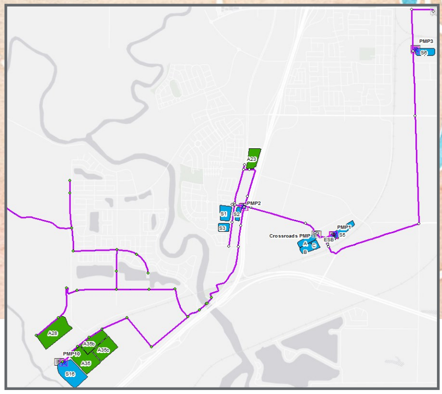

Recycled Water System Master Plan

City of Lathrop

Integrated Water Resources Master Plan Update

December 2018 | EKI B60038.00

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Recycled Water System Master Plan

City of Lathrop

Integrated Water Resources Master Plan Update

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December 2018

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CITY OF LATHROP

Recycled Water System Master Plan

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LIST OF ABBREVIATIONS

A#	WDR permitted land application area number
AAFES	Army & Air Force Exchange Services
ac	acre
ADWF	average dry weather flow
AOI	Area of Interest
CCI	Construction Cost Index
CII	commercial, industrial, and institutional
CIMIS	California Irrigation Management Information System
CIP	capital improvement projects
City	City of Lathrop
CLSP	Central Lathrop Specific Plan
d/D	depth to diameter
Depot	Sharpe Army Depot
DOF	Department of Finance
DPR	direct potable reuse
du	dwelling unit
EKI	EKI Environment & Water, Inc.
ENR	Engineering News Record
fps	feet per second
GIS	geographical information system
gpd	gallons per day
I-5	Interstate 5
I/I	Infiltration and Inflow
IPR	indirect potable reuse
IWRMP	Integrated Water Resources Master Plan
Lathrop CTF	Lathrop Consolidated Treatment Facility
LAA	land application area
LF	linear feet
LI	landscape irrigation

ls	lump sum
MDD	Max Day Demands
MG	million gallons
MGD	million gallons per day
mg/L	milligram per liter
MWQCF	Manteca Wastewater Quality Control Facility
NPDES	National Pollution Discharge Elimination System
OPC	Opinion of Probable Construction Cost
PD	Peak Daily
PMP	Pump
PS	Pump Station
PVC	polyvinyl chloride
PWWF	Peak Wet Weather Flow
RWSMP	Recycled Water System Master Plan
RWQCB	Regional Water Quality Control Board
S#	WDR permitted recycled water storage pond number
SCADA	Supervisory Control and Data Acquisition
SGMA	Sustainable Groundwater Management Act
SLSP	South Lathrop Specific Plan
SOI	Sphere of Influence
TDH	total dynamic head
UWMP	Urban Water Management Plan
WDR	Waste Discharge Requirement
WRP-1	Water Recycling Plant No. 1
WWSMP	Wastewater System Master Plan
WWTF	wastewater treatment facility

EXECUTIVE SUMMARY

EKI Environment & Water, Inc. (EKI) has prepared this Recycled Water System Master Plan (RWSMP) for the City of Lathrop, California (City). This RWSMP was developed as part of the City's Integrated Water Resources Master Plan (IWRMP) Update, a comprehensive update to the City's Potable Water System, Wastewater System, and Recycled Water System Master Plans. This RWSMP focuses on an evaluation of recycled water use and disposal alternatives, recycled water balance analyses, hydraulic assessment of the City's existing recycled infrastructure and key planned improvements, and development of recommended recycled water system improvements and operational recommendations.

Study and Service Areas

The City of Lathrop is located in San Joaquin County, approximately 10 miles south of the City of Stockton and directly west of the City of Manteca. The City lies east of the Coastal Range that separates California's Central Valley from the San Francisco Bay Area. Interstate 5 (I-5), a major north-south interstate corridor, bisects the City. The community was originally developed primarily east of I-5. However, most major new developments have been constructed west of I-5 and others are currently planned or under construction in this area.

City's Existing Recycled Water Infrastructure

The City's recycled water system supports the disposal of the effluent produced by the City-owned Lathrop Consolidated Treatment Facility (CTF). When the draft of this report was published in March 2018, the recycled water system had a disposal capacity of 1.0 million gallons per day (MGD) and included seven agricultural land application areas (LAAs; A23, A28, A30, A31, A35, A35b, and A35c), nine storage ponds (S1, S2, S3, S5, S6, S16, A, B, and C), their associated pump stations (PMP1, PMP2, PMP3, PMP10, and the Crossroads PMP), and approximately 30.3 miles of recycled water pipeline. This infrastructure supported the recent Phase 1 expansion of the Lathrop CTF and is referred to as "existing" or "Phase 1" infrastructure herein.

The City is currently expanding its recycled water distribution system to meet disposal requirements for the Phase 2 expansion of the Lathrop CTF, which will increase the Lathrop CTF treatment capacity and disposal capacity to 2.5 MGD. For purposes of this evaluation, it was assumed that the Phase 2 recycled water system expansion would be completed in two phases: Phases 2A and 2B. Phase 2A improvements were based on the planned initial infrastructure improvements as of October 2017, which were planned to provide a disposal capacity of 1.9 MGD. Phase 2B facilities would expand the disposal capacity to the full 2.5 MGD CTF Phase 2 treatment capacity.

Planned Phase 2A improvements included an expansion of the recycled water distribution network and the addition of a new lined recycled water storage pond (S28), a new percolation pond (PB-1), two new agricultural LAAs (A34 and A36), and a new pump station (RI-PS) that supplies recycled water to a private distribution system serving landscape irrigation use areas in the River Islands development area. Figure ES-1 and Figure ES-2 show the City's service area and locations of the City's major Phase 1 and Phase 2 recycled water system facilities, respectively.

During 2017 and 2018, the Phase 2A improvements were implemented, with the exception that LAA A34 was not constructed. This resulted in an interim disposal capacity of approximately 1.55 MGD. In late 2018, LAA A34 was constructed, but as of December 2018, the permitting has not yet been performed to increase the disposal capacity to approximately 1.9 MGD.

EKI understands that in late 2018, there have been some developments that may affect the phasing of the recycled water capacity as well as the configuration of Phase 2B. These developments include the possible removal or replacement of selected storage ponds and/or LAAs. These removals and/or replacements were not anticipated at the time of the original drafting of this RSWMP and are therefore not considered in the analysis herein.

Currently, the recycled water system is operated manually by the City's operation staff to transfer flows from the storage ponds to the LAAs. However, the City plans to convert the system to a pressurized on-demand system which operates similar to the City's potable water distribution system. Improvements required to improve the automation of the recycled water system operations are currently being designed.

Recycled Water Supply, Use, and Water Balance Evaluation

Future Lathrop CTF expansions are projected to produce up to 5.61 MGD of recycled water at buildout. Alternative uses of recycled water that rely less on disposal through land application than existing uses have the potential to either offset the City's potable water demand or provide other benefits to the City's overall water supply. Alternatives such as indirect or direct potable reuse, however, have permitting and infrastructure requirements that prohibit the City from pursuing them in the foreseeable future.

Other alternatives such as percolation and winter river discharge are likely more feasible to implement in the near-term. Increased use of percolation basins could increase groundwater supplies and reduce the land area needed for storage and land application. Discharge of CTF effluent to the San Joaquin River during winter months would dramatically reduce the land area required for storage. Both of these alternative uses would require additional studies and permitting efforts. Table ES-1 summarizes recycled water balance analysis outputs for required recycled water storage and total use area (including LAA, LI, and percolation) for expanded permitted uses (Alternative 1), increased percolation (Alternative 2), and winter river discharge (Alternative 3).

Hydraulic Assessment

EKI constructed a recycled water system hydraulic model to assess the City's existing infrastructure and key planned infrastructure against the system performance criteria (see Section 5). The hydraulic model was used to evaluate system performance during peak demand conditions for the Phase 1, Phase 2A, and Phase 2B operations. The hydraulic assessment did not model the system beyond the 2.5 MGD Phase 2B capacity due to uncertainty surrounding future uses of recycled water, potential disposal and storage locations, and the potential for winter river discharge, which would greatly reduce required storage and LAA disposal infrastructure.

Modeling results indicate that the City's distribution system pipes are adequately sized to convey peak flows, particularly when the full Phase 2B system is connected. In Phase 1 and Phase 2A modeling results, system pressures were shown to be deficient for certain scenarios. Phase 2B modeling indicated that these deficiencies were resolved by planned Phase 2B improvements and the recommended improvements discussed below.

Conclusions and Recommendations

The hydraulic assessment of the distribution system indicated that the distribution system pipelines are adequately sized to meet performance criteria through Phase 2B.

EKI has identified the following improvements that should be implemented during the Phase 2A expansion, in addition to those currently under construction:

- Conversion of the low-pressure PMP-10 to a high-pressure pump station should be completed as soon as possible to be able to effectively convey recycled water from S16. This improvement is anticipated to be funded by developers.
- Installation of flow meters and automatic control valves with radio telemetry at each LAA turnout location to facilitate automated delivery of recycled water to the LAAs. Costs for these improvements were estimated to be $480,000, not inclusive of estimated contingencies (PACE, 2018).
- Establish SCADA controls on pump and storage ponds to automate system operations. Costs have not been estimated for these operational improvements.

For expansion of permitted recycled water uses in Phase 2B, EKI recommends the following improvements, in addition to those already planned:

- Increase the capacity of PMP-1 in conjunction with the installation of Pond S-X (located directly north of S5). This improvement is anticipated to be funded by developers.
- Install a new pond and pump station in the western portion of the City, potentially at locations S13 and PMP6, to meet storage requirements and to meet system pressure criteria in Phase 2B. This improvement is anticipated to be funded by developers.

EKI evaluated alternative uses of recycled water in Phase 2B and beyond, including increased percolation and winter river discharge. These alternatives have the potential to provide increased water supply benefits and reduce the areas required for recycled water storage and disposal. EKI recommends that the City initiate a percolation study to assess locations in the City which have suitable soils for a percolation. EKI also recommends that the City initiate discussion with the RWQCB to better assess the potential for a river discharge permit.

Table ES-1
Projected Recycled Water Use Area Requirements

Recycled Water Use Component			Phase 1 1 MGD	Phase 2A 1.9 MGD	Phase 2B 2.5 MGD	Buildout 5.6 MGD (a)
Available Existing, Phase 2A, and Planned Phase 2B Use Areas (ac) (b)		*Percolation Area*	--	22.4	22.4	--
		Landscape Irrigation Area	--	56.0	281.9	--
		Land Application Area	222.4	312.9	375.8	--
		Total Use Area	**222.4**	**391.3**	**680.1**	**--**
Required Use Area (ac) (d)	Alternative 1 Current Permitted Uses	*Percolation Area (c)*	--	22.4	22.4	22.4
		Landscape Irrigation Area	--	56.0	281.9	673.3
		Land Application Area	220.0	311.0	274.7	669.6
		Total Required Use Area	**220.0**	**389.4**	**579.0**	**1,365.3**
		Total Projected Land Application Area Surplus (Deficit)	**2.4**	**1.9**	**101.1**	**--**
	Alternative 2 Expanded Percolation	*Percolation Area (c)*	--	40.5	40.5	73.8
		Landscape Irrigation Area	--	56.0	281.9	673.3
		Land Application Area	--	251.0	209.4	511.8
		Total Required Use Area	**--**	**347.5**	**531.8**	**1,258.9**
		Total Projected Land Application Area Surplus (Deficit)	--	**61.9**	**166.4**	**--**
	Alternative 3 Winter River Discharge	*Percolation Area (c)*	--	--	22.4	22.4
		Landscape Irrigation Area	--	--	281.9	673.3
		Land Application Area	--	--	97.4	274.0
		Total Required Use Area	**--**	**--**	**401.7**	**969.7**
		Total Projected Land Application Area Surplus (Deficit)	--	**--**	**278.4**	**--**

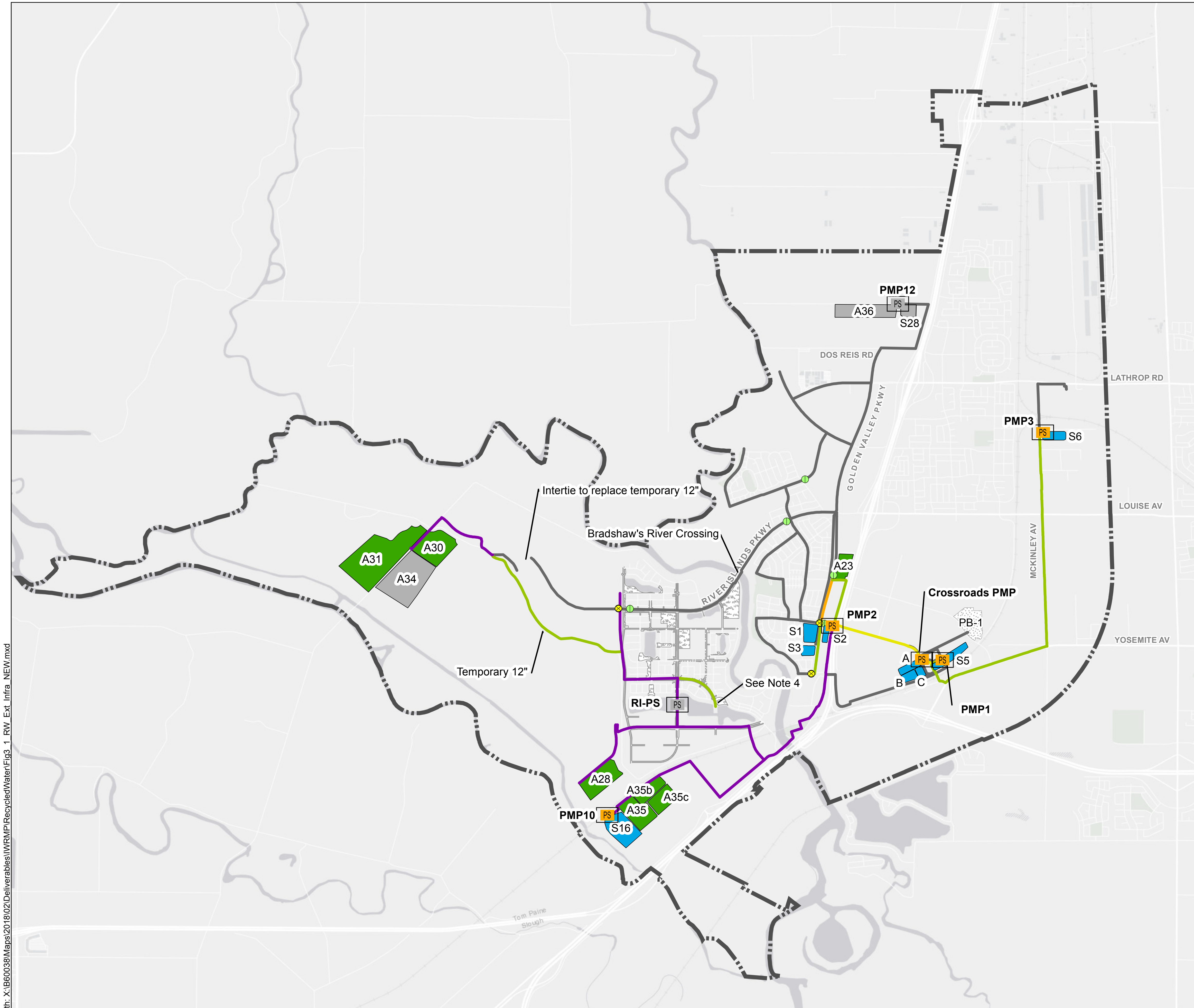
Notes:

(a) Buildout landscape areas estimated by assuming the same ratio of land application areas to landscape irrigation areas for Phase 2B Alternative 1 and assuming the same acerage of LI areas is carried into Alternative 2 and Alternative 3.

(b) Refer to Table 6-3 for a breakdown of which existing and planned areas are included in each time horizon.

(c) Percolation parcel areas listed are 22.4 acres for PB-1, 40.55 acres for PB-1 and S7, and 73.6 acres for PB-1, S7, and an additional future percolation basin. The disposal rate of these additional percolation basins were calculated based on the ratio of parcel area to percolation rate for PB-1.

(d) Total land use area required was calculated by water balance analysis while holding planned landscape irrigation areas and percolation areas constant to determine required land application area. Refer to Appendix A for individual water balances.



Legend

Pipe Diameter, Inches

6, 8, 10, 12, 16, 18, 20, 24, Inactive Pipe

Recycled Water Ponds

Phase 1

Inactive (Phase 2A)

Percolation Basins

Inactive (Phase 2A)

Agricultural Irrigation Use Areas

Phase 1

Inactive (Phase 2A)

Landscape Irrigation Use Areas

Inactive (Phase 2A)

Recycled Water Pump Stations

Phase 1

Inactive (Phase 2A)

Other Infrastructure

Closed Valve

Isolation Plate

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. Phase 1 refers to existing facilities permitted for 1.0 MGD disposal capacity. Phase 2A refers to facilities are currently being constructed for permitted disposal capacity of 1.9 MGD for the Phase 2 Expansion of the CTF.
3. The River Islands Pump Station (RI-PS) pumps to the independent River Islands non-potable water system (not shown).
4. Section of 12 inch pipe to be disconnected from City RW system and added to River Islands non-potable water distribution system.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 3 March 2018.

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Phase 1 Recycled Water Infrastructure

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Figure ES-1

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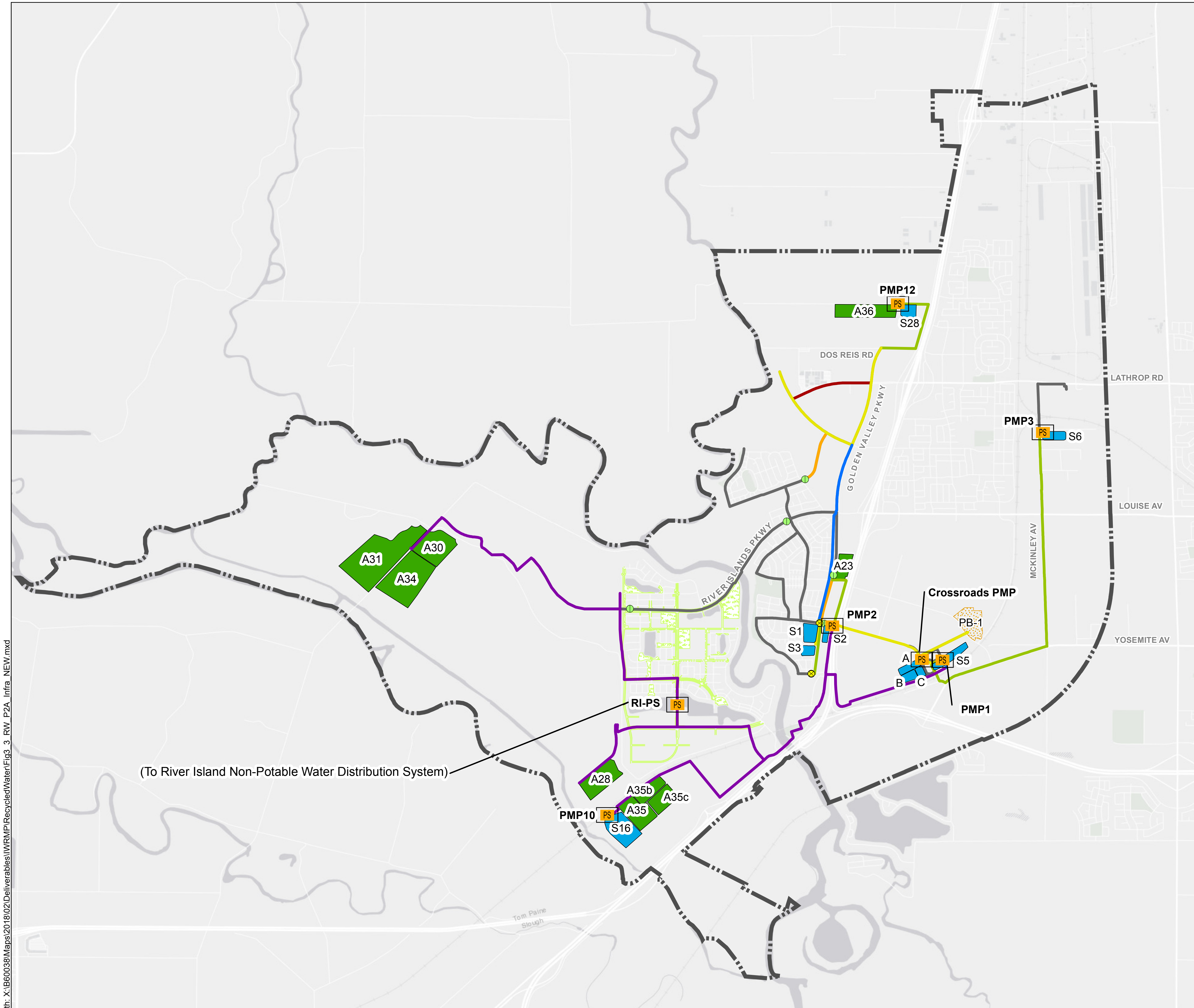

Legend

Sphere of Influence

Pipe Diameter, Inches

6
8
10
12
16
18
20
24
Inactive Pipe

Recycled Water Distribution Infrastructure

Storage Pond
Percolation Basin
Land Application Area
Landscape Irrigation Area
PS Pump Station

Other Infrastructure

Closed Valve
Isolation Plate

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. The River Islands Pump Station (RI-PS) pumps to the independent River Islands non-potable water system (not shown).
3. Section of 12 inch pipe to be disconnected from City RW system and added to River Islands non-potable water distribution system.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 5 March 2018.

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Phase 2A Recycled Water Infrastructure

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Figure ES-2

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1. INTRODUCTION

EKI Environment & Water, Inc. (EKI) has prepared this Recycled Water System Master Plan (RWSMP) for the City of Lathrop, California (City). This RWSMP was developed as part of the City's Integrated Water Resources Master Plan (IWRMP) Update, a comprehensive update to the City's Potable Water System, Wastewater System, and Recycled Water System Master Plans. The IWRMP Update was completed through a coordinated effort between multiple City departments and provides a unifying framework to support utility operations and Capital Improvement Project (CIP) development and implementation.

This RWSMP updates and supersedes the City's prior Recycled Water System Master Planning documents, including:

- City of Lathrop Master Plan (Nolte, 2001);
- City of Lathrop Master Plan Documents – Volume 1 Master Plan Studies – Recycled Water (Nolte, 2006);
- City of Lathrop Draft Master Plan Documents – Recycled Water – Amendment for Near Term Development (RMC, 2014);
- City of Lathrop Recycled Water Operations Plan (RMC, 2015); and,
- Technical Memo for Lathrop Recycled Water Plan (PACE, 2018).

1.1 Project Background

Since its last master plan updates, the City has added new development, updated its assumptions regarding anticipated future development, experienced volatility in terms of water use and wastewater flows, made significant infrastructure improvements, and changed its assumptions regarding future water supplies. These factors, in addition to recent regulatory changes, prompted reevaluation of the City's previous planning assumptions. The IWRMP project was thus initiated in summer of 2016.

The IWRMP is a major planning effort that will provide critical information and a unifying framework to support the City's General Plan, utility operations, CIP development and implementation, annual budgets and rate studies, and land use planning and development fees. It is also informing the City's response to regulatory requirements, such as development of the City's Sewer System Management Plan update, 2015 Urban Water Management Plan (UWMP) update, future Water Supply Assessments, and its strategic response to the Sustainable Groundwater Management Act (SGMA).

Work on the IWRMP was divided into two phases. The first phase focused on preliminary analyses to serve as the basis for the master plans and was completed in April 2017. The second phase focused on updating the water, wastewater, and recycled water master plans. The Phase 1 efforts and analyses included the following:

(1) Selection of hydraulic modeling software;

(2) Update of the City's infrastructure geodatabase;

(3) Update of the City's land use-specific water use and wastewater flow factors, establishment of development projections based on the City's General Plan and input from the development community, and projections of future water demand and wastewater flow by development area; and

(4) Evaluation of key water supply and reliability issues.

(5) Development of a water, wastewater, and recycled water policy and decision framework

These Phase 1 efforts were documented in draft technical memorandums and meeting presentations, which have been incorporated herein.

The IWRMP has been developed in close coordination with multiple City departments, including the Public Works, Finance, and Community Development Departments, as well as the City Manager's Office. To facilitate participation of City staff, monthly progress meetings were held throughout development of the IWRMP to review project status and major findings, as well as discuss key project decisions.

In addition, the City engaged stakeholders during the IWRMP process to share findings and solicit input on the IWRMP development and decision-making process. The City held a meeting with all stakeholders in October 2016 to introduce the IWRMP and initial findings and held a series of meetings with individual stakeholders in April 2017 to discuss the Phase 1 findings.

1.2 Scope of Work

The scope of work for the RWSMP included the following primary tasks:

- Review of the City's basic assumptions, criteria, and conclusions in recycled water planning, e.g., recycled water system design criteria, recycled water balance analyses, pump station operations, percolation basin operations, storage pond operations, and other identified system deficiencies;
- Evaluation of potential future uses of recycled water;
- Performance of recycled water balance analyses to assess future recycled water storage and disposal requirements for alternative future recycled water use scenarios;
- Development of updated peak recycled water demand projections;
- Assessment of existing distribution system under existing and future demand conditions using steady-state model simulations;
- Development of a recommended recycled water system improvements; and
- Preparation of the RWSMP document.

1.3 Report Organization

The WWSMP is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Study and Service Area
- Section 3 – Phase 1 and Phase 2A Recycled Water Infrastructure

- Section 4 – Recycled Water Balance Evaluation
- Section 5 – System Performance and Design Criteria
- Section 6 – Hydraulic Assessment of the Distributions System
- Section 7 – Conclusions and Recommendations
- Section 8 – References

2. STUDY AND SERVICE AREAS

The City of Lathrop is located in San Joaquin County, approximately 10 miles south of the City of Stockton and directly west of the City of Manteca. The City lies east of the Coastal Range that separates California's Central Valley from the San Francisco Bay Area. Interstate 5 (I-5), a major north-south interstate corridor, bisects the City. The City is also connected by Highway 120 which runs east-west through the southeastern-most part of the City, and by Interstate 205, which connects Interstate 580 to I-5. The City is also served by the Altamont Commuter Express (ACE) train, which travels along the southern and eastern border of the City. The community was originally developed primarily east of I-5. However, most major new developments have recently been constructed west of I-5 and others are currently planned or under construction in this area.

This section provides an overview of the City's service area, including discussions of the City's service area boundaries, planned developments, and population.

2.1 City Limits, Sphere of Influence, and Service Boundaries

The City currently encompasses an area of approximately 13,400 acres, or about 20.9 square miles, however its Sphere of Influence (SOI) is slightly larger with an area of about 13,600 acres, or 21.2 square miles. The City's SOI includes two unincorporated areas:

- Approximately 134 acres northeast of the City boundary and along Roth Road that is designated Freeway Commercial and Light Industrial, and
- Approximately 62 acres southeast of the City boundary that is pre-zoned for industrial uses and part of the Lathrop Gateway Business Park Specific Plan area.

The City reduced their SOI in 2016 to exclude an additional unincorporated area (approximately 2,100 acres) located north of the Central Lathrop Specific Plan (CLSP) area and west of I-5. Much of this area does not have a General Plan land use designation. The City has designated this area as an Area of Interest (AOI) (Lathrop, 2016). Figure 2-1 shows the City limits, SOI, and AOI.

The 724 acre Sharpe Army Depot is located in the northeast part of the City and is not currently served by the City's water system. As discussed below, the existing Army & Air Force Exchange Services (AAFES) and the California Military Department (CMD) portions of the property are anticipated to connect to City service in the near future.

The City's recycled water distribution system is within the City limits. The City currently provides recycled water to approximately seven land application areas (LAA), but plans to expand service to urban landscape irrigation areas (LI).

2.2 Specific Plans and Large Planned Unit Development

The City of Lathrop has several approved or pending large development projects. Infrastructure needs for these projects are evaluated in this document. The projects are described below per the City's Municipal Service Review (Lathrop, 2016) and shown on Figure 2-1:

- River Islands. The 4,995-acre River Islands development is located west of the San Joaquin River and east of Paradise Cut on land known as the Stewart Tract. The development proposes a mixture of low, medium and high density residential units. In total, River Islands will consist of 11,000 homes, a 260-acre employment center, a 47-acre town center, 265 acres of parks and nine schools. Construction has begun in the River Islands project with the completion of an elementary school for the Banta Elementary School District (Next Generation STEAM Academy) as well as the construction of a Charter School. About 450 low density residential units were constructed and occupied by the end of 2016. The estimated project completion date is 2040.

- Mossdale Landing. Mossdale Landing is a mixed-use master planned community that is anticipated to be completed by 2030. Construction at Mossdale Landing began in 2003 and approximately 1,570 residential units have been constructed thus far. An additional 66 low density and 62 high density units are anticipated by project completion. In addition, the development is allocating approximately 35 acres of land for two schools, 40 acres for parks, and 25 acres for commercial development.

- Mossdale Landing East. Mossdale Landing East (formerly referred to as Lathrop Station) is anticipated to be completed by 2030. Approximately 151 low density and 293 medium density residential units have been constructed so far. An additional 38 low density and 144 high density units are anticipated by project completion. The development plan also includes 6.5 acres of village commercial, 13.2 acres of service commercial, and 27.5 acres of highway commercial land uses.

- Mossdale Landing South. Mossdale Landing South is a proposed 104-acre development that is anticipated to be completed by 2030. The development will consist of about 280 medium density and 150 high density residential units, of which 140 medium density units have been constructed so far. In addition, the project includes 28 acres of commercial, 25 acres of open space, and 9.5 acres of parks.

- Mossdale Landing – Other. The City has identified additional areas for development within Mossdale Landing including the Sylveria property, on which the City anticipates 658 low density dwelling units will be built by City buildout.

- Historic Lathrop Infill and Other Developments East of I-5. The portion of the City east of I-5 is anticipated to expand and add density in the future. Currently, this area consists of approximately 3,076 low density and 78 medium density units, commercial and industrial areas, and a few public parks. Future residential growth of this area is expected on undeveloped/underutilized and redeveloped parcels consolidated from large lots where low density residential units would be demolished. New residential projects are estimated to consist of 34 low density, 158 medium density, and 25 high density residential units, increasing the total existing residential unit count by 217 total units.

- Central Lathrop Specific Plan. The Central Lathrop Specific Plan proposes development of 1,520 acres located west of I-5. The Specific Plan proposes approximately 6,790 low, medium and high density residential units and additional commercial land uses (offices). The project also includes two schools and 161 acres of recreational land use and open space. Phases 1 and 2 of the project are anticipated to be completed by 2040, adding 274 high density units, 2,236 variable density residential units, and 173 acres of commercial land uses.

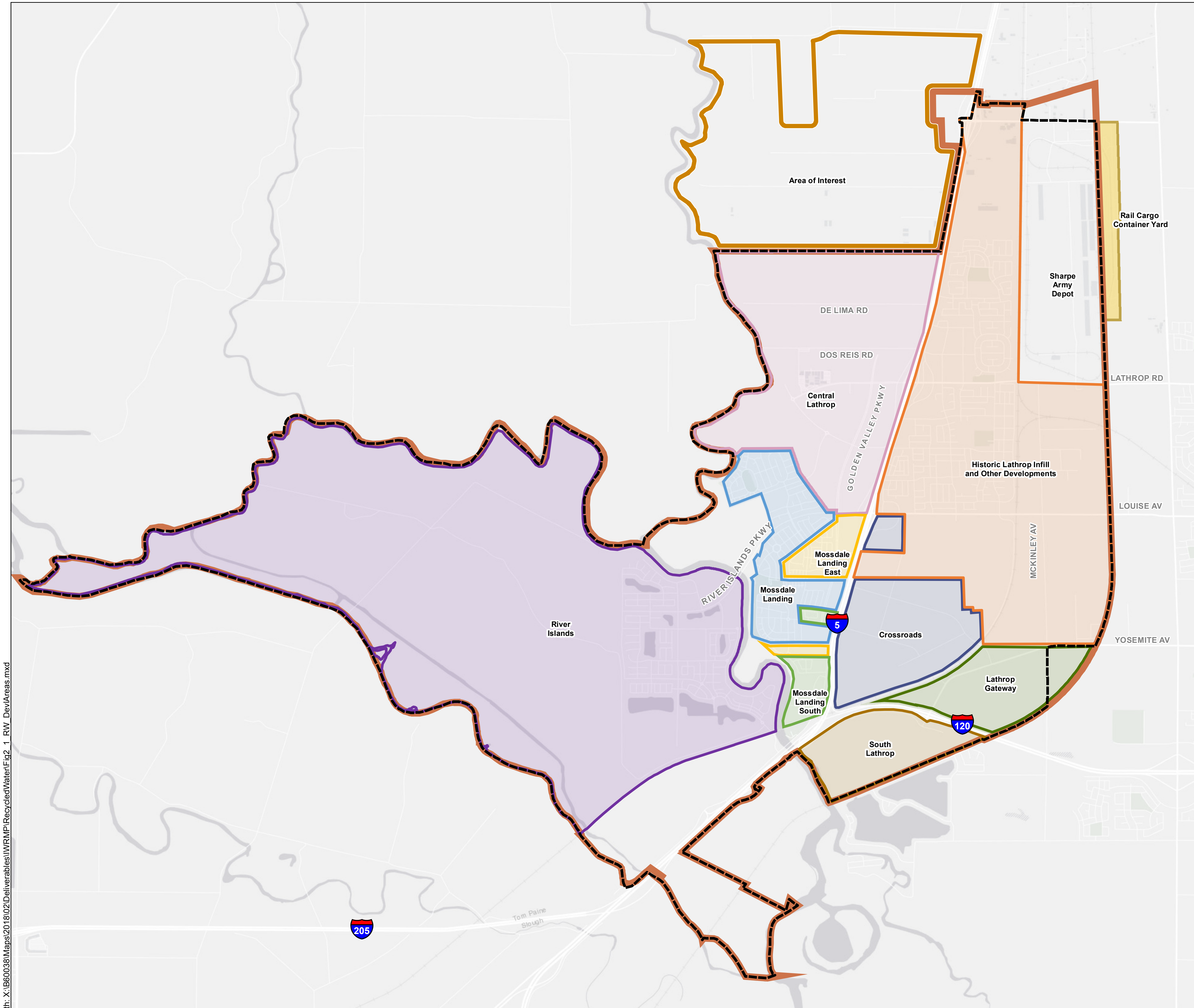
- Lathrop Gateway Business Park Specific Plan. The Lathrop Gateway Business Park Specific Plan proposes commercial and industrial development of approximately 384 acres to be completed by 2040. The City annexed 213 acres of this area in June 2012 and 99 acres of the remaining 117 acres in May 2016. This would result in approximately 4.7 million square feet of service commercial, limited industrial, distribution, and research and development related uses, and approximately 741,000 square feet of commercial office and retail uses. The first phase of the project, the Phelan Gateway Project, includes approximately 167 acres of limited industrial, 83 acres of service commercial, and 57 acres of office and commercial retail uses and is anticipated to be completed by 2025. and is anticipated to be completed by 2025.

