OLIVENHAIN
Municipal Water District

2015 POTABLE WATER AND RECYCLED WATER MASTER PLAN

April 2016

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In Association with

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1. EXECUTIVE SUMMARY

1.1. Introduction and Scope of Services

The Olivenhain Municipal Water District (District) is planning to update their capacity (connection) fees in 2016. The District is nearing buildout and has well-developed potable water treatment, conveyance, and distribution systems. Accordingly, the master plan forgoes some of the comprehensive assessments of traditional plans and instead focusses more narrowly on those categories of facilities and system planning issues of significance to the development of capacity fee calculations. This master plan was authorized through an agreement between the District and DLM Engineering, Inc. (DLM) dated June 19, 2015. The scope of services included:

- Prepare a potable water demand forecast
- Calculate the remaining equivalent dwelling units (EDUs) in the District
- Identify potable water storage projects
- Evaluate the steel tank maintenance program
- Develop an asphalt maintenance program
- Summarize pipeline lengths by diameter and material
- Identify a Phase II Village Park Recycled Water Project
- Evaluate additional recycled water customers in the San Dieguito Valley
- Evaluate recycled water service to the Bridges development
- Update the cost to convert the Wanket Tank to recycled water storage; and
- Identify changes to the 10- and 20-year capital spending plans.

DLM was assisted by Gillingham Water (GW) for the demand forecast and EDU analysis, and Hoch Consulting (HC) for the asphalt maintenance program and the pipeline lengths. Many District staff assisted in the preparation of this plan including George Briest, Joey Randall, Rainy Selamat, Dave Smith, Karen Ogawa, John Carnegie, Chad Williams, Don Hussey, Dan Bean, Mark Weber, Marvin Cohen, Adam Calm, and Teresa Chase. The authors appreciate their assistance. Staff of the San Elijo Joint Powers Authority (SEJPA) and Santa Fe Irrigation District (SFID) staff also provided information utilized in preparing this plan.

The following two sections provide a summary of the potable water and recycled water investigations and recommendations. Following the Executive Summary are more detailed descriptions of the investigations again organized by potable and recycled water.

1.2. Executive Summary - Potable Water

Demand Forecast

Over the past seven years, the effects of increased conservation, increasing water prices, drought restrictions, economic recession, and other factors have combined to produce a fundamental downward shift in per capita water use. The Master Plan Update projects these lower usage rates will endure, and that future demands will remain below their historical highs despite continuing growth in population, housing and employment of approximately 10 percent by 2050.

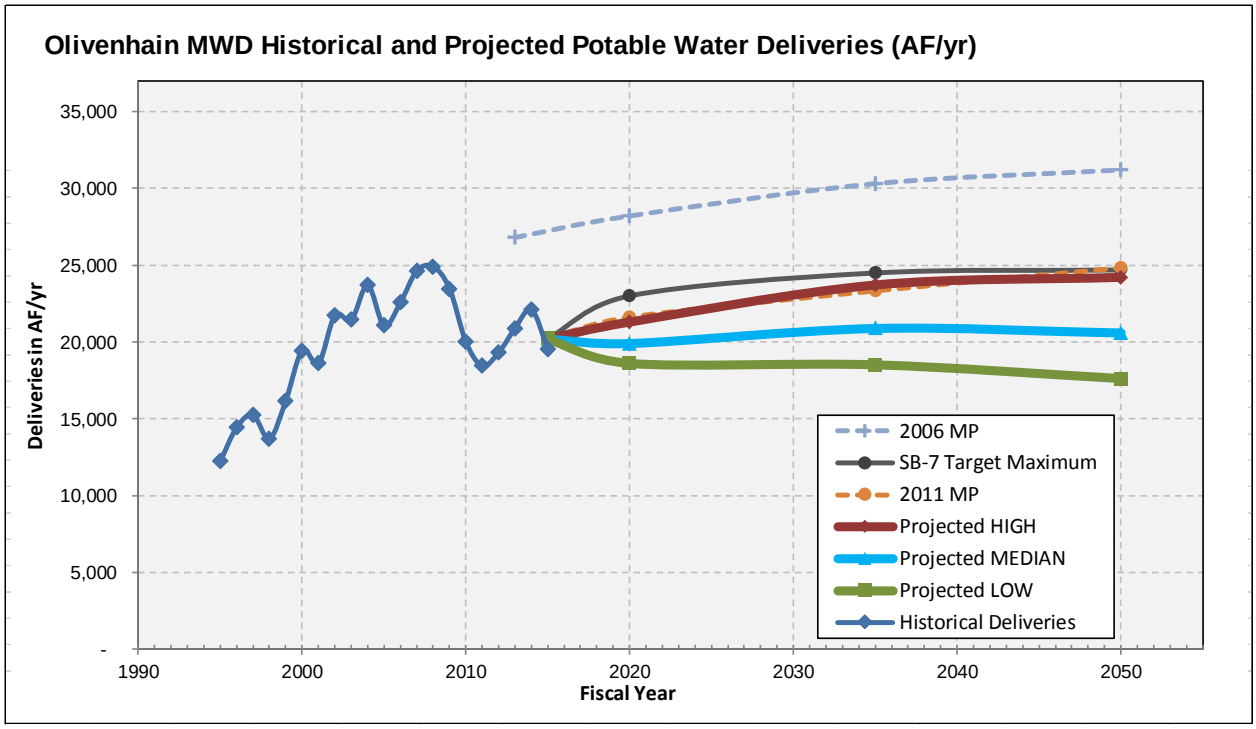
Historical and projected future water demands are summarized in **Table 1-1 and Figure 1-1** below.

Table 1-1: Demographic and Water Demand Forecast Summary

Fiscal Year:	2015 (actual)	2020	2035	2050	Increase 2015-2050	
DEMOGRAPHIC FORECAST (per SANDAG S.13)						
Population	70,522	72,567	77,276	78,014	7,492	11%
Employment	23,439	24,065	24,801	25,418	1,979	8%
Housing Units	25,966	26,547	27,886	28,430	2,464	9%
DEMANDS (Total Deliveries)	21,400	22,800	23,800	23,400	2,000	9%
Recycled[1]	1,900	2,400	2,400	2,400	500	26%
Potable[2]	19,500	20,400	21,400	21,000	1,500	8%
Per Capita Potable Demand (gpd)	247	251	247	240	-7	-3%
SB-7 Per Capita Use Goal (gpd)	--	283	--	--	--	--

1. Existing, verifiable, additional planned 2. Based on median forecast projection

Figure 1-1: Historical and Projected District Total Water Demands



Forecast Sensitivity

As depicted in Figure ES-1, the Master Plan forecast includes a planning envelope to account for the possibility that future demand conditions will develop differently than envisioned by the median demand forecast. The forecast variables used to create the envelope, and to define High and Low forecasts to bracket the Median forecast, are summarized in **Table 1-2**:

Table 1-2: Forecast Variables for Low, Median, and High Forecast Ranges

Planning Variable	Low	Median	High
Baseline water demand	5 percent reduction relative to 2013 demand levels	Per 2013 actual demands	5 percent increase relative to 2013 demand levels
Growth Forecast	Growth rate set at 75% SANDAG S.13	Per SANDAG S.13	Growth rate set at 125% SANDAG S.13
Conservation Factors	At 1.5x default levels	At default levels	At 0.5x default levels

Upon careful review, the District has elected to use the Median forecast as the planning basis for the Master Plan and its related Capital Improvement Plan. For financial planning purposes, the District will also consider the implications of the Low forecast.

Potable Water Storage

The District retained Infrastructure Engineering Corporation (IEC) to prepare a static, desktop evaluation of potable water storage (IEC, 2016). In this case, static means that the District's actual storage volumes were compared against storage criteria but that no hydraulic modeling was performed. The evaluation, divided the District into six main storage zones including:

- Zone 1 – West (Denk)
- Zone 2 – Southwest (Gaty and Miller)
- Zone 3 – Rancho Cielo
- Zone 4 – Central (Peay)
- Zone 5 – South (Gano, Zorro, Palms)
- Zone 6 – 4S Ranch

The evaluation concluded that the District's existing storage tank capacity meets and exceeds the storage planning criteria for both existing and ultimate demand conditions, in each of the six zones, and for the overall District. In addition, the evaluation concluded the minimum storage criteria would still be met if the Wanket, Gaty I, and Palms Tanks were removed from the system, except for Zone 5 which would have a deficit of 1.3 MG. Discussions with District staff indicated that, in the event of an emergency, operational changes could be made within a relatively short period of time to move water from zones with surplus storage into zones with storage deficits. For the overall District, with the tanks removed, there is still a surplus of more than 24 MG of storage.

Based on this assessment, the Master Plan recommends the District budget $250,000 in FY 2020-21 to begin decommissioning the Gaty I Reservoir. While there is no defined scope of work with this budget, it could potentially include demolition and disposal of the reservoir lining and cover, and asphalt plank lining.

Steel Tank Maintenance Program

In 2007, the District retained Utility Services Company to maintain nine of its potable water and recycled water tanks. The cost of this contract was evaluated and compared against data collected from several other water agencies. The evaluation concluded that retaining a high-quality third party to maintain the District's tanks is cost-effective. District staff reported high-quality coating and other maintenance work and excellent customer service. In addition, because this contract complies with GASB 34, the District does not need to depreciate these assets or set funds aside for their replacement. The contract is paid for as an ongoing operations and maintenance expense, and no capital funds need to be budgeted for these tanks at this time. On an annual basis, Utility Services Company rates the condition of each of the contract tanks with a Tank Assessment Index (TAI), a nationally recognized index. The index can range from 1.0 to 10.0 with 1.0 to 2.9 representing an unacceptable condition and 9.0 to 10.0 representing a very good condition. For fiscal year 2014-15, the lowest TAI for the contract tanks was the Roger Miller Tank, rated at 6.8, which is considered satisfactory. Utility Services Company will start on a partial interior renovation of the Roger Miller Tank in December 2015 with an exterior renovation scheduled for 2016. All other tanks were rated 7.8 (good) or higher.

Asphalt Maintenance Program

The District has approximately 29 acres of asphalt surfaces that provide driveways and site paving for its various facilities. Each of the District's 40 sites with asphalt pavement were evaluated in accordance with Caltrans standards. Nine sites were in found to be good condition, twenty-two were found to be in fair condition, and nine sites were found to be in poor condition. We recommend the District budget $448,000 over the next five years to address the required maintenance at the twenty sites rated poor and fair.

1.3. Executive Summary - Recycled Water

Figure 1 shows the existing and potential recycled water and potable reuse projects currently under consideration by the District. The leading candidate projects are summarized below.

Village Park Recycled Water Project Phase II

The Village Park Recycled Water Project (VPRWP) is currently under construction with completion anticipated in 2016. This system, shown in Figure 1, will serve an estimated 220 acre-feet per year (AFY) to the Village Park Community of the City of Encinitas. District staff, working with customers in the area, has identified the four short extensions of 4- and 8-inch pipe from or adjacent to the VPRWP, known as Phase II, and shown in Figure 2. These extensions will serve an estimated 30 AFY and construct pipelines that will eventually connect the Village Park and Northwest Quadrant and systems. The District has identified approximately $5 million of recycled water improvements, including Village Park Phase II that could be eligible for State of California Proposition 1 grant funding. Federal funding is also possible. Proposition 1 provides up to 35 percent of project costs, and depending on how much total funding can be obtained, the District will need to budget between $2.5 and $4.0 million for their share of costs of these projects.

