APPENDIX E

Wastewater Treatment / Reclamation Alternatives Study, Technical Memorandum No. 1

ATKINS

FINAL

Rainbow Municipal Water District

Wastewater Treatment / Reclamation Alternatives Study Technical Memo No. 1

September 2015

FINAL

RAINBOW MUNICIPAL WATER DISTRICT

Wastewater Treatment / Reclamation Alternatives Study Technical Memo No. 1

September 2015

Prepared for:
Rainbow Municipal Water District
3707 Old Highway 395
Fallbrook, California 92028

Prepared by:

ATKINS
3570 Carmel Mountain Road, Suite 300
San Diego, California 92130
Atkins Project No.: 100044880

in association with:
Dudek
Gillingham Water
West Coast Civil

Mark B. Elliott, P.E.
Project Engineer

Contents

Tables

Figures

Abbreviations

AFY	acre feet per year
ASP	activated sludge processes
CIP	Capital Improvement Program
City	City of Oceanside
CWA	San Diego County Water Authority
District	Rainbow Municipal Water District
EDU	equivalent dwelling units
gpm	gallons per minute
I-15	Interstate 15
IPR/DPR	Indirect Potable Reuse/Direct Potable Reuse
LS 1	Lift Station 1
MBR	Membrane Bioreactors
mg/L	milligram per liter
mgd	million gallons per day
MLSS	mixed liquor concentrations
MWD	Metropolitan Water District of Southern California
O&M	operations and maintenance
PDWF	peak dry weather flow
PWWF	peak wet weather flow
RO	reverse osmosis
SLRWRF	San Luis Rey Waste Reclamation Facility
SR-76	State Route 76
SWP	State Water Project
TDS	Total Dissolved Solids
TM	Technical Memorandum
WRF	water recycling facility

1.0 Introduction

Rainbow Municipal Water District (District) is embarking on a 2015 Water and Sewer Master Plan Update during a period of remarkable challenge and opportunity for the District. The decline in water demands and wastewater generation rates, increasing wholesale water rates and wastewater disposal costs, new residential and commercial development poised along the Interstate 15 (I-15) corridor at State Route 76 (SR-76), and heightened scrutiny of the efficiency of the District's operations and charges, together set the stage for the 2015 Master Plan Update.

There is potential for a District-controlled wastewater reclamation plant that economically off-loads the District's reliance on treatment in the City of Oceanside, while simultaneously producing a beneficial new local water supply. There is also the potential for up to $100 million in new water and sewer capacity fees from proposed San Diego County development to help fund a new treatment plant and develop new local water supplies.

This Technical Memorandum (TM No. 1) evaluates these inter-related wastewater and water supply issues and sets the course for planning a new long range Capital Improvement Program (CIP) for wastewater, water, and recycled water infrastructure.

1.1 Summary

Two fundamental wastewater treatment and disposal alternatives are compared:

- **No Project Alternative:** All wastewater generation (current + new developments) is conveyed to Oceanside, with the District continuing to pay Oceanside's billed costs for operations, maintenance, and capital replacement, and additional treatment capacity rights are acquired at San Luis Rey Water Reclamation Facility (SLRWRF). No recycled water is supplied to the District.

- **District Plant Alternative(s):** All or a portion of the future wastewater flows are collected at a District-controlled wastewater reclamation plant, producing a new local supply of recycled water for service to agriculture users and nurseries. District reliance on Oceanside facilities is reduced or eliminated.

A summary of capital and annual operating costs is provided in Table 1-1 below, including a brief synopsis of the District's exposure to risk and uncertainties in implementing each alternative. The District-controlled preferred alternative includes a 0.9 mgd plant located near the District office at I-15 and SR-76.

Detailed cost analysis of each alternative, cost assumptions, and cost sensitivity analyses are presented in **Section 5.0**.

Table 1-1 Comparison of Wastewater Treatment Alternatives				
Alternative	**Capital Cost (Million $)**	**Annual Cost (Million $)**	**Present Worth Cost (Million $)**	**Risk Elements**
No Project	32	1.72	76	• Potential future cost liability for SLR Plant, land outfall, and ocean outfall improvements • No local water supply developed • Requires acquisition of additional future capacity
District Plant	36	1.88	84	• Higher capital costs • Treatment facility staff to operate and maintain • Relies on strong housing market for new revenues • Environmental impacts with siting a wastewater plant • Recycled water system requires grant and/or subsidy funding to be cost-feasible to District. • Potential Oceanside buy back of capacity from Rainbow

1.2 Study Objectives

The District staff and consultant team collaborated early on to develop key success factors and benefits for the Wastewater Treatment/Reclamation Alternatives Study. These include:

1. **Serve as key a North San Diego County Environmental Steward in sustainability.** Reduce treatments costs to Oceanside and reduce ocean disposal.
2. **Provide for a new short-term Recycled Water Supply.** Develop reliable source of local water supply and future plan for Indirect Potable Reuse/Direct Potable Reuse (IPR/DPR).
3. **Save key local Agriculture Businesses due to rising water costs.** Provide drought-proof supply for major agriculture users and nurseries.
4. **Support the County's General Plan and Building Industry during the drought with a water supply offset program.** Serve as a possible water supply offset mitigation plan.

These objectives will serve to guide the team through the initial feasibility planning effort. The following section describes our detailed scope of services for the Wastewater Treatment/Reclamation Alternative Study (TM No. 1).

1.3 Wastewater Treatment/Reclamation Alternatives Study

TM No. 1 consists of the following scope elements:

- Review existing studies/reports on water supply and water and wastewater master planning for studies that have been completed and projects that have been constructed since 2006. Focus will be given to Addendum 1, Wastewater System Expansion Alternatives Analysis, in the 2006 Master Plan *(Dudek).*
- Review projected development within the District and its surrounding areas of influence. The development review is critical to projecting wastewater flows for use in the wastewater treatment study and the water and wastewater models that will support the 2015 Master Plan Update.

- Prepare a thorough evaluation of the potential demand for recycled water within the District. The assessment will involve quantitative and spatial analysis of existing irrigation and agricultural customers that would be eligible to participate in a recycled water system. The assessment will also address the role of development in potential recycled water demands and will propose alternative backbone systems for providing recycled water to potential customers.
- Prepare a feasibility analysis of a District-owned wastewater reclamation plant. The analysis will include an estimate of logical plant capacities, a brief evaluation of sites to optimize wastewater flows collected, a conceptual facilities layout, identification of reuse opportunities, and estimate of construction and operation and maintenance costs.
- Develop a maximum of three treatment capacity scenarios based upon potential development within and adjacent to the District. Compare the alternatives available based on a preliminary life-costs analysis and provide a recommendation regarding a District-owned reclamation plant and City of Oceanside treatment and disposal for the 2015 Master Plan Update.

2.0 Wastewater System Overview

The District is responsible for providing sewer service to over 2,150 customers throughout its sewer service area. The sewer service area is a small portion of the overall service area which encompasses over 7,800 potable water customers, with large agricultural water demands. The sewer service area along with the District boundary is shown on **Figure 2-1.**

Sewer customers currently generate an average dry weather wastewater flow of approximately 0.7 million gallons per day (mgd). The resulting unit sewer generation is approximately 325 gpd per connection. This high of a sewer generation rate is believed to be attributed to large single family homes and high occupancy, as well as infiltration in portions of the sewer interceptor system that are near the San Luis Rey River groundwater basins. Sewer flows are conveyed through a gravity collection system of pipes, six sewer lift stations and nearly two miles of force main, located throughout the sewer service area. This collection system conveys wastewater west out of the District and ultimately to the SLRWRF, located in Oceanside.

Several alternative locations throughout the District have been analyzed for potential wastewater reclamation plant sites based on the ability to collect existing and future flows. Those sites primarily include an area near I-15 and SR-76, including both the Meadowood development plant site and one near the District offices. A plant site was also considered downstream near Lift Station 1 and near Lift Station 2. Sizing of the initial plant capacity is dependent upon the amount of wastewater available for collection and treatment. Total existing wastewater flow tributary to each of the potential reclamation plant sites are presented below in **Table 2-1**. The existing flows represent a potential design flow at start-up assuming no major development activity has occurred. Location of each of the potential plant locations is included in **Section 3.0** and shown on **Figures 3-1** through **3-5**.

In addition to the quantity of flow currently available for initial phase of a reclamation plant, quality of the wastewater available is also essential to the feasibility. Wastewater quality will directly impact the quality of the effluent of the reclamation plant. The majority of recycled water customers within the District are agricultural customers, many of whom have critical thresholds for certain water quality constituents. Of particular concern with many nurseries and growers is Total Dissolved Solids (TDS). Total dissolved solids in irrigation supply can impact crop production, specifically avocados. TDS is also of concern because traditional treatment methods do not substantially reduce the TDS concentration.

Table 2-1 Existing Wastewater Flow Location Tributary Wastewater Flows

Tributary Location	Average Daily Water Flow (gpm)	Average Daily Water Flow (mgd) (2)
Meadowood Site	47	0.07
Near District Office	138	0.20
Lift Station 1	440	0.63
Lift Station 2 (1)	468	0.67

(1) Lift Station 2 is also considered for pumping flow back to a potential plant
(2) Average flow for the entire system is currently 0.69 mgd

The District receives its water supply from the Metropolitan Water District of Southern California (MWD) and San Diego County Water Authority (CWA) aqueduct systems. Filtered potable water from the Lake Skinner filtration plant is delivered to the District through multiple pipeline systems. The sources of the water treated at the Lake Skinner filtration plant are from the State Water Project (SWP) and from the Colorado River. Due to ongoing severe drought currently affecting the State of California, deliveries to MWD and CWA have consisted primarily of Colorado River water, which contains a much higher TDS level than does the SWP supply. **Table 2-2** presents annual average TDS levels for the District's supply and for the District's wastewater for the past six years.