- South Lathrop Specific Plan. The South Lathrop Specific Plan was recently approved by the City Council on 20 July 2015 and includes a 315-acre plan area. The Specific Plan proposes approximately 10 acres of commercial office uses, 246 acres of limited industrial, 31 acres of open space, and 27 acres of roads and public facilities. The City South Lathrop Specific Plan area was annexed into the City in May 2016. The South Lathrop Commerce Center, approximately 272 acres within the South Lathrop Specific Plan, is anticipated to be completed by 2025. The South Lathrop Commerce Center will encompass all of the South Lathrop Specific Plan area with the exception of approximately 24 acres of light industrial, 1.2 acres of office commercial, and 19 acres of open space and public roads.

- Sharpe Army Depot. During World War II, the US Army created the Sharpe Army Depot (Depot) in the rural Lathrop Community to allow shipment of major army supplies to the western United States. The Depot is comprised of a 724-acre facility south of Roth Road and has served both the Army and Airforce with a variety of supplies depending on the demand of goods and supplies created by war time efforts. The Depot is occupied by the West Coast Distribution Center that employs 348 workers. Prior to 30 September 2014 the Defense Logistics Agency was also housed at the Depot; its workforce of 700 workers has since been transferred to the larger Tracy Army Depot. Sharpe Army Depot was included in the City limits as part of the 1989 incorporation and is entirely self-contained: meaning all public services normally necessary to serve urban development such as water, sewer, storm drainage, police and fire services are provided by the US Army. The City of Lathrop does have an emergency water intertie with the Depot.

  The City and AAFES are currently in discussions to connect the AAFES property, including the West Coast Distribution Center and Building 240, to the City's water and sewer systems. The City is currently also in discussions with CMD to connect service to the remainder of the Depot and accommodate their future expansion plans. This connection is anticipated to occur before 2020 and is evaluated as part of the IWRMP.

Projected future development within each of the above development areas is presented in Table 2-1, based on City and developer projections. Specifically, Table 2-1 lists the number of new residential dwelling units and commercial, industrial, and institutional (CII) acreage that is anticipated to be developed in five-year increments between 2020 and 2040, and at buildout.



Legend
- City Limit
- Sphere of Influence
- Area of Interest
- Rail Cargo Container Yard

Development Areas
- Central Lathrop
- Crossroads
- Historic Lathrop Infill and Other Developments
- Lathrop Gateway
- Mossdale Landing
- Mossdale Landing East
- Mossdale Landing South
- River Islands
- Sharpe Army Depot
- South Lathrop

Notes
1. All locations are approximate.

Sources
1. Aerial photograph provided by ESRI's ArcGIS Online, 28 February 2018.

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(Scale in Feet)

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City of Lathrop Boundaries and Development Areas

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
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Figure 2-1

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig2_1_RW_DevlAreas.mxd

Table 2-1
City of Lathrop Development Projections by Development Area

Land Use Designation	Units	Incremental New Development (a)(b)						Total New Development	
		2020	2025	2030	2035	2040	Buildout	2040	Buildout
Central Lathrop									
Low Density Residential	du	600	771	626	--	--	4,101	1,997	6,098
Medium Density Residential	du	--	239	--	--	--	--	239	239
High Density Residential	du	--	274	--	--	--	179	274	453
Commercial	ac	19	115	39	--	--	106	173	279
Parks	ac	8.6	48	10	--	--	48	67	115
Schools	ac	--	--	--	--	--	55	--	55
Public Landscaping	ac	22	2.2	13	--	--	10	36	46
Mossdale Landing									
Low Density Residential	du	--	--	66	--	--	--	66	66
High Density Residential	du	62	--	--	--	--	--	62	62
Commercial	ac	--	1.5	--	4.5	--	--	6.0	6.0
Schools	ac	--	16	--	--	--	--	16	16
Mossdale Landing East									
Low Density Residential	du	37	--	--	--	--	--	37	37
High Density Residential	du	54	--	--	78	78	--	210	210
Commercial	ac	--	12	--	17	--	--	29	29
Mossdale Landing South									
Medium Density Residential	du	--	64	--	74	--	--	138	138
High Density Residential	du	150	--	--	--	--	--	150	150
Commercial	ac	--	--	--	--	13	--	13	13
Parks	ac	--	4.0	--	--	--	--	4.0	4.0
Mossdale Landing - Other (c)									
Low Density Residential	du	--	--	--	--	--	658	--	658
River Islands									
Low Density Residential	du	1,517	1,609	1,413	1,868	1,389	--	7,797	7,797
Medium Density Residential	du	253	330	290	383	285	--	1,539	1,539
High Density Residential	du	--	400	810	--	--	--	1,210	1,210
Commercial	ac	10	50	90	100	70	--	320	320
Schools	ac	11	23	57	11	11	--	113	113
Animal Campus	ac	--	10	--	--	--	--	10	10
Parks and Landscape Parcels (d)	ac	24	37	40	36	27	--	164	164
South Lathrop									
Light Industrial / R&D Flex	ac	165	57	--	--	--	24	222	246
Office Commercial	ac	--	8.8	--	--	--	1.2	8.8	10
Open Space-Parks	ac	5.6	--	--	--	--	15	6	21
Public Landscaping	ac	0.9	--	--	--	--	--	0.9	0.9
Lathrop Gateway									
Light Industrial / R&D Flex	ac	--	151	--	--	17	--	168	168
Office Commercial	ac	--	--	--	--	140	--	140	140
Open Space	ac	--	2.5	--	--	1.6	--	4.1	4.1
Public Landscaping	ac	--	2.6	--	--	8.8	--	11.4	11.4
Crossroads									
Industrial	ac	122	2.0	--	--	23	--	147	147
Commercial	ac	2.2	20	--	--	--	--	22	22

Table 2-1 (Cont.)
City of Lathrop Development Projections by Development Area

Land Use Designation	Units	Incremental New Development (a)(b)						Total New Development	
		2020	2025	2030	2035	2040	Buildout	2040	Buildout
Historic Lathrop and Other Development Areas									
Low Density Residential (e)	du	6	6	6	6	5	5	29	34
Medium Density Residential (e)	du	27	27	26	26	26	26	132	158
Industrial	ac	199	41	--	--	--	143	240	383
Parks	ac	--	--	--	--	--	--	0	0
Schools	ac	--	--	--	--	--	--	0	0
Sharpe Army Depot									
Industrial	ac	(f)	--	--	--	--	--	(f)	(f)

Notes:

(a) Dwelling unit counts and acreages based on information provided by developers and the City in November 2016, December 2016, May 2017, and July 2017.
(b) Includes dwelling units and acreages that are assumed to be developed during the preceding five-year period.
(c) Includes low density residential units for the Sylveria Property.
(d) Area of landscape parcels and parks to be irrigated with potable water, per O'Dell Engineering, 'Phase 1A &1B Irrigation Coverage Exhibit', 30 August 2016, and 'Stage 2A Irrigation Coverage Exhibit', 25 August 2016.
(e) Number of infill residential units from Appendix A, 2016 Housing Element Update (De Novo, 2016) distributed evenly over the planning period, except for parcels 196-050-20, 196-070-04 & -05 identified by the City as where development is highly unlikely.
(f) The existing AAFES facility at the Sharpe Army Depot will be connected to City's water service by 2018. Water demand for the AAFES facility is estimated using historical metered consumption, as described in Section 3. Water demand for the California Military Department based on projections provided on 12 April 2018 as seen in Table 4-6.

Table 2-2
Historical Service Area Population

Year	Service Area Population (a)	Annual Growth Rate
1990	6,841	
1991	7,018	2.6%
1992	7,063	0.6%
1993	7,434	5.3%
1994	8,410	13.1%
1995	8,713	3.6%
1996	9,031	3.6%
1997	9,172	1.6%
1998	9,508	3.7%
1999	9,786	2.9%
2000	10,445	6.7%
2001	10,802	3.4%
2002	11,616	7.5%
2003	12,089	4.1%
2004	12,482	3.3%
2005	12,768	2.3%
2006	14,489	13.5%
2007	16,271	12.3%
2008	17,282	6.2%
2009	17,589	1.8%
2010	18,023	2.5%
2011	18,688	3.7%
2012	19,090	2.2%
2013	19,642	2.9%
2014	20,158	2.6%
2015	20,796	3.2%
2016	22,174	6.6%

Notes:

(a) Historical and current population is based on population estimates by the California DOF for the City of Lathrop included in DOF, 2007; DOF, 2012; and DOF, 2016.

Table 2-3
Current and Projected Service Area Population

Current and Projected Service Area Population (a)(b)							
Year	2016	2020	2025	2030	2035	2040	Buildout
Population Served	22,174	32,395	46,434	58,653	67,844	74,581	93,485

Notes:

(a) Current population is based on population estimates by the California DOF for the City of Lathrop included in DOF, 2016.

(b) Projected populations for 2020 through 2040 and buildout are based on residential unit counts from Table 2-1, multiplied by the City's person per dwelling units figure reported by DOF in 2010 based on census data (3.77 persons per dwelling unit).

Figure 2-2
Historical and Projected Service Area Population

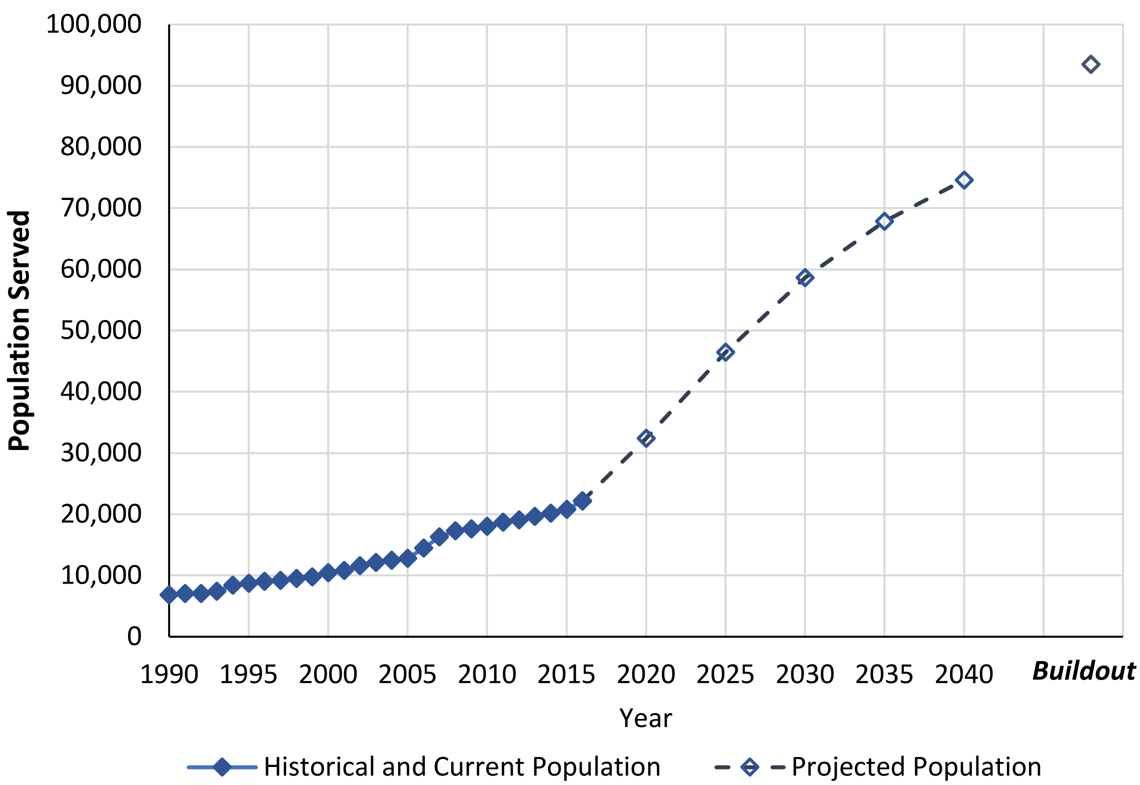


Table 2-4
Residential Buildout - Lands within Existing City Limits

Planning Area	Dwelling Units (a)	Estimated Population (b)
Historic Lathrop - Existing	3,293	12,415
Historic Lathrop - Underutilized	240	905
Mossdale Landing	1,697	6,398
Mossdale Landing East	691	2,605
Mossdale Landing South	428	1,614
Mossdale Landing - Other	658	2,481
Central Lathrop	6,790	25,598
River Island	11,000	41,470
Total	**24,797**	**93,485**

Notes:
(a) Dwelling Unit Counts at buildout provided by the City.
(b) Population estimates are based on the 2010 census figure for persons per household (3.77).

3. PHASE 1 AND PHASE 2A RECYCLED WATER INFRASTRUCTURE

The City's recycled water system supports the disposal of the effluent produced by the City-owned Lathrop Consolidated Treatment Facility (CTF). At the time of the original drafting of this report, the City's recycled water system had a disposal capacity of 1.0 million gallons per day (MGD) and consisted of seven agricultural land application areas (LAAs; A23, A28, A30, A31, A35, A35b, and A35c), nine storage ponds (S1, S2, S3, S5, S6, S16, A, B, and C), their associated pump stations (PMP1, PMP2, PMP3, PMP10, and the Crossroads PMP), and approximately 30.3 miles of recycled water pipeline. This infrastructure supported the recent Phase 1 expansion of the Lathrop CTF and is referred to as "existing" or "Phase 1" infrastructure herein.

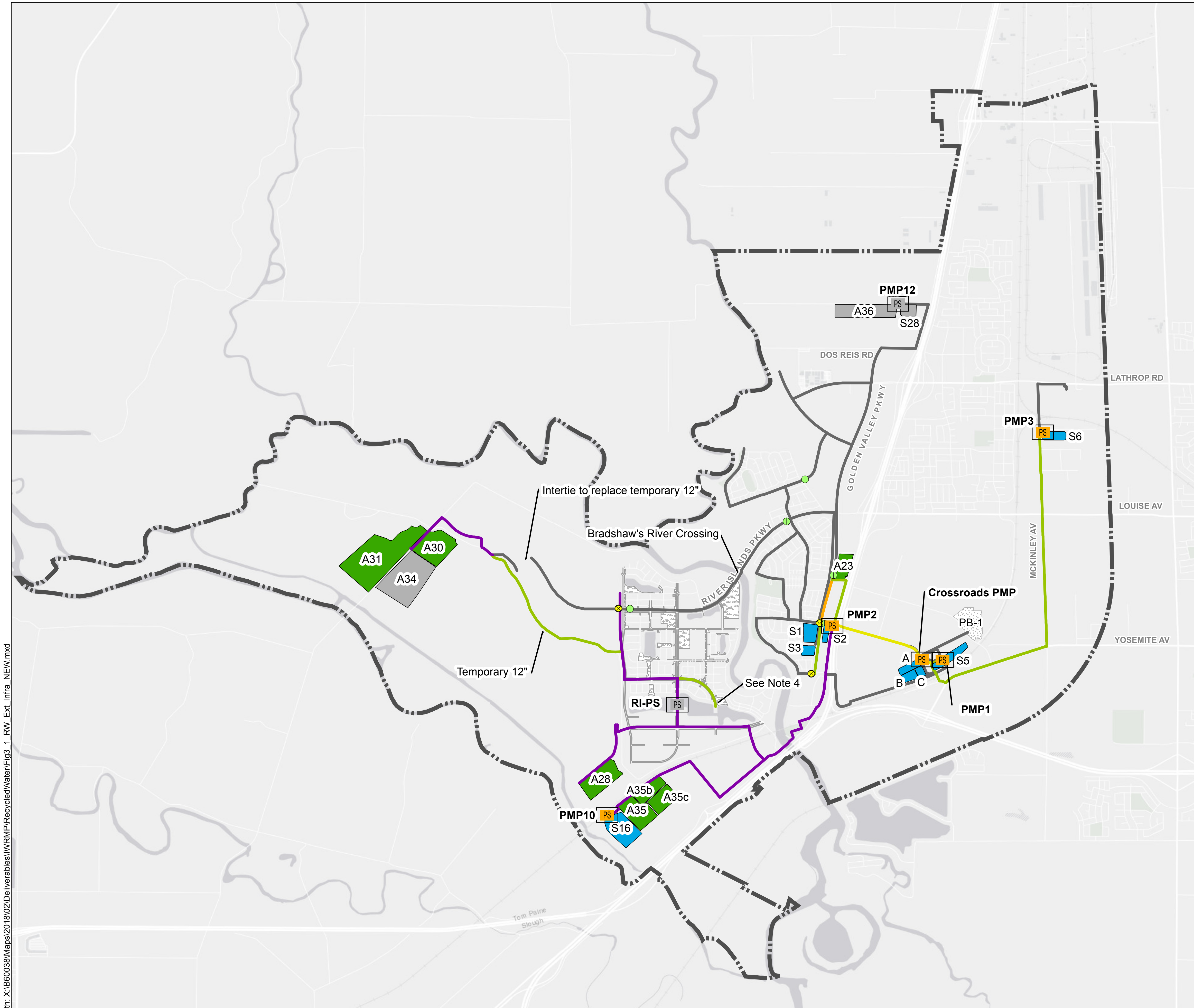
The City is currently expanding its recycled water distribution system to meet disposal requirements for the Phase 2 expansion of the Lathrop CTF, which will increase the Lathrop CTF treatment capacity and disposal capacity to 2.5 MGD. For purposes of this evaluation, it was assumed that the Phase 2 recycled water system expansion would be completed in two phases: Phases 2A and 2B. Phase 2A improvements were based on the planned initial infrastructure improvements as of October 2017, which were planned to provide a disposal capacity of 1.9 MGD. Phase 2B facilities would expand the disposal capacity to the full 2.5 MGD CTF Phase 2 treatment capacity.

Planned Phase 2A improvements included an expansion of the recycled water distribution network and the addition of a new lined recycled water storage pond (S28), a new percolation pond (PB-1), two new agricultural LAAs (A34 and A36), and a new pump station (RI-PS) that supplies recycled water to a private distribution system serving landscape irrigation use areas in the River Islands development area. Figure 3-1 and Figure 3-2 show the City's service area and locations of the City's major Phase 1 and Phase 2 recycled water system facilities, respectively.

During 2017 and 2018, the Phase 2A improvements were implemented, with the exception that LAA A34 was not constructed. This resulted in an interim disposal capacity of approximately 1.55 MGD. In late 2018, LAA A34 was constructed, but as of December 2018, the permitting has not yet been performed to increase the disposal capacity to approximately 1.9 MGD.

EKI understands that in late 2018, there have been some developments that may affect the phasing of the recycled water capacity as well as the configuration of Phase 2B. These developments include the possible removal or replacement of selected storage ponds and/or LAAs. These removals and/or replacements were not anticipated at the time of the original drafting of this RSWMP and are therefore not considered in the analysis herein.[1] The City's Phase 1 recycled water utilities are shown on Figure 3-1 and shown schematically on Figure 3-2. The City's Phase 2A recycled water utilities are shown on Figure 3-3 and shown schematically on Figure 3-4. The City's recycled water infrastructure is discussed in more detail in the following sections.

[1] Facilities that reportedly may be removed or replaced include LAAs A23 and A28, and Ponds S1 and S2.



Legend

Pipe Diameter, Inches

6, 8, 10, 12, 16, 18, 20, 24, Inactive Pipe

Recycled Water Ponds

Phase 1

Inactive (Phase 2A)

Percolation Basins

Inactive (Phase 2A)

Agricultural Irrigation Use Areas

Phase 1

Inactive (Phase 2A)

Landscape Irrigation Use Areas

Inactive (Phase 2A)

Recycled Water Pump Stations

Phase 1

Inactive (Phase 2A)

Other Infrastructure

Closed Valve

Isolation Plate

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. Phase 1 refers to existing facilities permitted for 1.0 MGD disposal capacity. Phase 2A refers to facilities are currently being constructed for permitted disposal capacity of 1.9 MGD for the Phase 2 Expansion of the CTF.
3. The River Islands Pump Station (RI-PS) pumps to the independent River Islands non-potable water system (not shown).
4. Section of 12 inch pipe to be disconnected from City RW system and added to River Islands non-potable water distribution system.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 3 March 2018.

N

0 4,000 8,000

(Scale in Feet)

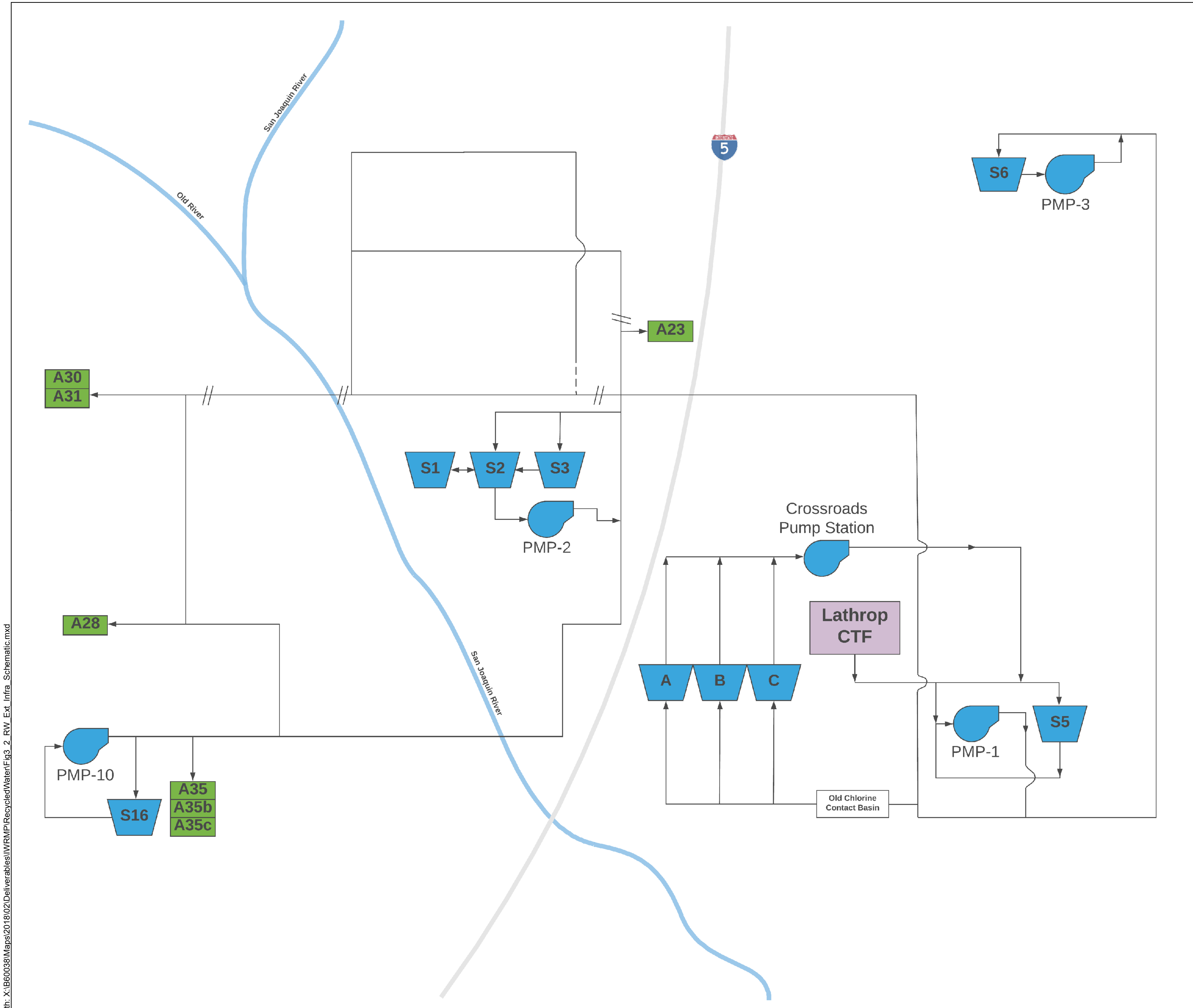
Phase 1 Recycled Water Infrastructure

DRAFT

eki environment & water

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

Figure 3-1



Legend

Recycled Water Pipeline

Phase 1

Recycled Water Ponds

S## Phase 1

Land Application Area

A ## Phase 1

Recycled Water Pump Stations

Phase 1

Other Infrastructure

// Isolation Plates or Closed Valves

Notes

1. All locations are approximate.

Phase 1 Recycled Water System Schematic

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Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
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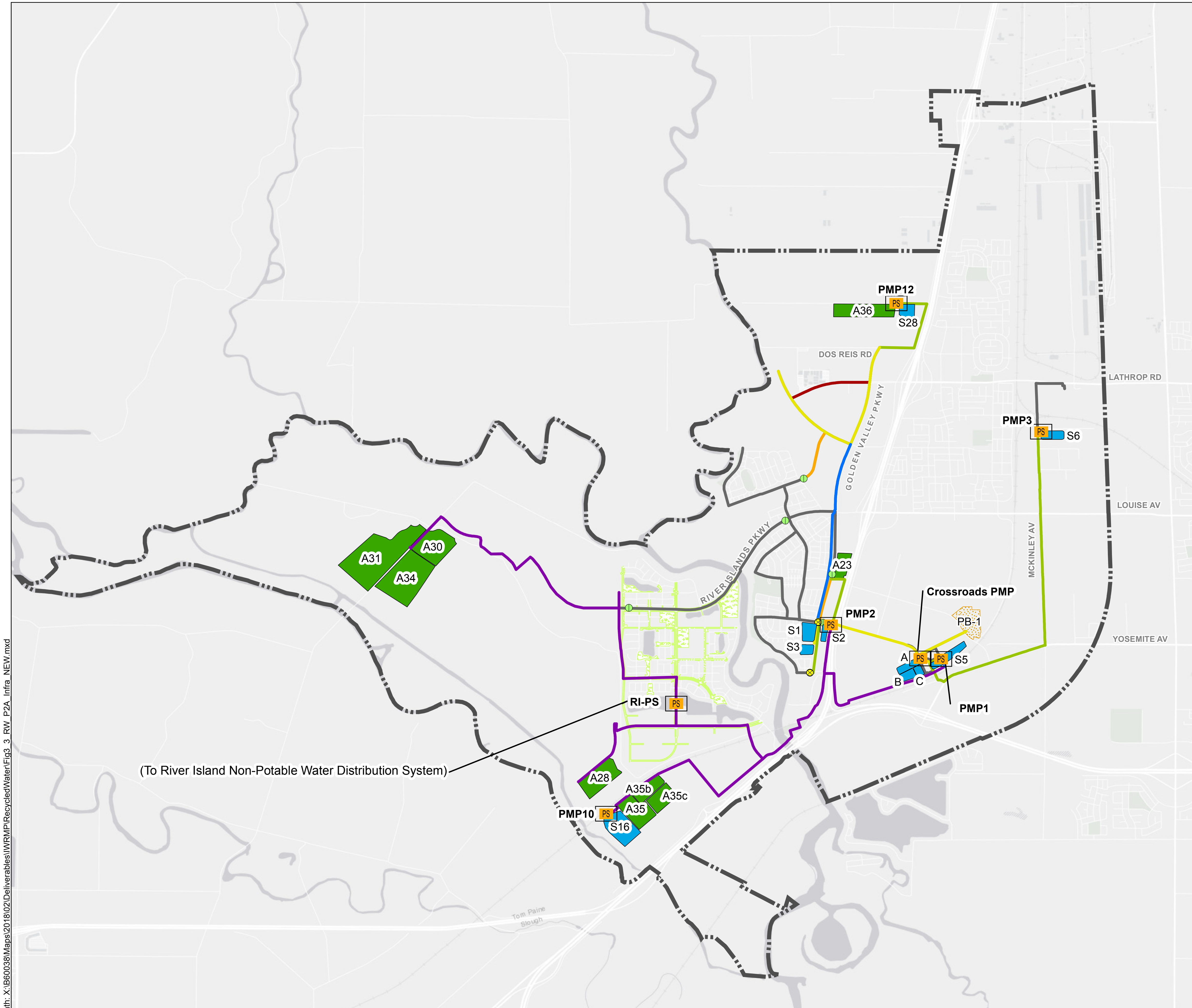
Figure 3-2



Legend

Sphere of Influence

Pipe Diameter, Inches

6
8
10
12
16
18
20
24
Inactive Pipe

Recycled Water Distribution Infrastructure

Storage Pond
Percolation Basin
Land Application Area
Landscape Irrigation Area
Pump Station

Other Infrastructure

Closed Valve
Isolation Plate

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. The River Islands Pump Station (RI-PS) pumps to the independent River Islands non-potable water system (not shown).
3. Section of 12 inch pipe to be disconnected from City RW system and added to River Islands non-potable water distribution system.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 5 March 2018.

N
0 4,000 8,000
(Scale in Feet)

Phase 2A Recycled Water Infrastructure

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Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

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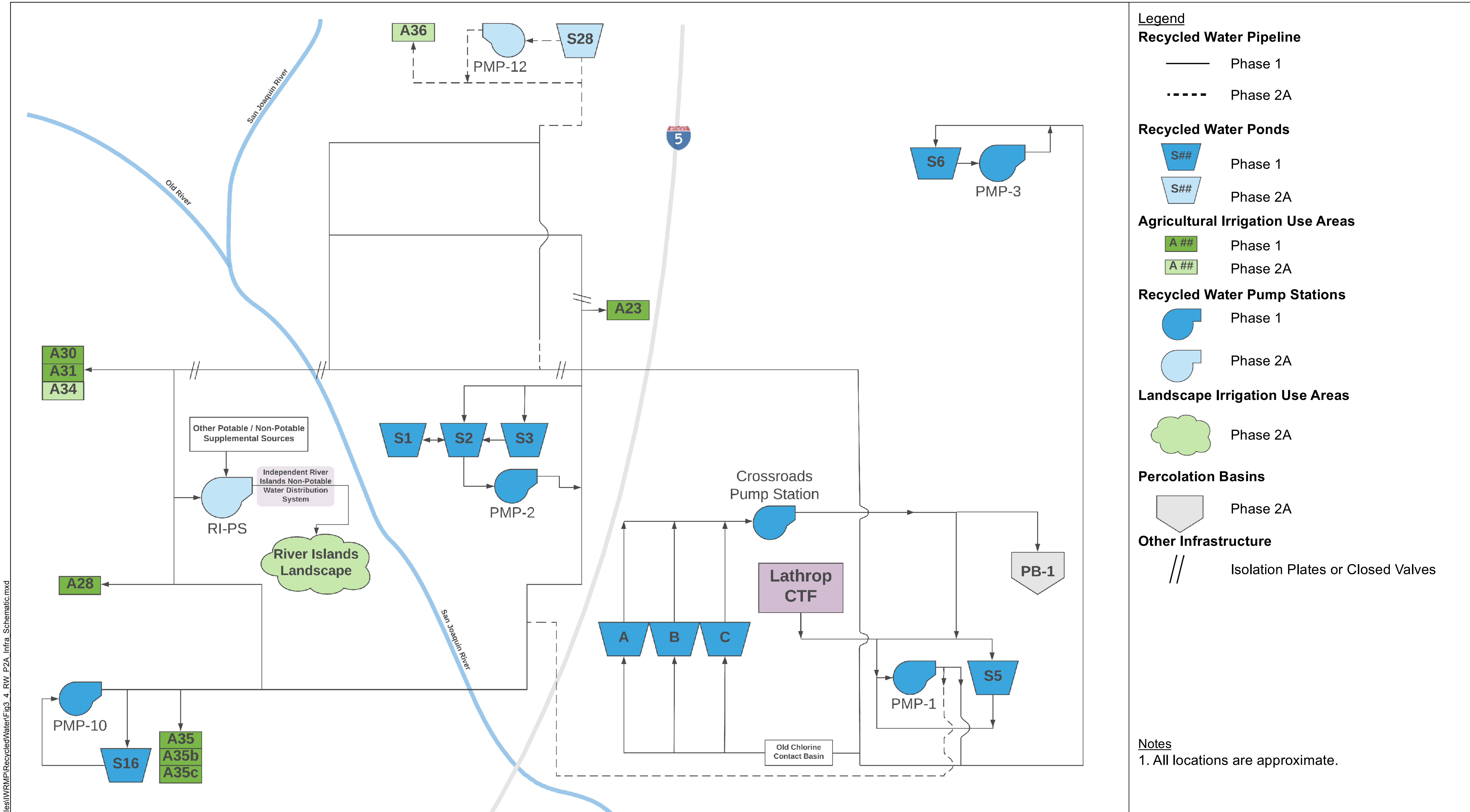
Figure 3-3

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig3_3_RW_P2A_Infra_NEW.mxd



Phase 2A Recycled Water System Schematic

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Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

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Figure 3-4

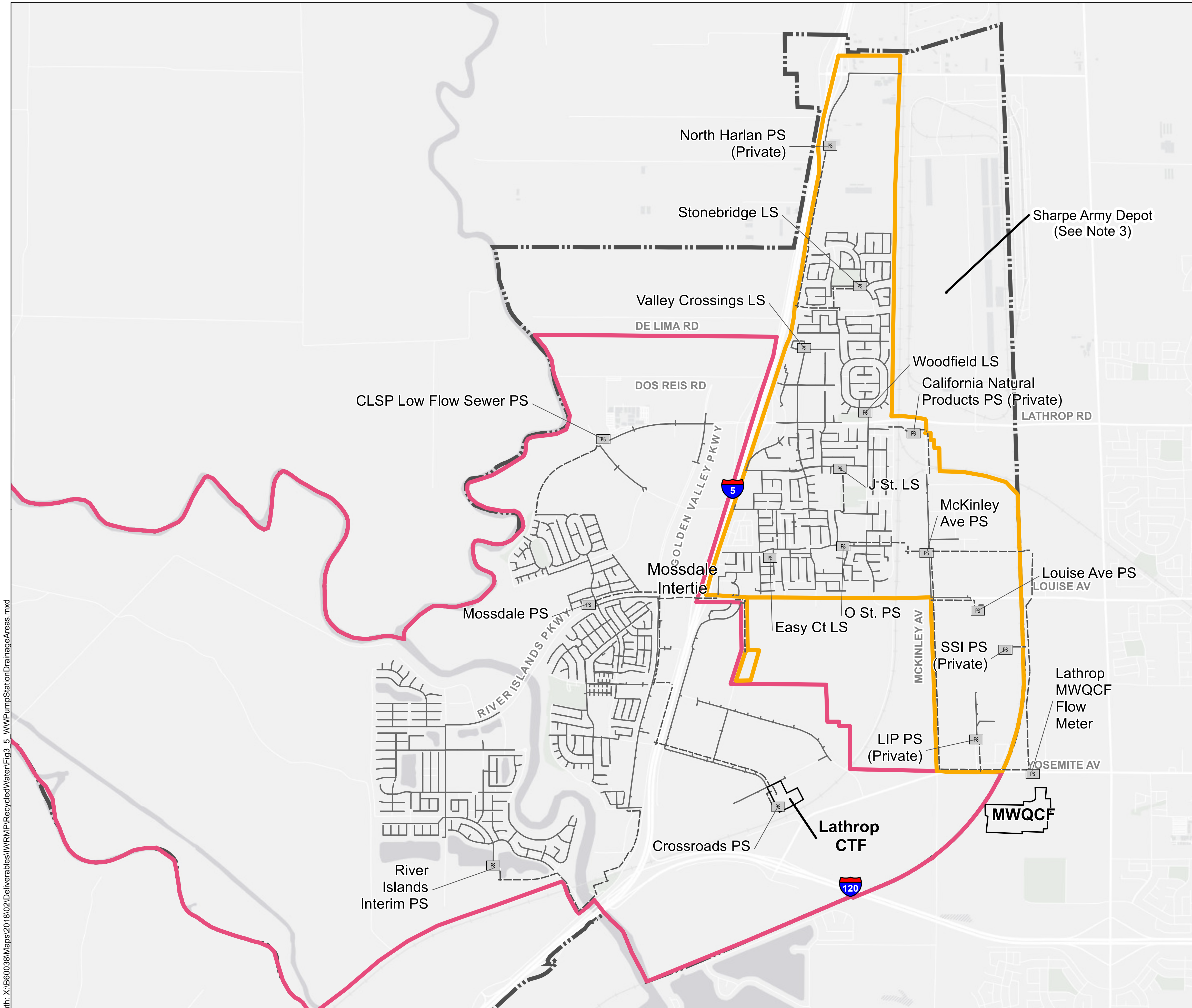
3.1 Recycled Water Treatment Facilities

Recycled water is produced at the City-owned Lathrop CTF. As discussed in the Wastewater System Master Plan (WWSMP), only a portion of the City's wastewater—primarily wastewater generated west of I-5—is collected and treated at the Lathrop CTF. The remaining wastewater is collected and conveyed to the Manteca Water Quality Control Facility (MWQCF). The two wastewater collection systems are shown on Figure 3-5.