Extension 153 – Additional Customers

Extension 153 includes 14- inch, 12-inch, and to 8-inch diameter pipeline in San Dieguito Road through Fairbanks Ranch and the San Dieguito Valley. It currently serves approximately 740 AFY to four golf courses. A number of irrigation customers in the area have recently requested recycled water service. The District reviewed all of the irrigation meters in the area and has identified those that can be served with relatively minor improvements. Their demands total approximately 190 AFY. Additional supply is available from the City of San Diego to serve these customers.

A hydraulic analysis of the pipeline was completed that showed, in general, that there is capacity available to serve additional customers. The District is considering Proposition 1 grant funding, and other grant funds to construct the needed improvements, as described in the previous section. In addition, several of the potential customers will fund the improvements needed for service. Therefore, additional projects and budgets do not need to be included in the recycled water Capital Spending Plan (CSP).

Bridges Development - Recycled Water Service

The Bridges Golf Course and Homeowners Association (HOA) is a District customer located north of San Dieguito Reservoir and west of the SFID Badger Filtration Plant, in Rancho Santa Fe. The Bridges development used between 400 and 500 acre-feet of potable water for irrigation in 2014 and has been interested in converting their source to recycled water for some time. The District is also interested in converting this site to recycled water; however, recycled water is not currently available in the area.

In 2011, SFID investigated a recycled water system throughout their eastern service area near the Bridges Development but concluded it was not cost-effective. The most likely source of recycled water for the Bridges is through a joint project with SFID and SEJPA. These agencies have completed a feasibility study of a potable reuse project involving an advanced water treatment plant at the SEJPA WRF, conveyance through the SDWD 30-inch Low Pressure Pipeline, pre-treatment at the San Dieguito Reservoir, and final treatment at the Badger Filtration Plant. While this project will take many years to implement, SEJPA staff has proposed a recycled water project in the interim to serve SFID customers and the Bridges, with a potential demand of 800 to 1,000 AFY. The Master Plan recommends the District consider budgeting $50,000 in FY 2016-17 for a joint study with SEJPA to investigate this concept.

Conversion of the Wanket Tank to Recycled Water Storage

The Wanket Tank has a capacity of 3 million gallons (MG) and was previously a part of the potable water distribution system. Because of the large volumes of storage in the central part of the District, additional west to east pipelines, and numerous connections between zones, the Wanket Tank was categorized as surplus and taken out of service.

The Tank is at a sufficient elevation to provide storage for the District's Northwest Quadrant and Village Park Recycled Water Distribution Systems, and also the SEJPA distribution system. However, none of these systems currently need storage. The District and/or SEJPA do not envision pursuing the tank conversion until significant additional recycled water demands are identified. In addition, the Leucadia Wastewater District has approached the District about expanding their recycled water distribution system and using Wanket for storage. Considering these potential projects, refurbishment and conversion of the tank is tentatively scheduled for fiscal year 2025 - 26. In 2025 dollars, tank refurbishment and conversion costs are estimated at approximately $600,000 and $1,500,000 respectively. These costs should be included in the CSP.

Another possible use for the Tank is for direct potable reuse. However, the regulations regarding this concept are in the process of being developed and implementation is not expected prior to fiscal year 2025 - 26.

The San Dieguito Water District (SDWD) owns one-third of the tank capacity and one-half of the site. The District has initiated discussions with SDWD to purchase their capacity but they are currently on hold. Therefore, the purchase costs are not currently included in the CSP.

2. POTABLE WATER MASTER PLAN

2.1. Introduction

This section describes the portion of the master plan related to potable water including:

- Unit Demands and Demand Forecast
- Existing and Future Equivalent Dwelling Units
- A Storage Study
- An Asphalt Maintenance Program
- A Steel Tank Maintenance Program; and
- The 10-and 20-Year CSP

2.2. Water Demand Forecast

Historical and Current Use

Fiscal Year	Population	Potable Deliveries (AF)	Per Capita Use (gpcd)
1995	39,111	12,230	279
1996	39,478	14,429	325
1997	40,153	15,234	339
1998	41,356	13,680	295
1999	42,590	16,165	339
2000	43,712	19,433	396
2001	49,965	18,586	332
2002	52,740	21,730	368
2003	55,121	21,425	347
2004	57,364	23,690	368
2005	57,248	21,052	328
2006	58,480	22,561	344
2007	62,006	24,613	354
2008	64,949	24,885	341
2009	65,505	23,455	320
2010	67,288	19,992	265
2011	67,986	18,440	242
2012	69,946	19,305	246
2013	69,245	20,887	269
2014	70,066	22,088	281
2015	70,522	19,549	247

Table 2-1: Historical Potable Demands: Potable demands peaked in FY 2008. Subsequently, demands have declined in response to the recession, price increases, recycled water use expansion, and increased adoption of water conservation measures.

Source: Annual population data for 1995 and 2000 to 2015 per SANDAG, 1996-1999 interpolated proportionate to OMWD number of active regular accounts.

For almost 50 years following its founding in 1959, total water demands in the District service area trended upwards, as lands developed and population increased. This trend is reflected in **Table 2-1**. Annual potable demands peaked in fiscal year 2008 at approximately 25,000 acre-feet.

Subsequent to 2008, potable demands have declined in response to economic recession, price increases, the use of recycled water, drought restrictions, and increased adoption of water conservation measures. These factors have combined to produce a fundamental downward shift in per capita water use, with usage rates declining by almost 30 percent from 2007 to 2013. Per capita use reached a minimum during the period from 2010 to 2012, but this was in response to economic recession, cooler than normal summer weather, and other impermanent conditions.

Considering factors of economic equilibrium, average weather conditions, and normal water supply conditions (without water use restrictions in place), **the Master Plan has judged calendar year 2013 to be representative of normal water use conditions in the current era,** and has defined calendar year 2013 water use as an appropriate baseline condition for use in demand forecasting.

Use by Customer Class

The District accounting system classifies several categories of water customers grouped as follows:

- Single-Family Residential (SFR)
- Multi-Family Residential (MFR)
- Commercial (COM) (commercial, industrial, governmental)
- School
- Agricultural
- Irrigation (park, landscape, and slopes)
- Other
- Temporary (construction meters)

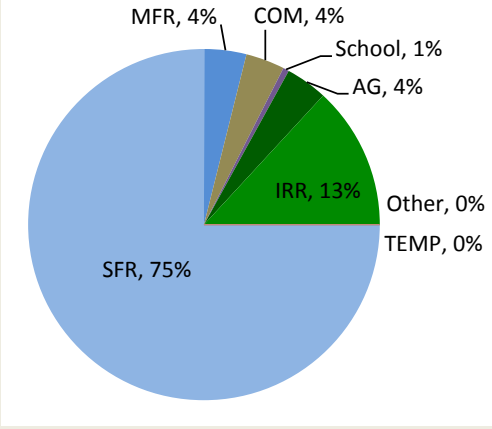


Figure 2-1: Distribution of Potable Use by Customer Class (Sales).
Residential uses predominate.

Figure 2-1 shows the distribution of water use by customer class, based on CY 2013 water sales. Residential uses predominate. Inclusive of a substantial share of Irrigation category use, much of which is for residential area slopes and common areas, residential uses make up approximately 90 percent of total District potable use.

Seasonal Variation / Monthly Peaking Factors

Water use in the District varies seasonally due to the seasonal nature of landscape irrigation demands. Irrigation demands are low during the winter months, and peak during the consistently dry summer months. Demands during the springtime months exhibit the greatest year-to-year variability, corresponding with variability in springtime precipitation levels.

Recent historical seasonal demand variation and monthly peaking factors are summarized in **Table 2-2**.

Table 2-2: Potable System Monthly Peaking Factors

	SDCWA Deliveries (MGD)								Monthly Peaking Factor								
	2007	2008	2009	2010	2011	2012	2013	2014	2007	2008	2009	2010	2011	2012	2013	2014	Avg.
Jan	16.4	10.1	13.8	10.8	10.8	12.3	10.3	16.7	0.73	0.47	0.72	0.65	0.64	0.69	0.55	0.86	0.63
Feb	9.3	8.8	10.2	7.9	11.7	11.9	11.3	13.7	0.41	0.41	0.54	0.48	0.69	0.67	0.60	0.70	0.54
Mar	17.8	17.3	17.1	12.8	10.2	11.8	15.3	13.7	0.79	0.80	0.90	0.78	0.60	0.66	0.81	0.70	0.76
Apr	21.4	24.1	20.2	14.0	15.0	13.5	18.8	18.9	0.95	1.11	1.06	0.85	0.88	0.76	1.00	0.97	0.94
May	20.3	25.4	22.8	21.1	20.3	19.8	21.8	25.2	0.90	1.18	1.20	1.28	1.20	1.11	1.16	1.30	1.15
Jun	29.3	27.9	20.8	23.7	22.3	23.9	24.7	25.7	1.30	1.29	1.09	1.44	1.32	1.34	1.32	1.32	1.30
Jul	31.8	33.7	23.9	22.9	25.3	24.9	24.8	25.9	1.41	1.56	1.25	1.39	1.49	1.39	1.32	1.33	1.40
Aug	33.0	30.3	24.4	24.4	24.9	26.0	25.4	23.5	1.46	1.40	1.28	1.48	1.47	1.45	1.35	1.21	1.41
Sep	32.4	27.1	24.8	23.4	22.7	24.6	24.4	23.9	1.44	1.25	1.30	1.42	1.34	1.38	1.30	1.23	1.35
Oct	26.8	25.5	21.6	12.8	18.3	19.7	19.7	21.3	1.19	1.18	1.13	0.77	1.08	1.10	1.05	1.10	1.07
Nov	20.7	18.5	18.5	13.4	10.0	16.6	14.7	16.1	0.92	0.85	0.97	0.81	0.59	0.93	0.78	0.83	0.84
Dec	10.9	10.3	10.2	10.2	11.7	9.4	13.5	8.4	0.48	0.47	0.53	0.62	0.69	0.52	0.72	0.43	0.58
Year	**22.6**	**21.6**	**19.1**	**16.5**	**17.0**	**17.9**	**18.7**	**19.4**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Notes: Data per SDCWA monthly delivery reports

Monthly peaking factors have gradually moderated during the past 30 years as the District service area has developed and as outdoor water use as a percentage of total use has declined. The Master Plan projects this moderating trend will continue throughout the planning horizon.

Regional Growth Projections

The Master Plan has utilized the most recent growth and demographic forecast prepared by the San Diego Association of Governments (SANDAG). This forecast is known as Series 13 in SANDAG's history of regional growth plans and forecasts. The Series 13 forecast is based on regional demographic and economic forecasts, and on the adopted land use plans of the County of San Diego and the various municipalities within the District service area. Additional information on the forecast and SANDAG's forecast methodologies are available at the SANDAG website, www.SANDAG.org.

The District worked with SANDAG to obtain custom data reports for the District service area as a whole, and for each of the five Zones of Benefit within the overall service area. Forecast data by zone of benefit is summarized in **Table 2-3**. Additional detailed data are presented in **Appendix D**.