Table 2-2 Potable Water versus Wastewater TDS Concentrations

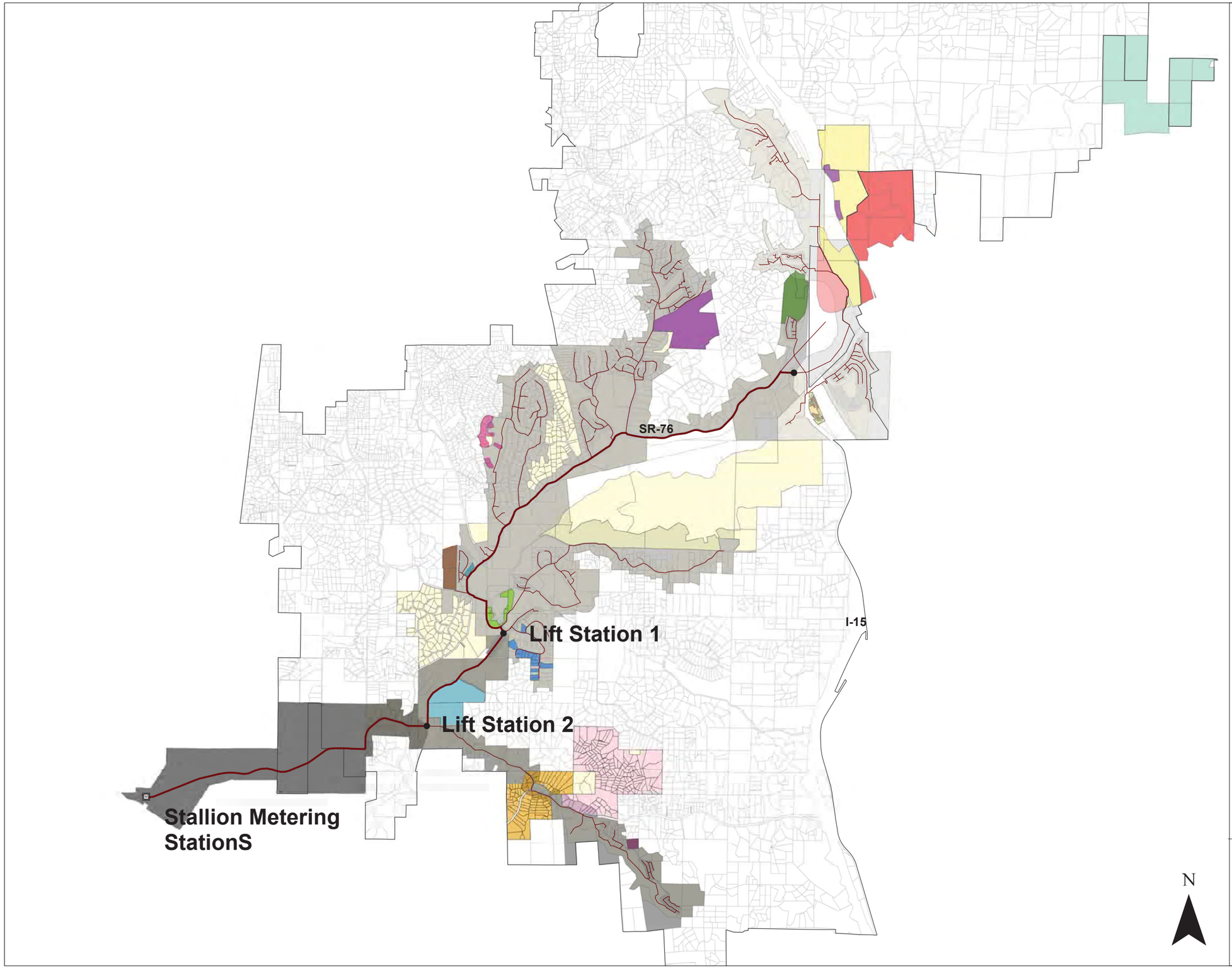
Calendar Year	Potable Water TDS (mg/L)	Wastewater TDS (mg/L)	TDS Increase (mg/L)
2008	541	981	440
2009	596	998	402
2010	563	954	391
2011	413	905	492
2012	386	807	421
2013	477	871	394
Average	496	919	423

TDS = total dissolved solids, mg/L = milligram per liter

As the table shows, typical TDS increases from potable water to wastewater range from 400 to 500 mg/L. Additionally, as mentioned previously, the more recent deliveries have been primarily Colorado River water and TDS of those deliveries has been consistently above 600 mg/L, meaning wastewater TDS levels may be well above 1000 mg/L.

2.1 Existing System Capacity, Conveyance and Pumping

The 2006 Wastewater System Master Plan *(Dudek)* and updates to that plan completed since then have all recognized that there are existing and potential additional future capacity constraints within the District's wastewater conveyance system. Capacity constraints exist both within the gravity system as well as the lift stations. In recent years the District has begun addressing these issues, upsizing two sections of trunk sewer totaling 2.3 miles in length and upgrading capacity at Lift Station 2. Several additional upgrades to the system have been identified for either the near or long term capacity of the system. Upgrades recommended that have not yet been completed are detailed in **Table 2-3**.



Legend

- Metering Station
- Lift Stations
- Existing Sewerlines
- Existing Trunklines
- District Boundary
- CPW
- Dulan
- Golf Green
- HCR
- Hidden Hills
- Lake Vista Estates
- Leatherbury
- Malabar Ranch
- Meadowood
- Morris Ranch
- Olive Hill Estates
- Pala Mesa Highlands
- Passarelle
- Polo Club
- Silver Holdings
- VVCC
- Warner Ranch
- Vessels

Sewer Subbasins

- Tributary to Stallion Metering Station
- Tributary to Lift Station 2
- Tributary to Lift Station 1
- Tributary to District Office Site (Vicinity)

5,000 2,500 0 5,000 Feet

N

Rainbow Sewer Service Area & Planned Developments

Figure 2-1
September 2015

This page intentionally left blank.

Table 2-3 shows the need for an estimated 8.3 miles of major gravity sewer as well as lift station upgrades. Additional upgrades to sewer mains and smaller trunks have also been recommended and are not included in **Table 2-3**. The District estimates that the cost to upgrade only the Outfall Sewer system to Oceanside to be approximately $14 million dollars including soft costs and contingencies.

Table 2-3 Recommended Pipeline and Lift Station Capacity Upgrades

Pipeline/Facility	Capacity Constraint	Capacity Constraint Timeframe	Detail
Lift Station 1	PWWF	Existing	Replace existing and increase to 2,700 gpm
Lift Station 1 Force Main	PWWF	Existing	Upsize from 10-inch to 12-inch force main
Trunk Sewer from Sweetgrass Lane to Lift Station 1	PDWF	Existing	Upsize approximately 10,000 feet of pipe from 12-inch to 18-inch (within SR-76)
Trunk Sewer from Lift Station 1 to Lift Station 2	PWWF	Existing	Upsize approximately 7,500 feet of pipe from 12-inch to 18-inch
Outfall Sewer from Lift Station 2 to Stallion Meter	PWWF	Existing	Upsize approximately 16,000 feet of pipe from 15-inch to 30-inch
Plant B Lift Station[(1)]	PWWF	Existing	Upgrade by Developers
Plant B Force Main	PWWF	Existing	Upgrade by Developers
Trunk Sewer North and East of Lift Station 1	PDWF	Future	Upsize approximately 4,400 feet of pipe from 8/10/12-inch to 12/15-inch
Sewer Main North of Plant B Lift Station	PDWF	Future	Upsize approximately 7,700 feet of 12-inch to 15-inch

[(1)] Campus Park developer designed new lift station at SR-76 and Pankey Road to replace Plant B Lift Station.

2.2 Oceanside Agreement

The District has rights to 1.5 mgd of sewer treatment and disposal capacity at the SLRWRF, a plant owned and operated by the City of Oceanside. The District's rights to said capacity are defined by an agreement between the City of Oceanside and the District from 2006. The purpose of that agreement is to provide for the construction, operation, maintenance and replacement of the wastewater system serving the respective parties, and to define financial obligations of the two parties relative to those capital and annual costs.

The City of Oceanside is the defined owner of the wastewater facilities, including any future additions or other facilities constructed as a result of the agreement. All decisions with respect to planning, design, construction, operation and maintenance of the facilities are under the sole purview of the City. The District only retains the contractual right to use the system in accordance with the said agreement. The City is obligated to operate the facilities in an economical and efficient manner, maintain the facilities in good repair, and comply with existing and future regulatory requirements.

At present, the District has rights to 1.5 mgd of the 13.5 mgd plant capacity (11.1 percent). As such, the District is responsible for 11.1 percent of the City's construction cost for plant improvements and betterment, including the collection system, pump stations, land outfall, and ocean outfall associated with the plant. The defined 1.5 mgd capacity right applies to all facilities equally. Within the collection system, there are a series of reaches with defined capacity rights based on tributary flow. The District maintains rights to 10 percent of the first reach and 58.25 percent of the second reach. The District has rights to 100

percent of the third reach. The Stallion Metering Station is the point of delivery between the District and City collection systems.

The agreement defines the limitations on the type and quality of wastewater that can be discharged to the SLRWRF and associated facilities. In general, these limitations include a Biological Oxygen Demand of less than 250 mg/L, Total Dissolved Solids of less than 1,200 mg/L, and Total Suspended Solids of less than 250 mg/L. Discharge of volatile organic compounds, heavy metals and other chemical constituents are also limited by the agreement. The quantity of wastewater is limited to a maximum of 1.5 million gallons in a 24-hour period, as measured over a ten day or more period for any three consecutive calendar days. The District is required to pay a penalty of 7.5 times the current unit cost for capacity, transmission and treatment if flows exceed the agreement limitations.

The agreement defines the various means and methods used to compute District cost on a monthly basis. The costs include both fixed and variable cost components. Billing to the District is projected at the beginning of each year based on the City's projected capital and operational costs. The District pays these costs on a monthly basis, with a reconciliation based on actual costs at the end of each fiscal year. In most years, the District receives a credit at the end of the year for overpayment of cost based on the initial cost projections. However, in the event of unforeseen cost events, the District is obligated to participate in all costs incurred at the end of the fiscal year. Interest charges are accrued at a rate of 10 percent per year on any unpaid balance. The City also charges the District an administrative cost of 2.7 percent of the District's identified charges.

2.3 Provisions for District Recycling and for Sell Back of Surplus Capacity

The agreement does not restrict the District from recycling its wastewater nor mandate any discharge quantity from the District. However, as the agreement is based on capacity rights, the District remains responsible for all capital costs based on its capacity right percentage, regardless of the amount of wastewater that is discharged. The aforementioned administrative cost also applies, as well as certain fixed operational costs. At present, based on current capacity rights and discharges, the District is experiencing an average operational cost of approximately $72,000 per month and approximate annual capital costs of approximately $500,000 per year.

The agreement does not address any rights of the District or procedures by which the District could sell back surplus capacity to the City or other parties. This issue is addressed further in **Section 3.2.5**.

2.4 Planned Development

Significant development is anticipated to occur within the I-15 corridor within and directly adjacent to the District's boundaries, largely within the I-15 and SR-76 corridor. Much of this development will be large scale production of single and multi-family homes as well as various commercial developments to support the new residential developments. Much of the District is characterized by low-density development in sparsely populated areas which necessitates the use of septic tanks for treatment of wastewater generated. Much of the new development, however, is anticipated to be higher density, and therefore will be required to be sewered. **Table 2-4** shows the current list of planned or entitled developments, including the type of development and the number of equivalent dwelling units (EDUs) anticipated from each development. Timeframes for the developments listed will vary, however, the majority of those listed are anticipated to be constructed by 2030.

Many of the larger developments noted in **Table 2-4** may require recycled water service were the District to build a reclamation plant and produce recycled water. Additional information regarding the requirements and availability of recycled water to the proposed developments is included in **Section 4.0.**

Table 2-4 Planned Developments and Sewer Flows by Basin

Proposed Reclamation Plant Site Basin [1]	Proposed Development	Proposed EDUs	Development Type	Projected Sewer Flow (mgd)
District Office (I-15/SR-76)	Meadowood[2]	850	Single Family	0.28
	Horse Creek Ridge	751	Single Family	0.14
	Campus Park West	538	Mixed	0.19
	Pala Mesa Highlands (Beazer)	130	Single Family	0.03
	Horse Creek Ridge Business Center	100	Commercial	0.05
	Palomar College	100	Commercial	0.05
	Dulan	51	Single Family	0.01
	Subtotal	2,520		0.73
Lift Station 1	Vessels	400	Single Family	0.09
	Golf Green Estates	94	Single Family	0.02
	Leatherbury	85	Single Family	0.02
	Bonsall Condos	76	Single Family	0.01
	Olive Hill Estates	37	Single Family	0.01
	Subtotal	692		0.15
Lift Station 2	Polo Club	156	Single Family	0.03
	Morris Ranch	89	Single Family	0.02
	Hidden Hills	53	Single Family	0.01
	Subtotal	298		0.07
	Total	**3,510**		**0.95**
Warner Ranch[3]		780	Mixed	0.31

EDU = equivalent dwelling units

(1) The "Basin" for each proposed plant site includes those developments tributary directly to only that location. All developments tributary to the District Office site are also tributary to the Lift Station 1 site, but reach the District Office first and directly.