Wastewater treatment and recycled water disposal at the City's Lathrop CTF is regulated under Waste Discharge Requirements (WDR) Order No. R5-2016-0028-01 by the Central Valley Regional Water Quality Control Board (RWQCB)[2]. Wastewater treatment processes at the Lathrop CTF include secondary treatment, tertiary membrane filtration, and disinfection prior to storage and disposal. The Lathrop CTF produces disinfected tertiary recycled water suitable for irrigation at parks, landscape strips, median islands, pond berms, and agricultural fields. Daily operations of the Lathrop CTF is contracted to a private contractor, Veolia Water NA.

The City is currently constructing the Phase 2 CTF expansion, which will increase the treatment capacity to a total of 2.5 MGD. The first portion of the Phase 2 expansion, Phase 2A was constructed in 2017 and 2018. As previously discussed, the permitted treatment and disposal capacity is 1.55 MGD as of December 2018, which is a portion of the originally planned Phase 2A capacity of 1.9 MGD. The Lathrop CTF is permitted for a maximum capacity of up to 6.0 MGD with additional expansions.

[2] The WDR is currently being amended to incorporate the Phase 2A facilities and increase the permitted capacity.



Legend
- Sphere of Influence
- Approximate Area of WWTF
- Pump Station or Lift Station
- Gravity Main
- Force Main

Collection System Boundaries
- MWQCF Collection System (Lathrop CS to Manteca WQCF CS)
- Lathrop CTF Collection System (WRP-1 MBR)

Abbreviations

CLSP = Central Lathrop Specific Plan
CTF = Consolidated Treatment Facility
LIP = Lathrop Industrial Park
LS = lift station
MWQCF = Manteca Water Quality Control Facility
PS = pump station
SSI = Super Store Industries
WWTF = wastewater treatment facility

Notes
1. All locations are approximate.
2. Only the CTF collection system contributes to recycled water production.
3. The City is currently evaluating whether the Sharpe Army Depot will be connected to the MWQCF or CTF collection system.

Sources
1. Aerial photograph provided by ESRI's ArcGIS Online, 3 March 2018.

N
0 3,000 6,000
(Scale in Feet)

City of Lathrop Sewer Collection Systems

DRAFT

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Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.02

Figure 3-5

3.2 Recycled Water Distribution, Storage, and Disposal Facilities

Recycled water uses in the City are regulated under WDR Order No. R5-2016-0028-01. Under the WDR permit, the City can store recycled water in above-ground lined storage ponds prior pumping to the distribution system for the following uses:

- Irrigation of agricultural LAAs;
- Irrigation of public landscape areas, including roadway medians, parks, pond berms, and open spaces;
- Percolation into the ground at PB-1 (former land application site LAS-3, which is currently being converted into a percolation pond).

The sections below describe the Phase 1 and 2A recycled water distribution, storage, and disposal facilities.

3.2.1 Storage Ponds and Pump Stations

As shown in Table 3-1, the City has approximately 273 million gallons (MG) of storage in nine open-air, lined storage ponds. The City's storage ponds are used to provide seasonal storage of recycled water produced in the winter months to supply peak irrigation demands in the summer months. Ponds are lined with 40-mil high density polyethylene, are fenced off with chain-link fencing, and have signage in accordance with Title 22 requirements. Currently under construction, pond S28 will add an additional 17.3 MG of storage for Phase 2A.

Table 3-2 lists the characteristics of each PMP. PMP1, PMP2, PMP3, and PMP10 pump recycled water from their associated storage ponds directly into the recycled water distribution system. The Crossroads PMP pumps recycled water from ponds A/B/C to PB-1 or to pond S5 but cannot pump directly into the recycled water distribution system.

PMP10, which serves S16, currently consists of two low-pressure pumps. These pumps will be replaced by high-pressure pumps during Phase 2A. Planned PMP-12 will add an additional 2,400 gpm of pumping capacity from pond S28 in Phase 2A.

3.2.2 Recycled Water Distribution Pipelines

The City's recycled water distribution network consists of approximately 30.3 miles of pipes, ranging from 6 inches to 30 inches in diameter. All recycled water system pipes are made of polyvinyl chloride (PVC) C900 or C905 Class 150. Table 3-3 summarizes the City's recycled water distribution pipelines by diameter. Distribution system pipes for Phases 1 and 2A are shown on Figure 3-1 and Figure 3-3, respectively.

Currently, portions of the system are isolated from the recycled water system by isolation plates or closed valves and charged with potable water for irrigation of parks and public landscaping in the Mossdale area. Also, the recycled water pipeline along River Islands Parkway, referred to as "Bradshaw's Crossing", has not yet been accepted by the City or connected to the distribution system.

3.2.3 Land Application Areas and Landscape Irrigation Areas

As shown in Table 3-4, the City has approximately 222 acres of LAAs. These sites are generally sown with farm fodder crops such as rye grass or alfalfa. These sites are flood irrigated, with recycled water applied from a standpipe at the high side of the site. A mild slope directs water across the site. Return flows are pump from a tailwater return ditch to the high side of the site.

Currently the City staff manually operate the PMPs to deliver recycled water to each LAA when requested by the farmers. The City is planning to install a flow meter and automatic control valve with a radio telemetry system at each LAA turnout to increase automation of system operations in Phase 2A.

As shown in Table 3-4 and on Figure 3-3, new landscape irrigation (LI) areas will be added in River Islands as part of the Phase 2A CTF expansion. LI areas will include ornamental turf, shrubs, and trees along parkways, road medians, and parks. The River Islands LI areas are supplied by a private non-potable water distribution system fed by the River Islands Non-Potable Water Pump Station (RI-PS). The RI-PS will be supplied by a combination of recycled water, river water from Old River and San Joaquin River, and lake water. Recycled water will be used as a primary source but the other sources can be blended in to lower total dissolved solids.

3.2.4 Percolation Basins

Percolation basin PB-1 was recently constructed for the Phase 2A Expansion of the CTF (see Figure 3-3 and Figure 3-4). The percolation basin is located at former land application area LAS-3, which is located northeast of the CTF plant.

PB-1 consists of four percolation basins with a total catchment area of approximately 16.5 acres, a total parcel area of approximately 22.2 acres and a total storage capacity of 11.6 MG. The operation of the basins will be rotated on approximately a two-week schedule, with basins to be filled, dried, cleaned, and scarified in cycles. One basin will remain out of service for redundancy. Based on previous percolation tests, it is estimated that the PB-1 will have a percolation rate of approximately 0.33 MGD[3] (PACE, 2016 and 2017). Initial startup testing has indicated that percolation rates may be higher than anticipated.

[3] At the time of the preparation of the percolation test report, the percolation pond was planned for disposal of secondary effluent from the Crossroads Wastewater Treatment Plant, rather than tertiary effluent from the CTF plant. The 0.33 MGD percolation rate was based on an assumed need to keep a minimum 5-foot vertical separation between the bottom of the percolation pond and the groundwater table in order to provide the additional treatment needed for the secondary effluent. Because only tertiary effluent will now be disposed of in the percolation pond, the 5-foot separation is no longer necessary, and as a result, it is possible that the actual percolation rate could be greater than 0.33 MGD. However, for purposes of the water balance described in Section 4.3.3 of this report, it is conservatively assumed that the percolation rate is 0.33 MGD.

Table 3-1
Phase 1 and Phase 2A Recycled Water Storage Ponds

Phase	Pond ID	Average Bottom Elevation (ft MSL)	Max Storage Depth (ft) (a)	Catchment Area (acres)	Parcel Area (acres)	Storage Capacity (MG)	Notes
Phase 1	A	7.7	12.1	4.4	9.8	13.7	(b)
	B	7.5	12.3	4.4	10.3	10.8	
	C	7.5	12.3	2.8		7.4	
	S1	6.0	15.0	9.3	13.3	41.0	(c)
	S2	6.0	15.0	3.9	6.9	15.4	
	S3	5.0	16.0	5.0	9.9	21.1	
	S5	6.0	15.0	8.9	10.0	28.5	
	S6	12.0	18.0	7.5	11.7	34.1	
	S16	8.0	16.0	20.4	30.2	101.3	(d)
			Subtotal (Existing)	**66.5**	**102.0**	**273.3**	
Phase 2A	S28	6.5	15.5	17.3	7.8	17.3	(e)
			Total (Existing and Phase 2A)	**83.8**	**109.7**	**290.6**	

Notes:
(a) Assumes 2 feet of freeboard.
(b) Sources: Average bottom elevation and max depth from as-built records prepared by Nolte Beyond Engineering dated 21 January 2014; Catchment area estimated based on aerial; Storage capacity based on capacity reported in WDR R5-2016-0028.
(c) Sources: Average bottom elevation and max depth from approved recycled water balance storage summary; Catchment area estimated based on aerial. Storage capacity based on reported capacity in WDR R5-2016-0028.
(d) Source: River Islands Recycled Water Storage Pond Design Drawings prepared by O'Dell Engineering dated August 2017.
(e) Source: CLSP Recycled Water Disposal Plan Stage 1 - Recycled Water Basin and Pump Station Design Documents, prepared by PACE Engineering dated August 2017.

Table 3-2
Phase 1 and Phase 2A Recycled Water Storage Booster Pump Station Characteristics

Phase	Pump Station	Source	Pump Number	Design Flow (gpm)	Head (ft)	Variable Frequency Drive (VFD)	Horsepower (hp)	Installation Date
Phase 1	PMP-1 (a)	CTF	1	1,450	160	✓	75	2003
			2	1,450	160	✓	75	2003
	Crossroads PMP (b)	A/B/C	1	2,100	116		100	2002
			2	2,100	116		100	2002
	PMP-2 (a)	S1/S2/S3	1	900	153		50	2004
			2	900	153		50	2004
			3	900	153		50	2004
	PMP-3 (a)	S6	1	900	150	✓	50	2005
			2	900	150	✓	50	2005
			3	900	150	✓	50	2005
	PMP-10 (c)	S16	1	1,400	30		15	2016
			2	1,400	30		15	2016
Subtotal (Existing)				**15,300**				
Phase 2A	PMP-12 (d)	S28	1	800	170	✓	50	--
			2	800	170	✓	50	--
			3	800	170	✓	50	--
Total (Existing and Phase 2A)				**17,700**				

Notes:
(a) Source: City of Lathrop Master Plan Documents - Volume 1 - Master Plan Studies - Recycled Water, Nolte 2004.
(b) Source: Lathrop WRP-1 Remediation Project Submersible Pump Specifications Section 11223, dated July 1, 2002.
(c) Source: Technical Memo for Lathrop Recycled Water Plan, PACE 2018. Planned to be replaced with high pressure pumps.
(d) Source: CLSP Stage 1 Recycled Water Basin and Pump Station Design by PACE August 2017.

Table 3-3
Recycled Water Distribution System Pipeline Inventory (a)(b)

Pipe Diameter (inches)	Total Pipe Length (feet)	Total Pipe Length (miles)	Percent of System
6	20,900	4.0	14.1%
8	40	0.01	0.03%
10	3,300	0.6	2.1%
12	55,900	10.6	37.4%
16	43,900	8.3	29.3%
20	17,500	3.3	11.7%
24	7,900	1.5	5.3%
Total	**149,440**	**28.3**	**100%**

Notes:
(a) Includes all Phase 1 and 2A pipes, including those currently charged with potable water or not yet connected to the recycled water system.
(b) Includes a temporary 12-inch line in the River Islands development area.

Table 3-4
Phase 1 and Phase 2A Land Application Sites

Phase	Site	Irrigated Area (Acres)	Notes
Existing	A23	12	(a)
	A28	31	(a)
	A30	36	(a)
	A31	95	(a)
	A35	21	(b)
	A35b	14	(b)
	A35c	15	(b)
	Subtotal (Existing)	**222**	
Phase 2A CTF Expansion	A34	65	(a)
	A36	26	(c)
	River Islands Stage 1A/1B Landscaping	56	(d)
	Total	**591**	

Notes:

(a) Source: Acreage based on reported acreage in WDR R5-2016-0028.
(b) Source: Order R5-2016-0028, City of Lathrop Consolidated Treatment Facility – Recycled Water Pond and Land Application Areas Design Amendment Request prepared by the City of Lathrop, dated October 2, 2017.
(c) Source: CLSP Recycled Water Disposal Plan Stage 1 - Recycled Water Basin and Pump Station Design Documents, prepared by PACE Engineering dated August 2017.
(d) Source: Phase 1A & 1B Irrigation Coverage Exhibit River Islands, prepared by O'Dell Engineering dated June 2017. Reduced from 78.22 ac pending completion of two parcels based on communication with River Islands on October 10, 2017.

3.2.5 Major Recycled Water System Improvements Completed Since 2014

The following recycled water system improvements have recently been completed or are currently under construction for the Phase 1 and Phase 2A CTF plant expansions:

- New River Islands Recycled Water Infrastructure:
  - 0.88 miles of 16-inch transmission mains in along River Islands Parkway.
  - 1.6 miles of 12-inch transmission mains at Bradshaw's Crossing.
  - 1.2 miles of 16-inch transmission mains to pond S16 extending from Manthey Road.
  - Storage pond S16 and pump station PMP10.
  - Agricultural LAAs A34, A35, A35b, and A35c.
  - RI-PS and 78.2 acres of River Islands landscape irrigation areas.
- Improvements near the CTF:
  - 1.28 miles of 16-inch transmission mains extending from PMP-1 along South Howland Road, across I-5 to Manthey Road at Sadler Oak.
  - Connection of PMP-1 discharge to ponds A/B/C.
  - Percolation Basin PB-1.
  - Connection of discharge from Crossroads PMP to pond S5.
- CLSP Infrastructure:
  - Agricultural LAA A36
  - Storage pond S28 and pump station PMP12.
  - 0.84 miles of 12-inch transmission mains from Golden Valley Parkway and Dos Reis Road to pond S28 and LAA A36.
  - A new 20-inch main on Brookhurst Boulevard between Manthey Way and Golden Valley Parkway to replace an existing 12-inch main and an intertie connecting the new 20-inch main to the existing 24-inch transmission main on Golden Valley Parkway.

4. RECYCLED WATER SUPPLY, USE, AND WATER BALANCE EVALUATION

The following sections provide an evaluation of City's future recycled water supplies and potential recycled water use alternatives that could either offset the City's potable water demand or provide other benefits to the City's overall water supply. For retained alternative this section evaluates future storage and disposal (e.g., LAAs, LI, and percolation) requirements based on a water balance analysis.

4.1 Recycled Water Supply

Table 4-1 and Figure 4-1 show projected wastewater flows to the Lathrop CTF and the Lathrop CTF and recycled water system capacities in 5-year increments through buildout. For the purposes of this RWSMP, recycled water production is assumed to equal wastewater influent flows to the Lathrop CTF.[4]

As discussed in the WWSMP, the Lathrop CTF Phase 2 expansion is projected to have sufficient treatment capacity to meet projected flows through 2026. Phase 2A recycled water improvements (1.9 MGD capacity) are projected to have sufficient storage and disposal capacity through approximately 2023, at which point Phase 2B improvements will need to be completed. Future Lathrop CTF expansions are projected to produce up to 5.61 MGD of recycled water.

4.2 Recycled Water Use Alternatives

As discussed in detail in the WSMP, the City is expected to have sufficient potable water supplies to meet water demands Citywide beyond 2040. However, the reliability of future water supply is uncertain because of uncertainties regarding the implementation of the Sustainable Groundwater Management Act (SGMA), the timing of South County Water Supply Project (SCWSP) Phase 2, and potential curtailments of SSJID surface water supplies. The following sections describe recycled water use alternatives that could provide additional water supply benefits to the City.

4.2.1 Current Permitted Uses of Recycled Water (RWSMP Alternative 1)

Recycled water uses in the City are regulated under WDR Order No. R5-2016-0028-01. As discussed in Section 3.2, under the WDR permit, the City can serve recycled water for the following uses:

- Irrigation of agricultural LAAs;
- Irrigation of public landscape areas, including roadway medians, parks, pond berms, and open spaces;
- Percolation into the ground at PB-1.

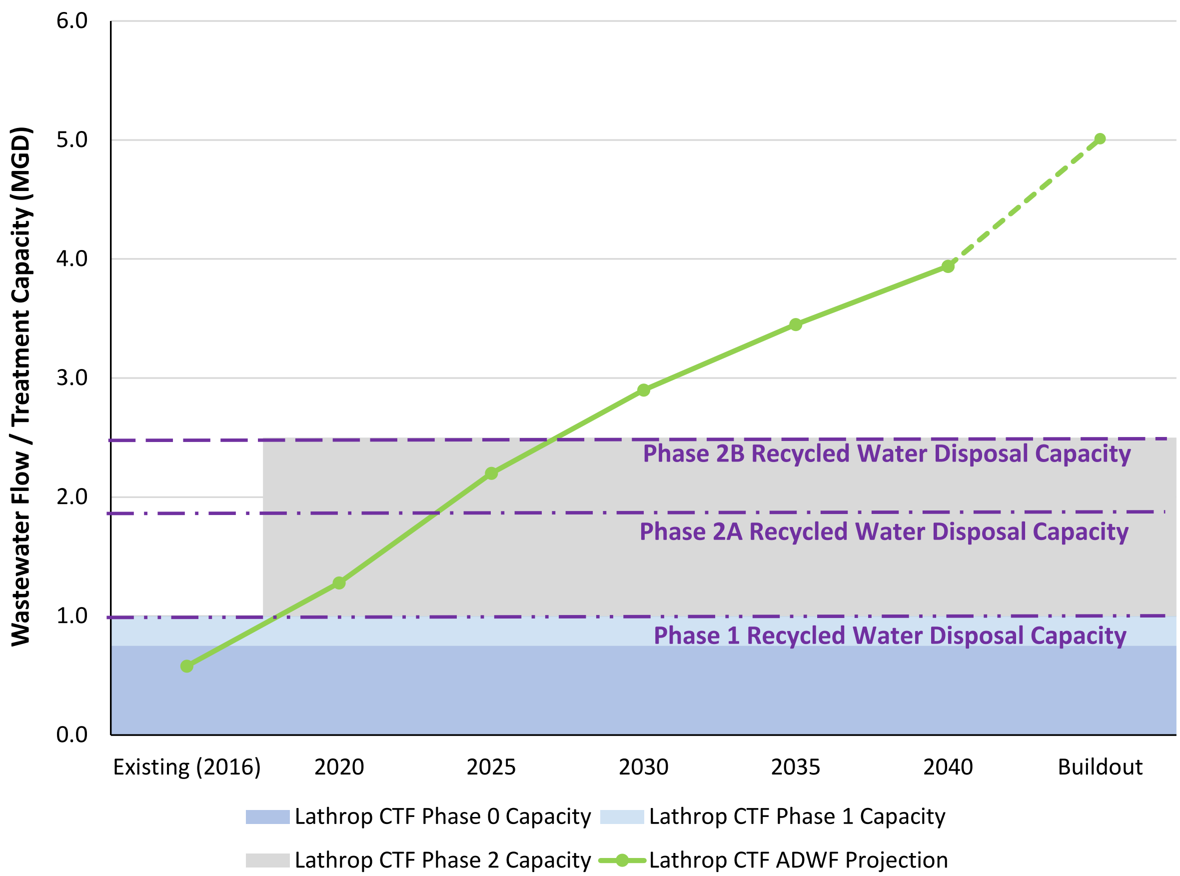
[4] A small portion of the wastewater flows are likely lost during the wastewater treatment process.

Table 4-1
Projected Wastewater Flow and Treatment Capacity at Lathrop CTF

	Estimated ADWF Influent and Treatment Capacity (MGD)						
	Existing (2016)	2020	2025	2030	2035	2040	Buildout
Projected Influent ADWF (a)							
ADWF Projection	0.58	1.28	2.20	2.90	3.45	3.94	5.01
Existing Capacity and Future CTF Expansions							
Lathrop CTF Phase 0	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Lathrop CTF Phase 1	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lathrop CTF Phase 2	-	1.50	1.50	1.50	1.50	1.50	1.50
Total Capacity	*1.00*	*2.50*	*2.50*	*2.50*	*2.50*	*2.50*	*2.50*

Notes:
(a) Wastewater influent to Lathrop CTF is the combination of wastewater flow from all city areas except for the Historic Lathrop area and Sharpe Army Depot.

Figure 4-1
Projected Wastewater Flow, Treatment Capacity at Lathrop CTF, and Recycled Water System Capacity



Existing and future permitted storage, LAA, LI areas, and percolation locations are shown on Figure 4-2. Note that locations which are still permitted but are no longer feasible for recycled water use are not included in Figure 4-2 for clarity.

Agricultural land application remains primarily a disposal method of the City's tertiary effluent but provides limited benefit to the City's water demand and supply portfolio. As discussed in the WSMP, land application at LAAs could contribute to potential groundwater budgets that may be implemented within the East San Joaquin (ESJ) Subbasin under SGMA; however, the majority of this water is lost to evapotranspiration. Additionally, many of the City's LAAs are located within the Tracy Subbasin. Recharge to the Tracy Subbasin is unlikely to provide any water supply benefit to the City, as the City's wells exclusively pump from the ESJ Subbasin.[5]

City will begin using recycled water for landscape irrigation in River Islands in Phase 2A.[6] The City intends to expand use of the recycled water for landscape irrigation to areas in Mossdale and CLSP starting in Phase 2B, which will offset potable demands by approximately 0.38 MGD or 426 acre-feet (see Table 4-5). Additionally, PB-1, located within the ESJ Subbasin, will provide additional groundwater supply benefits compared to agricultural land application.

The continued and expanded use of recycled water consistent with the existing WDR is evaluated as Alternative 1 in Section 4.3, below, to estimate future storage and land application requirements.

4.2.2 Expanded Percolation (RWSMP Alternative 2)

This alternative considers the potential expansion of the City's percolation capacity beyond PB-1. If suitably permeable soils exist, the City could decide to replace certain planned LAAs or storage basins with percolation basins, which would require substantially less total land area. As discussed above, percolation basins located in the ESJ Subbasin could potentially provide groundwater recharge credit and increase the City's groundwater allocation under SGMA. While most of water is lost through evapotranspiration in land application, percolation basins are more effective at recharging groundwater. However, among other things, it may be challenging for the City to demonstrate that recharge into the shallow aquifer can benefit groundwater conditions in the deeper aquifer, where the City's production wells are screened.

In addition to increasing recharge, converting lands from agricultural spray fields to percolation basins would have a benefit in decreasing the TDS of percolated waters (Stantec, 2014). During agricultural land application, evaporation and plant water uptake can increase the percolated recycled water TDS concentration from 1,400 milligrams per liter (mg/L) to an estimated 4,000 mg/L (Stantec, 2014).

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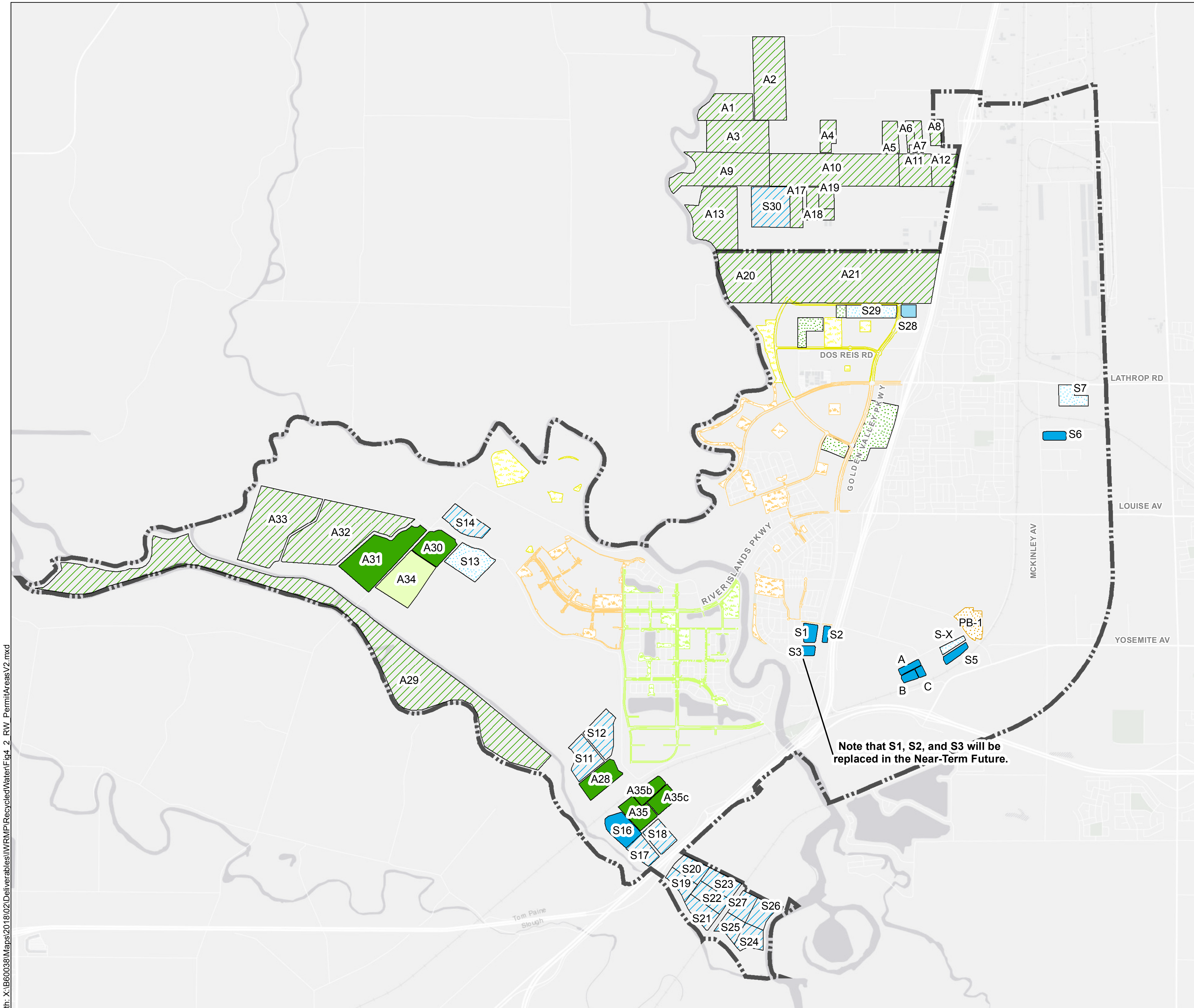
[5] The City is currently exploring a basin boundary modification to revise the ESJ and Tracy Subbasin boundaries such that the entire City is located within the Tracy Subbasin.

[6] The WSMP update did not include River Islands non-potable irrigation demands in its water demand projections and therefore these recycled water uses do not offset the City's potable demand projections.

Potential percolation areas include areas within the Sharpe Army Depot or other planned LAA or storage sites determined to be suitable for percolation. To implement this alternative, percolation studies to determine where suitable soils exist and a permit revision to expand percolation beyond PB-1. Expanded use of percolation basins is evaluated further as Alternative 2 in the Section 4.3, below.



Legend

Sphere of Influence

Recycled Water Ponds

- Phase 1
- Phase 2A
- Phase 2B
- Future Permitted

Percolation Basins

- Phase 2A

Agricultural Irrigation Use Areas

- Phase 1
- Phase 2A
- Phase 2B
- Future Permitted

Landscape Irrigation Use Areas

- Phase 2A
- Phase 2B
- Future Permitted

Abbreviations

PMP = Pump
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. Phase 1 refers to existing facilities permitted for 1.0 MGD disposal capacity. Phase 2A refers to facilities are currently being constructed for permitted disposal capacity of 1.9 MGD for the Phase 2 Expansion of the CTF. Phase 2B to facilities which will be construct for the full 2.5 MGD CTF Phase 2 capacity. Future permitted facilities include those listed in the current CTF Waste Discharge Requirements for ultimate 6.0 MGD expansion.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 2 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Permitted Recycled Water Storage and Use Areas

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

DRAFT

eki environment & water

Figure 4-2

Path: X:\B60038\Maps\2018\02\Deliverables\WRMP\RecycledWater\Fig4_2_RW_PermitAreasV2.mxd

4.2.3 Winter River Discharge (RWSMP Alternative 3)

The City is considering applying for a winter river discharge NPDES permit, which would allow the City to discharge Lathrop CTF effluent to the San Joaquin River during winter months. This alternative would significantly reduce the required pond storage volume, as recycled water produced during low recycled water demand winter months no longer needs to be stored until the summer irrigation season. The required LAA acreage would also be reduced, though less significantly. This alternative allows for the most land to be developed for land uses other than recycled water storage and land application. However, this alternative does not provide the City any water supply benefits compared to the existing permitted recycled water uses.

4.2.4 Indirect Potable Reuse

Advanced treated recycled water can be used as an alternative potable water source through indirect potable reuse (IPR). For IPR, advanced treated recycled water is either injected or percolated into a natural water source to augment drinking water supplies. The City may implement IPR in the deep aquifer through injection or in the shallow aquifer via percolation basins. IPR options may be constrained by the local aquifer's water quality and would require the City to upgrade to advanced treatment (e.g. reverse osmosis) at the Lathrop CTF.

In IPR systems, production wells are installed at a certain distance from recycled water injection points to ensure sufficient aquifer retention time. Public health concerns are of key importance in moving forward with IPR. California water regulations thoroughly cover treatment required for use of recycled water in IPR and require a multiple-barrier system, including wastewater treatment, natural aquifer treatment, and water treatment, as a reliable means to protect public health. The primary regulatory framework for IPR has been developed at the state level under Title 22, Division 4, Article 5.1. IPR may require multiple injection or percolation locations depending on aquifer conditions and expected flow rate. Injection locations can often be located within a few hundred feet of one another without causing significant groundwater mounding which would ultimately reduce allowable flowrate into each injection site.

This option would benefit the City by creating a semi-closed loop between water production and water recharge. Although water loss occurs due to evaporation and groundwater flow, it provides a means for the City to more fully use its recycled water to augment potable water supplies. Implementing IPR would require investment in permitting, advanced recycled water treatment, injection facilities, and water treatment facilities. However, the City would not need to build, operate, and maintain a recycled water distribution system except for the transmission mains to the injection sites.

Due the extensive capital costs and permitting challenges associated with IPR the City does not intend to explore the implementation IPR further at this time. As such, this alternative is not evaluated further, herein. However, the City may revisit IPR in the future.

4.2.5 Direct Potable Reuse

Direct potable reuse (DPR) refers to the delivery of recycled water directly to a potable or raw water distribution system upstream of a drinking water treatment facility, bypassing the environmental buffer of groundwater replenishment or surface water augmentation provided by IPR. No regulations currently exist that permit DPR, but California is currently developing regulations. As the first step of this effort, the State's expert panel recently issued a report that concluded, "it is feasible to develop uniform water recycling criteria for DPR that would incorporate a level of public health protection as good as or better than what is currently provided in California by conventional drinking water supplies, IPR systems using groundwater replenishment, and proposed IPR projects using surface water augmentation" (SWRCB, 2016). In lieu of environmental buffers provided by IPR, DPR will require, among other things, treatment trains with multiple, independent treatment barriers with a diverse set of processes to provide redundancy, resiliency, and robustness; advanced monitoring and probabilistic data analysis; a highly trained operational staff; and a robust source control program. Beyond the technical challenges, public perception may also create a hurdle to implementing DPR.

DPR would benefit the City by creating a closed loop between water production and wastewater treatment, but without the need to inject and pump the recycled water to and from the groundwater basin, as is required by IPR. DPR would provide a means for the City to fully use recycled water to augment drinking water supply. Implementing DPR would require investment in advanced recycled water and drinking water treatment facilities. However, the City would not need to build, operate, and maintain a recycled water distribution system or injection facilities.

Due to the fact that regulations are still in development, this option is not currently viable. As such, this alternative is not evaluated further, herein.

4.2.6 Local Water Transfer or Exchange

Recycled water may be used to indirectly augment the City's drinking water supply by implementing a transfer between the City and surrounding water users. For instance, in California, recycled water produced by the City of Turlock is delivered to an irrigation district in the Stanislaus County to augment the district's irrigation supplies in exchange for additional surface water supplies delivered to the Turlock. Potential recycled water transfers may be feasible between the City and South San Joaquin Irrigation District (SSJID) water users. In such a transfer, the City's would transfer recycled water for additional SCWSP allocations. Among other things, the challenge in implementing this solution is the lack of infrastructure to achieve such a transfer.

Due to the lack of infrastructure and a potential transfer partner, this alternative is not evaluated further, herein, but could be revisited at a later date.

4.3 Recycled Water Balance Evaluation

EKI conducted recycled water balance calculations for the three retained recycled water use alternatives described above to estimate the future storage and disposal/use area requirements. The following sections describe the evaluated recycled water balance scenarios, summarizes the recycled water storage and disposal requirements, and summarizes the water balance results.

4.3.1 Recycled Water Use Balance Scenarios

Recycled water balance calculations were conducted for the Phase 1, Phase 2A, Phase 2B, and Buildout planning horizons. Alternative recycled water uses were evaluated in the planning horizons when the alternatives could feasibly be implemented. The evaluated water balance scenarios summarized below:

- Phase 1 (1.0 MGD)
    - Alternative 1 – Existing Phase I Infrastructure
- Phase 2A CTF Expansion (1.9 MGD)
    - Alternative 1 – Existing and Future Infrastructure for Phase 2A CTF Expansion
    - Alternative 2 – Expanded Percolation Alternative
- Phase 2B CTF Expansion (2.5 MGD)
    - Alternative 1 – Expansion of Permitted Uses for the Phase 2B CTF Expansion
    - Alternative 2 – Expanded Percolation
    - Alternative 3 – Winter River Discharge
- Buildout (5.6 MGD)
    - Alternative 1 – Expansion of Permitted Uses
    - Alternative 2 – Expanded Percolation
    - Alternative 3 – Winter River Discharge

For Alternative 2 – Expanded Percolation, approximately 22.4 acres was assumed to be used for percolation in addition to PB-1 in Phase 2A and 2B, and an additional approximately 33 acres was assumed to be used for percolation in the buildout scenario. For the Alternative 3 – Winter River Discharge, river discharges of the Lathrop CTF effluent was assumed to be permitted only in November, December, January, and February.

