Rancho Murieta
Community Services District

Recycled Water Program
Preliminary Design Report

Kennedy/Jenks Consultants

June 2017

Recycled Water Program
Preliminary Design Report

June 2017

06/30/2017

Prepared under the responsible charge of

Kevin Kennedy
Registration No. C61206

Kennedy/Jenks Consultants
10850 Gold Center Drive, Suite 350
Rancho Cordova, California 95670

Table of Contents

List of Tables

List of Figures

Appendix

List of Abbreviations and Acronyms

ac	Acres
ACP	asbestos cement pipe
ADWF	average dry weather flow
AFY	acre-feet per year
CCB	chlorine contact basin
CCP	chlorine contact pipe
DAF	dissolved air flotation
DIP	ductile iron pipe
District	Rancho Murieta Community Services District
ENR	Engineering News Record
ft	Feet
gpm	gallons per minute
HGL	Hydraulic Grade Line
I/I	infiltration and inflow
In	Inch
IPR	Indirect Potable Recharge
IS/MND	Initial Study/Mitigated Negative Declaration Rancho Murieta Recycled Water System Expansion Project (AECOM, June 2014)
LF	linear feet
MCCs	motor control centers
MGD	million gallons per day
mm	Millimeter
NOA	Naturally Occurring Asbestos
NPDES	National Pollution Discharge Elimination System
PDR	Preliminary Design Report (this document)

PLC	Programmable Logic Controller
PRV	pressure reducing valve
psi	pounds per square inch
RMA	Rancho Murieta Association
RMCC	Rancho Murieta Country Club
RMPI	Rancho Murieta Properties, Inc.
RVs	recreational vehicles
SCADA	Supervisory Control and Data Acquisition
TDH	Total dynamic head
WDR	Waste Discharge Requirements
WWRP	Wastewater Reclamation Plant
WWTF	Wastewater Treatment Facility

Executive Summary

The purpose of this Preliminary Design Report (PDR) is to describe Phase 1 and Buildout of Rancho Murieta Community Services District's (District's) Recycled Water Program with respect to existing and future conditions; development projections, phasing and recycled water use areas; recommended improvements and descriptions and implementation plan. This PDR will also serve as the basis for subsequent environmental, regulatory permitting activities and detailed design and construction efforts associated with the recommended Phase 1 Recycled Water Improvements Project. In addition, this PDR also describes the approximate timeline for the improvements required for Buildout of the District's Recycled Water Program. Refinements and adjustment to the recommended Buildout improvements are expected to be conducted later as the implementation timeline draws closer and/or if development plans change.

Existing recycled water use areas can accommodate the equivalent of roughly 3,265 residential homes based on the 0.5 MGD ADWF capacity described in the WDR.[1] Review and comparison of the 3,265 equivalent residential homes to the development projections indicate the need to expand recycled water use beyond the North and South Golf Courses in the near future to accommodate growth. The projected average dry weather flow (ADWF) at Buildout is 0.79 MGD. The ADWF is currently about 0.34 MGD.

Development projections obtained from the District's Water Supply Assessment Technical Memorandum (Maddaus Water Management, Inc., January 18, 2016) and updated information obtained from developers indicate that the District's current rated ADWF of 0.5 MGD is projected to be exceeded in 2019. However this development timeline is consider both aggressive and optimistic compared to historic growth patterns. Actual development rates will likely be lower and the development timeline extended beyond the year 2035.

A series of improvements is recommended to provide the capacity needed to accommodate growth. Table ES-1 presents a summary of the recommended improvements and estimated costs.

Figure ES-1 presents a summary of recommended implementation activities, timelines and deadlines for Phase 1 improvements. Buildout improvements are anticipated to require about 3 years to complete. Flows are projected to approach the rated ADWF capacity of the existing seasonal storage reservoirs around 2023. Therefore, the District should initiate the expansion of the seasonal storage reservoirs no later than January 2020.

[1] 0.5 MGD flow includes allocations for infill (0.05 MGD), Murieta Gardens (residential and commercial) and The Retreats (residential) for a total of 3,265 total equivalent residential units.

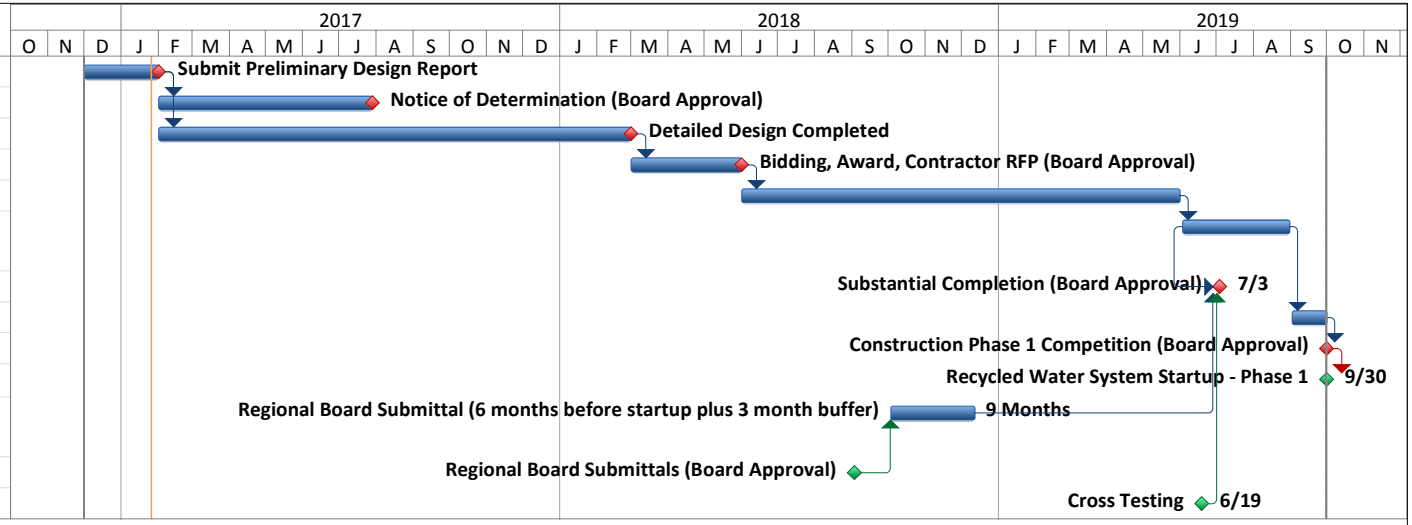
Table ES-1. *Recommended Recycled Water Improvements and Estimated Costs*

No.	Improvement	Estimated Cost ($)[a]
Phase 1 Recycled Water Improvements		
1	Recycled Water SCADA Control System	250,000
2	Equalization Basin Potable Water Air Gap	76,000
3	Recycled Water Pumping Station	1,165,000
4	District Headquarters Conversion	20,000
5	Northwest Recycled Water Transmission Main	1,006,000
6	Lookout Hill Booster Pumping Station	612,000
7	Escuela Park Conversion	16,000
8	Stonehouse Park Conversion	36,000
9	Lookout Hill Recycled Water Storage Tank	545,000
10	Main Northgate Conversion	18,000
11	Commercial Loop Conversion	*na*
	Phase 1 Subtotal (Estimated Construction Cost)	**3,740,000**
12	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	1,215,500
	Phase 1 Total (Project Cost)	**4,960,000**
Buildout Recycled Water Improvements		
13	SCADA Upgrades	82,000
14	Disinfection Facilities Upgrade	665,000
15	North Golf Course Conveyance System	1,620,000
16	Bass Lake Tank	1,216,000
17	Bass Lake Booster Pumping Station	625,000
18	Seasonal Storage Reservoir Expansion	3,407,000
19	Van Vleck Sprayfield 4	270,000
20	DAF Pumping Replacement	100,000
	Buildout Subtotal (Estimated Construction Cost)	**7,990,000**
21	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	2,600,000
	Buildout Total (Project Cost)	**10,590,000**
Phase 1 and Buildout Recycled Water Improvements		
	Grand Total (Phase 1 and Buildout)	**15,600,000**
	Estimated Number of New Equivalent Residential Units	2,440
	Estimated Cost per Connection ($/ERU)	**$6,395**

[a] Estimated costs based upon Engineering News Record (ENR) 20 City Average Construction Cost Index (CCI) at 10,385 (August 2016)

na Data not available to make this determination

ID	Task Name
1	Preliminary Design Report (Final)
2	Environmental Review
3	Detailed Design
4	Bidding and Award
5	Construction - Phase 1
6	Construction - Phase 1 Startup, Testing and Substantial Completion
7	Substantial Completion
8	Construction - Phase 1 Close Out
9	Construction Phase 1 Competition
10	**Recycled Water System Startup - Phase 1**
11	Regional Board Submittal (6 months before startup plus 3 month buffer)
12	**Regional Board Submittals**
19	**Cross Testing**



Project: 1670011.00 - RMCSD
Date: Thu 1/26/17

Task		External Tasks		Manual Task		Finish-only	
Split		External Milestone		Duration-only		Deadline	
Milestone		Inactive Task		Manual Summary Rollup		Progress	
Summary		Inactive Milestone		Manual Summary			
Project Summary		Inactive Summary		Start-only			

Figure ES-1. Proposed Phase 1 Implementation Schedule

THIS PAGE INTENTIONALLY BLANK

Section 1: Introduction

This Preliminary Design Report (PDR) describes Phase 1 and Buildout of Rancho Murieta Community Services District's (District's) Recycled Water Program with respect to existing and future conditions; development projections, phasing and recycled water use areas; recommended improvements and descriptions (including costs and timeline) and implementation plan.

This section presents and describes the Recycled Water Program background, objectives, benefits, PDR organization, development projections, and acknowledgements.

1.1: Background and Objectives

The District's existing recycled water use areas (i.e., the North and South Golf Courses) can accommodate roughly 3,265 equivalent residential units[2] based on the 0.5 million gallons per day (MGD) average dry weather flow (ADWF) capacity described in the District's Waste Discharge Requirements (WDR). Review and comparison of this 3,265 equivalent residential units limitation to the current development projections indicate the need to expand recycled water use to accommodate projected development within Rancho Murieta. Recycled water use provides disposal and beneficial reuse of the treated wastewater effluent required to accommodate future planned development.

The District's Board of Directors adopted the Recycled Water Standards (October, 2013) in response to the adoption of District Policy No. 2011-07, Authorized and Mandated Use of Recycled Water (Recycled Water Policy) and the adoption of District Code, Chapter 17, Recycled Water Code (Recycled Water Code). The Recycled Water Policy requires the use of recycled water wherever economically and physically feasible as determined by the Board and identified, in general, that the lands subject to mandatory recycled water use are the undeveloped parcels within the existing District service area. Specific future developments areas were further designated[3] within the existing District service area and the District's off-site disposal area on the neighboring Van Vleck Ranch. Expanded recycled water use at specific future sites is expected to provide the District with the increased disposal and beneficial reuse of treated wastewater effluent required to serve future developments, accommodate growth within Rancho Murieta, provide an offset to potable water demands, and comply with the WDR.

The objectives of this PDR are to describe Phase 1 and Buildout needs/requirements of the District's Recycled Water Program with respect to existing and future conditions; development projections, phasing and recycled water use areas; recommended improvements and descriptions (including costs and timeline) and implementation plan. Table 1 presents a listing of the proposed Phase 1 and Buildout future developments and recycled water use areas. Figure 1 shows existing developments along with proposed developments for Phase 1 and Buildout.

This PDR will serve as the basis for subsequent environmental, regulatory permitting activities, and detailed design and construction efforts associated with the recommended Phase 1 Recycled Water Improvements Project described in Section 3 of this PDR. In addition, this PDR also describes the approximate timeline for the improvements required for Buildout of the District's Recycled Water Program. Refinements and adjustment to the recommended Buildout improvements are expected

[2] 0.5 MGD flow includes allocations for infill (0.05 MGD), Murieta Gardens (residential and commercial) and The Retreats (residential) for a total of 3,265 total equivalent residential units.
[3] Within the District's submittal of the Report of Waste Discharge and subsequent adoption of the Master Reclamation Permit (December 20, 2013).

to be conducted later as the implementation timeline draws closer and/or if development plans change.

