation of the persistence and vertical transport of emerging contaminants in the soil zone following land application of biosolids

In addition to growing regulatory scrutiny, land application of both Class A and Class B biosolids is threatened by the growth of organic farming in California. The US Department of Agriculture's (USDA's) National Organic Program excludes the use of biosolids and compost product in organic farming. Organic farming has grown steadily in California over the last 20 years, with sales increasing from $75 million in 1992 to $1.5 billion in 2012. During the same period, the acreage dedicated to raising organic crops increased from 42,000 acres to over 250,000 acres. Organic pasture and rangeland added nearly 350,000 additional acres (Klonsky, 2012).

If current agricultural practices in Sonoma County are replaced with organic farming practices, opportunities for land application of biosolids (Class A or Class B) will diminish. To mitigate for this trend the City could purchase agriculture lands specifically for biosolids application and then enter into leases with local farmers for agricultural operations, or advocate for change to the restriction on use of biosolids on organic crops.

Water Reuse

Existing and anticipated regulations that could impact the City's future plans for water reuse are focused in three areas: (1) groundwater replenishment (surface spreading and direct injection), (2) surface water augmentation, and (3) direct potable reuse. There are currently no regulatory guidelines for streamflow augmentation projects with recycled water. For the purpose of this Master Plan, it is assumed that the treatment technologies and water quality requirements for streamflow augmentation would be similar to a groundwater replenishment project via direct injection. The following sections describe existing and potential future regulations regarding water reuse.

Groundwater replenishment through surface spreading and direct injection are governed by the Groundwater Replenishment Reuse (GRR) Regulations, which were promulgated on June 18, 2014. Table 5-8 below summarizes the GRR Regulations for spreading and direct injection.

Table 5-8 Summary of Groundwater Replenishment Reuse Regulations

Water Quality Limits for Recycled Water	Treatment and Diluent Requirements
≥ 12-log virus reduction ≥ 10-log Giardia cyst reduction ≥ 10-log Cryptosporidium oocyst reduction Drinking water MCLs (except for nitrogen) ≤ 10 mg/L total nitrogen Action levels for lead and copper TOC ≤ 0.5/RWC	**Surface Spreading with Tertiary and Diluent Water** Oxidation, Filtration, Disinfection, Soil Aquifer Treatment Diluent Water (based on TOC of recycled water) **Surface Spreading with FAT*** Oxidation, Reverse Osmosis (RO), Advanced Oxidation Process (AOP) Diluent Water (based on TOC of recycled water) **Direct Injection with FAT*** Oxidation, RO, AOP No Diluent water required
Other Selected Requirements	
Treatment train shall consist of at least 3 separate treatment processes to achieve the pathogenic (microorganism) control For each pathogen (i.e., virus, Giardia, or Cryptosporidium (V/G/C)), a separate treatment process may be credited with no more than 6-log reduction, with at least 3 processes each being credited with no less than 1.0-log reduction ≥ 2-month retention (response) time underground Initial maximum RWC ≤ 20% for spreading tertiary treated water (depending on TOC of recycled water) or up to 100% for Injection with FAT. Over time the RWC can be increased if certain requirements are met. For spreading, or Injection with FAT, 1-log virus reduction credit automatically given per month of subsurface retention For spreading, 10-log Giardia reduction and 10-log Cryptosporidium reduction credit given to disinfected tertiary effluents with at least 6 months retention time underground	

Notes:
MCL = maximum contaminant level, TOC = Total Organic Carbon
RWC = recycled water contribution (the quantity of recycled water applied at the recharge site divided by the sum of the quantity of recycled water applied at the site and diluent water)
FAT = Full Advanced Treatment
* The treatment technologies listed do not include the full range of advanced treatment processes available to achieve FAT (i.e. Microfiltration (MF), ozone, decarbonation, etc.). Also, an alternative treatment approach to meeting the GRR Regulations may be approved if the project can demonstrate to DDW that the proposed alternative can reliably meet all water quality objectives and assures at least the same level of protection of public health.

In **Surface Spreading**, recycled water is discharged into spreading basins, where it percolates through the vadose (unsaturated) zone until it joins native groundwater and travels horizontally (saturated zone) towards extraction wells. Physical (filtration), chemical, and biological processes treat water through the vadose and saturated zones. This geopurification system is known as soil aquifer treatment (SAT). Per the GRR Regulations, the wastewater needs to be treated to meet the criteria for Title-22 RW unrestricted use (e.g. disinfected tertiary recycled water). Implementation of any surface spreading project requires blending recycled water with a diluent water such as surface water, stormwater, native groundwater or imported water. The LTP has the appropriate level of treatment to meet the GRR Regulations for surface spreading.

In **direct injection**, recycled water that has gone through a Full Advanced Treatment (FAT) process is directly injected into the saturated groundwater zone, bypassing SAT. The implementation of FAT, also referred as Advanced Water Purification (AWP), includes microfiltration (MF), reverse osmosis (RO) and an advanced oxidation process (AOP) and allows for the use of up to 100% recycled water (e.g. no dilution requirement) and as little as a 2-month minimum retention time, if the 12-10-10 microbial requirements are met.

The GRR Regulations have specific requirements for the RO and AOP technologies in the FAT train. The RO membranes must achieve a minimum and average sodium chloride rejection of 99.0% and 99.2%, respectively. The initial RO permeate TOC must be less than 0.25 mg/L and not exceed 0.5 mg/L over the long term, based on a 20-week running average of all TOC results and the average of the last four TOC results. Any advanced treatment train constructed as part of a direct injection GRR project would result in a brine concentrate from the RO process that would require disposal via and outfall to the ocean or by further concentrating the brine to allow for land disposal.

Alternative treatment process trains are considered by the DDW if all water quality objectives can be reliably met and comparable protection of public health can be proven.

A **Surface Water Augmentation** (SWA) project is defined as a project that plans to use recycled municipal wastewater for the purpose of augmenting a reservoir that is designated as a source of domestic water supply. In the most recent draft SWA regulations, the requirements include achieving:

- a dilution requirement in the reservoir of 100:1 (or 10:1 with an additional 1-log microbial pathogen treatment), and
- a retention time of four to six months (calculated as total volume divided by total outflow).

If both of these requirements cannot be met then the project may be considered a direct potable reuse project with a small environmental buffer. The inclusion of an alternative permitting process in the draft SWA regulations is uncertain at this time.

The anticipated treatment requirements for SWA look very similar to the GRR Regulations, particularly with regard to pathogenic microorganism control. The draft SWA regulations require that any 24-hour input of recycled water into the reservoir must be mixed such that water withdrawn for use as drinking water never contains more than 1% (or 10% with an additional 1-log treatment) recycled water. A dilution factor of 10% would require treatment to achieve 12/10/10 log removal requirement for virus, Giardia, or Cryptosporidium (V/G/C). If the dilution factor is above the 1% dilution, but below the 10% dilution requirements, the pathogenic microorganism control requirement would likely require additional treatment to achieve 13/11/11 log removal requirement for V/G/C.

Where treatment credits are concerned, the principal difference between groundwater recharge and reservoir augmentation is the availability of treatment credit in the conventional drinking water treatment plant. The proposed treatment system concept for SWA would be to achieve the required 12/10/10 log removal requirement for V/G/C through FAT and rely on drinking water treatment that is located on the downstream side of the reservoir storage to meet the incremental increase to 13/11/11 log removal requirement for V/G/C.

A **DPR** (Direct Potable Reuse) project is defined as the planned introduction of recycled water either directly into a public water system or into a raw water supply immediately upstream of a water treatment plant. The recently released report “Draft Investigation on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse” (SWRCB, 2016) identified the three possible types of DPR projects:

- Small Environmental Buffer: delivers purified water into reservoir that is too small to comply with the SWA criteria,
- Source Water Blending: blends purified water upstream of a drinking water treatment plant (directly or with the raw water supply), and
- Pipe-to-Pipe: directly augments the public water system’s distribution system with purified water.

The concept of DPR is fairly new and untested in California. As a result, there is very little data on DPR treatment design, performance, and safety. The feasibility of developing regulations for DPR will be completed by the end of 2016; however, there is no mandated timeline for the state to develop a formal DPR regulatory framework. Regardless of the regulatory framework, successful implementation of DPR depends on highly trained operators and technicians in addition to infrastructure that incorporates redundancy and other measures to protect public health.

The WateReuse Research Foundation (WRRF) has created a keystone project that seeks to tie together many of the findings from the last six years of potable reuse research. This project is WRRF 14-12, entitled "Demonstrating Redundancy and Monitoring to Achieve Reliable Potable Reuse". This project utilized a 1.6-MGD demonstration project at the City of San Diego's North City Water Reclamation Plant. WRRF 14-12 has developed a DPR conceptual process train that further augments both the treatment protection and the monitoring to provide continuous and demonstrable performance of a DPR train. The treatment train used in WRRF 14-12 includes the addition of ozone and biologically activated carbon (BAC) as pretreatment. Thus, for the purpose of this study it is assumed that a DPR treatment train would include a similar FAT process as described for GRR via direct injection, with the addition of ozone and BAC.

The regulatory requirements for groundwater replenishment, surface water augmentation and direct potable reuse would impact WRS operations only if the City were to adopt one of these described practices for reuse. Current practices (urban and agricultural irrigation and steamfield injection) are not impacted by these regulations and if the City elects to continue or expand the current practices there would likely be no need for additional treatment.

5.2.4 Failure of Critical Facilities

The City depends on the continued availability of certain assets and systems to meet its service levels. Failure of critical facilities impairs the City’s ability to meet these levels of service and could lead to permit violations and failure to satisfy contract obligations. Potential risks associated with failure of critical facilities were identified based on existing documents and interviews with City staff are described below.

Treatment Facilities

The Laguna Treatment Plant Condition Assessment Project (Carollo, 2012) identified possible single points of failure at the LTP. Failure of the following assets was deemed to be a probable cause of substantial disruption to the plant.

- 42-inch Equalization Basin Supply (EBS) pipe – Peak flow is managed by directing primary flow to the Equalization Basin using this pipe. The pipe is difficult to isolate, and the City plans to contract for emergency pumping in the event of failure.
- Aeration header – a single header and pipe conveys all aeration air from the blower building to the aeration basins. Failure of this pipe would critically disrupt secondary treatment.

- Backwash Waste Water (BWW) and Equalization Basin Return (EBR) pipelines – these pipes convey filter backwash to the backwash equalization basins and return pump station to the aeration basins. The BWW pipeline has no redundancy, but the plant is able to reroute return flow to the headworks.
- Solids handling – a single 24-inch RAS (Return Activated Sludge) line conveys RAS from clarifiers 6A-6D. A failure in this line would constrain plant staff's ability to operate the secondary treatment process. Sludge from the four digesters is routed to the belt filter presses using a single drain pump. Failure of this pump would impede sludge transfer from the digesters; however, this would not be an immediate point of failure.

Additional areas of potential failure have also been identified by plant staff and included in the 2017 CIP budget. These improvements include seismic retrofit and roofing of the LTP maintenance building, and Filter Influent Pump Station discharge piping.

Seasonal Storage

All of the City's ponds are critical for seasonal storage, given the inability to discharge from May through October. Seasonal storage is also needed to ensure adequate recycled water supply to meet contractual demand for the Geysers system, and to provide seasonal irrigation for urban and agricultural customers. Potential modes of failure related to the seasonal storage ponds include:

- Seismic breach of pond berms;
- Pipeline breach and resulting erosion of pond berms;
- Breach of pond berms from rodents and burrowing animals.

The City maintains a water storage model that is used to predict future required storage volumes based on historical trends and current weather patterns. This tool should be updated monthly so that immediate measures can be taken to move water if there is a breach at any of the ponds. In addition, the City should perform regular inspection of pond berms and related appurtenances, checking for signs of damage or loss of integrity of any earthen berm, inlet or outlet structure, and appurtenant piping. The Delta Pond and Meadow Lane Pond complexes also fall under jurisdiction of the Department of Safety of Dams (DSD), and must meet DSD requirements for dam safety and maintenance.

Geysers Conveyance

Loss of operability of the Geysers conveyance system could have significant implications on level of service depending on the length of time that the system was down. Without the Geysers conveyance system the City would need to store the water that would otherwise be delivered to Calpine and, depending on the time of year, storage capacity could be limited. Also, depending on the cause of the failure and duration of the system outage, the City could fail to meet its monthly delivery to Calpine which could have financial implications if the loss of water is not made up in subsequent deliveries. Potential modes of failure for the Geysers system include:

- Catastrophic event (fire or earthquake) resulting in loss of a pump station;
- Pipeline breach due to an earthquake that necessitates shutdown of the system while repairs are conducted;
- Pipeline breach caused by a landslide that necessitates shutdown of the system while repairs are conducted;
- Loss of all communications from SCADA/slave facilities; and
- Loss of Geysers command center (SCADA master).

Preventative measures that are currently or could be taken to mitigate risk of a failure in the Geysers conveyance system include:

- Maintain spare parts inventory for long lead items, such as pump impellers, wear rings, and motor(s);
- Conduct periodic condition assessments and surveys to monitor potential landslide activity near the pipeline;
- Perform routine testing and preventative maintenance on seismic isolation valves; and
- Continue to maintain redundant communications: the Geysers Pump Stations and SCADA/ communications systems are wired for both fiber optic communication and radio telemetry to provide critical process feedback for the Geysers Pump Stations.

The Geysers conveyance system was designed with features that mitigate the probability of failure and, in the event that a major failure does occur, there would typically be storage capacity available in the seasonal storage ponds during most occasions to divert water until repairs could be made. In the spring when the storage ponds are often filled to near capacity there is a risk that a failure of the Geysers facilities would lead to a discharge and potentially a discharge violation. Additional storage capacity is expensive to build, but would provide added flexibility for managing stored water if an unexpected failure of the Geysers conveyance system were to occur at any time. There are two connections between the Geyser Pump Station and the recycled water storage facilities, one at the Delta Pond and the other at the town of Winsor's recycled water storage pond. Both can receive water from the Geysers Pipeline; either or both can be used to drain the pipeline if needed for repair, maintenance, or other uses. The connection between the Geyser Pump Station and the Delta Pond contains a 130-foot section 12-inch section of main that should be replaced with 33-inch pipe to eliminate this hydraulic bottleneck.

Recycled Water Distribution (High Pressure)

Vulnerabilities to the high-pressure system are similar to those of the City's potable water distribution system:

- Temporary power failure;
- Pipeline damage from unrelated construction or material failure due to age; and
- Equipment failure.

Potential mitigation strategies include the following:

- *Rely on installed standby units while affected unit is repaired;*
- *Maintain spare parts on hand for long lead items such as pump impellers, vertical motors;*
- *Maintain on-call contracts with underground pipeline contractor;*
- *Enforce City's design/construction standards for recycled water mains;*
- *Provide backup power at critical pump stations;*

The vulnerability of Santa Rosa's high-pressure system is low because it is relatively new and the demands are smaller. This smaller system could easily accommodate reduced deliveries for brief periods of time, as both the short-term and long-term consequences are negligible, without the consequence of fines or significant economic damage.

Recycled Water Transmission (Low Pressure)

Vulnerabilities to the low-pressure system are unique, and include:

- *Reliable working pressures are not known for all reaches of the pipeline. Documentation of the design basis of the mains and appurtenances is limited, and as a result, the system must be operated at very low pressures; and*
- *No condition assessment of the buried assets has been completed.*
- *Risk of failure in buried creek crossings*

Failure of the low-pressure system would have significant consequences as it moves recycled water to the storage ponds and serves all agriculture and urban irrigation users

Some portions of the low-pressure system, such as the West College pipeline, were converted from gravity service to low-pressure service, and consequences of a breach could result in damage from localized flooding, potential permit violations if recycled water is discharged to a creek, and reduced deliveries of recycled water to customers.

Mitigation measures to address vulnerabilities in the low-pressure system include:

- *Exercising existing isolation valves regularly;*
- *Isolating breaks using existing isolation valves;*
- *Adding new isolation valves to increase isolation capabilities;*
- *Maintaining recycled water deliveries from the E Pump Station and Delta Pond Pump Station. The Delta Pond Pump Station can serve customers north of breach, and E Pump Station can be used to serve south of breach. This operation is not inconsistent with how the pump stations operate normally;*
- *Performa a detailed condition assessment on the low-pressure transmission main to establish a working pressure.*

Compost Facilities

There are several components of the compost facility that pose potential points of failure. These include the following:

- *Conveyor. There is a single conveyor that moves compost from inside the compost building out to the yard where curing piles are constructed. Composting operations would stop should the conveyor breakdown.*
- *Walking floor drive units. The hydraulic drives units for the compost facility's walking floors are located below ground in an area prone to flooding. This hampers maintenance and puts the equipment at risk of water damage. Loss of the hydraulic drive units would stop composting operations.*
- *Roof structure: the portion of the roof that encloses the agitated bay composting station is failing; approximately two-thirds of the facility roof structure needs to be replaced.*
- *Fire suppression system requires inspection to determine ability to meet required demands.*

The uninterrupted operation of the composting facility is critical to the successful operation of the LTP and its regulatory compliance requirements. Outages could be mitigated by maintaining excess biosolids storage capacity within the compost facility and stocking adequate spare parts to reduce downtime.

Because of the nature of its operations, the compost facility is vulnerable to fire hazard, primarily from spontaneous combustion in the compost itself. The exothermic composting process can generate temperatures high enough to cause spontaneous combustion. While this is relatively rare, it is a hazard that should be monitored. The City should consult with the local authority having jurisdiction to identify mitigation and emergency procedures. Controlling moisture content during curing is typically used to manage compost temperature and avoid reaching conditions where spontaneous combustion could occur.

5.2.5 Loss of Recycled Water and Biosolids Disposal Options

Many of the City's disposal options rely on agreements or partnerships with private partners. Beneficial reuse sites are documented in the City's Laguna Regional Water Reclamation System Annual Reports. The loss of any of these disposal options would pose a significant challenge to the City. The following discussion evaluates risks to the City's current disposal practices. The City should determine where existing agreements can be strengthened or new agreements reached to secure the partnership of all users, especially agricultural customers.

Class B Biosolids

Class B biosolids are reused through agricultural land application and disposal at the Redwood landfill where they are used as alternative daily cover. Threats to reuse and disposal of Class B biosolids include:

- *Conversion of agricultural property to other uses. Climate change (decreasing precipitation and lower crop yields) and changes in property ownership (generational transfer of agricultural properties) both contribute to loss of local property suitable for Class B land application.*
- *Growth of organic farming. Under USDA rules, organic farming practices are precluded from using either Class A or Class B biosolids. As organic farming becomes more prevalent, use of biosolids may decrease.*
- *Permitting new land application sites is extremely difficult in the presence of the CTS*
- *Reduction of available irrigation water. The application of biosolids is related to crop production, so if lack of water supply forces farmers to reduce the land used for agricultural production, the amount of biosolids applied to the land can also be reduced.*
- *Closure or changes in management at Redwood landfill. Many landfills will not accept biosolids as alternative daily cover. Though there are other Class III landfills in the region permitted to accept water/wastewater sludge, it is uncertain whether any would accept Santa Rosa's biosolids as alternative daily cover. The Central Landfill in Sonoma County and the Redwood Landfill in Marin County are the only facilities in the North Coast RWQCB region permitted to accept wastewater sludge. The Hay Road landfill in Solano County (Central Valley RWQCB) also accepts wastewater sludge.*

Class A Biosolids

Composted (Class A) biosolids are sold as commercial soil amendment. Limitations on use of compost include:

- *Growth of organic farming. Under USDA rules, organic farming practices are precluded from using either Class A or Class B biosolids. As organic farming becomes more prevalent, use of biosolids may decrease.*
- *Climate change. Persistent drought conditions and ongoing water conservation efforts (such as installation of more efficient irrigation and conversion to low water demand landscaping) have reduced landscaping on private property, leading to a decrease in compost demand for landscaping and gardening.*

Recycled Water

The current NPDES permit requires that the City maintain a total reclamation capacity of 4,015 mg annually for Geysers Recharge, and another 2,590 mg annually for distribution to permitted users. See Table 5-4 in section 5.1.3 for a tabulated summary of demands. The WRS capacity fulfills this requirement but the City is also reliant on agreements with Calpine for their Geysers Power Company and local agricultural operators to achieve these mandated reuse objectives. Potential threats to meeting the NPDES requirements include:

- *Termination of Geysers Power Company (GPC) agreement. Power production declines and/or seismic activity associated with recharge increases, compelling Calpine to buy out of the agreement prior to its expiration.*
- *Failure to successfully renegotiate GPC agreement with Calipine. There is risk that the City and GPC could disagree on terms during contract renegotiation, resulting in the loss of this customer.*
- *Loss of local agriculture. Climate change (decreasing precipitation and lower crop yields) and changes in property ownership (generational transfer of agricultural properties) both contribute to loss of local agricultural operations seeking to use recycled water for irrigation.*
- *The risk of termination of the GPC agreement appears to be low given the level of investment in power production infrastructure. The loss of agricultural operations that are currently permitted users is more likely, but not a significant concern at this time. Failure to successfully renegotiate an agreement with Calpine is possible, though this also seems unlikely as GPC is heavily reliant on reuse water from the City.*
- *Moving forward, the City may wish to consider renegotiating with existing agriculture customers to begin charging for delivery, manpower, infrastructure and electricity. As shown in Table 5-4, agriculture customers represent approximately 29% of the beneficial reuse (1,859 MGal/yr. To mitigate the risk associated with loss of local agricultural partners, the City could enter into new agreements with agricultural operations along the Geysers pipeline, investigate expanding urban reuse, or increase deliveries to Calpine.*

5.2.6 Shortage of Recycled Water

Because the availability of recycled water is weather dependent, the City requires a buffer in its recycled water user agreements that allows the City to modulate deliveries based on the availability of recycled water in drier years. This buffer is provided currently through the agricultural user agreements. With the potential for urban demands increasing in the future, and with the need for the region to comply with SGMA, there may be more pressure on recycled water deliveries going forward that could lead to contract re-negotiations or terminations. Potential threats for recycled water demands exceeding availability include:

- *Surface water rights from Russian River are curtailed due to drought or permit issues and interest in recycled water for IPR/DPR increases with potential urban users requiring a non-interruptible water supply.*
- *Climate change increases irrigation demands for agriculture. Higher temperatures and extended drought cycles lead to higher evapotranspiration rates for agricultural operations, resulting in higher irrigation demands. SGMA requires a sustainable water balance for groundwater aquifers putting a limit on groundwater pumping, and local farmers look to recycled water as the solution to meet the higher irrigation demands.*

Surface water diversions could be curtailed under extended drought conditions. If Sonoma County's surface water supply was ever compromised, potable water supplies would be scarce and interest in indirect potable reuse could grow.

The Regional Agreement provides for each of the Partners to have the right to their percentage of wastewater conveyed to the LTP for treatment. Although the urban demands from Rohnert Park and Santa Rosa are well under their respective contributions, this could change if surface water supplies were to be curtailed in the future. An increase in urban demands would require that the City renegotiate agreements with other users to balance supply of the limited resource. The alternatives considered would need to be cleared by the Regional Board and the NPDES permit amended to address how the recycled water would be used to avoid illegal discharges. In any case, the City would need to maintain a buffer to account for weather-dependent recycled water deliveries.

5.2.7 Capacity Limitations

The WRS facilities were in large part designed to handle the projected buildout ADWF condition of 25.89 mgd received at the LTP. Capacity limitations are limited to a few facilities and include:

- *UV Disinfection. The UV disinfection facility is nearing the end of its service life and the City is currently working on the design of a replacement facility. Due to a downward trend in UV transmittance of the treated water in recent years, the peak capacity of the facility was re-rated from the original design capacity of 67 mgd peak day down to 48.5 mgd peak day. The new facility will restore capacity to the full amount needed to handle peak day flows at buildout.*
- *Biosolids Seasonal Storage. Seasonal storage of biosolids at the Alpha Farm pole barn is required during the wet season (October through May). The facility holds about 7,000 wet tons and is currently at capacity. With flows to the LTP expected to increase due to growth in the service area, the City's new HSW receiving facility introducing new solids that were previously exported to other treatment plans, the City needs to add storage for an additional 5,000 wet tons of storage capacity for the buildout conditions.*
- *Geysers Pump Stations. The three mountain pump stations have a maximum capacity of 16.9 mgd with all five pumps operating, which is adequate to just meet the maximum monthly flow needed to satisfy the requirements of Schedule I of the GPC contract. During many months of the year, the Geysers Pump Stations operate well below maximum capacity.*

5.3 Summary

The following tables summarize key opportunities and risk mitigation needs at the Regional Water Resources Recovery Facilities.