(2) The Meadowood development is within the Valley Center Municipal Water District and may pursue an Out of Service Sewer Agreement with the District.

(3) Warner Ranch is not included in the analysis.

2.5 Future Sewer Flows

Upgrades and expansions to the wastewater system will be required as planned development comes online, and water demands and sewer flows within the system increase significantly. Sewer flows are of particular concern because the anticipated increases represent as much as a doubling of the current level of flow, whereas the increase in flow through the water infrastructure is small in comparison to the current flow. As shown in **Table 2-3** and already discussed, the District is already aware of a substantial number of upgrades to their existing infrastructure that are needed currently or will be triggered by development. **Table 2-4** includes the anticipated developments and their projected sewer flow, organized

by the proposed reclamation plant basin locations. The total increases in flow anticipated in each reclamation plant basin as well as the total future flow in each basin are shown included in **Table 2-5**.

Warner Ranch, a large development outside of the District's service area, which is included above in **Table 2-4**, is not included in the feasibility analysis.

Table 2-5 Projected 2030 Sewer Flows by Reclamation Plant Basin

Proposed Reclamation Plant Site Basin	Project Flow Increase (mgd)	Projected Total Flow (mgd)
District Office (I-15/SR-76)	0.73	0.93
Lift Station 1	0.14	1.49
Lift Station 2	0.08	1.62

mgd = million gallons per day

3.0 Wastewater Reclamation Plant Evaluation

At present, the District conveys the entirety of the wastewater collected within its sewer service area to the City of Oceanside for treatment and disposal. Conveyance of wastewater to the City is governed by an inter-agency agreement prepared in February of 2006 titled *"An Agreement between the City of Oceanside, California and the Rainbow Municipal Water District for the Construction, Use, Maintenance, and Operation of Wastewater, Transmission, Treatment and Disposal Facilities."* The details of this agreement were discussed further in **Section 2.2** of this report.

In light of recent and ongoing drought conditions within southern California, the District has contemplated whether construction of its own water recycling facility (WRF) would be more cost effective than continued conveyance of wastewater flows to the City. A similar study was completed in the early 2000's, in which it was determined that the District would benefit substantially from recycling its wastewater and developing a drought-tolerant local water supply. Since that time, water demand has decreased significantly, and wastewater flows have decreased similarly. Therefore, the District must reevaluate the issue under current and future flow conditions (defined in **Section 2.0** of this report). Current wastewater generation combined with identified new development within the District forms the basis upon which the wastewater recycling analysis is completed.

3.1 Wastewater Treatment & Disposal Alternatives

As stated, the District currently conveys all of its wastewater to the City for treatment and ultimate disposal. As such, the District received no residual value from the wastewater stream as a local water resource. Wastewater conveyed to the City is subsequently available for recycling at the San Luis Rey Water Reclamation Facility (SLRWRF), thereby available for downstream uses. Under this operations scenario, the District loses its rights to a potential recycled water resource.

A series of available wastewater treatment and disposal alternatives were defined through discussions with District staff. These alternatives comprise wastewater treatment options available to the District, ranging from continuing to convey wastewater to the City to full treatment and use of the water resource within the District service area. The following alternatives were defined for further evaluation:

- **Alternative No. 1: No Project Alternative**. Under this alternative, the District would continue to convey wastewater generated within its service area to the SLRWRF for treatment and disposal. This alternative continues to be governed by the terms and conditions of the 2006 inter-agency agreement, thereby eliminating the potential for a local recycled water resource for revenue generation and reduction of imported water volumes (**Figure 3-1**).

- **Alternative No. 2: Construction of a New Treatment Facility near the District Office Site (I-15/SR-76)**. Under this alternative, the District could construct a 0.9-mgd WRF either on District property adjacent to its current office location or on a suitable site in the vicinity thereof. Construction of such a facility would reduce conveyance to the SLRWRF to approximately 0.72 mgd, thereby reducing capital, operation and maintenance obligations under the inter-agency agreement (**Figure 3-2**).

- **Alternative No. 2X: Construction of a New Treatment Facility near the District Office Site with Conveyance of LS 1 flows to the WRF**. Under this alternative, the District could construct a 1.5-mgd WRF at or near the District office site, with a companion 0.6-mgd lift station at the LS 1 site. Wastewater flow tributary to the LS 1 site is pumped to the new WRF for treatment. Construction of these facilities would reduce conveyance to the SLRWRF to approximately 0.12 mgd, thereby reducing capital, operation and maintenance obligations under the inter-agency agreement (**Figure 3-2X**).

- **Alternative No. 2XL: Construction of a New Treatment Facility near the District Office Site with Conveyance of LS 1 and LS 2 Flows to the WRF**. Under this alternative, the District could construct a 1.62-mgd WRF at or near the District office site, with companion 0.72-mgd and 0.12-mgd lift stations at or near the LS 1 and LS 2 sites, respectively. Wastewater flow tributary to the LS 2 site would be conveyed to the LS 1 site, and all flows tributary to the LS 1 site would be conveyed to the WRF for treatment. Construction of these facilities would eliminate conveyance to the SLRWRF, thereby eliminating capital, operation and maintenance obligations under the inter-agency agreement (**Figure 3-2XL**).

- **Alternative No. 3: Construction of a New Treatment Facility near the existing Lift Station 2 Site** Under this alternative, the District could construct a 1.5-mgd WRF at or near the District's existing Lift Station 1 (LS 1) site. Construction of such a facility would reduce conveyance to the SLRWRF to approximately 0.12 mgd, thereby significantly reducing capital, operation and maintenance obligations under the inter-agency agreement (**Figure 3-3**).[1]

These alternative define a series of progressive steps or phases by which the District may reduce or eliminate the need to continue its obligations under the 2006 inter-agency agreement with the City. As currently written, the 2006 inter-agency agreement defines the District's cost obligations based on the District's allocated capacity rights at the SLRWRF and the District's tributary wastewater flow and strength. As such, it will be necessary to renegotiate the terms of that agreement under any of the With Project alternatives to realize reduced costs relative to the agreement. If the District continues to maintain its current 1.5-mgd capacity rights, cost obligations under the agreement will remain unchanged with the exception of reduce flow and strength calculations. Reducing the District's capacity rights at the SLRWRF

[1] Note: A siting variation of this option would be to locate the plant near the LS 2 site, which may provide potentially more feasible sites with the recent closure of the San Luis Rey Golf Course.

through renegotiation of the 2006 agreement may result in avoided costs that can be subsequently applied to funding construction of its own WRF.

3.2 Wastewater Analysis Assumptions

As can be derived from the aforementioned alternatives, a variety of assumptions are required for analysis of each alternative. These assumptions, applied proportionately between the various alternatives, form the basis of a comparative analysis between the various options. Renegotiation of the 2006 Agreement with the City, future preliminary design efforts and other project refinements will further define project details. For the purposes of this analysis, the following assumptions were applied proportionately to evaluation of each of the previously identified wastewater treatment and disposal alternatives.

3.2.1 Treatment Plant Process

For treatment capacities up to approximately 2.0 mgd, two treatment processes are primarily applicable and found to be most cost effective including Membrane Bioreactor Systems and the Aero-Mod Treatment System. Although other treatment process options are available, the District has expressed a preference for these treatment processes based on past experience and the performance of other local treatment facilities of similar capacity. Selection of the preferred process between these two identified options depends on a variety of factors. The following discussions identify key considerations that differentiate the two treatment processes.

- **Membrane Bioreactors (MBRs):** The facilities operate on the same principle of other extended aeration activated sludge processes (ASPs). The difference between MBRs and conventional ASPs is in the design of the clarifiers. In the MBR facility, the conventional clarifier is replaced with membranes. The membranes act as a physical barrier, separating resulting treatment solids (sludge) from the treated wastewater. The MBR process does not rely on sludge settleability, which allows mixed liquor concentrations (MLSS) to be increased. Operating at higher MLSS concentration, coupled with the absence of large clarifiers, reduces the footprint of an MBR facility compared to that of a conventional ASP of equivalent capacity. MBRs require careful pretreatment to protect the sensitive membranes from damage. Operating costs are often higher for MBRs compared to conventional ASPs, and membrane replacement adds an additional cost component. However, MBRs produce very high quality effluent (no TSS, by definition) which makes this the preferable technology when contemplating recycling of the effluent for the purposes of creating a local water resource.

- **Aero-Mod System**: These facilities are also extended aeration ASPs. Aero-Mod facilities claim reduced footprint compared to conventional ASPs, primarily associated with its shared-wall design. The process requires no submersible pumps, with flow controlled by weirs and air-lift facilities. Aero-Mod employs an aeration scheme that allows for nitrification-denitrification in the same basin. Aero-Mod systems produce secondary effluent that is suitable for further treatment if reuse is desired. An Aero-Mod facility would likely be a less costly alternative to an MBR system, both in capital and O&M, but would require a significantly larger footprint.

After considering the merits of both options, Atkins selected the MBR process for the purposes of this analysis. This decision was primarily associated with the smaller footprint of the resulting facility and the ability to avoid potential odor production from a more conventional treatment process. Therefore, the MBR process was assumed in the evaluation of all identified treatment alternatives.

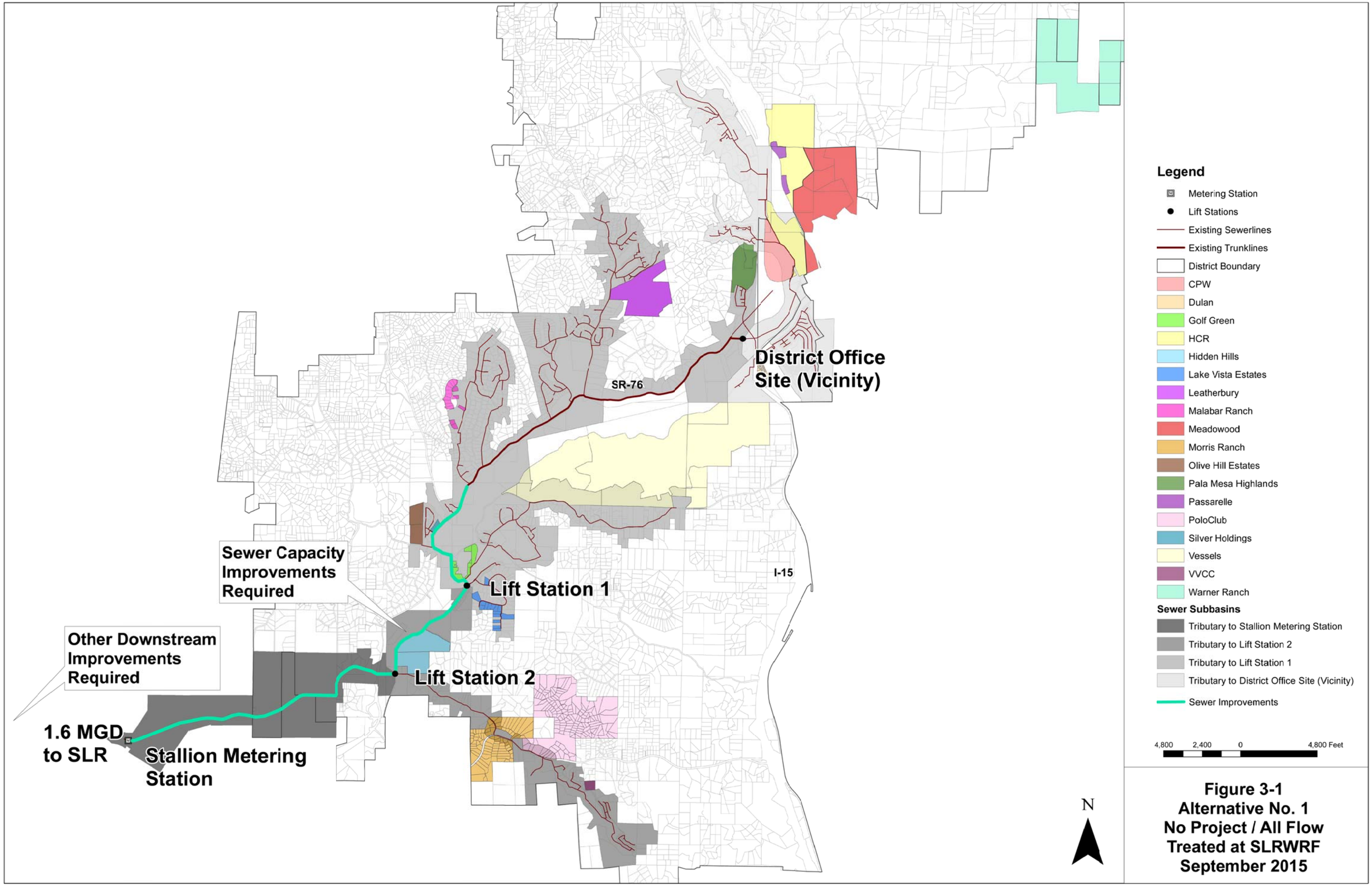


Figure 3-1
Alternative No. 1
No Project / All Flow
Treated at SLRWRF
September 2015