Table 2-3: SANDAG Series 13 Growth Forecast Data for District

Zone of Benefit	Year	Total Pop	HH Pop	GQ Pop	Total Housing Units	SFR Units	MFR Units	Mobile Home Units	Total Employment	Persons Per Household
A	2015	37,856	37,686	170	14,868	12,001	2,634	233	12,936	2.55
	2020	38,572	38,391	181	15,068	12,127	2,708	233	12,887	2.56
	2035	39,123	38,914	209	15,101	12,165	2,703	233	13,491	2.59
	2050	39,002	38,775	227	15,131	12,239	2,659	233	14,015	2.58
	% Increase	3%	3%	34%	2%	2%	1%	0%	8%	1%
B	2015	8,278	8,278	0	2,860	2,849	11	0	941	2.89
	2020	9,192	9,192	0	3,118	3,107	11	0	1,294	2.95
	2035	11,100	11,100	0	3,758	3,747	11	0	1,294	2.95
	2050	11,368	11,368	0	3,933	3,922	11	0	1,387	2.89
	% Increase	37%	37%	--	38%	38%	0%	--	47%	0%
C	2015	416	416	0	158	158	0	0	30	2.63
	2020	781	781	0	306	306	0	0	30	2.55
	2035	1,511	1,511	0	585	585	0	0	30	2.58
	2050	1,688	1,688	0	665	665	0	0	30	2.54
	% Increase	306%	306%	--	321%	321%	--	--	0%	-4%
D	2015	6,981	6,981	0	2,683	2,624	59	0	1,905	2.60
	2020	6,969	6,969	0	2,658	2,599	59	0	1,985	2.62
	2035	8,465	8,465	0	3,045	2,986	59	0	1,996	2.78
	2050	9,068	9,068	0	3,304	3,245	59	0	1,996	2.74
	% Increase	30%	30%	--	23%	24%	0%	--	5%	5%
E	2015	16,991	16,991	0	5,397	3,509	1,888	0	7,627	3.15
	2020	17,053	17,053	0	5,397	3,509	1,888	0	7,869	3.16
	2035	17,077	17,077	0	5,397	3,509	1,888	0	7,990	3.16
	2050	16,888	16,888	0	5,397	3,509	1,888	0	7,990	3.13
	% Increase	-1%	-1%	--	0%	0%	0%	--	5%	-1%
All	2015	70,522	70,352	170	25,966	21,141	4,592	233	23,439	2.72
	2020	72,567	72,386	181	26,547	21,648	4,666	233	24,065	2.73
	2035	77,276	77,067	209	27,886	22,992	4,661	233	24,801	2.77
	2050	78,014	77,787	227	28,430	23,580	4,617	233	25,418	2.74
	% Increase	11%	11%	34%	9%	12%	1%	0%	8%	1%

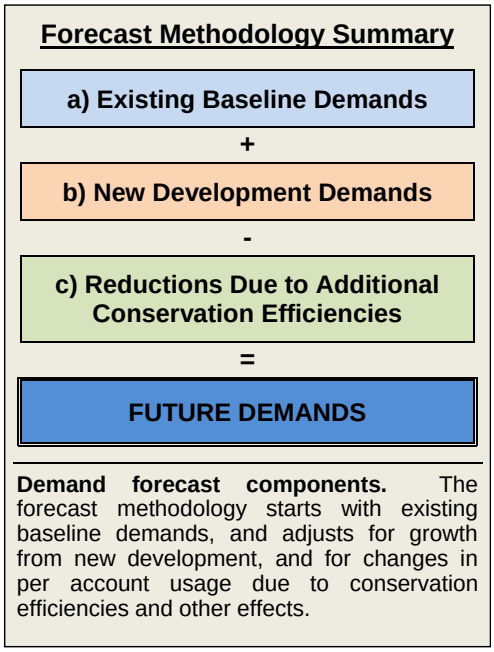
Notes: Percentage increase data is for the range from 2015 to 2050. SANDAG categorizes population into Household (HH) population, and Group Quarters (GQ), with the latter category including college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, and correctional facilities. Housing units are subdivided into Single Family Residential (SFR), Multi-Family Residential (MFR), and Mobile Home units. PPH = persons per household.

The SANDAG forecast indicates the District service area will continue to grow throughout the forecast horizon, with population projected to increase 11 percent by 2050.

Demand Forecast Methodology

The 2015 Master Plan forecasts future water demands using existing demands as a base, and scales these based on the net effects of growth, conservation, and other factors. The forecast methodology is outlined below.

a) **Existing baseline unit demands.** The Master Plan uses actual unit use factors for calendar year 2013 as the baseline normal condition demands for the forecast period. 2013 demands are sufficiently distant from the Water Use Alert conditions in effect in most of the County during 2009-10. 2013 was moderately dryer than normal, which would tend to increase use, but this increase is offset by below-normal economic activity as the economy continued to recover from the Great Recession.



Demand forecast components. The forecast methodology starts with existing baseline demands, and adjusts for growth from new development, and for changes in per account usage due to conservation efficiencies and other effects.

b) **New development.** New development demands are generated using the baseline unit use factors, and the SANDAG Series 13 projections for the District at the Zone of Benefit level of spatial resolution.

- Residential: SFR and MFR usage is scaled upwards proportionate to housing unit counts for each category, and adjusted for projected changes in Persons Per Household rates.
- Commercial: Commercial, industrial, and governmental usage is scaled upwards from existing use proportionate to employment projections.
- Irrigation: Usage is scaled upward as a weighted average of the change in SFR, MFR, and COM usage.
- Temporary Meters: TEMP account usage is custom entered to reflect levels consistent with the building activity reflected in the S.13 forecasts, based on past TEMP account usage from 2000 to 2007.

c) **Reduced demands due to additional conservation efficiencies and other factors.** The Master Plan projects unit use rates will continue to decline over time in response to increased water rates, conservation education, and shifting landscape preferences. These factors are summarized in **Table 2-4**.

Table 2-4: Summary of Unit Use Adjustment Factors

FACTORS DRIVING UNIT USE REDUCTIONS	
1) Landscape Ordinances	As required by State law from 2010 and as amended by the State Water Resources Control Board in 2015, all land use jurisdictions have adopted landscape ordinances limiting new landscape construction water use to 55% ET for residential construction, and 45% for non-residential construction. The state requirements also limiting turf utilization in all types of construction and in and streetscape uses. As a result, new construction in the District will feature less grass, and be lower water using in comparison to pre-2010 construction.
2) Weather-Based Irrigation Controllers	Newer landscape irrigation controllers can automatically adjust irrigation schedules consistent with actual climate conditions and plant water needs, reducing unnecessary use due to over-irrigation. The use of these controllers will become increasingly common during the planning horizon.
3) Turf Retirement	Up until late-2015 MWD and SDCWA were providing financial incentives to customers who replaced grass with low water use landscapes, helping drive a transition of customer landscape preferences away from turf. In the District service area, this transition will likely continue gradually over the course of the planning horizon.
4) High-efficiency clothes washers	Newer clothes washing machines, in particular front-loading versions, are more water efficient than older traditional-style washers.
5) High-efficiency toilets	California regulations enacted in 2011 require new toilets to operate with a maximum of 1.28 gallons per flush, compared to 1.6 gpf per the previous 1992 requirements. This will reduce water use at new SFR and MFR construction. Rebate programs funded by MWD and others will support a gradual transition to the newer toilets.
6) MFR Submetering	Future MFR construction will be subject to requirements that individual units be submetered and billed by usage. The direct price signal to the consumer results in reduced water use.
7) Increasing Real Prices / Behavioral Changes	Retail water rates may continue to increase at a rate faster than inflation, driven by increases in wholesale rates. Customers respond by reducing use.
FACTORS DRIVING UNIT USE INCREASES	
8) Climate Change	Per SDCWA's most recent climate change analysis (2013 Water Facilities Master Plan, Appendix E), the median predicted climate change will increase average ETo in the District service area 1.9% by 2035, and approximately 3% by 2050.

Projected Demands and Sensitivity Analysis

The Master Plan projects that potable water demands in the District service area will remain relatively flat over time relative to existing demands, despite underlying growth in population and employment, with demands remaining below the District's peak demand conditions of 2007 and 2008. The Master Plan projects future demands at 2050 will be approximately 15 percent lower than those forecast in the District's 2011 master plan, and one-third lower than forecast in the 2006 plan.

Historical and projected future water demands are summarized in **Table 2-5, Figure 2-2, and Table 2-6** below.

Table 2-5: Demographic and Water Demand Forecast Summary

Fiscal Year:	2015 (actual)	2020	2035	2050	Increase 2015-2050	
DEMOGRAPHIC FORECAST (per SANDAG S.13)						
Population	70,522	72,567	77,276	78,014	7,492	11%
Employment	23,439	24,065	24,801	25,418	1,979	8%
Housing Units	25,966	26,547	27,886	28,430	2,464	9%
DEMANDS (Total Deliveries)	21,400	22,800	23,800	23,400	2,000	9%
Recycled[1]	1,900	2,400	2,400	2,400	500	26%
Potable[2]	19,500	20,400	21,400	21,000	1,500	8%
Per Capita Potable Demand (gpd)	247	251	247	240	-7	-3%
SB-7 Per Capita Use Goal (gpd)	--	283	--	--	--	--