Table 5-9 Summary of Opportunities at WRS

Area	Summary of Opportunity
Compliance Strategies	• Develop long-term nutrient management strategy to address reduced options for water quality credit trading over next 20 years • Pursue regulatory advocacy and partner with local stakeholders with shared interests in the Laguna/Russian River watershed • Promote Total Maximum Daily Load (TMDL) development and completion • Consider Title V air permit applicability and possible change to a synthetic minor permit • Consider implementation of an environmental management program to ensure compliance
Cost Efficiency – Energy	• Confirm, prioritize, and implement recommended cost-effective Energy Efficiency Measures (EEMs) and process improvements identified in the Energy Optimization Plan (Parts 1 and 2)
Cost Efficiency – Optimize Built Capacity	• Continue to promote high strength waste (HSW) discharge in order to fully utilize existing digestion capacity to maximize power and heat production from CHP facility • Implement existing CIP project for LTP Onsite Diversion to maximize utility of Flow Equalization Basins (FEBs) • As flows to LTP increase and existing customer needs are consistently met, identify potential agricultural customers in Alexander Valley to optimize use of Geysers pipeline • Implement existing CIP project for West College Storage Facility to maximize use of emergency storage facilities • Perform condition assessment of low-pressure recycled water system to develop replacement strategy and determine optimal pressure range to fully utilize existing delivery system • Install flow meters to monitor and reduce recycled water pressure bypass flows
Resource Recovery – Energy	• Implement recommended EEMs from the Energy Optimization Plan (Parts 1 and 2)
Resource Recovery – Recycled Water	• As flows to LTP increase, evaluate increased demands from existing customer base • Implement recommendations of ongoing study assessing delivery of recycled water to SCWA storage facility to maximize reuse capability
Resource Recovery – Potable Reuse	• Continue to monitor development of regulatory policy and regional projects with respect to regional potable reuse options
Resource Recovery – Biosolids	• Maximize beneficial reuse through diversity of products focused on market demand
Resource Recovery – Nutrients	• Assess opportunity for direct nutrient recovery at LTP as an alternative to current practices of nutrient recovery through water reuse and land application of biosolids

Table 5-10 Summary of Risk Mitigation Needs at WRS

Area	Key Risk Mitigation Needs
Aging Infrastructure	• Provide comprehensive condition assessments of aging infrastructure that has not been previously studied; implement renewal/replacement projects as needed
Climate Variability and Natural Disasters	• Implement CIP project for LTP Flood Protection • Develop fire mitigation program for mountain reach of Geysers conveyance system and perform ongoing monitoring of conditions at pump stations and HDPE pipeline • Address high priority retrofit needs and conduct Tier 2 Evaluation based on LTP Condition Assessment seismic evaluation
New Regulations	• As flows to LTP increase, increase seasonal storage to limit discharges as regulations become more restrictive • Continue to develop nutrient credit trading framework for restoration activities • Purchase land as mitigation for potential loss of biosolids land application sites • Evaluate treatment requirements to address potential regulations for CECs
Failure of Critical Facilities	• Perform condition assessments and implement renewal/replacement projects for critical facilities identified in the LTP Condition Assessment Project • Provide condition assessment and ongoing inspection of seasonal storage ponds • Conduct period assessment of Geysers conveyance to monitor active landslides in proximity to pipeline • Implement improvements in 2017 CIP to address critical condition deficiencies • Develop replacement strategy for low pressure recycled water delivery system
Loss of Disposal Options	• Maintain long-term agreement with Geysers Power Company • Assess potential agricultural demand along Geysers pipeline to mitigate loss of local agricultural customers • Secure additional lease agreements for biosolids land application
Shortage of Recycled Water	• Develop shortage plan to confirm priorities and balance delivery of recycled water during shortfall
Capacity Limitations	• Replace UV Disinfection facility with new equipment having a peak day capacity of 67 mgd • Install additional seasonal storage for Class B biosolids to accommodate increased flows from growth in service area, or increase capacity to deliver Class A biosolids • If recycled water deliveries to Calpine increase beyond Schedule I, expand three mountain Geysers pump stations to increase capacity • Increase storage at West College Storage Facility from 22.6MG to 49.6MG

6. Recommended Strategic Initiatives

Previous sections of this Master Plan describe existing WRS facilities, resource flow streams under current and buildout conditions, levels of service for WRS operations, and identify and characterize potential opportunities and risks anticipated over the next 20 years. This section provides the basis for recommended investments over the next 20 years that serve to achieve desired levels of service while managing risks and overall cost of service.

6.1 Optimization Strategies

Optimization strategies focus on strategic planning, cost efficiencies and revenue streams to balance cost of ownership with regulatory compliance and other service levels.

6.1.1 Strategic Planning

The City of Santa Rosa Water Department (Santa Rosa Water) convenes a Steering Team to facilitate long term planning activities for the utility, including the WRS. Each of the 23 sections of Santa Rosa Water prepares a 5-year strategic plan that aligns with Santa Rosa Water's mission, vision and goals. The current plans are through June 2017 and updates will be completed during fiscal year 2016/17. In addition to the periodic update of these strategic plans it is recommended that the City update the WRS Master Plan on a 5-year cycle to consolidate goals and objectives regarding the WRS into a single document, update opportunities and risks based on evolving drivers and regulatory requirements, and to incorporate new maintenance, renewal/replacement, and capital projects into the long term investment plan. The WRS Master Plan would therefore be updated next in fiscal year 2022/23.

6.1.2 Cost Efficiencies

Cost efficiency strategies include compliance strategies that avoid hard infrastructure investments, improved energy efficiency at WRS facilities, and making the best use of existing assets to maximize benefits from sunk costs.

Compliance Strategies

The City's three tiered approach to meeting its no net loading of phosphorous permit limitation includes 1) reusing as much recycled water as possible to reduce discharges, 2) removing as much phosphorous as possible during the wastewater treatment process and 3) offsetting phosphorous through the nutrient offset program.

The City's water quality credit trading program serves as a cost-effective strategy for complying with the Regional Board's requirement for no net loading of phosphorous in the Laguna watershed. As nutrient offset projects are completed, it will become increasingly difficult to implement cost-effective nutrient credit trading projects. The City needs to develop a long-term nutrient management plan that recommends alternative strategies and triggers for implementation of projects and programs that will continue to meet the mandated discharge limitations.

Energy Efficiency Strategies

In many cases, replacing older equipment increases service reliability and reduces lifecycle cost of ownership for the assets. Benefits that achieve a payback for the initial investment cost includes improved energy efficiency, better performance and reduced maintenance requirements (including staff time).

The City's EOP serves as a road map to strategically and systematically optimize energy use and lower operating costs. Part 1 of the EOP (Santa Rosa, 2014c) identified fifteen (15) energy efficiency measures (EEMs) that create savings in all four areas of the Regional facility operations (LTP, Geysers, Compost and Recycled Water) as described in Section 5, Table 5-1.

Part 2 of the EOP identified 7 additional EEMs (waste heat utilization, EMS, irrigation pump optimization, solar P, and mechanical digester mixing) as described in Section 5, Table 5-2. Total energy savings from the 22 EEMs recommended in the EOP is estimated to be 12.3 million kilowatt-hours (kWh) per year, resulting in an average annual savings of over $670,000 per year, and a Net Present Value (NPV) of cumulative net savings over 20 years of nearly $7.5 million.

Total annual GHG emission reductions from the EOP is 262 metric tons of CO_2 ($MTCO_2$), and cumulatively over the 20 years the EOP will reduce the City's GHG emissions by 23,400 $MTCO_2$ which is the equivalent of taking about 250 cars off the road for 20 years.

Optimize Built Capacity

Optimizing capacity of the existing treatment facilities is one of the most cost-effective strategies available to provide the desired level of services at the lowest possible cost. Opportunities that would optimize the existing built capacity are identified in Table 6-1 below.

Table 6-1 Optimization Strategies at the LTP and Compost Facilities

Opportunity	Description
Implement chemically enhanced primary treatment (CEPT)	CEPT uses chemical addition to enhance organic and solids removal and achieve phosphorus removal in the primary treatment process. Increasing organic and solids removal will reduce the load on the secondary treatment process, and can impact nitrogen removal by limiting available carbon. Removal of phosphorus using CEPT will also reduce the nutrient credits required to offset any phosphorus discharges from the plant effluent. The City is in the process of evaluating CEPT to remove nutrients.
Gas utilization improvements	With the increased gas production associated with HSW addition, LTP staff are concerned that gas production will exceed that required for one engine generator, but not be sufficient to operate two engine generators. To maximize beneficial reuse of digester gas, the City should obtain approval to supplement digester gas with natural gas in the engine generator feed. The City is in the process of implementing the SCR process to enable the use of more natural gas.
Digester Mixing Improvements	Retrofitting Digesters 3 and 4 as recommended under Energy Efficiency Strategies results in higher volatile solids reduction compared with current operation. This improvement is projected to reduce residual biosolids production by 12%.

6.1.3 Maximize Revenue Streams

Maximizing revenue streams is another means the City can use to minimize cost of ownership of WRS assets. Strategies for increasing revenue streams are described below.

Recycled Water

Recycled water used for urban reuse, agricultural reuse, and the Geysers steamfields accounts for the majority of the effluent produced at the LTP with the Geysers steamfield receiving the highest proportion of recycled water based on the average annual distribution from 2004-2016 (see Figure 6-1). Recycled water is an important source of supply in the region, and for customers of the Regional System. Potable water, raw water, and groundwater are available at varying reliabilities to customers of the Regional System, in addition to recycled water. Table 6-2 shows the rate schedules for potable, raw, groundwater, and recycled water of the City of Santa Rosa and nearby cities. While these water sources are not directly comparable, the table provides an illustration of the value of recycled water compared with other water sources in the region.

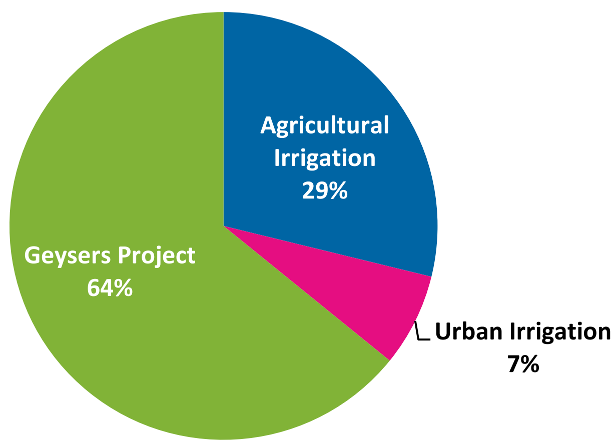


Figure 6-1 Average Annual (2004-2016) Recycled Water Distribution

Based on the rate schedules in Table 6-2 the greatest additional revenue could be generated by expanding recycled water deliveries to wholesalers and/or commercial and industrial customers. Increasing deliveries to these customers would come at the expense of deliveries to the Geysers steamfields and agricultural operations, customers that currently do not pay for water deliveries. This would be difficult to implement in the near term because the City has contractual arrangements for water deliveries to these customers and the WRS NPDES permit specifically calls for deliveries to the Geysers for weather independence and maintaining agricultural irrigation as a buffer for varying recycled water availability.

Cost to Operate

Looking strictly at the cost of energy to deliver water to various user types, the value of water can be compared for each type of demand (agricultural, urban, and Geysers) based on the energy costs to operate the largest pump stations. An energy audit of the recycled water system (Santa Rosa, 2014c) was conducted in 2014 and included the Regional System's major conveyance facilities as well as the small pump stations dedicated to individual agricultural users. Pumping costs from this Energy Audit are described in the following section.

Table 6-2 Comparison of Potable, Raw, Groundwater, and Recycled Water Rate Schedules in nearby Cities - $/AF

	Potable Water	Raw Water	Recycled Water						
	City of Santa Rosa		Regional	City of Petaluma	Town of Windsor	Napa Sanitation District[8]	Town of Yountville	City of Healdsburg	City of Calistoga
Urban Irrigation	$1,795-$2,274[1, 2]	$889-$2,252[3]	NA	NA	$961	$342-$512	$88-$176[9]	Does not charge for recycled water.[12]	Does not charge for recycled water.[13]
Commercial/ Industrial	$1,906	NA	NA	NA			$4,810[10]		
Agricultural	NA	NA	[6]	$819	$150		$88-$176[11]		
Wholesale	NA	NA	$130 - $254[7]	NA	$848		NA		
Other	NA	NA		NA	$300[7]	NA	NA		
Average	$1,940	$1,305	$1,858	$819	$474	$415	$1,691		

Notes:

1. Residential rates range for Single Family Residential Tier 1 (Up to sewer cap), Single Family Residential Tier 2 (Usage above sewer cap), Single Family Residential with no irrigation, and Multi-Family Residential
2. Dedicated irrigation rates range for Tier 1 (Up to 125% of billing period water budget) and Tier 2 (Over 125% of billing period water budget)
3. Rates range depending on contract type and service area.
4. Not used
5. Calpine provides power to the three mountain pump stations plus $300,000 per year through 2022 per Amendment 2 to the GPC Agreement.
6. Agricultural contracts were not reviewed as part of this study.
7. Wholesale rates are $130/af for interruptible deliveries, and $254.25/af for uninterruptible deliveries.
8. Rates range based on peak/off peak/time of year and minimum demand contracts.
9. Golf course irrigation
10. Commercial/Industrial consists of haul away construction water and includes an annual permit fee of $350 (escalated by 5%/year since 2014) and a flat rate of $992 (escalated by 5%/year since 2014) for the first 100,000 gallons.
11. Rates range based on peak (irrigation season) and non-peak demand.
12. Demands include haul away and direct line agricultural and construction (dust control).
13. Demands for golf course irrigation

Discharge

The City's energy cost to discharge to the river is the cost of energy for the E Pump Station (EB1, EB2, and EB3 pumps only). The E Pump Station conveys recycled water north to Delta Pond, where it is either pumped further for reuse or gravity fed to Laguna de Santa Rosa for discharge. Table 6-3 below presents the specific energy and unit cost of water to the City for discharge of recycled water. These costs do not include operations and maintenance, repair, spare parts, or staff time.

Table 6-3 Cost of Energy to Deliver Recycled Water – Discharge

Pump Station	Specific Energy (kWh/AF)	Unit Cost ($/AF)[2]
E Pump Station: EB1, EB2, EB3[1]	103	$10.32

Source: Pump Test Results provided by City of Santa Rosa for EOP Part 2

Notes:

1. E Pump Station data is based on an average of pump tests conducted in 2015 running each combination of two of the three EB pumps at a time.
2. Pump tests were performed to measure specific energy at each City owned pump station (i.e. energy requited to pump a unit volume of water). Cost of energy was assumed at $0.100/kWh.

Agriculture

The City's energy cost to convey recycled water to agricultural customers is the cost of energy for the E Pump Station (EB1, EB2, and EB3 pumps only) and the Delta Pond Pump Station. In general, those agricultural customers that are south of the Delta Pond Pump Station receive service through the E Pump Station only, and those customers that are located along the West College lateral off the Delta Pond Pump Station receive service through the E Pump Station and the Delta Pond Pump Station. Table 6-4 below presents the specific energy and unit cost of water to the City to deliver water to agricultural customers through the Regional Pump Stations.

Table 6-4 Cost of Energy to Deliver Recycled Water – Regional Agricultural Demand

Pump Station	Specific Energy (kWh/AF)	Unit Cost ($/AF)
Customers South of Delta Pond		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Customers Along West College Laterals		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Delta Pond	61	$6.67
Total, West College Laterals	**164**	**$16.98**

Sources: Pump Test Results provided by City of Santa Rosa for EOP Part 2 and 2014 Recycled Water Energy Audit

Notes:

1. Pump Station data based on an average of pump tests running each combination of two of the three EB pumps at a time.
2. Pump tests were performed to measure specific energy at each pump station. Estimates of energy costs are based on these test results and assume an average rate of $0.100/kWh and assumes $0.11/kWh.

The costs above do not include the cost to operate the pump stations dedicated to individual agricultural users or the cost of operations and maintenance, repair, spare parts, or staff time.

Table 6-5 below lists the pump stations (with PG&E data collected during the 2014 energy audit) that primarily serve individual agricultural users and their associated Regional Pump Station. Pump stations that pump recycled water from storage ponds or directly from the conveyance trunk line for reuse are excluded from this list (i.e., Rohnert Park, Meadow Lane Ponds, Brown Pond, Alpha Pond, Kelly Pond, Ambrosini Pond, West College Pond, Delta Pond, Denver, and Todd Road).

Table 6-5 Individual Agricultural User Pump Station Efficiency Evaluation

Pump Station [1]	Specific Energy Requirement (kWh/AF)[2]	Unit Cost ($/AF)[3]	Regional Pump Station(s) Used
MORRISON/N WEST 30HP	694	$138	E
OAKRIDGE	361	$123	E
MORRISON /S.WEST	423	$110	E
TOMROSE	361	$102	E
DEI SOUTH	336	$85	E
MUELRATH HM	328	$84	E
MUELRATH S	237	$71	E
TERRI LINDA	287	$67	E
MELLO A JR E	323	$63	E
BERETTA SOUTH	269	$57	E
PETERS DAIRY	354	$56	E
BERETTA RNCH	240	$52	E
#1384 DEI HOME	224	$51	E
LAFRANCONI WEST	287	$46	E
CHRISTENSEN S	303	$44	E
MATOS 30HP	173	$40	E
VANAZZA	743	$277	E + Delta Pond
HANSEN F WEST	563	$145	E + Delta Pond
ROBBINS	550	$133	E + Delta Pond
HENRY 15HP	264	$76	E + Delta Pond
HANSEN F EAST	376	$63	E + Delta Pond

Notes:
1. Pump Station name provided by City of Santa Rosa. See Recycled Water System Energy Audit Energy Optimization Plan (EOP) – Phase 1 Technical Memorandum 3 Attachment D for account information and meter numbers.
2. Calculated by dividing the annual flow by the annual energy use. Presented as the three-year average from 2011-2013.
3. Calculated by dividing the annual cost by the annual flow. Presented as the three-year average from 2011-2013.
4. This list is not comprehensive and contains only those pump stations with data from the 2014 Audit.
5. Energy cost based on pump tests and assume $0.100/kWh.

From Table 6-4 and Table 6-5 above, Santa Rosa's cost for energy to pump recycled water to agricultural customers range from $50/AF to $294/AF and averages about $102/AF. Table 6-6 below presents the total specific energy and unit cost of water to the City for conveyance of recycled water to agricultural customers.

Table 6-6 Cost of Energy to Deliver Recycled Water – Agricultural Demand Total

	Specific Energy (kWh/AF)	Unit Cost ($/AF)
Customers South of Delta Pond		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Average of Individual User Pump Stations[2]	325	$74.31
Total	**428**	**$84.63**
Customers Along West College Laterals		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Delta Pond[3]	61	$6.67
Average of Individual User Pump Stations[4]	499	$138.80
Total	**663**	**$155.78**

Notes:
1. E Pump Station data based on an average of pump tests conducted in 2015 running each combination of two of the three EB pumps at a time. Pump tests assume $0.100/kWh, and estimate specific energy and unit costs based on energy and time to pump 1,000,000 gallons.
2. Average of Agricultural User Pump Stations South of Delta Pond.
3. Assumes $0.110/kWh.
4. Average of Agricultural User Pump Stations along West College Laterals.

Table 6-7 Cost of Energy to Deliver Recycled Water – City of Santa Rosa and City of Rohnert Park Urban Demand

Pump Station	Specific Energy (kWh/AF)	Unit Cost ($/AF)
City of Santa Rosa		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Delta Pond[2]	61	$6.67
West College[3]	251	$27.60
Total	**415**	**$44.58**
City of Rohnert Park		
E Pump Station: EB1, EB2, EB3[1]	103	$10.32
Delta Pond[2]	61	$6.67
Rohnert Park[4]	359	$143.19
Total	**523**	**$160.17**

Source: Pump Test Results provided by City of Santa Rosa for EOP Part 2, Reclamation System Energy Audit

Notes:
1. E Pump Station data based on an average of pump tests running each combination of two of the three EB pumps at a time. Assumes $0.10/kWh.
2. Assumed $0.11/kWh.
3. Energy data for the West College Pump Station was not made available and is an estimate based on hydraulic grade line, system pressure. Assumes $0.11/kWh.
4. From 2015 Pump Test for Rohnert Park Pump Station P1 (Poncia Pump Station)

Urban Reuse

The City's energy cost to convey recycled water to their urban reuse customers is the cost of the E Pump Station (EB1, EB2, and EB3 pumps only), the Delta Pond Pump Station, and the West College Pump Station (City of Santa Rosa urban reuse) or the Rohnert Park Pump Station (City of Rohnert Park urban reuse). Table 6-7 above presents the specific energy and unit cost of water to the City for conveyance of recycled water to urban customers. These costs do not include operations and maintenance, repair, spare parts, or staff time.

Geysers

The City's energy cost to convey Geysers Project recycled water is the cost of energy to operate Llano Pump Station at the LTP. Calpine also provides the power to the three mountain pump stations that lift recycled water to the Terminal Tank at the Geysers steamfields. Table 6-8 below shows the specific energy and unit energy cost to the City to deliver water to the Geysers System.

Table 6-8 Cost of Energy to Deliver Recycled Water – Geysers Demand

Pump Station	Specific Energy (kWh/AF)	Unit Cost ($/AF)
Llano	486	$35.47

Sources: Reclamation System Energy Audit, 2012-2013 City of Santa Rosa Reclamation Reports. Assumes $0.11/kWh.

The City currently delivers recycled water to the Geysers Project according to Schedule I of the Construction and Operating Agreement (Agreement) between the City of Santa Rosa and Calpine. According to the Agreement, the amount of water required to be delivered by the City and which Calpine must accept is the "Guaranteed Delivery". The Guaranteed Delivery amount can increase if the City chooses to advance the Delivery Schedule (with a 24 month notice to Calpine).

According to the Agreement (Exhibit 6), payment obligations by both the City and Calpine are based on the percentage that the water delivered or accepted is below the Annual Amount in the active schedule beginning with 90 percent. In other words, the City would pay a penalty to Calpine that increases with the percent of water delivered that is less than the Annual Amount; similarly, Calpine would pay a penalty to the City that increases with the percent of water that is not accepted that is less than the Annual Amount. The penalty payment schedule is the same for both the City and Calpine. Table 6-11 below summarizes the estimated energy cost savings and penalty payments were the City to reduce deliveries under the current Agreement with Calpine.

If the annual Geysers guaranteed deliveries under the current delivery schedule (4,607 mg per year at Schedule I) were reduced by half throughout the year, an additional 2,300 mg could become available for agricultural and other users, assuming adequate storage to prevent discharge during the non-irrigation season and wet weather events. Furthermore, with this reduction in pumping through the Geysers Llano Pump Station, for which energy is paid by the City, the City could save as much as 10 GWh or over $400,000 per year in energy, as shown in Table 6-9. However, between now and the end of the Agreement, the City is obligated to pay Geysers Power Company for reductions in deliveries as shown in Table 6-9.

Table 6-9 Savings and Costs by Reducing Geysers Deliveries under Current Contract

% below Annual Amount	Energy Savings (kWh/Yr)	Energy Savings ($/Yr)[3]	Penalty Payment to Geysers Power Company ($/Yr)[3]	Net Cost/Savings ($/Yr)[3]
0 to 10[1]	0 to 912,000	$0 to $100,000	$0	$0 to -$100,000
11 to 25[2]	1,000,000 to 2,371,000	$110,000 to $261,000	$350,000 to $1,200,000	-$240,000 to -$939,000
26 to 50	2,462,000 to 3,684,000	$271,000 to $405,000	$1,200,000 + Termination Rights/Fee[4]	-$929,000 to -$1,795,000

Notes:

1. City delivers about 93% of the current delivery schedule on average.
2. Payment obligations under the Agreement are the same regardless of if the defaulting party is the City or Geysers Power Company, with the exception of the Termination Fee.
3. Assumes $0.11/kWh.
4. If the percent below Annual Amount is greater than 25%, the penalty payment is capped at $1,200,000 and the Geysers Power Company retains the Agreement Termination Rights and right to receive the Termination Fee, the value of which ranges from $1,000,000 to $20,000,000, decreasing from the year 2007 to the year 2037.

From Table 6-9 above, the City would see a marginal cost benefit by reducing Geysers deliveries by 10 percent or less. For example, above 10 percent, it would cost the City at least $240,000 per year to divert water away from the Geysers Project. In comparison, this cost would require, at minimum, an additional 42 mg in recycled water deliveries for urban use, an increase in average urban demand of 10 percent, in order to break even at an average rate of $1,858/af. Therefore, there is no financial incentive for the City to reduce discharge to Geysers.

Figure 6-2 below compares the approximate energy cost to convey recycled water for discharge, agricultural irrigation, urban reuse, and Geysers recharge, as well as the average annual discharge volume for each.

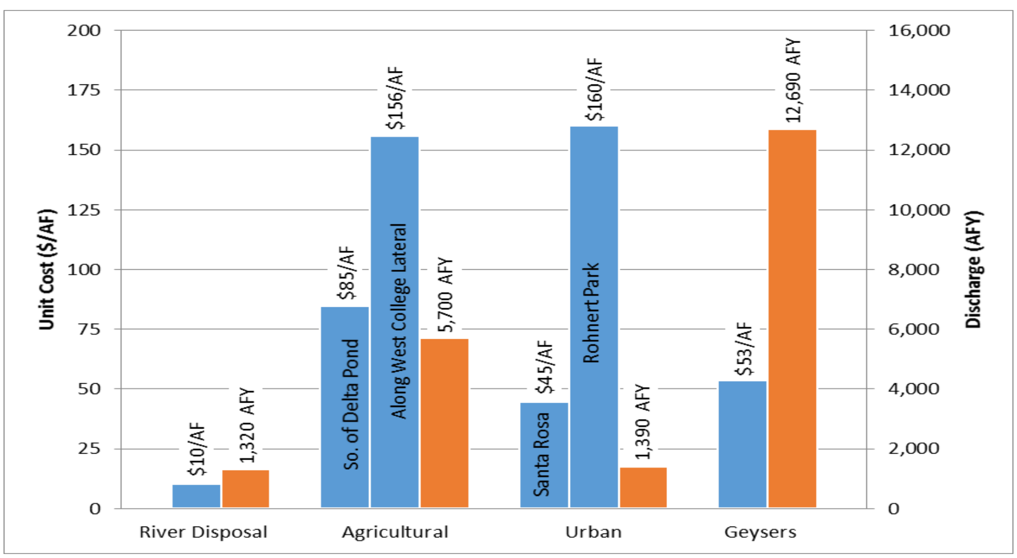


Figure 6-2 Recycled Water Cost of Energy Conveyance

In reviewing level of service and rate optimization, the City should consider the following regional goals for recycled water distribution:

- Santa Rosa Board of Public Utilities stated objective to maximize beneficial reuse of recycled water.
- IRWP goal to operate the recycled water system in ways to protect the Russian River and its tributaries. Strategically the City should maintain the ability to discharge to the river when necessary.
- Sonoma County goal to protect lands currently or potentially suitable for agricultural production (Sonoma County General Plan 2020 Land Use Element, Goal LU-9).

Similarly, the City should review the following regional pressures on the distribution of recycled water:

- North Coast Regional Water Quality Control Board requirement to eliminate or offset nutrient discharges to the Laguna.
- Maintain and enhance the City's recreational assets related to the Laguna de Santa Rosa.
- IRWP objective to maintain a system and system components that can be successfully financed and economically feasible. High cost of service and low incentive for optimization of agricultural irrigation. Transfer of individual booster pump stations to property ownership would significantly reduce the cost of service and incentivize operation, potentially reducing recycled water shortfalls.