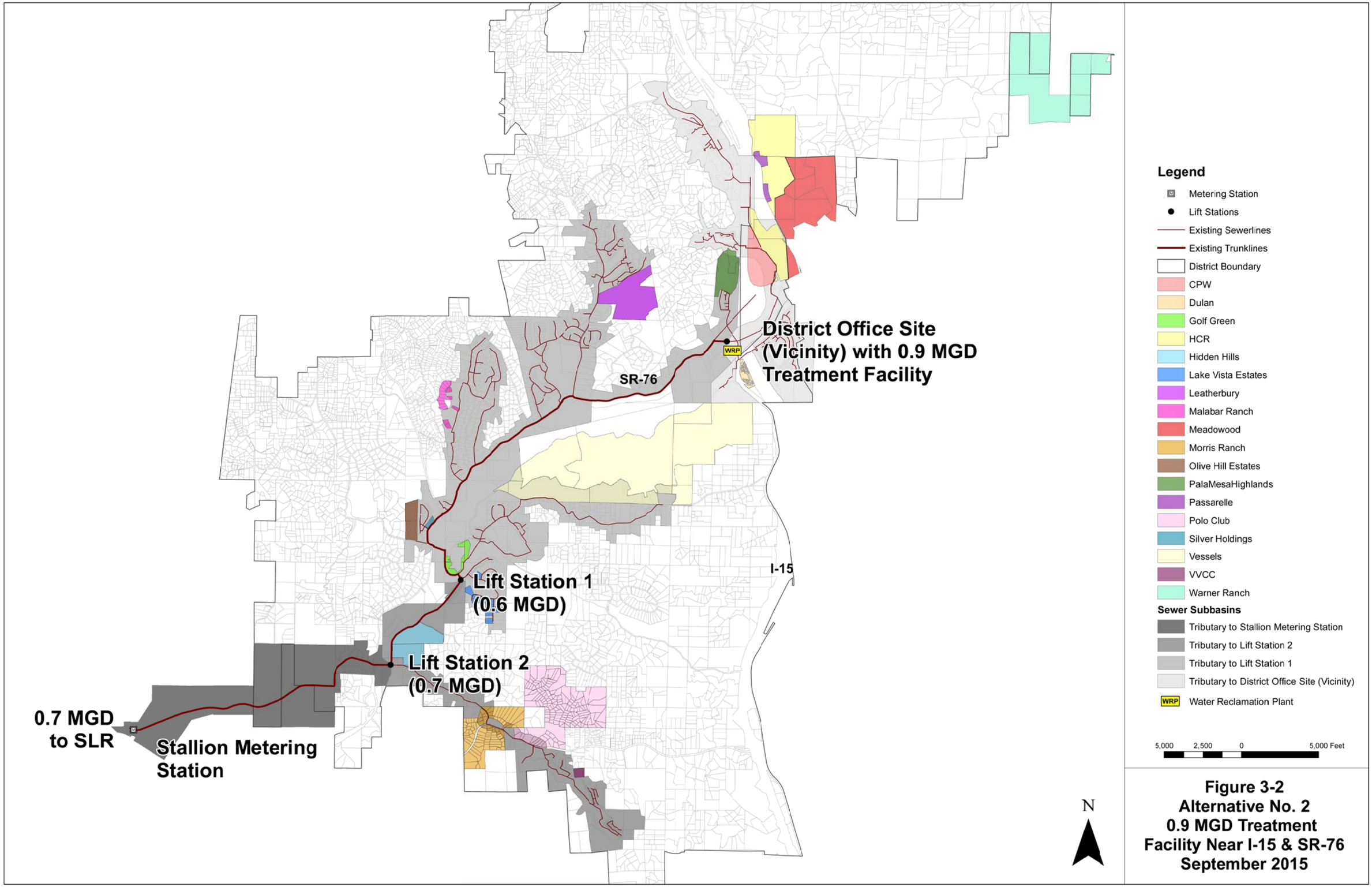


Figure 3-2
Alternative No. 2
0.9 MGD Treatment
Facility Near I-15 & SR-76
September 2015

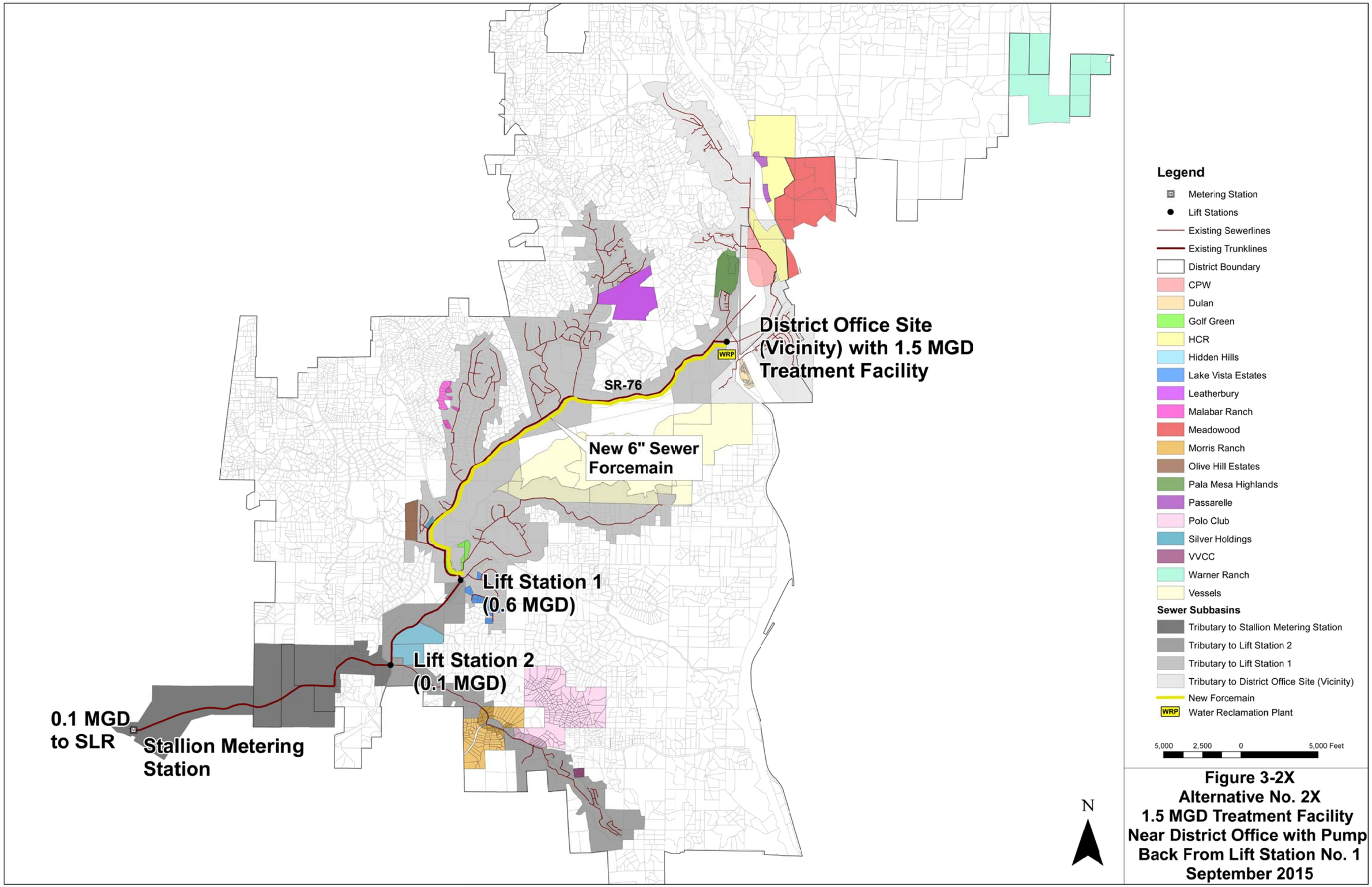


Figure 3-2X
Alternative No. 2X
1.5 MGD Treatment Facility
Near District Office with Pump Back From Lift Station No. 1
September 2015