Table 1. *Proposed Developments and Recycled Water Use Areas*

Phase	Proposed Developments	Proposed Recycled Water Use Areas
Phase 1	Murieta Gardens Retreats (North, West and East)	Murieta Gardens[a] [U, R] Retreats[a] (North, West and East) [U] Stonehouse Park[b] (existing) [U] Escuela Park[b] (existing) [U] Main Northgate [b] (existing) [U] District Office[b] (existing) [U] *Commercial Loop*[c]
Buildout	Residences of Murieta Hills Apartments Industrial/Commercial/Residential Village A Village B Village C Village D Village E Village F Village G Village H Riverview Lakeview	Residences of Murieta Hills[a] [U,R] Apartments[a] [U] Industrial/Commercial/Residential[a] [U,R] Village A[a] [R] Village B[a] [R] Village C[a] [R]

[a] As requested by the District Board at the December 16, 2015 Board meeting.
[b] As requested by District staff for October 10, 2016 Improvements Committee presentation *and if deemed to be cost effective by the District Board.*
[c] Recycled water service to this existing urban irrigation areas appears to be cost effective. However, discussions with the owner are recommended prior to moving forward.
U = urban recycled water irrigation, see definition below
R = residential recycled water irrigation, see definition below

Phase 1 and Buildout of the District's Recycled Water Program consists of a series of improvements to the District's existing Wastewater Reclamation Plant (WWRP) and North Golf Course recycled water conveyance system[4] to serve future residential developments, existing parks, common areas and other landscaping consistent with the District's adopted Recycled Water Code, Recycled Water Standards and Waste Discharge Requirements. Ultimately, the District's expanded Recycled Water Program will provide the disposal capacity needed to accommodate future developments and offset (reduce) potable water demands by approximately 400 acre-feet per year (AFY).

For the purposes of this report, future reuse areas have been categorized in Table 1 according to the following definitions:

- Residential Recycled Water Irrigation [R]: Future recycled water front and backyard irrigation of future residential development landscaping consistent with the District's adopted Recycled Water Code, Recycled Water Standards and Waste Discharge Requirements. As indicated in Table 1, there are six developments that have use areas which fall within this category.

[4] Originally owned by RMPI, now Rancho Murieta Properties, LLC., and operated by Rancho Murieta Country Club (RMCC) as described in Section 2.

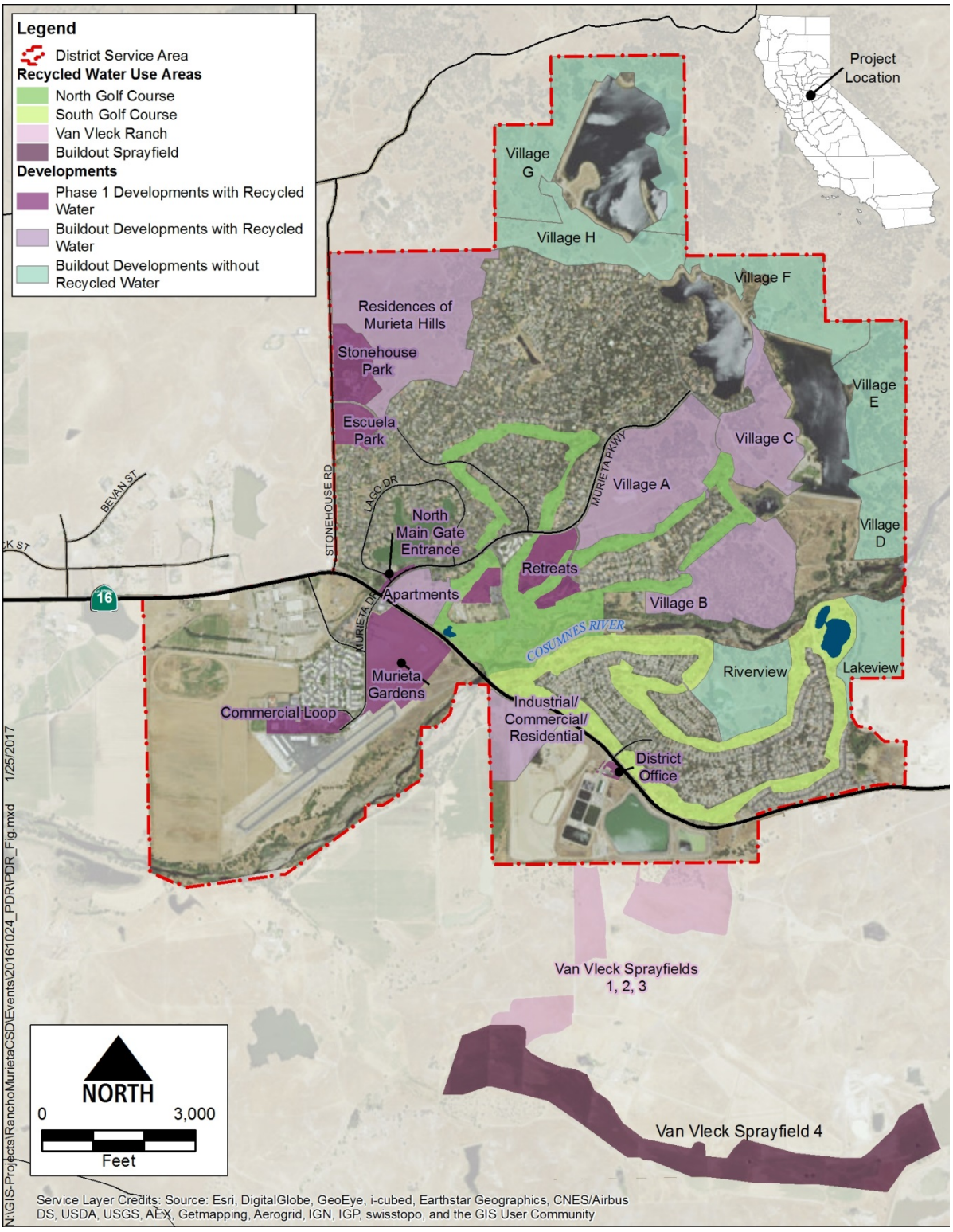


Figure 1. *Proposed Phase 1 and Buildout Developments*

- Urban Recycled Water Irrigation [U]: Future recycled water irrigation of existing parks, common areas and other landscaping consistent with the District's adopted Recycled Water Code, Recycled Water Standards and Waste Discharge Requirements. As indicated in Table 1, there are nine developments that have use areas which fall within this category.

Phase 1 of the District's Recycled Water Program could be initiated as early as mid-2019 as described later in the last section of the PDR. According to development projections provided by developers/owners of the remaining undeveloped parcels within the District's service area, Buildout is projected to occur in the 2035 timeline as described later in Section 2.3.

The following documents, reports, studies, etc., (presented in sequence) were used in the development of this PDR:

- Agreement for Availability and Use of Reclaimed Wastewater, May 17, 1988
- Amendment to Agreement for Availability and Use of Reclaimed Wastewater, May 4, 1994
- Rancho Murieta North Infrastructure Master Plan (MacKay & Somps, May 2003)
- Recycled Water Code, District Code Chapter 17 (Rancho Murieta Community Services District, January 8, 2012)
- Title XVI Recycled Water Feasibility Study (AECOM, June 2014)
- Initial Study/Mitigated Negative Declaration Rancho Murieta Recycled Water System Expansion Project (AECOM, June 2014)
- California Regional Water Quality Control Board, Central Valley Region Order No. R5-2014-149 Wastewater District Requirements and Master Recycling Permit (WDR)
- USBR Funding Application (AECOM, January 13, 2016)
- Water Supply Assessment Technical Memorandum (Maddaus Water Management, Inc., January 18, 2016)
- Retreats West Capacity Certification Letter (Kennedy/Jenks Consultants, May 4, 2016)
- Draft Sewer Study for the Retreats North & East (Baker-Williams Engineering Group, May 6, 2016)
- Draft Sewer Study for Murieta Gardens I & II (Baker-Williams Engineering Group, May 15, 2016)
- Preliminary Sewer Study for Rancho Murieta North (Baker-Williams Engineering Group, May 31, 2016)
- Draft Recycled Water Modeling Study (AECOM, June 2016)

1.2: Development Projections

Buildout is projected to occur around 2035 based on the latest development projections and result in roughly 4,817 equivalent residential units[5] within the District's service area. Figure 2 graphically illustrates a summary of development and associated ADWF projections. The level of development reflects an increase of roughly 85 percent above the current number of equivalent residential units.

Review and analyses of the development projections indicate the following distinct periods of different projected rates of growth:

- 2016 through 2020: Approximately 1,355 new equivalent residential units (11%/yr. growth rate)
- 2020 through 2030: Approximately 490 new residential homes (1.2%/yr. growth rate)

[5] Value and values shown in Figure 2 do not include future 227 Murieta Gardens commercial and/or industrial connections and are based on 2,604 existing equivalent residential units.

- 2030 through 2035: Approximately 370 new residential homes (1.7%/yr. growth rate)
- 2035 through 2045: At Buildout, no new homes (0%/yr. growth rate thereafter)

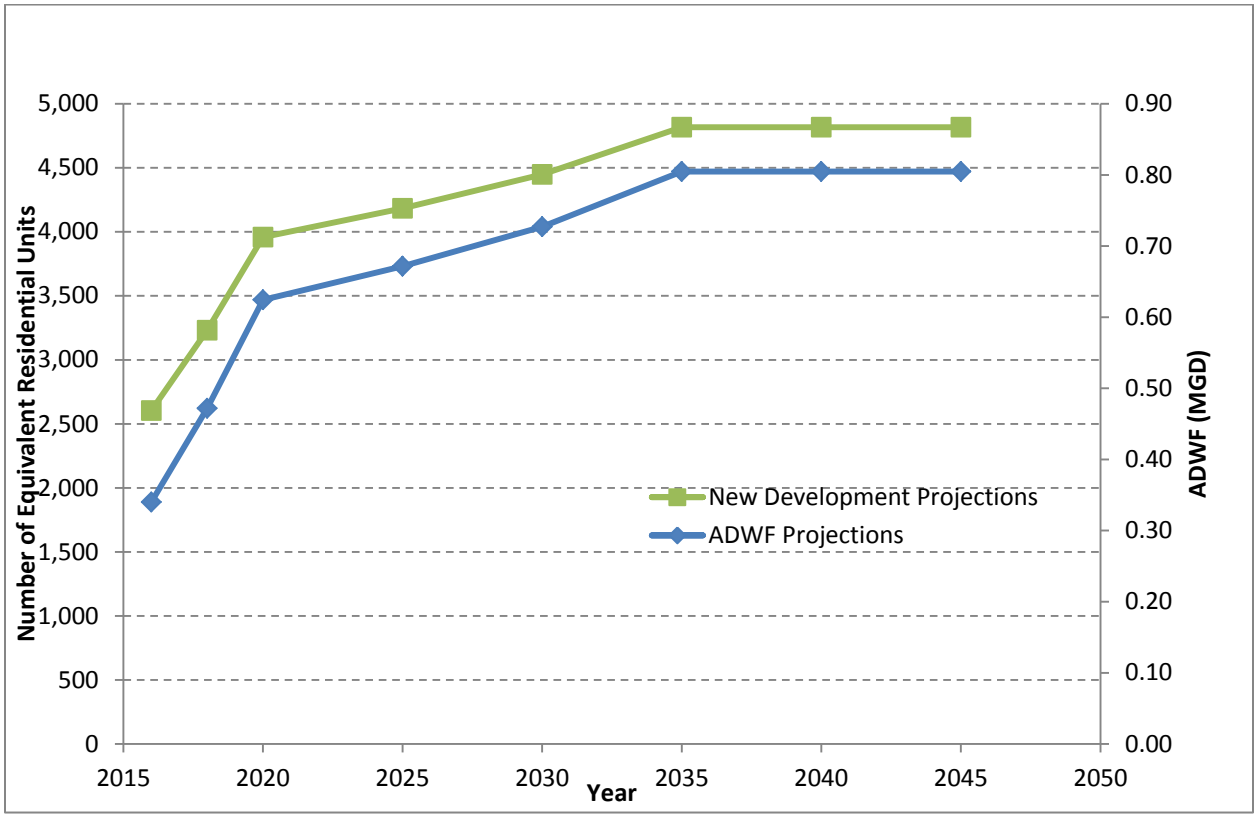


Figure 2. *Phase 1 and Buildout Development and ADWF Projections*

Existing recycled water use areas (i.e., North and South Golf Courses) can accommodate roughly 3,265 equivalent residential units based on the 0.5 MGD ADWF capacity described in the WDR[6]. Review and comparison of the 3,265 equivalent residential units to the development projections shown in Figure 2 indicate the need to expand recycled water use beyond the North and South Golf Courses in the future to support the level of development currently projected for Rancho Murieta.