Figure 6-2 shows that Geysers is the most cost-effective element of the City's recycled water application portfolio based on the cost of energy to convey volume of recycled water. It is also the only weather-independent element of the recycled water portfolio. As flows to the LTP increase, increased flow to Geysers should be prioritized. The value of water to GPC is almost immeasurable, because without it, the long-term sustainability of steam power generation could be jeopardized. This is especially true as GPC is in the process of expanding Geysers power generation capacity by building two new power plants, an investment total of about $700 million. These new power plants would need a steady and guaranteed source of water to pay off this accumulated debt of investment, and it is anticipated that these new power plants will receive recycled water from the Regional System. Moreover, if the Geysers use an alternative water source, the Geysers Power Company will need to invest additional capital into a new conveyance system to receive that water.

- Discussing renegotiation of contract before end of contract is not within scope of this master plan. The dynamics of opening a current contract and amending it are different from negotiating a contract when it expires. For the purposes of negotiating with Geysers Power Company and its parent company, Calpine, it is recommended that negotiations be limited to contract renewal. The current Agreement is effective through December 31, 2037; after that time, the City can decide to charge Geysers Power Company for the recycled water and can reduce deliveries to the Geysers without penalty.
- In order to maximize flows to Geysers within the framework of the existing contract, firm pumping capacity at the Geysers pump stations should be increased. Increasing firm capacity to 17.6 mg per month (equivalent to about 440 gpm in February) provides a reliable pumping capacity for the Guaranteed Delivery flows through Schedule V commitments. Increasing firm capacity to 20 mg per month (equivalent to about 500 gpm in February) provides reliable pumping capacity for the Guaranteed Delivery, City Option, and Best Effort flows included in

the current contract. The pump stations can be upgraded to provide 17.6 mg per month of firm capacity by rebuilding pumps but retaining existing motors and drives. Increasing capacity to 20 mg per month requires replacing and/or upgrading the motors, drives and associated electrical systems. To provide maximum ability to convey flows to the Geysers within the allowance of the existing contract, the firm capacity of the pump stations should be increased to 20 mg per month.

- Figure 6-2 also shows that recycled water used for agriculture is the highest cost element of the City's recycled water portfolio. As an initial step in achieving cost efficiencies, transfer of booster pump stations to property owners would reduce the City's cost, and also provide incentive for agricultural users to optimize water used for irrigation. Generating revenue from agricultural users would also incentivize efficient water use and decrease the City's total cost to supply water.

Biosolids

Optimization to achieve cost efficiencies in biosolids management can be recognized by providing a comparable biosolids product at a lower cost, increasing the quantity of biosolids that can be processed with the existing equipment, or by improving the quality of the existing biosolids product to reach an expanded market (e.g., golf courses, vineyards, etc.) and command a higher sale price. These three approaches are described below.

Additional Screening

Providing additional screening of the finished compost is an option to improve the marketability of (and potentially revenue from) the City's compost product. This option relies on continued use of the City's existing agitated in-vessel composting system, which is relatively expensive to operate with an estimated cost of $150 per wet ton of compost produced. Finished compost quality was an issue when the City received green waste from Sonoma Compost, which frequently contained plastic material that remained visible in the finished compost. Since switching to green waste from Ukiah following the closure of Sonoma Compost, this has not been an issue. However, City staff have identified that improved screening of the finished compost would result in a higher quality product that could open new markets for the City's compost and allow the price of compost to be increased.

Options for improving compost quality include double-screening the compost using the existing trammel screen with associated perforated plate screen, or providing a new perforated plate screen with smaller openings. The City recently purchased a new mesh wire screen with smaller openings to determine the ability of the existing trammel to produce better quality compost. A wire mesh type screen was tested instead of the preferred perforated plate type screen because perforated plate type screens with smaller openings were not available for the existing trammel screen. Quality of the compost did not improve. City staff report that they believe this was due to the use of the mesh wire type screen instead of a perforated plate type screen with smaller openings.

The installed cost of a new trammel screen with perforated plate screen with smaller openings is estimated to be $330,000. The City should conduct a market assessment to determine the potential market for higher quality compost material and assess whether it is more cost-effective to double-screen compost using the existing screen, purchase a new screen, or maintain the current screening process.

City staff note that there may not be sufficient space on the existing compost site to store additional compost products. While the total amount of compost would not increase, storing material in separate piles according to type would require additional space than is required under current operations.

Enhanced Composting Capacity

The Biosolids Management Strategic Plan (Santa Rosa, 2014e) examined alternatives to optimize the existing compost process, including analysis of lessons learned during the compost season from 2012 to 2013. The 2012/2014 compost season was unseasonably dry, resulting in minimal rewetting of biosolids stored next to the outdoor storage pond. Operation with drier biosolids demonstrated that:

- Equipment operates more efficiently with drier biosolids, with reduced plugging and sticking and maximizing run time.
- Drier biosolids require less bulking agent (green waste), increasing the amount of biosolids per batch of compost.

The EOP (Santa Rosa, 2014c) included a detailed evaluation of the benefits of increasing solids content in dewatered biosolids sent to the compost facility. Drier solids require less green waste, allowing more biosolids to be processed per batch of compost. Compost facility staff also report that wetter biosolids increases wear on the agitators, so increased dryness reduces the frequency of breakdowns and associated maintenance cost.

The Strategic Plan identified several means of increasing solids content (e.g., operational changes, covered biosolids storage, and improved dewatering at the Plant). Cost savings that could be obtained by increasing the throughput of the Compost Facility (economy of scale) were then determined. An annual throughput goal of 12,000 wet tons of biosolids was identified as an optimum goal, with an associated potential annual savings of about $120,000. The Strategic Plan recommended this goal be met via operational changes rather than significant capital investment (e.g., covered storage). It suggested changing to a “just-in-time” model for delivering biosolids to the Compost Facility. The intent was to avoid accumulating biosolids in the Compost Facility’s uncovered biosolids pond storage area. Because it is uncovered, storing solids in the pond during years with normal precipitation has resulted in significant wetting of the material resulting in solids concentrations as low as 10% to 12%.

As noted, the Strategic Plan based its value for annual savings on composting 12,000 wet tons of biosolids each year. Actual operations since 2010 show an average of only 8,000 wet tons of biosolids composted per year. Compost Facility staff believe that achieving a 50% increase in the amount of biosolids composted each year is not likely, because achieving this increase requires dramatically adjusting the compost ratio to increase the pounds of biosolids to green waste. The current ratio uses 12,000 wet pounds per batch, which is a 33% increase since startup of the facility. Staff invested a significant amount of time to fine tune the recipe, and have unsuccessfully tried using as much as 14,000 pounds per batch.

The operating time of the Compost facility could be shortened, however, if dryer biosolids are treated. Two options for increasing biosolids dryness were evaluated in the Energy Optimization Plan:

- Cover Biosolids Storage Area to protect against rewetting associated with rainfall. The cost of providing covered storage for dewatered biosolids was estimated to range from $1M for a small or non-permanent facility to $3.4M for a permanent facility similar to that at Alpha farm.
- Change LTP Dewatering Process. Increasing biosolids dryness from an average of 15% to 18% could produce net savings of $150,000/year in compost facility operation; however, these savings would be offset by additional costs incurred at LTP.

Neither of these options were cost-effective from the standpoint of producing sufficient energy savings to warrant implementation, and were therefore not recommended. However, if land application sites become limited and biosolids processing at the Compost facility must be increased, these could be implemented as interim improvements prior to switching to the full-scale Class A process recommended in the Biosolids Strategic Plan.

Alternate Composting Technology

The Biosolids Management Strategic Plan (Santa Rosa, 2014e) evaluated a range of alternatives to achieve the City's long-term goal of having a full Class A biosolids program. The Plan examined process improvements to enhance the existing compost operation such as those described above, and consider a range of alternatives to replace it with a different type of Class A digestion process. It did not, however, evaluate the alternative of replacing the existing composting operation with a different type of composting process. Replacing the existing compost facility with newer technology such as covered aerated static pile (CASP) composting allows the City to maintain its current approach for solids handling, at a lower operating cost. An example of a CASP composting system with fabric covers manufactured by GORE® Cover is shown in Figure 6-3 below. If implemented, this option would move composting outdoors eliminating the need for a number of relatively high energy consuming and costly pieces of equipment, such as the bin agitators.

Figure 6-3 Covered Aerated Static Pile (CASP) Composting

If the Composting Facility were converted to a CASP system, site layout would most likely be like that shown in Figure 6-4. Composting would be moved outdoors with the piles being constructed in the area currently occupied by the curing piles and biosolids storage pond. Because the existing biosolids storage area is also used as a stormwater surge basin, the capacity of the existing stormwater pumping station would likely be needed. A total of 12 piles would be needed to match the throughput of the existing facility.

Biosolids storage would move indoors to the facility's existing agitated bin area. Conversion of the bins for this use should be relatively easy, resulting in the ability to store about 6,000 wet tons of biosolids. The aeration system and associated gravel layer and the internal bin walk would be removed, and short concrete ramps into each bin would be constructed to allow access by front end loader. Push walls (concrete or ecology blocks) would be added to close off the north end of each bin.

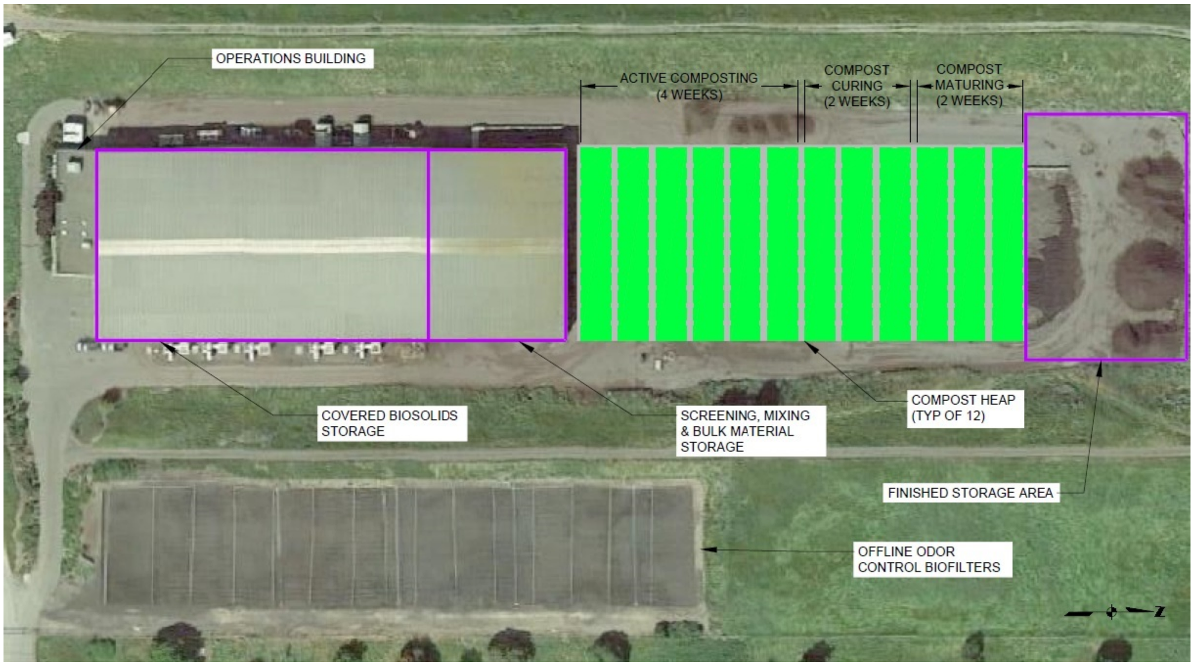


Figure 6-4 Covered Aerated Static Pile Site Layout

The covered biosolids storage building would require ventilation at a rate of six (6) air changes per hour to meet NFPA 820 fire standards. This would require the continued use of the existing exhaust fans with their associated high energy use. A preliminary review of the building's structural design drawings, however, indicates that it should be possible to remove sections of the exterior walls on the east and west sides of the building. With this structural modification, the space would no longer be considered by NFPA 820 to be enclosed, which would eliminate the need for mechanical ventilation and result in significant energy savings for the facility. The potential for odors would have to be evaluated but experience at the Alpha Farm storage area indicates this may not be a problem.

The capital costs of the fabric cover type CASP composting system are lower than other composting technologies with fewer permanent structures required. The covered piles typically measure about 160 ft long by about 25 ft wide and contain about 1,200 cy of composting material. Short concrete walls surrounding the piles allow efficient use of space, help contain leachate and reduce labor associated with securing the fabric covers to the ground. The piles are aerated under positive pressure with each pile having its own low horsepower fan that delivers air to the composting material through in-ground aeration trenches that also serve to collect any leachate generated within the pile. With the pile configuration shown in Figure 6-4, space exists within the existing compost facility footprint for 12 compost piles which would match the throughput of the existing facility (approximately 400 cy per day). Converting the existing agitated bin composting system to a CASP system would cost approximately $3.9 million but would reduce annual operating costs by about $500,000. With these improvements, winter storage of stormwater would no longer be supported.

Assuming the LTP continues to produce biosolids with an average solids concentration of 15%, a CASP system with capacity to treat full biosolids production from the LTP would require the addition of approximately 7 more acres to the composting facility and cost roughly $13.3 million. The amount of land required and overall cost of the new compost facility could be reduced by approximately 50%, however, if the LTP were able to produce biosolids with a solids concentration of 25% instead of 15%. A CASP system treating 25% solids could fit nearly all of the LTP solids production through buildout within the footprint of the existing Compost facility, with a capital cost of approximately $6.6 million. Conversion to a CASP system can be considered in the future when the City conducts a detailed Class A biosolids study as recommended in the Biosolids Management Strategic Plan.

Energy

The City has taken steps to maximize revenue from energy production through accepting high strength waste at the LTP. An additional step the City could take is increasing the power production from solar energy.

Solar Photovoltaics (*ongoing investigation*)

One of the opportunities identified for detailed analysis in the EOP (Santa Rosa, 2014c) is expansion of energy production through the use of solar photovoltaics (PV). The evaluation included a comprehensive study of City-owned sites, investigating both conventional solar panels and floating solar panels (flotovoltaics). The primary purpose of the evaluation was to:

- Perform an assessment of flotovoltaics as a new solar PV technology and assess the work already done by Sonoma County.
- Conduct a comprehensive site evaluation study of City-owned sites, prioritize potential sites, and identify top sites.
- For the top sites, determine the cost-effectiveness of regular and flotovoltaics solar PV projects.

Santa Rosa has been collecting a Solar PV allocation for many years, and has used those funds to build various small solar PV projects on City property. The four existing projects include a ground solar PV array at the LTP, a Solyndra installation at the LTP, and solar arrays at Alpha Farm and Brown Farm. The power produced from these facilities creates an annual gross savings of $21,000.

The EOP is evaluating additional City-owned properties to assess their potential as solar PV project sites. The analysis considers site constraints, conflicting site uses, size, solar resources, site/location/land use, operational impacts, sensitive neighbors, sensitive environment, and constructability.

The analysis is also considering three financial models for the preferred solar PV projects: own/operate a turnkey design/build ground-mounted system, power purchase agreement (PPA) contract for a ground-mounted system, and PPA contract for a flotovoltaic system. The results of the analysis will indicate which sites have a positive net present value and desirable return on investment, and which financial model beset suits the project(s).

Nutrients

Nutrient recovery is a growing market in the wastewater industry. As nutrients – particularly phosphorus – grow in scarcity and value, and as more wastewater treatment facilities implement biological nutrient removal to address water quality limitations in receiving streams, recovering nutrients as marketable fertilizer is becoming more common. Facilities that produce digester supernatant or dewatering pressate streams high in nitrogen and phosphorus are able to recover those nutrients as magnesium ammonium phosphate (struvite). This product can be sold as commercial fertilizer for agricultural use. A study by the Water Environment Research Foundation (WERF, 2010) estimated that a 10 MGD wastewater treatment plant practicing enhanced nutrient removal (ENR) has a potential resource recovery opportunity of up to $85,000/year.

Several manufacturers produce process equipment used for nutrient recovery in wastewater treatment plants. The processes generally involve upflow reactors in which pH is controlled and chemicals (typically magnesium) added to provide the optimal concentrations for precipitation of struvite. The struvite crystals produced in the reactor are recovered and used as slow-release fertilizer. An example of nutrient recovery equipment manufactured by Mulitform Harvest is shown in Figure 6-5.

Implementing nutrient recovery for revenue generation requires that the LTP be upgraded for full ENR and installation of a nutrient recovery process. The Integrated Recycled Water Plan Discharge Compliance Project (Santa Rosa, 2007) evaluated ENR options for full discharge of all LTP flows. The ENR evaluation included upgrading the existing process to 5-stage Bardenpho for biological nitrogen and phosphorus removal, with ENR facilities sized for the full flow to the LTP.

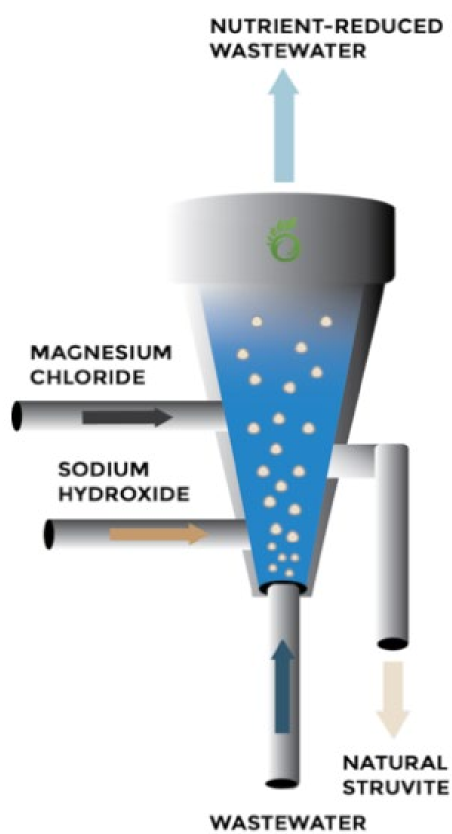


Figure 6-5 Multiform Harvest Struvite Recovery System

To implement the 5-stage Bardenpho process (shown in Figure 6-6), a portion of the flow from the equalization basin would go to the existing aeration basins and the remainder would go to the future aeration basins. Each aeration basin would have an anaerobic zone at the head of the basin that would be unaerated and low in nitrate. Primary effluent and RAS would be blended with mixed liquor in the anaerobic zone where phosphorus uptake would occur. Mixed liquor from the anaerobic zone would flow by gravity to the first anoxic zone, which would also be unaerated. Mixed liquor would then flow by gravity from the anoxic zone to the aeration zone where diffused aeration would be used to promote nitrification. A portion of the mixed liquor from the aerated zone would be recycled to the anoxic zone where denitrification occurs. Mixed liquor would flow by gravity from the first aerated or oxic zone to the second anoxic zone. An external carbon source such as methanol would be added to the second anoxic zone to promote further denitrification. The process would produce total phosphorus of <1 to 3 mg/L, and total nitrogen <3 mg/L. The cost of the 5-stage Bardenpho expansion was estimated to be $14.7 million at the time of the IRWP completion. Escalating to 2017, the current cost of the ENR expansion is estimated to be $18.9 million.

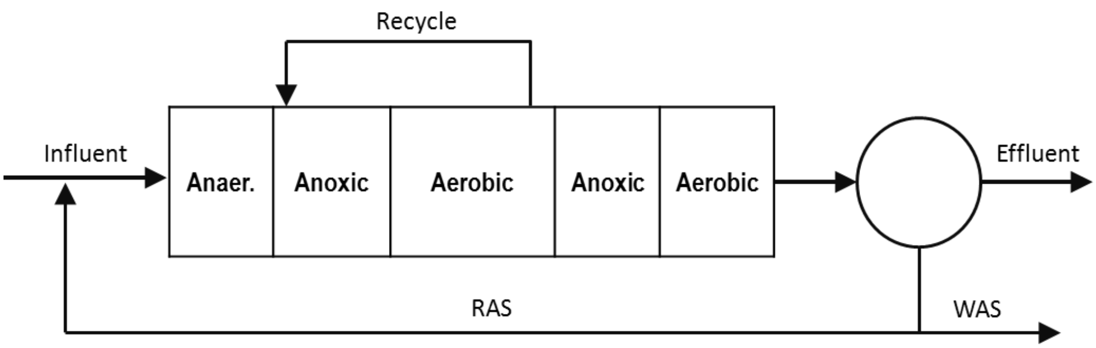


Figure 6-6 Typical 5-Stage Bardenho Process

Construction of a nutrient recovery system for the full 25.6 MGD facility is estimated to be $4.7 million, based on equipment quotes for an Ostara nutrient recovery system. The annual revenue potential for nutrient recovery at the LTP could range from $175,000 - $220,000. At this range, the simple payback for implementing nutrient recovery facilities at the LTP is over 100 years. If ENR improvements were required for permit compliance, the payback period for nutrient recovery is reduced to 21-26 years. In addition to the potential revenue, nutrient recovery provides noneconomic benefits of reusing a finite resource and reducing the need to mine phosphorus, and benefitting the watershed. Based on this evaluation, adding nutrient recovery is not currently recommended as a strategy to maximize revenue streams, but should be considered if permit conditions drive the City to implement ENR.

6.2 Risk Mitigation Strategies

Risk mitigation strategies are needed to optimize WRS operations by achieving balance between cost of service, level of service and risk. The strategies described below include those that the City is currently using and should continue, and new strategies to mitigate for anticipated risks that could arise over the planning horizon.

6.2.1 Preventative Maintenance, Renewal and Replacement

The City's approach to managing WRS assets continues to evolve with updates and improvements to tools and procedures that provide additional utility, transparency and consistency for management decision-making. The City's current CMMS (Hansen) is in the process of being replaced and a new platform will be selected and installed in 2017. The CMMS is used to track assets, generate work orders and maintain an updated asset register for reporting maintenance, renewal and replacement activities by asset. The City recently developed a planning tool for budgeting annual preventative maintenance and asset renewal and replacement costs based on the current asset register in CMMS, and the current practices utilizing the CMMS and planning tool are recommended to continue into the future.

The next step for progressing asset management will be to develop tactical asset management plans for the various WRS facilities (e.g. – the LTP, biosolids facilities, Geysers, conveyance, etc.) that are risk-based and data driven. Although this is done currently in an informal manner, the framework and data required for risk-based asset management is incomplete and the methods used are not consistent across all WRS facilities. Development of an asset management plan is recommended that builds on the City's current practices and that is tailored specifically to the operation of the WRS enterprise. Benefits of furthering the WRS asset management program include:

- Developing risk profiles of assets and asset groups for prioritizing investments;
- Generating data needed to assess condition and risk for assets and asset groups;
- Providing consistent methods and transparent documentation for investment decisions; and
- Creating transparency and consistency across the enterprise for smooth succession of management responsibilities over time.

6.2.2 Resource Management

Regional resources need to be managed in a holistic manner that allows the City to achieve most beneficial and effective use of resources aligned with achieving overall service levels for the WRS.

Regional Lands

The Regional lands are critical to the reliable operation of the enterprise and provide numerous benefits, including:

- Providing a water reuse buffer through agricultural irrigation at the City farms;
- Providing agricultural operations for land application of biosolids;
- Providing space for seasonal storage of biosolids and recycled water;
- Providing opportunities for ecological enhancements and environmental mitigation projects at the City farms; and
- Providing space buffers around the LTP.

A land management plan is needed that describes the Regional lands and their various functions, including current land management practices, restrictions, and agreements with tenant agriculture operators and other stakeholders. The plan would also identify additional needs such as purchasing land for land application of biosolids to reduce risk associated with leasing the property, and purchasing additional land for space buffer around the LTP. Reserving land at the City farms for future uses, such as additional seasonal storage, would also be identified in the plan.

Recycled Water

Recycled water is a relatively reliable source of water for green energy production at the Geysers steam fields, urban irrigation, and agricultural irrigation. As identified previously, demand for recycled water use at the Geysers is anticipated to increase substantially in the future with the expansion of the Geysers power plant generation capacity.

While meeting the goal for low-carbon footprint power generation, Geysers recycled water demand has also resulted in a decrease in the amount of recycled water supply that is available to agricultural customers. Since the start of Geysers operations, average annual deliveries to agricultural customers have decreased by over 3,000 af. While some of this reduction in agricultural irrigation deliveries can be attributed to changes in cropping patterns and improvements in irrigation practices, agricultural customers may still need to turn to groundwater use if Geysers demand continues to increase. Some of the reduced agricultural consumption could also be attributed to mandatory reductions in recycled-water allocations. Agricultural demand could be further reduced with more efficient irrigation operations and elimination of inefficient or small volume connections.

Based on historic records between 2000 and 2016 the Regional Partners would need to produce an additional 3,200 af of recycled water to meet the demands of both Geyser and agriculture users. A minimum production (available to the Geyser and agriculture users) of 16,808 af occurred in 2014 and a maximum demand (from Geyser and agriculture users) of 20,006 occurred in 2011.

Conversely, urban reuse of recycled water has increased over the years, with the completion of the Santa Rosa's Urban Reuse Pilot Project in 2007. Although the City does not currently anticipate further expansion of recycled water reuse within Santa Rosa, the City of Rohnert Park is planning an expansion of their city's recycled water distribution over the next 10 years for an increase in demand of 25 percent through 2040. Currently urban reuse makes up about 6 percent of recycled water demand, and it is anticipated that the City will continue to meet its urban reuse contracts.

The value of recycled water to the Regional Partners can be characterized based on social, economic, and environmental values for each of the current recycled water uses/disposal methods. Table 6-10 summarizes these values to Regional partners.