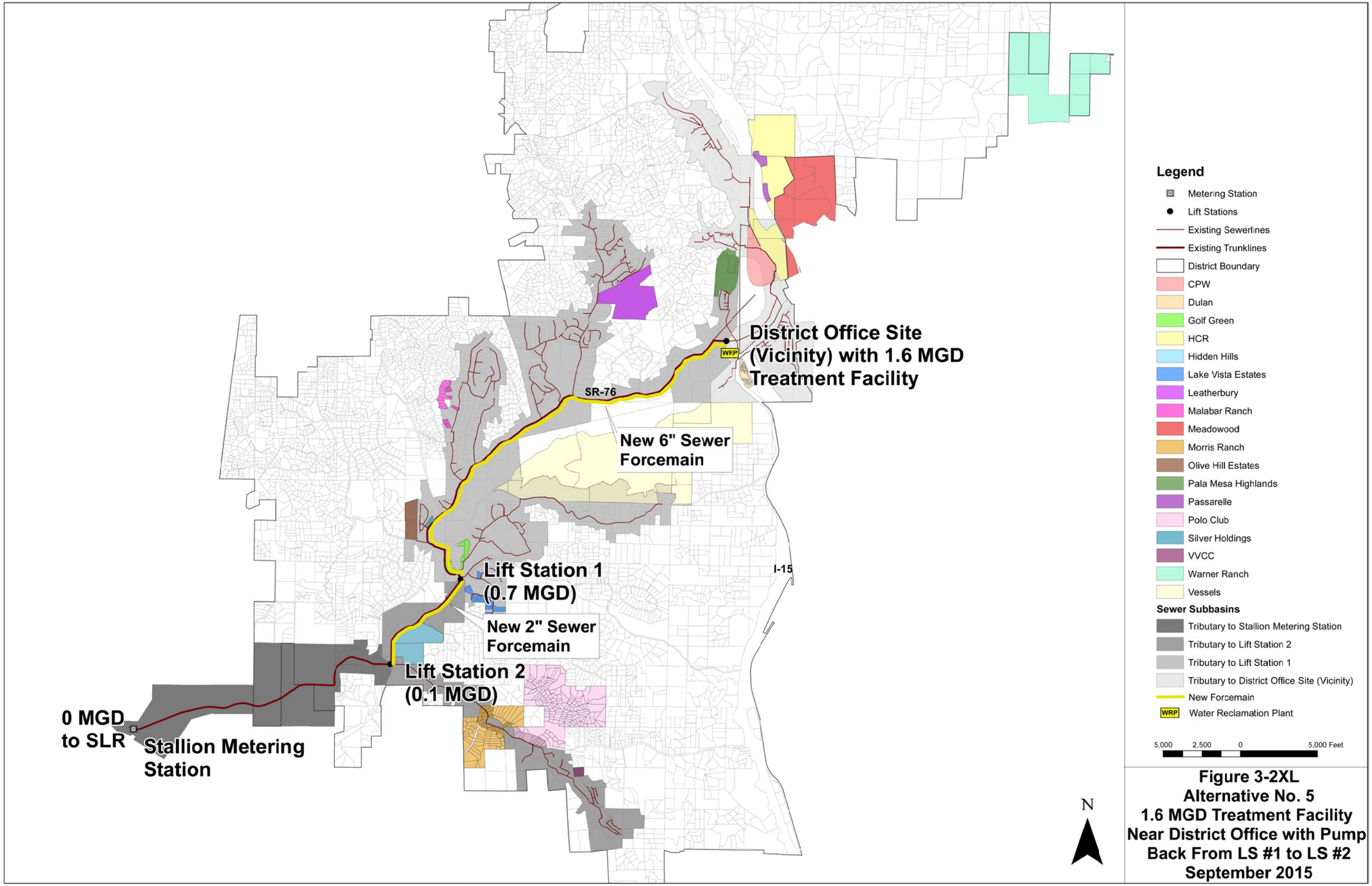


Figure 3-2XL
Alternative No. 5
1.6 MGD Treatment Facility
Near District Office with Pump
Back From LS #1 to LS #2
September 2015

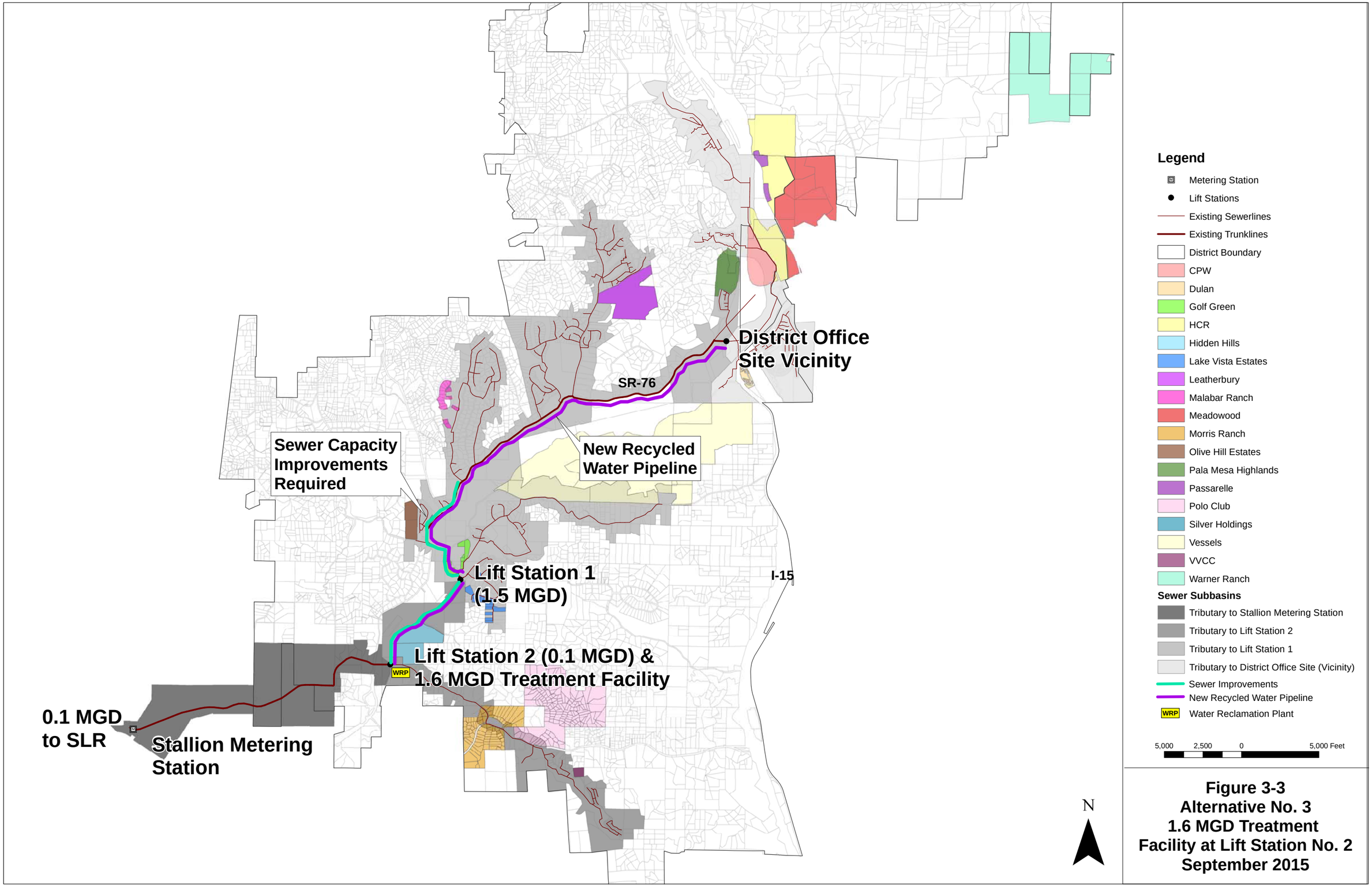


Figure 3-3
Alternative No. 3
1.6 MGD Treatment Facility at Lift Station No. 2
September 2015

This page intentionally left blank.

3.2.2 Solids Handling

Under current operations, solids resulting from the treatment process are handled at the SLRWRF. If the District constructs its own WRF, treatment and disposal of solids may be handled in primarily two ways.

- **SLRWRF Solids Handling**: The first method of handling solids could include continuing to discharge treatment solids to the existing conveyance system and continue to pay the City to treat and dispose of the solids. This option would require that the City maintain a proportionate capacity right within the SLRWRF based on the flow and strength discharged. Under this scenario, the flow tributary to SLRWRF would be very low and the strength would be very high.
- **District Solids Handling**: Alternatively, the District could construct solids handling at its new WRF, thereby eliminating the need for maintenance of such capacity at the SLRWRF. The smaller volume of solids produced at the District WRF would result in use of aerobic digestion for treatment of solids, minimizing the potential for odor production. The treated solids would be trucked off for disposal at an appropriate landfill site.

For the purposes of this analysis, it is assumed that the District will provide for solids handling at its new WRF, thereby eliminating the need for continued capacity at the SLRWRF for solids handling.

3.2.3 Capital, Operation & Maintenance Costs

The District has an extensive history of ongoing wastewater treatment and disposal costs under its agreement with the City. For the purposes of this analysis, these historical costs were assumed in the evaluation of alternatives involving continued conveyance to the SLRWRF. Capital improvement and betterment costs are projected based on historical costs based on recent City invoicing to the District.

With respect to a new WRF constructed by the District, local treatment plants of a similar capacity were consulted to define the annual capital and O&M costs associated with the proposed plant. Capital construction costs were derived from recent bidding results for plants of similar capacity and process.

3.2.4 Conveyance Requirements

The existing District conveyance facilities have a design capacity of approximately 1.0 mgd. Recent studies completed by the District identify required improvements to both pipeline and pump station facilities to accommodate the District's existing capacity right of 1.5 mgd at the SLRWRF. Therefore, for the purposes of this analysis, those recent studies were used to define needed improvements and costs relative to the existing conveyance. Similarly, where conveyance flows were found to not exceed a capacity of 1.0 mgd, the existing conveyance system was assumed to be adequate. With respect to LS 1 and LS 2, recent studies were used to define both capacity increase and O&M needs. Where capacity increases were not required, the O&M improvements were included, where appropriate. In some alternatives, LS 1 and LS 2 are no longer required, and were treated appropriately.

3.2.5 Cost Recovery at SLRWRF

As discussed previously, the existing inter-agency agreement establishes cost obligations to the District based on capacity rights at the SLRWRF. Therefore, where the District is reducing conveyance to the SLRWRF, the District would not realize a cost savings if the same capacity right was maintained at SLRWRF. It was assumed that the District would renegotiate its agreement with the City to reduce its capacity right at SLRWRF, and further assumed that such a renegotiation would result in the City purchasing back that

capacity from the District. The cost per gallon associated with the City purchasing back treatment capacity was assumed relative to the current proposed treatment capacity changes being considered by the City with Valley Center Municipal Water District and a discussion between the City and District staff regarding future upgrades to the City's treatment and disposal system. As a result of this discussion and knowledge of the City's current proposed treatment capacity charges, the City buy back of treatment capacity costs was included to account for potential cost recovery (assumed to range from $10 to $20 per gallon) that would benefit the District relative to construction of its own WRF.

3.2.6 Recycled Water Production / TDS Reduction

As the primary purpose of this analysis is to evaluate the production of a new local water resource, tertiary treatment facilities were assumed to be included in the District WRF, and a recycled water pump station was included to convey the resulting water off-site to local users and storage. For the purposes of this analysis, recycled water production was assumed to be 90 percent of the identified WRF treatment capacity.

Production of recycled water is also projected to require demineralization facilities to reduce the overall Total Dissolved Solids (TDS). For the purposes of this analysis, a side-stream reverse osmosis (RO) treatment component would be added to the treatment plant facilities. The RO facilities would be used to treat a portion of the recycled water, which would then be blended with the remainder to achieve a product water to reduce the TDS to an acceptable concentration.

Reviewing District records, the average TDS of the wastewater conveyed to SLRWRF normally ranges from 800 to 1000 mg/L. Based on the upper concentration and a recycled water production of 0.9 mgd, the District would be required to treat approximately 0.25 mgd of recycled water prior to blending. The RO treatment process would produce an underflow (brine) of approximately 5 percent of the treated flow or 0.012 mgd. The brine flow cannot be conveyed to the SLRWRF and will require ultimate disposal.

Several brine disposal options were evaluated, including:

- Elimination of RO facilities by blending recycled water with raw water in Beck Reservoir,
- Construction of a separate brine conveyance pipeline from the WRF site to the Fallbrook Land Outfall, and
- Storage, concentration and hauling of brine volumes to a local ocean outfall facility.

It was determined that the added raw water conveyance facilities and raw water pricing would not be as cost effective as disposing of brine. Because of the anticipated capital costs of a lengthy brine line to a local outfall facility as well as the cost to acquire disposal capacity, brine hauling to a local ocean outfall facility was used as the brine disposal method for this study. However, the recurring cost of brine hauling will accumulate as development comes online and the plant treats larger flows. Because of the continuing costs of brine hauling, both options should be considered for further exploration.

4.0 Conceptual Recycled Water System

A conceptual backbone recycled water system was developed to provide recycled water to potential agricultural customers. Potential recycled water demands along a conceptual piping system were identified by pressure zone. Seasonal storage and supplemental raw water to improve water quality were evaluated to assess the benefits of Beck Reservoir becoming part of a recycled water system. The conceptual recycled water system was sized and a cost opinions were developed.