1.3: Program Benefits

The District's Recycled Water Program is aligned with the actions needed to (1) provide additional water to help offset California's dwindling water supplies, (2) aggressively promote and demonstrate water programs that stretch California's available potable water supplies, and (3) contribute to the long-term recovery of the Canal Basin and Delta and Cosumnes River ecosystems. The District's Recycled Water Program will:

- Leverage and apply the District's Recycled Water Program Codes, Standards, requirements, etc.
- Offset potable water demands, conserve surface water supplies and reduce Cosumnes River diversions (approximately 400 AFY).
- Provide a beneficial, sustainable and long-term means for treated effluent disposal.
- Help the District meet their 20x2020 Water Conservation Goals.
- Increase water supply reliability and reduce drought deficits.

[6] 0.5 MGD flow includes allocations for infill (0.05 MGD), Murieta Gardens (residential and commercial) and The Retreats (residential) for a total of 3,265 total equivalent residential units.

- Maximize use of existing infrastructure.
- Provide opportunities to serve other potential users along the recycled water transmission pipeline alignments.
- Reduce the potential need to upgrade the District's existing Wastewater Treatment Facility (WWTF) and WWRP to more modern and conventional facilities that may have been otherwise required for surface water discharge via request and approval of a National Discharge Elimination System (NPDES) permit or Indirect Potable Reuse (IPR).

1.4: Preliminary Design Report Organization

This PDR has been organized as follows:

- Executive Summary
- Section 1. Introduction (this section)
- Section 2. Basis of Design
- Section 3. Recommended Improvements
- Section 4. Project Implementation

1.5: Acknowledgements

We appreciate and would like to thank the Rancho Murieta Community Services District for providing the opportunity to develop this PDR and work on their Recycled Water Program. We appreciate and acknowledge the efforts of the District staff, most notably Darlene Thiel, General Manager and Paul Siebensohn, Director of Field Operations, along with the Board of Directors. Without their input and support, this PDR could not have been completed.

Section 2: Basis of Design

This section presents the basis of design, assumptions and a summary of the system requirements recommended for Phase 1 and Buildout of the District's Recycled Water Program. Development projections, wastewater production and recycled water demand estimates, hydraulic modeling and other calculations used to establish design criteria can be found in the Appendix.

2.1: Service Area

Rancho Murieta is located approximately 20 miles east of Sacramento on State Highway 16. The area served by the District is illustrated in Figure 3 and encompasses approximately 3,500 acres. Land uses within the District service area include approximately 2,000 acres for single family residences, townhouses, apartments, duplexes and mobile homes. In January 2016, when the District's Water Supply Assessment was adopted by the Board, the District served 2,604 metered connections comprised of 2,502 residential, 97 commercial and 5 park connections.[7] Local parks are currently being irrigated with potable water. According to Sacramento County's approved Planned Unit Development Plan at Buildout, the development of the District's service area potentially represents roughly 5,189 residential units. However as described in the previous section, recent development plans reflect a lower number of connections at Buildout than Sacramento County's approved Planned Unit Development Plan.

2.2: District Recycled Water Code and Standards

With respect to wastewater collections treatment and disposal, the District falls within the jurisdiction of the Central Valley Regional Water Quality Control Board (Regional Board), whose mission is to preserve, enhance, and restore the quality of California's water resources and to ensure their proper allocation and efficient use for the benefit of present and future generations. A specific goal of the Regional Board is to promote and expand the beneficial use of recycled water. In an effort to support this goal, where applicable, the District has chosen to serve recycled water to future customers, where deemed to be cost effective and to protect, preserve, and conserve ground and surface water resources within the District's service area.

The District's Board of Directors adopted the Recycled Water Standards (October, 2013) in response to the adoption of District Policy No. 2011-07 Authorized and Mandated Use of Recycled Water (Recycled Water Policy) and the adoption of District Code, Chapter 17, Recycled Water Code (Recycled Water Code). The Recycled Water Policy requires the use of recycled water wherever economically and physically feasible as determined by the Board and identified, in general, that the lands subject to mandatory recycled water use are the undeveloped parcels within the existing District service area. Specific future developments areas were further designated[8] within the existing District service area and the District's off-site disposal area on the neighboring Van Vleck Ranch. Expanded recycled water use at specific future sites is expected to provide the District with the increased disposal and beneficial reuse of treated wastewater effluent required to serve future developments, accommodate growth within Rancho Murieta, provide an offset to potable water demands, and comply with the WDR.

The District's Recycled Water Standards were developed to establish procedures and minimum standards, specifications and limitations to ensure the health, safety, and general welfare of the citizens of Rancho Murieta when installing infrastructure for, and the use of, recycled water, consistent with the laws and regulations of the State of California, as well as to ensure uniformity in

[7] Since January 2016, there has been an increase of 32 residential units; equivalent to roughly a 0.12% per year growth rate.

[8] With the District's submittal of the Report of Waste Discharge and subsequent adoption of the Master Reclamation Permit (December 20, 2013).

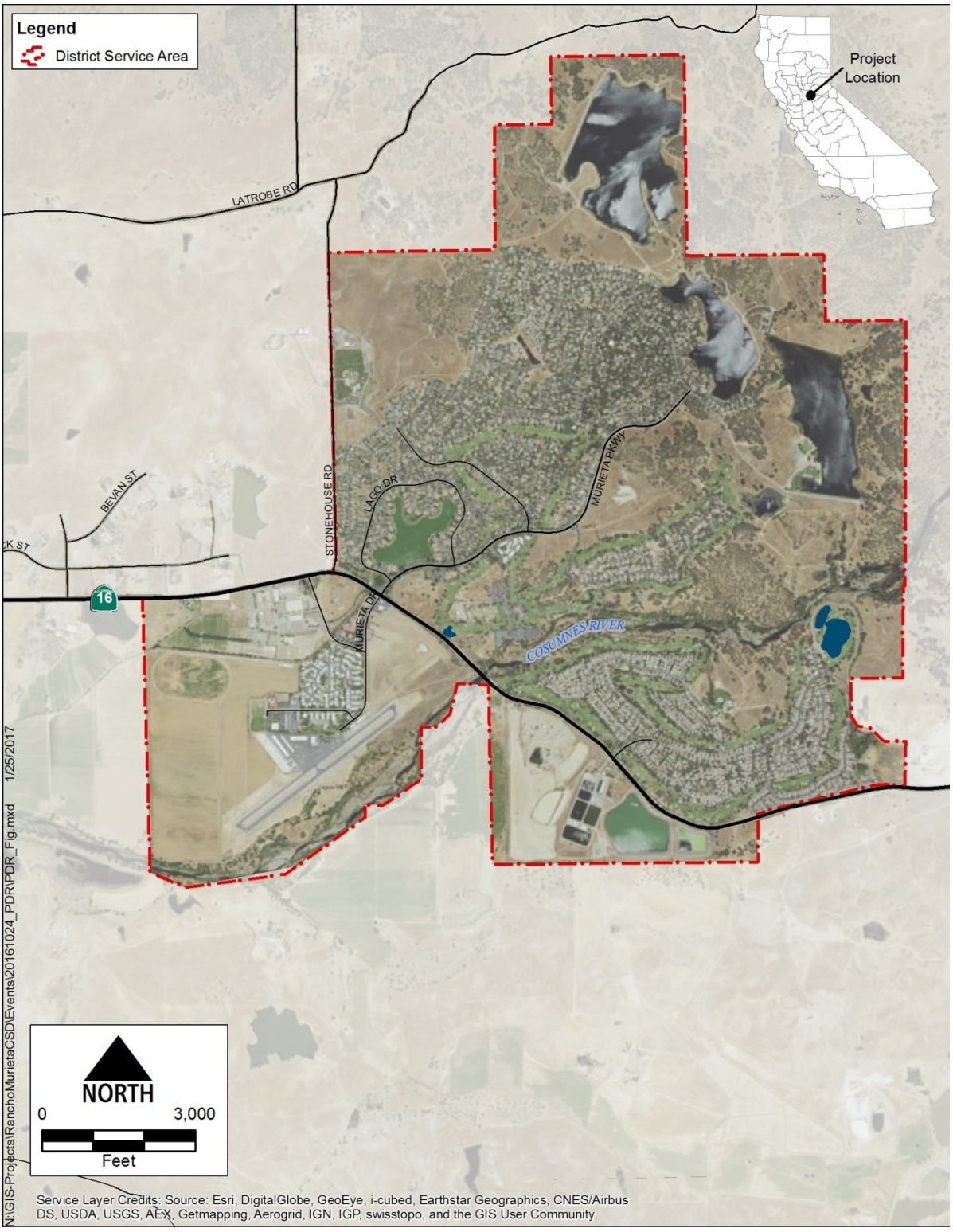


Figure 3. *District Service Area Boundary*

infrastructure design, format, methodology, construction materials, and quality of work products of the facilities associated with the expanded recycled water system. The Recycled Water Standards are intended to assist recycled water use applicants, authorized contractors, customers, and design consultants with the planning, design, repair, and construction of the expanded recycled water system and were intended to be consistent and ensure compliance with the District's Recycled Water Code and other governing policies, instructions, and regulations related to the use of recycled water. Aspects of the District's Recycled Water Standards applicable to the expanded recycled water system include the general guidelines (e.g., general requirements, system responsibilities, user liability and responsibility, recycled water infrastructure and service, etc.), design and construction standards[9] and standard details.

2.3: Existing and Proposed Developments

Existing and future proposed Phase 1 and Buildout developments are shown in Figure 4 and Figure 5, respectively, and their assumed timelines are provided below in Table 2. The following sections describe proposed future developments. Estimated wastewater production and recycled water demand estimates were either obtained from the latest development-specific sewer studies or the Title XVI Recycled Water Feasibility Study.

Table 2. *Summary of Future Development Timelines*[10]

Development and Phase[1]		Percent of Future Homes Occupied (%)[1]						
		2018	2020	2025	2030	2035	2040	2045
Murieta Gardens (305)	Phase 1	100						
The Retreats (88)	Phase 1	100						
Village A (167)	Buildout		70	15	7	8		
Village B (167)	Buildout		10	30	30	30		
Village C (130)	Buildout		10	40	40	10		
Village D (42)	Buildout			25	25	50		
Village E (43)	Buildout				20	80		
Village F (95)	Buildout			2	38	60		
Village G (53)	Buildout				10	90		
Village H (122)	Buildout			10	25	65		
Apartments (170)	Buildout		70	15	7	8		
Residences of Murieta Hills (198)	Buildout		100					
Lakeview (99)	Buildout		100					
Riverview (140)	Buildout		100					
Industrial/Commercial/ Residential (160)	Buildout		15	30	30	25		
	Developments to be served recycled water							
	Developments not to be served recycled water							

[1]Values shown are percentages and represent the percent of total number of equivalent residential units estimated to be constructed and/or occupied by the referred date. Values shown in parentheses () represent the number of equivalent residential units to be added.

[9] Where applicable given the expectation of reusing or re-purposing existing pipelines.

[10] Village A through H, Apartments and Industrial/Commercial/Residential timelines obtained from the District's Water Supply Assessment. Lakeview, Riverview, and Residences of Murieta Hills development timelines based on discussions with Les Hock of Hock Construction Management Inc. Timelines for Murieta Gardens and The Retreats obtained from Murieta Gardens I & II Sewer Study and The Retreats North & East and The Retreats West Sewer Studies.