Table 6-10 Value of Recycled Water Distribution Options to Regional Partners

	Social Value	Economic Value	Environmental Value
Agricultural Irrigation	**Benefits:** • Supports community desire to preserve agriculture and greenbelts • Supports farming and production • Improves public perception by reducing dependency on discharges **Drawbacks:** • Lack of appropriate rate	**Benefits:** • Reduces permit violations and fines by limiting discharge • Rate of $50/af for new user agreements **Drawbacks:** • Variable demand requires increased vigilance to avoid permit violations • City currently pays O&M costs for onsite pumping	**Benefits:** • Reduces dependency on limited groundwater resource • Helps maintain permit compliance by limiting discharge **Drawbacks:** • Variable demand requires increased vigilance to avoid permit violations

	Social Value	Economic Value	Environmental Value
Urban Reuse	**Benefits:** • Enhances public acceptance of alternative water sources • Supports recreation by providing irrigation for public parks/greenspaces and golf courses **Drawbacks:** • Public perception of using recycled water in public spaces	**Benefits:** • Generates revenue to support operations • Reduces permit violations and fines by limiting discharge **Drawbacks:** • Variable demand requires increased vigilance to avoid permit violations	**Benefits:** • Reduces demand for fresh water supplies • Helps maintain permit compliance by limiting discharge **Drawbacks:** • Increased vigilance required to monitor and prevent spills/surface runoff • Reporting requirements
Geysers Recharge	**Benefits:** • Reliable and significant demand minimizes need for discharge **Drawbacks:** • Diverts water resource out of local basin	**Benefits:** • Vital resource to Geysers Power Company to operate steam power plants and supply power to County customers. • Provides revenue to support operations • Payment to the City of $300,000 per year through 2020 **Drawbacks:** • Penalty costs for failure to deliver at least 90% of the contracted volumes annually.	**Benefits:** • Helps maintain permit compliance by limiting discharge • Necessary component to produce low-carbon footprint (renewable) energy that produces enough incremental energy for 100,000 homes in the surrounding region **Drawbacks:** • None
Discharge	**Benefits:** • Provides clean water to support downstream beneficial uses in the river **Drawbacks:** • Public perception of 'polluting' the river	**Benefits:** • Disposal mechanism with lowest energy cost at $38/AF. • Does not require additional capital investment in new recycled water storage. **Costs:** • Requires City to develop offset projects to mitigate nutrient discharge • Permit violations costs up to $10,000 per day of discharge and up to $10 per gallon of discharge • Does not generate revenue	**Benefits:** • Requires the least amount of energy for disposal • Provides clean water to support beneficial uses in the river **Costs:** • Missed opportunity for resource recovery and beneficial reuse of recycled water. • Costs for water quality monitoring/reporting to comply with NPDES and WDR permits

The following risk-mitigation strategies are recommended for managing the limited recycled-water resource:

- In the near-term and under drought conditions, minimize deliveries to Geysers within the framework of the existing agreement. This approach eliminates penalty costs while maximizing the water available for urban and agricultural reuse.
- Reduce the level of service to agricultural customers. Currently the City pays all O&M costs for the onsite pumping facilities at each end user without regard to the level of efficiency or capital costs. Instead, the City should turn over all ownership responsibilities of the onsite pump stations to the end users. The City would remain responsible for delivering low-pressure recycled water to the properties, but the responsibility for boosting pressure would fall to the property owner. This fundamental policy change would accomplish several important goals:
  - Encourages conservation and irrigation optimization by shifting some of the responsibility to the beneficiaries.
  - Reduces City staff time for maintenance of onsite pump stations.
  - Substantial energy-cost reduction by shifting some of the pumping responsibility to the end users. The City still pays for all low-pressure pumping, but a regulatory violation (runoff caused by a failure of system) would be a shared liability, since operations and maintenance is already performed by the property owner.
- Reduce the size of agricultural customer base. Eliminate obligation to low use customers at end of dead end laterals that have high replacement costs.
- Maintain status quo with respect to urban recycled water. This approach avoids large capital investments in expanding recycled-water distribution infrastructure. Urban demands are a relatively small fraction of the total, and the cost of service is partially offset by the revenue that is generated.

Potable Reuse

Potable reuse is becoming an attractive resource management strategy as many communities in the Western United States face water shortages and depleting groundwater supply. Some forms of potable reuse are addressed in current regulations and have proven track records in limited applications, while others are emerging approaches that do not yet have clear regulatory guidelines or records of public acceptance. Some potable reuse opportunities can accept large volumes of water, making this a strategy worth considering to help mitigate the risk of the loss of the Geysers Project. However, significant additional effort would be required to assess potential potable reuse opportunities, determine the potential demands associated with different options, and identify potential pathways and costs for implementation. Table 6-11 provides a brief summary of potable reuse concepts for Santa Rosa, as well as an indication of the relative order of magnitude of costs relative to the other potable reuse approaches. Actual costs would vary based on the locations of reuse sites and the extent of infrastructure and mitigation measures required.

Table 6-11 Potential Potable Reuse Concepts for Santa Rosa

Potable Reuse	Concept	Benefits/Opportunities	Risks/Challenges	Relative IPR/DPR Cost
Indirect Potable Reuse (IPR) and Groundwater Replenishment Reuse (GRR) via Surface Spreading	• Groundwater replenishment of disinfected tertiary treated RW via new or repurposed percolation ponds. • New conveyance infrastructure to suitable spreading site to achieve sufficient underground retention time prior to extraction. • Diluent water source would be needed (surface water or native underflow) • Utilize soil aquifer treatment (SAT) for additional treatment credits • Potential sites would need to be developed via groundwater modeling • Extraction wells would capture most of the recharged water	• Increase groundwater levels – allows for more extraction • Current level of treatment is adequate • Potential to repurpose existing pond for percolation • Potential to utilize existing purple pipe system for conveyance • Potential to recharge during wet years when additional disposal capacity is needed	• Meeting GW quality objectives • Identification of suitable diluent water supply • Construction of new pond may require land acquisition/potential environmental mitigation needs • Coordination with other groundwater management activities (GWMP, SNMP, SGMA, GSA) • The 2014 GWMP recommends a Best Management Objective (BMO-13) to increase water reuse in a safe, appropriate and environmentally sound manner; but focuses on irrigation uses • Requires separate or supplemental operator certification for potable reuse or advanced water treatment • Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	
IPR and GRR via Direct Injection	• Groundwater replenishment of purified RW via new injection wells • Advanced Water Purification Facility (AWPF) required to treat 100% of flow for GRR • New conveyance infrastructure to suitable injection site to achieve at	• Increase groundwater levels – allows for more extraction • Improve groundwater quality and levels (via groundwater recharge with purified water) • Potential to recharge during wet years when additional disposal capacity is needed	• Requires advanced treatment - higher costs, energy requirements and operational complexities • Environmental issues and costs associated with brine disposal • New infrastructure required to pump and convey water to point of use	MEDIUM

Potable Reuse	Concept	Benefits/Opportunities	Risks/Challenges	Relative IPR/DPR Cost
	least 2 months underground retention time prior to extraction. • No diluent water source would be needed • No SAT credits would be received • Potential sites would need to be developed via groundwater modeling • Extraction wells would capture most of the recharged water		• Coordination with other groundwater management activities (GWMP, SNMP, SGMA, GSA) • Requires separate or supplemental operator certification for potable reuse or advanced water treatment • Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	
IPR via Surface Water Augmentation (SWA)	• Use of purified RW to augment a surface water reservoir that is designated as a source of domestic water supply • Advanced Water Purification Facility (AWPF) required to treat 100% of flow for SWA • New conveyance infrastructure to suitable reservoir site with sufficient dilution (100:1 or 10:1) and retention time (preferably >6 months) • Assumes availability of treatment credit in the conventional drinking water treatment plant • Potential reservoirs could be Lake Sonoma (30 miles as the crow flies) or Lake Mendocino (60 miles as the crow flies) • Agreements would need to be developed to trade/exchange augmented flows	• Maintain or increase lake levels to manage, or supplement, instream flow requirements (via surface water augmentation) • Regional and Environmental benefits for increased flows in Russian River	• Lack of conventional drinking water treatment plant may preclude this from being defined as a SWA project • Requires advanced treatment - higher costs, energy requirements and operational complexities • Environmental issues and costs associated with brine disposal • Significant infrastructure (and associated environmental mitigation) required to pump and convey water to point of use • Meeting temperature and water quality objectives for the Russian River • Difficult to quantify associated increase in potable supplies • Limited capacity in reservoirs during wet years when additional disposal capacity is needed	HIGH

Potable Reuse	Concept	Benefits/Opportunities	Risks/Challenges	Relative IPR/DPR Cost
			• Requires separate or supplemental operator certification for potable reuse or advanced water treatment • Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	
Streamflow Augmentation	• Use of purified RW to augment a stream or a surface water reservoir that releases to a stream • Advanced Water Purification Facility (AWPF) required to treat 100% of flow for SWA • New conveyance infrastructure to deliver flows upstream of SCWA collector wells or inflatable dam • New discharge facility on the river (direct or indirect discharge) • Agreements would need to be developed to trade/exchange augmented flows	• Increase allowable diversion or extraction capacity from collector wells • Regional and Environmental benefits for increased flows in Russian River	• Lack of conventional drinking water treatment plant prior to potable distribution to provide an additional treatment barrier • Requires advanced treatment - higher costs, energy requirements and operational complexities • Environmental issues and costs associated with brine disposal • New infrastructure (and associated environmental mitigation) required to pump and convey water to point of use • Meeting temperature and water quality objectives for the Russian River • Difficult to quantify associated increase in potable supplies • Insufficient guidelines for project development and implementation • Complex and lengthy permitting process • Limited benefit to augmenting streamflow during wet years when river flows are already high • Requires separate or supplemental operator certification for potable reuse or advanced water treatment	HIGH

Potable Reuse	Concept	Benefits/Opportunities	Risks/Challenges	Relative IPR/DPR Cost
			• Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	
Direct Potable Reuse (DPR) through Small Environmental Buffer or Source Water Blending	• Introduction of purified RW into a raw water supply upstream of a drinking water treatment plant (DWTP) • Advanced Water Purification Facility (AWPF) required to treat 100% of flow • New conveyance infrastructure to deliver flows a drinking water treatment plant or blends with the source water upstream of the DWTP	• Drinking water treatment plant provides an additional barrier • Less infrastructure than IPR	• Lack of conventional DWTP as part of the City's water supply system would preclude this project as defined. • Requires separate or supplemental operator certification for potable reuse or advanced water treatment • Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	MEDIUM
DPR through Pipe-to-Pipe	• Introduction of purified water directly into a public water system • Advanced Water Purification Facility (AWPF) required to treat 100% of flow • New conveyance infrastructure to deliver flows to the public water system (i.e. a storage tank or pipe-to-pipe)	• Directly augments the potable system • Potential for City to maintain full control of project by reintroduction of water into the Santa Rosa Service Area • Less infrastructure than other indirect potable reuse concepts • Lack of an environmental buffer could reduce permitting requirements related monitoring effects on the environment	• DPR concept is fairly new and untested in California. • Very little data on DPR design, performance, and safety. • Limited benefit to augmenting potable supplies during wet years when available raw water supplies are plentiful • Requires separate or supplemental operator certification for potable reuse or advanced water treatment • Requires additional permitting, water quality monitoring, and reporting to ensure public health standards are met	MEDIUM

The City of Santa Rosa is a leader in the reuse of municipal recycled water for urban and agriculture irrigation and for deliveries to the Geysers steam field. With the exception of Geysers discharges, these non-potable uses serve to offset potable water demands and in some cases, provide in-lieu groundwater recharge through reduced pumping at sites where groundwater demand is replaced by recycled water supplies. There is currently a lack of available recycled water supply from the LTP after meeting existing recycled water demands for urban and agriculture customers and satisfying the Geysers contract requirements. Thus, the opportunity to implement a potable reuse project in the near-term is limited by available supply.

Potable reuse could, however, offer a contingency plan for the future if:

- The Geysers contract is not renewed,
- Future flows to Geysers decrease, or
- Future expansion of reuse is required to meet TMDL requirements

The potable reuse concepts within the Santa Rosa Region explored for the purposes of the WRS include groundwater recharge, surface water augmentation, streamflow augmentation and direct potable reuse. Key benefits and risks are summarized in Table 6-12 for each potable reuse concept; however, a recommendation to pursue a given concept is not provided herein.

Table 6-12 Potable Reuse Considerations

Potable Reuse Concept	Primary Benefits	Primary Risks
GRR through Surface Spreading	This would be the least expensive type of IPR project because additional treatment beyond tertiary would not be required, existing recycled water infrastructure could potentially be used to convey recycled water to the place of use and an existing recycled water storage pond could potentially be repurposed for recharge. The ability to recharge recycled water during wet years would provide the greatest benefit to providing the LTP with an alternative to streamflow discharge during wet years when additional disposal capacity is needed.	Coordination with ongoing groundwater management activities and agencies (such as the GWMP, SNMP, SGMA, GSA) would be challenging due to increasingly stringent groundwater quality objectives and competition with other sources being considered for groundwater recharge. The perception by some GWMP stakeholders that reuse is not an environmentally sound practice, public acceptance and permitting requirements may also be significant impediments to implementation.
GRR through Direct Injection	The additional treatment required for direct injection would likely meet or exceed all groundwater quality objectives, eliminate the need for a diluent water supply, allow for a reduced underground retention time and require minimal space for above ground facilities. The ability to recharge recycled water during wet years would provide the greatest benefit to providing the LTP with an alternative to streamflow discharge during wet years when additional disposal capacity is needed.	Similar to surface spreading, coordination with ongoing groundwater management activities and agencies (GWMP, SNMP, SGMA, GSA), stakeholder/public acceptance and permitting requirements would be challenging. The additional AWP treatment requirements, brine disposal and conveyance requirements would make this type of project more costly and energy intensive compared with other sources of supply, though there is the possibility that brine could be accepted at Geysers.

Potable Reuse Concept	Primary Benefits	Primary Risks
Surface Water Augmentation	Augmenting Lake Mendocino or Lake Sonoma could provide regional and environmental benefits through maintaining lake levels and increasing flows in the Russian River. This type of project may provide an integrated approach solving multiple issues, with the potential to bring together a number of stakeholders in Santa Rosa and Sonoma County. In terms of water supply, increased flows could translate to increased allowable diversions from the Russian River, resulting in increased extraction capacity from collector wells.	Similar to direct injection, the additional AWP treatment requirements, brine disposal (unless accepted by Geysers) and significant conveyance requirements to deliver purified water to either reservoir would make this type of project more costly and energy intensive compared with other sources of supply. The ability to obtain regulatory approval is uncertain due to the lack of a conventional drinking water treatment plant downstream, temperature and water quality objectives for the Russian River, and operational requirements in the reservoirs. In terms of water supply benefits, it would be difficult to quantify the associated increase in potable supplies and agreements would need to be developed to trade and exchange augmented flows. In terms of discharge compliance benefits it is likely there would be limited capacity in the reservoirs during wet years when additional disposal capacity is needed most.
Streamflow Augmentation	Similar to SWA, augmenting River flows could provide regional and environmental benefits and present an integrated approach to solving multiple issues including the potential to increase diversions and extraction to supplement water supplies.	The additional AWP treatment requirements, brine disposal, conveyance requirements and need for a discharge facility would make this type of project more costly and energy intensive compared with other sources of supply. The ability to obtain regulatory approval is uncertain due to the lack regulatory guidance for streamflow augmentation projects with recycled water and temperature and water quality objectives for the Russian River. In terms of water supply benefits, it would be difficult to quantify the associated increase in potable supplies and agreements would need to be developed to trade and exchange augmented flows. In terms of discharge compliance there would be limited benefit to augmenting streamflow during wet years when river flows are already high

Potable Reuse Concept	Primary Benefits	Primary Risks
Direct Potable Reuse	The introduction of purified water directly into the potable water system would provide a new, local water supply directly into the Santa Rosa Service Area that can be fully controlled by the City. There would be less conveyance infrastructure required than other indirect potable reuse concepts and the lack of an environmental buffer would minimize losses and potential environmental monitoring requirements (as compared to groundwater and surface water augmentation).	The DPR concept is fairly new and untested in California. There is very little data on DPR design, performance, and safety, thus there is uncertainty related to permitting requirements and public acceptance. In terms of discharge compliance there would be limited benefit to augmenting potable supplies during wet years when available raw water supplies are plentiful.

Biosolids

New regulations, increased public scrutiny, and less demand due to the growth in organic farming all pose risks to the City's existing biosolids management program. The City's existing biosolids program is dependent on being able to produce Class B biosolids with approximately two thirds of all biosolids going to land application sites. Should public acceptance of the City's Class B land application program change, the City would be at risk of being unable to dispose of its biosolids since the compost facility has little additional capacity and landfill disposal options are limited.

The long-term strategy recommended in the City's Biosolids Strategic Plan (Santa Rosa, 2014e) is to achieve full Class A biosolids production by constructing a thermal hydrolysis process. Although Class A biosolids cannot be used on organic farms, its use is otherwise unrestricted, resulting in a much larger potential market than Class B biosolids. The Biosolids Strategic Plan considered 25 alternatives for long-term biosolids management, and evaluated eight alternatives that showed present worth savings. These eight alternatives were evaluated using a Business Case Evaluation (BCE), arriving at thermal hydrolysis as the recommended approach. This alternative is estimated to have a capital cost of $10.6 million.

Thermal hydrolysis includes high pressure steam treatment upstream of anaerobic digestion, producing Class A biosolids that allow increased digester loading, improve dewatering performance, and increase gas production. The Biosolids Strategic Plan estimated that thermal hydrolysis would increase dewatering performance from 15% to 28% total solids. This increase in dewaterability combined with increased solids destruction significantly reduces sludge volume, resulting in a quantity of biosolids that can be stored in existing facilities during the winter and eliminating the need for the compost facility.

Moving to a full Class A biosolids program consistent with the City's long-term goal will mitigate the risks associated with the current biosolids program. The Strategic Plan recommends that the City continue to monitor installation of thermal hydrolysis processes at other treatment plants, as well as potential regional partnership opportunities for biosolids management. The Plan recommends a more detailed evaluation as the need to convert to full Class A treatment becomes stronger. This detailed evaluation should include conversion to a different type of compost operation, and should be informed by a Market Assessment to determine the potential demand for different types of Class A products.

The City's near-term ability to manage biosolids resources is constrained by a lack of dewatered biosolids storage capacity. As indicated in Section 2, the winter storage capacity for dewatered Class B biosolids is at capacity. Additional covered storage area is required to manage increased biosolids production prior to implementation of a full Class A treatment process. Additional storage capacity could be provided by expanding storage at Alpha Farm, or potentially at a South County site as suggested in the Biosolids Management Strategic Plan. Based on capital costs estimated in the Strategic Plan, a new 5,000 wet ton storage facility is estimated to cost $5.2 million. Costs would vary depending on the location and configuration of the storage facility, and should be updated through a predesign effort.

6.2.3 Seasonal Storage

Recycled water storage is a critical part of the Regional system, mitigating risk of both effluent discharge and supply shortage. An Excel spreadsheet model was prepared to simulate potential future seasonal storage strategies based on expected production and demand. The model uses plant flows and demand data for the years 2012 to 2016, rainfall data from the University of California Davis Pest Management Program Weather Database, and monthly pan evaporation data from Lake Berryessa. The model includes a starting volume of 200 mg, based on input from the City that typical carryover volume ranges from 100-300 mg.

Storage and discharge were modeled using a range of climatological conditions: Extended Drought, Very Dry, Dry, Normal, Wet, Very Wet, and Extreme Wet. The normal rainfall of 31.22 inches per year represents average conditions based on 30 years of weather data in Santa Rosa. Evaporation Factor related to volume was assumed to be 0.75 for Pan Evaporation Coefficient for North Coast Interior Valleys. The Extended Drought and Extreme Wet conditions are 5 percent below and 10 percent above, respectively, the lowest and highest rainfall in the existing record for Santa Rosa. Storage was modeled for the water year starting on October 1 and ending on September 30.

Model Calibration

The average of the 2012-2016 of the plant flows and Santa Rosa and agricultural demands were assumed to be representative of Dry climatological conditions due to the drought from 2013 through 2015. Rohnert Park data was available for 2014-2016, and the average of that demand data was assumed to be more representative of Normal climatological conditions.

Figure 6-7 shows a comparison of modeled storage and actual storage 2012-2016 water year. The climatological conditions for each year are also show for illustrative purposes. Comparison of modeled storage aligns relatively well to actual storage, but the model tends to underestimate the storage under very dry conditions.

Under existing conditions, the model predicts shortfalls in supply during Dry, Very Dry and Extended Drought years, and discharge under Very Wet and Extreme Wet years. This is consistent with recent experiences during years with both drought conditions and heavy rainfall.

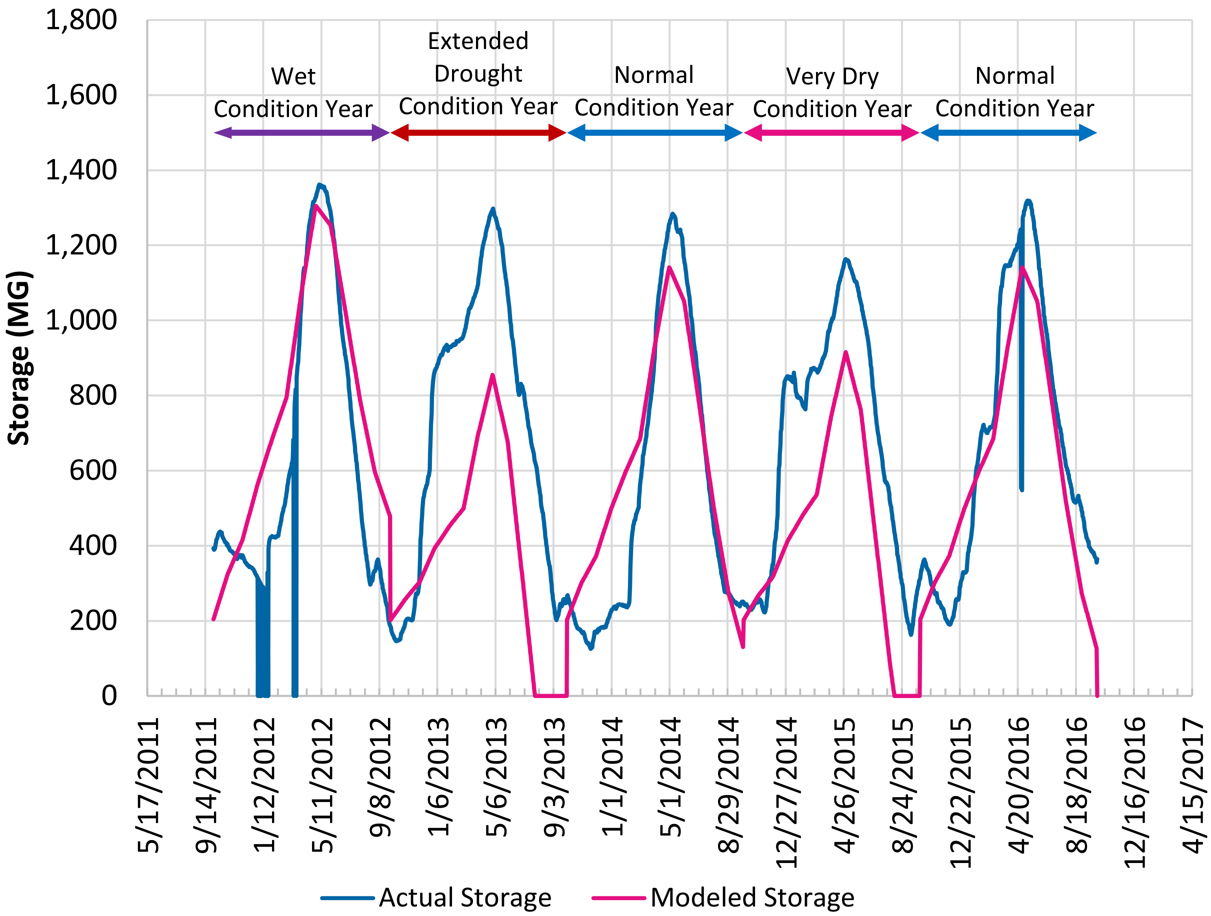


Figure 6-7 Storage Model Calibration

Storage Scenarios

Four scenarios were evaluated at three points in time: existing conditions, 20-year planning horizon, and future buildout conditions, as described in Table 6-15 below. Under 20-year and future buildout conditions, Normal flows to the LTP were increased to 22.4 and 25.9 mgd, respectively. Agricultural and urban demand remained constant, and were not increased from current conditions. Geysers demand was also not increased under the baseline condition. For each of the three conditions, four scenarios were modelled, described below. Scenario 1 includes additional storage volume of 500 mg that was recommended the *IRWP Seasonal Storage Project* (Santa Rosa, 2008) as an approach to support long-term recycled water use and discharge compliance. Scenario 2 includes additional guaranteed delivery to Geysers, and Scenario 3 combines these two modifications.

Table 6-13 Future Storage and Discharge Scenarios

Scenario	Description
Baseline	Existing storage volume, existing agricultural & urban reuse demand, Geysers Schedule I delivery
Scenario 1	Additional 500 mg storage volume, existing agricultural & urban reuse demand, Geysers Schedule I delivery
Scenario 2	Existing storage volume, existing agricultural & urban reuse demand, Geysers Schedule II delivery
Scenario 3	Additional 500 mg storage volume, existing agricultural & urban reuse demand, Geysers Schedule II delivery

Complete details of the model and results is provided in Appendix C and summarized in the following section.

Results – Existing Conditions

Under existing conditions, the model predictions reflect recent reality – annual shortfalls occur under Extended Drought, Very Dry, and Dry conditions for the baseline (current) scenario. The annual shortfall volume is 80-907 mg, with 23-101 days of shortfall annually. Adding storage eliminates the shortfall under all climatological conditions, and increasing Geysers delivery increases both shortfall volume and days of shortfall. Figures 6-8 and 6-9 show annual shortfall and days of shortfall under existing conditions for the range of conditions examined.