1. Existing, verifiable, and additional planned.
2. Based on median forecast projection

Figure 2-2: Historical and Projected District Total Water Demands

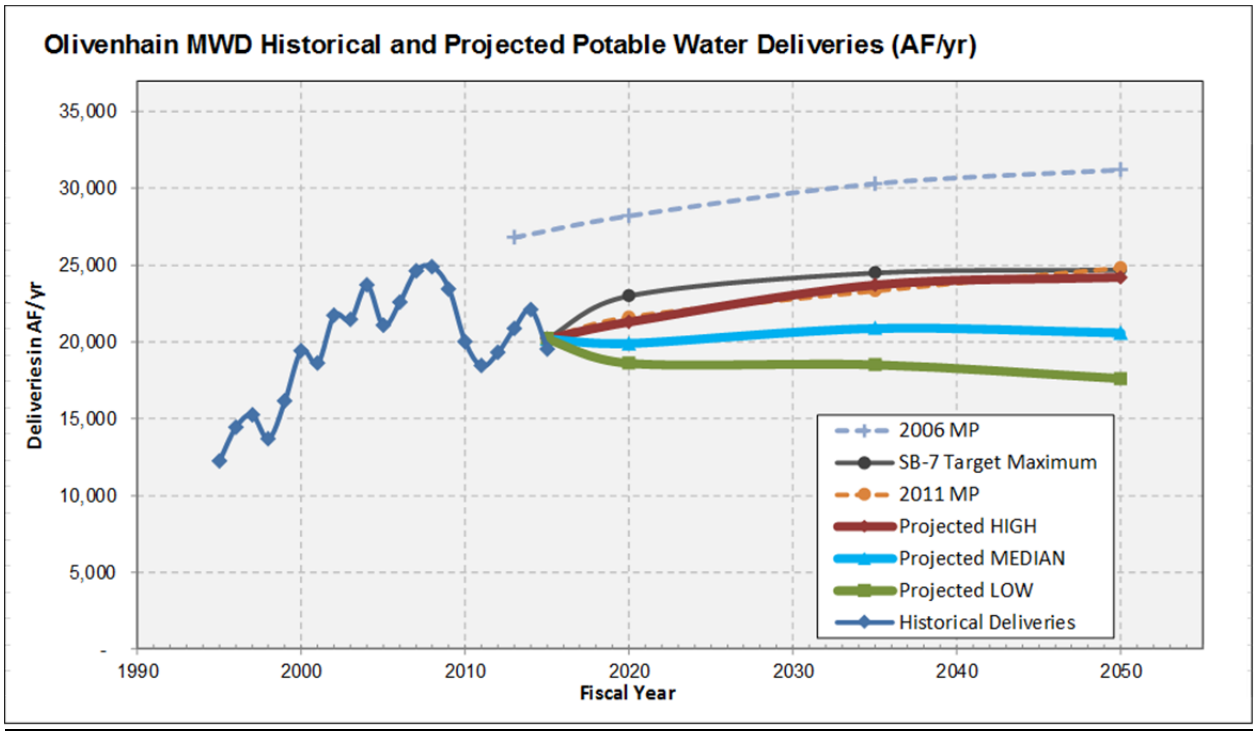


Table 2-6: Median Potable Forecast by Zone and Customer Class

Calendar Year	2013 AF/yr		2020 AF/yr	2035 AF/yr	2050 AF/yr	2020	2035	2050
Zone A	DELIVERIES					% Change vs. 2013		
SFR	5,920		5,740	5,600	5,430	-3%	-5%	-8%
MFR	480		480	480	470	0%	0%	-2%
COM	430		410	430	440	-5%	0%	2%
School	90		80	80	80	-11%	-11%	-11%
AG	50		50	50	50	0%	0%	0%
IRR	1,000		720	630	600	-28%	-37%	-40%
Other	-		-	-	-	0%	0%	0%
TEMP	-		-	-	-	0%	0%	0%
TOTAL	**7,970**		**7,490**	**7,270**	**7,070**	**-6%**	**-9%**	**-11%**
Zone B	DELIVERIES					% Change vs. 2013		
SFR	3,970		4,000	4,340	4,200	1%	9%	6%
MFR	20		20	20	20	0%	0%	0%
COM	40		50	50	50	25%	25%	25%
School	-		-	-	-	0%	0%	0%
AG	570		560	560	560	-2%	-2%	-2%
IRR	700		710	780	790	1%	11%	13%
Other	-		-	-	-	0%	0%	0%
TEMP	-		10	10	10	0%	0%	0%
TOTAL	**5,300**		**5,350**	**5,770**	**5,630**	**1%**	**9%**	**6%**
Zone C	DELIVERIES					% Change vs. 2013		
SFR	250		400	700	740	60%	180%	196%
MFR	-		-	-	-	0%	0%	0%
COM	-		-	-	-	0%	0%	0%
School	-		-	-	-	0%	0%	0%
AG	10		10	10	10	0%	0%	0%
IRR	70		100	170	190	43%	143%	171%
Other	-		-	-	-	0%	0%	0%
TEMP	-		-	-	-	0%	0%	0%
TOTAL	**330**		**510**	**880**	**940**	**55%**	**167%**	**185%**
Zone D	DELIVERIES					% Change vs. 2013		
SFR	3,750		3,520	3,860	3,840	-6%	3%	2%
MFR	30		30	30	30	0%	0%	0%
COM	60		60	60	60	0%	0%	0%
School	10		10	10	10	0%	0%	0%
AG	160		160	160	160	0%	0%	0%
IRR	720		680	720	740	-6%	0%	3%
Other	-		-	-	-	0%	0%	0%
TEMP	-		10	10	10	0%	0%	0%
TOTAL	**4,730**		**4,480**	**4,860**	**4,860**	**-5%**	**3%**	**3%**
Zone E	DELIVERIES					% Change vs. 2013		
SFR	1,700		1,640	1,590	1,530	-4%	-6%	-10%
MFR	270		270	270	260	0%	0%	-4%
COM	210		210	210	210	0%	0%	0%
School	10		10	10	10	0%	0%	0%
AG	-		-	-	-	0%	0%	0%
IRR	250		240	230	220	-4%	-8%	-12%
Other	-		-	-	-	0%	0%	0%
TEMP	-		-	-	-	0%	0%	0%
TOTAL	**2,440**		**2,360**	**2,310**	**2,230**	**-3%**	**-5%**	**-9%**
TOTAL DISTRICT -- DELIVERIES (AF/yr)						% Change vs. 2013		
SFR	15,580		15,290	16,090	15,730	-2%	3%	1%
MFR	800		790	800	780	-1%	0%	-3%
COM	740		730	750	760	-1%	1%	3%
School	110		110	110	110	0%	0%	0%
AG	800		780	780	780	-3%	-3%	-3%
IRR	2,730		2,690	2,840	2,840	-1%	4%	4%
Other	-		-	-	-	0%	0%	0%
TEMP	-		20	20	20	0%	0%	0%
TOTAL*	**20,760**		**20,400**	**21,400**	**21,000**	**-2%**	**3%**	**1%**

*Rounded

Forecast Envelope – Alternative Demand Futures

As depicted in Figure 2, the Master Plan forecast includes a planning envelope to account for the possibility that future demand conditions will develop differently than envisioned by the median demand forecast. The forecast variables used to create the envelope, and to define High and Low forecasts to bracket the Median forecast, are summarized in **Table 2-7** below:

Table 2-7: Forecast Variables for Low, Median, and High Forecast Ranges

Planning Variable	Low	Median	High
Baseline water demand	5 percent reduction relative to 2013 demand levels	Per 2013 actual demands	5 percent increase relative to 2013 demand levels
Growth Forecast	Growth rate set at 75% SANDAG S.13	Per SANDAG S.13	Growth rate set at 125% SANDAG S.13
Conservation Factors	At 1.5x default levels	At default levels	At 0.5x default levels

Upon careful review, the District has elected to use the Median forecast as the planning basis for the Master Plan and its related Capital Improvement Plan. For financial planning purposes, the District will also consider the implications of the Low forecast.

2.3. Existing and Future Equivalent Dwelling Units

Previous District master plans have focused on Equivalent Dwelling Units (EDUs) as the basis for land use development and water demand forecasting. Detailed land use analysis conducted in 1996 in support of the District's Water Storage Project [Assessment District 96-1] debt issuance identified then-existing and projected future EDUs to buildout. Subsequent master plans and financial plans used this analysis as a base, and updated it for changing land use projections including the transition of some developable but undeveloped parcels to dedicated open space.

The water demand forecast of the current master plan has transitioned from the EDU basis of previous master plans to the SANDAG-based approach reviewed in the previous section. The master plan has implemented this transition to better align District forecasts with the regional growth forecasts and adopted land use plans of the County and the various municipalities within the District service area, and in recognition that the EDU database no longer accurately reflects remaining development.

Even though EDUs are no longer being used as the basis for demand forecasting, the metric remains useful for financial planning purposes in that it supports forecasts of future capacity fee revenue. To support the District's financial planning, the master plan has developed a forecast of meter sales on an EDU-equivalent basis. The forecast utilizes the SANDAG Series 13 growth forecast for the District, broken down by the District's five Zones of Benefit. The forecast is summarized in **Table 2-8** below.

Table 2-8: Existing and Projected Additional EDUs, by Zone of Benefit

Customer Class	2014 Units (billing)	Potable EDUs	EDUs per Unit	Housing Units and Employment per SANDAG S.13 2015	2020	2035	2050	Additional EDUs (projected) 2020	2035	2050
ZONE A										
SFR	11,513	11,390	0.99	12,001	12,127	12,165	12,239	125	162	235
MFR	3,864	2,705	0.70	2,634	2,708	2,703	2,659	52	52	52
COM	--	742	--	12,936	12,887	13,491	14,015	10	20	30
Other	--	1,181	--	--	--	--	--	5	10	15
Subtotal A	**15,377**	**16,018**	**--**	**--**	**--**	**--**	**--**	**191**	**244**	**332**
ZONE B										
SFR	2,737	3,905	1.43	2,849	3,107	3,747	3,922	368	1,281	1,531
MFR	9	6.3	0.70	11	11	11	11	0	0	0
COM	--	86	--	941	1,294	1,294	1,387	5	5	10
Other	--	458	--	--	--	--	--	60	130	200
Subtotal B	**2,746**	**4,456**	**--**	**--**	**--**	**--**	**--**	**433**	**1,416**	**1,741**
ZONE C										
SFR	188	347	1.85	158	306	585	665	273	789	936
MFR	5	3.5	0.70	0	0	0	0	0	0	0
COM	--	7	--	30	30	30	30	0	0	0
Other	--	11	--	--	--	--	--	0	0	0
Subtotal C	**193**	**369**	**--**	**--**	**--**	**--**	**--**	**273**	**789**	**936**
ZONE D										
SFR	2,860	3,752	1.31	2,624	2,599	2,986	3,245	0	475	815
MFR	154	108	0.70	59	59	59	59	0	0	0
COM	--	103	--	1,905	1,985	1,996	1,996	0	0	0
Other	--	383	--	--	--	--	--	0	20	40
Subtotal D	**3,014**	**4,345**	**--**	**--**	**--**	**--**	**--**	**0**	**495**	**855**
ZONE E										
SFR	3,383	3,433	1.01	3,509	3,509	3,509	3,509	0	0	0
MFR	1,974	1,382	0.70	1,888	1,888	1,888	1,888	0	0	0
COM	--	314	--	7,627	7,869	7,990	7,990	0	0	0
Other	--	208	--	--	--	--	--	0	0	0
Subtotal E	**5,357**	**5,337**	**--**	**--**	**--**	**--**	**--**	**0**	**0**	**0**
TOTAL DISTRICT										
SFR	20,681	22,827	1.10	21,141	21,648	22,992	23,580	766	2,707	3,517
MFR	6,006	4,204	0.70	4,592	4,666	4,661	4,617	52	52	52
COM	--	1,252	--	23,439	24,065	24,801	25,418	15	25	40
Other	--	2,241	--	--	--	--	--	65	160	255
TOTAL	**26,687**	**30,524**	**--**	**--**	**--**	**--**	**--**	**898**	**2,944**	**3,864**

Notes: Data for 2014 housing units and potable EDUs is per the District billing system database, with EDUs calculated by meter equivalency except for MFR accounts for which EDUs are counted as number of housing units x 0.7. Additional EDUs are calculated as the additional number of housing units projected by SANDAG relative to the SANDAG count for 2015, times the applicable EDU per Unit adjustment multiplier. Additional EDUs for Commercial and Other accounts are District estimates. "Other" accounts as presented here includes all potable accounts other than SFR, MRF, and COM.

Per the EDU projection in Table 2-8, the District can expect to sell approximately 3,900 additional EDU's by 2050, where 2050 reflects buildout conditions. For comparison, the 2011 master plan projected an additional 4,200 EDUs at buildout. Accounting for EDU sales subsequent to the 2011 forecast to the present date, these forecasts are essentially equivalent.

2.4. Summary of Potable Water Storage Study

The District retained Infrastructure Engineering Corporation (IEC) to prepare a static desktop evaluation of potable water storage (IEC, 2016). In this case, static means that the District's actual storage volumes were compared against storage criteria but that no hydraulic modeling was performed. The evaluation divided the District into six main storage zones including:

- Zone 1 – West (Denk)
- Zone 2 – Southwest (Gaty and Miller)
- Zone 3 – Rancho Cielo
- Zone 4 – Central (Peay)
- Zone 5 – South (Gano, Zorro, Palms)
- Zone 6 – 4S Ranch

The minimum storage criteria for each zone, and for the District overall, was set at operational storage of 150 percent of an average annual demand (AAD) plus emergency storage plus the maximum fire flow demand, as shown in **Table 2-9**. Emergency storage was set at 50 percent of AAD for Zones 1, 2, 4, and 6, zones supplied by large tanks, and 100 percent of AAD for Zones 3 and 5. If, for example, the maximum fire flow was a commercial fire at 3,500 gallons per minute (gpm) for three hours, the storage requirement would be 630,000 gallons or 0.63 million gallons (MG). Existing and buildout demands were set at 18.6 mgd, as discussed in section 2.2.