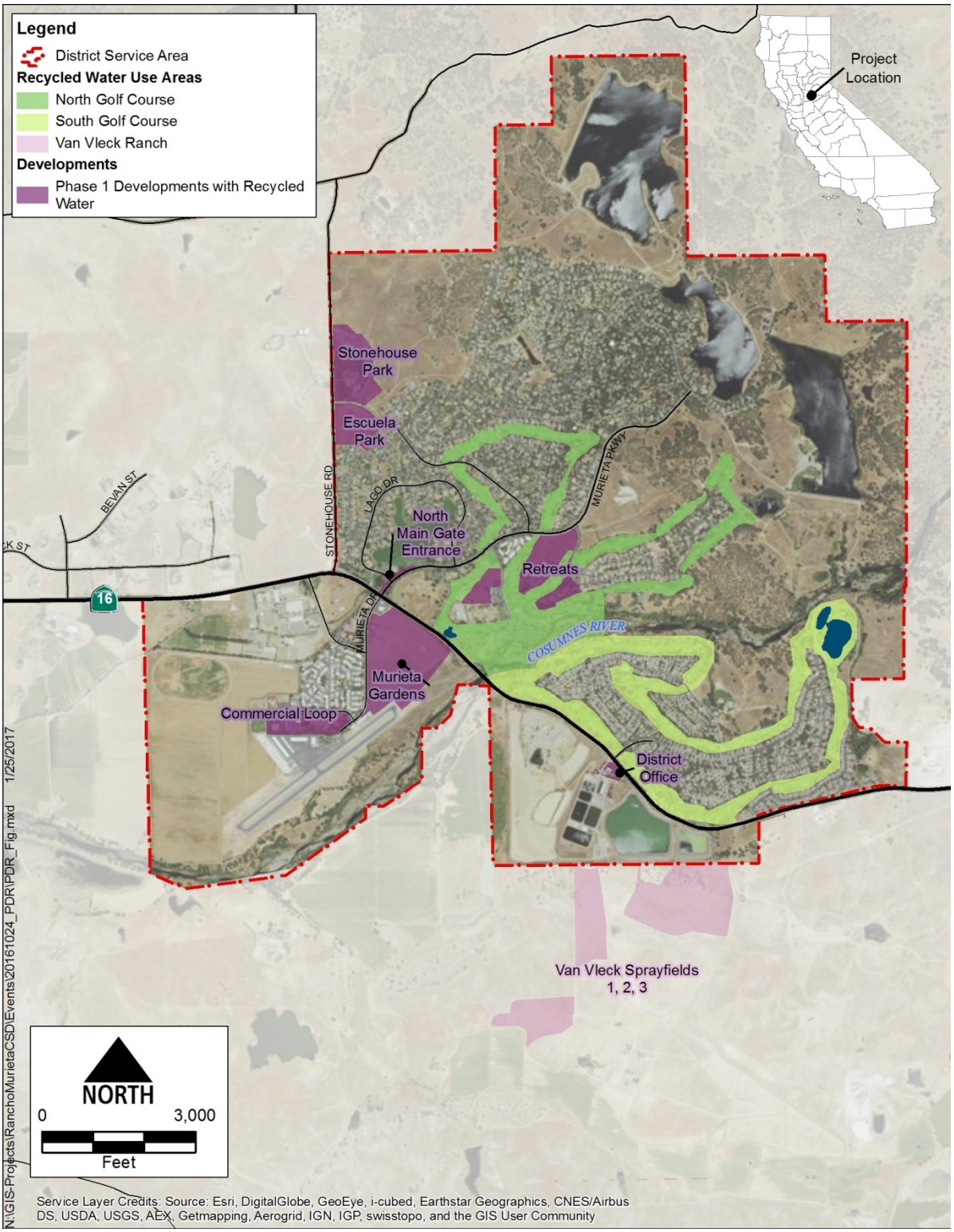


Figure 4. *Existing and Planned Phase 1 Developments*

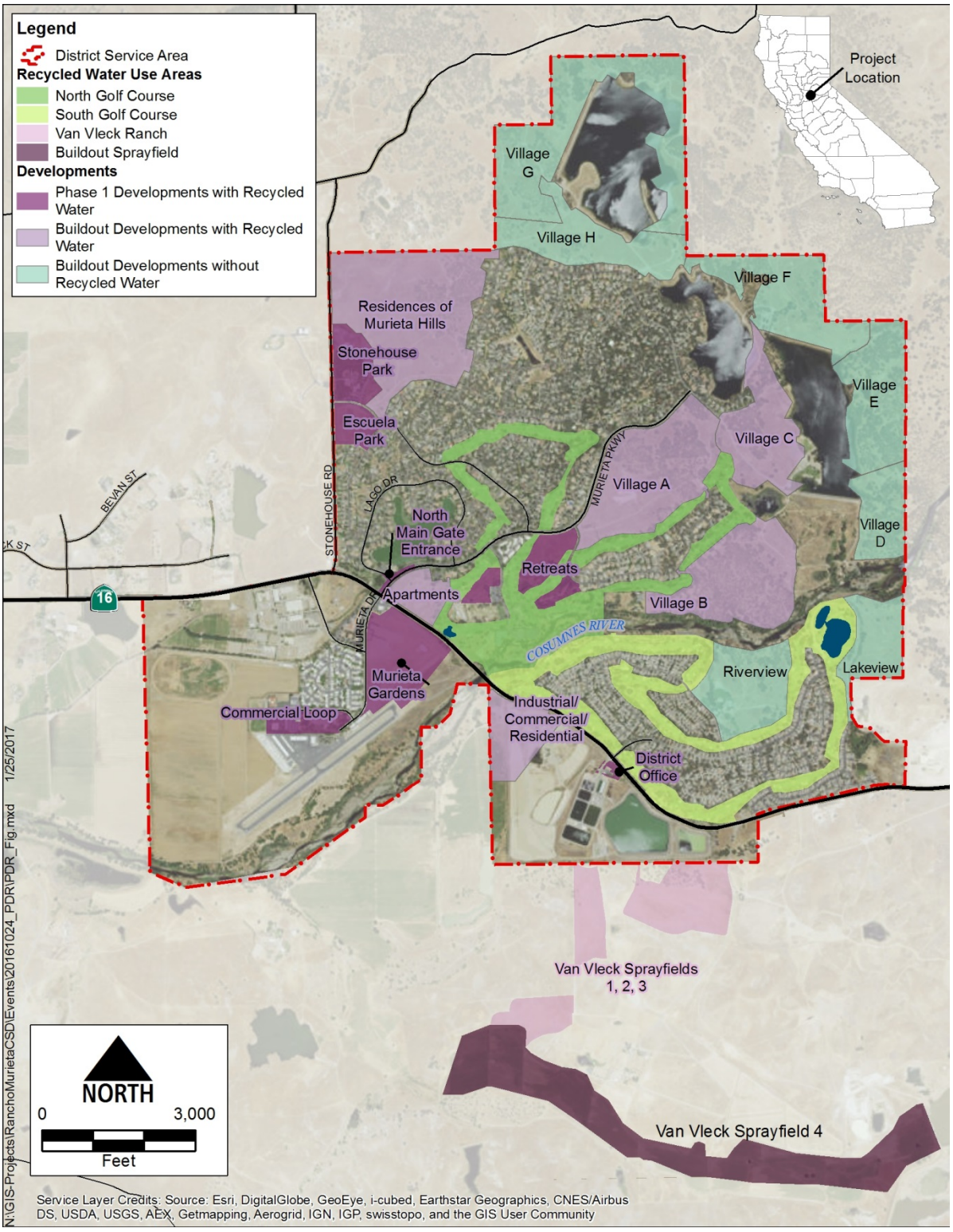


Figure 5. *Existing and Planned Phase 1 and Buildout Developments*

2.3.1: Murieta Gardens (Phase 1)

As described in the May 15, 2016 Sewer Study, Murieta Gardens is a Phase 1 development consisting of mixed use commercial development (Murieta Gardens I) and a residential development (Murieta Gardens II) located southeast of the intersection of Highway 16 (Jackson

Highway) and Murieta Drive. The Murieta Gardens I phase will consist of roughly 36.5 AC of commercial development that will include a hotel, an extended stay, commercial shops/pads, potential restaurants, one acre park, a self-storage facility and a 5.4 AC detention basin area. The Murieta Gardens II phase will consist of 78 single family residential homes on roughly 16.4 acres. Estimated wastewater production and recycled water demand for Murieta Gardens are 71.9 and 30.5 AFY, respectively. These values as well as the others described in this section were obtained from the latest developer submitted sewer studies.

The hotel is currently under construction and is expected to be completed Spring 2017. Construction of the other development phases and components are scheduled to be completed by Fall 2018.

2.3.2: The Retreats (Phase 1)

As described in the May 3 and 6, 2016 Sewer Studies, The Retreats is a Phase 1 development consisting of the following three elements located near the intersection of De La Cruz Drive and Murieta Parkway:

- Retreats West: 22 single family residential homes
- Retreats North: 52 single family residential homes
- Retreats East: 10 single family residential homes

Total estimated wastewater production and recycled water demand for The Retreats (North, West, and South) are 19.8 and 15.1 AFY, respectively.

The Retreats West is currently under construction and is expected to be served with potable water for irrigation purposes on an interim basis until recycled water is available. Construction of the Retreats North and East are scheduled to be completed by Fall 2018.

2.3.3: Village A (Buildout)

Development densities for Villages A through H are based on the Preliminary Sewer Study for Rancho Murieta North. These densities are undergoing further evaluation and revision that will more likely result in lower densities.

Village A will encompass approximately 94.5 acres of which 59.0 acres are proposed for the development of 167 residential homes. This Buildout development is scheduled to receive recycled water. Estimated wastewater production and recycled water demand for Village A are 39.3 and 61.4 AFY, respectively.

2.3.4: Village B (Buildout)

Village B will encompass approximately 81.7 acres of which 63.8 acres are proposed for the development of 167 residential homes. This Buildout development is scheduled to receive recycled water. Estimated wastewater production and recycled water demand for Village B are 39.3 and 64.6 AFY, respectively.

2.3.5: Village C (Buildout)

Village C will encompass approximately 63.3 acres of which 40.8 acres are proposed for the development of 130 residential homes. This Buildout development is scheduled to receive recycled water. Estimated wastewater production and recycled water demand for Village C are 30.6 and 49.6 AFY, respectively.

2.3.6: Village D (Buildout)
Village D will encompass approximately 28.5 acres of which 24.7 acres are proposed for the development of 42 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Village D is 9.9 AFY.

2.3.7: Village E (Buildout)
Village E will encompass approximately 79.0 acres of which 6.3 acres are proposed for the development of 43 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Village E is 10.1 AFY.

2.3.8: Village F (Buildout)
Village F will encompass approximately 77.1 acres of which 36.8 acres are proposed for the development of 95 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Village F is 15.3 AFY.

2.3.9: Village G (Buildout)
Village G will encompass approximately 114.6 acres of which 28.7 acres are proposed for the development of 53 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Village G is 12.5 AFY.

2.3.10: Village H (Buildout)
Village H will encompass approximately 67.6 acres of which 49.5 acres are proposed for the development of 122 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Village H is 28.7 AFY.

2.3.11: Apartments (Buildout)
The Apartments will be located just east of the intersection of Highway 16 and Murieta Parkway. The Apartments encompass approximately 17.8 acres proposed for the development of 170 residential units. This Buildout development is scheduled to receive recycled water. Estimated wastewater production and recycled water demand for the Apartments are 23.3 and 23.8 AFY, respectively.

2.3.12: Residences of Murieta Hills (Buildout)
The Residences at Murieta Hills will be located in the northwest corner of the service area. This development will encompass approximately 146.1 acres of which 74.4 acres are proposed for the development of 198 residential homes. This Buildout development is scheduled to receive recycled water. Estimated wastewater production and recycled water demand for Residences of Murieta Hills are 46.6 and 73.8 AFY, respectively.