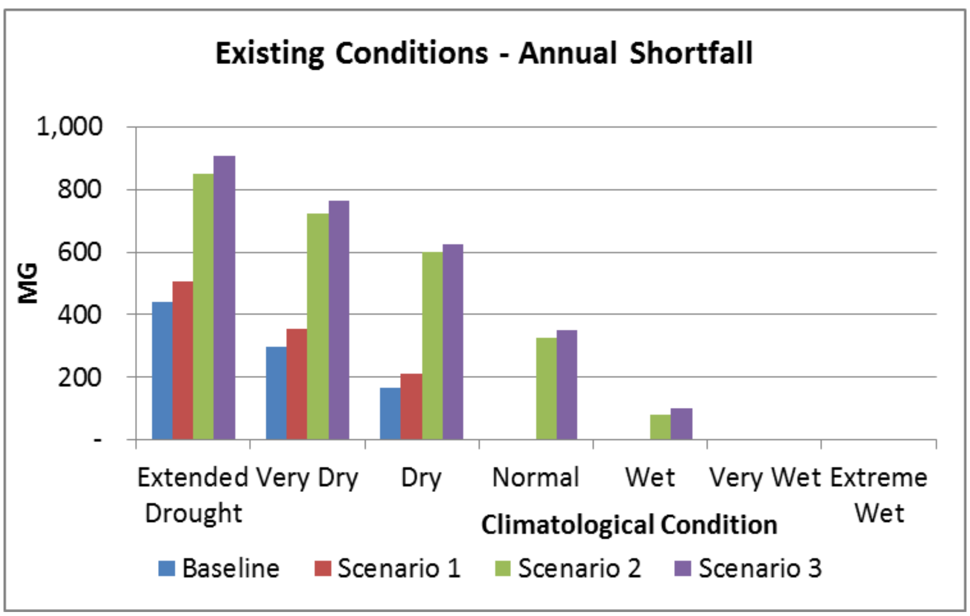


Figure 6-8 Annual Shortfall, Existing Conditions

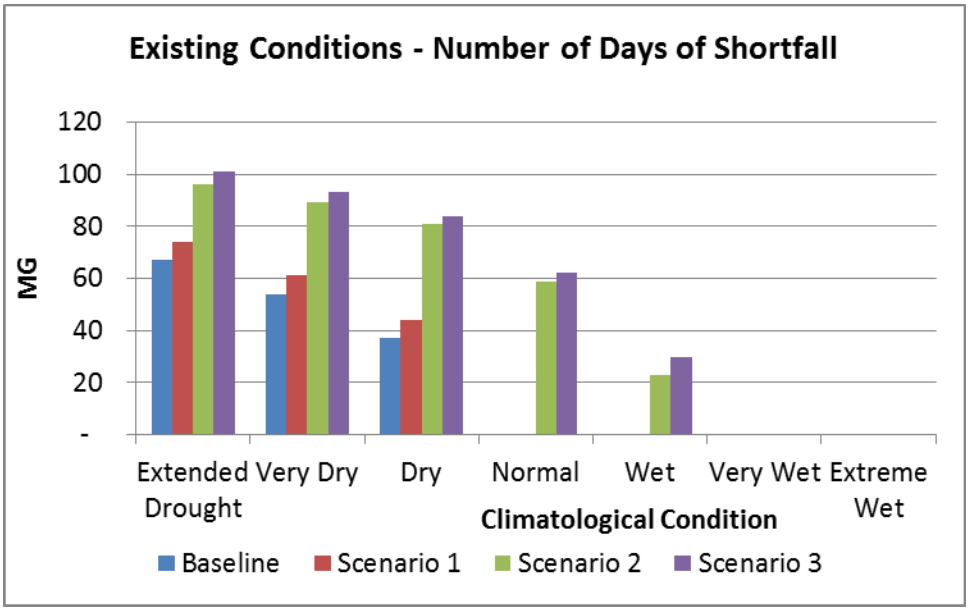


Figure 6-9 Days of Shortfall, Existing Conditions

Discharge is predicted in the baseline scenario for Very Wet (69 mg per year, 6 days of discharge) and Extreme Wet (253 mg per year, 21 days of discharge) climatological conditions. Annual discharge is eliminated by adding storage or increasing Geysers demand as modelled in Scenarios 1, 2, and 3. Figures 6-10 and 6-11 show annual discharge and days of discharge under existing conditions for the range of climatological conditions examined.

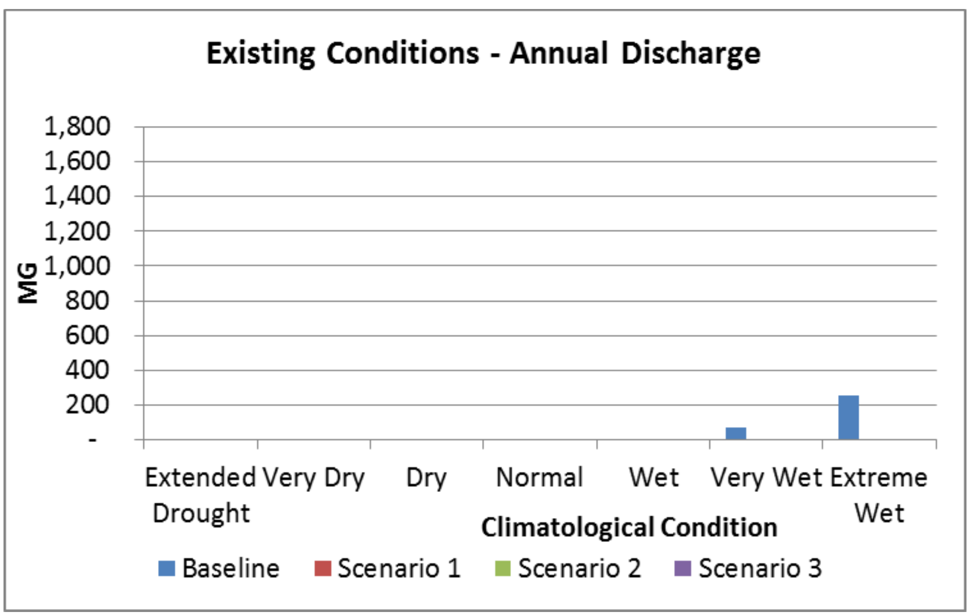


Figure 6-10 Annual Discharge, Existing Conditions

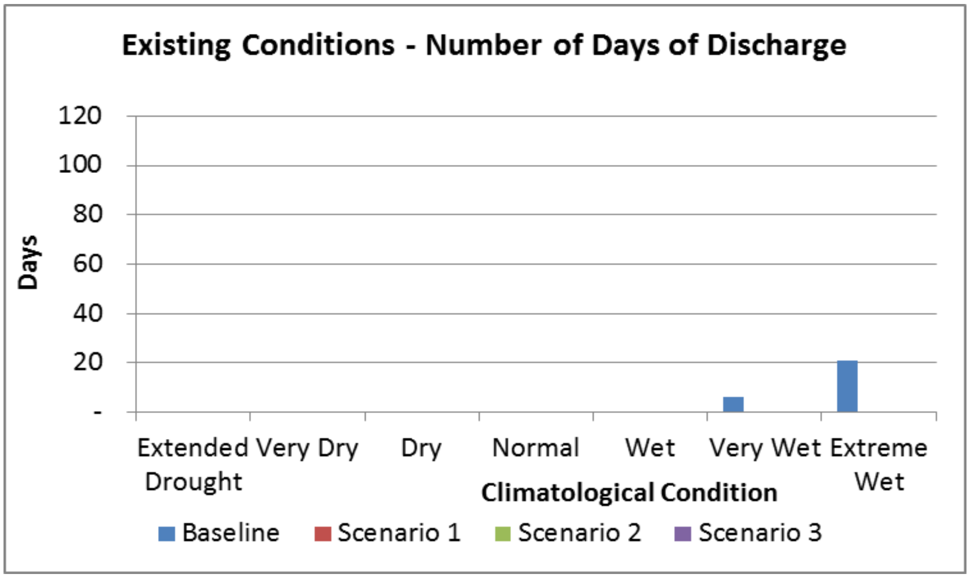


Figure 6-11 Days of Discharge, Existing Conditions

Results – 20-Year Planning Horizon

Without any growth in demand, the increase in plant flows over 20 years provides sufficient supply to meet current recycled water demands under all scenarios, but the duration and volume of discharge also increases. Under the baseline scenario (no increase in storage or Geysers delivery), discharge is projected under all climatological conditions. The volume of discharge is reduced by increasing Geysers delivery (Scenario 2), but discharge is still predicted under all conditions. Adding storage (Scenario 1) eliminates discharge during Dry through Extended Drought conditions, and adding storage with additional Geysers delivery (Scenario 3) limits discharge to only Very Wet and Extreme Wet conditions. Figures 6-12 and 6-13 show annual discharge and days of discharge at the 20-year planning horizon for the range of climatological conditions examined.

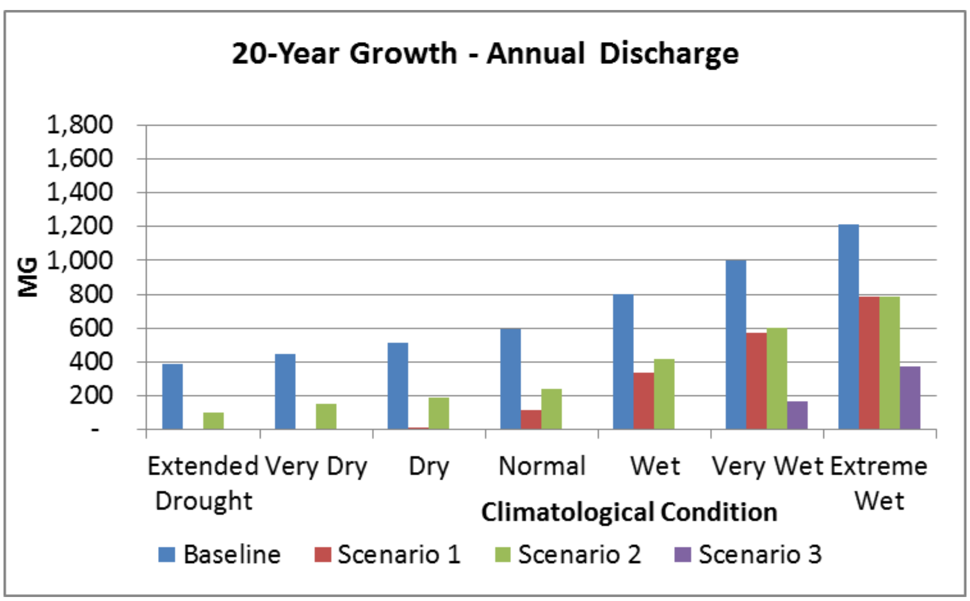


Figure 6-12 Annual Discharge, 20-year Horizon

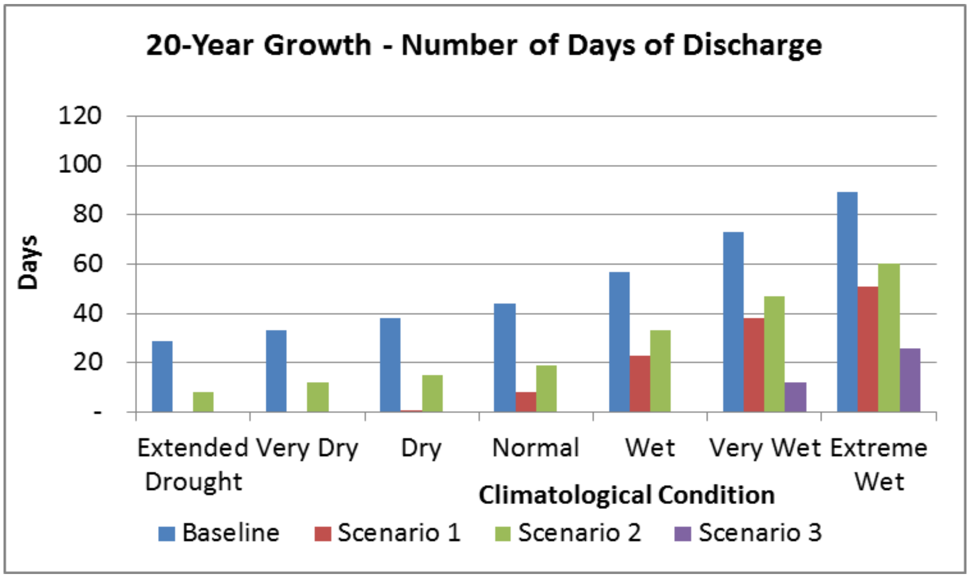


Figure 6-13 Days of Discharge, 20-year Horizon

Results – Buildout Conditions

As at the 20-year horizon, flows at buildout are sufficient to meet current reclamation demands, and as would be expected, the volume and extent of discharge is predicted to increase. Storage alone is no longer sufficient to prevent discharges under dry conditions; even during extended drought, annual discharge of 100 mg is predicted. Combining storage and increased Geysers delivery allows the City to avoid discharge under dry conditions, with minimal discharge under normal conditions (42 mg of discharge over 3 days). Under Wet to Extreme Wet conditions, discharges vary from 1,100-1,600 mg under the Baseline scenario to 247-660 mg in Scenario 3. Figures 6-14 and 6-15 show annual discharge and days of discharge under future buildout conditions for the range of climatological conditions examined.

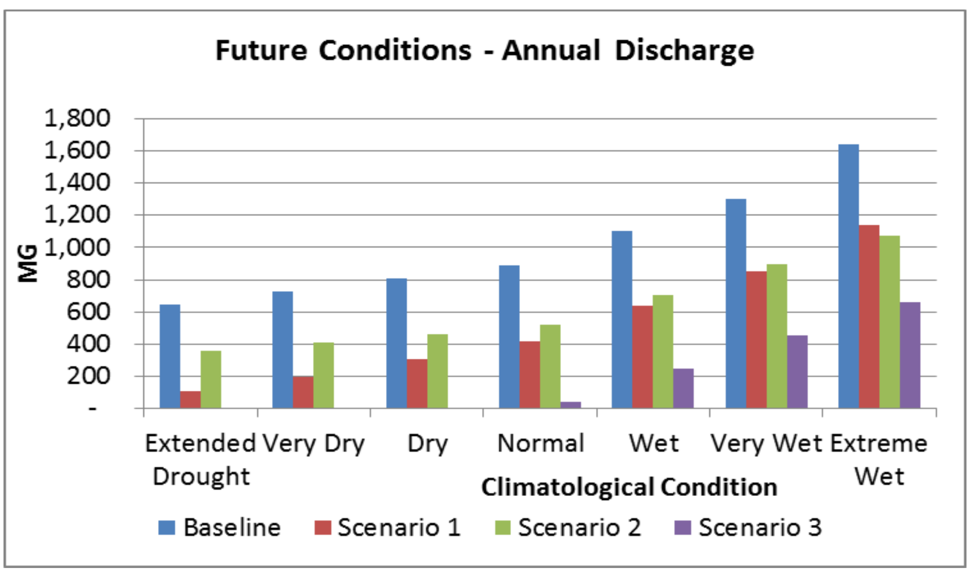


Figure 6-14 Annual Discharge, Buildout Conditions

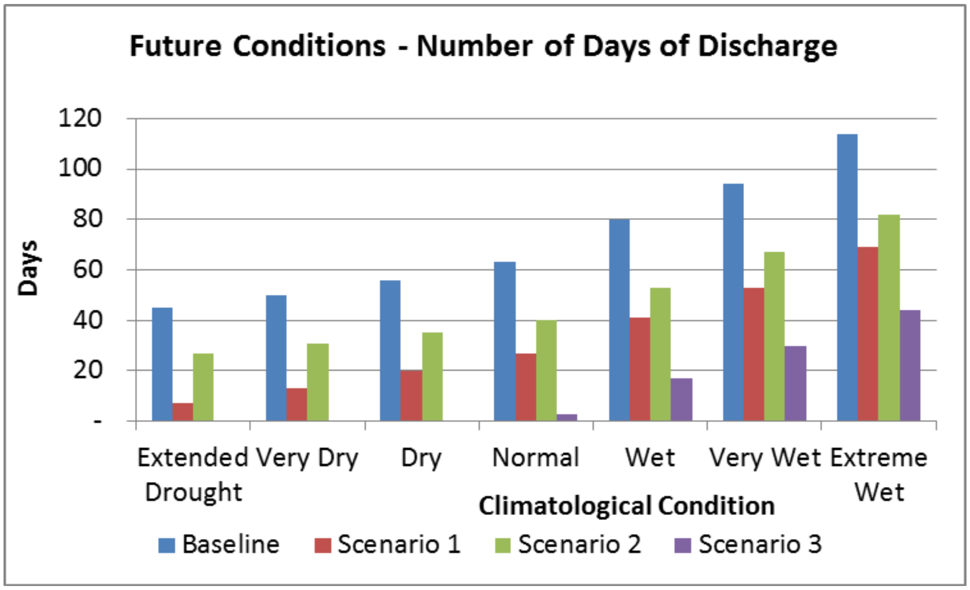


Figure 6-15 Days of Discharge, Buildout Conditions

Agricultural Deliveries Versus Demand

This model assumes that the delivered supply to agricultural and urban customers is equivalent to the demand for recycled water; however, the actual agricultural demand can be over twice what is being delivered. A sensitivity analysis was conducted to evaluate the impact of additional agricultural deliveries on near-term shortfall and long-term projected discharge. Adjusting the Existing Conditions Baseline Scenario model to assume twice the agricultural demand (plus Santa Rosa urban irrigation), or about 24-inches per acre (assuming 6,400 acres of farmland irrigated with recycled water) shows shortfall in supply for all climatological conditions and range from 454 mg over 50 days annually to 2,645 mg over 122 days annually. The increase in plant flows in the 20-Year Growth and Future Buildout Conditions does not eliminate shortfall in demand except in Very Wet climatological conditions (with an additional 500 mg of storage) and in Extreme Wet climatological conditions (baseline and with an additional 500 mg of storage).

The potential additional agricultural demand could aid in reducing and minimizing discharges in 20-Year Growth and Future Buildout Conditions. In 20-Year Growth Conditions, additional demand plus additional storage would allow discharge to be avoided under all but Very/Extreme wet conditions. Adding increased Geysers delivery would nearly eliminate discharge under all conditions, and would allow discharge to be avoided under all but Very wet and Extreme Wet conditions through buildout.

Conclusions

Several conclusions can be drawn from the evaluation of these storage and recycled water scenarios using the Excel spreadsheet model:

- Increase in average day plant flows will meet all existing recycled water demands (agricultural, Santa Rosa urban, Rohnert Park, and Geysers) under Buildout conditions.
- Additional storage is more effective in preventing discharge than increasing deliveries to the Geysers to Schedule II levels; however, increasing Geysers deliveries is more effective in

reducing the volume of discharges. The combination of both would be the most effective way to eliminate discharges.

- The 500 mg of storage recommended in the *IRWP Seasonal Storage Project EIR* (Santa Rosa, 2008) limits discharges to wet conditions in the 20-year planning horizon, but to limit discharge to only very wet or extreme wet conditions, increasing Geysers delivery to Schedule II levels is required.
- Additional storage (beyond 500 mg) will be required to manage projected flows under buildout conditions.

It is recommended that the City continue to calibrate the Excel spreadsheet storage model with recent recycled water demands, and select a preferred location for new dual-use storage basins that will mitigate both recycled water shortages and wet year discharges. The capital cost of new storage will inform the optimum timing for construction of a new storage basin to maximize recycled water revenue and minimize the cost of nutrient offsets associated with discharge.

6.2.4 Treatment Facilities

With the UV disinfection improvements underway and the planned expansion of West College Pond No. 1, the existing treatment facility will have sufficient capacity to treat projected future flows until late in the 20-year planning horizon. According to Order R1-2013-0001, as planned growth occurs and flows approach the existing permitted ADWF of 21.3 mgd, the City can submit an Engineering Report to the RWQCB detailing needed modifications to increase capacity up to ADWF 25.9 mgd. This incremental increase in flow will still be subject to the same discharge limits and zero net loading TMDL requirement, therefore to avoid discharge violations, additional flow must be used for reclamation.

Near-term flow projections were estimated based on projections compiled from 2015 Urban Water Management Plans of the member agencies. Flows are projected to increase over the 20-year planning horizon as shown in Figure 6-16, reaching the existing permitted capacity of 21.3 mgd by 2030 and slightly exceeding the current permitted capacity by 2035.

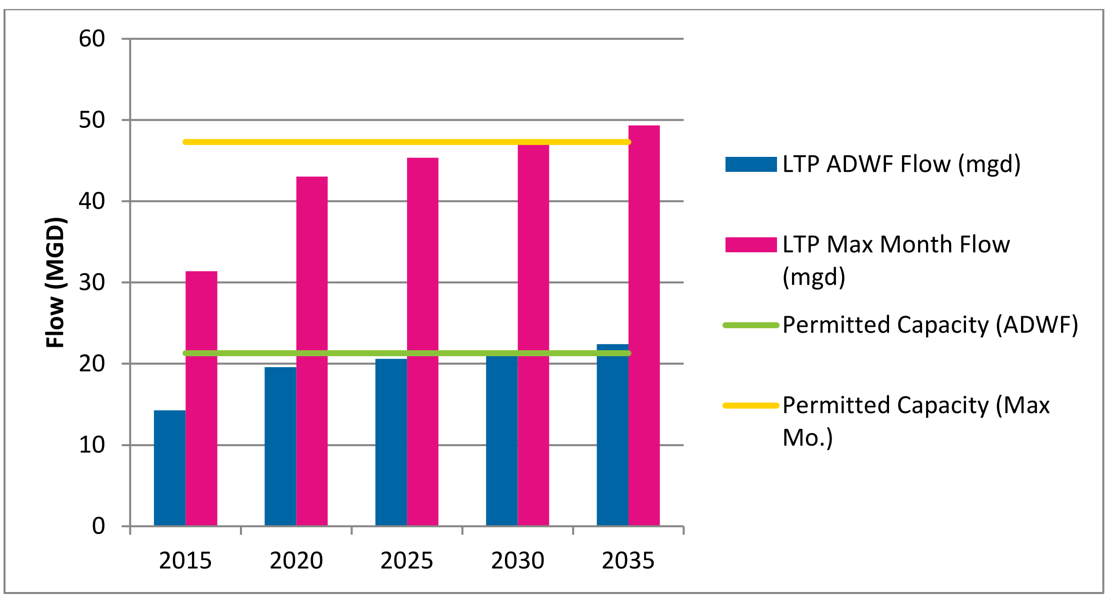


Figure 6-16 Projected Flows over Planning Horizon

Given the available capacity at the treatment plant, strategies to mitigate the risks identified in Section 5 focus on infrastructure reliability and redundancy, and discharge management.

Based on the existing effluent discharge and reuse program, additional treatment for CECs is not anticipated during the planning horizon of this Master Plan. Monitoring for CECs and addition of advanced treatment such as reverse osmosis and advanced oxidation may be required if the City implements potable reuse using groundwater recharge through surface spreading or direct injection. The findings of the State's CEC Advisory Panel indicated that irrigation and similar recycled water uses with low water injection rates do not warrant monitoring of CECs (SWRCB, 2010); however, the City should continue to track state-wide research and data collection that could change regulatory policy regarding CECs.

Infrastructure Reliability and Redundancy

Managing aging infrastructure is perhaps one of the most critical risks at the LTP. The preventative maintenance, renewal, and replacement program described in Section 6.2.1 will allow the City to maintain the desired level of service in all LTP assets, and plan for asset replacement at the appropriate time.

Through site visits and interviews with City staff, a number of immediate needs were identified related to the existing condition of the facilities. The LTP Condition Assessment Project (Santa Rosa, 2012b) also identified possible single points of failure at the LTP. These needs are noted in Table 6-14 below. Condition assessment needs associated with other Regional facilities were identified in Table 5-10 in the summary in Section 5.3 as key risk mitigation needs.

Table 6-14 Condition-Driven Improvements at the LTP

Description	Action Needed
Inadequate Freeboard. Freeboard in filter effluent channel may be limited.	Review past hydraulic profiles and update/calibrate as needed to determine freeboard.
Plant Piping Corrosion: Several plant piping systems (aeration air, RAS, filter effluent, and digester gas) have significant corrosion issues.	Staff has already replaced sections of the digester gas system. Continue proactive piping replacement, with priority given to 6" waste, 8" digester dewatering, and 24" RAS piping.
Cathodic Protection: System condition is unknown.	Conduct condition assessment of the cathodic protection systems.
Tertiary Filtration: Filter valve actuators have reached end of their useful life.	Half of actuators have been replaced. Continue Plant staff efforts to replace remaining valve actuators.
Discharge System Recovery/Access: Discharge line from LTP lacks adequate access.	Add access port to allow for inspection and maintenance.
Storage for non-compliant Water. Storage needed for water not meeting regulatory standards.	Improvements have been implemented to store non-compliant water at Brown Farm. Need to monitor influent conditions during return of non-compliant water back to the plant to assess turbidity impact and identify mitigation measures if needed.

Description	Action Needed
Digestion- H2S Removal: Existing equipment reduces concentrations to about 10 parts per million (ppm). Staff note that the engine generators are supposed to run with no more than 13 to 15 ppm of H2S and that there is not sufficient margin of safety.	Expand or replace existing system to provide sufficient H2S removal.
Digester Covers: Roofing of the two digesters with floating covers are in poor condition.	Project underway to replace floating covers with fixed covers.
Variable Speed Drives: Various variable speed drives are near the end of their useful lives.	Replace drives as needed.
Plant Power Facilities: Many electrical components are nearing the end of their useful life, including switchgear M1 and many load centers from 1976.	Replace electrical equipment per recommendations of 2006 Power Master Plan.
Laboratory. Additional testing facilities are needed: for nutrient testing, deionized (DI) water storage, off-site data backup/storage, and in-line nutrient monitoring.	Provide equipment as needed.
Laboratory: Existing space is at capacity given current staffing levels.	Review City's space allocation guidelines to determine need for additional space.
HVAC: Staff indicate that additional HVAC capacity is needed.	Provide additional capacity as needed.