Table 2-9: Build-out Storage Requirements (MG)

Zone	Demand (gpm)	Operational Storage	Emergency Storage	Fire Storage	Total
1	2,599	5.61	1.87	0.63	8.1
2	4,364	9.43	3.14	0.63	13.2
3	502	1.08	0.72	0.96	2.7
4	1,917	4.14	1.38	0.96	6.5
5	2,120	4.58	3.05	0.96	8.6
6	1,414	3.06	1.02	0.96	5.0
Total	12,917	27.90	11.19	5.10	44.2
(mgd)	18.6				

The evaluation concluded that the District's existing storage tank capacity meets and exceeds the District's storage planning criteria, for existing and ultimate demand conditions, in each of the six zones and for the overall District, as shown in **Table 2-10** below. In addition, the evaluation concluded the minimum storage criteria would still be met if the Wanket, Gaty I, and Palms Reservoirs were removed from the system. The exception was Zone 5, which would have a deficit of 1.3 MG. Discussions with District staff indicated that, in the event of an emergency, operational changes could be made within a relatively short period of time to move water from zones with surplus storage into zones with storage deficits. For the overall District, with the tanks removed, there is still a surplus of more than 24 MG of storage. IEC did recommend dynamic modeling to determine the hydraulic impacts of removing the reservoirs from the system, and to make recommendations for system improvements, if necessary, to accommodate the reservoir removals.

Table 2-10: Existing Storage Capacity and Build-out Storage Requirements (MG)

Zone	Tanks	Existing Capacity	Build-out Storage Required	Surplus/ Deficit
1	Wanket	0.00		
1	Denk	9.97		
Total Zone 1		9.97	8.1	1.9
2	Gaty I	0.00		
2	Gaty II	12.38		
2	Miller	7.98		
Total Zone 2		20.36	13.2	7.2
3	Berk	3.48		
3	Marylloyd	0.00		
3	Cielo	0.98		
Total Zone 3		4.46	2.7	1.7
4	Peay	9.77		
4	4G	0.05		
Total Zone 4		9.82	6.5	3.3
5	Gano	5.99		
5	Zorro	1.30		
5	Palms #1	0.00		
5	Palms #2	0.00		
Total Zone 5		7.29	8.6	-1.3
6	4S I	10.42		
6	4S II	5.99		
Total Zone 6		16.41	5.0	11.4
Totals		68.31	44.1	24.2

Based on this assessment, the Master Plan recommends the District budget $250,000 in FY 2020-21 to begin decommissioning the Gaty I Reservoir. While there is no defined scope of work with this budget, it could potentially include demolition and disposal of the reservoir lining and cover, and asphalt plank lining.

The Wanket Reservoir has been out of service for several years and the District is planning to convert it to recycled water storage. It may also be utilized for direct potable reuse when the regulations allow such use. The costs of converting this reservoir are discussed in more detail in the recycled water portion of this report. The District is also considering converting the Palms II Reservoir to recycled water storage for the Extension 153 portion of the Southeast Quadrant Recycled Water Distribution System. Extension 153 is also discussed in the recycled water portion of this report.

Additionally, the District has retained Investigative Sciences to evaluate each District property that potentially has excess land area, to determine the best use. This evaluation includes the Gaty I Reservoir site.

2.5. Steel Tank Maintenance Program

Historically, District operation's staff periodically inspected and monitored the condition of their steel water storage tanks. A main focus of the District inspection, and the most significant steel tank maintenance cost, was the evaluation and renovation of the interior and exterior coating. When the inspection indicated that a renovation or major maintenance project was warranted, operations staff would inform the Engineering Department who would execute the following plan:

1. Investigate the tank condition and develop a scope of work
2. Budget capital funds for the renovation
3. Hire a consultant to develop plans and specifications
4. Conduct a public bidding process and award a contract to the lowest responsible bidder
5. Hire a consultant construction manager; and
6. Hire a specialized coating inspector

This process was cumbersome and with the public bidding requirements, the District ended up with a different coating contractor for each project which resulted in inconsistent quality in workmanship.

In 2007, the District investigated alternative approaches and ultimately concluded that a tank maintenance contract would be more cost-effective. The cost of the contract is a maintenance expense but helps avoid capital expenses. The District selected Utility Services Company, Inc. (USCI) to maintain nine steel tanks for potable and recycled water storage. The contract became effective in FY 2007 – 08 with a five-year term through FY 2012-13, and subsequently has been renewed on an annual basis. Under the terms of the contract, the District pays USCI a pre-determined annual payment. In return, USCI is responsible for and assumes the risk associated with the long-term inspection, maintenance, and repair of the District's tanks. **Table 2-11** lists the capacities and approximate interior and exterior surface areas of the tanks covered by the USCI contract.

Table 2-11: Tanks in the Contract and Their Attributes

Name	P/R	MG	Interior Area (sf)	Exterior Area (sf)	Total Area (sf)	FY 2014-15 TAI
Cielo	P	1.0	12,000	7,600	19,600	9.3
Denk	P	10.0	113,100	68,500	181,600	9.0
4S I	P	10.0	113,100	68,500	181,600	8.3
4S II	P	4.0	33,000	15,100	48,100	9.1
R Miller	R	8.0	92,700	57,100	149,800	6.8
T Miller	P	1.0	12,000	7,600	19,600	8.1
Peay	P	10.0	113,100	68,500	181,600	9.6
Wiegand	P	1.0	16,500	12,000	28,500	10.0
Zorro	P	1.2	13,600	8,300	21,900	7.8
Totals					832,300	

P = Potable, R = Recycled
Cielo, 4S II, Thelma Miller, and Zorro have aluminum dome roofs that are not painted.

The last column in Table 2-11 is the Tank Asset Index, a nationally recognized index utilized to rate the condition of each tank. USCI prepares the rating on an annual basis. The Unacceptable condition range is 1.0 to 2.9; Sub Standard is 3.0 to 4.9; Satisfactory is 5.0 to 6.9; Good is 7.0 to 8.9, and Very Good is 9.0 to 10.0. All of the tanks in the contract except Roger Miller are rated good, or better. The Roger Miller Tank will undergo a partial interior renovation starting in December 2015 with an exterior renovation scheduled for 2016.

Under this type of contract, USCI is incentivized to provide a robust program of inspection and maintenance to avoid the expense of failures and major repairs. Because USCI specializes in tank maintenance programs, and provides similar service to many other water agencies, they are able to provide expertise and economies of scales not available to the District in-house or through the design-bid-build approach.

DLM evaluated and commented on the cost-effectiveness of the contract to the District. The scope included a review of the contract terms and a general comparison to the design-bid-build approach based on readily available data. The District does not have historical maintenance costs broken down into enough detail to allow a direct comparison. Instead, cost data was collected from several other agencies and consultants for comparison.

On September 8, 2015, District staff and DLM met with USCI staff to review and discuss the contract, including completed and upcoming work and fees. This section summarizes the results of the evaluation.

Conclusions

Overall, the USCI contract appears to be less costly and appears to provide the District with better quality tank maintenance than the District's previously utilized design-bid-build approach. The contract is currently budgeted as a maintenance expense so the District does not need to include costs in the capital spending plans. The advantages of the contract to the District include the following:

1. Frequent Inspection - District tanks are visually inspected every year and drained, washed out, and inspected every other year. District staff attends the inspections and any maintenance that is required is performed by USCI. This approach helps avoid problems.
2. Frequent Coating Renovation – The frequency with which USCI renovates tank coatings is consistent with, or more frequent than that used by other agencies we contacted, 7 to 8 years for the exterior, and 11 to 12 years for the interior. This helps to maintain the tanks in good condition. USCI believes, based on the maintenance of 6,500 tanks, that this is the frequency necessary to maintain coating quality and avoid larger costs associated with deferring a renovation.
3. Lower Costs for Coating Renovation – The USCI costs for coating renovation are consistently lower than what other agencies we contacted are using for planning purposes, or are seeing in bids. The contract includes approximately 832,500 square feet of surface that needs coating maintenance. Every dollar saved per square foot totals over $800,000 in savings to the District.

4. Improved Coating Quality – Theoretically, because USCI specializes in this type of work, and uses consistent staffing and subcontractors, the result should be high quality coatings. USCI must achieve an annual Tank Asset Index of at least 6.5. District staff confirmed that to date, coating work has been high-quality and staff is able to review the quality every other year during the tank drain and washout.
5. Avoidance of Design and Inspection Costs – USCI is responsible by contract for selecting and applying coatings that meet specific minimum regulatory and industry standards. This avoids the need for design and inspection services which can exceed $100,000 for each renovation project.
6. Excellent Customer Service – District staff report that USCI customer service is excellent. They have repaired deficiencies and when minor maintenance is needed, USCI responds quickly.
7. Avoidance of Depreciation – This type of maintenance program meets Government Standards Accounting Board (GASB) 34 requirements to report a full asset value. Consequently, the District does not have to depreciate the tanks, or set aside funds for replacement. For the nine tanks currently in the contract, the depreciation would have exceeded $400,000 per year.

DLM has several comments and suggestions regarding the tank maintenance contract for the District to consider.

1. Audit the Contract Work – If not already audited, the District staff should confirm annually that the contract work was actually completed on schedule or is planned in the near future. We did receive a list of work completed from USCI and it appears that most of the scheduled work was completed although it was sometimes delayed (in one case at District request). The last few projects are scheduled in the next two or three years.
2. Retain a Certified Independent Coating Inspector – At a minimum, the District should take advantage of the scheduled draining/ washouts as their opportunity to confirm the condition of the tank. Consider retaining an independent certified coating inspector to periodically review the USCI work during the coating renovation projects.
3. Monitor the Staffing and Work – To date, District staff report that USCI has performed very well. Recently however, USCI has been acquired by a larger company. The District should continue monitoring the USCI staffing and performance to make sure there is consistency in staffing and a continued high-level of service and quality. As mentioned in the advantages of the contract, the consistency of staffing is critically important coating quality and to the success of this contract.
4. Contract Amendment – District operation's staff will be working on a contract amendment with USCI. This amendment should include more definitive criteria for minimum tank condition. Incorporate the Tank Asset Index (TAI) minimum of 6.5 and the criteria that leads to this rating. The District may also want to consider a multi-year contract that might further incentivize the long-term avoidance of capital expenditures.

2.6. Asphalt Maintenance Program

The District currently maintains approximately 29 acres of asphalt pavement for driveways and facility sites at 40 locations. The locations and areas are summarized in **Table 2-12**.

Table 2-12: Asphalt Pavement Area by Facility Type

Facility	Site Area (SF)	Driveway Area (SF)
Ammonia Feed Injection Facility	4,700	0
Office Building Complex	72,000	23,560
Potable Water Pump Stations	9,190	1,500
Reclaimed Water Facilities	6,400	0
Storage Tanks	262,793	244,085
Roadways	0	17,400
Sewer Lift Stations	60,715	25,760
4S Ranch Water Reclamation Facility	120,000	4,800
McCollom Water Treatment Plant	126,275	200,000
Operations & Maintenance Yard	65,550	11,250
Total (SF)	**727,623**	**528,355**
Grand total (SF)		**1,255,978**
Total (Acres)	**16.7**	**12.1**
Grand Total (Acres)		**28.8**

In order to maintain the functionality of the asphalt at these sites, extend pavement life, and plan and budget for repairs, rehabilitation and replacement, the District initiated an asphalt maintenance program. Typically, this type of program includes preventative maintenance, minor rehabilitation, and routine maintenance.