4.3.2 Recycled Water Storage Capacity and Disposal Capacity Requirements

Per the City's Waste Discharge Requirements and Master Recycling Permit Order No. R5-2016-0028-01, which states:

> *B.2.d. The Discharger shall demonstrate through a water balance capacity analysis that sufficient effluent storage and disposal capacity is available at the proposed flow limit to ensure compliance with this Order.*
>
> *D.10. Wastewater treatment, storage, and disposal ponds or structures shall have sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, and ancillary inflow and infiltration during the winter while ensuring compliance with all requirements of this Order. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.*

EKI followed accepted recycled water balance analysis methodology as described below.

4.3.3 Recycled Water Balance Methodology

The recycled water balances summarize system inflows (CTF effluent, and precipitation) and system outflows (evaporation, irrigation, and percolation) for a 100-year precipitation condition assuming a set average dry weather flow. Assumptions made in the water balances are consistent with those made in previously-submitted water balances used to support the WDR amendments, and are as follows:

- Inflow and infiltration ("I/I") is assumed to be 8% of the total annual flow. (Although this is consistent with previously-submitted water balances, recent data from the wastewater treatment plant suggests that the actual I/I is likely lower than 8%.)
- Precipitation and evapotranspiration data are based on 1987 to 2013 data from the California Irrigation Management Information System ("CIMIS") station 70 located in Manteca.
- Irrigation demands for agricultural use is assumed to be for fodder crops and are equal to reference evapotranspiration, while irrigation demands for landscaping is assumed to be 20% less than the reference evapotranspiration as there is a combination of high water use turf and lower water use trees and shrubbery.
- An irrigation efficiency of 75% is assumed for the fodder crop (i.e., agricultural irrigation), while an irrigation efficiency of 80% is assumed for landscape irrigation.
- A 10% leaching requirement is assumed in the calculation of the irrigation demand.
- 90% of the pond surface area is assumed to be subject to evaporation.
- An evaporation discount factor of 90% is used in calculation of evaporation from ponds.
- A land use efficiency of 95% is assumed.
- The pond capacities assume a minimum of two feet of freeboard in all ponds at all times.
- Use area acreages account for the required setbacks.
- Percolation rate for PB-1 is assumed to be the design rate of 0.33 MGD. The ratio of total parcel area to disposal rate for PB-1 was used to estimate disposal rate for expanded percolation.
- The area of LI in the Phase 2B Alternative 1 scenario are estimated based on planning documents and RWQCB approved locations (see Appendix D). The same ratio of LI areas to LAAs in the Phase 2B Alternative 1 scenario is assumed in the Buildout Alternative 1 scenario.
- Water balances for Alternatives 2 and 3 in the Buildout planning horizon assume that LI area will be the same as estimated for Alternative 1.

4.3.4 Recycled Water Balance Results

Water balance reports for each scenario are presented in Appendix A. The calculated requirements for land use area and storage volume are summarized in Table 4-2. As discussed below, expanded percolation (Alternative 2) and winter river discharge (Alternative 3) will reduce the storage and LAA requirements compared to the expansion of existing permitted recycled water uses (Alternative 1).

4.3.4.1 Recycled Water Storage Capacity Evaluation

The City's available Phase 1, Phase 2A, and Phase 2B storage facilities are presented in Table 4-3. Table 4-4 compares available storage against storage requirements determined by recycled water balance analyses.

The recycled water balances for Alternative 1, expansion of existing permitted uses, indicate that the City will have approximately 18 MG of surplus storage for Phase 2A. In Phase 2B, the City will need to add 23 MG of storage beyond what is currently planned. The City is projected to need 913 MG of storage at Buildout if existing permitted uses are expanded.

The recycled water balances for Alternative 2, expanded percolation, indicate that Phase 2B storage requirement decreases compared to Alternative 1, but the deficit would increase to 51 MG because the S7 site (or other suitable site) is a percolation basin instead of a storage basin[7]. For Alternative 2 at Buildout, which includes an additional 33-acre percolation basin, the total storage requirement is reduced by approximately 110 MG when compared to Alternative 1.

The recycled water balances for Alternative 3, winter river discharge, indicate that there will be a surplus of 279 MG in Phase 2B and only 125 MG of storage will be required at Buildout. With a winter river discharge permit, the City would be able to convert a significant amount of its existing storage ponds to other land uses.

4.3.4.2 Recycled Water Disposal and Use Capacity Evaluation

The City's available Phase 1, Phase 2A, and Phase 2B disposal and use areas are presented in Table 4-5. Table 4-6 compares these available areas against disposal and use requirements determined by recycled water balance analyses. In these comparisons, the same acreages of LI areas are assumed to be constructed regardless of the alternative and the total amount of LAA is adjusted to meet the disposal requirements.

The recycled water balances for Alternative 1, expansion of existing permitted uses, indicate that the City has a small surplus of disposal capacity through Phase 2A. In Phase 2B, the water balance indicates that a surplus of 101 acres of LAAs is currently planned, thus the use of certain planned LAAs could be delayed until after Phase 2B to support future expansions. The City is projected to require approximately 670 acres of LAAs at Buildout, assuming that LI areas continue to be added at the same ratio to LAAs in Phase 2B.

The recycled water balances indicate that total required LAAs for Alternative 2 are 42, 47, and 106 acres less than those required for Alternative 1 in the Phase 2A, Phase 2B, and Buildout scenarios, respectively. Although Alternative 2 requires a small amount of additional storage be constructed in Phase 2A to replace S7, more acreage is gained in the reduction of required LAAs.

---

[7] A disposal rate of 0.0147 MGD per acre, calculated based on the ratio of PB-1 disposal rate to area, was assumed for potential percolation sites.

Note that percolation is approximately twice as effective at disposal per unit area in comparison to LAA or LI.

The recycled water balances for Alternative 3, winter river discharge, indicate that approximately 177 and 395 fewer acres of LAAs are required in Phase 2B and Buildout, respectively, compared to Alternative 1.

Table 4-2
Summary of Required Recycled Water Storage and Use Areas (a)

		Existing 1 MGD	Phase 2A 1.9 MGD	Phase 2B 2.5 MGD	Buildout 5.6 MGD
Alternative 1 Current Permitted Uses	Required Storage (MG)	170	273	380	913
	Required RW Use Land Area (ac) (b)	220	389	579	1,365
Alternative 2 Expanded Percolation (c)	Required Storage (MG)	--	239	351	803
	Required RW Use Land Area (ac) (b)	--	348	532	1,259
Alternative 3 Winter River Discharge (d)	Required Storage (MG)	--	--	79	125
	Required RW Use Land Area (ac) (b)	--	--	402	970

Notes:

(a) Based on Water Balance analysis included in Appendix A.
(b) Required RW land area includes LAAs, LI areas, and percolation areas. Refer to Table 4-5 for a breakdown of these areas.
(c) Alternative 2 assumes that S7 is used as a percolation basin in Phase 2A, 2B, and Buildout, and an additional 33 acres of percolation is included in Buildout.
(d) Alternative 3 assumes that CTF plant effluent is discharged to the river for four months during the winter (November, December, January, and February).

Table 4-3
Phase 1, Phase 2A, and Phase 2B Storage

Scenario	Pond ID (a)	Catchment Area (acres)	Storage Volume (MG)
Phase 1 (1.0 MGD)	A	4.4	13.7
	B	4.4	10.8
	C	2.8	7.4
	S1	9.3	41.0
	S2	3.9	15.4
	S3	5.0	21.1
	S5	8.9	28.5
	S6	7.5	34.1
	S16 (b)	25.0	101.3
Total (Existing)		**71.1**	**273.3**
Phase 2A (1.9 MGD)	A	4.4	13.7
	B	4.4	10.8
	C	2.8	7.4
	S1	9.3	41.0
	S2	3.9	15.4
	S3	5.0	21.1
	S5	8.9	28.5
	S6	7.5	34.1
	S16 (b)	25.0	101.3
	S28 (c)	4.6	17.3
Total (Existing & Phase 2A)		**75.7**	**290.6**
Phase 2B (2.5 MGD)	A	4.4	13.7
	B	4.4	10.8
	C	2.8	7.4
	S5	8.9	28.5
	S6	7.5	34.0
	S16 (b)	25.0	101.3
	S28 (c)	4.6	17.3
	S7	12.0	57.4
	S-X (North of S5)	7.6	21.3
	S29 (West of S28) (d)	17.60	65.8
Total (Existing, Phase 2A, & Phase 2B)		**94.7**	**357.5**

Notes:
(a) Source (unless otherwise noted): Waste Discharge Requirements, City of Lathrop,
(b) Source: Design Drawings by O'Dell Engineering, August 2017.
(c) Source: Stage 1 Recycled Water Basin and Pump Station Design, PACE August 2017.
(d) Source: Memorandum - CLSP Sewer and Recycled Water Plan Summary, MacKay and Somps November 2017. Catchment Area and Capacity estimated from ratios of existing pond parcel area to catchment area and capacity.

Table 4-4
Projected Citywide Recycled Water Storage Requirement

Storage Component			Phase 1 1 MGD	Phase 2A 1.9 MGD	Phase 2B 2.5 MGD	Buildout 5.6 MGD
Total Available Phase 1, Phase 2A, and Planned Phase 2B Storage Capacity			273.3	290.6	357.5	(c)
Total Available Storage Capacity without Pond S7 (Alternative 2)(b)			273.3	233.2	300.1	
Required Storage Capacity (MG)	Alternative 1 Current Permitted Uses	Required Storage (MG) (a)	170	273	380	913
		Total Projected Storage Capacity Surplus (Deficit)	**103**	**18**	**(23)**	**(c)**
	Alternative 2 Expanded Percolation (b)	Required Storage (MG) (a)	--	239	351	803
		Total Projected Storage Capacity Surplus (Deficit) (b)	--	**52**	**(51)**	**(c)**
	Alternative 3 Winter River Discharge (c)	Required Storage (MG) (a)	--	--	79	125
		Total Projected Storage Capacity Surplus (Deficit)	--	--	**279**	**(c)**

Notes:

(a) Based on Water Balance analysis as included in Appendix A.

(b) Total available Phase 2B storage capacity is 57 MG less for Alternative 2 because it does not include pond S7, which is assumed to be used for percolation. See Table 4-3 for a breakdown of which ponds are included in each scenario.

(c) Buildout storage capacities and deficits are not listed due to uncertainty regarding future storage locations.

Table 4-5
Phase 1, Phase 2A, and Phase 2B Recycled Water Use Areas

Scenario	Type	Site	Irrigated Area (Acres)
Phase 1 (1.0 MGD)	LAA	A23	11.5
	LAA	A28	30.6
	LAA	A30	35.5
	LAA	A31	94.7
	LAA	A35	21.0
	LAA	A35b	14.0
	LAA	A35c	15.0
		Total (Existing)	**222.4**
Phase 2A (1.9 MGD)	LAA	A23	11.5
	LAA	A28	30.6
	LAA	A30	35.5
	LAA	A31	94.7
	LAA	A35	21.0
	LAA	A35b	14.0
	LAA	A35c	15.0
	LAA	A34	65.0
	LAA	A36	25.5
	P	PB-1 (d)	--
	LI	River Islands 1A/1B Landscape	56.0
		Total (Existing and Phase 2A)	**368.9**
Phase 2B (2.5 MGD)	LAA	A28	30.6
	LAA	A30	35.5
	LAA	A31	94.7
	LAA	A35	21.0
	LAA	A35b	14.0
	LAA	A35c	15.0
	LAA	A34	65.0
	PB	PB-1 (a)	--
	LI	River Islands 1A/1B Landscape	56.0
	LAA	CLSP 1	18.0
	LAA	CLSP 2	9.0
	LAA	CLSP 3	13.0
	LAA	CLSP 4	60.0
	LI	Mossdale Landscape	45.3
	LI	CLSP Landscape Phase 1A/1B/1C/1D	61.1
	LI	Additional River Islands 1A/1B Landscape	22.2
	LI	River Islands 2A/2B Landscape	97.3
		Total (Existing, Phase 2A, and Phase 2B)	**657.7**

Notes:
(a) Source: City of Lathrop Land Application Site 3 Recycled Water Percolation Basin Operation and Maintenance Manual, PACE September 2016.

Table 4-6
Projected Recycled Water Use Area Requirements

Recycled Water Use Component			Phase 1 1 MGD	Phase 2A 1.9 MGD	Phase 2B 2.5 MGD	Buildout 5.6 MGD (a)
Available Existing, Phase 2A, and Planned Phase 2B Use Areas (ac) (b)		*Percolation Area*	--	22.4	22.4	--
		Landscape Irrigation Area	--	56.0	281.9	--
		Land Application Area	222.4	312.9	375.8	--
		Total Use Area	**222.4**	**391.3**	**680.1**	**--**
Required Use Area (ac) (d)	Alternative 1 Current Permitted Uses	*Percolation Area (c)*	--	22.4	22.4	22.4
		Landscape Irrigation Area	--	56.0	281.9	673.3
		Land Application Area	220.0	311.0	274.7	669.6
		Total Required Use Area	**220.0**	**389.4**	**579.0**	**1,365.3**
		Total Projected Land Application Area Surplus (Deficit)	**2.4**	**1.9**	**101.1**	**--**
	Alternative 2 Expanded Percolation	*Percolation Area (c)*	--	40.5	40.5	73.8
		Landscape Irrigation Area	--	56.0	281.9	673.3
		Land Application Area	--	251.0	209.4	511.8
		Total Required Use Area	**--**	**347.5**	**531.8**	**1,258.9**
		Total Projected Land Application Area Surplus (Deficit)	--	**61.9**	**166.4**	**--**
	Alternative 3 Winter River Discharge	*Percolation Area (c)*	--	--	22.4	22.4
		Landscape Irrigation Area	--	--	281.9	673.3
		Land Application Area	--	--	97.4	274.0
		Total Required Use Area	**--**	**--**	**401.7**	**969.7**
		Total Projected Land Application Area Surplus (Deficit)	--	**--**	**278.4**	**--**

Notes:

(a) Buildout landscape areas estimated by assuming the same ratio of land application areas to landscape irrigation areas for Phase 2B Alternative 1 and assuming the same acerage of LI areas is carried into Alternative 2 and Alternative 3.

(b) Refer to Table 6-3 for a breakdown of which existing and planned areas are included in each time horizon.

(c) Percolation parcel areas listed are 22.4 acres for PB-1, 40.55 acres for PB-1 and S7, and 73.6 acres for PB-1, S7, and an additional future percolation basin. The disposal rate of these additional percolation basins were calculated based on the ratio of parcel area to percolation rate for PB-1.

(d) Total land use area required was calculated by water balance analysis while holding planned landscape irrigation areas and percolation areas constant to determine required land application area. Refer to Appendix A for individual water balances.

5. SYSTEM PERFORMANCE AND DESIGN CRITERIA

This section summarizes the criteria used to evaluate the City's recycled water distribution system. These criteria are based on *2014 Lathrop Design and Construction Standards* ("Standards"; Lathrop, 2014), the City's previous master plan analyses, and EKI's recommendations. A summary of the recycled water system design criteria is provided in Table 5-1 and described in detail in the following sections. These design criteria have been developed anticipating that the system will transition into an on-demand, high pressure system in Phase 2A to facilitate use at both LAA and LI sites. As discussed in Section 6, this RWSMP only evaluates system performance through Phase 2B (2.5 MGD capacity) due to the uncertainty of future recycled water uses and locations of future ponds and LAAs.

The City intends to update the City Standards to be consistent with the criteria described above.

5.1 Distribution System Performance Criteria

5.1.1 Peak Demand Requirements

The distribution system performance is evaluated for peak demand conditions. Peak demands are summarized for each LAA, LI area, and PB-1 in Table 5-2. The methodology used to develop these peak demands are described below.

5.1.1.1 LAA Peak Demands

LAAs are generally sown with farm fodder crops such as rye grass or alfalfa and flood irrigated. During peak growing seasons, crops are harvested in four- to six-week cycles. During each growing cycle, the LAAs are flood irrigated over a two- to three-week period by cycling through application of recycled water to different LAAs. For planning purposes, we assume that peak monthly demands according to the water balance will be applied continuously over half of the month. Thus, peak demand rate equals twice of the maximum monthly demand or 14.8 gpm/acre. It is conservatively assumed that these demands for each LAA occur simultaneously.

5.1.1.2 LI Peak Demands

Maximum day demands (MDDs) for LI areas are assumed to equal the maximum monthly demands according to the water balance (see Section 4.3). Landscape irrigation with recycled water is assumed to occur between the hours of 10 PM and 6 AM to limit public contact with recycled water. Peak demands are estimated assuming that the MDDs are applied over this 8-hour irrigation period, thus equal three times the MDDs or 16.6 gpm/acre. For River Islands LI areas, the total peak demand is required at the RI-PS.

5.1.1.3 Percolation Basin Peak Demands

As discussed in Section 3.2.4, it is estimated that the PB-1 will have a percolation rate of approximately 0.33 MGD. It is assumed that this flow is applied continuously to PB-1.

Table 5-1
Summary of Recommended Recycled Water System Performance and Operational Criteria

Component	Criteria	Data Sources/Remarks (a)
RECYLED WATER SYSTEM PERFORMANCE		
Demand Factors		
Recycled Water Use Factors	Refer to Table 5-2	EKI Recommendation
Distribution System Pressures		
Maximum Pressure	55 psi system-wide	AWWA Manual M24 Recommendation
Minimum Pressure	45 psi at urban landscape irrigation service connections 5 psi at agricultural irrigation service connections	EKI Recommendation
Demand Condition To Be Met	Peak Conditions: Provide firm pumping capacity at each pump station (one pump offline at each pump station) and firm pump station capacity (one storage pond offline) to meet peak hour demands.	
FACILITIES SIZING		
Pipelines		
Minimum Velocity	1 fps	Nolte 2006 RWMP
Maximum Velocity	7 fps	EKI Recommendation
Maximum Head loss	7 ft per 1,000 ft for pipes < 16 inches in diameter 5 ft per 1,000 ft for pipes ≥ 16 inches in diameter	
Hazen Williams "C" Factor	Existing Pipelines = 130 New Pipelines = 140	
Pipeline Material	All Mains: PVC C900 or C905 Class 150	
Recycled Water System Storage and Disposal Capacity Requirement		
Requirements To Be Met	Provide sufficient storage and disposal capacity to accommodate for 100-year rainfall based on recycled water balance analysis.	Waste Discharge Requirements and Master Recycling Permit Order No. R5-2016-0028

Notes:
(a) Source: Recycled Water System Standards, City of Lathrop Department of Public Works Design and Construction Standards, January 2014, unless noted otherwise.

Table 5-2
Summary of Recycled Water Use Factors

Recycled Water Uses	Monthly Peak Season Demands (ac-inch/ac) (a)	Average Day Maximum Month Demands (gpd/ac) (b)	Peak Demand	
			(gpd/ac)	(gpm/ac)
LAAs (c)	11.8	10,700	21,400	14.8
LI Areas (d)	8.8	8,000	23,900	16.6
Percolation (e)	16.3	14,700	14,700	10.2

Notes:
(a) Monthly peak season demands are derived from the Water Balance Evaluation (See Appendix A).
(b) Average Day Max Month Demands equal the Monthly Peak Season Demands divided by 30 days
(c) LAA peak demands assume that Monthly Peak Season Demands are applied continuously over half the month, thus equalling two times Average Day Maximum Month Demands.
(d) LI area peak demand assumes that Average Day Maximum Month Demands are applied over an 8-hour period, thus equal three times Average Day Maximum Month Demands.
(e) Percolation demands are assumed to be constant and are based on the assumed capacity (0.33 MGD) and the parcel area (22.4 acres) of PB-1.

5.1.2 Distribution System Pressures

The distribution system's ability to maintain adequate system pressures during peak demand conditions is the primary indicator of acceptable system performance. The distribution system must maintain 5 psi at all discharge locations to agricultural LAAs during peak demand conditions. At LI service connections, the distribution system must maintain a pressure of 45 psi. Because LI in the River Islands development area is supplied by an independent non-potable water distribution system, the City's distribution system is only required to provide a positive discharge pressure with peak demands at the RI-PS wet well.

AWWA Manual M24 – *Planning for the Distribution of Reclaimed Water* recommends that the recycled water target operating pressure be approximately 10 psi lower than the potable water system. The City's potable water system currently operates at 55 psi. Due to the lack of looping in the City's recycled water system and the relatively low potable water system pressure, the distribution cannot achieve the pressure requirements listed with a maximum pressure of 45 psi (10 psi less than the water system). Therefore, the maximum system pressure must not exceed the potable water system pressure of 55 psi, and the recycled water PMPs are set to discharge at 55 psi.

5.1.3 Recycled Water Transmission and Distribution Pipeline Sizing Criteria

Pipeline velocity and head loss criteria will be used for sizing new transmission and distribution pipelines. However, when evaluating the existing system, velocity and head loss criteria are secondary to the system pressure criteria. For example, if system pressures are satisfied under peak demand conditions, an existing pipe that exceeds maximum velocity or head loss criteria will not necessarily be indicative of a problem that requires system improvements. Any identified exceedances will be reviewed on a case-by-case basis to determine if they are influencing any deficient system pressures or if improving these pipes to meet velocity or head loss criteria would benefit recycled movement within the system or increase system redundancy.

5.1.3.1 Velocity Criteria

The following velocity criteria under peak demand conditions, in conjunction with head loss criteria described below, are recommended for sizing of new water mains:

- Maximum velocity of 7 feet per second (fps) for all mains
- Minimum velocity of 1 fps for all mains

As discussed above, for existing infrastructure these criteria are secondary to pressure criteria and are evaluated to identify potential bottlenecks in the system that could be upsized to address pressure deficiencies. Minimum velocity criteria are considered to reduce water age and increase water quality.

5.1.3.2 Head Loss Criteria

In addition to velocity criteria, the following head loss criteria under peak demand conditions must also be met for sizing of new recycled water mains:

- Pipes < 16 inches in diameter: Maximum head loss of 7 feet per 1,000 feet of pipe (ft/k-ft)
- Pipes ≥ 16 inches in diameter: Maximum head loss of 3 ft/k-ft

The peak demand head loss criteria distinguish between pipes less than 16 inches and those greater or equal to 16 inches in diameter. The larger pipes generally used transmit water long distances from sources to smaller distribution pipelines which serve customer connections.

For existing pipelines these criteria are used to identify bottlenecks in the system that if upsized could relieve downstream pressure to meet pressure criteria and improve system connectivity.

5.1.4 Booster Pump Stations

In order to meet peak demand conditions, the City must provide firm pumping capacity with one pump offline at each PMP and one pond/PMP offline given that certain ponds may remain empty in dry years. This criterion exists to ensure there is sufficient pumping capacity distributed throughout the system to meet peak demand conditions while planning for low water years which may inhibit equal distribution of recycled water between all ponds.

6. HYDRAULIC ASSESSMENT OF THE DISTRIBUTION SYSTEM

EKI constructed a recycled water system hydraulic model to assess the capacity of City's distribution system in Phase 1, Phase 2A, and Phase 2B assuming the continued expansion of existing permitted recycled water uses. The hydraulic model transforms information about the physical facilities and system into a mathematical model that is used to analyze the recycled water system under peak demand conditions. The hydraulic model then generates information on flow, velocity, head loss, and pressure that can be used to assess system performance and identify system capabilities and deficiencies. The hydraulic model can also be used to verify the adequacy of recommended or proposed system improvements.

The hydraulic assessment did not model the system beyond the 2.5 MGD Phase 2B capacity due to uncertainty surrounding future uses of recycled water, potential disposal and storage locations, and the potential for winter river discharge, which would greatly reduce required storage and LAA disposal infrastructure.

6.1 Hydraulic Modeling Approach

To evaluate collection system performance against hydraulic design criteria, EKI conducted steady-state model simulations of peak demand conditions and evaluated pipeline capacity and pressure requirements at LI service connections and agricultural LAA turnouts for the Phase 1 (1.0 MGD), Phase 2A (1.9 MGD), and Phase 2B (2.5 MGD) CTF expansions. The model assumes continued use of existing permitted uses (Alternative 1; see Section 4), including increased LAA, LI, and storage capacity to meet Phase 2B disposal requirements.

6.2 Hydraulic Model Construction

This section documents the development of the hydraulic model that was used to assess the capacity of the City's recycled water system. The section provides an overview of the modeling platform selection and the model construction process, including descriptions of the modeled network and modeled flows. The hydraulic model was used to evaluate capacity needs within the distribution system under existing and future flow conditions and to complete the hydraulic assessment portion of the RWSMP.

6.2.1 Model Platform

The City selected to use Innovyze InfoWater as the model platform for this RWSMP update. This selection was partially based on the platform's geographical information system (GIS) integration capabilities. To optimize the modeling building and maintenance process, a key objective of the IWRMP modeling effort was to construct hydraulic models that are integrated with the City's infrastructure GIS and allow for automatic synchronization between the model and infrastructure GIS to limit future maintenance efforts. InfoWater is the same modeling platform used for the City's potable water system model.

6.2.2 Model Construction

The City maintains a GIS geodatabase of its infrastructure assets which was used as the basis of information to construct the recycled water system hydraulic model. Prior to constructing the model, EKI updated the City's GIS database to address City identified inconsistencies, added most recent infrastructure improvements, and identified and filled data gaps to make sure the GIS database accurately represented the City's existing utility infrastructure. This effort is documented in Appendix B.

Data gaps remained after the City's geodatabase updates were completed. After importing the City's GIS data into the hydraulic model, the following steps were performed to address data gaps, validate network data, and create a fully connected network:

- The model network was reviewed and refined for connectivity.
- Elevations were assigned to each model node by extracting elevations from publicly available light detection and ranging (LiDAR) data.
- Pump station configurations, head, and flow rate were verified and updated as needed.
- Global parameters including Hazen-Williams C-Factors were applied to pipes.
- Planned transmissions mains, ponds, and PMPs were digitized and added for the Phase 2A and Phase 2B scenarios.
- Modeling scenarios were created with associated active facilities.
- Parcel-level recycled water demand projections were allocated to the nearest node for LI areas.
- Recycled water demands for LAA were assigned to their service connection.

6.2.3 Model Validation

EKI assigned a Hazen-Williams friction factors (C-factors) of 130 to existing pipes and 140 to new pipes. EKI did not calibrate the hydraulic model due to lack of recycled water flow data. However, points of reference for available flow at A30/A31 were provided by City staff and modeled results were within approximately 10% of expected which is acceptable for master planning purposes.

6.3 Hydraulic Evaluation Scenarios

Recycled water infrastructure included in the Phase 1 and Phase 2A scenarios is described in Section 3 and shown on Figure 3-1 through Figure 3-4.

Figure 6-1 shows the locations of planned infrastructure for Phase 2B. Figure 6-2 provides a schematic of the Phase 2B system. As discussed in Section 4.3.4.1, additional storage is needed in Phase 2B beyond what has been identified to date. EKI recommends that a new storage pond and pump station be constructed in the western portion of the City (west of I-5) to meet the storage requirement and improve pumping redundancy and system pressures in this area. For planning purposes, EKI has assumed that storage pond and pump station will be located at S13 and PMP6.

Listed below is a summary of existing and key planned infrastructure included in Phase 1, Phase 2A, and Phase 2B modeling scenarios:

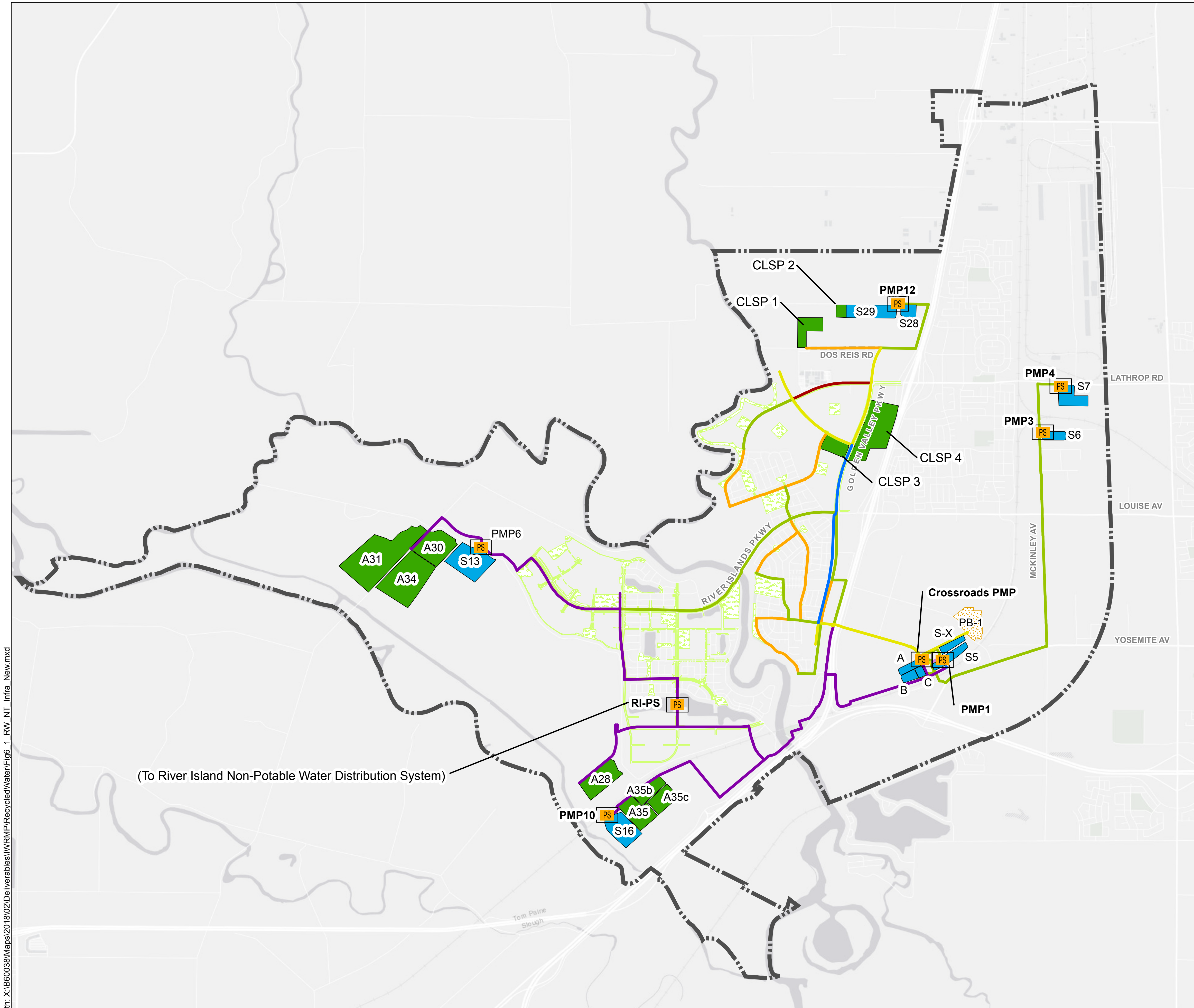
- Phase 1 (1.0 MGD)
  - Ponds: A/B/C, S1, S2, S3, S5, S6, and S16
  - Pumps Stations: PMP-1, PMP-2, PMP-3, PMP-10 (Low Pressure), and Crossroads PMP[8] (not modeled)
  - LAA: A23, A28, A30, A31, A35, A35b, and A35c
- Phase 2A (1.9 MGD)
  - Ponds: A/B/C, S1, S2, S3, S5, S6, S16, and S28
  - Pumps: PMP-1, PMP-2, PMP-3, PMP-10 (High Pressure), Crossroads PMP (not modeled), and PMP-12
  - LAA: A23, A28, A30, A31, A34, A35, A35b, A35c, A36
  - LI: Partial River Islands 1A/1B Landscaping
  - Percolation: PB-1 (not modeled)
- Phase 2B (2.5 MGD)
  - Ponds: A/B/C, S5, S-X (North of S5), S6, S7, S13, S16, S28, and S29
  - Pumps: PMP-1, PMP-3, PMP-4, PMP-6, PMP-10 (High Pressure), PMP-12, and Crossroads PMP (not modeled).
  - LAA: A28, A30, A31, A34, A35, A35b, A35c, A36, and CLSP LAA (NT 1, 2, 3)[9]
  - LI: Full River Islands 1A/1B Landscaping, River Islands 2A/2B Landscaping, Mossdale Landscaping, and CLSP Landscaping
  - Percolation: PB-1 (not modeled)

Pumping characteristics assumed for future pump stations (PMP- 4 and PMP-6) and future pump station upgrades are discussed in Section 6.4.

Table 6-1 summarizes model demands by scenario based on the peak demand requirements described in Section 5.1.1.

[8] Note that the Crossroads PMP currently serves only PB-1 and is not connected to the rest of the distribution system. Therefore, it is not included in model analysis.

[9] Planned LAA NT 4 is not included in Phase 2B so that LAAs to reduce the available LAA surplus (see Section 4.3.4.2).



Legend

Sphere of Influence

Pipe Diameter, Inches

6, 8, 10, 12, 16, 18, 20, 24

Recycled Water Distribution Infrastructure

Storage Pond

Percolation Basin

Land Application Area

Landscape Irrigation Area

Pump Station

Other Infrastructure

Closed Valve

Isolation Plate

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
SOI = Sphere of Influence
RW = Recycled Water
PB = Percolation Basin
S# = Storage Pond
A# = Agricultural Irrigation Use Area

Notes

1. All locations are approximate.
2. The River Islands Pump Station (RI-PS) pumps to the independent Rivier Islands non-potable water system (not shown).