2.3.13: Lakeview (Buildout)
The Lakeview subdivision will be located in Rancho Murieta South, just west of Lakes 10 and 11. It encompasses approximately 41.6 acres proposed for development of 99 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Lakeview is 21.4 AFY.

2.3.14: Riverview (Buildout)
The Riverview subdivision will be located in Rancho Murieta South, just east of Lakes 10 and 11. It encompasses approximately 57.4 acres proposed for development of 140 residential homes. This Buildout development is NOT currently scheduled to receive recycled water. Estimated wastewater production for Lakeview is 32.9 AFY.

2.3.15: Industrial/Commercial/Residential (Buildout)

This development consists of a 40 acre undeveloped commercial site located on the south side of Highway 16 just west of the District's WWTP. The proposed specific uses for this site have not been determined by the developer at this time. However, according to the Preliminary Sewer Study for Rancho Murieta North, the sewer demand for the 40 acre development is anticipated to be equivalent to approximately 160 residential units, which is the value used for the development of this PDR.

2.4: Wastewater Production and Recycled Water Demand Estimates

Recycled water is produced through treatment of the community's wastewater at the District's WWTF and WWRP. Existing recycled water use within the community is currently limited to irrigation of the North and South Golf Courses and during above average levels of annual precipitation, the Van Vleck Ranch Sprayfield. Historical raw and recycled water deliveries for the North and South Golf Courses and Van Vleck Ranch Sprayfield are summarized in Table 3 and Table 4. As indicated, current and future golf course recycled water deliveries for a typical year are estimated to be about 550 AFY as described in the District's WDR.

Table 3. Historic and Projected Recycled Water North and South Golf Course Demands

Golf Course	Historic Golf Course Irrigation Demand (AFY)	Recycled Water Supply (AFY)	Max Month / Max Day Demand (MGD)	Maximum Irrigation Rate	
				8-hr Irrigation (gpm)[d]	9-hr Irrigation (gpm)[e]
North	640[a]	550[b]	1.01[c]	2,105	1,870
South			0.92[c]	1,915	1,705
Total			**1.93**	**4,020**	**3,575**

[a] Average of historic 2007 through 2015 golf course irrigation demands (raw plus recycled water deliveries) shown in Table 4
[b] As described in the District's WDR
[c] Derived from historic records and discussed with RMCC
[d] Daily 8 hour irrigation period
[e] Daily 9 hour irrigation period

Table 4. *Historic Golf Course and Van Vleck Ranch Water Deliveries*

Year	Golf Course Deliveries (AFY) [a]		Deliveries to Van Vleck Ranch (AFY) [b,c]
	Historic Golf Course Irrigation Demand (AFY)	Deliveries Recycled Water (AFY)[c]	
2007	561.4	586.1	104.8
2008	596.5	487.9	18.2
2009	644.6	451.4	25.1
2010	556.4	418.2	70.7
2011	562.9	335.5	134.1
2012	681.3	416.3	1.6
2013	754.2	435.3	0.0
2014	708.4	390.2	0.0
2015	676.5	329.0	10.4
Average	**640**	**430**	**40**
Maximum	**755**	**585**	**135**
Minimum	**555**	**330**	**0**

[a] Raw and recycled water deliveries.
[b] Limited to 215 AFY and permitted either as part of the District's current WDR or NPDES Order No. R5-2007-0109 prior to 2015.
[c]. Recycled water deliveries.

Wastewater production estimates shown in Table 5 and illustrated in Figure 6 are based on the development timelines and projections previously described, and 210 gallons per day per residential home connection (gpd/connection) unit flow factor. Recycled water demand estimates were obtained from the latest information; either developer submitted sewer studies[11] or the District's RWD and/or WDR as described in Table A5 in the Appendix.

North Maingate, Stonehouse and Escuela Parks and the District office reuse areas shown in Table 5 reflect conversion from potable to recycled water. Wastewater production shown in Table 5 for these areas is already included as part of a previous line item and thus wastewater production estimates for these particular conversions have been set to 0.

At Buildout, projected wastewater production, based on average levels of precipitation and evaporation, is estimated to be limited to about 940 AFY, which is roughly 35 AFY less than the sum of the projected recycled water demands of 970 AFY. Of this amount, the North and South Golf Courses have the highest priority for recycled water service. The total combined disposal capacity (irrigation demand) of the existing and proposed recycled water use areas, including Van Vleck, is 1,595 AFY.[12] However, this amount of disposal capacity is only anticipated to be required following periods of unusually high levels of precipitation (e.g., above 100-year level of annual precipitation).

2.5: Design Criteria

The following are criteria that will serve as the basis for the development of the District's recommended Recycled Water Program.

2.5.1: Historic Golf Course Irrigation Demands

Historic North and South Golf Course irrigation demands were obtained from District staff and reviewed. As shown in Figure 7, the overall average irrigation demand for the last nine years (i.e., 2007 through 2016) was about 630 AFY (640 AFY without 2006 as indicated in Table 4). The average golf course irrigation demand for the last 4 years was 705 AFY or 12 percent higher than the average of the last 10 years due primarily to the affects and impacts of the recent drought. The District's WDR provides for an estimated total combined golf course recycled water demand of 550 AFY.

Monthly trends were also reviewed and are shown in Figures 8 and 9. Monthly recycled water demands in terms of AF per month are presented graphically in Figure 8 with each point representing the average of two irrigation seasons. As expected, demands are highest during the summer months due to the hotter, drier weather conditions. Monthly recycled water demands presented as percentages of the total annual irrigation season demands are shown in Figure 9. The peak month irrigation demand of 40 percent shown in Figure 9 is considered abnormal given that (1) this value is much higher compared to the others and (2) it was not repeated and thus historic peak monthly demands are expected to represent 20 to 25 percent of the annual irrigation demand. This 20 to 25 percent derived from review of historic data is slightly lower than the 31 percent described in the District's Recycled Water Standards.[13] Discussions with District staff indicated their preference to continue to use 31% as the basis for maximum month/peak day demands.

[11] Limited to Murieta Gardens and The Retreats for both wastewater production and recycled water demand estimates.
[12] See Provision 17 of the District's Waste Discharge Requirements.
[13] See Article 2.1.1 of the District's Recycled Water Standards.

Table 5. *Existing and Proposed Recycled Water Production and Demand Projections*

Development/Proposed Recycled Water Use Area	Description	Projected RW Demand (AFY)	Wastewater Production (AFY)
Existing Recycled Water Use Areas			
Existing Development			
Rancho Murieta North & South Golf Courses	18-hole golf courses (~250 ac)	550	380.9
Van Vleck Ranch	Field 1 (~49ac), Field 2 (~25ac), Field 3 (~22 ac)	215	
Sub Total		**550* / 765****	**380**
Phase 1 Proposed Expanded Recycled Water Use Areas (~2016-2020)			
Infill	0.05 MGD allocation assumed	0	56.0
Main Northgate	Conversion to recycled water	2.8	0.0
District Office[a]	Conversion to recycled water	5.4	0.0
Retreats (North, East and West)	84 residential units	15.1	19.8
Murieta Gardens	78 residential units, commercial equivalent to 227 residential units	30.5	71.9
Stonehouse Park (4-acre park)	Conversion to recycled water	36.2	0.0
Escuela Park (4-acre park)	Conversion to recycled water	12.1	0.0
Commercial Loop (to be developed)	*Potential conversion to recycled water; could be 20 to 30 AFY demand; require coordination with Owner to proceed*		
	Phase 1 Sub Total	**102**	**148**
	Sub Total	**650* / 865****	**530**
Phase 2 Proposed Expanded Recycled Water Use Areas (~2020-2025)			
Village A	167 residential units	56.5	39.3
Village B	167 residential units	64.6	39.3
Village C	130 residential units	49.6	30.6
Village D	42 residential units	0	9.9
Village E	43 residential units	0	10.1
Village F	95 residential units	0	22.3
Village G	53 residential units	0	12.5
Village H	122 residential units	0	28.7
Riverview	140 residential units	0	32.9
Lakeview	99 residential units	0	23.3
Apartments	170 residential units	23.8	23.3
Residences of Murieta Hills	198 residential units	73.8	46.6
Industrial/Commercial/Residential	160 equivalent residential units	50.9	37.6
Van Vleck Ranch	Sprayfield 4	410	
Future I/I (Average) Contribution	-	0	50[a]
	Phase 2 Sub Total	**320* / 730****	**405**
	Grand Total	**970* / 1,595****	**935**

* Beneficial reuse
** Beneficial reuse plus Van Vleck sprayfield disposal demands
[a] Based on 85% of current average I/I contributions of 57.5 AFY described in water balance