Staff from DLM and HC met with District staff to collect a list of all sites, details and invoices from recent maintenance, and other related information. Staff from HC then created a site evaluation template and evaluated each site using Caltrans pavement assessment criteria (Caltrans 2008). The following types of pavement distresses were visually investigated at each site to determine the overall pavement condition:

- Cracking
- Deformation
- Deterioration
- Mat Problems
- Seal Coat Distress

An overall pavement condition rating was given to each site as defined below:

- Good – Pavement has minor to no cracking or deterioration, no deformation, mat problems, or seal coat distress.
- Fair – Pavement has minor or localized cracking and minor deformation, deterioration, mat problems, or seal coat distress.

- Poor – Pavement has excessive cracking deformation, deterioration, mat problems, or seal coat distress.

In general, almost 77 percent of the sites evaluated were assessed as good or fair, with minimal maintenance recommended over the next five years. **Table 2-13** lists 10 sites assessed as poor and **Table 2-14** lists 10 sites assessed as fair along with the estimated costs for the recommended preventative and restorative maintenance repairs. Two of those sites, the District Lower Yard and Office are recommended for full pavement reconstruction. **Table 2-15** lists the sites assessed as good and not needing maintenance. The costs are summarized by year in **Table 2-16** and these are considered maintenance costs and do not need to be included in the CSPs. Additional details and a two-page summary for each site can be found in the maintenance program report[4]. The front parking lot at the District Office should be reconstructed as a part of the Office expansion and remodel (building D Project).

Table 2-13: Estimated Costs for Sites Assessed as Poor

Facility	Year	Estimated Costs
Office and Yard	2016	$156,000
Lower Yard	2017	$118,000
4S Wet Weather Pond	2018	$9,000
Golem Tank	2018	$4,000
Neighborhood 1 SPS	2018	$9,000
Palms Tanks	2018	$29,000
Rancho Lakes PS	2018	$1,000
Wanket Tank	2018	$27,000
Wiegand Tank	2018	$8,000
Denk Tank	2019	$47,000
	Totals	**$408,000**

Table 2-14: Estimated Costs for Sites Assessed as Fair

Facility	Year	Estimated Costs
Firehouse SPS	2019	$4,000
Ridgeline Road	2019	$3,000
Roger Miller Tank	2019	$3,000
4S I Tank	2020	$4,500
Gano Tank	2020	$6,500
Gaty II Tank	2020	$3,500
Peay Tank	2020	$4,500
Santa Fe Valley Reservoir	2020	$6,000
Thornton PS	2020	$1,000
Zorro Tank	2020	$4,000
	Totals	$40,000

Table 2-15: Facilities with a Good Condition Rating

4S II Tank	4S WRF	Berk Tank	Building J	Cielo PS A
Cielo PS B	Cielo PS	Cielo Tank	Connemara PS	Cielo Midpoint PS
Unit Z PS	Neighborhood 3 Sewer PS			

PS = Pump Station

Table 2-16: Asphalt Maintenance Budget Summary

Year	Budget
2016	$156,000
2017	$118,000
2018	$86,000
2019	$58,000
2020	$30,000
Totals	$448,000

2.7. 10-Year and 20-Year Potable Water Capital Spending Plans (CSP)

In addition to the projects addressed in this master plan, the District staff has identified other high-priority capital projects that are either not currently in the CSP, or are in the CSP but required budget revisions. The recommendations for the CSP are as follows:

1. Budget $250,000 in FY 2020 – 21 for Gaty I Reservoir decommissioning work.

2. Increase the budget in the CSP for the El Camino Real Pipeline replacement, Encinitas Boulevard to Olivenhain Road, to $4,300,000. This project is currently scheduled for FY 2021-22 and 2022-23. The District is about to start work on a comprehensive pipeline condition assessment program that will re-evaluate this schedule.

3. Add the Encinitas Boulevard Pipeline Replacement, El Camino Real to La Bajada to the CSP with a budget of $4,300,000. The schedule for this work will also be evaluated in the condition assessment program.

4. Develop budgets and schedules for a pressure reducing station replacement program. The District Operations Department is currently working on this program.

5. Develop budgets and schedules for a nylon bushing replacement program. The District Operations Department is currently working on this program.

6. Work with Finance in the spring of 2016 to revise the 10-year CSP for FY 2016-17.

3. RECYCLED WATER MASTER PLAN

3.1. Introduction

The District has two recycled water service areas, the Northwest Quadrant and the Southeast Quadrant. In 2016, a third system, the Village Park Recycled Water Project will begin service. This master plan focuses on the following four opportunities to expand these recycled systems in coastal areas:

- The Village Park Recycled Water Project, Phase II
- Extension 153, Additional Recycled Water Customers
- Service to the Bridges Golf Course and HOA through the 30-Inch SDWD Low Pressure Pipeline and; and
- Conversion of the Wanket Tank to Recycled Water

These projects are shown in **Figure 3-1** and discussed in the following sections. The last section provides recommendation for changes to the District's 10- and 20-year capital spending programs.

3.2. Village Park Recycled Water Project Phase II

The Village Park Recycled Water Project Phase I will distribute approximately 220 AFY of recycled water within the Village Park Community of the City of Encinitas. Recycled water supplied by the San Elijo Joint Powers Authority (SEJPA) is conveyed from SEJPA's Oak Crest Tank north to the District's Wiegand Tank through a 12-inch pipeline. From Wiegand, the water is conveyed easterly through a 12-inch pipeline to a pump station just west of El Camino Real and then pumped through 12-inch and smaller pipelines to customers in Village Park to irrigate turf and plants in the common use areas of numerous HOAs. The facilities and service area are shown in Figure 3-1. The project is currently under construction and will be completed in mid-2016.

The District developed a Village Park Recycled Water Project Phase II to serve interested customers in close proximity to Phase I infrastructure while beginning to interconnect the Village Park and Northwest Quadrant Systems. Specifically, Phase II will serve several customers along El Camino Real, Wandering Road, Glen Arbor Drive, and Avenida La Posta. The proposed customers and facilities are listed in Table 3-1 and shown in Figure 3-2. The District has identified approximately $5 million of recycled water improvements, including Village Park Phase II that could be eligible for State of California Proposition 1 grant funding. Federal funding is also possible. Proposition 1 provides up to 35 percent of project costs, and depending on how much total funding can be obtained, the District will need to budget between $2.5 and $4.0 million for their share of costs of these projects.

Twin D Tanks (Carlsbad) HWL = 424

Secondary Effluent From Encina WPCF

Meadowlark Water Reclamation Facility (VWD)

Mahr Reservoir (VWD)

Gafner Water Reclamation Facility (LWD)

La Costa Golf Course

Future PS (LWD)

Existing Northwest Quadrant Recycled Water System (OMWD)

Wanket Tank (OMWD) HWL = 419

Encinitas Ranch Golf Course

Existing North Distribution System (SEJPA)

4" El Camino Real Pipeline Extension*

4" Avienida La Posta Pipeline Extension*

8" Glen Arbor Drive Pipeline Extension*

4" Wandering Road Pipeline Extension*

Existing PS (OMWD) HGL = 567

Wiegand Tank (OMWD) HWL = 428

Existing Village Park Recycled Water System (OMWD)

Oak Crest (SEJPA) HWL = 416

Bridges Golf Course

R.E. Badger Filtration Plant (SFID)

Existing PS (SFID)

San Dieguito Reservoir (SFID)

Future PS (SFID)

Future Storage Tank

Rancho Santa Fe Country Club Golf Course

San Elijo Water Reclamation Facility (SEJPA)

(E) 30" Low Pressure Pipeline Future Potable Reuse Project

Existing PS (SEJPA)

Future PS (SEJPA)

Existing South Distribution System (SEJPA)

San Diego #1

Extension 153 4S Ranch Southeast Quadrant RW System (OMWD)

Farms Golf Club Turnout

Raw Water #2

Morgan Run Club and Resort

The Farms Golf Club

Morgan Run Turnout

Fairbanks Ranch Turnout

Del Mar Country Club Turnout

Del Mar Country Club

Fairbanks Ranch Country Club

LEGEND

- Treatment Facility
- Storage Tank
- Pump Station
- OMWD Service Area
- Reservoir
- PS — Pump Station
- * — Future Village Park Phase II Expansion
- Existing RW Service Area
- Future RW Service Area

PIPELINES: SCHEMATIC

- Existing Pipeline Direction of Flow
- Existing Pipeline Future Project
- Future Pipeline Direction of Flow

PIPELINES: ALIGNMENT

- Future Pipeline
- Existing Pipeline

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FIGURE 3-1
NORTH COASTAL RECYCLED/ POTABLE REUSE SYSTEM

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Figure 3-2
Village Park Recycled Water Project - Phase II

Table 3-1: Village Park Phase II Customers and Facilities

Name	Account	Use (AFY)	Facilities	Cost (1)
Northview II Pool House	06-048-266-110 06-054-144-300	9.2	1,000 feet of 6 to 8-inch PVC Pipe in Glen Arbor Drive	$350,000
Villanitas Park Pool House		6.7	400 feet of 4-inch PVC Pipe in Wandering Road	$100,000
La Posta RSF Vista HOA Meters 2, 3, 4	11-051-030-000 11-051-061-000 11-051-243-010	8.2	800 feet of 4-inch PVC Pipe, in Avenida La Posta west of Ave. Esteban	$200,000
Armstrong Garden Center	09-044-133-10	0.7	1,200 feet of 4-inch PVC Pipe in El Camino Real	$300,000
San Diego County Credit Union	09-044-130-00	1.3	Included above	
AAA	06-054-445-010	0.1	Included above	
US Postal Service	06-053-160-000	3.8	Included above	
City of Encinitas Medians	06-053-160-200	0.1	Included above	
	Total	30.1	Total	$950,000

(1) Estimated by District staff generally based on Village Park Recycled Water Project Bids plus 25% for Engineering, Construction Management, and Administration.

3.3. Extension 153, Additional Recycled Water Customers

Extension 153 is a recycled water distribution pipeline that follows San Dieguito Road and serves customers in the Fairbanks Ranch and San Dieguito Valley Areas. It was originally constructed in 1991 to provide recycled water to the Del Mar Country Club golf course. The pipeline is shown in **Figure 3-3** and current customers include the following:

- The Farms Golf Club and HOA
- The Morgan Run Club and Resort
- The Fairbanks Ranch Country Club; and
- The Del Mar Country Club

Calendar year 2014 demands were approximately 740 AFY. The pipeline can be supplied by several sources including the District's 4S Ranch Water Reclamation Facility (WRF), the Rancho Santa Fe Community Services District's Santa Fe Valley WRF or the City of San Diego through a connection known as SD #1. The pipeline is 14-inches in diameter in the east and reduces to 12-inches and 8-inches as it progresses to the west. Several customers adjacent to the existing main line have contacted the District and requested service. The District reviewed all of the irrigation meters in the area and identified those that can be served with relatively minor improvements. Their demands total approximately 190 AFY as shown in Table 10. Additional supply is available from the City of San Diego to serve these customers. A brief hydraulic analysis of the pipeline concluded that, in general, capacity was available to serve the new customers with minor facility improvements (DLM, 2015). The study report includes the specific locations of the potential customers in **Table 3-2**.