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 3 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 2B Recycled Water Infrastructure

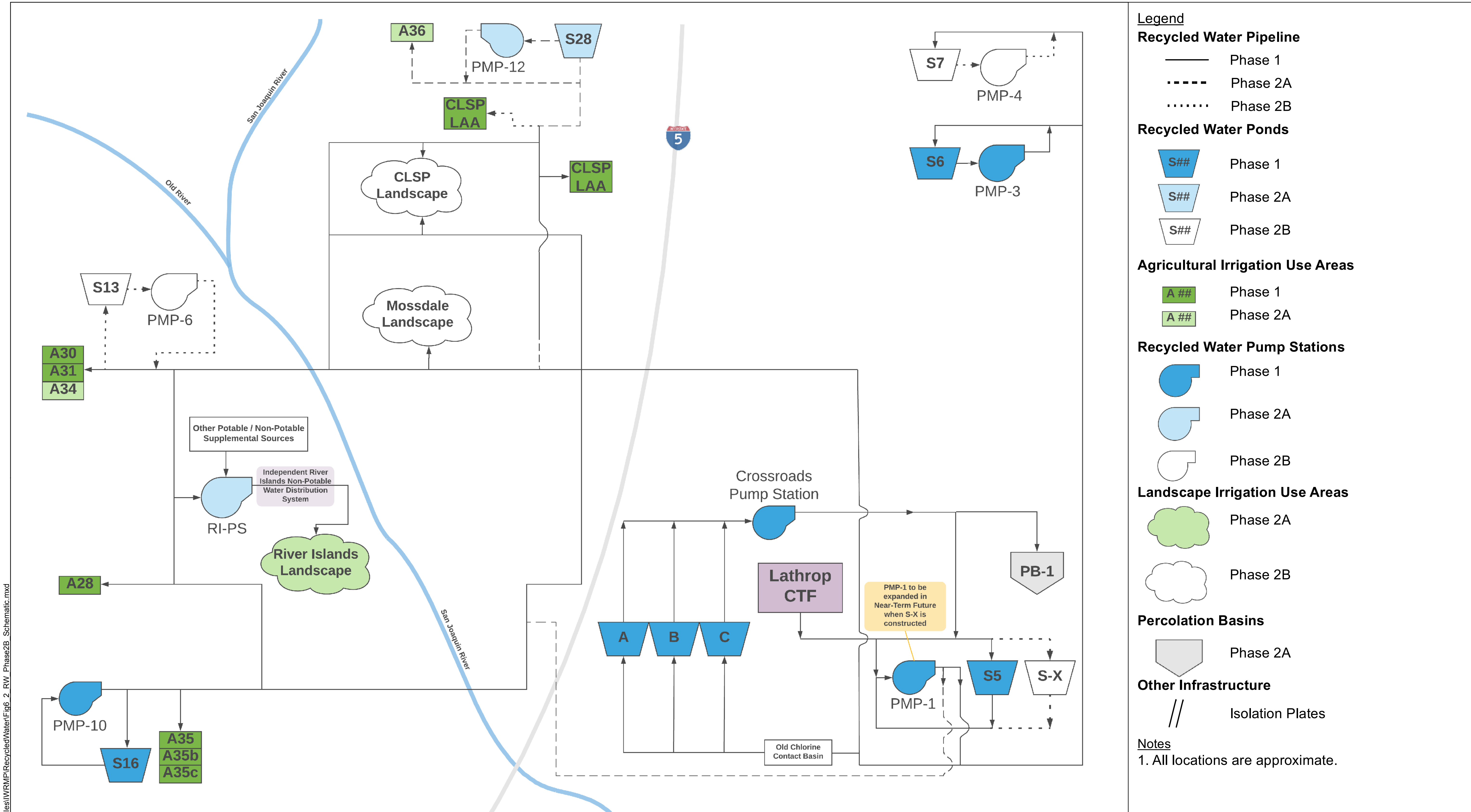
DRAFT

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

eki environment & water

Figure 6-1

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_1_RW_NT_Infra_New.mxd



Phase 2B Recycled Water System Schematic

DRAFT

eki environment & water

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
December 2018
B60038.00

Figure 6-2

Path: X:\B60038\Maps\2018\02\Deliverables\WRMP\RecycledWaterFig6_2_RW_Phase2B_Schematic.mxd

Table 6-1
Phase 1, Phase 2A, and Phase 2B Recycled Water Model Demands

Scenario	Type	Site	Irrigated Area (Acres)	Recycled Water Demands (a) Monthly Peak Season Demands (ac-inch)	Average Day Maximum Month Demands (gpd)	Peak Demand (gpd)	Peak Demand (gpm)
Phase 1 (1.0 MGD)	LAA	A23	11.5	136	123,000	246,000	171
	LAA	A28	30.6	361	327,000	654,000	454
	LAA	A30	35.5	419	379,000	758,000	527
	LAA	A31	94.7	1,117	1,011,000	2,023,000	1,405
	LAA	A35	21.0	248	224,000	449,000	311
	LAA	A35b	14.0	165	150,000	299,000	208
	LAA	A35c	15.0	177	160,000	320,000	222
		Total (Existing)	**222.4**	**2,624**	**2,374,000**	**4,749,000**	**3,298**
Phase 2A (1.9 MGD)	LAA	A23	11.5	136	123,000	246,000	171
	LAA	A28	30.6	361	327,000	654,000	454
	LAA	A30	35.5	419	379,000	758,000	527
	LAA	A31	94.7	1,117	1,011,000	2,023,000	1,405
	LAA	A35	21.0	248	224,000	449,000	311
	LAA	A35b	14.0	165	150,000	299,000	208
	LAA	A35c	15.0	177	160,000	320,000	222
	LAA	A34	65.0	767	694,000	1,388,000	964
	LAA	A36	25.5	301	272,000	545,000	378
	P	PB-1 (b)	22.4	365	330,000	330,000	229
	LI	River Islands 1A/1B Landscape	56.0	493	446,000	1,338,000	929
		Total (Existing and Phase 2A)	**391.3**	**4,550**	**4,116,000**	**8,350,000**	**5,800**
Phase 2B (2.5 MGD)	LAA	A28	30.6	361	327,000	654,000	454
	LAA	A30	35.5	419	379,000	758,000	527
	LAA	A31	94.7	1,117	1,011,000	2,023,000	1,405
	LAA	A35	21.0	248	224,000	449,000	311
	LAA	A35b	14.0	165	150,000	299,000	208
	LAA	A35c	15.0	177	160,000	320,000	222
	LAA	A34	65.0	767	694,000	1,388,000	964
	LAA	CLSP NT 1	18.0	212	192,000	384,000	267
	LAA	CLSP NT 2	9.0	106	96,000	192,000	133
	LAA	CLSP NT 3	13.0	153	139,000	278,000	193
	LAA	CLSP NT 4	(c)	--	--	--	--
	PB	PB-1 (b)	22.4	365	330,000	330,000	229
	LI	River Islands 1A/1B	56.0	493	446,000	1,338,000	929
	LI	Mossdale Landscape	45.3	399	361,000	1,083,000	752
	LI	CLSP Landscape Phase 1A/1B/1C/1D	61.1	538	486,000	1,459,000	1,014
	LI	Additional River Islands 1A/1B Landscape	22.2	195	177,000	530,000	368
	LI	River Islands 2A/2B Landscape	97.3	856	775,000	2,325,000	1,615
Total (Existing, Phase 2A, and Phase 2B)			**620.1**	**6,573**	**5,947,000**	**13,810,000**	**9,592**

Table 6-1 (cont.)
Phase 1, Phase 2A, and Phase 2B Recycled Model Demands

Notes:
(a) Refer to Table 5-2 for a summary of demand factors.
(b) Area listed for PB-1 is the parcel area.
(c) LAA NT 4 is not included in the Phase 2B scenario to adjust the total LAA closer to the required LAA (see Section 4).

6.4 Recycled Water Pumping Capacity Evaluation

The City's required minimum pumping capacity is equal to peak demands (see Table 6-1) with each pump station operating at firm capacity and the largest capacity pump station out of service (i.e., the associated pond is empty). Table 6-2 provides an evaluation of pumping capacity and indicates that the City has a sufficient pumping capacity in Phase 1 and Phase 2A. The City will need additional pumping capacity in Phase 2B to replace PMP-2 and expand pumping capacity to meet the increased peak demands.

EKI has assumed the following future pump stations improvements in Phase 2B to meet the capacity requirements:

- PMP-1: Expansion of PMP Addition of a third 1,450 gpm, 160-foot head pump in conjunction with installation of pond S-X to increase firm capacity to 2,900 gpm.
- PMP-4: Installation of PMP-4 to deliver flows from S7 at a firm capacity of 1,800 gpm at 150-foot of head.
- PMP-6: Installation of PMP-4 to deliver flows from S13 at a firm capacity of 1,800 gpm at 150-foot of head.

In addition, we assume that the existing low-pressure pumps at PMP-10 will be replaced by high pressure pumps (160-foot head) of the same capacity (1,400 gpm) in Phase 2A.

6.5 Recycled Water Distribution System Hydraulic Evaluation

The following sections discuss the hydraulic modeling results for each CTF expansion phase. For each phase, peak demand scenarios were run with (1) all PMPs on to represent system performance in a wet year during which all the ponds were filled and (2) with one PMP offline to represent system performance during a typical year in which not all the ponds are filled. The one-PMP-offline scenarios were used to assess system redundancy and determine a preferred pond filling priority.

Hydraulic modeling results are summarized in Table 6-3. For each scenario, Table 6-3 lists (1) the pressure at each LAA turnout and (2) if the pressure is less than required (5 psi), the percentage of the required demand that can be delivered to meet the 5 psi criteria. For LI areas, Table 6-3 lists the minimum pressure of LI demand nodes in each development area. Supplemental model results are included in Appendix C. Appendix C includes figures for each scenario that show system pressures and pipe velocities.

6.5.1 Phase 1 System Evaluation

Model results for Phase 1 indicate that the distribution system can nearly deliver peak demands with all PMPs online[10]. With either PMP-1 or PMP-2 offline, deliveries are limited to A30/A31 (by 92% and 82% of peak demands, respectively). PMP-3, which conveys flows from pond S6, is unable to provide significant flow to the system, and model results with PMP-3 offline are similar

[10] Pressure requirements are met at all LAAs except for A30/A31, which receives 99% of peak demands at 5 psi.

to those with PMP-3 on line all pumps running. Additionally, PMP-10 with its low-pressure pumps is unable to convey flows from S16 with either PMP1 or PMP2 online, which is evidenced by the fact that the model results are the same whether PMP-10 is on or off.

EKI recommends that planned PMP-10 replacement with high-pressure pumps be completed as soon as possible. Pond S16 represents approximately 40% of system storage in Phase 1, which cannot be reasonably conveyed throughout the system before these high-pressure pumps are installed.

For each scenario, pipe velocities are below the maximum velocity criteria (see Appendix C, Figures C-1 to C-5). Velocities are elevated in the southern river crossing along Manthey Road and in the temporary 12-inch line to LAAs A30/A31, but do not exceed criteria in any scenario.

6.5.2 Phase 2A Pumping Capacity Evaluation

The modeled results for Phase 2A, which assumes that PMP-10 has been replaced with a high-pressure PMP, indicate that the system cannot deliver peak demands to LAAs A30/A31/A34 in all scenarios. As shown in Table 6-3, peak demand deficits range from 10% to 30% at LAAs A30/A31/A34. With PMP10 offline, available deliveries are 6% and 20% less than required at LAA A28 and the RI-PS, respectively. Model results indicate that the Phase 2A system can meet all pipeline capacity criteria in all cases, except for when PMP-10 is offline (see Appendix C, Figures C-6 to C-11). With PMP-10 offline, the southern river crossing along Manthey Road does not meet velocity criteria.

These deficiencies are due to the lack of adequate transmission capacity from the eastern portion of the City across I-5 to the LAAs in River Islands. However, these issues are addressed by connecting to the system the existing pipeline along River Islands Parkway referred to as “Bradshaw’s Crossing” as discussed in Section 3.2.2.

6.5.3 Phase 2B Pumping Capacity Evaluation

As shown in Table 6-3 and Figures C-12 to C-18, model results indicate that the Phase 2B system can meet minimum pressure criteria under peak demand conditions, except for slight pressure deficiencies at the Mossdale and CLSP landscaping areas with either PMP-1 or PMP-10 offline. EKI believes that these deficiencies can be addressed operationally (see Section 6.6). All pipe velocities meet criteria. This indicates that the deficiencies identified in Phase 1 and Phase 2A are resolved with the connection of Bradshaw’s Crossing and installation of pond S13 and the pump station improvements described in Section 6.4.

Table 6-2
Evaluation of Existing Firm Pumping Capacity

Pumping Component (a)		Firm Pumping Capacity (gpm)		
		Phase 1 1 MGD	Phase 2A 1.9 MGD	Phase 2B 2.5 MGD
Available Pumping Capacity	PMP-1	1,450	1,450	1,450
	PMP-2	1,800	1,800	--
	PMP-3	1,800	1,800	1,800
	PMP-10	1,400	1,400	1,400
	PMP-12	1,600	1,600	1,600
	Firm Pumping Capacity (b)	8,050	8,050	6,250
	Firm Pond Pumping Capacity (c)	6,250	6,250	4,450
Required Pumping Capacity	Peak Demands	3,288	5,787	9,589
	Pumping Capacity Surplus (Deficit)	2,962	463	(5,139)

Notes:

(a) The crossroads pump station is not considered in this analysis because it is not connected to the distribution system and can only serve PB-1 or transfer back to pond S5.
(b) Firm pumping capacity reflects the capacity of each pumping station with the largest pump offline.
(c) Firm pond pumping capacity reflects the firm pumping capacity with the largest pump station offline.

Table 6-3
Peak Demand Pressures and Available Flow (a)

Scenario	Site	Total Required Demands (gpm)	Required Pressure	Available Pressure at Peak Hour Demand (psi) (b)(c)								Percent of Required Flow Available at Required Pressure (gpm) (d)							
				All Pumps On	PMP 1 Off	PMP 2 Off	PMP3 Off	PMP10 Off	PMP12 Off	PMP4 Off	PMP6 Off	All Pumps On	PMP 1 Off	PMP 2 Off	PMP3 Off	PMP10 Off	PMP12 Off	PMP4 Off	PMP6 Off
Phase 1 (1.0 MGD)	A23	171	5 PSI	58	50	38	57	58	N/A	N/A	N/A	--	--	--	--	--	N/A	N/A	N/A
	A28	453		33	25	14	33	33				--	--	--	--	--			
	A30	1,925		4	< 0	< 0	4	4				99%	92%	82%	99%	99%			
	A31																		
	A35	739		39	32	20	39	39				--	--	--	--	--			
	A35b											--	--	--	--	--			
	A35c											--	--	--	--	--			
Phase 2A (1.9 MGD)	A23	171	5 PSI	56	56	56	56	56	56	N/A	N/A	--	--	--	--	--	--	N/A	N/A
	A28	453		28	28	27	28	4	28			--	--	--	--	94%	94%		
	A30	2,886		< 0	< 0	< 0	< 0	< 0	< 0			90%	90%	90%	90%	70%	90%		
	A31																		
	A34																		
	A35	739		52	52	52	52	22	52			--	--	--	--	--	--		
	A35b																		
	A35c																		
	A36	377		55	55	55	55	55	55			--	--	--	--	--	--		
	River Islands Pump Station	932		25	25	25	25	2	25			--	--	--	--	80%	--		

Table 6-3 (cont.)
Peak Demand Pressures and Available Flow (a)

Scenario	Site	Total Required Demands (gpm)	Pressure Required	Available Pressure at Peak Hour Demand (psi) (b)(c)								Percent of Required Flow Available at Required Pressure (gpm) (d)							
				All Pumps On	PMP 1 Off	PMP 2 Off	PMP3 Off	PMP10 Off	PMP12 Off	PMP4 Off	PMP6 Off	All Pumps On	PMP 1 Off	PMP 2 Off	PMP3 Off	PMP10 Off	PMP12 Off	PMP4 Off	PMP6 Off
Phase 2B (2.5 MGD)	A28	453	5 PSI	43	35	N/A	43	32	42	43	30	--	--	--	--	--	--	--	--
	A30	1,925		44	36		44	35	43	44	21								
	A31																		
	A34																		
	A35	739		53	51		53	37	53	53	52								
	A35b																		
	A35c																		
	CLSP NT 1	266		46	36		46	41	44	46	43								
	CLSP NT 2	133		55	55		55	55	51	55	55								
	CLSP NT 3	192		52	42		52	47	50	52	49								
	CLSP NT 4	--		52	42		52	47	50	52	49								
	River Islands Pump Station	2,920		43	35		43	32	42	43	28								
	Mossdale Landscape (e)	754	45 PSI	51	41		50	44.6	49	50	46								
	CLSP Landscape (e)	1,016		52	42		52	47	50	52	49								

Notes:

(a) Land application areas with common discharge locations are grouped.
(b) Shaded cells indicate that the required flow cannot be provided at the required pressure.
(c) Pressure in psi calculated by applying all peak hour demands on the system with pump discharge pressure set to 55 psi for VFDs.
(d) Available flow in gpm at 5 psi determined by limiting peak hour flow where peak hour pressures did not meet pressure criteria.
(e) Table lists minimum pressure at landscaping nodes in the Mossdale or CLSP development areas.

6.6 Recycled Water Operational Priorities

The City developing an operational strategy and SCADA controls to deliver recycled water on-demand. It will be important for the City to properly prioritize the filling of storage ponds such that peak demands can still be delivered during years in which not all the storage ponds are used.[11]

Based on the model results (see Table 6-3), it is critical that PMP-1, which conveys flows either directly from the CTF effluent line, pond S5, or indirectly from Ponds A/B/C (through the Crossroads PMP), be online to provide required system pressures. Once PMP-10 is upgraded with high-pressure pumps, operation of PMP-10 is also critical. Therefore, the City should prioritize filling S5/A/B/C and S16 going forward so that recycled water is available to be pumped from PMP-1 and PMP-10 to meet peak demands during either a dry or wet year.

System operations do not suffer with PMP3 and PMP4 offline due to their significant distance from use locations. Therefore, ponds S6 and S7 should be the lowest priority ponds to fill.

[11] During an average rainfall year, for example, the water balance analyses indicate that approximately 85% of available storage is utilized.

7. CONCLUSIONS AND RECOMMENDATIONS

The hydraulic assessment of the distribution system indicates that the distribution system pipelines are adequately sized to meet performance criteria through Phase 2B.

EKI has identified the following improvements that should be implemented during the Phase 2A expansion, in addition to those currently under construction:

- Conversion of the low-pressure PMP-10 to a high-pressure pump station should be completed as soon as possible to be able to effectively convey recycled water from S16. This improvement is anticipated to be funded by developers.
- Installation of flow meters and automatic control valves with radio telemetry at each LAA turnout location to facilitate automated delivery of recycled water to the LAAs. Costs for these improvements were estimated to be $480,000, not inclusive of estimated contingencies (PACE, 2018).
- Establish SCADA controls on pump and storage ponds to automate system operations. Costs have not been estimated for these operational improvements.

For expansion of permitted recycled water uses in Phase 2B, EKI recommends the following improvements, in addition to those already planned:

- Increase the capacity of PMP-1 in conjunction with the installation of Pond S-X (located directly north of S5). This improvement is anticipated to be funded by developers.
- Install a new pond and pump station in the western portion of the City, potentially at locations S13 and PMP6, to meet storage requirements and to meet system pressure criteria in Phase 2B. This improvement is anticipated to be funded by developers.

EKI evaluated alternative uses of recycled water in Phase 2B and beyond, including increased percolation and winter river discharge. These alternatives have the potential to provide increased water supply benefits and reduce the areas required for recycled water storage and disposal. EKI recommends that the City initiate a percolation study to assess locations in the City which have suitable soils for a percolation. EKI also recommends that the City initiate discussion with the RWQCB to better assess the potential for a winter river discharge permit.

8. REFERENCES

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APPENDIX A
WATER BALANCE CALCULATIONS

TABLE A-1 - Water Balance for Alternative 1 - Ponds and Sprayfields - Existing 1.0 MGD

Date: 12/14/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		1	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		1.08	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***6,257***	ac-in
		170.35	MG
Application Field Input and Assumptions			
Total Application Area		***220.48***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	100.00%	0.00%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	220	0.0	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	Y	1,510	9.3	41.0
S2	Y	567	3.9	15.4
S3	Y	777	5.0	21.1
S5	Y	1,031	8.9	28.0
S6	Y	1,252	7.5	34.0
Phase 2 - 1.9 MGD	N	0	0.0	0
Near-Term - 2.5 MGD	N	0	0.0	0
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	N	--	0	--
Total		***6,312***	***46***	***171***
Total % of Area for Evap Calc		90%	***41***	
Evaporation Discount Factor		90%		

100-year Irrigation Requirement

Precipitation/Evaporation Data					Application Area			Storage and Percolation Ponds							Excess Flow
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	1,394	236	34	0	0	1,597	4,171	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	1,246	201	65	0	0	1,383	5,554	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	1,282	131	126	0	638	650	6,204	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	1,180	71	188	0	1,398	-336	5,868	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	1,210	64	241	0	1,856	-824	5,044	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	1,117	11	282	0	2,316	-1,470	3,574	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	1,144	2	299	0	2,464	-1,617	1,957	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	1,146	4	265	0	2,184	-1,300	657	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	1,119	13	194	0	1,594	-657	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	1,199	54	124	0	930	199	199	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	1,210	99	60	0	233	1,016	1,215	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	1,270	120	32	0	0	1,358	2,574	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	14,517	1,006	1,910	0	13,613	0	37,017	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	1,210	84	159	0	1,134	0	3,085	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	40	3	5	0	37	0	101	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-2 - Water Balance for Alternative 1 - Ponds and Sprayfields - Phase 2 CTF Expansion 1.9 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		1.9	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		2.05	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***10,265***	ac-in
		279	MG
Application Field Input and Assumptions			
Total Application Area		***366***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	84.82%	15.18%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	311	***56***	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	Y	1,510	9.3	41.0
S2	Y	567	3.9	15.4
S3	Y	777	5.0	21.1
S5	Y	1,031	8.9	28.0
S6	Y	1,252	7.5	34.0
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	N	0	0.0	0
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	8	--
Total		***10,668***	***72***	***290***
Total % of Area for Evap Calc		90%	***65***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	11.6

100-year Irrigation Requirement															
Precipitation/Evaporation Data					**Application Area**			**Storage and Percolation Ponds**							**Excess Flow**
Month	Days	Precip in.	Eff. Precip. in.	ET_o in.	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
					LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	2,649	369	52	377	0	2,589	6,706	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	2,368	314	101	340	0	2,241	8,948	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	2,436	205	197	377	1,001	1,066	10,014	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	2,242	110	293	365	2,231	-537	9,477	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	2,298	99	375	377	2,965	-1,319	8,158	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	2,122	17	439	365	3,707	-2,372	5,786	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	2,174	4	467	377	3,943	-2,609	3,177	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	2,177	6	414	377	3,496	-2,104	1,073	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	2,125	20	302	365	2,552	-1,073	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	2,279	84	194	377	1,484	308	308	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	2,299	154	93	365	360	1,635	1,944	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	2,413	188	50	377	0	2,174	4,118	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	27,582	1,568	2,977	4,436	21,738	0	59,707	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	2,299	131	248	370	1,812	0	4,976	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	76	4	8	12	60	0	164	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-3 - Water Balance for Alternative 2 - Precolation - Phase 2 CTF Expansion 1.9 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		1.9	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		2.05	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***8,767***	ac-in
		239	MG
Application Field Input and Assumptions			
Total Application Area		***307***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	81.75%	18.25%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	251	***56***	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	Y	1,510	9.3	41.0
S2	Y	567	3.9	15.4
S3	Y	777	5.0	21.1
S5	Y	1,031	8.9	28.0
S6	Y	1,252	7.5	34.0
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	N	0	0.0	0
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	14	--
Total		***10,668***	***78***	***290***
Total % of Area for Evap Calc		90%	***70***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
S7 PERC	0.267	306.6	5.9	8.3
Total	0.60	733.62	14.00	20

	Parcel Acre
PB-1	22.4
S7 PERC	18.15

100-year Irrigation Requirement															
Precipitation/Evaporation Data					**Application Area**			**Storage and Percolation Ponds**							**Excess Flow**
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	2,649	399	57	682	0	2,309	5,845	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	2,368	340	109	616	0	1,983	7,828	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	2,436	221	213	682	828	935	8,763	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	2,242	119	317	660	1,850	-466	8,297	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	2,298	107	406	682	2,459	-1,141	7,155	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	2,122	19	475	660	3,076	-2,070	5,085	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	2,174	4	505	682	3,272	-2,281	2,804	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	2,177	6	447	682	2,901	-1,847	957	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	2,125	22	327	660	2,117	-957	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	2,279	91	210	682	1,231	247	247	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	2,299	166	101	660	297	1,408	1,656	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	2,413	203	54	682	0	1,880	3,536	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	27,582	1,696	3,219	8,030	18,029	0	52,173	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	2,299	141	268	669	1,502	0	4,348	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	76	5	9	22	49	0	143	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-4 - Water Balance for Alternative 1 - Ponds and Sprayfields - Near-Term 2.5 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		2.5	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		2.70	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***13,953***	ac-in
		380	MG
Application Field Input and Assumptions			
Total Application Area		***557***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	49.35%	50.65%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	274.7	***282***	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	Y	1,256	7.5	34.1
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	Y	7,349	52.9	200
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	8	--
Total		***15,185***	***107***	***412***
Total % of Area for Evap Calc		90%	***96***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
Total	0.33	427	8.15	12

100-year Irrigation Requirement															
Precipitation/Evaporation Data					**Application Area**			**Storage and Percolation Ponds**							**Excess Flow**
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	3,486	547	78	377	0	3,578	9,311	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	3,116	466	149	340	0	3,092	12,403	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	3,205	304	292	377	1,310	1,531	13,934	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	2,950	163	435	365	3,047	-734	13,200	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	3,024	147	557	377	4,062	-1,825	11,376	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	2,792	26	651	365	5,107	-3,305	8,071	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	2,860	5	692	377	5,432	-3,635	4,435	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	2,864	9	614	377	4,816	-2,934	1,501	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	2,796	30	448	365	3,515	-1,501	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	2,998	125	287	377	2,028	431	431	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	3,026	228	138	365	451	2,300	2,731	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	3,175	278	74	377	0	3,003	5,733	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	36,293	2,326	4,414	4,436	29,768	0	83,126	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	3,024	194	368	370	2,481	0	6,927	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	99	6	12	12	82	0	228	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-5 - Water Balance for Alternative 2 - Percolation - Near-Term 2.5 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		2.5	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		2.70	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***12,877***	ac-in
		351	MG
Application Field Input and Assumptions			
Total Application Area		***491***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	42.63%	57.37%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	209.4	***281.9***	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	Y	1,256	7.5	34.1
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	Y	5,324	69.3	145
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	14	--
Total		***13,159***	***129***	***357***
Total % of Area for Evap Calc		90%	***116***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
S7 PERC	0.267	302.8	5.9	8.2
Total	0.60	730	14.00	20

	Parcel Acre
PB-1	22.4
S7 PERC	18.15

100-year Irrigation Requirement															
Precipitation/Evaporation Data					**Application Area**			**Storage and Percolation Ponds**							**Excess Flow**
Month	Days	Precip in.	Eff. Precip. in.	ET_o in.	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
					LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	3,486	661	94	682	0	3,370	8,569	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	3,116	563	180	616	0	2,882	11,452	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	3,205	367	353	682	1,121	1,417	12,868	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	2,950	197	526	660	2,633	-672	12,196	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	3,024	178	673	682	3,513	-1,666	10,531	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	2,792	31	786	660	4,421	-3,045	7,485	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	2,860	6	836	682	4,703	-3,355	4,131	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	2,864	10	742	682	4,169	-2,719	1,412	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	2,796	36	541	660	3,043	-1,412	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	2,998	151	347	682	1,753	367	367	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	3,026	276	167	660	382	2,092	2,459	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	3,175	336	90	682	0	2,740	5,199	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	36,293	2,811	5,335	8,030	25,739	0	76,668	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	3,024	234	445	669	2,145	0	6,389	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	99	8	15	22	71	0	210	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-6 - Water Balance for Alternative 3 - Winter Discharge - Near-Term 2.5 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		2.5	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		2.70	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***2,909***	ac-in
		79	MG
Application Field Input and Assumptions			
Total Application Area		***379***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	Fodder Crop	Turf	Trees
% of Total App. Area	25.67%	74.33%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	97.4	***282***	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	N	0	0.0	0.0
C	N	0	0.0	0.0
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	Y	1,256	7.5	34.1
Phase 2 - 1.9 MGD	N	0	0.0	0
Near-Term - 2.5 MGD	N	0	0.0	0
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	8	--
Total		***2,810***	***29***	***76***
Total % of Area for Evap Calc		90%	***26***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
Total	0.33	427	8.15	12

Note: Zero net storage point modified to September.

100-year Irrigation Requirement

Precipitation/Evaporation Data					Application Area			Storage and Percolation Ponds							Excess Flow
Month	Days	Precip in.	Eff. Precip. in.	ET_o in.	Demand, in/ac: Rye Grass	Turf	Trees & Shrubs	Inflow, ac-in: WW	Precip.	Outflow, ac-in: Evap.	Percolation	Total Irrigation	Volume, ac-in: Change	Net	Volume, ac-in
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	0	148	21	300	0	-173	199	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	0	126	40	0	0	86	285	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	3,205	82	79	377	797	2,035	2,319	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	2,950	44	118	365	1,923	589	2,909	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	3,024	40	151	377	2,569	-33	2,876	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	2,792	7	176	365	3,244	-987	1,889	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	2,860	1	188	377	3,450	-1,153	736	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	2,864	2	166	377	3,059	-736	***0***	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	2,796	8	121	365	2,233	86	86	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	2,998	34	78	377	1,280	1,297	1,297	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	0	62	37	365	264	-604	693	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	0	75	20	377	0	-321	372	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	23,490	631	1,197	4,019	18,819	86	13,661	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	1,957	53	100	335	1,568	7	1,138	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	64	2	3	11	52	0	37	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-7 - Water Balance for Alternative 1 - Ponds and Sprayfields - Buildout 5.61 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		5.61	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		6.06	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***33,542***	ac-in
		913	MG
Application Field Input and Assumptions			
Total Application Area		***1,343***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	49.86%	50.14%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	669.6	673.3	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	Y	1,256	7.5	34.1
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	Y	5,324	35.1	145
Build Out - 5.6 MGD	Y	21,249	170.0	577
Percolation	Y	--	8	--
Total		***34,408***	***259***	***934***
Total % of Area for Evap Calc		90%	***233***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
Total	0.33	427	8.15	12

100-year Irrigation Requirement

Precipitation/Evaporation Data					Application Area			Storage and Percolation Ponds							Excess Flow
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	7,822	1,327	189	377	0	8,584	22,435	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	6,992	1,131	363	340	0	7,420	29,855	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	7,192	737	708	377	3,167	3,677	33,533	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	6,621	396	1,056	365	7,364	-1,768	31,764	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	6,786	357	1,352	377	9,816	-4,402	27,363	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	6,264	62	1,580	365	12,340	-7,958	19,405	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	6,418	13	1,681	377	13,125	-8,751	10,653	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	6,427	21	1,490	377	11,636	-7,055	3,598	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	6,275	72	1,088	365	8,494	-3,598	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	6,728	303	698	377	4,901	1,055	1,055	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	6,789	554	335	365	1,091	5,552	6,607	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	7,126	675	180	377	0	7,244	13,851	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	81,441	5,648	10,719	4,436	71,934	0	200,120	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	6,787	471	893	370	5,994	0	16,677	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	223	15	29	12	197	0	548	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-8 - Water Balance for Alternative 2 - Ponds and Sprayfields - Buildout 5.61 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		5.61	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		6.06	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***29,553***	ac-in
		805	MG
Application Field Input and Assumptions			
Total Application Area		***1,185***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	43.19%	56.81%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	511.8	673.3	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	Y	505	4.4	13.7
B	Y	398	4.4	10.8
C	Y	273	2.8	7.4
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	Y	1,256	7.5	34.1
Phase 2 - 1.9 MGD	Y	4,355	17.6	118
Near-Term - 2.5 MGD	Y	3,210	23.4	87
Build Out - 5.6 MGD	Y	17,493	136.7	475
Percolation	Y	--	30	--
Total		***28,538***	***236***	***775***
Total % of Area for Evap Calc		90%	***212***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
S7 PERC	0.267	302.8	5.9	8.2
S11 PERC	0.491	864.8	16.5	23.5
Total	1.09	1594.61	30.50	43.41

	Parcel Acre
PB-1	22.4
S7 PERC	18.15
S11 PERC	33.3

100-year Irrigation Requirement															
Precipitation/Evaporation Data					Application Area			Storage and Percolation Ponds							Excess Flow
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	7,822	1,211	172	1,242	0	7,619	19,706	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	6,992	1,032	331	1,122	0	6,571	26,278	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	7,192	673	646	1,242	2,711	3,266	29,544	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	6,621	361	964	1,202	6,363	-1,547	27,997	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	6,786	326	1,233	1,242	8,487	-3,851	24,145	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	6,264	57	1,442	1,202	10,682	-7,004	17,141	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	6,418	12	1,533	1,242	11,362	-7,707	9,434	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	6,427	19	1,359	1,242	10,072	-6,229	3,205	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	6,275	66	992	1,202	7,352	-3,205	***0***	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	6,728	276	637	1,242	4,235	890	890	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	6,789	505	306	1,202	925	4,862	5,752	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	7,126	616	164	1,242	0	6,335	12,087	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	81,441	5,153	9,780	14,624	62,189	0	176,180	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	6,787	429	815	1,219	5,182	0	14,682	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	223	14	27	40	170	0	483	***0***
Peak Season Daily					0.4	0.3	0.2								

TABLE A-9 - Water Balance for Alternative 3 - Winter Discharge - Buildout 5.6 MGD

Date: 3/2/2018

General Inputs and Assumptions			Units
Average Dry Weather Wastewater Flow		5.61	MGD
Assumed I&I		8%	
Total Flow with both ADWF and I/I		6.06	MGD
Average/100-year Scenario		100-year	
Effective Rainfall Discount		0%	
Minimum Pond Storage Required		***7,360***	ac-in
		125	MG
Application Field Input and Assumptions			
Total Application Area		***948***	Acres
Weighted Land Use Efficiency		95%	
Vegetation Types	LAA	LI	Trees
% of Total App. Area	28.95%	71.05%	0.00%
Leaching Requirement	10.0%	10.0%	10.0%
Irrigation Efficiency	75%	80%	80%
App. Area (ac)	274	673.3	0

Storage Basin Input and Assumptions				
Basin ID	Included in Analysis?	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
A	N	0	0.0	0.0
B	N	0	0.0	0.0
C	N	0	0.0	0.0
S1	N	0	0.0	0.0
S2	N	0	0.0	0.0
S3	N	0	0.0	0.0
S5	Y	1,050	8.9	28.5
S6	N	0	0.0	0.0
Phase 2 - 1.9 MGD	Y	3,719	13.0	101
Near-Term - 2.5 MGD	N	0	0.0	0
Build Out - 5.6 MGD	N	0	0.0	0
Percolation	Y	--	8	--
Total		***4,769***	***30***	***130***
Total % of Area for Evap Calc		90%	***27***	
Evaporation Discount Factor		90%		

Percolation Pond Assumptions				
Basin ID	Flow Capacity (MGD)	Max Storage (ac-in)	Catchment Area (Ac)	Max Storage MG
PB-1	0.33	427	8.15	12
Total	0.33	427	8.15	12

Note: Zero net storage point modified to September.