4.1 Recycled Water Conceptual Piping System

The conceptual piping system was developed based on a spatial analysis of existing irrigation and agricultural customers, as well as the role of development in potential recycled water demands. **Figure 4-1** presents the average annual demand in million gallons per day of the known future development projects and existing irrigation and agricultural customers that may potentially be served by a recycled water system.

Based on the concentration of demands and topography, the conceptual recycled water piping system was laid out to include supplying Beck Reservoir with Title 22 effluent, servicing demands south of SR-76 and west of I-15 in a first phase of the recycled system, and servicing the new development projects west of I-15 and northern demands in the Rainbow Valley via Rice Canyon Road. Reservoir include the benefits of Beck Reservoir include both blending and seasonal storage. **Figure 4-2** presents the conceptual recycled water piping system.

Based on the topography, it is anticipated that four pressure zones would be needed to service the conceptual recycled water system. **Figure 4-3** presents a schematic hydraulic grade line profile.

4.2 Potential Recycled Water Demands

From the conceptual piping layout, 73 existing irrigation or agriculture customers were identified as potential recycled water demands along with the known future developments. **Table 4-1** provides a summary of the potential recycled water demands by pressure zone.

Table 4-1 Average Annual Demand Summary by Pressure Zone

Pressure Zone	Description	Demand (AFY)	Demand (mgd)
893 PZ	Beck	918	0.8
1011 PZ	Southern (Closed)	294	0.3
790 PZ	Campus Park	112	0.4
1206 PZ	North	136	1.2
TOTAL		1,460	2.7

AFY = acre feet per year, mgd = million gallons per day
Existing Demands based on Fiscal Year 2014 demands provided by the District
Projected Demands taken from October 2010 County of San Diego Fallbrook Projects Recycled Water Feasibility Study

It is anticipated that the initial phase of the conceptual recycled water system would include serving the 893 Beck and 1011 Southern (Closed) pressure zones serving approximately 1.1 mgd of average annual demand. The second phase would include Campus Park and 1206 North pressure zones serving approximately 1.6 mgd of average annual demand.

4.3 Seasonal Storage and Supplemental Raw Water

Beck Reservoir offers the benefit of providing seasonal storage sufficient to balance seasonal variations in recycled water demands with the constant supply of recycled water produced by a District-owned WRF. Provided below is a summary of seasonal demands and required seasonal storage.

Seasonal demands were evaluated from the 73 identified potential recycled water conversion customers to assess seasonal trends and patterns. **Figure 4-4** presents the minimum, average, and maximum demands by month over the last 10 years. Monthly average demands vary by season largely dictated by climatic conditions. Under average annual conditions, the recycled water system can be expected to supply a minimum month demand of approximately 1.0 mgd and a maximum month demand of approximately 4.0 mgd.

Seasonal storage requirements at Beck Reservoir will largely be dictated by prolonged periods of minimum demand. The California Department of Public Health requires 84 days of emergency storage for recycled water system that do not have a fail-safe. While this doesn't necessarily apply to the proposed recycled water system, it is a benchmark to assess whether the 203 million gallon Beck Reservoir has adequate capacity. **Figure 4-5** presents the seasonal storage required assuming 1.5 mgd of treated effluent is continuously conveyed to Beck Reservoir over the minimum, average, and maximum month demands from the past 10 years. The figure shows that the Beck Reservoir has the capacity to weather prolonged periods of minimum demand.

The District shall provide a raw water source to serve as a back-up to the recycled system, allowing for occasional blending, and potentially supplement supply during peak demands.

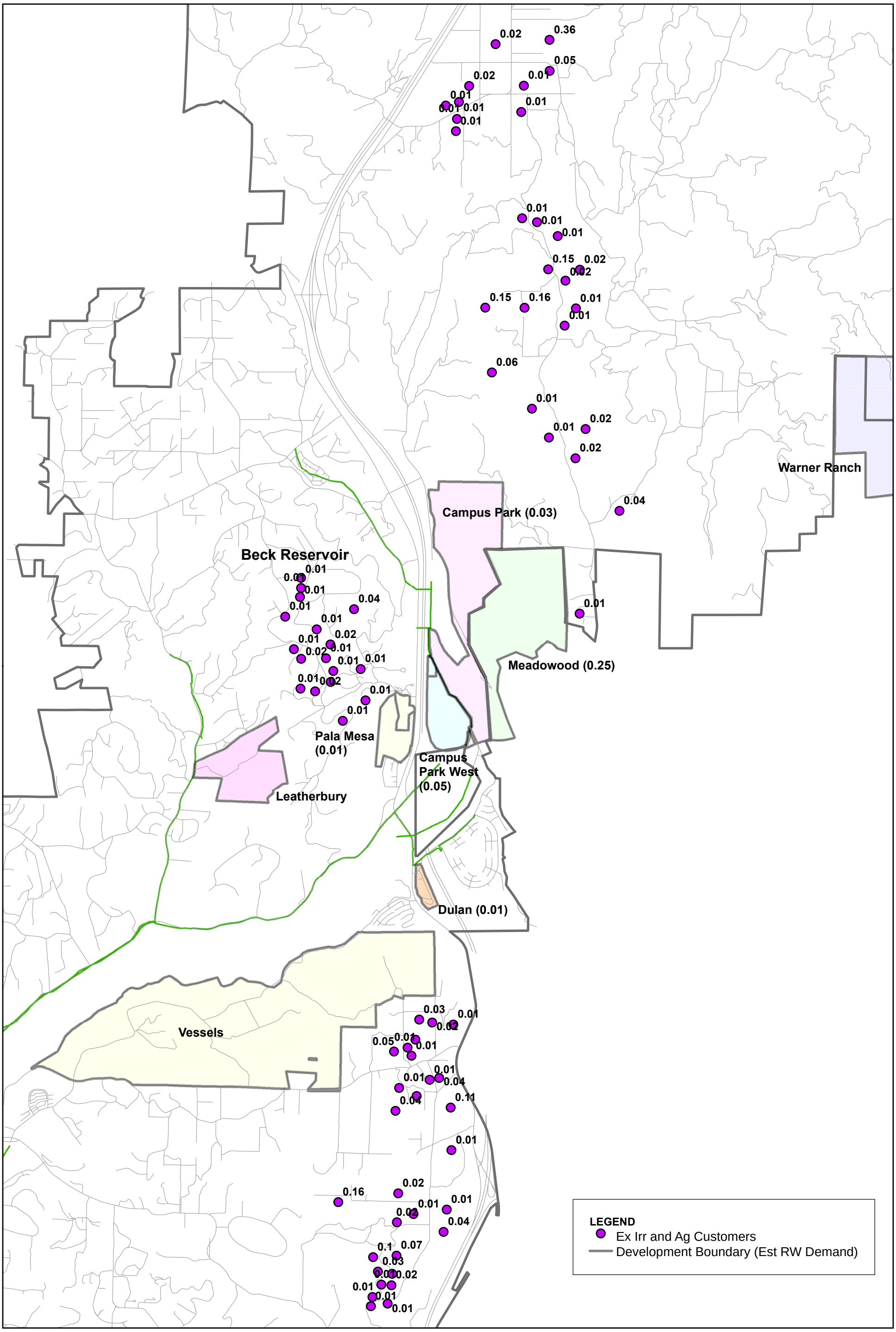
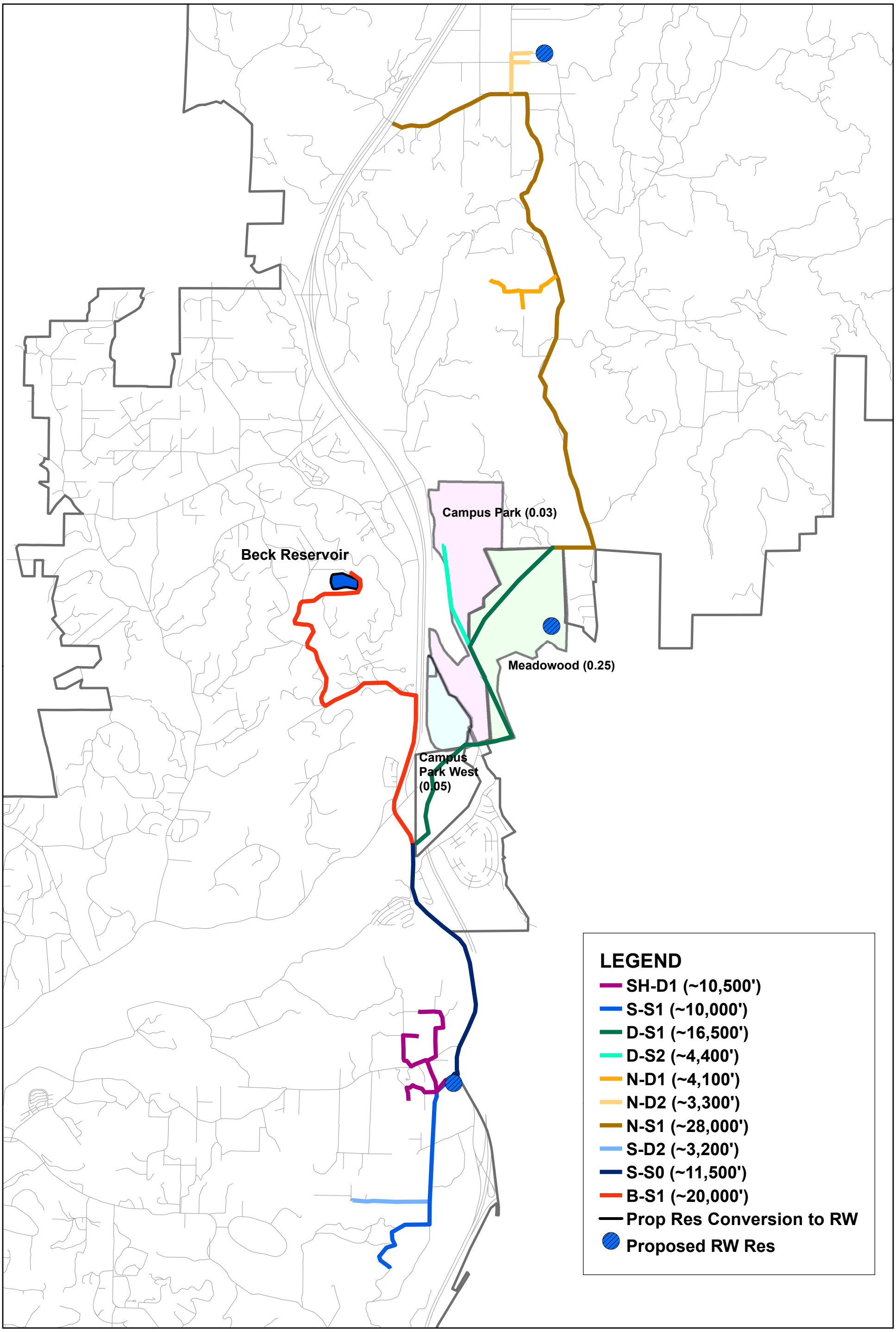