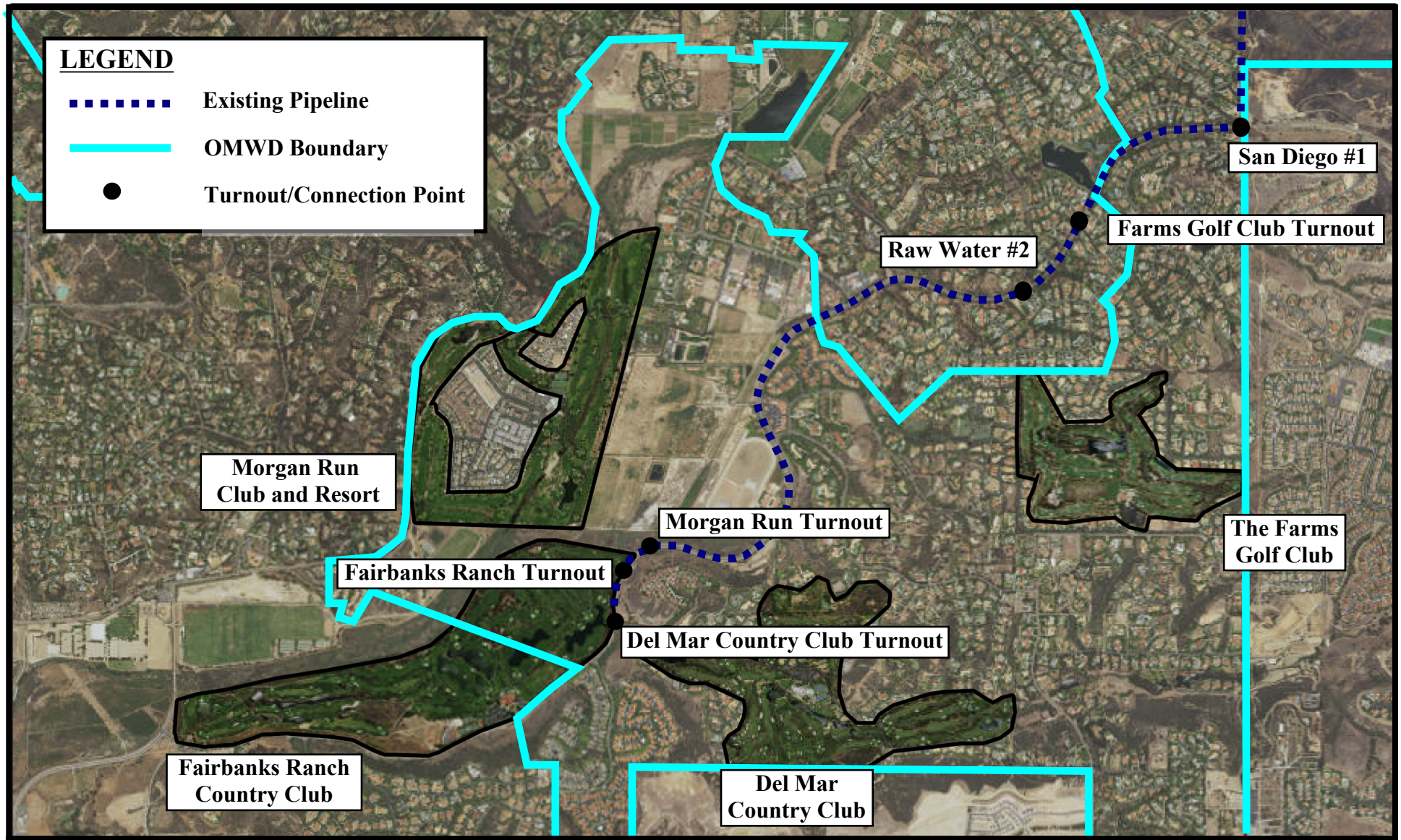

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Figure 3-3
Extension 153 Recycled Water System

Table 3-2: Potential Phase I Customers Extension 153 Service Area

Customer	Demand (AF/YR) (1)	Facilities Required for Recycled Water Service	Estimated Cost (2)
Del Mar CC	7.2		
Fairbanks Montecito	14.7	1 service lateral in San Dieguito Road 1 service lateral in Camino Santa Fe	$40,000
RSF Farms	26.7	Re-start private pump station	$30,000
Del Rayo Estates	11.0	1 service Lateral	$20,000
Del Rayo Downs Pool	22.0	1 to 2 service laterals	$30,000
Rancho Paseano	8.8		
Fairbanks Ranch Association	0.5		
Fairbanks Ranch Country Club	36.9		
Senterra HOA	16.9	750-feet 8-inch pipe, 1 meter	$150,000
Fairbanks Stratford	44.0	750-feet 8-inch pipe, 1 meter	$150,000
Total	189		

(1) Calendar Year 2014 Average Annual Demands
(2) Capital Costs estimated by District for Potential Proposition 1 Grant Applications

The District is also considering Proposition 1 and other grant funds to extend service to some of these customers, as described in the previous section. In the meantime, any required improvements will be funded by the customers. The Palms Tank, (1.2 MG) may also be converted to recycled water to provide storage, improve operations, and to possibly serve additional customers in the Extension 153 area.

3.4. Recycled Water Services to the Bridges Development, 30-Inch SDWD Low Pressure Pipeline

The Bridges Golf Course and HOA (Bridges) is a District customer located north of San Dieguito Reservoir and west of the SFID Badger Filtration Plant in Rancho Santa Fe. In 2014, the account's irrigation water use was 400 to 500 acre-feet. The Bridges development has long been interested in recycled water service and the District is interested in serving them but there is no recycled water available in the area. The Bridges Golf Course is the only golf course in the District, and the last major concentrated irrigation demand not served recycled water.

Several years ago the District completed a study of a satellite water reclamation plant to serve the Bridges. The source of water was the City of Escondido Land Outfall which runs along Escondido Creek and adjacent to the Bridges. The project did not proceed because of the potential liability the District would have to assume for sewer spills from the Outfall.

In 2011, SFID completed planning for a project known as the Eastern Service Area Recycled Water Project (RMC, 2011) to serve irrigation customers including the Rancho Santa Fe Country Club. Recycled water would be supplied by SEJPA and the project included a pump station at the SEJPA WRF, lining of the 30-inch Low Pressure Pipeline, and a tank and pump station at the country club. The 30-Inch Low Pressure Pipeline was constructed in 1950 to deliver potable water by gravity from San Dieguito Reservoir to the Cardiff area but is currently not in service. The pipeline is owned by SDWD and its schematic alignment is shown in **Figure 3-4**.

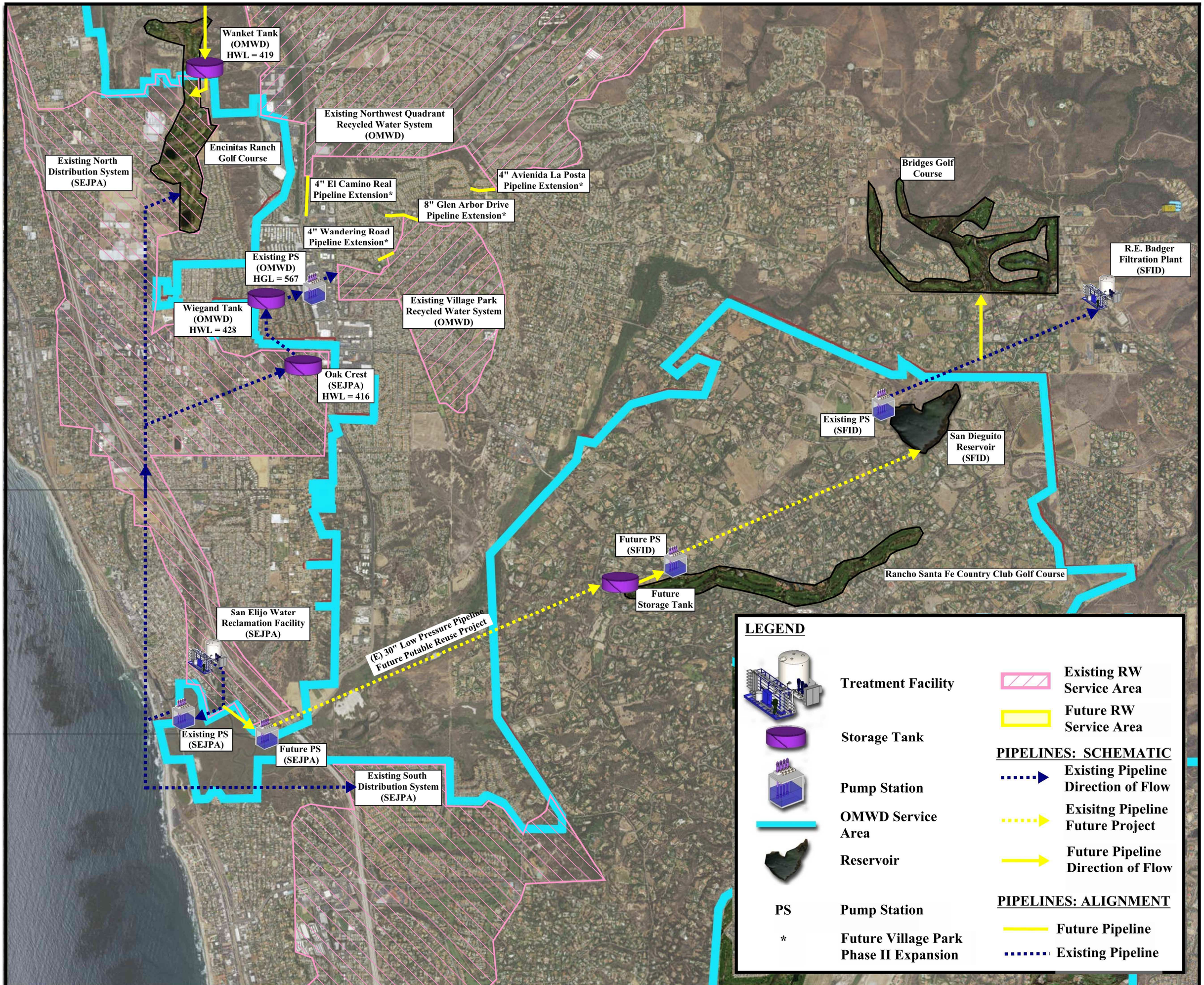

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FIGURE 3-4
POTENTIAL RECYCLED WATER SERVICE TO THE BRIDGES DEVELOPMENT

The cost of the Eastern Area Recycled Water Plan was in excess of $2,500 per acre-foot, and consequently SFID decided not to proceed with the project. If implemented, this project could have been extended to provide recycled water service to the Bridges Development.