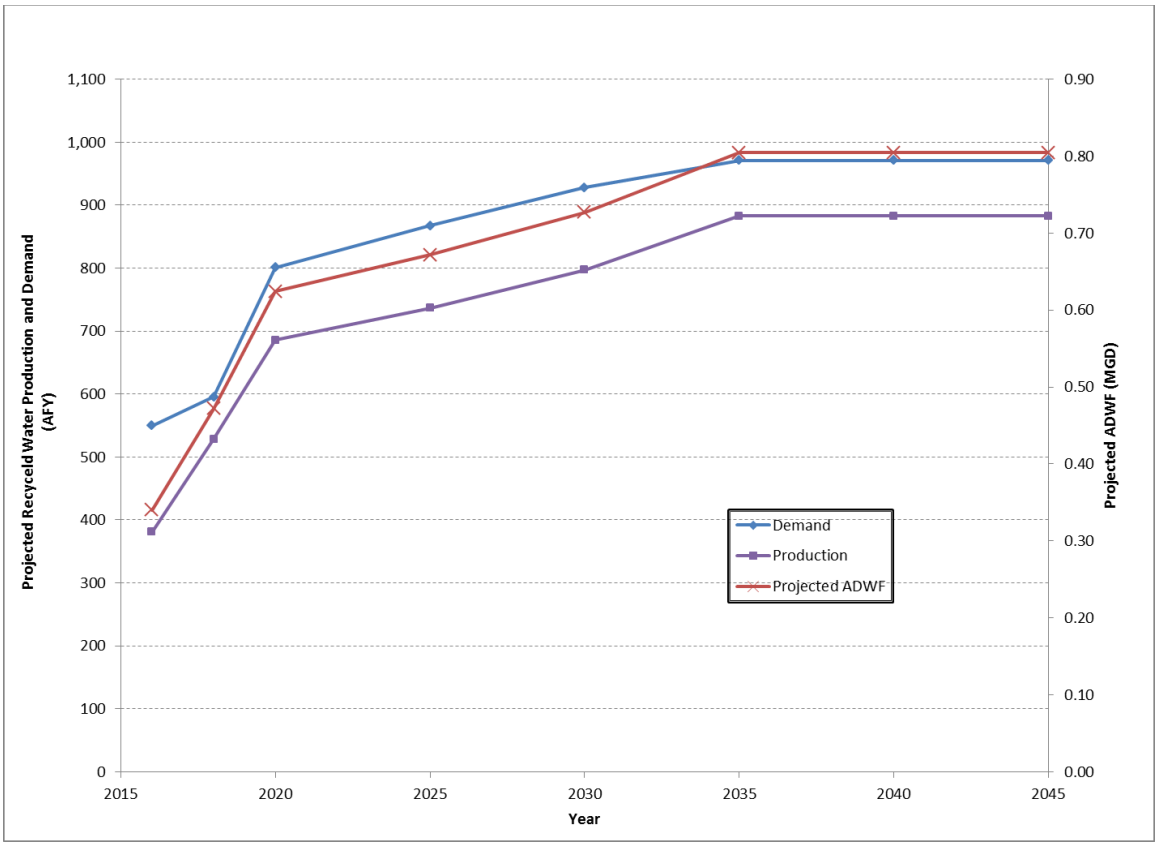


Figure 6. *Recycled Water Production and Demand Estimates*

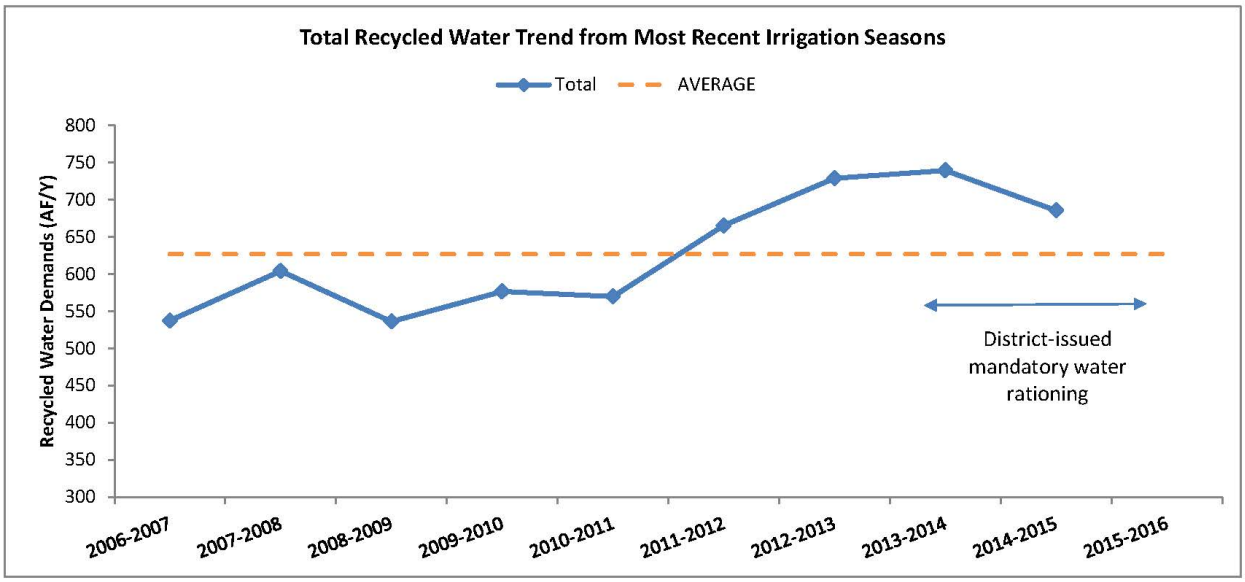


Figure 7. *Historic Annual Golf Course Irrigation Demands (Raw and Recycled Water)*

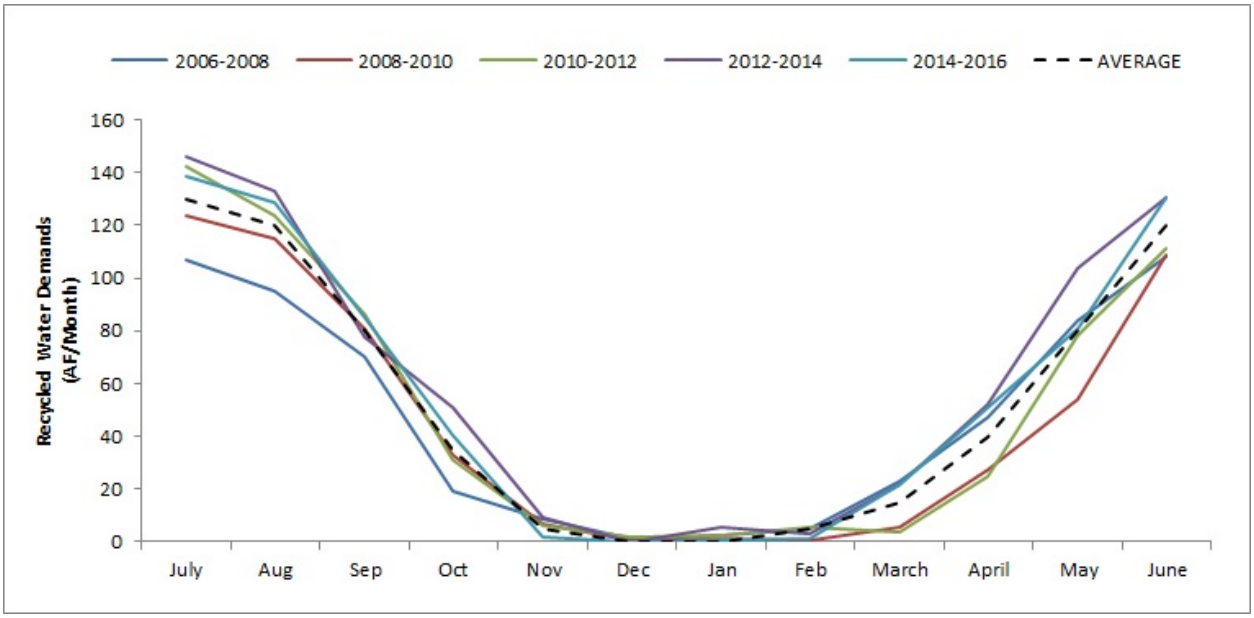


Figure 8. *Historic Monthly Golf Course Recycled Water Irrigation Demands (AF per Month)*

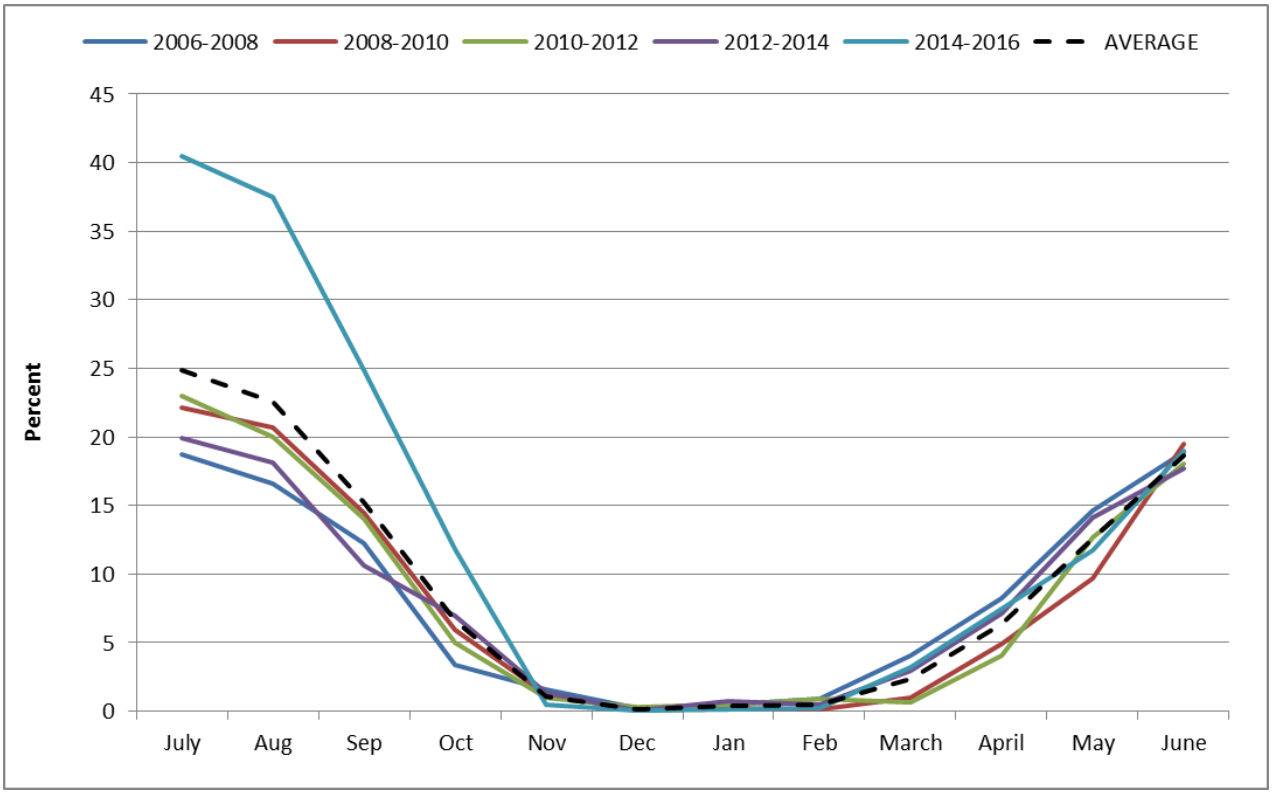


Figure 9. *Historic Monthly Golf Course Recycled Water Irrigation Demands (Percent of Total Annual Demand)*

2.5.2: Review of Historic Unit Flows and Golf Course Demands

A workshop was held on January 30, 2017 at the District's office to discuss the draft report, results and recommendations with the District's Board of Directors and solicit and obtain comments and feedback. A copy of the workshop presentation is attached in the appendix for reference. Historic unit flows and golf course demands were reviewed and discussed at the workshop. The District's Board of Directors asked that further analyses be conducted to describe, examine and potentially leverage:

1. Higher historic average golf course demands; bracket potential production and future improvement ramifications.
2. Review and compare the District's standard to historic unit flow factors; describe alternative approach if recommended along improvement cost ramifications.

Table 6 presents a summary of the data reviewed and further analyzed. Key outcomes derived from this analysis include:

Table 6. ***Unit Flow Factors and Golf Course Demands***

Year	Rainfall (in/yr)	ADWF (MGD)	Number of Customers (Connections)	Unit Flow Factor (gpd/connection)	Total Golf Course Demand (AFY)
2006	24.50	0.49	2,542	193	548
2007	14.17	0.47	2,548	184	586
2008	14.77	0.44	2,541	173	597
2009	17.52	0.43	2,544	169	645
2010	29.32	0.43	2,545	169	556
2011	20.78	0.43	2,545	169	563
2012	23.08	0.40	2,545	157	681
2013	6.16	0.39	2,547	153	754
2014	22.86	0.35	2,548	137	708
2015	12.86	0.35	2,549	137	677
Average	**18.60**	**0.42**	**2,545**	**164**	**632**
Maximum	**29.3**	**0.49**	**2,549**	**193**	**754**
Minimum	**6.2**	**0.35**	**2,541**	**137**	**548**

- Of the data shown in Table 6, rainfall showed the highest level of variability followed by ADWF, unit flow factor and total golf course demand, all having about the same level of variability. Number of customers had the lowest and essentially no variability.
- 2006 and 2007 ADWFs were equivalent to 97 to 98% of the rated 0.5 MGD ADWF capacity. Typically wastewater system expansions are initiated when 80 to 85 % of the rated capacity is exceeded.
- Even though the unit flow factors shown in Table 6 are based on dry summer months, and presumably do not contain infiltration or inflow contributions (I/I), unit flow factors were found to be influenced slightly by rainfall and trend upwards with increased rainfall (165 gpd/customer at 25 in/yr; increase to about 180 gpd/customer near 45 in/yr).
- Total (raw plus recycled water) golf course demands were found to trend downward with increased rainfall. Golf course demands for average rainfall amounts (24.6 in/yr) were projected to be 600 to 630 AFY. However, golf course demands for 100-year levels (45.3 in/yr) were projected to be 550 AFY.

Review of the historic data presented in Table 6 indicates the following:

- As described previously and shown in Table 6, average golf course demands were 630 AFY (approximately, with rounding), or 80 AFY higher than the 550 AFY currently used in the District's RWD or WDR. As shown in Table 7, Scenarios A, C and E were developed to assess the impact an increased golf course demand would have on the improvements recommended in the draft report.
- As described in Table 6, historic unit flow factors ranged between 137 and 193 with an average of 164 gpd per equivalent residential home. As shown in Table 7, Scenarios B and C are based on the overall average demand of 165 (approximately) gpd per equivalent residential home. Scenarios D and E are based on the average of 2012 and 2013 value of 155 gpd per equivalent residential home.