Security of Reclamation System and Offset Program

Loss of disposal options is another critical risk to reliable LTP operation. Mitigating this risk requires ensuring that the reclamation system is able to provide beneficial reuse for as much effluent as is cost-effective, and that the treatment system reduce nutrients cost effectively in coordination with the nutrient credit trading program obtaining adequate credits to offset effluent discharge during wet years. Constructing additional seasonal storage as recommended in the *IRWP Seasonal Storage Project EIR* (Santa Rosa, 2008) will limit discharges from the LTP and associated nutrient credits required.

6.2.5 Emergency Preparedness

The City has taken many steps to identify, mitigate, and prepare for response to emergencies. The City-wide Emergency Operations Plan (Santa Rosa, 2008) provides a framework for emergency response for all City Departments, including a Continuity of Operations Program (COOP) for basic City functions and Standard Operating Procedures (SOPs) for the Utilities Department.

Recent flood protection improvements provide increased protection for the LTP against inundation by flooding or extreme weather events. In addition, emergency preparedness recommendations are documented in the City's Local Hazard Mitigation Plan (Santa Rosa, 2016c) and Climate Action Plan (Santa Rosa, 2012).

The City could further mitigate risk of natural disasters by developing a fire protection plan and implementing appropriate mitigation measures for the remote portions of the Geysers system.

6.2.6 Quality Assurance

A robust quality assurance program is critical to meeting regulatory requirements and maintaining proper operation of the Regional facilities. The City's Environmental Services laboratory utilizes a strong Quality Assurance Program to assure that data collection, analysis, storage, and reporting, and meets all current regulatory requirements. In the future, the City could consider the following to enhance quality assurance practices and programs:

- **Additional offsite backup of lab data.** The City has a data backup system onsite for short-term backup. It is recommended that the City determine long-term data backup needs, and secure appropriate long-term backup capabilities in a reliable offsite location.
- **Evaluate online nutrient monitoring.** Online measurement of nitrogen would provide reliable permit compliance data as well as valuable process control information. The City should conduct a business case evaluation to determine the appropriate type and location of online monitoring.
- **Use process model to validate equipment calibration**. Process models are valuable tools for process control and planning operations and maintenance activities at treatment facilities. They can also be used to validate data collected through online instrumentation and identify when instruments are out of calibration or beginning to drift from acceptable calibration range.

6.2.7 Institutional Resiliency

The institutional resiliency of the Regional operations is constantly being tested by internal and external forces. Internal changes such as staff turnover by retirement and other factors, especially supervisory and management positions, can leave gaps that take time to fill and creates a learning curve for those new to their positions. Capturing institutional knowledge through developing standard operating procedures, cross-training and job shadowing, and through the use of technology (GIS, databases, document libraries, etc.) are all measures that the City deploys to mitigate impacts from internal change. The City should consider a more formal succession planning program that includes progressive operator licensing to account for potential new technologies (nutrient recovery systems, advanced water treatment, etc.).

Aging work force is an industry-wide issue and preparations should be made for knowledge transfer to the next generation entering the workforce in this industry. Santa Rosa Water Management should be embracing recruitment and outreach at high schools and the JC operator program.

External forces such as economic, regulatory and environmental factors can also create the need for adaptation within the utility. Through strategic planning and professional development of staff the City manages to stay in front of emerging drivers by identifying opportunities and risks and developing strategies to appropriately manage for the anticipated changes that lay ahead. The City needs to continue these practices going forward with an eye towards building a learning organization that is resilient to change.

7. Recommended Financial Investments

The City has invested in several major capital projects and planning initiatives over the past 25-plus years to achieve desired service levels for the Regional Partners. This Master Plan is the first comprehensive planning effort for the WRS since the *IRWP EIR* completed more than a decade ago, but the City has continued over this period to perform condition assessments, implement needed capital improvements and advance its asset management practices to stay in front of emerging issues and refine the management and operation of the utility. This Master Plan serves to summarize recent studies and investment decisions, provides recommendations for additional assessments and capital projects, identifies strategic initiatives, and projects annual asset maintenance and renewal/replacement needs over the next 20 years.

7.1 Recommended Capital Improvement Projects

Recommended investments for capital projects, including assessments, infrastructure improvements, and strategic initiatives, create opportunities to achieve greater energy efficiencies and lower cost of operations, and serve to mitigate identified risks to achieving desired levels of service. The projects documented in this section include CIP projects previously identified by the City, recommendations from previous studies not yet implemented, and new projects identified through this master planning effort.

7.1.1 Basis for Estimated Costs

The cost estimates developed for recommended projects under this Master Plan are planning level and intended for comparing alternatives and establishing estimates of probable project costs for the City's budget. Project costs are Class 5 (planning-level) estimates of probable cost as defined by the Association for the Advancement of Cost Engineering, International (AACE). AACE defines the "Class 5" estimate as follows:

> *Generally prepared on very limited information, where little more than proposed plan type, its location, and the capacity are known, and for strategic planning purposes such as but not limited to market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, long-range capital planning, etc. Some examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. Typically, very little time is expended in the development of this estimate. The typical expected accuracy ranges for this class estimate are -20% to -50% on the low side and +30% to +100% on the high side.*

Construction costs are based on the May 2018 Engineering News Record Construction Cost Index (ENR CCI) for San Francisco, CA (12,014.72).

7.1.2 Prioritization of Recommended Capital Projects

Capital projects include previously identified CIP projects, recommended projects from recent studies completed by the City, and projects identified from this master planning effort. These projects are categorized by WRS functional area including the LTP and environmental laboratory, biosolids facilities, reclamation facilities, and Geysers facilities. City staff reviewed these projects in aggregate and prioritized them as "A" (immediate need), "B" (near-future need) or "C" (future need).

Recommended capital projects are presented in Tables 7-1 through 7-4 for each of the WRS functional areas in order of priority. Recommended capital projects generated from this master planning effort are described in Appendix B of this Master Plan. Descriptions for the other capital projects can be found in the City's CIP.

Table 7-1 Recommended Capital Projects – LTP and Environmental Laboratory

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
PID2050	LTP Elec Infrastructure Replacement	Replace aging assets	$4,000,000	A
PID544	LTP Flood Protection	Operational reliability and safety	$15,818,671	A
FP01	Uninterruptable Power Supply	Operational reliability	$25,000	A
PID2051	Primary Influent Pump Drive Replacement	Replace aging assets	$1,876,249	A
PID284	Disinfection Replacement	Replace aging assets	$39,022,150	A
PID2192	Emergency Generator Fuel Tank Replacement	Replace aging assets	$175,000	A
PID2193	Repair Roofs and Replace Insulation Digester Nos. 1 & 2	Rehabilitate aging assets	$350,000	A
PID2100	Filter Influent Pmp Stn Discharge Piping	Replace aging assets	$400,000	A
PID2170	Manhole Rehabilitation and Coating of Influent Suction Pipes	Rehabilitate aging assets	$400,000	A
PID2098	Seismic Eval and retrofit - LTP Maint Building	Operational reliability and safety	$900,000	A
PID2172	Seismic Evaluation and Retrofit of LTP Annex Building	Operational reliability and safety	$650,000	A
PID2106	Subregional EOP Project #1	Energy optimization	$100,000	A
PID1836	Subregional Asset Management Implementation	Asset management	$650,440	A
PID2094	LTP On-Call Contractor	Asset management	$6,000,000	A
MP04	Nutrient Management Plan	Compliance	$75,000	A
PID1640	Nutrient Offset Program and Discharge Compliance	Compliance	$4,000,000	A
PID1980	NPDES Compliance Consultation Services	Compliance	$2,000,000	A
MP02	LTP Piping Conditioning Assessment	Asset management	$350,000	A
MP03	LTP Buried Ductbank Condition Assessment	Asset management	$50,000	A
MP12	Filter Effluent Hydraulic Review	Capacity	$75,000	A
PID1957	LTP Onsite Diversion System	Operational reliability and compliance	$2,076,498	A
PID1959	Natural Gas Engine Conversion - Combined Heat & Power facility	Energy optimization	$1,200,000	A
PID2174	SCTPW Project Coordination - Subregional	Pavement maintenance coordination	$100,000	A
PID1370	Subregional PLC Replacement	Replace aging assets	$69,251	B
PID2171	Rehabilitation and Coating of Influent and Effluent Channels	Rehabilitate aging assets	$525,000	B

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
MP21	Llano Trunk Sewer - CIPP Lining	Rehabilitate aging assets	$16,500,000	B
PID1978	Replace Compressors Waste Gas Assembly	Replace aging assets	$12,800,000	B
PID2096	Filter Valve Actuators - Phase 2	Replace aging assets	$1,300,000	B
PID2049	Superstructure Removal Phase 2	Operational reliability and safety	$4,000,000	B
PID1979	Secondary Clarifier No 4 Rehabilitation	Rehabilitate aging assets	$500,000	B
PID2103	LTP Booster Stn 1 Replacement	Replace aging assets	$200,000	B
PID1976	West College Concrete Basin Joint Repair	Rehabilitate aging assets	$400,000	B
PID2166	Digester No. 3 and 4 Rehabilitation	Rehabilitate aging assets	$600,000	B
PID2046	Subregional Mitigation Bank Development	Compliance	$950,000	B
PID2173	Seismic Evaluation and Retrofit of LTP Chemical Building	Operational reliability and safety	$250,000	B
MP15	Environmental Laboratory Upgrades	Compliance and capacity	$595,000	B
MP17	Asset Management Plan	Asset management	$1,200,000	B
MP18	Master Plan Updates	Asset management	$200,000	B
MP19	Integrated Water Management Study	Compliance and optimization	$500,000	B
PID1910	Laguna Effluent Line Access Port Installation	Maintenance	$500,000	B
FP07	Digester Mixing Upgrades	Energy optimization	$50,000	B
PID2196	Potable Water Line to Admin Building	Replace aging assets	$350,000	B
PID2195	Plant Paving Rehabilitation	Rehabilitate aging assets	$250,000	C
FP08	Holistic LTP plant modeling process	Operational optimization and compliance	$200,000	C
FP10	Aeration Tank Diffuser Replacements	Replace aging assets	$100,000	C
FP13	Repair Failing Non Structural Masonry Coating on Exterior of Digester No. 4.	Rehabilitate aging assets	$50,000	C
MP29	Concrete Coating of Settled Sewage, RAS and Mixed Liquor Channels	Rehabilitate aging assets	$1,525,000	C
PID2104	LTP Fleet Gas Station	Optimization	$300,000	C
PID2132	Admin Building Remodel	Rehabilitate aging assets	$650,000	C
PID2119	LTP Stormwater Treatment Enhancements - 2017 Bonds	Compliance	$4,050,000	C
MP09	Environmental Laboratory Facility Needs Assessment	Asset management	$50,000	C
PID1447	Energy Optimization Plan- Subregional	Energy optimization	$515,920	C

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
PID1838	Alternative Funding Pursuit	Identify and pursue funding sources	$2,000,000	C
PID511	Subregional Plant Alternative Energy Opportunities	Energy optimization	$777,480	C
MP14	Building Systems Assessment for Admin and Compost Ops Buildings	Asset management	$50,000	C
MP22	High Strength Waste Facility Capacity Expansion	Energy optimization and capacity	$200,000	C
MP28	Coat Process Basins	Rehabilitate aging assets	$500,000	C

Notes: a. Recommended capital projects generated from the master planning effort have an assigned “MP” number. Additional projects identified by the City have a “PID” number if they were previously identified in the CIP, or “FP” (Future Project) designation if they are new to the list and have not yet been assigned a PID.

Table 7-2 Recommended Capital Projects – Biosolids Facilities

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
FP04	Sump Pump Check Valves	Replace aging assets	$30,000	A
PID1975	Compost Building Roof and Ventilation Rehabilitation	Replace aging assets	$3,000,000	B
MP08	Biosolids Market Study	Potential revenue source	$100,000	B
PID2102	Biosolids Agitator Position Control Improvements	Operational optimization	$250,000	C
FP11	Biofilter Media Upgrade	Replace aging assets	$50,000	C
MP25	Conversion to Class A Biosolids Program	Compliance	$10,600,000	C
MP10	Biosolids Seasonal Storage Expansion	Capacity	$5,200,000	C

Notes: a. Recommended capital projects generated from the master planning effort have an assigned “MP” number. Additional projects identified by the City have a “PID” number if they were previously identified in the CIP, or “FP” (Future Project) designation if they are new to the list and have not yet been assigned a PID.

Table 7-3 Recommended Capital Projects – Reclamation Facilities

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
PID2110	Reclamation System Condition Assessment Analysis – Phase 1	Asset management	$200,000	A
PID2107	Subregional EOP Project #2	Energy optimization	$200,000	A
MP11	Reclamation System Condition Assessment Phase 2 - Physical Assessment	Asset management	$600,000	A
FP02	Pond Lease for 1 MW Floating Solar PV, PPA (REM 9-5) #9, Tier 1 EOP project	Energy optimization	$20,000	A
MP13	Delta Pond Access Road	Operational reliability and safety	$1,000,000	B
PID1909	Rock Slope Protection - Ponds Delta, C, D	Rehabilitate aging assets	$1,500,000	B

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
PID2197	Repair Deep Anode Cathodic Protection Well	Rehabilitate aging assets	$150,000	B
PID2093	Reclamation Pipe Replacement	Replace aging assets	$100,000	B
FP06	Delta Pond Piping Diffuser Improvements	Rehabilitate aging assets	$250,000	B
FP09	Upgrade Delta Pump #2	Rehabilitate aging assets	$50,000	C
FP12	Repair Mixing Valve at Delta Pond	Rehabilitate aging assets	$100,000	C
MP27	Expansion of Seasonal Storage	Capacity	$110,000,000	C
MP07	Agricultural Reuse Optimization	Optimize renewable resources	$150,000	C
MP20	Land Management Plan/Ranch Plan Updates	Compliance	$150,000	C
MP34	Brown Pond Re-grading	Rehabilitate aging assets	$400,000	C

Notes: a. Recommended capital projects generated from the master planning effort have an assigned “MP” number. Additional projects identified by the City have a “PID” number if they were previously identified in the CIP, or “FP” (Future Project) designation if they are new to the list and have not yet been assigned a PID.

Table 7-4 Recommended Capital Projects – Geysers Facilities

MP, PID, or FP No.[a]	Project	Purpose/Scope	Estimated Costs	Priority Class
PID2191	Geysers Terminal Reservoir Bypass Piping	Operational optimization and reliability	$250,000	A
PID2194	Geysers Terminal Reservoir Recoating	Rehabilitate aging assets	$125,000	A
FP03	Excessive head losses in Geyser Pipeline near Bear Canyon .(#4) Tier 1 EOP project	Energy optimization	$30,000	A
PID2189	Slip out repair: Pine Flat Rd. at Mayacamas Pump station	Maintenance	$200,000	B
FP05	Restore Geysers Pipeline Capacity	Capacity	$70,000	B
PID1973	Pine Flat Road Stabilization Measures	Maintenance	$500,000	B
MP26	Increase Pumping Capacity of Geysers Pump Stations	Capacity	$7,100,000	C
MP24	Geysers Pipeline Condition Assessment	Asset management	$500,000	C

Notes: a Recommended capital projects generated from the master planning effort have an assigned “MP” number. Additional projects identified by the City have a “PID” number if they were previously identified in the CIP, or “FP” (Future Project) designation if they are new to the list and have not yet been assigned a PID.

7.2 Annual Asset Renewal and Replacement Needs

Although this Master Plan focuses on recommended capital projects, the City will need to have in place a financial plan that accommodates annual asset renewal and replacement needs. The timing of the capital projects and the overall average investment costs, including renewal and replacement, are important factors in developing the long-term financial picture of the WRS enterprise. During the budget planning period for the 2018/19 budget year the City performed an assessment of annual asset renewal and replacement needs to develop a preliminary picture of total spending needs.

7.2.1 Asset Renewal and Replacement Needs Analysis

The data used to estimate asset renewal and replacement costs is a 2015 spreadsheet containing all WRS assets from the City's CMMS database. Key attributes including installation date, estimated service life, frequency of refurbishments, replacement cost and refurbishment cost are included in the spreadsheet. This data set consisted primarily of electrical and mechanical equipment. For a complete assessment the City added assets covering pipelines, buildings, site civil improvements, electrical distribution, and other miscellaneous assets that were missing in the original spreadsheet. The City has not thoroughly vetted this data set, which requires significant time and effort, and it provides only an approximation of the spending needs for the WRS facilities. The City should continue to review and improve the quality of the data in the CMMS database as part of its ongoing asset management program.

The original data set included only construction costs; soft costs were not included. For this analysis a project multiplier of 1.4 for renewal and replacement costs that were expected to cost less than $150,000 (maintenance projects), and a project multiplier of 1.7 for projects expecting to cost more than $150,000 (capital projects). These multipliers allow for administration, design, permits and construction management costs. Renewal and replacement costs covered under proposed capital projects described in Tables 7-1 through 7-4 were set aside to avoid double counting.

The anticipated annual renewal and replacement costs are based on industry standard preventative maintenance schedules and industry standard service life by asset type. The timing and value of actual expenditures could differ based on the judgement of City personnel who are monitoring WRS asset conditions in real time. The renewal and replacement costs summarized in Table 7-5 provide a realistic representation of the average investment needs over time to renew and replace existing WRS assets.

Table 7-5 Projected Annual Asset Renewal and Replacement Costs

Asset Grouping	5-Year Average	10-Year Average	15-Year Average	20-Year Average
LTP and Laboratory	$4,435,646	$6,689,446	$5,311,993	$4,745,119
Biosolids Facilities	$470,367	$422,574	$411,715	$495,158
Reclamation Facilities	$384,252	$7,716,333	$5,650,082	$4,321,983
Geysers Facilities	$181,510	$379,209	$1,130,127	$1,125,636
All WRS Facilities	**$5,471,775**	**$15,207,563**	**$12,503,917**	**$10,687,896**

Note: All costs are in 2017 dollars.

The Master Plan covers a 20-year planning horizon and there are several significant events that impact the average annual spending needs presented in Table 7-5:

- Replace over 32,000 linear feet of 27-inch diameter recycled water transmission pipe (Master Plan Year 6)
- Replace primary and secondary sludge collectors installed in 1976 (Master Plan Year 9)
- Replace air, sludge, gas, electrical duct and miscellaneous yard piping installed in 1976 (Master Plan Year 9)

- Replace over 60,000 linear feet of 12- to 48-inch diameter recycled water pipe (Master Plan Year 10)

These large replacement expenditures could potentially be deferred and spread over more years if recommended condition assessments, covered under recommended capital projects, indicate that the assets are in good condition and service lives can be extended. Information on the asset renewal and replacement analysis is provided in Appendix D.

7.3 20-Year Financial Investment Profile

Viewing the recommended financial investments along a 20-year timeline is helpful to highlight investment spikes and average annual budget needs across the full planning horizon. Figure 7-1 provides a 20-year capital investment profile for the WRS. These capital investments are necessary to address planned growth within the service area, maintain operability and reliability of aging assets, and anticipate evolving drivers that could change the levels of service expected from the Regional System.

The City has approved a bond program to pay for the near term investment spike for several large capital projects that will restore LTP capacity to a peak day flow of 67 mgd, protect the LTP from floods, and address aging infrastructure concerns, some of which are urgent. A second investment spike is predicted in another 15 to 20 years, primarily due to the need for additional seasonal storage. The investment profile shown includes half of the needed investment for seasonal storage ($55 million) under the assumption that the two additional ponds could be constructed in phases. The City should begin planning for how to pay for that inevitable investment now.

This Master Plan and the 20-year investment profile should be updated every 5 years to ensure that long term funding needs are monitored and necessary improvements are made to operate the WRS in a sustainable manner, balancing levels of service with cost of service and acceptable risk. This will allow the Regional Partners to continue their historical practice of managing the WRS at the lowest cost of ownership without sacrificing desired levels of service for stakeholders.

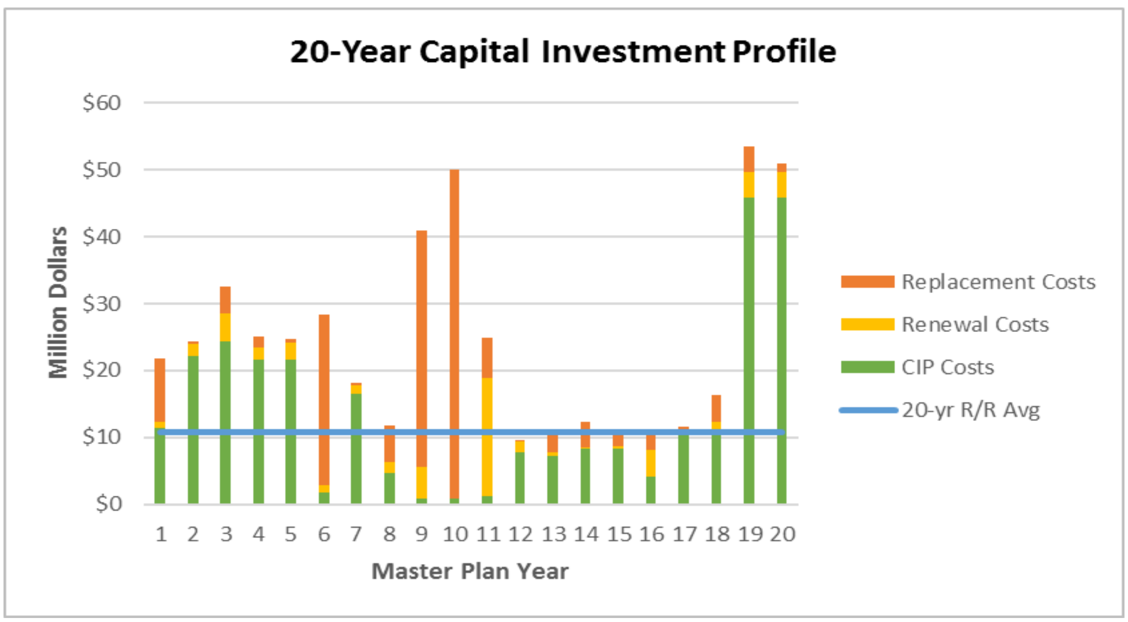


Figure 7-1 20-Year Profile of Recommended WRS Investments

Appendices

Appendix A References

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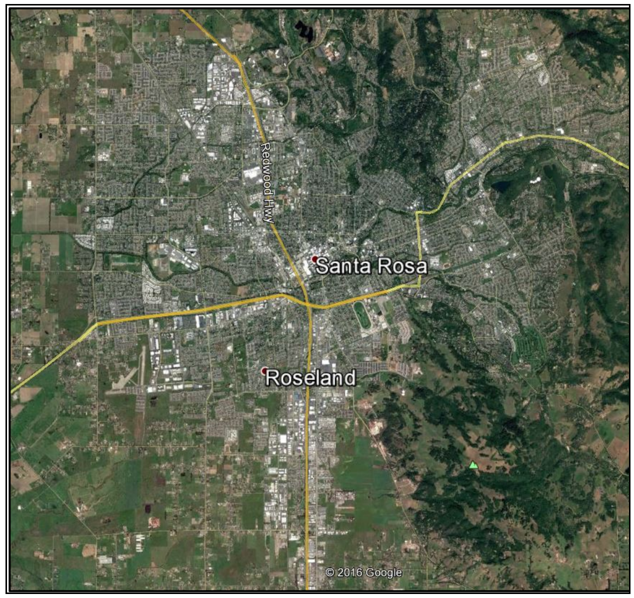
Appendix B Project Descriptions and Budgetary Costs

MP11 Reclamation System Condition Assessment - Phase 2

Project Description
Conduct physical condition assessment of the low-pressure transmission mains to establish maximum safe working pressure and remaining useful life. The design basis for the existing transmission pipelines is largely unknown, so historical practices dictate how the system is operated. The absence of critical design information imposes artificial limits on how the pipeline and pump stations can be operated, and is potentially risky if the pipeline is being operated at higher pressures than originally designed for. Use of the Meadow Lane pressure-relief bypass can be reduced if the safe working pressure of the low-pressure transmission main can be safely increased.



Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding:**	$600,000

MP02 LTP Piping Condition Assessment

Project Description

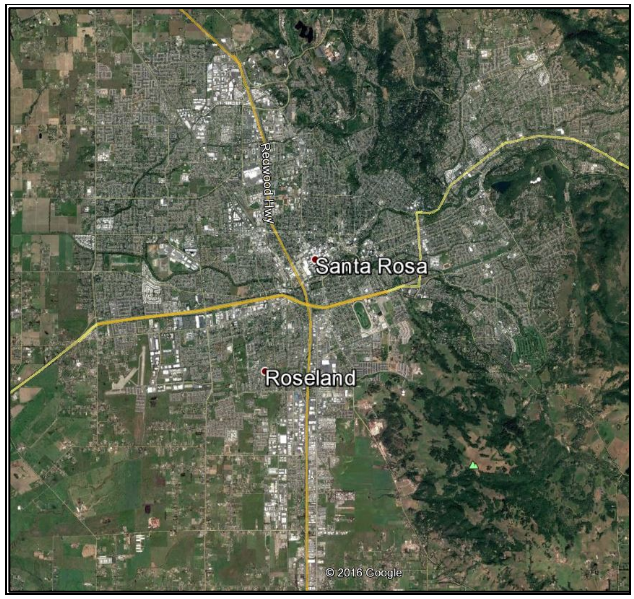
The 2012 LTP Condition Assessment only evaluated influent piping. Conduct condition assessment of buried and exposed piping systems and cathodic protection systems. Corrosion issues noted in aeration air, return activated sludge (RAS), filter effluent, and digester gas piping.

Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$350,000

MP08 Biosolids Market Study

Project Description

Conduct a market study to determine demand for and relative appeal of different types of Class A biosolids product. Results will support future assessment recommended in the Biosolids Management Strategic Plan and determination of final Class A strategy

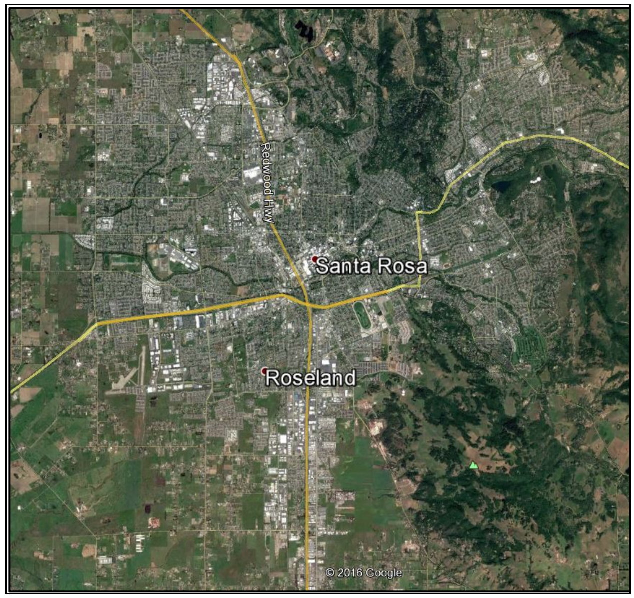


Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$100,000

MP07 Agricultural Reuse Optimization

Project Description

Evaluate current agriculture reuse and recommend best practices to optimize reuse and potentially reduce annual demands.



Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$150,000

MP09 Laboratory Facility Needs Assessment

Project Description

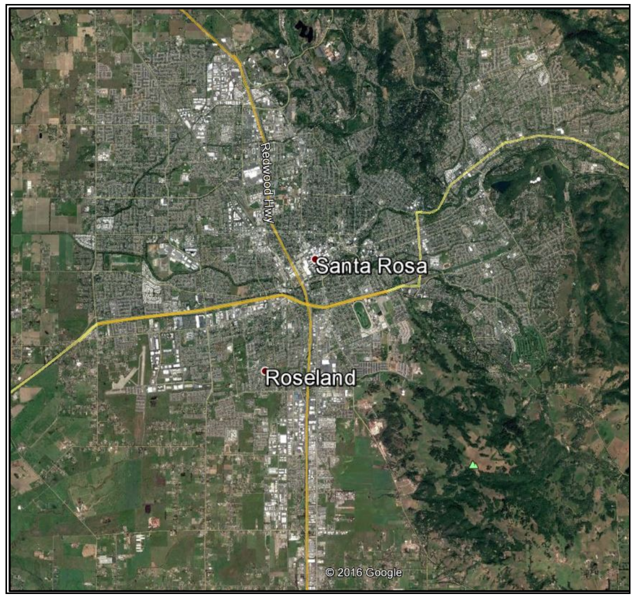
Laboratory space is at capacity with current staffing levels. Review City's space allocation guidelines to determine additional space required for staff, and anticipated needs for lab facilities.

Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$50,000

MP07 Agricultural Reuse Optimization

Project Description

Agricultural reclaimed water is the most expensive water the City provides. A study should be conducted to evaluate the feasibility of transferring ownership of small onsite booster pump stations to the property owners that they serve. This change has the effect of reducing delivery pressures and optimizing energy for time-of-use.



Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$150,000

MP12 Filter Effluent Hydraulic Review

Project Description

Staff noted limited freeboard, and indicated that sandbagging of filter structure is required at high flows. Conduct hydraulic study to confirm capacity and identify improvements to mitigate risk of overtopping structures.

Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$75,000

MP20 Land Management Plan / Ranch Plan Updates

Project Description

Create a land management plan for currently owned and desired properties supporting the SWRRF. Document existing parcels, easements, and agreements, identify parcels desired for buffer or other uses, and update the Ranch Plans.

Project Contact:	TBD	**Estimated Construction:**	N/A
Cumulative Prior Funding:	$0	**Estimated Funding After 2018/19:**	
Total 5-Year Funding:		**Total Project Funding**	$150,000

MP15 Environmental Laboratory Upgrades

Project Description

Additional testing facilities are needed for nutrient testing, deionized (DI) water storage, off-site data backup/storage, and in-line nutrient monitoring.

Project Contact:	TBD	**Estimated Construction:**	TBD
Cumulative Prior Year Funding:	$0	**Estimated Funding After 2018/19:**	$595,000
Total 5-Year Funding:	$595,000	**Total Project Funding:**	$595,000

MP10 Biosolids Seasonal Storage Expansion

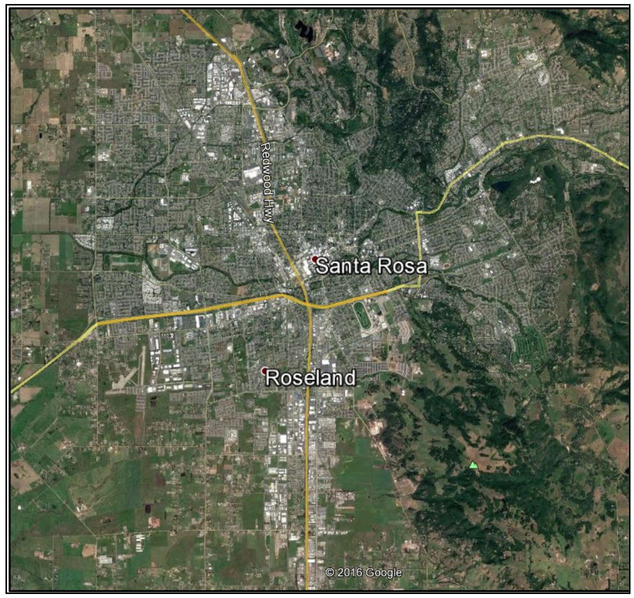
Project Description
Provide additional 5000 wet tons of covered storage for Class B biosolids at existing City farms.

Project Contact:	TBD	**Estimated Construction:**	TBD
Cumulative Prior Year Funding:	$0	**Estimated Funding After 2018/19:**	$5,200,000
Total 5-Year Funding:	$5,200,000	**Total Project Funding:**	$5,200,000

MP26 Geysers Pump Stations Upgrades

Project Description

Provide improvements to increase firm pumping capacity at the Geysers Pump Stations (Bear Canyon, Mayacamas, and Pine Flat) to allow delivery of up to 20 mgd to the Geysers. Project includes upgrade of all three pump stations.



Project Contact:	TBD	**Estimated Construction:**	TBD
Cumulative Prior Year Funding	N/A	**Estimated Funding After 2018/19**	$7,100,000
Total 5-Year Funding:	$7,100,000	**Total Project Funding**	$7,100,000

Appendix C Water Reuse Model Results

Table C-1: Reuse System Model Results - Existing Conditions

		Annual Rainfall	Volume in Use	Annual Shortfall in Supply	Average Shortfall in Supply	Max Shortfall in Supply	No. Days Shortfall in Supply	Annual Discharge	Average Discharge	Max Discharge	No. Days Discharge
		in	MG	MG	MGD	MG		MG	MGD	MG	
Extended Drought	Baseline	10.95	1,422.80	439.51	1.20	9.54	67.00	-	-	-	-
	Scenario 1	10.95	1,922.80	505.75	1.39	9.54	74.00	-	-	-	-
	Scenario 2	10.95	1,422.80	849.53	2.33	11.25	96.00	-	-	-	-
	Scenario 3	10.95	1,922.80	907.20	2.49	11.24	101.00	-	-	-	-
Very Dry	Baseline	15.33	1,422.80	298.07	0.82	6.91	54.00	-	-	-	-
	Scenario 1	15.33	1,922.80	355.13	0.97	8.15	61.00	-	-	-	-
	Scenario 2	15.33	1,422.80	721.97	1.98	10.29	89.00	-	-	-	-
	Scenario 3	15.33	1,922.80	762.63	2.09	10.29	93.00	-	-	-	-
Dry	Baseline	20.88	1,422.80	164.56	0.45	6.24	37.00	-	-	-	-
	Scenario 1	20.88	1,922.80	212.38	0.58	8.37	44.00	-	-	-	-
	Scenario 2	20.88	1,422.80	598.19	1.64	11.48	81.00	-	-	-	-
	Scenario 3	20.88	1,922.80	625.82	1.71	12.11	84.00	-	-	-	-
Normal	Baseline	30.61	1,422.80	-	-	-	-	-	-	-	-
	Scenario 1	30.61	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	30.61	1,422.80	326.66	0.89	6.76	59.00	-	-	-	-
	Scenario 3	30.61	1,922.80	351.26	0.96	8.71	62.00	-	-	-	-
Wet	Baseline	43.01	1,422.80	-	-	-	-	-	-	-	-
	Scenario 1	43.01	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	43.01	1,422.80	80.32	0.22	3.60	23.00	-	-	-	-
	Scenario 3	43.01	1,922.80	102.63	0.28	3.57	30.00	-	-	-	-
Very Wet	Baseline	60.91	1,422.80	-	-	-	-	68.70	0.19	11.45	6.00
	Scenario 1	60.91	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	60.91	1,422.80	-	-	-	-	-	-	-	-
	Scenario 3	60.91	1,922.80	-	-	-	-	-	-	-	-
Extreme Wet	Baseline	67.26	1,422.80	-	-	-	-	253.09	0.69	12.06	21.00
	Scenario 1	67.26	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	67.26	1,422.80	-	-	-	-	-	-	-	-
	Scenario 3	67.26	1,922.80	-	-	-	-	-	-	-	-

Table C-2: Reuse System Model Results – 20-Year Planning Horizon Conditions

		Annual Rainfall	Volume in Use	Annual Shortfall in Supply	Average Shortfall in Supply	Max Shortfall in Supply	No. Days Shortfall in Supply	Annual Discharge	Average Discharge	Max Discharge	No. Days Discharge
		in	MG	MG	MGD	MG		MG	MGD	MG	
Extended Drought	Baseline	10.95	1,422.80	-	-	-	-	390.94	1.07	13.80	29.00
	Scenario 1	10.95	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	10.95	1,422.80	-	-	-	-	100.70	0.28	12.59	8.00
	Scenario 3	10.95	1,922.80	-	-	-	-	-	-	-	-
Very Dry	Baseline	15.33	1,422.80	-	-	-	-	445.80	1.22	13.91	33.00
	Scenario 1	15.33	1,922.80	-	-	-	-	-	-	-	-
	Scenario 2	15.33	1,422.80	-	-	-	-	151.52	0.42	12.63	12.00
	Scenario 3	15.33	1,922.80	-	-	-	-	-	-	-	-
Dry	Baseline	20.88	1,422.80	-	-	-	-	514.03	1.41	14.02	38.00
	Scenario 1	20.88	1,922.80	-	-	-	-	14.02	0.04	14.02	1.00
	Scenario 2	20.88	1,422.80	-	-	-	-	189.98	0.52	12.67	15.00
	Scenario 3	20.88	1,922.80	-	-	-	-	-	-	-	-
Normal	Baseline	30.61	1,422.80	-	-	-	-	597.03	1.64	14.14	44.00
	Scenario 1	30.61	1,922.80	-	-	-	-	113.01	0.31	14.14	8.00
	Scenario 2	30.61	1,422.80	-	-	-	-	241.38	0.66	12.71	19.00
	Scenario 3	30.61	1,922.80	-	-	-	-	-	-	-	-
Wet	Baseline	43.01	1,422.80	-	-	-	-	802.24	2.20	14.74	57.00
	Scenario 1	43.01	1,922.80	-	-	-	-	338.82	0.93	14.74	23.00
	Scenario 2	43.01	1,422.80	-	-	-	-	420.48	1.15	13.59	33.00
	Scenario 3	43.01	1,922.80	-	-	-	-	-	-	-	-
Very Wet	Baseline	60.91	1,422.80	-	-	-	-	999.02	2.74	15.35	73.00
	Scenario 1	60.91	1,922.80	-	-	-	-	573.04	1.57	15.35	38.00
	Scenario 2	60.91	1,422.80	-	-	-	-	602.44	1.65	14.13	47.00
	Scenario 3	60.91	1,922.80	-	-	-	-	166.74	0.46	14.13	12.00
Extreme Wet	Baseline	67.26	1,422.80	-	-	-	-	1,214.52	3.33	15.96	89.00
	Scenario 1	67.26	1,922.80	-	-	-	-	788.76	2.16	15.96	51.00
	Scenario 2	67.26	1,422.80	-	-	-	-	788.74	2.16	14.67	60.00
	Scenario 3	67.26	1,922.80	-	-	-	-	374.73	1.03	14.67	26.00

Table C-3: Reuse System Model Results - Buildout Conditions

		Annual Rainfall	Volume in Use	Annual Shortfall in Supply	Average Shortfall in Supply	Max Shortfall in Supply	No. Days Shortfall in Supply	Annual Discharge	Average Discharge	Max Discharge	No. Days Discharge
		in	MG	MG	MGD	MG		MG	MGD	MG	
Extended Drought	Baseline	10.95	1,422.80	-	-	-	-	648.25	1.78	15.00	45.00
	Scenario 1	10.95	1,922.80	-	-	-	-	105.03	0.29	15.00	7.00
	Scenario 2	10.95	1,422.80	-	-	-	-	359.62	0.99	13.79	27.00
	Scenario 3	10.95	1,922.80	-	-	-	-	-	-	-	-
Very Dry	Baseline	15.33	1,422.80	-	-	-	-	724.08	1.98	15.11	50.00
	Scenario 1	15.33	1,922.80	-	-	-	-	196.48	0.54	15.11	13.00
	Scenario 2	15.33	1,422.80	-	-	-	-	408.75	1.12	13.83	31.00
	Scenario 3	15.33	1,922.80	-	-	-	-	-	-	-	-
Dry	Baseline	20.88	1,422.80	-	-	-	-	809.13	2.22	15.22	56.00
	Scenario 1	20.88	1,922.80	-	-	-	-	304.39	0.83	15.22	20.00
	Scenario 2	20.88	1,422.80	-	-	-	-	457.93	1.25	14.20	35.00
	Scenario 3	20.88	1,922.80	-	-	-	-	-	-	-	-
Normal	Baseline	30.61	1,422.80	-	-	-	-	885.12	2.42	15.34	63.00
	Scenario 1	30.61	1,922.80	-	-	-	-	413.78	1.13	15.34	27.00
	Scenario 2	30.61	1,422.80	-	-	-	-	520.73	1.43	14.25	40.00
	Scenario 3	30.61	1,922.80	-	-	-	-	42.04	0.12	14.25	3.00
Wet	Baseline	43.01	1,422.80	-	-	-	-	1,099.87	3.01	15.94	80.00
	Scenario 1	43.01	1,922.80	-	-	-	-	638.39	1.75	15.94	41.00
	Scenario 2	43.01	1,422.80	-	-	-	-	704.08	1.93	14.79	53.00
	Scenario 3	43.01	1,922.80	-	-	-	-	246.91	0.68	14.79	17.00
Very Wet	Baseline	60.91	1,422.80	-	-	-	-	1,303.75	3.57	16.55	94.00
	Scenario 1	60.91	1,922.80	-	-	-	-	851.03	2.33	16.55	53.00
	Scenario 2	60.91	1,422.80	-	-	-	-	894.35	2.45	15.33	67.00
	Scenario 3	60.91	1,922.80	-	-	-	-	451.50	1.24	15.33	30.00
Extreme Wet	Baseline	67.26	1,422.80	-	-	-	-	1,641.06	4.50	17.16	114.00
	Scenario 1	67.26	1,922.80	-	-	-	-	1,136.76	3.11	17.16	69.00
	Scenario 2	67.26	1,422.80	-	-	-	-	1,075.89	2.95	15.87	82.00
	Scenario 3	67.26	1,922.80	-	-	-	-	659.88	1.81	15.87	44.00

Appendix D Recommended Financial Investments

- Tech Memo – Estimated WRS Annual Renewal & Replacement Costs
- City of Santa Rosa's Draft CIP Project Prioritization with GHD Comments (10/27/2018)
- Annual Cost of Implementing Recommended CIP Projects over 20 Years

Tech Memo – Estimated WRS Annual Renewal & Replacement Costs

TECHNICAL MEMORANDUM

SWRRF Master Plan
TM Title

Prepared For:	City of Santa Rosa
Prepared By:	Ted Whiton, GHD
Reviewed By:	Heather Stephens, K/J
Date:	27 January 2018

As owner and operator of the Santa Rosa Regional Water Reuse System (WRS), the City seeks to deliver levels of service expected by regulators and ratepayers in balance with the cost of delivering these services, and at a level of risk acceptable to the Board of Public Utilities. The WRS master plan recommends capital projects intended to serve this goal. These projects, when added to the ongoing renewal and replacement needs for existing assets and the currently approved Capital Investment Program (CIP) projects represent a significant portion of the financial investment needs of the WRS. This technical memorandum summarizes the renewal/replacement and capital project financial investment needs over the next 20 years.

Renewal/Replacement of Existing Assets

The data used to estimate asset renewal and replacement costs is a 2015 spreadsheet containing all WRS assets from the City's CMMS database. Key attributes including installation date, estimated service life, frequency of refurbishments, replacement cost and refurbishment cost are included in the spreadsheet. This data set consisted primarily of electrical and mechanical equipment. For this analysis, GHD and City staff have added assets covering pipelines, buildings, site civil improvements, electrical distribution, and other miscellaneous assets that were missing in the original spreadsheet. The City has not thoroughly vetted this data set, which requires significant time and effort, and it provides only an approximation of the spending needs for the WRS facilities. The City should continue to review and improve the quality of the data in the CMMS database as part of its ongoing asset management program.

The original data set included only construction costs; soft costs were not included. For this analysis GHD used a project multiplier of 1.4 for renewal and replacement costs that were expected to cost less than $150,000 (maintenance projects), and a project multiplier of 1.7 for projects expecting to cost more than $150,000 (capital projects). These multipliers allow for administration, design, permits and construction management costs. Renewal and replacement costs covered under proposed capital projects were removed from the spreadsheet to avoid double counting.

The anticipated annual renewal and replacement costs are based on industry standard preventative maintenance schedules and industry standard service life by asset type. The timing and value of actual expenditures could differ based on the judgement of City personnel who are monitoring WRS asset conditions in real time. The renewal and replacement costs presented herein provide a realistic representation of the average investment needs over time to maintain and replace existing WRS assets.

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The master plan covers a 20-year planning horizon and there are several significant:

- Replace over 32,000 linear feet of 27-inch diameter recycled water transmission pipe (Year 6)
- Replace primary and secondary sludge collectors installed in 1976 (Year 9)
- Replace air, sludge, gas, electrical duct and miscellaneous yard piping installed in 1976 (Year 9)
- Replace over 60,000 linear feet of 12- to 48-inch diameter recycled water pipe (Year 10)

These large replacement expenditures could potentially be deferred and spread over more years if recommended condition assessments, covered under capital projects, indicate that the assets are in good condition and service lives can be extended.

Recommended Capital Projects

Recommended capital project costs are based on the City's draft Subregional CIP Prioritization spreadsheet (from January 11, 2018, version 3), which includes recommended projects from the Draft WRS Master Plan and the final EOP recommendations. For this master planning exercise the future costs identified in the spreadsheet are used, and the costs identified as having already been appropriated are ignored. The City's prioritization of recommended capital projects provides the basis for the timing of expenditures over the 20-year planning horizon. Years with significant expenditures for renewal and replacement were noted and expenditures for capital projects are adjusted to smooth out high and low points in the combined annual expenditures.

Recommended capital project expenditures are greatest in years 1 – 5 and in years 19 – 20. The big initial spends are related to the UV disinfection replacement project and the LTP flood protection project. The big spend in years 19 and 20 are related to construction of 500 million gallons of new seasonal storage to accommodate planned growth in the service area.

Total Spending Needs

Table 1 provides a summary of the average annual spending needs based on the projects included in this financial analysis over four planning horizons.

Table 1 Average Annual Spending Needs

Planning Horizon	Replacement	Renewal	CIP	Total
Years 1 - 5	$3,189,611	$2,282,163	$20,235,756	$25,707,530
Years 1 - 10	$13,171,365	$2,036,198	$12,592,974	$27,800,537
Years 1 - 15	$9,780,713	$2,723,204	$10,619,380	$23,123,297
Years 1 - 20	$7,977,810	$2,710,086	$13,826,333	$24,514,229

Table 2 provides a breakdown of the annual expenditures by year over the 20-year planning horizon.

Table 2 Annual Spending Needs for 20-Year Planning Horizon

Planning Year	Replacement	Renewal	CIP	Total
1	$9,397,581	$962,406	$11,377,192	$21,737,179
2	$326,962	$1,785,937	$22,217,112	$24,330,011
3	$4,001,937	$4,282,065	$24,297,192	$32,581,194
4	$1,675,607	$1,873,677	$21,590,091	$25,139,375
5	$545,969	$2,506,732	$21,697,192	$24,749,893
6	$25,634,448	$978,741	$1,797,192	$28,410,381
7	$317,135	$1,329,287	$16,762,192	$18,408,614
8	$5,450,703	$1,670,783	$4,597,192	$11,718,678
9	$35,215,486	$4,867,141	$797,192	$40,879,819
10	$49,147,817	$105,215	$797,192	$50,050,224
11	$5,879,209	$17,766,842	$1,197,192	$24,843,243
12	$215,064	1,579,402	$8,222,192	$10,016,658
13	$2,927,505	$508,670	$7,297,192	$10,733,367
14	$3,840,851	$161,660	$8,397,192	$12,399,703
15	$2,134,422	$469,501	$8,247,192	$10,851,115
16	$2,975,127	$4,004,040	$4,047,192	$11,026,359
17	$637,432	$135,591	$10,797,192	$11,570,215
18	$4,058,877	$1,532,284	$10,797,192	$16,388,353
19	3,860,781	$3,847,897	$45,797,192	$53,505,870
20	$1,313,292	$3,833,839	$45,797,192	$50,944,323
Total	**$159,556,205**	**$54,201,710**	**$276,526,659**	**$490,284,574**

City of Santa Rosa’s Draft CIP Project Prioritization with GHD Comments (10/27/2018)

Numerical Ranking	PID	IFAS Key	Project Title	Project Ranking	Already Appropriated	Future Cost Estimate	Project Status	Cumulative Funding Need	GHD Comments for Master Plan
21	255	86380	IRWP - Reuse Expansion	NA	$63,592	$0	Continuous	#VALUE!	Not included; no future costs
22	255	51055	Incremental Recycled Water Program Management, Phase II	NA	$216,012	$0	Continuous	#VALUE!	Not included; no future costs
19	262	86592	Lakeville Property Projects	B	$110,352	$0	Continuous	#VALUE!	Not included; no future costs
20	262	70345	Reclamation System Improvements (Land Purchases)	B	$315,508		Continuous	#VALUE!	Not included; no future costs
112	284	86509	Disinfection Replacement	A	$1,156,095	$39,022,150	Hold	#VALUE!	Included future costs
113	284	TMP1942	Disinfection and Replacement - 2017 Bonds	A	$0	$0	Hold	#VALUE!	Not included; no future costs
1	294	86364	Laguna Treatment Clarifier Upgrade - Phase 2	A	$4,573	$0	Complete	$0	Not included; no future costs
23	511	86384	Subregional Plant Alternative Energy Opportunities	NA	$38,874	$539,113	Continuous	$539,113	Assumed annual cost of $38,874 for 20 years
24	523	86458	Subregional CIP Project Contingency	NA	$1,925,400	$0	Continuous	$539,113	Not included; no future costs
30	544	86575	LTP Flood Protection - Design	A	-$21,351	$64,000	Design	$603,113	Added future costs for 544 together
31	544	86534	Flood Protection	A	$1,995,296	$15,754,671	Design	$16,357,784	Added future costs for 544 together
32	544	TMP1943	Flood Protection - 2017 Bonds	A	$0		Design	$16,357,784	Added future costs for 544 together
2	1110	86381	IRWP - Discharge Compliance	A	$34,014	$0	Complete	$16,357,784	Not included; no future costs
2	1110	86461	IRWP - Discharge Compliance Project - Subregional	A	$9,043	$0	Complete	$16,357,784	Not included; no future costs
48	1370	86497	Subregional PLC Replacement	B	$69,251	$69,251	Planning	$16,427,035	Included future costs
25	1447	86494	Energy Optimization Plan- Subregional	NA	$25,796	$25,796	Continuous	$16,452,831	Assumed annual cost of $25,796 for 20 years
14	1640	86540	Nutrient Offset Program	A	$299,664	$1,299,664	Continuous	$17,752,495	Added both 1640 projects together and used $200,000 per year for 20 years
15	1640	86510	Dischrg Compliance-Nutr Offset	A	$324,510	$324,510	Continuous	$18,077,005	Added both 1640 projects together and used $200,000 per year for 20 years
10	1765	86568	AMI/AMR Implementation - Subregional	A	$149,914	$149,914	Construction	$18,226,919	Not included; in construction
25	1800	86522	Ongoing Subregional System Upgrades	NA	$61,170	$0	Continuous	$18,226,919	Not included; no future costs
3	1829	86544	LTP Filter Valve Actuators & Refurbishment	A	$339,649	$0	Complete	$18,226,919	Not included; no future costs
16	1836	86524	Subregional Asset Management Implementation	A	$32,522	$532,522	Continuous	$18,759,441	Assumed annual cost of $32,522 for 20 years
26	1838	86525	Alternative Funding Pursuit	NA	$99,452	$599,452	Continuous	$19,358,894	Assumed annual cost of $100,000 for 20 years
49	1850	86536	Pond Hydraulic Conductivity Study - NPDES Compliance - Bonds	B	$82,061	$0	Planning	$19,358,894	Not included; no future costs
4	1880	86537	Geysers Pipeline Stabilization on Pine Flat Rd	B	$42,666	$0	Complete	$19,358,894	Not included; no future costs
9	1883	86538	High Strength Waste Receiving Facility	A	$164,550	$0	Warranty	$19,358,894	Not included; no future costs
27	1885	86553	Subregional System Master Plan, Phase 2	NA	$50,000	$650,000	Continuous	$20,008,894	Not included; work is almost complete
28	1885	86543	Subregional System Master Plan	NA	$304,382	$271,763	Continuous	$20,280,657	Not included; work is almost complete
8	1889	86513	Mechanical Tech Office Expansion	B	$16,898	$0	Cancelled	$20,280,657	Not included; no future costs
38	1909	86552	Rock Slope Protection - Ponds Delta, C, D	B	$24,740	$1,500,000	Design	$21,780,657	Included future costs
66	1910	86561	Laguna Effluent Line Access Port Installation	NA	$0	$500,000	Planning	$22,280,657	Included future costs
10	1951	86545	Brown Farm Pond Drain to Llano Trunk	A	$0	$0	Warranty	$22,280,657	Not included; no future costs
11	1952	86529	Sanford and Eastside Road Investigation and Repairs	A	$17,462	$0	Construction	$22,280,657	Not included; no future costs
67	1957	86557	LTP Onsite Diversion System	NA	$2,075,305	$2,076,498	Planning	$24,357,155	Included future costs
5	1958	86556	Geysers Hypochlorination System	A	$101,195	$0	Cancelled	$24,357,155	Not included; no future costs
40	1959	86558	Natural Gas Engine Conversion - Combined Heat & Power facility	NA	$932,011	$1,200,000	Design	$25,557,155	Included future costs
29	1973	86554	Pine Flat Road Stabilization Measures	NA	$0	$500,000	Continuous	$26,057,155	Assigned Priority "B" and broke into two $250,000 years
40	1974	86559	Water Efficient Landscape Upgrades	C	$138,731	$0	Design	$26,057,155	Not included; no future costs
50	1975	86555	Compost Building Roof and Ventilation Replacement	B	$0	$3,000,000	Planning	$29,057,155	Included future costs
51	1976	86560	West College Concrete Basin Joint Repair	B	$0	$400,000	Planning	$29,457,155	Included future costs
52	1978	86563	Digester Cover Upgrade	B	$0	$12,400,000	Planning	$41,857,155	Included future costs
53	1978	86578	Replace Compressors Waste Gas Assembly	B	$0	$400,000	Planning	$42,257,155	Included future costs
54	1979	86562	Secondary Clarifier No 4 Rehabilitation	B	$0	$500,000	Planning	$42,757,155	Included future costs
17	1980	86551	NPDES Compliance Consultation Services	A	$118,015	$500,000	Continuous	$43,257,155	Assumed annual cost of $100,000 for 20 years
6	1984	86565	Laboratory Information Management System Replacement	A	$43,388	$0	Cancelled	$43,257,155	Not included; no future costs
32	2012	86574	Alpha Barn Fire Suppression System	A	$103,406	$0	Design	$43,257,155	Not included; no future costs
7	2013	86546	Compost Building Roof and Ventilation Rehabilitation	A	$6,909	$0	Cancelled	$43,257,155	Not included; no future costs
55	2046	86571	Subregional Mitigation Bank Development	B	$150,000	$950,000	Planning	$44,207,155	Included future costs
17	2047	86569	Nutrient Removal Infrastructure Improvements	A	$867,787	$0	Continuous	$44,207,155	Not included; no future costs
55	2049	86573	Superstructure Removal Phase 2	B	$250,000	$4,000,000	Planning	$48,207,155	Included future costs
18	2050	86572	LTP Electrical Infrastructure Replacement	A	$450,000	$4,000,000	Continuous	$52,207,155	Included future costs
33	2051	86570	Primary Influent Pump Drive Replacement	A	$98,542	$0	Design	$52,207,155	Not included; no future costs
34	2051	TMP1941	Primary Influent pump drive replacement - 2017 Bonds	A	$0	$1,876,249	Design	$54,083,404	Included future costs