The SDWD, Santa Fe Irrigation District (SFID), and SEJPA are currently considering a potable reuse project that would include the following facilities:

- An additional advanced water treatment plant at the SEJPA WRF
- A pump station at the SEJPA WRF
- A lining of the 30-Inch Pipeline to San Dieguito Reservoir
- A new pump station, currently under construction, from San Dieguito Reservoir to the SFID R.E. Badger Filtration Plant; and
- Additional treatment at Badger, if required

Implementation could take five to ten years as regulations are developed and the planning, design, permitting, construction and start-up are completed. In the interim, some of the facilities could be constructed and used to convey recycled water to the Bridges, the Rancho Santa Fe Country Club, and any other customers who could be easily served. This concept could take an estimated demand of 800 to 1,000 acre-feet per year off of the potable system. DLM staff met with SFID staff to discuss their potable reuse project and the interim recycled concept. SFID indicated that the partners in the study may be reluctant to consider recycled water uses for the 30-inch pipeline. This appears to be one of the best current options for serving the Bridges with recycled water.

A considerable amount of useful planning work was completed in the 2011 SFID Study. A next step for this project would be to prepare a conceptual facilities plan and cost estimate by updating some of the work on the pump station and 30-inch pipeline relining contained in the 2011 Study. The goal of the engineering work would be to minimize the facilities and capital costs needed to serve recycled water to the Rancho Santa Fe Country Club and the Bridges. The project may also be a good candidate for grant funding including the Integrated Regional Water Management (IRWM) grants and Proposition 1. Grants could reduce the unit cost of water down to feasible level. DLM also met with SEJPA staff and they are interested in working with the District on this effort. A $50,000 (District share) placeholder budget has been included in the 10-year CSP for this study.

The 30-Inch Low Pressure Pipeline alignment roughly parallels Manchester Boulevard for approximately one mile east of Interstate 5. The District has irrigation demands in this area, and if the 30-inch pipeline were converted to recycled water use, it could potentially serve these customers. The District recently received an IRWM Proposition 84 grant to extend an existing recycled pipeline along Manchester Avenue from Interstate 5 to the east to serve some of the customers. This project is known as Manchester Avenue Phase I and its year 2013 demands are shown in **Table 3-3**. It may be possible to use these grant funds to improve the 30-inch pipeline rather than constructing a new pipeline.

Table 3-3: Manchester Avenue Phase I Potential Recycled Water Customers

Customer	Meter No.	Address	Demand (AFY)
Williamson Produce	03-064-443-410	1920 S. El Camino Real	2.8
Mira Costa College	03-064-412-900	1315 Lux Canyon	4.7
Greek Orthodox Church	03-064-411-700	1720 S. El Camino Real	1.1
Lux	03-064-410-400	1544 S. El Camino Real	0.0
Belmont Village	03-064-405-410	1550 S. El Camino Real	3.5
Temple Solel	03-064-405-000	1500 S. El Camino Real	1.8
		Total	13.9

Additional customers in the Manchester Avenue corridor east of Phase I may also be able to be served with recycled water off of the 30-inch pipeline. Potential customers and demands are shown in **Table 3-4**.

Table 3-4: Manchester Avenue Phase II Potential Recycled Water Customers

Customer	Meter No.	Address	Demand (AFY)
Lux	03-064-404-540	1920 S. El Camino Real	0.2
Lux	03-064-404-200	1315 Lux Canyon	0.0
Pacific Pines	03-064-402-720	1720 S. El Camino Real	5.5
Carlos Floral	03-064-402-410	1544 S. El Camino Real	0.1
Lux Art	03-064-400-200	1550 S. El Camino Real	2.2
Grauer	03-064-401-900	1500 S. El Camino Real	0.9
5-Star Summerfield	03-064-350-010	1350 S. El Camino Real	1.5
Villatoro	03-064-326-100	1935 S. El Camino Real	0.0
Abernathy	03-064-325-810	3615 Manchester Ave.	0.0
NC Presbyterian	03-064-326-700	1831 S. El Camino Real	0.2
Kingdom Hall	03-064-326-800	1821 S. El Camino Real	2.3
Sage Cyn HOA	03-064-150-010	Sage Canyon Drive	2.4
Calle Ryan HOA	10-033-344-010	IRRIG. S. El Camino Real	2.1
		Total	17.4

3.5. Conversion of the Wanket Tank to Recycled or Potable Reuse

The J. C. Wanket Reservoir (Wanket Tank) is a 3 million gallon (MG) concrete water storage tank that was constructed in 1975. It is located west of El Camino Real and north of Leucadia Boulevard, adjacent to the Encinitas Ranch Golf Course, as shown in Figure 1. The original purpose of the tank was to provide potable water operational, fire, and emergency storage for the 437 Zone in the western portion of the District. Since the tank was constructed, the District built large water storage tanks in the central part of the District, additional west to east pipelines, and several pressure reducing stations from the 562 and 545 Zones into the 437 Zone. With these new facilities and operations, the Wanket Tank did not fill and drain on a regular basis, leading to water quality challenges, and the District took it out of service. The primary storage for the 437 Zone I is now provided by the 10 MG Denk Tank. A recent study (IEC, 2016) confirmed that the District's potable water storage criteria are met on a local and regional basis, without the Wanket Tank in service.

San Dieguito Water District (SDWD) owns one-third of the tank capacity and one-half of the tank site but they have never connected their system to the tank. Several appraisals have been

completed for the tank and site (Dexter Wilson, 2010 and Anderson and Brabant, 2010) and the District has initiated, but not completed, discussions to purchase the SDWD share. The Dexter Wilson study estimated the costs to refurbish the tank as shown in **Table 3-5**. Until these discussions are continued, DLM does not recommend including buy-out costs in the 10-year capital spending program.

Table 3-5: Wanket Reservoir Refurbishment Construction Costs

No.	Item	2010 Cost (1)
1	Mobilization/ Demobilization	$26,280
2	Floor Repairs	$19,920
3	Interior Wall Repairs	$121,800
4	Replace all Interior Metallic Components	$43,980
5	Roof Repairs	$32,400
6	Replace all Exterior Metallic Components	$24,720
	Construction Subtotal	$269,100
	Contingency (20%)	$53,800
	Subtotal	$322,900
	Engineering, CM Administration (25%)	$80,700
	Total	$403,650
	2015 Cost (2)	$446,000
	2020 Cost (3)	$517,000
	2025 Cost (3)	$599,000

1. AECOM, Olivenhain Municipal Water District, Update of Potable and Recycled Water Master Plan Capital Improvement Program, March 2011, ENRLACCI = 9945.44
2. ENRLACCI = 10981.02 (July 2015)
3. Escalated at 3 percent per year

Both the District and the San Elijo Joint Powers Authority (SEJPA), and more recently the Leucadia Wastewater District (LWD), have discussed the conversion of the Wanket Tank to recycled water storage. The source of the recycled water would be either the SEJPA Water Reclamation Facility (WRF) or the LWD Gafner WRF through a new pump station and pipeline which is shown schematically in Figure 1. However, neither the District, SEJPA, nor LWD are ready to proceed with the conversion until sufficient demands are identified to warrant the expense.

An additional option that has been discussed recently is to modify the tank for potable reuse. Current potable reuse regulations do not allow potable reuse water to be added directly to small distribution storage tanks like Wanket; however, the drinking water industry anticipates that at some time in the future this will be permitted. Sources of the potable reuse water could be an advanced water treatment plant at the Gafner WRF or some other source.

The cost to convert the tank to recycled water was estimated in 2010 (Anderson and Brabant, 2010). Because the timing of the conversion is unknown at this point, both the refurbishment and conversion costs should be included in approximately 10 years in the recycled water CSP. **Table 3-6** shows the original estimated conversion costs as well as the escalated costs in 2015, 2020, and 2025.

Table 3-6: Wanket Reservoir Recycled Water Conversion Construction Costs

No.	Item	2010 Cost (1)
1	Onsite Costs, Piping & Valve Disconnect, New Piping & Valves	$210,000
2	New 520 to 437 Zone Aboveground PRV	$200,000
3	Pipeline Disconnect. Connections, Allowance (16 Inches)	$250,000
	Construction Subtotal	$660,000
	Contingency (20%)	$132,000
	Subtotal	$792,000
	Engineering, CM Administration (25%)	$198,000
	Total	$990,000
	2015 Cost (2)	$1,093,000
	2020 Cost (3)	$1,267,000
	2025 Cost (3)	$1,469,000

1. Dexter Wilson Engineering, Inc., 2010, ENRLACCI = 9945.44
2. ENRLACCI = 10981.02 (July 2015)
3. Escalated at 3 percent per year

3.6. 10-Year and 20-Year Capital Spending Plans

The District anticipates that most of the costs for serving new recycled customers will be customer-funded, or funded through grants. The recommended changes to the 10-year CSP are listed below:

1. The District has identified approximately $5 million of recycled water improvements, including Village Park Phase II that could be eligible for State of California Proposition 1 grant funding. Federal funding is also possible. Proposition 1 provides up to 35 percent of project costs, and depending on how much total funding can be obtained, the District will need to add between $2.5 and $4.0 million to the CSP for their share of costs of these projects.

2. Budget $50,000 in FY 2016 – 17 for a joint study with SEJPA of recycled water for the Bridges Development.

3. Budget $2,070,000 in FY 2025 – 26 for the Wanket Tank refurbishment and conversion to recycled water storage.

3.7. Summary of Future Recycled Water Projects

District staff and met and have agreed on the projects and schedules shown in Table 3-7. Each project is assigned a classification that the Water Authority uses for planning its water supplies:

- Verifiable – CEQA satisfied permits in hand, or contracts have been executed.
- Additional Planned – Actively pursuing but not yet at the verifiable level.
- Concept – projects in the pre-planning and pre-feasibility analysis phase.

Table 3-7: Summary of Future Recycled Water Projects

• Project	Use (AFY)	Class	Status	Year Full Delivery
Village Park RWP	213	Verifiable	Construction/Site Conversions	2018
Diegueno MS	7	Verifiable	Designed, CEQA Complete	2017
Villanitas, Summit	9	Verifiable	Future connect to Village Park	2020
Subtotal	229	Verifiable		
Manchester Ph I	14	Planned	IRWM Grant, Funded, Cat Ex	2020
Manchester Ph II	17	Concept	Planning	2025
VPRWP Phase II	30	Concept	Planning	2025
Ext.153 Ph I**	189	Concept	Planning	2025
Ext. 153 Ph II	300	Concept	Planning	2030
SD Polo Club	80	Concept	Planning	2020
Bridges	400	Concept	Planning	2025
Rancho Cielo	100	Concept	Planning	2030
Total	1,359			

4. REFERENCES

1. Infrastructure Engineering Corporation, Olivenhain Municipal Water District, Study of District Potable Water Storage, Technical Memorandum No. 2, March 28, 2016.

2. AECOM, Olivenhain Municipal Water District, Update of Potable and Recycled Water Master Plan Capital Improvement Program, AECOM, March 2011.

3. Caltrans Division of Maintenance, MTAG Volume 1, Flexible Pavement Preservation, 2nd Edition, February 2008.

4. Hoch Consulting, Olivenhain Municipal Water District, Asphalt Maintenance Program, September 2015.

5. DLM Engineering, Inc., Olivenhain Municipal Water District, Study of Extension 153, November 2015.

6. RMC Water and Environment, Santa Fe Irrigation District, Eastern Service Area Recycled Water Facilities Plan, September 2, 2011.

7. Dexter Wilson Engineering, Inc., San Dieguito Water District, J.C. Wanket Reservoir Storage Valuation and Conversion Cost Estimate, August 24, 2010.

8. Anderson and Brabant, Inc., Wanket Tank Site, Quail Gardens Road, Encinitas, CA Summary Appraisal Report, SDWD, August 26, 2010.