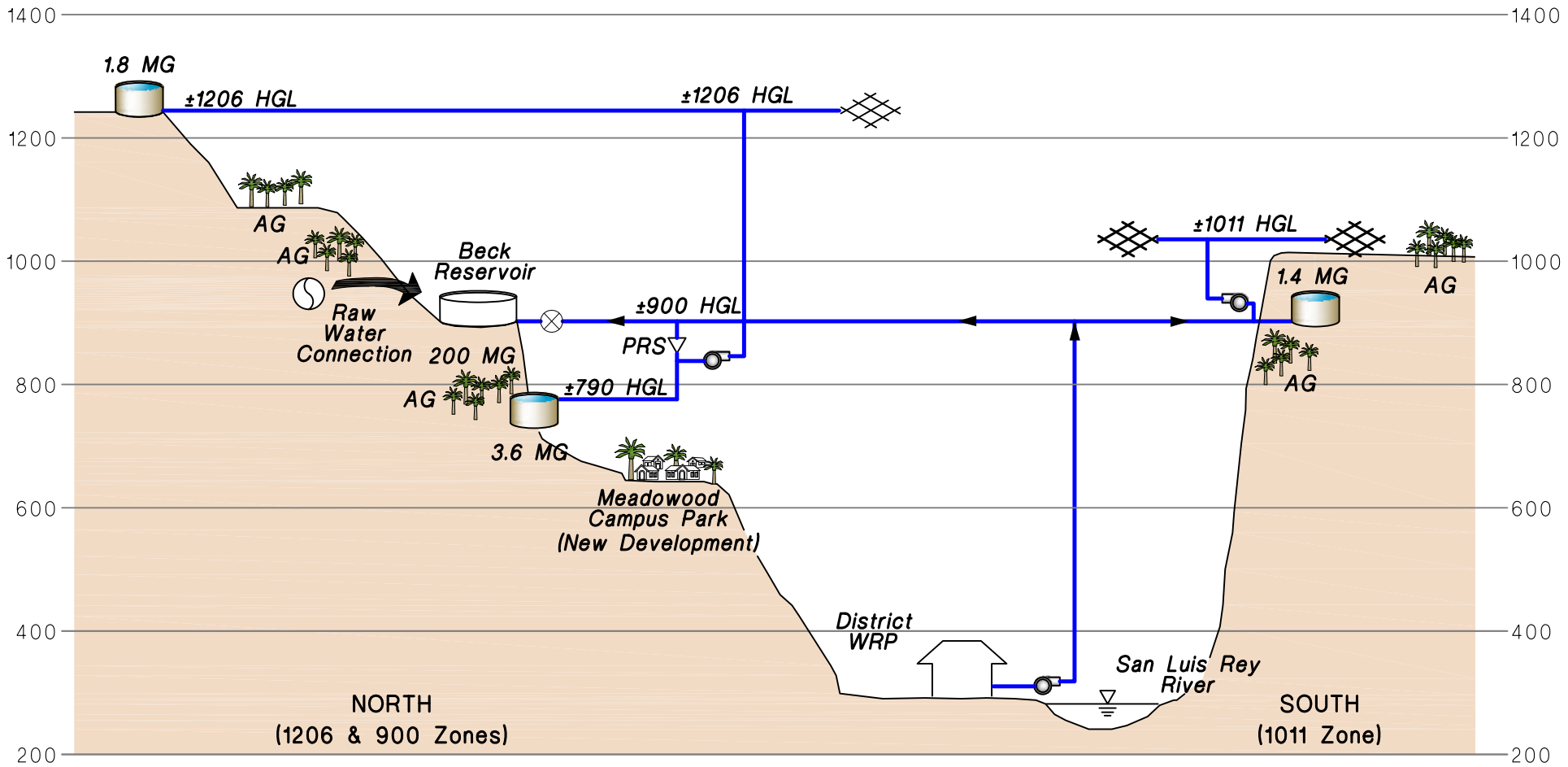
Figure 4-1
Wastewater Treatment / Reclamation Alternatives Study
Existing Large Irrigation and Agricultural Customers
September2015

ATKINS



ATKINS

Figure 4-2
Wastewater Treatment / Reclamation Alternatives Study
Existing Large Irrigation and Agricultural Customers
September2015



Proposed RW Tank

Proposed RW PS

Proposed PRS

Proposed Pipeline

DRAFT

CONCEPTUAL
RECYCLED WATER - HYDRAULIC PROFILE

FIGURE 4-3

H:\Clients\Rainbow MWD\100044880 2015 MP Update\CAD\44880 RW Prelim-Profile September-2015.dwg 9-10-15

Figure 4-4 Observed Seasonal Demands

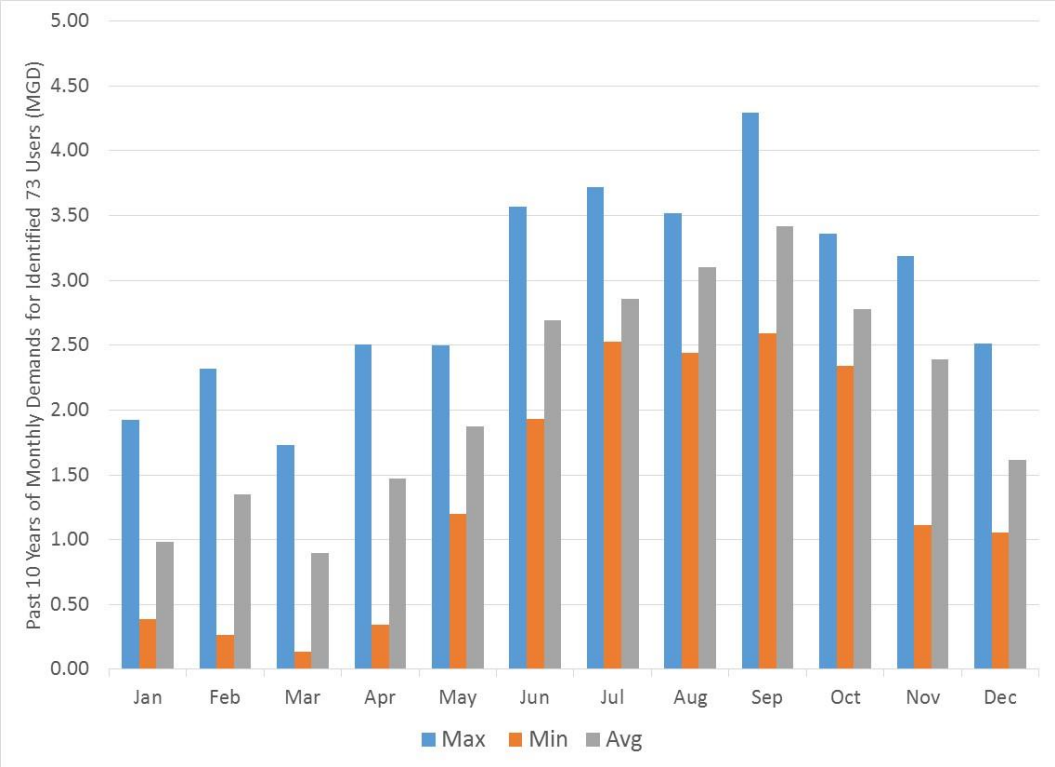
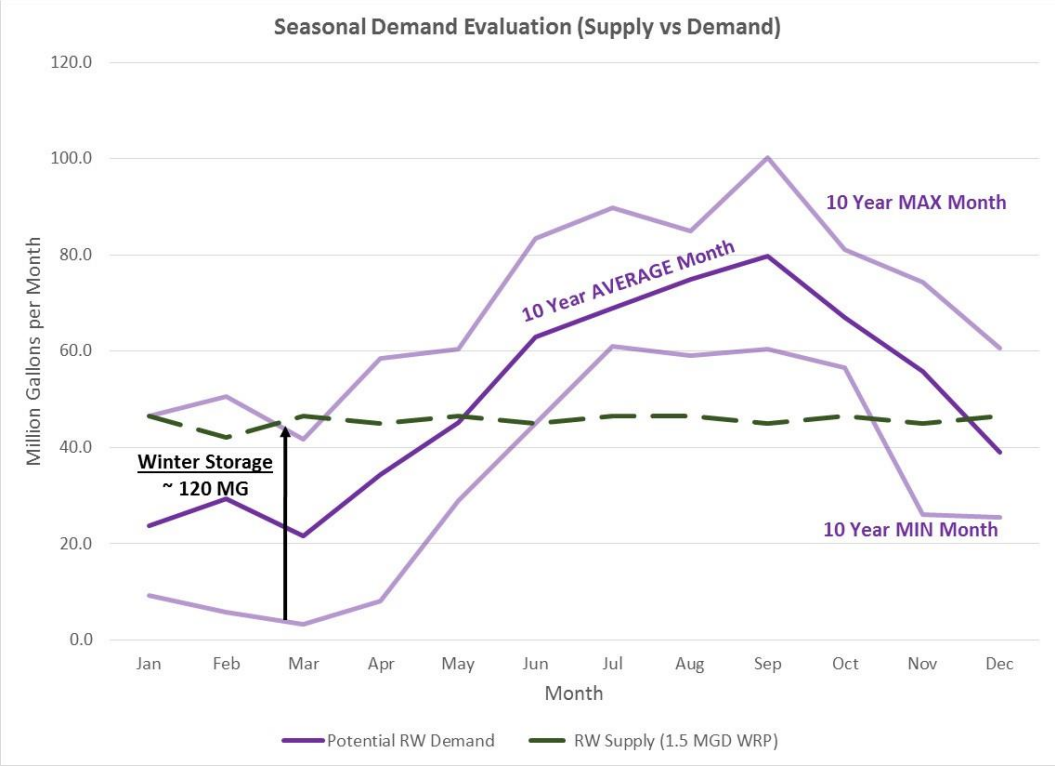


Figure 4-5 Seasonal Storage Evaluation



4.4 System Sizing & Cost Opinion

To develop preliminary level cost opinions, the conceptual recycled water backbone system was sized using planning level criteria and then costs were estimated for individual components. Preliminary system sizing was based on limiting headloss through an extensive piping system while providing the operational storage and pumping capacity needed to supply projected maximum day and peak hour demands, where needed. The cost opinion was developed based on typical unit facility, operation and maintenance, including power costs. **Table 4-2** presents a summary of the anticipated facilities and their respective capital and O&M costs.

Table 4-2 Recycled Water System Cost Summary

Pump Stations

$1.50	per gallon (Capital)
$0.18	per kWh Power Cost
75%	Assumed Energy Efficiency
1.5%	of Capital Cost - Assumed O&M for Pump Station

Name	AAD	Head	Capital Cost	Power Cost	Other O&M	Total O&M	MDD	HP	kWh/yr
South Upper	0.31	136	$1,650,000	$12,000	$25,000	$37,000	1.1	35	64,000
North	1.96	410	$7,350,000	$216,000	$110,000	$326,000	4.9	468	1,200,000
Total			**$9,000,000**	**$228,000**	**$135,000**	**$363,000**		**503**	**1,264,000**
Per MGD (ADD)			$3,285,000	$83,000	$49,000	$132,000		184	461,000

Pipelines

$12.00	per inch Dia per ft-Length (Capital)
1.0%	of Capital Cost - Assumed O&M for Pipelines

Name	Dia	Length	Capital Cost
TP-S1	12	0	$0
B-S1	20	20,005	$4,801,000
S-S0	16	11,357	$2,181,000
S-S1	12	10,150	$1,462,000
S-D2	4	3,242	$156,000
SH-D1	12	13,379	$1,927,`000
D-S1	20	16,624	$3,990,000
D-S2	4	4,397	$211,000
N-S1	16	28,317	$5,437,000
N-D1	8	4,149	$398,000
N-D2	12	3,272	$471,000
Total		**114,892**	**$21,034,000**
Per MGD (ADD)		42,931	$7,677,000

Tanks / Reservoirs

$1.00	per gallon (Capital)
1.0%	of Capital Cost - Assumed O&M for Reservoirs

Name	MG	Capital Cost
897 South	1.4	$1,400,000
790 Dev	3.6	$3,600,000
1206 North	1.8	$1,800,000
Total	**6.8**	**$6,800,000**
Per MGD (ADD)	2.5	$2,480,000

5.0 Life Cycle Cost Analysis

A preliminary life cycle cost analysis was prepared for each wastewater treatment plant alternative. **Table 5-1** presents our initial findings for Alternatives 1, 2 and 3, based on treatment plant capacity and O&M costs, avoided costs to Oceanside and other required District sewer upgrades.