100-year Irrigation Requirement															
Precipitation/Evaporation Data					Application Area			Storage and Percolation Ponds							Excess Flow
Month	Days	Precip	Eff. Precip.	ET_o	Demand, in/ac			Inflow, ac-in		Outflow, ac-in			Volume, ac-in		Volume, ac-in
		in.	in.	in.	LAA	LI	Trees & Shrubs	WW	Precip.	Evap.	Percolation	Total Irrigation	Change	Net	
Jan	31	5.13	3.02	0.90	0.0	0.0	0.0	0	154	22	377	0	-245	1,494	0.0
Feb	28	4.37	2.42	1.73	0.0	0.0	0.0	0	131	42	340	0	-251	1,243	0.0
Mar	31	2.85	1.30	3.38	3.0	1.9	1.0	7,192	86	82	377	2,024	4,795	6,038	0.0
Apr	30	1.53	0.49	5.04	6.7	4.9	3.5	6,621	46	123	365	4,857	1,322	7,360	0.0
May	31	1.38	0.41	6.45	8.9	6.5	4.8	6,786	41	157	377	6,489	-195	7,165	0.0
Jun	30	0.24	0.00	7.54	11.1	8.3	6.2	6,264	7	184	365	8,187	-2,464	4,702	0.0
Jul	31	0.05	0.00	8.02	11.8	8.8	6.6	6,418	2	195	377	8,708	-2,860	1,841	0.0
Aug	31	0.08	0.00	7.11	10.4	7.8	5.9	6,427	2	173	377	7,720	-1,841	***0***	0.0
Sep	30	0.28	0.00	5.19	7.6	5.7	4.3	6,275	8	126	365	5,635	157	157	0.0
Oct	31	1.17	0.30	3.33	4.4	3.2	2.3	6,728	35	81	377	3,234	3,072	3,072	0.0
Nov	30	2.14	0.84	1.60	1.1	0.6	0.2	0	64	39	365	674	-1,013	2,058	0.0
Dec	31	2.61	1.14	0.86	0.0	0.0	0.0	0	78	21	377	0	-319	1,739	0.0
Annual Total	365	21.8	9.9	51.2	65.0	47.8	34.7	52,711	656	1,245	4,436	47,529	157	36,870	***0***
Monthly Average	30	1.8		4.3	5.4	4.0	2.9	4,393	55	104	370	3,961	13	3,073	***0***
Daily Average	1	0.1		0.1	0.18	0.13	0.10	144	2	3	12	130	0	101	***0***
Peak Season Daily					0.4	0.3	0.2								

APPENDIX B
RECYCLED WATER INFRASTRUCTURE GEODATABASE UPDATES

B. RECYCLED WATER INFRASTRUCTURE GEODATABASE UPDATES

The recycled water infrastructure GIS updates described herein supported EKI's use of the City's GIS database to build a hydraulic model of the City's water system.

B.1 Background

The City provided EKI their existing GIS database on 16 June 2016 in a geodatabase file format. The geodatabase contains utility information, administrative boundaries, zoning, parcel data, City facilities, and other geographic information relevant to City.

The last comprehensive update to the geodatabase was performed by Stantec Inc. (Stantec) in March 2012. As part of that update, Stantec prepared "map books" for each of the City's utilities (i.e., potable water, wastewater, recycled water, and stormwater). EKI understands that the City has only minimally edited the geodatabase since 2012. City staff prepared a list of review comments and map book markups in March 2012, but the majority of these comments were not addressed in the geodatabase received by EKI. Additionally, utility projects completed since 2012 had not been incorporated into the geodatabase.

Prior to updating the geodatabase, EKI identified and organized the feature files relevant to the water, wastewater, and recycled water systems, as well as data files containing administrative boundaries, San Joaquin County parcel data, zoning districts, and other relevant planning data. In cases where there were multiple feature files for the same type of infrastructure element, EKI used and updated only the files consistent with those shown on the map books prepared by Stantec in 2012.

B.2 Infrastructure Updates

EKI used the updated City's geodatabase to build hydraulic models for the City's potable water, wastewater, and recycled water systems. Therefore, updates to the infrastructure GIS data were needed to accurately represent the City's existing utility infrastructure in the models. EKI updated the GIS infrastructure information in four steps:

1. EKI addressed the City's 2012 map book review comments;
2. EKI added infrastructure improvements completed since the previous GIS update;
3. EKI compared the GIS information against other available sources such as the City's existing hydraulic models and available record drawings to identify discrepancies and attempted to reconcile these discrepancies; and
4. EKI identified and attempted to fill relevant gaps in the existing infrastructure data.

When editing the City's infrastructure GIS, EKI followed the existing database structures and conventions, including adding IDs to each new feature using the established unique ID implementation methodology[1]. For each updated element, EKI recorded the editor and edit date in the attribute fields "Last Editor" and "Last Update", respectively. EKI also recorded the record drawing or other data source used as the basis for each update in either the data field "Sources" or the data field "EKI_Comments".

EKI added two new data fields to the attribute tables: "Status" and "EKI_Comments". Information added to "Status" included information about whether an infrastructure element was existing and active, planned for future construction, abandoned, or built for future use. EKI recorded assumptions and comments regarding the updates in the "EKI_Comments" field.

EKI relied primarily on record drawings provided by the City as sources for the updates. EKI georeferenced each record drawing plan and added the plans to GIS to accurately add new features and directly compare the existing features in the geodatabase against the record drawings. Where record drawings were not available, EKI relied on design drawings, sewer flushing records, or the City staff's knowledge of the systems to confirm updates. EKI arranged two meetings with the City Public Works staff to address questions regarding the City's 2012 review comments and to validate data sources (i.e., on 18 August 2016 and 3 October 2016).

Each of the steps that EKI took to update the infrastructure geodatabase features are discussed in more detail below. A summary of the water system update is listed in Table B-1.

B.2.1 City's 2012 Map Book Review Comments

As discussed above, EKI first updated the City's infrastructure GIS to address the City's 2012 map book review comments. The comments were provided in separate tables for each system and on scanned markups of the map books. EKI addressed comments by assigning the infrastructure status (i.e., existing and active, future planned, future built, and abandoned) and ownership (i.e., City owned, or private), adding missing pipeline segments, updating diameters of existing pipes, adding manholes, and correcting misaligned pipes.

The City's original 2012 comments, a description of EKI's edits, and the sources used to confirm the edits are summarized in Table B-1. As mentioned above, EKI only addressed comments that were relevant to the planned hydraulic modeling effort.

B.2.2 Recent Infrastructure Improvements

EKI added infrastructure improvements and changes completed since the March 2012 GIS update to the geodatabase. A number of new water system projects were completed since the last GIS update, as listed in Table B-1.

New water infrastructure projects were added to the geodatabase using the georeferenced record drawings (or design drawings when record drawings were not available). EKI only added

[1] "Final Unique ID Implementation" provided by City staff on 24 June 2016.

new elements that were essential for hydraulic modeling, such as mainline pipes, hydrants, and control valves. EKI did not add features such as service laterals or line valves.

Recent improvements constructed in River Islands (Phases 1A, 1B, and 2A) were also incorporated into the GIS database.

B.2.3 Comparison Against Other Available Data Source

In the processes of addressing the City's map book comments and incorporating recent infrastructure improvements, EKI identified discrepancies between certain water features in the geodatabase and the georeferenced record drawings. EKI updated these features, as listed in Table B-1, for consistency with the record drawings.

To update the City's recycled water system GIS, EKI compared the features in the City's geodatabase with shapefiles prepared by RMC Water and Environment (RMC), dated 22 July 2015, which were prepared as part of the 2014 Recycled Water Master Plan Amendment. EKI confirmed that the existing infrastructure in the City's geodatabase was consistent with the RMC shapefiles. However, EKI identified a number of differences in the planned future pipes, pump stations, storage ponds, spray fields and landscaping locations. Instead of making individual changes to the City's geodatabase to resolve the discrepancies, EKI deleted the non-existing features in the City's geodatabase and appended the future features from the RMC shapefiles to the City's geodatabase layers. EKI also confirmed that the pond and spray field locations were consistent with those listed in the Consolidated Treatment Facility's Waste Discharge Requirements (Central Valley Regional Water Quality Control Board R5-2016-0028).

Additionally, EKI identified over 350 duplicate, overlapping pipe segments in the recycled water GIS and removed the duplicates.

B.2.4 Quality Assurance / Quality Control

After the GIS data were imported into the hydraulic models, EKI performed processing and quality assurance/quality control (QA/QC) steps to ensure that all the modeled network parts (i.e., pipes, nodes, etc.) are accurately connected to each other and that the attribute data are complete. Specifically, EKI used the software to identify and correct elements that were missing, duplicate, or misaligned and reviewed pipe characteristics and connection data for accuracy.

TABLE B-1
Summary of Recycled Water System GIS Updates

Map Page	Issue / Project Name	Notes / Description of Update	Data Source
City's Recycled Water System Map Review Notes (a)			
F13	General Note: RW ponds and basins from the 5 year Wastewater Plan permit application are shown as existing for the WRP-1(MBR) RW system. The only existing active LAAs for the WRP-1(MBR) system are A30 and A28; A31 and A23 are inactive. For the WRP-1(MBR) ponds; only S1 through S6 are active and existing. Need to add field or move into layer for future infrastructure so they are not confused with existing infrastructure. Also, would like a way to differentiate the WRP-1(MBR) and Crossroads RW systems using a layer or field.	Assigned statuses of agricultural irrigation areas and ponds as existing, near-term, or future. Changed label of WRP-1 to Lathrop CTF.	(1)
G13	LAA A30 is mislabled A35; A31 mislabeled as A36.	Revised labels.	
I18	LAA A28 mislabeld as A33.	Revised label.	
L12	LAA at fire station has been abandoned and developed into a residential neighborhood.	Deleted LAA.	
M12	RW main is privately maintained and operated by COGEN (see also Sheets M13, N12, O10, O11, O12)	Moved to "Private COGEN or CNP" layer	(2)
O10	RW main is privately maintained and operated by CNP (see also Sheet O11)	Moved to "Private COGEN or CNP" layer	(2)
F13	General Note: many of the RW monitoring wells not shown within active grid system. Also, may be more appropriate to use "Sampling Location" feature class than "Water Production Well".	Changed feature class of monitoring wells to "Sampling Location". Did not add missing locations (see Attachment A).	
K10	Future RW mains infrastructure shown as existing (see also Sheets K11, K13, K14, L9, L10, L11, L14, L15)	Assigned statuses of recycled water mains as existing, near-term, or future.	(1)
M10	RW main crossing I-5 not shown in correct location (see Sheet 3 of plans "Caltrans I-5 Bore and Jack" by cbg)	Deleted I-5 crossing at M10. (Confirmed crossing is shown correctly in L15.)	(3)
L12	Connect gap of water mains on Golden Valley.	Gaps connected.	
Updates to Resolve Discrepancies with RWMP and/or RWQCB Permit (b)			
M8, M9	Areal extents of ponds S28 and S29 inconsistent with RWMP.	Adjusted areas of S28 and S29.	(1)(4)
L14	Agricultural land application sites A24 and A25 are not shown on the RWMP.	Deleted A24 and A25.	(1)(4)(5)
M8	Agricultural land application site A36 inconsistent with RWMP.	Adjusted area of A36.	(4)
K6	Agricultural irrigation areas A14, A15, and A16 are covering the area where pond S30 is located in the RWMP.	Merge A14, A15, and A16 areas into pond S30.	(1)

TABLE B-1
Summary of Recycled Water System GIS Updates

Abbreviations

CBG = Carlson, Barbee & Gibson, Inc.
CTF = Consolidated Treatment Facility
I-5 = Interstate 5
LAA = land application area
MBR = membrane bioreactor
RW = recycled water
RWMP = Recycled Water Master Plan (Reference 1)
RWQCB = Regional Water Quality Control Board
WRP = water reclamation plant

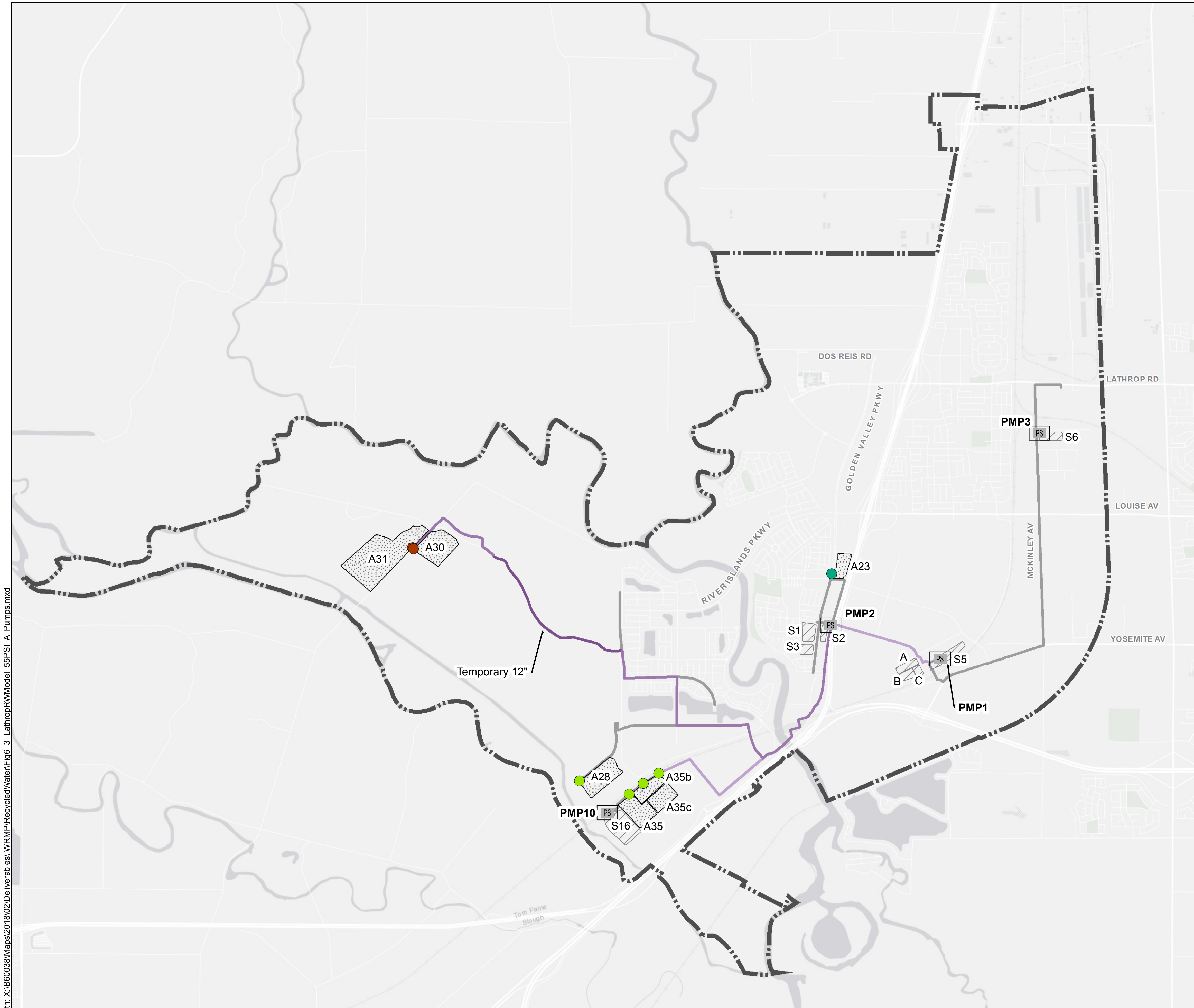
Notes

(a) City review comments and markups dated 22 March 2012 on Recycled Water System Map Book prepared by Stantec, Inc.
(b) Includes updates to address discrepancies identified between sources (1) and (4).

Data Sources

(1) City of Lathrop Master Plan Documents, Recycled Water, Amendment for Near Term Development, DRAFT, RMC, 22 August 2014 (RWMP).
(2) Confirmed by City's Public Works staff on a 18 August 2016 conference call.
(3) Project Plans for Bore and Jack Under Interstate 5 for City of Lathrop, CBG, June 2006
(4) NOA of Order R5-2016-0028, WDR for City of Lathrop, Lathrop Consolidated Treatment Facility, 2 May 2016
(5) Confirmed by City's Public Works staff in 17 October 2016 email.

APPENDIX C
SUPPLEMENTAL HYDRAULIC MODELING RESULTS



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

PS Pump Station

Junction Pressure, psi

- Less than 5 (Not Meeting Criteria)
- 5 - 10
- 10 - 20
- 20 - 45
- Greater than 45

Pipe Velocity, fps

- Less than 1 (Not Meeting Criteria)
- 1 - 3
- 3 - 5
- 5 - 7
- Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP	=	Pump
RI-PS	=	River Islands Pump Station
psi	=	pounds per square inch
SOI	=	Sphere of Influence
RW	=	Recycled Water
fps	=	feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 1 RW System Performance Evaluation
All Pumps Online

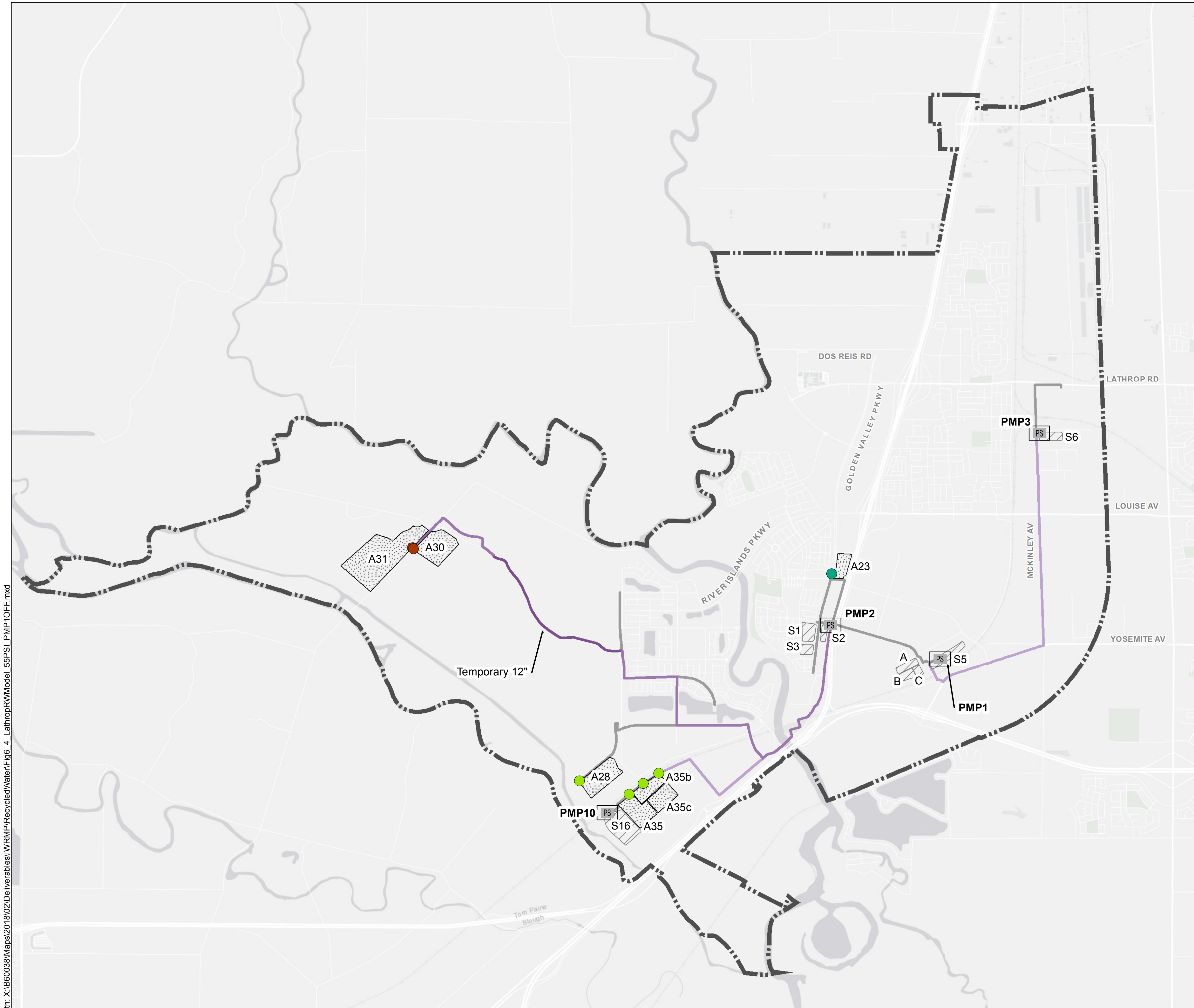
DRAFT

eki environment & water

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

Figure C-1

Path: X:\B60038\Maps\2018\02\Deliverables\WRMP\RecycledWater\Fig6_3_LathropRWModel_55PSI_AllPumps.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

PS Pump Station

Junction Pressure, psi

- Less than 5 (Not Meeting Criteria)
- 5 - 10
- 10 - 20
- 20 - 45
- Greater than 45

Pipe Velocity, fps

- Less than 1 (Not Meeting Criteria)
- 1 - 3
- 3 - 5
- 5 - 7
- Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
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psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 1 RW System Performance Evaluation
PMP-1 Offline

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
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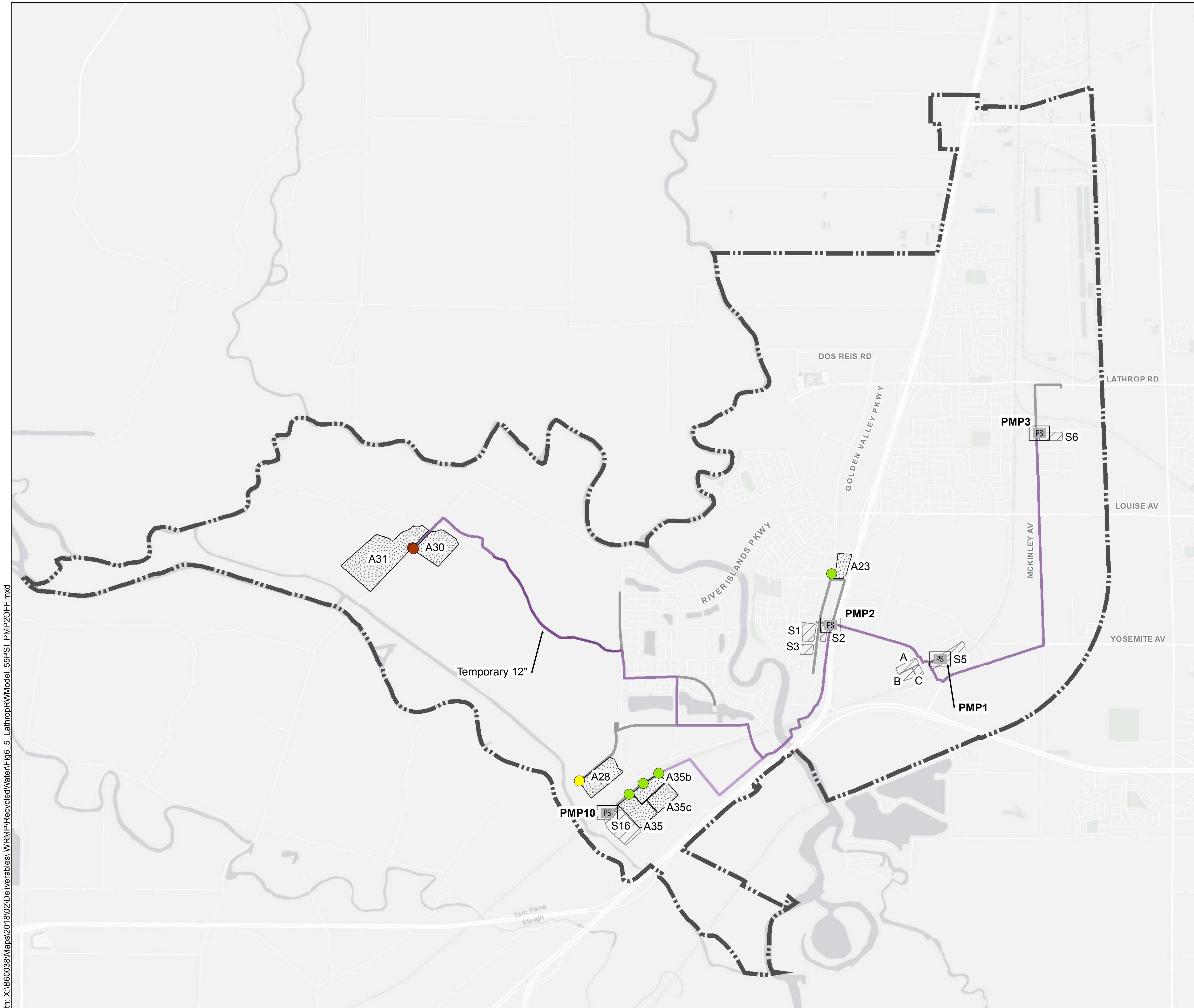
Figure C-2



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Pump Station

Junction Pressure, psi

- Less than 5 (Not Meeting Criteria)
- 5 - 10
- 10 - 20
- 20 - 45
- Greater than 45

Pipe Velocity, fps

- Less than 1 (Not Meeting Criteria)
- 1 - 3
- 3 - 5
- 5 - 7
- Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 1 RW System Performance Evaluation
PMP-2 Offline

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March 2018
B60038.00

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Figure C-3

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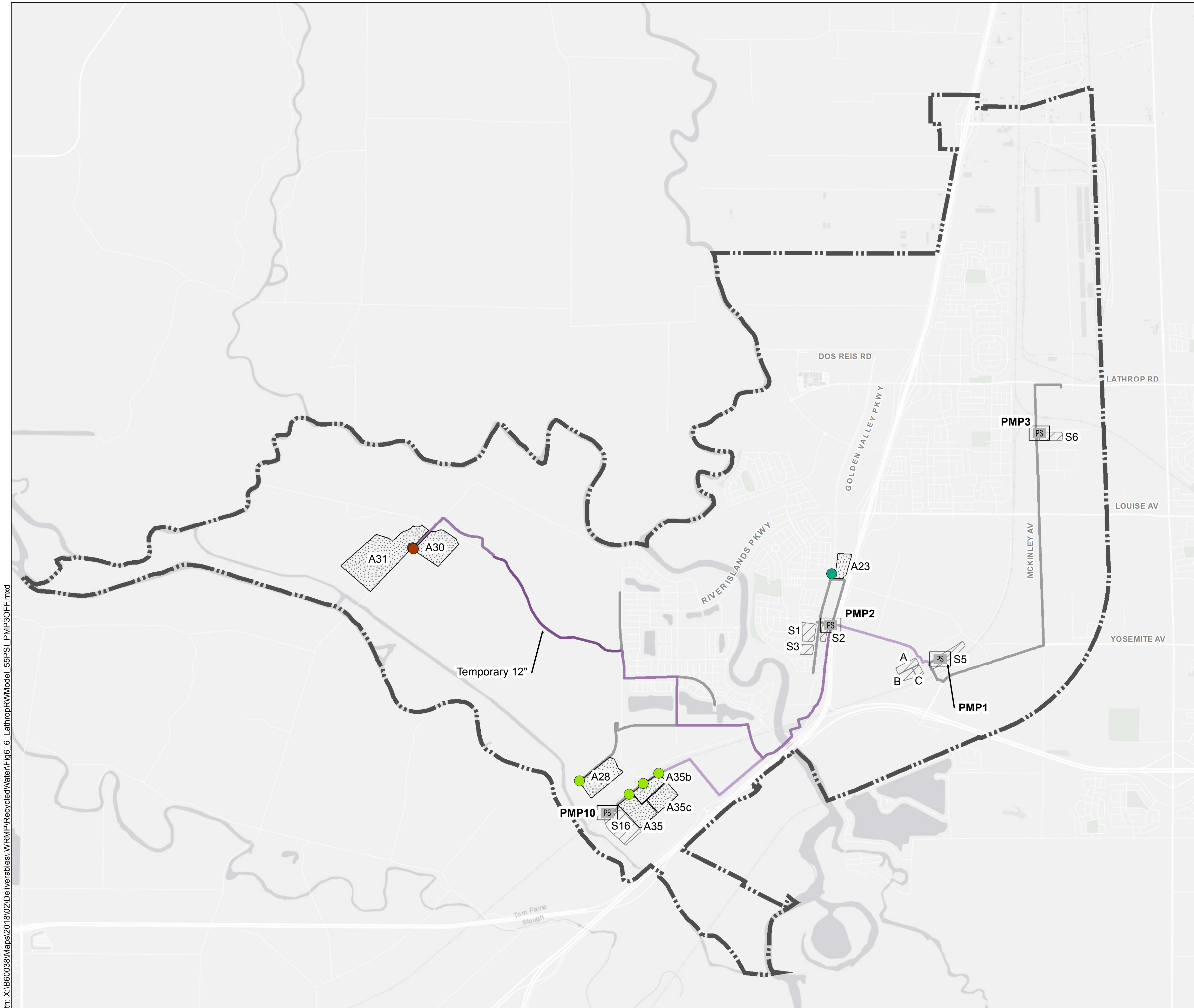

Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 1 RW System Performance Evaluation
PMP-3 Offline

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

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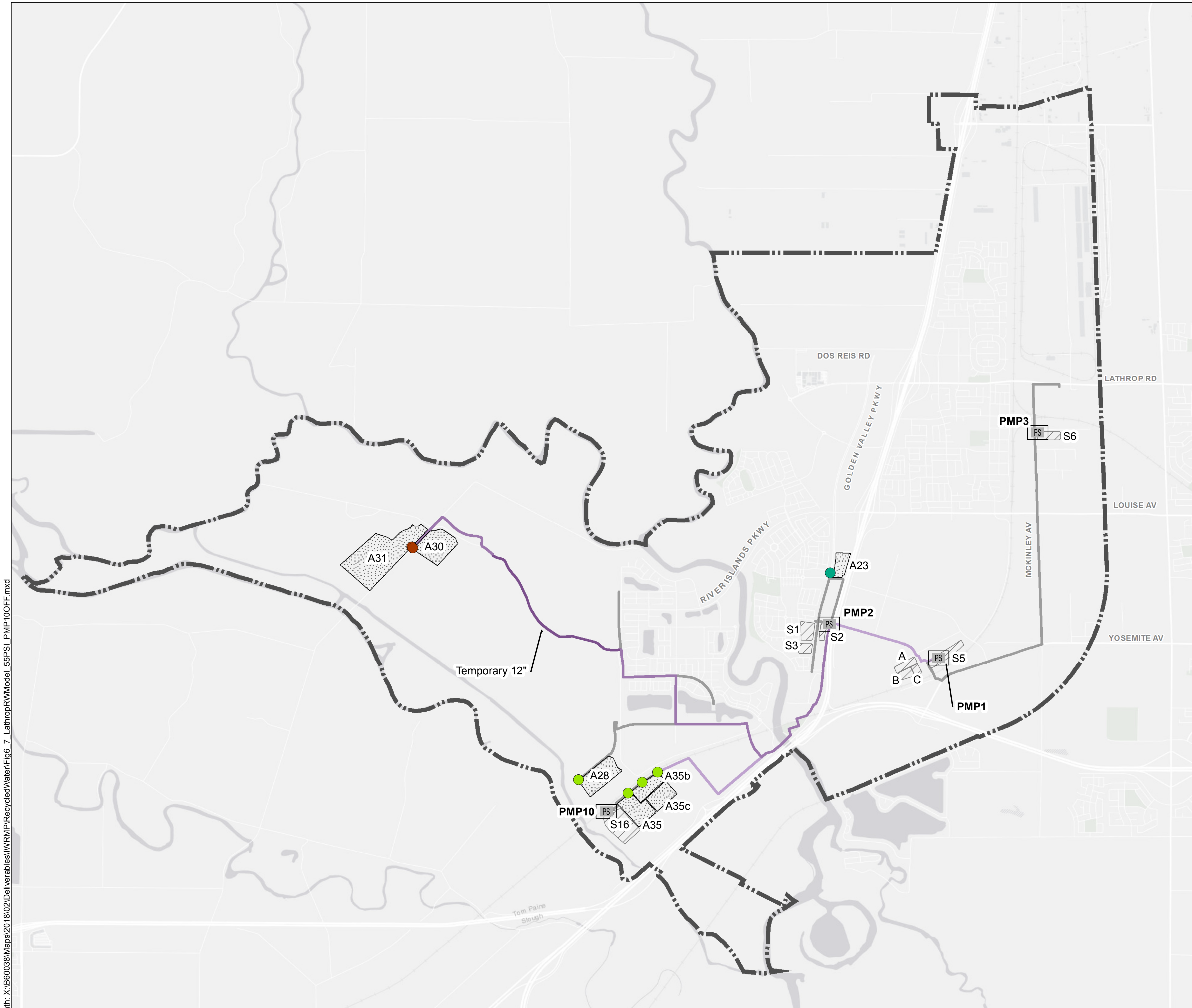
Figure C-4



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 1 RW System Performance Evaluation
PMP-10 Offline

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

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Figure C-5

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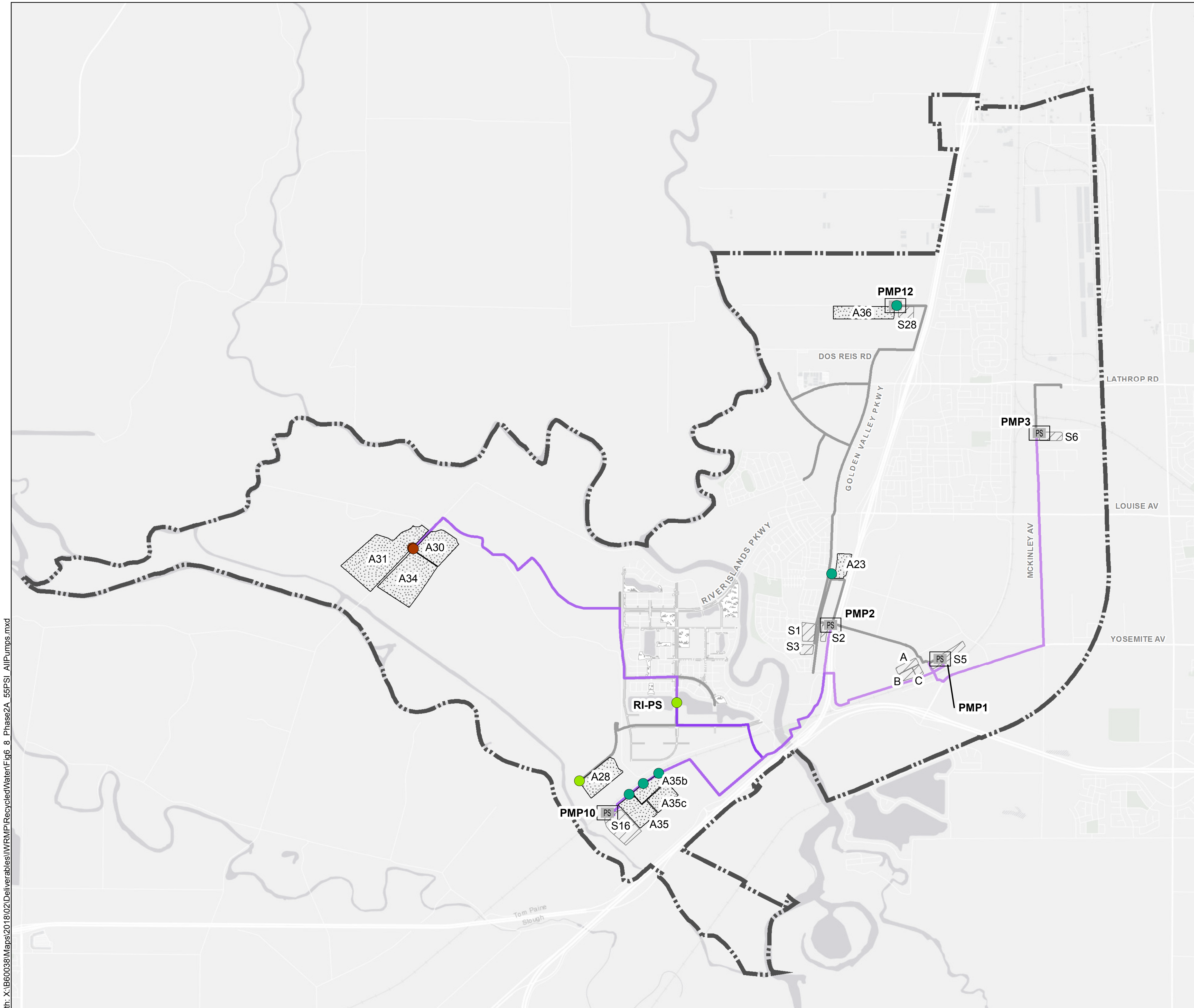

Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2A RW System Performance Evaluation
All Pumps Online

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

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Figure C-6

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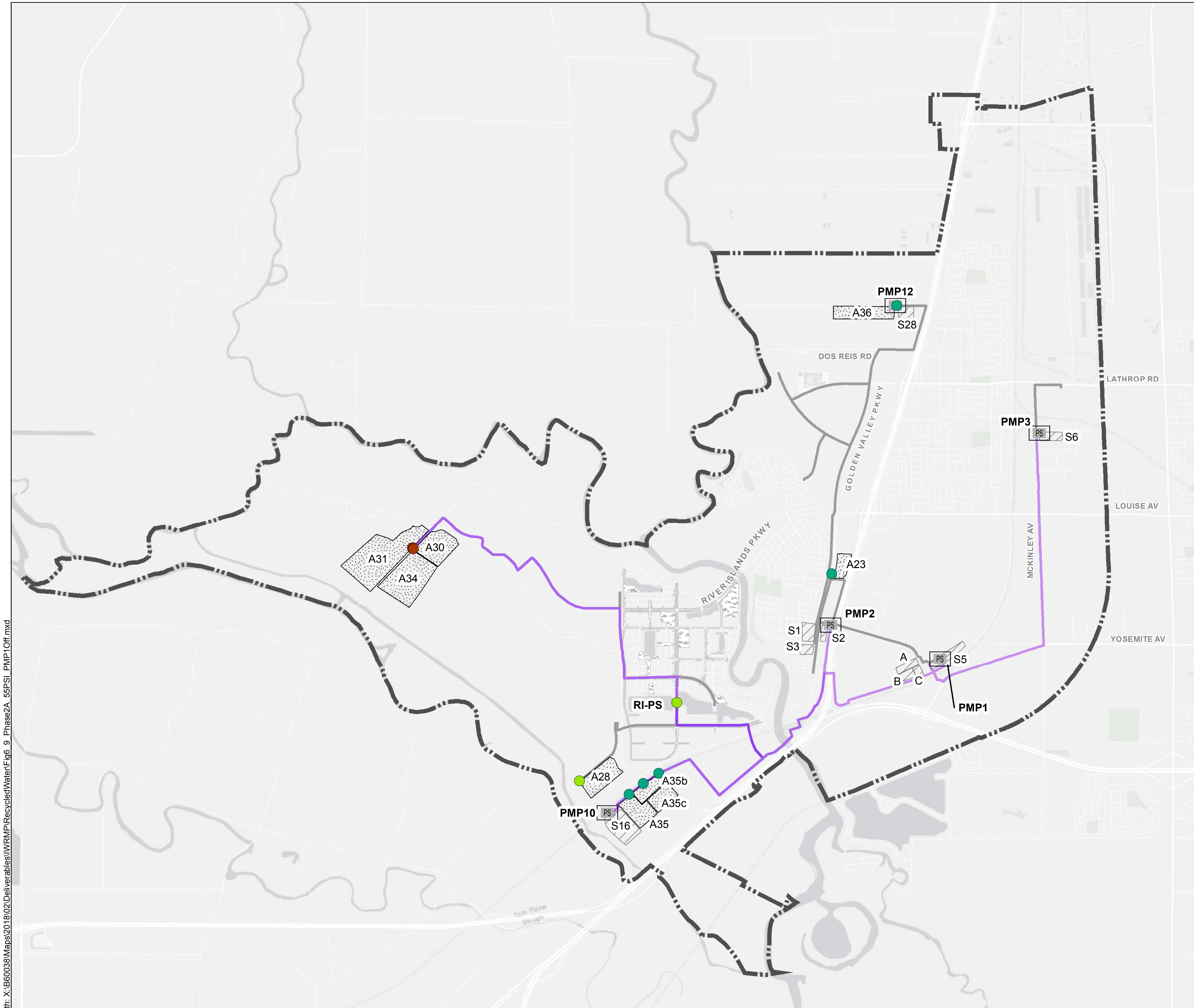

Legend

Sphere of Influence

Modeled Infrastructure

- Storage Pond
- Agricultural Land Application Area
- Landscape Irrigation Area
- Pump Station

Junction Pressure, psi

- Less than 5 (Not Meeting Criteria)
- 5 - 10
- 10 - 20
- 20 - 45
- Greater than 45

Pipe Velocity, fps

- Less than 1 (Not Meeting Criteria)
- 1 - 3
- 3 - 5
- 5 - 7
- Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

Phase 2A RW System Performance Evaluation
PMP-1 Offline

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March 2018
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Figure C-7

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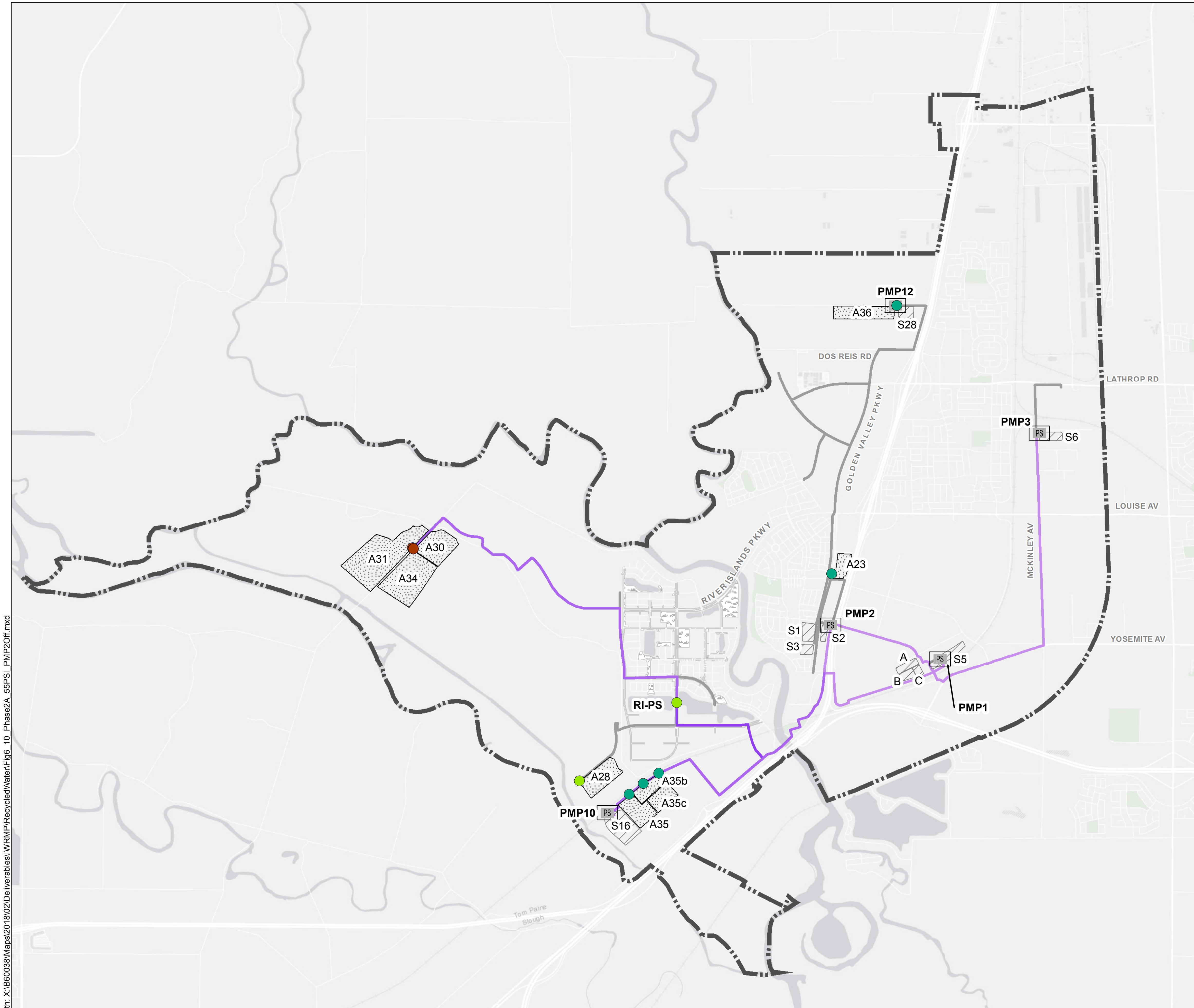

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Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

PS Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

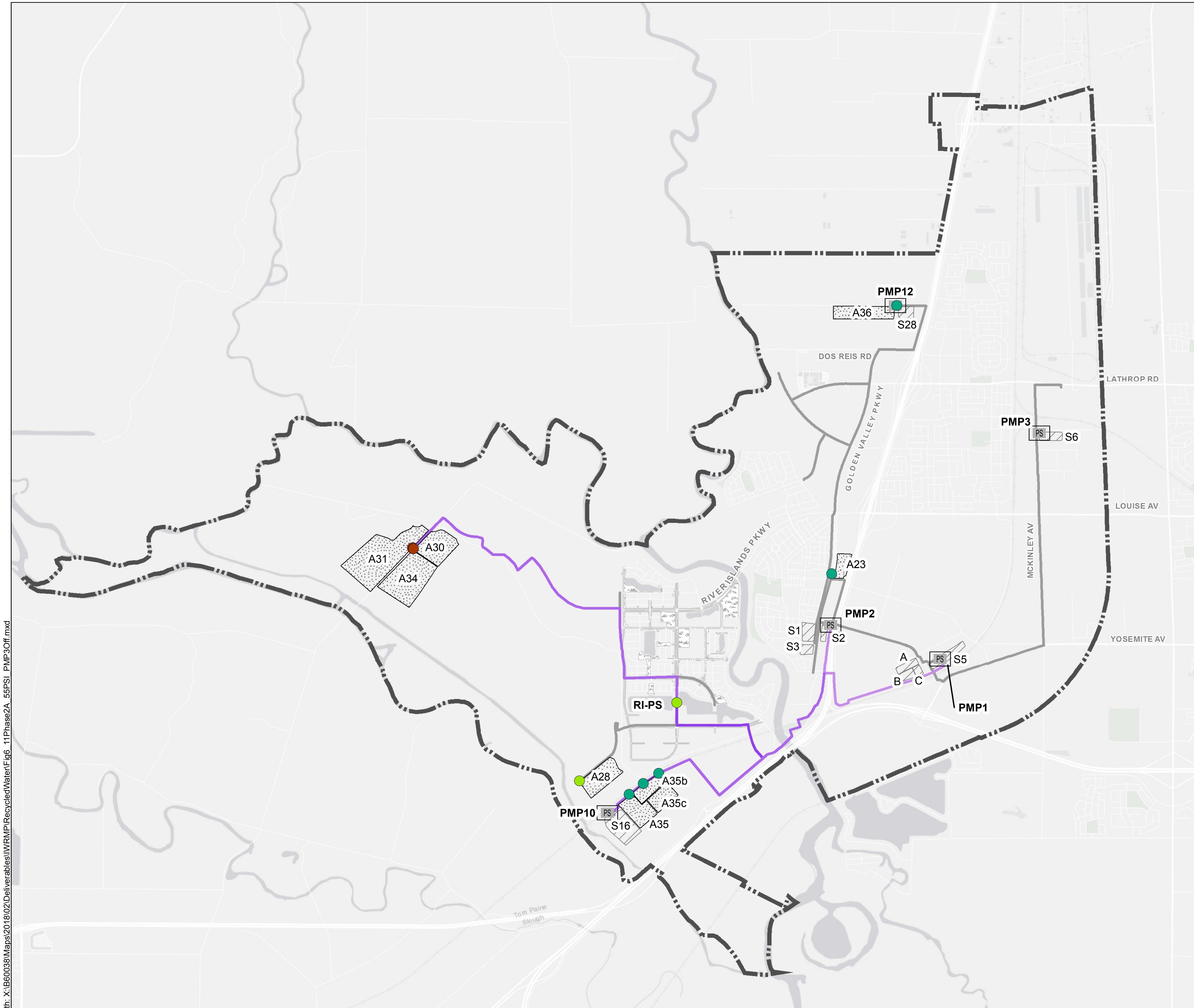
Phase 2A RW System Performance Evaluation
PMP-2 Offline

DRAFT

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

eki environment & water

Figure C-8



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

PS Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump

RI-PS = River Islands Pump Station

psi = pounds per square inch

SOI = Sphere of Influence

RW = Recycled Water

fps = feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2A RW System Performance Evaluation
PMP-3 Offline

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
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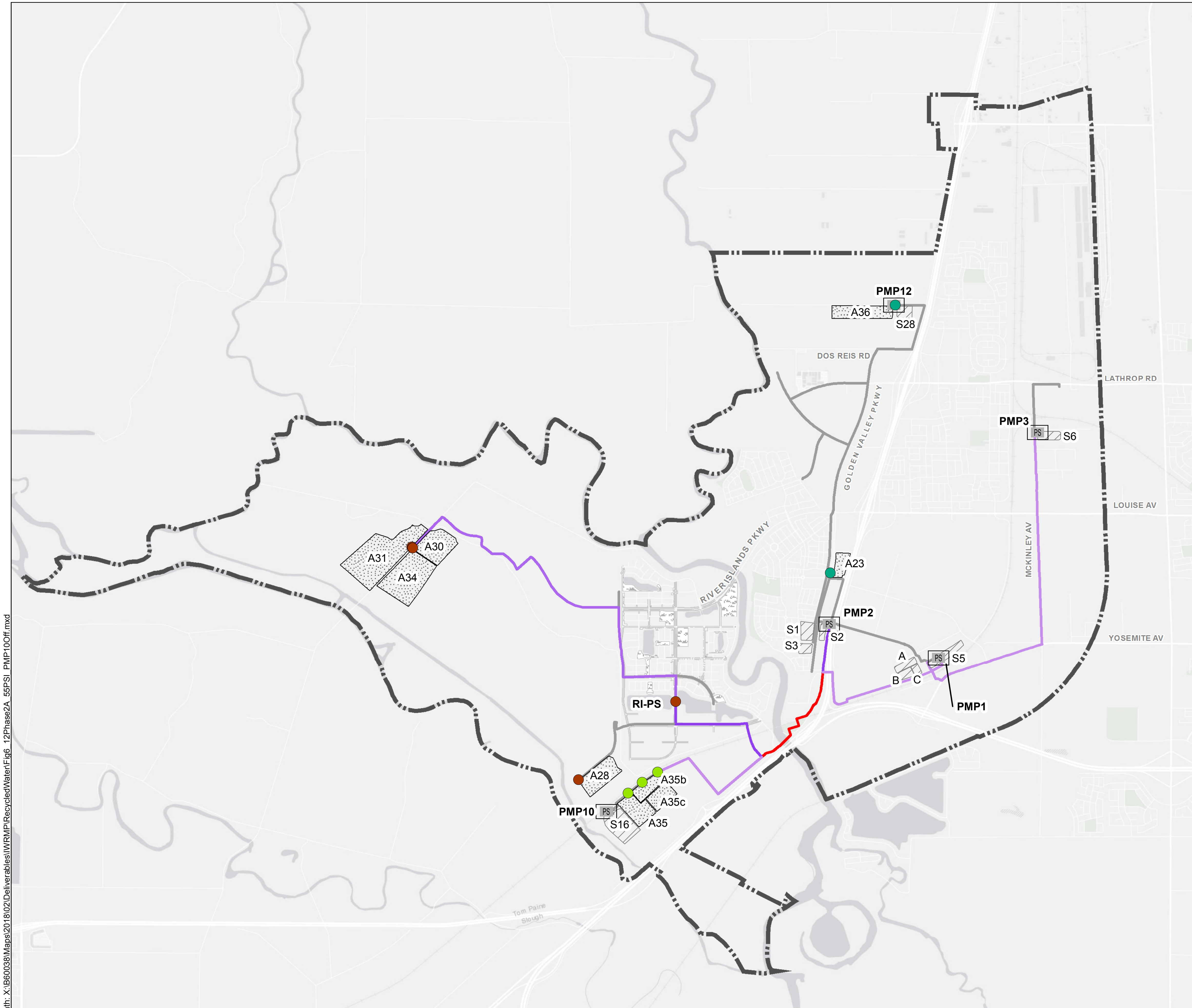
Figure C-9

Path: X:\B60038\Maps\2018\02\Deliverables\WRMP\RecycledWater\Fig6_11Phase2A_55PSI_PMP3Off.mxd



Legend
Sphere of Influence

Modeled Infrastructure
Storage Pond
Agricultural Land Application Area
Landscape Irrigation Area
Pump Station

Junction Pressure, psi
Less than 5 (Not Meeting Criteria)
5 - 10
10 - 20
20 - 45
Greater than 45

Pipe Velocity, fps
Less than 1 (Not Meeting Criteria)
1 - 3
3 - 5
5 - 7
Greater than 7 (Not Meeting Criteria)

Abbreviations
PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes
1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources
1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N
0 4,000 8,000
(Scale in Feet)

Phase 2A RW System Performance Evaluation
PMP-10 Offline

DRAFT

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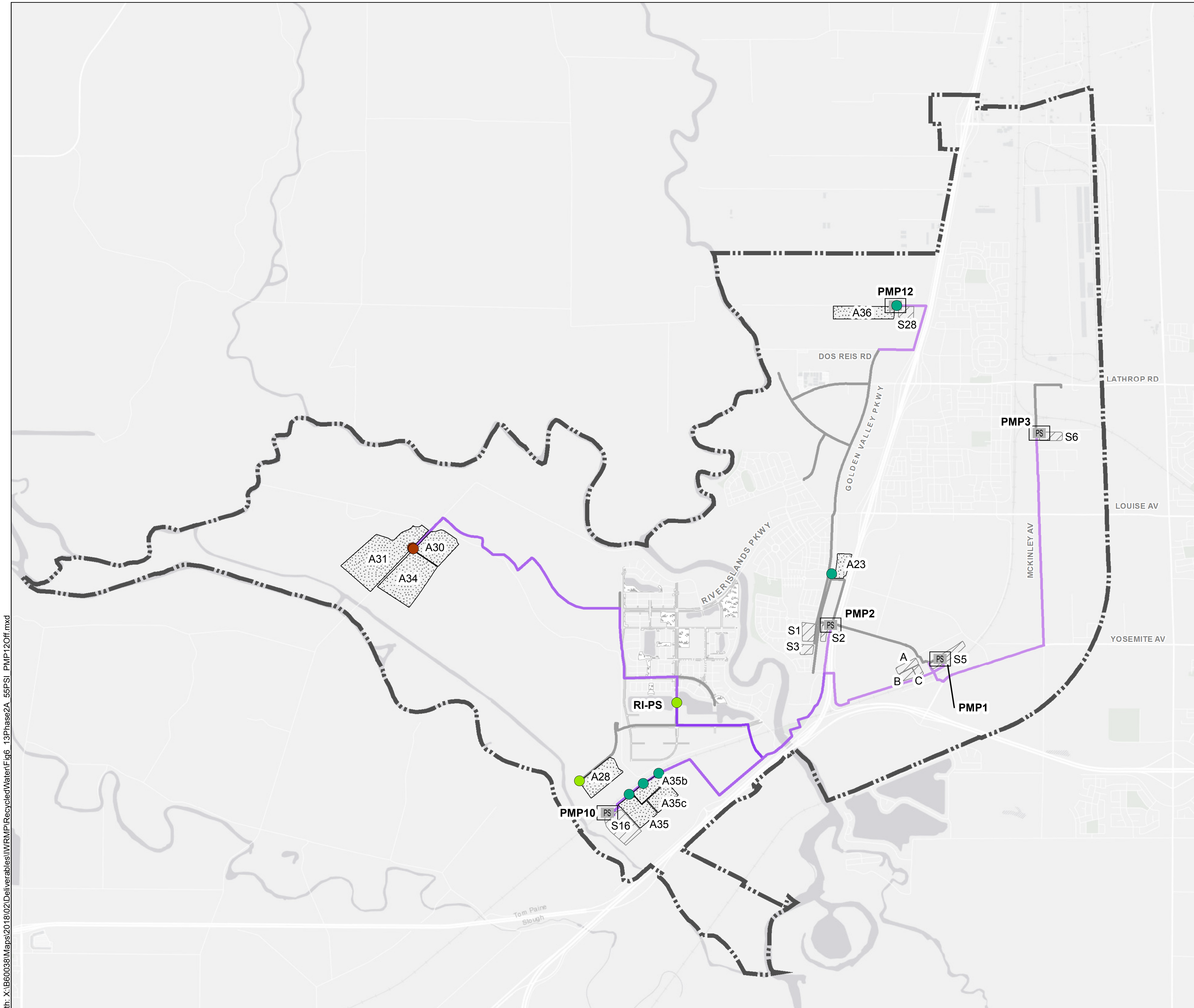
Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

Figure C-10

Path: X:\B60038\Maps\2018\02\Deliverables\WRMP\RecycledWater\Fig6_12Phase2A_55PSI_PMP10Off.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP	=	Pump
RI-PS	=	River Islands Pump Station
psi	=	pounds per square inch
SOI	=	Sphere of Influence
RW	=	Recycled Water
fps	=	feet per second

Notes

1. All locations are approximate.
2. Pipelines which are existing, but not currently operational are not included. Refer to Figure 3-1 for more detail.
3. Results are shown for peak hour demands.
4. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2A RW System Performance Evaluation
PMP-12 Offline

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
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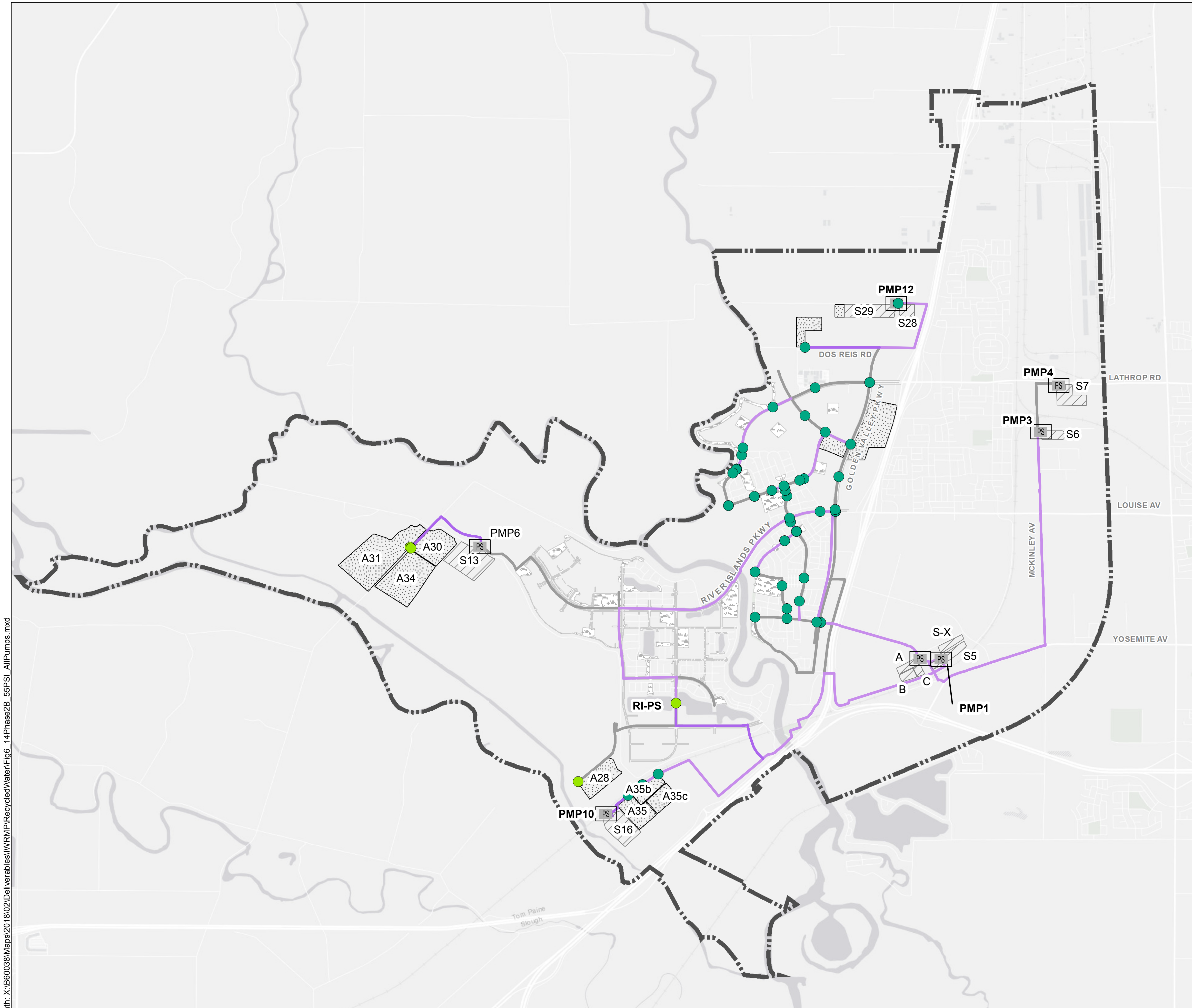
Figure C-11

Path: X:\B60038\Maps\2018\02\Deliverables\RWRMP\RecycledWater\Fig6_13Phase2A_55PSI_PMP12Off.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP	=	Pump
RI-PS	=	River Islands Pump Station
psi	=	pounds per square inch
SOI	=	Sphere of Influence
RW	=	Recycled Water
fps	=	feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2B RW System Performance Evaluation
All Pumps On

DRAFT

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
B60038.00

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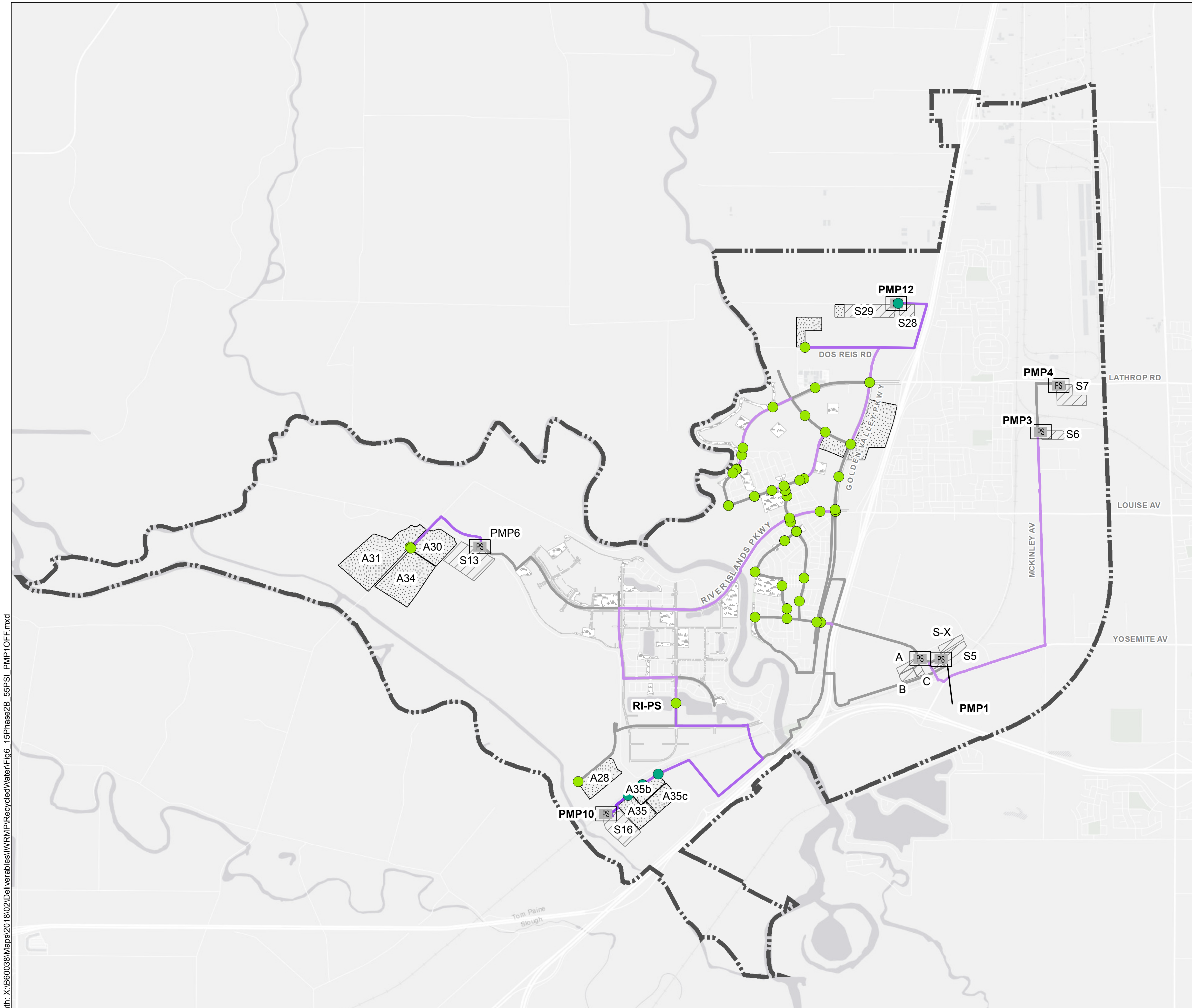
Figure C-12

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_14Phase2B_55PSI_AllPumps.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP	=	Pump
RI-PS	=	River Islands Pump Station
psi	=	pounds per square inch
SOI	=	Sphere of Influence
RW	=	Recycled Water
fps	=	feet per second

Notes
1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources
1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-1 Off

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City of Lathrop
Lathrop, CA
March 2018
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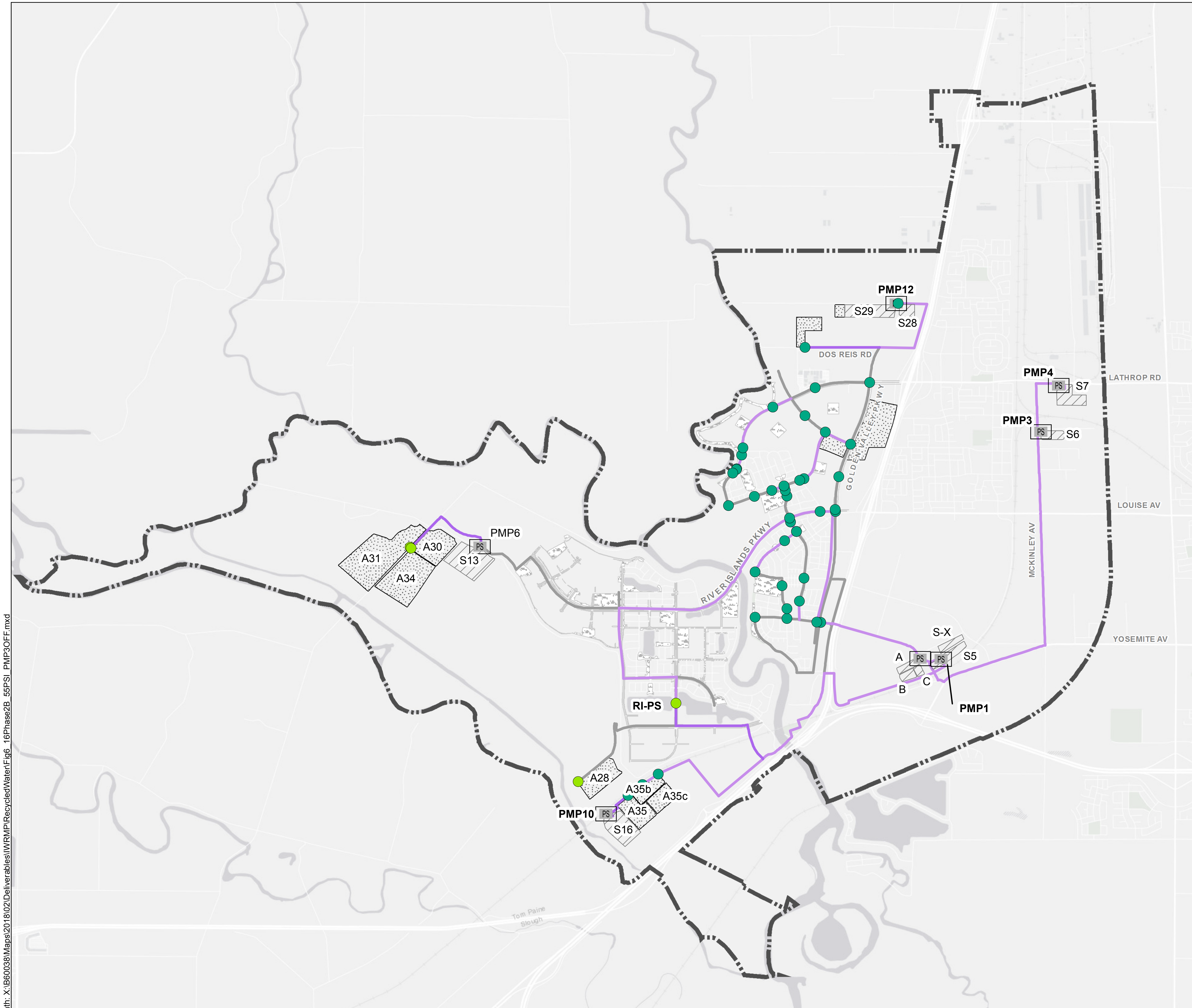
Figure C-13

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_15Phase2B_55PSI_PMP1OFF.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-3 Off