Table 7 presents a summary of analyses results. As shown in Scenarios C and E, use of a lower unit flow factor coupled with an 80 AFY increase in average golf course demand has the potential to impact the following improvements recommended in the draft report:

Table 7. *Summary of Unit Flow Factor and Golf Course Demand Assessment Results*

Scenario	Unit Flow Factor	Wastewater Production (AFY)	Recycled Water Demand[a] (AFY)	Required Storage Capacity[b] (AF)	Estimated Storage Cost	Recycled Water Service to Villages A, B and C Required?	Bass Lake Tank Required?
Base	210	1,165/985	1,220/550/ 390/280	880	$3.0M	Yes	Yes
A	210	1,165/985	1,220/630/ 310/280	880	$3.0M	Yes	Yes
B[c]	165	1,085/885	1,135/550/ 290/295	840	$1.1M	Yes	Yes
C[c]	**165**	**1,085/885**	**1,135/630/ 210/295**	**840**	**$1.1M**	**No**	**No**
D[d]	155	1,060/865	1,110/550/ 265/295	825	$1.0M	Yes	Yes
E[d]	**155**	**1,060/865**	**1,110/630/ 185/295**	**825**	**$1.0M**	**No**	**No**

[a] Values represent the following recycled water demands Total/Raw and Recycled Water Golf Course/Urban/Van Vleck Ranch.

[b] See water balances in Appendix.

[c] Scenario approximately equal to the arithmetic average unit flow factor of 2006 through 2015 (164 gpd/customer).

[d] Scenario reflects historic 2012 and 2013 values (prior to drought).

- Recycled Water Pumping Station – Cost impact expected to be minor/marginal; impact limited to firm pumping capacity reduction.
- Lookout Hill Recycled Water Storage Tank – Not required. Sources of supply appear adequate provided future demands do not coincide with golf course recycled water deliveries.
- North Golf Course Conveyance System – Limited future service; use of existing 12-inch AC forcemain will be required. However only a small segment of existing 8-inch AC forcemain will be required in the future to serve The Retreats.
- Bass Lake Recycled Water Storage Tank – Not required. Sources of supply appear adequate provided future demands do not coincide with golf course recycled water deliveries.

- Seasonal Storage Requirements – Significant cost reduction associated with reducing storage from 880 to 825 AF as indicated in Table 7.

The estimated cost reduction associated these modifications is expected to be in the range of about $5M or roughly 35% of the total estimated cost presented in the last section of this report. Although this cost reduction is significant, implementation of lower unit flow factors and higher golf course demands is not recommended due to the following:

- Would not reduce or impact potable water demands within District's service area.
- May not be supported by the golf course owners.
- May not coincide with actual wastewater flows produced by the service area. District does not control actual unit flow factors; District's influence is limited to the implementation of drought related water conservation measures which have been described as inelastic (anticipated to increase at some time in the future).
- Places more emphasis and importance on District staff accurately projecting future unit flow factors and requires higher level of management to monitor and manage production/demand and rectify imbalances.
- Decreased recycled water revenue potential coupled with higher likelihood of conveying more recycled water to Van Vleck Ranch. Revenue differentials between Base and Scenarios D and E are estimated to be $68,750 and $112,750 per year, respectively based on an assumed cost of $550 per AF.

2.6: Wastewater Treatment Facility and Reclamation Plant

The existing WWRP receives domestic wastewater and a relatively small amount of commercial wastewater from the community of Rancho Murieta as well as recreational vehicles (RVs) sewage from two RV dump stations. There are no industries or industrial activities that discharge wastewater to the WWRP.

Raw wastewater is pumped to the WWTF and WWRP through three main pumping stations located throughout Rancho Murieta. The WWTF and WWRP provide secondary and tertiary treatment suitable for the production of *disinfected tertiary recycled water* as defined by Title 22 of the California Code of Regulations. Treatment processes and their locations are shown in Figure 10.

The secondary wastewater treatment plant has a permitted ADWF capacity of 1.55 MGD and a 3.0 MGD peak wet weather flow capacity. Secondary treatment takes place in a series of five clay-lined aerated facultative ponds (Aeration Ponds 1 through 5). Secondary effluent is stored in two clay-lined storage reservoirs (Reservoirs 1 and 2) with a combined storage capacity of approximately 747 AF, with two feet of freeboard, prior to tertiary treatment and disinfection. Wastewater is stored in the reservoirs during the rainy season (typically between the months of mid to late October and March) until needed for irrigation of the golf courses during the dry season. Tertiary treatment and disinfection, typically operated from April through mid-October, consists of two dissolved air floatation units, two rapid sand filters, a chlorine gas feed system, chlorine contact basin, and 6,600 linear feet of chlorine contact pipe installed in a concrete lined equalization basin. The design capacity of the tertiary treatment plant is 3.0 MGD, however the disinfection system (i.e., modal contact time) currently has a rated capacity of only 2.3 MGD. After going through tertiary and disinfection facilities, the final effluent is stored in the equalization basin prior to reuse.

Figure 10. *Existing WWTF and WWRP*

The existing WWTF, WWRP, and recycled water conveyance system serving the North Golf Course are to be leveraged to reduce costs associated with the Phase 1 and Buildout Recycled Water Program.[14] The existing WWRP is designed to produce up to 3.0 MGD provided that the modal contact time is increased through the implementation of a future chlorine contact basin improvement and/or some other means as described in Section 3. The existing Recycled Water Pump Station, which draws recycled water from the equalization basin, requires expansion to satisfy projected increased recycled water demands and pressure requirements. Moreover, this station currently serves two purposes, to pump recycled water to either the North Golf Course and/or the Van Vleck Ranch Sprayfield. To maximize long term pumping efficiency and minimize costs, it is recommended that these two requirements be served by two separate pump stations in the future, if sufficient funding is available.

2.7: Recycled Water Use Areas and Conveyance Systems

The District produces and distributes *disinfected tertiary recycled water* to the Rancho Murieta Country Club (RMCC) for subsequent use via irrigation of two 18-hole golf course properties, the North and South Golf Courses (approximately 250 acres combined area). Both golf courses are operated by the RMCC. The locations of these golf courses are shown in Figure 11. Recycled water is pumped to the golf courses and stored in five unlined irrigation storage reservoirs (Lake 10, Lake 11, Lake 16, Lake 17, and Bass Lake) situated around the golf courses prior to beneficial reuse. The

[14] Considering construction, operating and maintenance related (e.g., net present worth) items.

two golf courses are expected to have a combined total annual recycled water irrigation demand of 550 AF during a typical year (e.g., average levels of precipitation) as described in the District's WDR.

Disinfected tertiary recycled water can also be used to irrigate three separate pasture lands (sprayfields) on the Van Vleck Ranch. However, the District limits Van Vleck recycled water deliveries to those following wet seasons with above average levels of precipitation because those deliveries do not offset potable water demands. Distribution and use of recycled water at the Van Vleck Ranch is managed by the District. The approximate locations of Sprayfield 1 (49 ac), Sprayfield 2 (25 ac), and Sprayfield 3 (22 ac) are shown on Figure 11. The existing Van Vleck Ranch Sprayfields have a combined total irrigation demand of 215 AFY. An above ground and mobile spray irrigation system is used to apply the recycled water to the sprayfields. A similar system is assumed to be installed to accommodate future development requirements associated with above average levels of precipitation.

The following sections describe the conveyance systems associated with the golf courses and Van Vleck Ranch Sprayfields.

2.7.1: North and South Golf Courses

Recycled water conveyance and transmission systems associated with the two golf courses were installed in approximately 1983. Since that time, recycled water has been successfully used in accordance with regulatory requirements to meet golf course irrigation demands. Tertiary treated recycled water is pumped from the equalization basin located at the WWRP to Bass Lake by the Recycled Water Pump Station, which is located adjacent to the equalization basin. Recycled water to be delivered to the North Golf Course is conveyed through a 12-inch asbestos cement pipe (ACP) from the WWRP, across Highway 16, over the foot bridge (Yellow Bridge), to the 10th hole of the North Golf Course. From this point, the pipeline is reduced to an 8-inch ACP and runs east along the golf course fairways to Bass Lake. The exact alignment and/or location of this pipeline appears to be unknown at this time, as does its depth and condition.

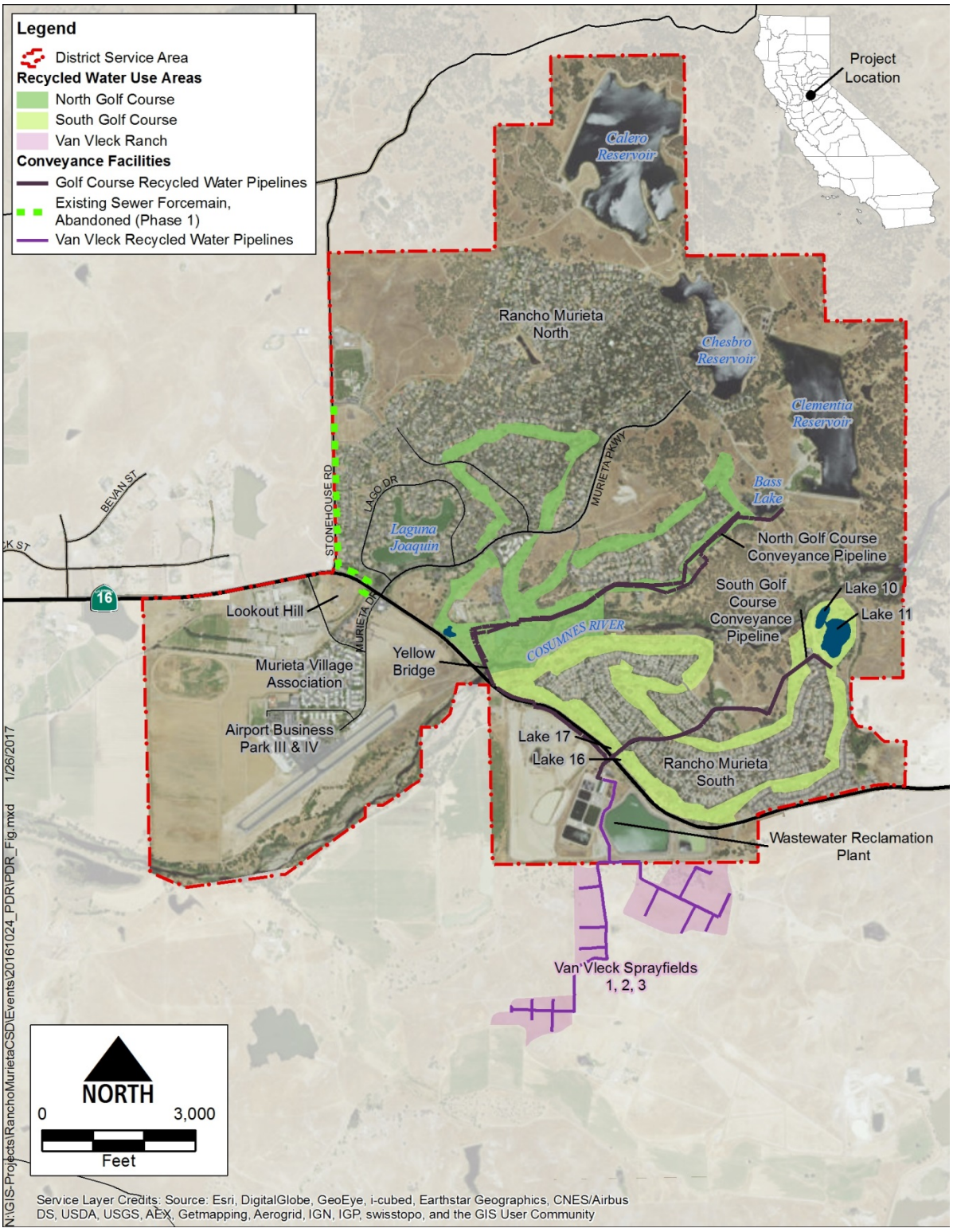


Figure 11. *Existing Recycled Water Conveyance Systems and Use Areas*

Tertiary treated recycled water is also conveyed by gravity from the WWRP to Lake 16 of the South Golf Course through another 12-inch ACP pipeline. Lakes 16 and 17 of the South Golf Course are interconnected by a culvert. From these lakes, recycled water is pumped to Lakes 10 and 11. The pipeline from Lake 17 to Lake 11 also runs along the golf course fairways and is 8-inch, Class 150 ACP.