The comparison of No Project to a District-controlled plant alternative is highly sensitive to assumptions about SLR system capacity sell back prices, the unit cost of the District's WRF, and other factors as presented in the spreadsheet. **Nevertheless, it appears reasonable to conclude, at a concept level, that the WRF Project alternatives offer real opportunities for life-cycle cost savings in comparison to the No Project alternative, while developing a new local water supply.**

Table 5-2 summarizes the recycled water analysis. There are many challenges with funding an expansive recycled system. The revenues and avoided purchase costs that accrue to the recycled system fund only approximately 40 percent of the system's life-cycle costs of construction and operation, which is not surprising given the length, pumping and storage needed to construct. The recycled system will require additional funding or subsidies to reach break-even, and the amount is in excess of the potential savings (ability to pay) on the WRF side. Accordingly, the recycled system will need to be funded through grants, new supply offset fees (capacity fees), developer conditions of development, other sources, or a combination of these to be economically sound.

Therefore, an important funding source for the District may reside with future development and capacity/connection fees. A portion of the recycled water system in and around a new plant site near the District office may be partially be funded by new development or constructed by new development as a condition. The initial cost and flow analysis assumes 3,500 new EDUs connected to the District's sewer system. Potential revenue streams include water capacity fees being approximately $46 million ($13,000 per EDU x 3,500 EDUs) and wastewater capacity fees being approximately $60 million ($17,000 per EDU x 3,500 EDUs).

Table 5-1 Rainbow MWD Water Reclamation Plant -- Preliminary Cost Analysis [1]

Project Alternative:		Alt. 1 No Project (All flow to Oceanside)	Alt. 2 Baseline WRP @ Vicinity I-15/76 No pump-back	Alt. 3 (revised) WRP @ LS#2 No pump-back
Flow Parameters				
Total Wastewater Flow, 2030 (MGD)		1.62	1.62	1.62
District WRP Capacity (MGD)		0.00	0.90	1.62
Remaining Flow to SLR (MGD)		1.62	0.72	0.00
District Existing SLR Capacity Right (MGD)		1.50	1.50	1.50
Flow @ PS1 (MGD)		1.50	0.60	1.50
Flow @ PS2 (MGD)		1.62	0.72	-
Addtl. Capacity Required at SLR (MGD)		0.12	-	-
Surplus Capacity Available for Sell-back [2]		-	0.78	1.50
District Share of SLR Existing Capacity	13.5 MGD	12.0%	5.3%	0.0%
District Share of SLR Future Capacity	17.4 MGD	9.3%	4.1%	0.0%

Life-Cycle Cost Summary — For SLR Capacity Sell-Back Price = $10 /gpd

		Alt. 1 No Project (All flow to Oceanside)	Alt. 2 Baseline WRP @ Vicinity I-15/76 No pump-back	Alt. 3 (revised) WRP @ LS#2 No pump-back
N (yrs): 30	*i* (%/yr): 3.50%			
j (escalation rate) (%/yr):	2.50%			
Amortization Factor (A/P, *i* , N):	0.0544			
Capitalization Factor [3] (P/A, *i* , *j* , N):	25.3			
Present-Worth Cost Analysis				
Total Annual O&M		$ 1,720,000	$ 1,880,000	$ 1,790,000
Present-Worth of Annual Costs	Pj = 25.3	$ 43,500,000	$ 47,500,000	$ 45,200,000
Total Capital		$ 32,000,000	$ 36,000,000	$ 79,000,000
Total Present Worth Costs (rounded)		$ 76,000,000	$ 84,000,000	$ 124,000,000
Equivalent Annual Costs (" ")	A/P = 0.0544	**$ 4,100,000**	**$ 4,600,000**	**$ 6,700,000**

Capital Costs

				Alt. 1	Alt. 2	Alt. 3
District WRP (pre mark-up)			$25 /gpd		$ 22,500,000	$ 40,500,000
RO Equipment	Q= 27%	Y= 95%	$4.00/gpd		$ 1,000,000	$ 1,700,000
Lift Station and Sewer Main Upgrades						
District Outfall Expansion			$14 MM	$ 8,970,000		
Mission Rd. to LS2	14,000 ft.	18 in.	$15 in./ft.	$ 3,780,000		$ 3,780,000
LS#1 Upgrades	per mgd flow at LS1		$3.5 MM	$ 5,250,000	$ 2,100,000	$ 5,250,000
Forcemain (pump back)	28,200 ft.	10 in.	$12 in./ft.			
LS#2 Upgrades	per mgd flow at LS2		$0.4 MM	$ 650,000	$ 290,000	$ -
Forcemain (pump back)	7,770 ft.	6 in.	$15 in./ft.			
Recycled (Failsafe) Conveyance & Storage						
Pump Station	per mgd flow at plant		$0.6 MM		$ 540,000	$ 970,000
Pipeline to District Site	35,970 ft.	12 in.	$15 in./ft.			$ 6,470,000
Pipeline to Beck	0 ft.	12 in.	$15 in./ft.		$ -	$ -
Beck Improvements			$1.0 MM		$ 1,000,000	$ 1,000,000
Beck Raw Water Connect. Rehab.			$0.5 MM		$ 500,000	$ 500,000
Subtotal (rounded)				$18,700,000	$27,900,000	$60,200,000
Contingency	@		30%	$5,600,000	$8,400,000	$18,100,000
Subtotal Construction				$24,300,000	$36,300,000	$78,300,000
Design/Permitting/Admin.	@		20%	$4,900,000	$7,300,000	$15,700,000
Subtotal Capital Cost				$29,200,000	$43,600,000	$94,000,000
Purchase of Additional SLR Capacity			$20/gpd	$ 2,400,000		
Sell-back of SLR System Capacity			$10 /gpd		$ (7,800,000)	$ (15,000,000)
TOTAL CAPITAL COSTS (rounded)				**$ 32,000,000**	**$ 36,000,000**	**$ 79,000,000**

Annual Costs

				Alt. 1	Alt. 2	Alt. 3
District WRP O&M Costs						
Contract O&M Service	$ 15,000	/mn./mgd			$ 160,000	$ 290,000
Maint./Replace. Fund, as % WRP Constr.			1.00%		$ 230,000	$ 410,000
Concetrate Hauling [4]	13,500 gpd/MGD		$90/kgal.		$ 400,000	$ 720,000
Power	e= 75%	$0.18	/kWh			
Pumping to SLR	(Q varies)	@TDH=	120 ft.	$ 52,000	$ 23,000	$ -
Pump-back	(Q varies)	@TDH=	120 ft.			
Recycled PS (District site)		@TDH=	725 ft.		$ 320,000	
Recycled PS (LS2 Site)		@TDH=	850 ft.			$ 370,000
SLR Usage Charges (1.5 mgd cap.)	$85,000	/mn.		$ 1,100,000	$ 490,000	$ -
SLR System Maint./Repl. Fund, District share						
WWTP, as % of Constr. Cost	$435 MM		1.25%	$ 510,000	$ 230,000	$ -
Outfalls, as % of Constr. Cost	$60 MM		1.00%	$ 56,000	$ 25,000	$ -
TOTAL ANNUAL O&M COSTS (rounded)				**$ 1,720,000**	**$ 1,880,000**	**$ 1,790,000**

Notes:
1) PRELIMINARY COSTS: Preliminary cost analysis, subject to review and revision
2) SLR CAPACITY SELL-BACK ASSUMPTIONS: The analysis assumes the sell-back of its unneeded SLR system capacity rights is achievable, and that the District's ownership share and financial responsibility for SLR system costs would decrease proportionate with its decrease in capacity right.
3) CAPITALIZATION FACTOR: The capitalization factor is a percentage gradient series present worth factor, with future annual costs escalating at the rate specified.

Table 5-2 Rainbow Recycled Water System Concept Study – Preliminary Cost Analysis

COST SUMMARY – FACILITIES

		Capital Cost	Power Cost	Other O&M	Total O&M
Pipelines		$21,000,000	$0	$210,000	$210,000
Pump Stations		$9,000,000	$230,000	$140,000	$370,000
Reservoirs		$7,000,000	$0	$70,000	$70,000
Customer Retrofit Assistance		$2,000,000	$0	$0	$0
System Ops (inc. T22 compliance)		$0	$0	$200,000	$200,000
Subtotal		$39,000,000	$230,000	$620,000	$850,000
Contingency @	30%	$12,000,000	$0	$190,000	$190,000
Subtotal		$51,000,000	$230,000	$810,000	$1,040,000
Design/Permitting/Admin.	20%	$10,000,000	$0	$0	$0
Total		**$61,000,000**	**$230,000**	**$810,000**	**$1,040,000**
Per MGD (ADD)	2.74	$22,000,000	$80,000	$300,000	$380,000
Per AF/yr	3,072	$19,600	$70	$270	$340

ANNUAL COSTS AND OFFSETS

Calculated on a unit-cost basis			**Blend Ratio**	**Unit Cost ($/AF)**
Facilities O&M Unit Cost Total (from above)				**$340**
Raw Water Blend %	10%			
Avoided Treated Water All-In Cost		-$1,439/AF	1.00	-$1,440
Raw Water All-In Cost		$1,159/AF	0.10	$120
Recycled Purchase Cost		$0/AF	0.90	$0
Sales Price Discount vs. Potable		$300/AF	1.00	$300
Lost Water Revenue for System o/h		$250/AF	1.00	$250
Subtotal				-$770
Total Net of Annual Cost Items				**-$430**

LIFECYCLE COSTS

Finance Terms	30 yrs	3.5%
Escalation Rate (%/yr)	2.5%	
Amortization Factor	0.0544	
Capitalization Factor	25.3	

Present-Worth Cost Analysis			**Unit Cost ($/AF)**
Net of Annual Costs, from above			-$430
Present-Worth of Annual Costs	Pj = 25.3		-$10,870
Total Capital (from above)			$19,600
Total Present Worth Costs (rounded)		$8,730	
Equivalent Annual Costs (" ")	A/P = 0.0544		$470

Subsidy Required from WRF to Reach Break-Even		
Remaining Unfunded Unit Life-Cycle Cost ($/AF)		$470
Capitalized Value ($/AF)		$8,600
Capitalized Value ($/mgd)		$10,000,000
Amount per MGD of WRF Capacity, at Specified Blend ($/mgd)		$11,000,000
If funded by new Supply Offset Capacity Fee, per EDU per mgd	3,500 EDU	$3,100

DISCUSSION – LIFE-CYCLE COSTS AND SUBSIDY REQUIREMENTS

- **Recycled System Cost Deficit:** The revenues and avoided purchase costs that accrue to the recycled system fund only 10 percent of the system's life-cycle costs of construction and operation.
- **Subsidy Requirement to Reach Break-Even:** The recycled system will require large subsidies to reach break-even . . . not counting the indirect benefits of local supply.
- **Subsidy amount is beyond the reach of the WRF:** The recycled system would need to be funded through grants, new supply offset fees (capacity fees), other sources, or a combination of these.