Numerical Ranking	PID	IFAS Key	Project Title	Project Ranking	Already Appropriated	Future Cost Estimate	Project Status	Cumulative Funding Need	GHD Comments for Master Plan
68	2057	55740	Computer Maintenance Management System Replacement	NA	$323,407	$0	Planning	$54,083,404	Not included; no future costs
12	2064	86533	Superstructure Removal - Seismic Needs Phase 1	A	$90,672	$0	Construction	$54,083,404	Not included; no future costs
56	2093	86579	Reclamation Pipe Replacement	B	$0	$100,000	Planning	$54,183,404	Included future costs
13	2094	86489	LTP On-Call Contractor	A	$396,234	$1,500,000	Construction	$55,683,404	Assumed annual cost of $300,000 for 20 years
82	2096	86580	Filter Valve Actuators - Phase 2	B	$0	$1,300,000	Future	$56,983,404	Included future costs
39	2097	86587	Cmbnd Heat and Power Exhaust Mods	B	$200,000	$0	Design	$56,983,404	Not included; no future costs
42	2098	86581	Seismic Eval and retrofit - LTP Maint Building	A	$0	$900,000	Planning	$57,883,404	Included future costs
43	2100	86582	Filter Influent Pmp Stn Discharge Piping	A	$0	$400,000	Planning	$58,283,404	Included future costs
35	2101	86588	Digester Gas Cond Improvements	A	$450,000	$0	Design	$58,283,404	Not included; no future costs
63	2102	86583	Biosolid Agitator Pos Ctl Improvements	C	$0	$250,000	Planning	$58,533,404	Included future costs
57	2103	86584	LTP Booster Stn 1 Replacement	B	$0	$200,000	Planning	$58,733,404	Included future costs
63	2104	86585	LTP Fleet Gas Station	C	$0	$300,000	Planning	$59,033,404	Included future costs
36	2105	86589	Replace Chillers and HVAC Admin Bldg	A	$1,048,715	$0	Design	$59,033,404	Not included; no future costs
70	2106	TMP1931	Subregional EOP Project #1	A		$100,000	Future	$59,133,404	Included future costs
44	2107	TMP1932	Subregional EOP Project #2	A		$200,000	Planning	$59,333,404	Included future costs
70	2110	86577	Reclamation System Condition Assessment Analysis - Phase 1	A	$50,000	$200,000	Future	$59,533,404	Included future costs
37	2111	86586	Upsize Geysers connection - Delta Pond	A	$387,196	$0	Design	$59,533,404	Not included; no future costs
41	2118	86590	Recycled Water Pond Metering Valve Imprvmnts	A	$300,831	$0	Project Pool	$59,533,404	Not included; no future costs
64	2119	TMP1947	LTP Stormwater Treatment Enhancements - 2017 Bonds	C	$0	$4,050,000	Planning	$63,583,404	Included future costs
65	2132		Admin Building Remodel	C		$650,000	Planning	$64,233,404	Included future costs
58	2149	86593	LTP Security Project Phase 2	B	$150,000	$0	Planning	$64,233,404	Not included; no future costs
83	2166	TMP1969	Digester No. 3 and 4 Rehabilitation	B	$0	$600,000	Future	$64,833,404	Included future costs
71	2170	TMP1968	Manhole Rehabilitation and Coating of Influent Suction Pipes	A	$0	$400,000	Future	$65,233,404	Included future costs
84	2171	TMP1970	Rehabilitation and Coating of Influent and Effluent Channels	B	$0	$525,000	Future	$65,758,404	Included future costs
72	2172	TMP1971	Seismic Evaluation and Retrofit of LTP Annex Building	A	$0	$650,000	Future	$66,408,404	Included future costs
85	2173	TMP1972	Seismic Evaluation and Retrofit of LTP Chemical Building	B	$0	$250,000	Future	$66,658,404	Included future costs
111	2174	TMP1973	SCTPW Project Coordination - Subregional	NA	$0	$100,000	Future	$66,758,404	Assigned Priority "A" and assumed one time expenditure
59	2189	TMP1976	Slip out repair: Pine Flat Rd. at Mayacamas Pump station	B	$0	$200,000	Planning	$66,958,404	Included future costs
45	2191	TMP1978	Geysers Terminal Reservoir Bypass Piping	A	$0	$250,000	Planning	$67,208,404	Included future costs
46	2192	TMP1979	Emergency Generator Fuel Tank Replacement	A	$0	$175,000	Planning	$67,383,404	Included future costs
47	2193	TMP1980	Repair Roofs and Replace Insulation Digester Nos. 1 & 2	A	$0	$350,000	Planning	$67,733,404	Included future costs
48	2194	TMP1981	Geysers Terminal Reservoir Recoating	A	$0	$125,000	Planning	$67,858,404	Included future costs
69	2195	86523	Plant Paving Rehabilitation	NA	$0	$250,000	Planning	$68,108,404	Assigned Priority "C"
60	2196	TMP1982	Potable Water Line to Admin Building	B	$0	$350,000	Planning	$68,458,404	Included future costs
61	2197	TMP1983	Repair Deep Anode Cathodic Protection Well	B	$0	$150,000	Planning	$68,608,404	Included future costs
73	MP02		LTP Piping Conditioning Assessment	A		$350,000	Future	$68,958,404	Included future costs
74	MP03		LTP Buried Ductbank Condition Assessment	A		$50,000	Future	$69,008,404	Included future costs
75	MP04		Nutrient Management Plan	A		$75,000	Future	$69,083,404	Included future costs
76	MP06		Reclamation System Condition Assessment Phase 1 - Desktop Analysis	A		$200,000	Future	$69,283,404	Duplicate; covered under PID 2110
93	MP07		Agricultural Reuse Optimization	C		$150,000	Future	$69,433,404	Included future costs
85	MP08		Biosolids Market Study	B		$100,000	Future	$69,533,404	Included future costs
94	MP09		Environmental Laboratory Facility Needs Assessment	C		$50,000	Future	$69,583,404	Included future costs
95	MP10		Biosolids Seasonal Storage Expansion	C		$5,200,000	Future	$74,783,404	Included future costs
77	MP11		Reclamation System Condition Assessment Phase 2 - Physical Assessment	A		$600,000	Future	$75,383,404	Included future costs
78	MP12		Filter Effluent Hydraulic Review	A		$75,000	Future	$75,458,404	Included future costs
86	MP13		Delta Pond Access Road	B		$1,000,000	Future	$76,458,404	Included future costs
96	MP14		Building Systems Assessment for Admin and Compost Ops Buildings	C		$50,000	Future	$76,508,404	Included future costs
87	MP15		Environmental Laboratory Upgrades	B		$595,000	Future	$77,103,404	Included future costs
88	MP17		Asset Management Plan	B		$1,200,000	Future	$78,303,404	Included future costs

Numerical Ranking	PID	IFAS Key	Project Title	Project Ranking	Already Appropriated	Future Cost Estimate	Project Status	Cumulative Funding Need	GHD Comments for Master Plan
89	MP18		Master Plan Updates	B		$200,000	Future	$78,503,404	Included future costs
90	MP19		Integrated Water Management Study	B		$500,000	Future	$79,003,404	Included future costs
98	MP20		Land Management Plan/Ranch Plan Updates	C		$150,000	Future	$79,153,404	Included future costs
91	MP21		Llano Trunk Sewer - CIPP Lining	B		$16,500,000	Future	$95,653,404	Included future costs
99	MP22		High Strength Waste Facility Capacity Expansion	C		$200,000	Future	$95,853,404	Included future costs
100	MP24		Geysers Pipeline Condition Assessment	C		$500,000	Future	$96,353,404	Included future costs
101	MP25		Conversion to Class A Biosolids Program	C		$10,600,000	Future	$106,953,404	Included future costs
103	MP26		Increase Pumping Capacity of Geysers Pump Stations	C		$7,100,000	Future	$114,053,404	Included future costs
102	MP27		Expansion of Seasonal Storage	C		$110,000,000	Future	$224,053,404	Included future costs
101	MP28		Coat Process Basins	C			Future	$224,053,404	Included future costs
107	MP29		Concrete Coating of Settled Sewage, RAS and Mixed Liquor Channels	C		$1,525,000	Future	$225,578,404	Included future costs
97	MP34		Brown Pond Re-grading	C		$400,000	Future	$225,978,404	Included future costs
62	New		Restore Geysers Pipeline Capacity	B		$70,000	Planning	$226,048,404	Renamed NEW5 based on priority assigned by City
78	New		Uninterruptable Power Supply	A		$25,000	Future	$226,073,404	Renamed NEW1 based on priority assigned by City
79	New		Pond Lease for 1 MW Floating Solar PV, PPA (REM 9-5) #9, Tier 1 EOP project	A		$20,000	Future	$226,093,404	Renamed NEW2 based on priority assigned by City
80	New		Excessive head losses in Geyser Pipeline near Bear Canyon .(#4) Teir 1 EOP project	A		$30,000	Future	$226,123,404	Renamed NEW3 based on priority assigned by City
81	New		Sump Pump Check Valves	A		$30,000	Future	$226,153,404	Renamed NEW4 based on priority assigned by City
92	New		Delta Pond Piping Diffuser Improvements	B		$250,000	Future	$226,403,404	Renamed NEW6 based on priority assigned by City
93	New		Digester Mixing Upgrades	B		$2,900,000	Future	$229,303,404	Renamed NEW7 based on priority assigned by City; $50,000 for study but no project based on EOP memo
104	New		Aeration Tank Diffuser Replacements	C		$100,000	Future	$229,403,404	Renamed NEW10 based on priority assigned by the City
105	New		Biofilter Media Upgrade	C		$50,000	Future	$229,453,404	Renamed NEW11 based on priority assigned by the City
106	New		Repair Mixing Valve at Delta Pond	C		$100,000	Future	$229,553,404	Renamed NEW12 based on priority assigned by the City
108	New		Repair Failing Non Structural Masonry Coating on Exterior of Digester No. 4.	C		$50,000	Future	$229,603,404	Renamed NEW13 based on priority assigned by the City
108	New		Holistic LTP plant modeling process	C		$200,000	Future	$229,803,404	Renamed NEW8 based on priority assigned by City
109	New		Upgrade Delta Pump #2	C		$50,000	Future	$229,853,404	Renamed NEW9 based on priority assigned by City
110	New		Bear Canyon Pump Coating	C			Future	$229,853,404	Not included; no future costs (maintenance)
						$268,875,554			

Annual Cost of Implementing Recommended CIP Projects over 20 Years

																	Priority "A" Projects		
Year	**Master Plan Year**	**PID2050**	**PID544**	**FP01**	**PID2051**	**PID284**	**PID2192**	**PID2193**	**PID2100**	**PID2170**	**PID2191**	**PID2098**	**PID2172**	**PID2194**	**PID2110**	**PID2106**	**PID2107**	**MP11**	**PID1836**
2018	1	$500,000	$900,000	$25,000	$1,000,000	$5,000,000	$175,000	$350,000	$400,000	$400,000	$250,000				$200,000	$100,000	$200,000		$32,522
2019	2	$1,500,000	$918,671		$876,249	$15,000,000						$900,000	$650,000	$125,000				$600,000	$32,522
2020	3	$1,500,000	$6,000,000			$15,000,000													$32,522
2021	4	$500,000	$6,000,000			$4,022,150													$32,522
2022	5		$2,000,000																$32,522
2023	6																		$32,522
2024	7																		$32,522
2025	8																		$32,522
2026	9																		$32,522
2027	10																		$32,522
2028	11																		$32,522
2029	12																		$32,522
2030	13																		$32,522
2031	14																		$32,522
2032	15																		$32,522
2033	16																		$32,522
2034	17																		$32,522
2035	18																		$32,522
2036	19																		$32,522
2037	20																		$32,522
		$4,000,000	**$15,818,671**	**$25,000**	**$1,876,249**	**$39,022,150**	**$175,000**	**$350,000**	**$400,000**	**$400,000**	**$250,000**	**$900,000**	**$650,000**	**$125,000**	**$200,000**	**$100,000**	**$200,000**	**$600,000**	**$650,440**

PID2094	MP04	PID1640	PID1980	MP02	MP03	MP12	PID1957	PID1959	FP02	FP03	FP04	PID2174	PID1370	MP13	PID2171	PID1909	MP21	PID1975	PID1978
$300,000		$200,000	$100,000	$350,000	$50,000			$600,000	$20,000	$30,000	$30,000								
$300,000	$75,000	$200,000	$100,000			$75,000		$600,000				$100,000							
$300,000		$200,000	$100,000				$1,000,000												
$300,000		$200,000	$100,000				$1,076,498						$69,251	$500,000	$525,000	$100,000	$2,000,000	$500,000	
$300,000		$200,000	$100,000											$500,000		$1,400,000	$14,500,000	$2,500,000	
$300,000		$200,000	$100,000																$1,000,000
$300,000		$200,000	$100,000																$11,800,000
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$300,000		$200,000	$100,000																
$6,000,000	**$75,000**	**$4,000,000**	**$2,000,000**	**$350,000**	**$50,000**	**$75,000**	**$2,076,498**	**$1,200,000**	**$20,000**	**$30,000**	**$30,000**	**$100,000**	**$69,251**	**$1,000,000**	**$525,000**	**$1,500,000**	**$16,500,000**	**$3,000,000**	**$12,800,000**

Priority "B" Projects																				
PID2096	**PID2189**	**PID2049**	**FP05**	**PID1979**	**PID2103**	**PID2197**	**PID1976**	**PID2166**	**PID2046**	**PID2173**	**MP08**	**MP15**	**MP17**	**MP18**	**MP19**	**PID1910**	**PID1973**	**PID2093**	**FP06**	**FP07**
$1,300,000	$200,000	$4,000,000																		
			$70,000	$500,000	$200,000	$150,000	$400,000	$600,000				$595,000	$600,000			$500,000	$250,000			$50,000
									$950,000	$250,000	$100,000		$600,000	$200,000	$500,000		$250,000	$100,000	$250,000	
$1,300,000	**$200,000**	**$4,000,000**	**$70,000**	**$500,000**	**$200,000**	**$150,000**	**$400,000**	**$600,000**	**$950,000**	**$250,000**	**$100,000**	**$595,000**	**$1,200,000**	**$200,000**	**$500,000**	**$500,000**	**$500,000**	**$100,000**	**$250,000**	**$50,000**

														Priority "C" Projects					
PID2196	**PID2195**	**FP08**	**FP09**	**FP10**	**FP11**	**FP12**	**FP13**	**MP29**	**PID2104**	**PID2102**	**PID2132**	**MP25**	**PID2119**	**MP10**	**MP26**	**MP27**	**MP24**	**MP09**	**MP07**
$350,000	$250,000																		
		$200,000						$200,000											
			$50,000	$100,000	$50,000	$100,000	$50,000	$1,325,000	$300,000	$250,000	$200,000	$1,600,000	$1,000,000				$500,000	$50,000	$150,000
											$450,000	$4,500,000	$1,550,000						
												$4,500,000	$1,500,000	$1,000,000	$600,000				
														$4,200,000	$3,250,000				
															$3,250,000				
																$10,000,000			
																$10,000,000			
																$45,000,000			
																$45,000,000			
$350,000	**$250,000**	**$200,000**	**$50,000**	**$100,000**	**$50,000**	**$100,000**	**$50,000**	**$1,525,000**	**$300,000**	**$250,000**	**$650,000**	**$10,600,000**	**$4,050,000**	**$5,200,000**	**$7,100,000**	**$110,000,000**	**$500,000**	**$50,000**	**$150,000**

PID1447	PID1838	MP20	PID511	MP14	MP22	MP34	MP28
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000	$150,000	$38,874	$50,000	$200,000	$400,000	$500,000
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$25,796	$100,000		$38,874				
$515,920	**$2,000,000**	**$150,000**	**$777,480**	**$50,000**	**$200,000**	**$400,000**	**$500,000**

		Priority "A" Projects																	
Year	**Master Plan Year**	**PID2050**	**PID544**	**FP01**	**PID2051**	**PID284**	**PID2192**	**PID2193**	**PID2100**	**PID2170**	**PID2098**	**PID2172**	**PID2106**	**PID1836**	**PID2094**	**MP04**	**PID1640**	**PID1980**	**MP02**
2018	1	$500,000	$900,000	$25,000	$1,000,000	$5,000,000	$175,000	$350,000	$400,000	$400,000			$100,000	$32,522	$300,000		$200,000	$100,000	$350,000
2019	2	$1,500,000	$918,671		$876,249	$15,000,000					$900,000	$650,000		$32,522	$300,000	$75,000	$200,000	$100,000	
2020	3	$1,500,000	$6,000,000			$15,000,000								$32,522	$300,000		$200,000	$100,000	
2021	4	$500,000	$6,000,000			$4,022,150								$32,522	$300,000		$200,000	$100,000	
2022	5		$2,000,000											$32,522	$300,000		$200,000	$100,000	
2023	6													$32,522	$300,000		$200,000	$100,000	
2024	7													$32,522	$300,000		$200,000	$100,000	
2025	8													$32,522	$300,000		$200,000	$100,000	
2026	9													$32,522	$300,000		$200,000	$100,000	
2027	10													$32,522	$300,000		$200,000	$100,000	
2028	11													$32,522	$300,000		$200,000	$100,000	
2029	12													$32,522	$300,000		$200,000	$100,000	
2030	13													$32,522	$300,000		$200,000	$100,000	
2031	14													$32,522	$300,000		$200,000	$100,000	
2032	15													$32,522	$300,000		$200,000	$100,000	
2033	16													$32,522	$300,000		$200,000	$100,000	
2034	17													$32,522	$300,000		$200,000	$100,000	
2035	18													$32,522	$300,000		$200,000	$100,000	
2036	19													$32,522	$300,000		$200,000	$100,000	
2037	20													$32,522	$300,000		$200,000	$100,000	
		$4,000,000	**$15,818,671**	**$25,000**	**$1,876,249**	**$39,022,150**	**$175,000**	**$350,000**	**$400,000**	**$400,000**	**$900,000**	**$650,000**	**$100,000**	**$650,440**	**$6,000,000**	**$75,000**	**$4,000,000**	**$2,000,000**	**$350,000**

														Priority "B" Projects					
MP03	**MP12**	**PID1957**	**PID1959**	**PID2174**	**PID1370**	**PID2171**	**MP21**	**PID1978**	**PID2096**	**PID2049**	**PID1979**	**PID2103**	**PID1976**	**PID2166**	**PID2046**	**PID2173**	**MP15**	**MP17**	**MP18**
$50,000			$600,000																
	$75,000		$600,000	$100,000															
		$1,000,000																	
		$1,076,498			$69,251	$525,000	$2,000,000		$1,300,000	$4,000,000									
							$14,500,000												
								$1,000,000											
								$11,800,000			$500,000	$200,000	$400,000	$600,000			$595,000	$600,000	
															$950,000	$250,000		$600,000	$200,000
$50,000	**$75,000**	**$2,076,498**	**$1,200,000**	**$100,000**	**$69,251**	**$525,000**	**$16,500,000**	**$12,800,000**	**$1,300,000**	**$4,000,000**	**$500,000**	**$200,000**	**$400,000**	**$600,000**	**$950,000**	**$250,000**	**$595,000**	**$1,200,000**	**$200,000**

				Priority "C" Projects														
MP19	**PID1910**	**FP07**	**PID2196**	**PID2195**	**FP08**	**FP10**	**FP13**	**MP29**	**PID2104**	**PID2132**	**PID2119**	**MP09**	**PID1447**	**PID1838**	**PID511**	**MP14**	**MP22**	**MP28**
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
	$500,000	$50,000											$25,796	$100,000	$38,874			
$500,000			$350,000	$250,000									$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
					$200,000			$200,000					$25,796	$100,000	$38,874			
						$100,000	$50,000	$1,325,000	$300,000	$200,000	$1,000,000	$50,000	$25,796	$100,000	$38,874	$50,000	$200,000	$500,000
										$450,000	$1,550,000		$25,796	$100,000	$38,874			
											$1,500,000		$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
													$25,796	$100,000	$38,874			
$500,000	**$500,000**	**$50,000**	**$350,000**	**$250,000**	**$200,000**	**$100,000**	**$50,000**	**$1,525,000**	**$300,000**	**$650,000**	**$4,050,000**	**$50,000**	**$515,920**	**$2,000,000**	**$777,480**	**$50,000**	**$200,000**	**$500,000**

		"A"	"B"		"C"			
Year	**Master Plan Year**	**FP04**	**PID1975**	**MP08**	**PID2102**	**FP11**	**MP25**	**MP10**
2018	1	$30,000						
2019	2							
2020	3							
2021	4		$500,000					
2022	5		$2,500,000					
2023	6							
2024	7							
2025	8			$100,000				
2026	9							
2027	10							
2028	11							
2029	12				$250,000	$50,000	$1,600,000	
2030	13						$4,500,000	
2031	14						$4,500,000	$1,000,000
2032	15							$4,200,000
2033	16							
2034	17							
2035	18							
2036	19							
2037	20							
		$30,000	**$3,000,000**	**$100,000**	**$250,000**	**$50,000**	**$10,600,000**	**$5,200,000**

		"A"				"B"					"C"					
	Master Plan															
Year	**Year**	**PID2110**	**PID2107**	**MP11**	**FP02**	**MP13**	**PID1909**	**PID2197**	**PID2093**	**FP06**	**FP09**	**FP12**	**MP27**	**MP07**	**MP20**	**MP34**
2018	1	$200,000	$200,000		$20,000											
2019	2			$600,000												
2020	3															
2021	4					$500,000	$100,000									
2022	5					$500,000	$1,400,000									
2023	6															
2024	7							$150,000								
2025	8								$100,000	$250,000						
2026	9															
2027	10															
2028	11															
2029	12										$50,000	$100,000		$150,000	$150,000	$400,000
2030	13															
2031	14															
2032	15															
2033	16															
2034	17												$10,000,000			
2035	18												$10,000,000			
2036	19												$45,000,000			
2037	20												$45,000,000			
		$200,000	**$200,000**	**$600,000**	**$20,000**	**$1,000,000**	**$1,500,000**	**$150,000**	**$100,000**	**$250,000**	**$50,000**	**$100,000**	**$110,000,000**	**$150,000**	**$150,000**	**$400,000**

		"A"			"B"			"C"	
Year	Master Plan Year	PID2191	PID2194	FP03	PID2189	FP05	PID1973	MP26	MP24
2018	1	$250,000		$30,000					
2019	2		$125,000						
2020	3								
2021	4				$200,000				
2022	5								
2023	6								
2024	7					$70,000	$250,000		
2025	8						$250,000		
2026	9								
2027	10								
2028	11								
2029	12								$500,000
2030	13								
2031	14							$600,000	
2032	15							$3,250,000	
2033	16							$3,250,000	
2034	17								
2035	18								
2036	19								
2037	20								
		$250,000	**$125,000**	**$30,000**	**$200,000**	**$70,000**	**$500,000**	**$7,100,000**	**$500,000**