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City of Lathrop
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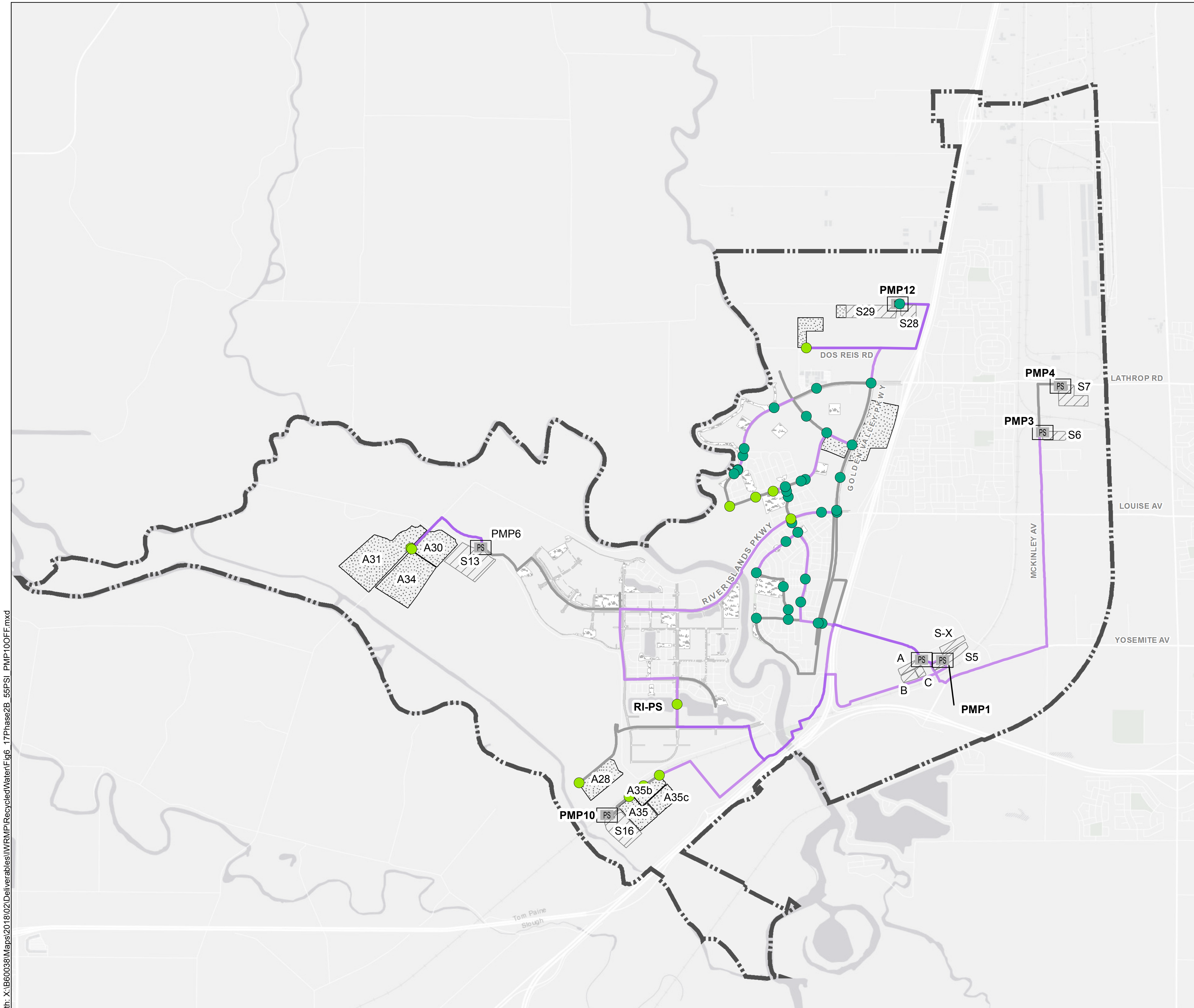
Figure C-14

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_16Phase2B_55PSI_PMP3OFF.mxd



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000

(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-10 Off

DRAFT

Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
March 2018
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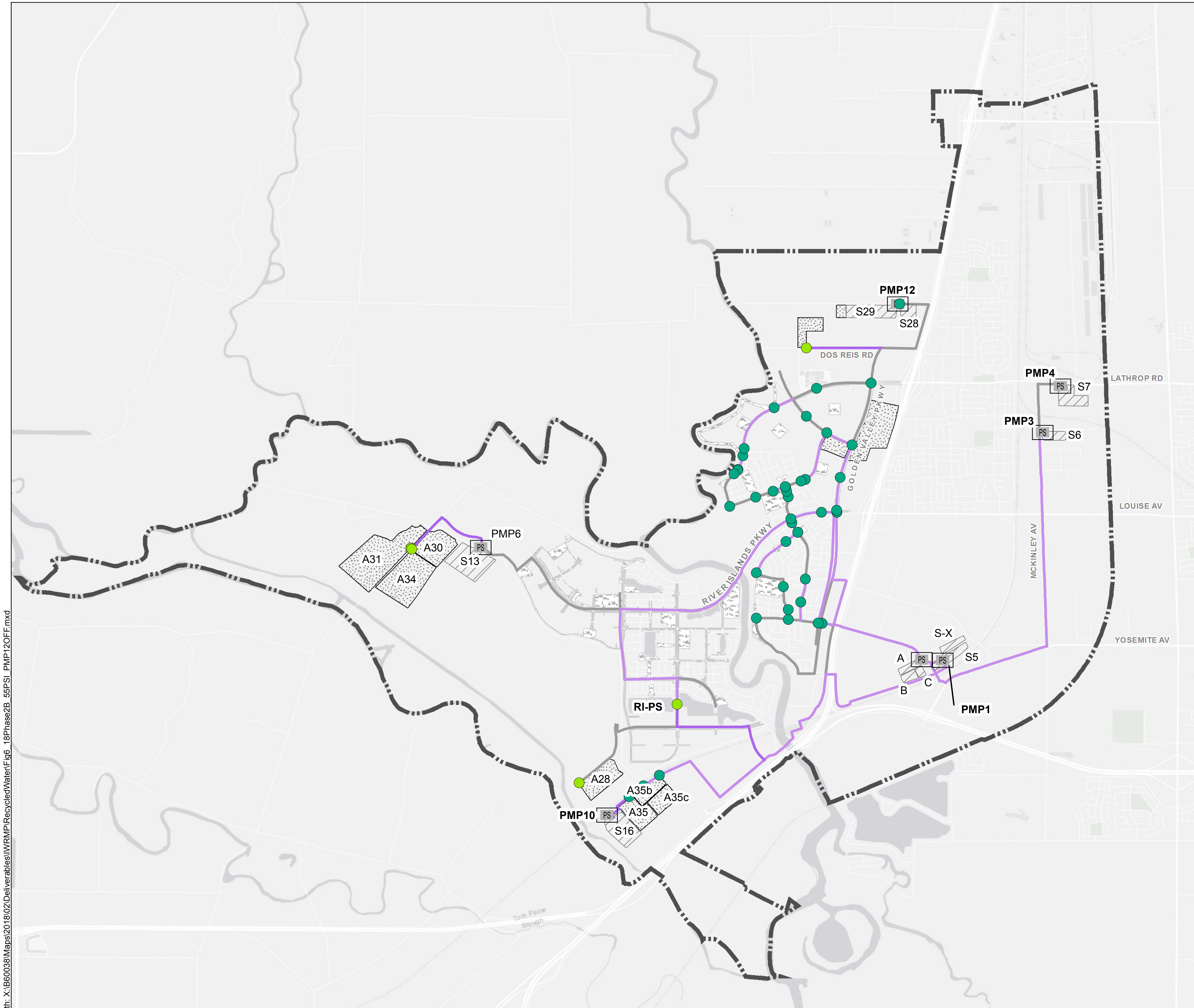
Figure C-15

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_17Phase2B_55PSI_PMP10OFF.mxd



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Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-12 Off

DRAFT

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Lathrop, CA
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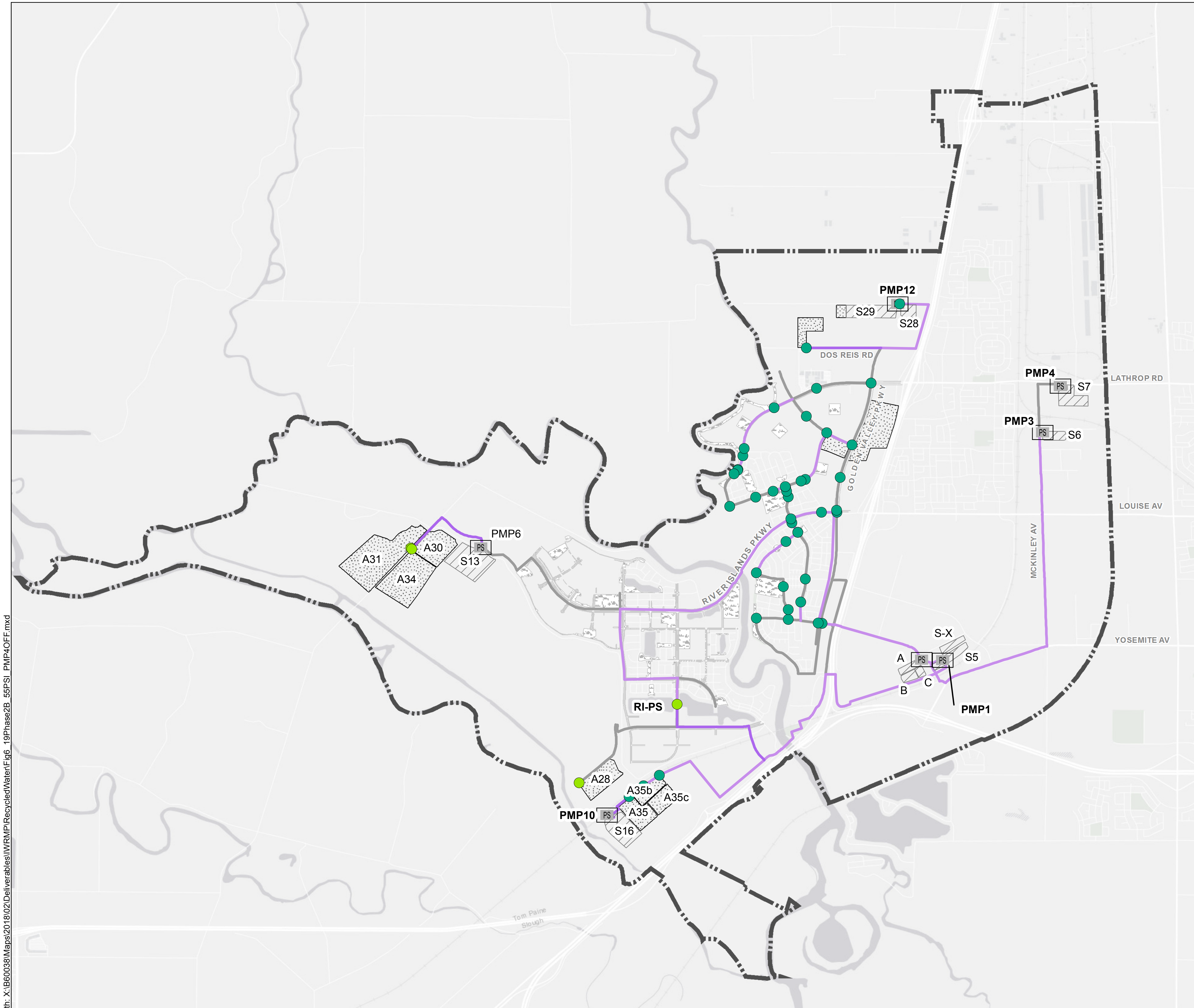
Figure C-16



Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-4 Off

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Recycled Water System Master Plan
City of Lathrop
Lathrop, CA
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Figure C-17

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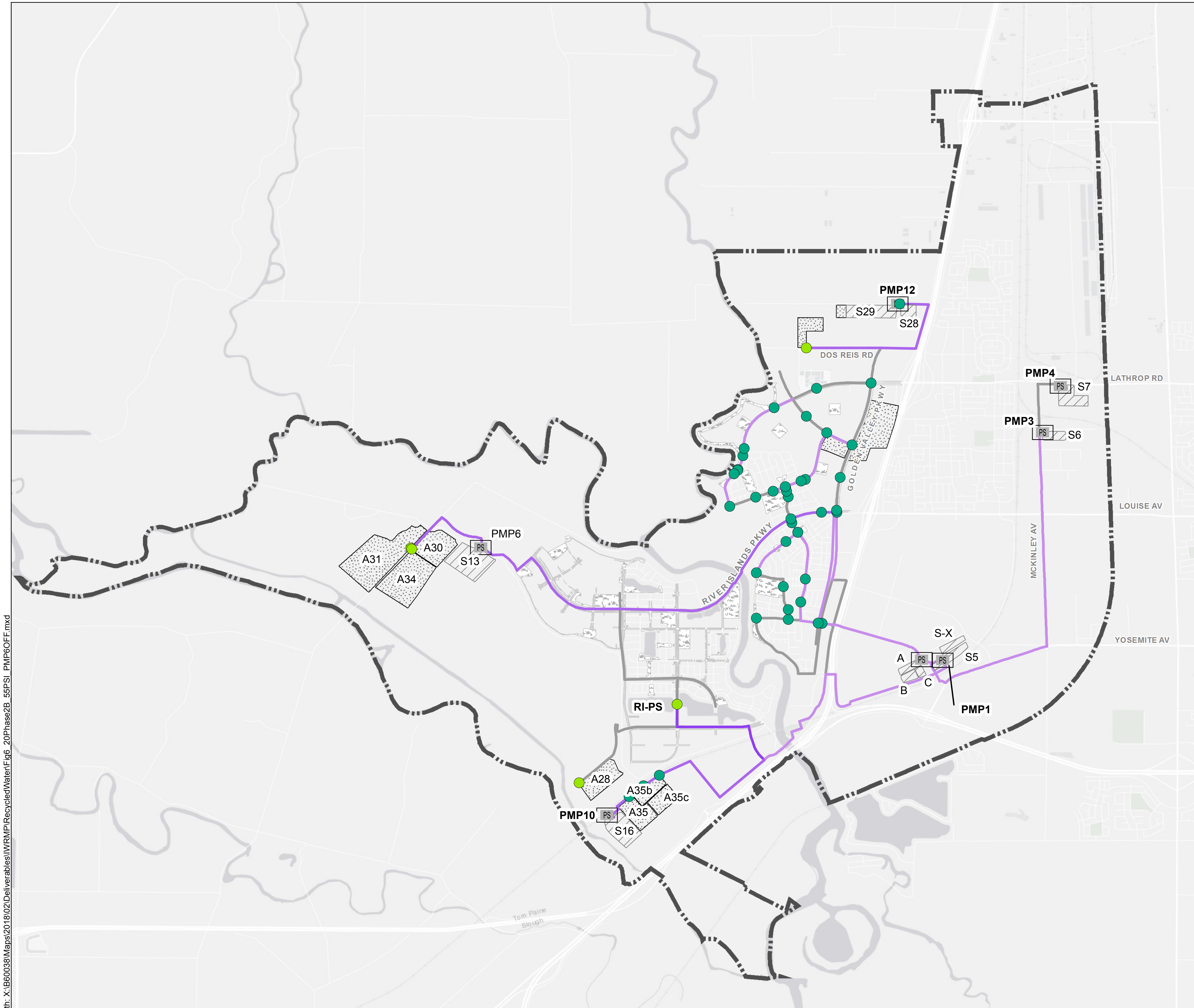

Legend

Sphere of Influence

Modeled Infrastructure

Storage Pond

Agricultural Land Application Area

Landscape Irrigation Area

Pump Station

Junction Pressure, psi

Less than 5 (Not Meeting Criteria)

5 - 10

10 - 20

20 - 45

Greater than 45

Pipe Velocity, fps

Less than 1 (Not Meeting Criteria)

1 - 3

3 - 5

5 - 7

Greater than 7 (Not Meeting Criteria)

Abbreviations

PMP = Pump
RI-PS = River Islands Pump Station
psi = pounds per square inch
SOI = Sphere of Influence
RW = Recycled Water
fps = feet per second

Notes

1. All locations are approximate.
2. Results are shown for peak hour demands.
3. Percolation Basin 1, the Crossroads Pump, and connecting piping are not modeled and therefore not shown.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 1 March 2018.

N

0 4,000 8,000
(Scale in Feet)

Phase 2B RW System Performance Evaluation
PMP-6 Off

DRAFT

Recycled Water System Master Plan
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Figure C-18

Path: X:\B60038\Maps\2018\02\Deliverables\IWRMP\RecycledWater\Fig6_20Phase2B_55PSI_PMP6OFF.mxd

APPENDIX D
WDR PERMITTED STORAGE PONDS AND LAND USE AREAS

Table D-1: Existing and Planned Effluent Storage Ponds
Source: Tentative Waste Discharge Requirements R5-2016-0028-01

Site ID	APN	Development Area	Parcel Area (acres)	Capacity (mgal) [1]	Use Status	Project Level CEQA Completed [3]
S1	191-190-32	Mossdale	13.26	41	Existing	a, b
S2	191-190-33	Mossdale	6.89	15	Existing	a, b
S3	198-130-35	Mossdale South	9.91	21	Existing	c
S5	198-130-47	East Lathrop	9.96	28	Existing	a
	198-130-48	East Lathrop	0.59		Existing	a
S6	198-060-16	East Lathrop	5.61	34	Existing	e
	198-060-17		6.06		Existing	e
S7	198-040-14	East Lathrop	18.15	57	Planned	f
S8	241-020-70	East Lathrop	60.59	182	Planned	d
S9	241-030-13	East Lathrop	159.92	457	Planned	d
S11	213-300-07	River Islands	72.5	102	Planned	h, j
	213-300-08		86.83		Planned	h, j
S12	213-300-07	River Islands	72.5	97	Planned	h, j
	213-300-08		86.83		Planned	h, j
S13	213-210-06	River Islands	290.81	116	Planned	a
S14	213-22-001	River Islands	96.16	90	Planned	h
S15	198-120-08	East Lathrop	116.99	135	Planned	a, f
	198-120-09		48.64		Planned	a, f
	198-140-16		19.96		Planned	a, f
S16	213-290-02	River Islands	121.88	101	Near Term	a, h, k
S17				61	Planned	a, h, k
S18				71	Planned	a, h, k
S19	239-040-04	River Islands	142.25	55	Planned	f, h
S20				66	Planned	f, h
S21				67	Planned	f, h
S22				71	Planned	f, h
S23				74	Planned	f, h
S24	239-040-07	River Islands	137	65	Planned	f, h
S25				56	Planned	f, h
S26				63	Planned	f, h
S27				58	Planned	f, h
S28	191-220-14	CLSP	89.82	25	Planned	i
S29				95	Planned	i
S30	191-270-05	Northern Lathrop	20	172	Planned	g
	191-270-04		7.6		Planned	g
	191-260-22		31.4		Planned	g
Pond A, B, and C	198-130-19	Crossroads WWTF	9.8	32	Near Term	l
	198-130-20					
PB-1	198-13-032	Crossroads WWTF	19.5	Unknown [2]	Near Term	l

1 Assuming two feet of freeboard.
2 Currently a land application area to be developed into percolation pond(s) for future disposal capacity.
3 Corresponding environmental documentation:

a. City of Lathrop. 2002. Draft Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. December 31. Prepared by EDAW. AND City of Lathrop. 2003. Final Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. February 28. Prepared by EDAW.

b. City of Lathrop. 2002. Draft Environmental Impact Report for the Mossdale Landing Urban Design Concept. SCH# 2001052059. 2002. Volume I: DEIR. August 29. Prepared by EDAW. AND City of Lathrop. Draft Environmental Impact Report for the Mossdale Landing Urban Design Concept. SCH# 2001052059. 2003. Volume I: DEIR. January. Prepared by EDAW.

c. City of Lathrop. 2003. Public Review Draft Supplemental Environmental Impact Report for Mossdale Landing East. December 6. Prepared by InSite Environmental, Inc. AND City of Lathrop. 2004. Public Review Draft Supplemental Environmental Impact Report for Mossdale Landing East. January 30. Prepared by InSite Environmental, Inc.

d. City of Lathrop. 2004. Draft Environmental impact Report for the CLSP (CLSP). SCH# 2003072132. July. Prepared by EDAW. and City of Lathrop. 2004. Final Environmental impact Report for the CLSP (CLSP). SCH# 2003072132. October. Prepared by EDAW.

e. City of Lathrop. 2004. Addendum the Environmental Impact Report for the City of Lathrop Wastewater Recycling Plant No. 1 (SCH#2001122108) relative to the Nurisso Road Recycled Water Storage Ponds. November 17. Prepared by InSite Environmental, Inc.

f. City of Lathrop. 2005. Addendum to the City of Lathrop Water, Wastewater, and Recycled Water Master Plan Environmental Impact Report. December 14. Prepared by EDAW.

g. City of Lathrop. 2006. Addendum the Environmental Impact Report for the City of Lathrop Wastewater Recycling Plant No. 1 (SCH#2001122108) relative to the Frewert Road Recycled Water Storage Pond. May 5. Prepared by InSite Environmental. Prepared by InSite Environmental, Inc.

h. City of Lathrop. 2002. Draft Subsequent Environmental Impact Report for the River Islands at Lathrop Project. Volume 1a. (SCH#1993112027). October 16. AND Prepared by EDAW. AND City of Lathrop. 2003. Draft Subsequent Environmental Impact Report for the River Islands at Lathrop Project. Volume 1a. #1993112027). January 22. Prepared by EDAW

i. City of Lathrop. 2014. CLSP Environmental Impact Report Addendum II (SCH#2003072132). March. Prepared by Ascent.

j. City of Lathrop. Initial Study for River Islands Disposal Fields Expansion. 2004. November. Prepared by the City of Lathrop Public Works Department.

k. City of Lathrop. 2014. River Islands at Lathrop Project Subsequent Environmental Impact Report Addendum IV. SCH#1993112027. Prepared by Ascent.

l. City of Lathrop. 7 July 2015, Notice of Determination for the City of Lathrop Crossroads Decommissioning Project.

Table D-2: Existing and Planned Agricultural Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN**	**Development Area**	**Parcel Area (acres)**	**Irrigated Area (acres)**	**Phase**	**Project Level CEQA Completed [1]**
A 01	191-280-10	Northern Lathrop	49.49	42.1	Planned	d
A 02	191-280-09	Northern Lathrop	101.2	86.0	Planned	d
A 03	191-270-33	Northern Lathrop	58.56	49.8	Planned	d
	191-270-32	Northern Lathrop	8.2			d
A 04	191-260-25	Northern Lathrop	18.09	15.4	Planned	f
A 05	191-260-13	Northern Lathrop	19.52	16.6	Planned	f
A 06	191-250-03	Northern Lathrop	8.83	7.5	Planned	f
A 07	191-250-12	Northern Lathrop	9.48	8.1	Planned	f
A 08	191-250-06	Northern Lathrop	10.3	8.8	Planned	f
A 09	191-270-24	Northern Lathrop	95.18	80.9	Planned	d
	191-270-25	Northern Lathrop	3.26			d
A 10	191-260-27	Northern Lathrop	154.77	131.6	Planned	d
	191-270-26	Northern Lathrop	4.82			d
A 11	191-230-01	Northern Lathrop	40	34.0	Planned	d
A 12	191-230-02	Northern Lathrop	29.33	24.9	Planned	d
A 13	191-270-21	Northern Lathrop	95.54	81.2	Planned	f
A 17	191-260-21	Northern Lathrop	20	17.0	Planned	f
A 18	191-260-28	Northern Lathrop	22.89	19.46	Planned	f
	191-260-29	Northern Lathrop	13.14			f
A 19	191-260-23	Northern Lathrop	12.75	10.8	Planned	f
A 20	191-220-04	CLSP	99.1	84.2	Planned	d
A 21	191-220-05	CLSP	313.88	266.8	Planned	d
A 23	191-190-49	Mossdale	12.4	10.5	Existing	a, h
A 28	213-300-09	River Islands	33.71	28.7	Existing	a, j
A 29	213-130-05	River Islands	231.4	444.2	Planned	a
	213-130-06	River Islands	74.7			a
	213-130-07	River Islands	12.5			a
	213-200-01	River Islands	153			a
	213-200-02	River Islands	229.42			a
A 30	213-210-06	River Islands	294.72	250.5	Existing	a, h
A 31	213-110-03	River Islands	151	128.4	Existing	a, f
A 32	213-110-02	River Islands	178.12	151.4	Planned	h
A 33	213-110-01	River Islands	221.21	188.0	Planned	h
A 34	213-210-06	River Islands	294.72	250.5	Planned	a, h
A 35	213-290-02	River Islands	25.44	22	Near Term	h, k
A35b	213-290-02	River Islands	121.8	15	Near Term	h, k
A35c	213-290-02	River Islands	121.8	15	Near Term	h, k

Table D-2: Existing and Planned Agricultural Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN**	**Development Area**	**Parcel Area (acres)**	**Irrigated Area (acres)**	**Phase**	**Project Level CEQA Completed [1]**
A 36	191-220-10	CLSP	5.15	34.5	Planned	i
	191-220-11		10.43			i
	191-220-12		0.96			i
	191-220-13		16.38			i
	191-220-37		7.72			i
A 37	191-220-15	CLSP	19.48	125.5	Planned	i
	191-220-17		9.80			i
	191-220-35		8.96			i
	191-220-18		19.61			i
	191-22014		89.82			i
A 38	191-220-44	CLSP	1.74	2.6	Planned	i
	191-220-45		1.26			i

[1] Corresponding environmental documentation:

a. City of Lathrop. 2002. Draft Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. December 31. Prepared by EDAW. AND City of Lathrop. 2003. Final Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. February 28. Prepared by EDAW.

b. City of Lathrop. 2002. Draft Environmental Impact Report for the Mossdale Landing Urban Design Concept. SCH# 2001052059. 2002. Volume I: DEIR. August 29. Prepared by EDAW. AND City of Lathrop. Draft Environmental Impact Report for the Mossdale Landing Urban Design Concept. SCH# 2001052059. 2003. Volume I: DEIR. January. Prepared by EDAW.

c. City of Lathrop. 2003. Public Review Draft Supplemental Environmental Impact Report for Mossdale Landing East. December 6. Prepared by InSite Environmental, Inc. AND City of Lathrop. 2004. Public Review Draft Supplemental Environmental Impact Report for Mossdale Landing East. January 30. Prepared by InSite Environmental, Inc.

d. City of Lathrop. 2004. Draft Environmental impact Report for the CLSP (CLSP). SCH# 2003072132. July. Prepared by EDAW. AND City of Lathrop. 2004. Final Environmental impact Report for the CLSP (CLSP). SCH# 2003072132. October. Prepared by EDAW.

e. City of Lathrop. 2004. Addendum the Environmental Impact Report for the City of Lathrop Wastewater Recycling Plant No. 1 (SCH#2001122108) relative to the Nurisso Road Recycled Water Storage Ponds. November 17. Prepared by InSite Environmental, Inc.

f. City of Lathrop. 2005. Addendum to the City of Lathrop Water, Wastewater, and Recycled Water Master Plan Environmental Impact Report. December 14. Prepared by EDAW.

g. City of Lathrop. 2006. Addendum the Environmental Impact Report for the City of Lathrop Wastewater Recycling Plant No. 1 (SCH#2001122108) relative to the Frewert Road Recycled

Water Storage Pond. May 5. Prepared by InSite Environmental. Prepared by InSite Environmental, Inc.

h. City of Lathrop. 2002. Draft Subsequent Environmental Impact Report for the River Islands at Lathrop Project. Volume 1a. (SCH#1993112027). October 16. AND Prepared by EDAW. AND City of Lathrop. 2003. Draft Subsequent Environmental Impact Report for the River Islands at Lathrop Project. Volume 1a. #1993112027). January 22.
Prepared by EDAW

i. City of Lathrop. 2014. CLSP Environmental Impact Report Addendum II (SCH#2003072132). March. Prepared by Ascent.

j. City of Lathrop. Initial Study for River Islands Disposal Fields Expansion. 2004. November. Prepared by the City of Lathrop Public Works Department.

k. City of Lathrop. 2014. River Islands at Lathrop Project Subsequent Environmental Impact Report Addendum IV. SCH#1993112027. Prepared by Ascent.

Table D-3: Existing and Planned Landscape Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN(s)**	**Acres**	**Land Development Area**	**Land Use**	**Phase**	**Project Level CEQA Completed [1]**
L01	191-220-35; 191-220-17	3.38	CLSP [2]	Park	Planned	a, d
L02	191-22015	7.80	CLSP [2]	K-8(2)	Planned	d
L03	191-22017	3.38	CLSP [2]	Park	Planned	d
L04	191-21032	11.10	CLSP	Park	Planned	d
L05	191-21032; 191-210-07; 191-210-33; 191-210-07; 191-210-33; 191-210-23; 191-210-17	3.38	CLSP	Park	Planned	d
L06	191-210-05	3.75	CLSP	Park	Planned	d
L07	191-210-23	3.75	CLSP	Park	Planned	d
L08	191-210-32	3.36	Mossdale	Park	Planned	a, b, d
L09	Right of Way	0.05	Mossdale	Median	Planned	a, d
L10	Right of Way	0.21	CLSP	Parkway	Planned	a, b, d
L11	Right of Way	0.74	Mossdale	Parkway	Planned	b
L12	Right of Way	0.05	Mossdale	Median	Planned	b
L13	Right of Way	0.45	Mossdale	Parkway	Planned	c
L14	191-330-09	6.00	Mossdale	Park	Planned	a, b
L15	Right of Way	0.10	Mossdale	Parkway	Planned	b
L16	Right of Way	0.23	Mossdale	Parkway	Planned	b
L17	Right of Way	0.04	Mossdale	Median	Planned	b
L18	Right of Way	0.26	Mossdale	Parkway	Planned	b
L19	191-540-61	1.20	Mossdale	Park	Planned	b
L20	191-350-04	6.20	Mossdale	Park	Planned	a, b
L21	Right of Way	0.29	Mossdale	Parkway	Planned	b

Table D-3: Existing and Planned Landscape Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN(s)**	**Acres**	**Land Development Area**	**Land Use**	**Phase**	**Project Level CEQA Completed [1]**
L22	191-210-17	3.38	Mossdale	Park	Planned	b
L23	Right of Way	0.14	Mossdale	Parkway	Planned	b
L24	Right of Way	0.91	Mossdale	Parkway	Planned	b
L25	Right of Way	0.04	Mossdale	Median	Planned	b
L26	Right of Way	0.40	Mossdale	Median	Planned	b
L27	191-360-68	0.75	Mossdale	Park	Planned	b
L28	Right of Way	0.32	Mossdale	Parkway	Planned	b
L29	Right of Way	0.34	Mossdale	Parkway	Planned	b
L30	Right of Way	0.10	Mossdale	Median	Planned	b
L31	Right of Way	0.09	Mossdale	Median	Planned	b
L32	Right of Way	0.04	Mossdale	Median	Planned	b
L33	191-380-67	1.05	Mossdale	Park	Planned	b
L34	Right of Way	0.06	Mossdale	Median	Planned	a
L35	Right of Way	0.10	Mossdale	Median	Planned	b
L36	Right of Way	0.10	Mossdale	Median	Planned	b
L37	Right of Way	0.03	Mossdale	Median	Planned	b
L38	Right of Way	0.09	Mossdale	Parkway	Planned	a
L39	Right of Way	0.37	Mossdale	Parkway	Planned	a
L40	Right of Way	0.28	Mossdale	Parkway	Planned	b
L41	Right of Way	0.18	Mossdale	Median	Planned	b
L42	Right of Way	0.31	Mossdale	Parkway	Planned	b
L43	191-190-32; 191-190-33	5.50	Mossdale	Pond Berm	Planned	a, b
L44	Right of Way	2.30	Mossdale	Park/Median	Planned	a, b

Table D-3: Existing and Planned Landscape Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN(s)**	**Acres**	**Land Development Area**	**Land Use**	**Phase**	**Project Level CEQA Completed [1]**
L45	241-0020-52	2.10	Mossdale	Pond Berm	Planned	a, b
L46	198-060-16	3.00	Not Applicable [3]	Pond Berm	Planned	e
L47	213-300-06	0.30	River Islands	Median	Planned	h
L48	213-300-06	6.00	River Islands	Park	Planned	h
L49	213-300-06	1.60	River Islands	Park	Planned	h
L50	213-300-06	0.20	River Islands	Median	Planned	h
L51	213-300-06	0.40	River Islands	Park	Planned	h
L52	213-300-06	0.40	River Islands	Park	Planned	h
L53	213-300-06	15.00	River Islands	Park	Planned	h
L54	213-300-06; 213-310-10	0.20	River Islands	Median	Planned	h
L55	213-300-06	0.50	River Islands	Median	Planned	h
L56	213-300-06	0.10	River Islands	Median	Planned	h
L57	213-300-06	0.40	River Islands	Median	Planned	h
L58	213-300-06	0.40	River Islands	Median	Planned	h
L59	213-300-06	1.50	River Islands	Median	Planned	h
L60	213-300-06	2.70	River Islands	Park	Planned	h
L61	213-300-06	1.20	River Islands	Median	Planned	h
L62	213-300-06	1.10	River Islands	Median	Planned	h
L63	213-300-08; 213-300-09; 213-300-11; 213-300-07; 213-300-06; 213-310-10	2.10	River Islands	Park	Planned	h
L64	213-310-10	0.40	River Islands	Median	Planned	h
L65	213-310-10	1.90	River Islands	Park	Planned	h
L66	213-310-10	2.00	River Islands	Park	Planned	h

Table D-3: Existing and Planned Landscape Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	APN(s)	Acres	Land Development Area	Land Use	Phase	Project Level CEQA Completed [1]
L67	213-310-10; 213-310-09	2.30	River Islands	Park	Planned	h
L68	213-310-10	0.40	River Islands	Median	Planned	h
L69	213-310-10	0.90	River Islands	Park	Planned	h
L70	213-310-10; 213-310-08	2.50	River Islands	Park	Planned	h
L71	213-310-09	0.40	River Islands	Median	Planned	h
L72	213-310-09; 213-310-08	2.30	River Islands	Park	Planned	h
L73	213-310-09	2.00	River Islands	Park	Planned	h
L74	213-310-08	6.00	River Islands	Park	Planned	h
L75	213-310-08; 213-310-10	0.10	River Islands	Median	Planned	h
L76	213-310-10	0.50	River Islands	Median	Planned	h
L77	213-220-02	2.80	River Islands	Park	Planned	h
L78	213-220-02; 213-310-08	0.50	River Islands	Median	Planned	h
L79	213-230-05	1.10	River Islands	Park	Planned	h
L80	213-230-05	0.80	River Islands	Median	Planned	h
L81	213-230-06	4.40	River Islands	Park	Planned	h
L82	213-230-01	34.00	River Islands	Park	Planned	h
L83	213-220-02	1.10	River Islands	Park	Planned	h
L84	213-310-08	2.20	River Islands	Park	Planned	h
L85	191-200-13; 191-210-05	0.94	CLSP	Median	Planned	d
L86	191-200-13; 191-210-05	1.37	CLSP	Parkway	Planned	d
L87	191-200-13; 191-210-05	2.50	CLSP	Open Space	Planned	d
L88	191-220-42	0.44	CLSP	Median	Planned	d
L89	191-220-42	0.64	CLSP	Parkway	Planned	d

Table D-3: Existing and Planned Landscape Irrigation Use Areas Source: Tentative Waste Discharge Requirements R5-2016-0028-01						
Site ID	**APN(s)**	**Acres**	**Land Development Area**	**Land Use**	**Phase**	**Project Level CEQA Completed [1]**
L90	191-210-04; 191-220-42	0.41	CLSP	Median	Planned	d
L91	191-210-04; 191-220-42	0.96	CLSP	Parkway	Planned	d
L92	191-210-05	1.28	CLSP	Median	Planned	d
L93	191-210-05	1.82	CLSP	Parkway	Planned	d
L94	191-210-05	1.50	CLSP	Open Space	Planned	d
L95	191-210-05	0.13	CLSP	Median	Planned	d
L96	191-210-05	1.29	CLSP	Parkway	Planned	d
L97	191-210-05; 191-210-04	1.43	CLSP	Parkway	Planned	d
L98	191-200-13	1.11	CLSP	Parkway	Planned	d
L99	191-200-13	1.05	CLSP	Parkway	Planned	d
L100	191-210-05; 191-210-04	1.71	CLSP	Parkway	Planned	d

[1] Corresponding environmental documentation:

a. City of Lathrop. 2002. Draft Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. December 31. Prepared by EDAW. AND City of Lathrop. 2003. Final Environmental Impact Report for the Lathrop Water Recycling Plant No. 1 Phase 1 Expansion Project. February 28. Prepared by EDAW.

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