Irrigation pump stations are located adjacent to both Bass Lake and Lake 11 and are controlled and operated by the RMCC. These stations continuously pump recycled water from the lakes and pressurize the golf course irrigation systems. Multiple pumps are used to meet varying demands, and fertilizer injection systems are also present. The piping material for the irrigation system is PVC and varies in size from 2- to 6-inch in diameter. The main irrigation distribution pipelines run along the golf course fairways with branches for the sprinkler heads. Irrigation valves are located throughout the golf courses to control the operation of the sprinkler heads. Most valves in the fairways control 3 to 4 sprinklers, while each sprinkler on the greens is generally controlled by individual control valves.

Table 8 presents a summary of roles and responsibilities for specific recycled water conveyance system assets. This table was derived from the Agreement for Availability and Use of Reclaimed Water (May 17, 1988) and the Amendment to Agreement for Availability and Use of Reclaimed Water (May 4, 1994).

Table 8. *Recycled Water Conveyance System Roles and Responsibilities*[a]

System and Facility	Ownership and O&M Costs		
	District	RMPI[b]	RMCC
Equalization Basin	X		
South Golf Course			
Equalization Basin – Lakes 16 & 17 Pipeline	c		c
Lake 16 & 17 – Lake 10 & 11 Pipeline		d	d
North Golf Course			
Recycled Water Pump Station	c		c
North Golf Course Forcemain to Yellow Bridge Pipeline	c	c	
North Golf Course Forcemain from Yellow Bridge to Bass Lake Pipeline		e	e

[a] Adapted from Agreement for Availability and Use of Reclaimed Water (May 17, 1988) and the Amendment to Agreement for Availability and Use of Reclaimed Water (May 4, 1994)

[b] Rancho Murieta Properties, Inc. (RMPI) was the original owner, current owner is Rancho North Properties, LLC.

[c] RMCSD to own, operate and maintain; operation and maintenance costs to be split 50/50 between RMCSD and RMCC.

[d] RMPI to own, RMCC to operate and maintain; operation and maintenance costs to be split 50/50 between RMPI and RMCC.

[e] RMPI to own, RMCC to operate and maintain.

2.7.2: Van Vleck Ranch Pipelines

Recycled water can also be pumped from the existing Recycled Water Pump Station to Van Vleck Ranch. Typically, this is only done during years of above average levels of precipitation but is also done at least once every two years to maintain the associated easement rights. Recycled water can be transmitted to Van Vleck Ranch through approximately 1,800 linear feet of aboveground piping. Both 12- and 8-inch Certa-Lok™ PVC irrigation pipes are used to convey recycled water to the Van Vleck Ranch boundary, and about 4,050 linear feet (LF) of aboveground 8-, 6-, 4-, and 3-inch Certa-Lok™ PVC irrigation pipe is used to convey recycled water to three spray irrigation systems. The 12- and 8-inch PVC pipeline was installed in 2007 and is owned and operated by the District. One of the

three existing pumps within the Recycled Water Pump Station is used to convey recycled water through the transmission pipeline to three sprayfields. There are no potable water or sewer pipelines along the transmission or distribution pipeline alignment.

The distribution system consists of approximately 29 strings of K-line irrigation systems, which are in turn composed of movable sprinklers and 40 millimeter (mm) piping. Each movable sprinkler is housed within a plastic pod. The connecting piping is flexible and the entire string of sprinklers can be moved within each sprayfield.

2.7.3: Existing Stonehouse 12-inch Sewer Forcemain

As described in the District's Initial Study/Mitigated Negative Declaration (AECOM, June 2014), the existing Stonehouse 12-inch ACP sewer forcemain may be used in some fashion to convey recycled water to Stonehouse Park (Phase 1), Escuela Park (Phase 1) and Residences of Murieta Hills (Buildout) for recycled water irrigation. As shown in Figure 11, this pipeline extends from the District's Main Lift North Pumping Station to the Stonehouse Park. The District has completed a condition assessment of this pipeline to determine how best to leverage this asset in the future. Future condition assessment is expected to be conducted for the 8- and 12-inch ACPs that convey recycled water from the WWRP to Bass Lake. Information drawn from the next condition assessment will be helpful in refining costs for rehabilitating the North Golf Course Conveyance System.

A risk assessment was conducted to determine the appropriate level of condition assessment to conduct. Assessment results place the Stonehouse 12-inch sewer forcemain in the High Risk Level, which results in recommending a proactive and detailed assessment, including systematic pipe testing. The high risk level assignment was due to the recycled water being considered highly aggressive. Even though the Stonehouse 12-inch sewer forcemain has not been put into service, and has not conveyed recycled water, Phenolphthalein dye test, Shore D and other tests indicate significant wear and reduced useful life. The estimated remaining useful life of the Stonehouse 12-inch sewer forcemain is about 19 years based on specific and assumed service conditions as compared to about 50 to 70 years for a new asbestos cement (AC) forcemain.

Comparison of potential corrosion management alternatives indicated that chemical addition (pH and/or alkalinity addition) is the lowest cost alternative and is thus recommended. Other alternatives considered included non-structural liners and/or forcemain replacement. A copy of the report is included in the Appendix for reference.

2.8: Conveyance System Requirements

The hydraulic model developed by AECOM was updated and modified to reflect the proposed configuration of the Buildout recycled water system and setup to provide separate irrigation cycles to accommodate golf course and urban and residential recycled water demands. The model and other data sources (i.e., drawings) served as the means of determining the conveyance system operating requirements, limitations, etc. described below in Sections 2.8.1 through 2.8.5.

2.8.1: Recycled Water Supplies and Demands

Recycled water demands shown in the draft AECOM hydraulic model were adjusted to reflect those described in this PDR. Supplies were limited to the production from the WWRP. Tanks and golf course lakes were used to provide operational storage to help satisfy diurnal and instantaneous demands. Demands were limited to existing and proposed reuse areas.

2.8.2: Pressure Limitations of Existing Pipelines

The District's ability to convey recycled water both now and in the future relies heavily upon existing Class 150 ACP pipelines, which are close to 33 years old and have rated pressure limitations of about 150 pounds per square inch (psi). The updated model was configured to limit pipeline pressures to below this limitation by:

- Adding a pressure reducing valve (PRV) immediately downstream of the proposed Recycled Water Pumping Station. The downstream PRV setting was 150 psi.
- Verifying that the modeled pressures in the entire system do not exceed the maximum operations pressure of 150 psi.

2.8.3: Recycled Water Tank Locations and Elevations

The proposed Lookout Hill Recycled Water Tank was assumed to be configured relatively the same as the abandoned existing tank with respect to size, elevation and maximum water level as assumed and described in the District's Initial Study/Mitigated Negative Declaration. The location of the Bass Lake Tank was also reviewed using the updated hydraulic model. Modeling results indicate that:

- Bass Lake Tank should be located at an elevation that will maintain the Hydraulic Grade Line (HGL) in the existing 8-inch ACP pipeline above the topography's high point to avoid negative pressures in the pipeline; the tank should be set at a base elevation of at least 225.
- Bass Lank Tank should be located relatively close to the existing 8-inch ACP pipeline and uphill, where elevations are increasing (as opposed to on the downside of a hill).

The following are summaries of recommended tank criteria to be used for developing preliminary layouts and costs:

Table 9. *Recycled Water Storage Tank Design Criteria (Preliminary)*

Recommend Criteria / Requirements	Lookout Hill Tank	Bass Lake Tank
Number of Tanks	1	1
Nominal Volume, gal	200,000	500,000
Diameter, ft	40	70
Working Depth, ft	4 to 22	4 to 18
Tank Base Elevation	244	$\geq$225

2.8.4: System Controls

The use of the existing ACP conveyance pipelines and their associated hydraulic capacities, limitations, etc. dictate the need to replenish golf course lakes separately from urban and residential recycled water irrigation demands with respect to time. It has been assumed that urban and residential irrigation will occur over an 8- or 9-hour period between the hours of 9 or 10 pm and 6 am. The refilling of the golf course lakes will take place between the hours of 6 am and 9 or 10 pm, during the periods when urban and residential irrigation are not occurring. The following is a summary of the irrigation cycle times used for system modeling:

- Urban and Residential Irrigation: 8- or 9-hour period between 9 or 10 pm and 6 am
- Refilling of Golf Course Lakes: 6 am and 9 or 10 pm (non-urban and residential irrigation hours)
- Golf Course Irrigation: May occur at any time and be drawn from Lakes 10, 11, 16, 17 and Bass Lake

Timing of recycled water deliveries is anticipated to require the installation of the following process, flow, etc., control elements. These items were incorporated into the hydraulic model and will serve as the basis for developing the instrumentation and control cost estimates described in Section 4.

1. **Recycled Water Pumping Station Pressure Reducing Valve (Phase 1).** To be located immediately downstream of proposed Recycled Water Pumping Station. Limit pressurization of pipelines to below the maximum operating pressure.

2. **Recycled Water Pumping Station Flow Meter (Phase 1).** To be located immediately downstream of proposed Recycled Water Pumping Station. Meter demands and records in Supervisory Control and Data Acquisition (SCADA).

3. **Recycled Water Pumping Station Pressure Gauge (Phase 1).** To be located downstream of proposed Recycled Water Pumping Station along existing 12-inch ACP pipeline or at critical (i.e., location experiencing highest pressure) location near Yellow Bridge.

   Measures pipeline operating pressure and records in SCADA. The speed of the pumps within the Recycled Water Pumping Station will be reduced upon a high pressure reading or shutdown if needed.

4. **Lookout Hill Flow Control (Open / Close) Valve (Phase 1).** To be installed and used to isolate the 12-inch pipeline leading to Murieta Gardens (and ultimately Stonehouse and Escuela Parks and Residences of Murieta Hills) from the existing North Golf Course Transmission Main. This leg will be shut off and refilled from the Lookout Hill Tank and pressurized by the Lookout Hill Booster Pumping Station when Bass Lake is being filled for golf course irrigation.

   This flow control valve should be configured to open based on time - when urban and residential irrigation begins at 9 or 10 pm - and close once urban and residential irrigation has been completed and the Lookout Hill Tank is full; which is anticipated to be around 6 am.

5. **Bass Lake Flow Control (Open/Close) Valve (Phase 1).** To be installed to control recycled water conveyance into Bass Lake. The valve is recommended to be located on the existing Bass Lake pipeline downstream of the split to Bass Lake Tank connection. The Bass Lake fill pipeline will essentially be isolated (shut off) from the remaining system during urban and residential irrigation.

   This flow control valve should be configured to close based on time - when urban and residential irrigation begins at 9 or 10 pm and remain closed through 6 am.

6. **Lookout Hill Tank Altitude Valve (Phase 1).** To be installed to automatically shutoff recycled water source once the tank has reached a predetermined maximum operating level (assumed to be 266 in the hydraulic model).

7. **Bass Lake Tank Altitude Valve (Buildout).** To be installed to automatically shutoff recycled water source once the tank has reached a predetermined maximum operating level (assumed to be 243 in the hydraulic model).

8. **Lookout Hill Booster Pumping Station (Phase 1).** To be installed downstream of the proposed tank and have a nominal capacity of 1,000 gpm. In order to support the delivery of recycled water for drip irrigation throughout the day, the Lookout Hill Booster Pumping Station will be configured to maintain pressure within the 12-inch pipeline serving Murieta Gardens, Stonehouse and Escuela Parks, Main Northgate and Residences of Murieta Hills to a predetermined set point during the golf course irrigation cycle.

9. **Bass Lake Tank Booster Pumping Station (Buildout).** To be installed downstream of the proposed tank and have a nominal capacity of 1,200 gpm.

10. **Lookout Hill Pressure Gauge (Phase 1).** To be installed downstream of Lookout Hill Flow Control Valve along 12-inch pipeline, potentially at critical location (i.e., location experiencing highest pressure) near Main Lift North Pumping Station.

    This pressure gauge will continuously monitor pipeline pressure and send this data to SCADA. If operating pressures above the pipeline's capacity are experienced, SCADA will lower the pump speed or shut down the Recycled Water Pumping Station pumps. In order to support the delivery of recycled water irrigation throughout the day, the Lookout Hill Booster Pumping Station will be configured to maintain pressure within the 12-inch pipeline serving Murieta Gardens, Stonehouse and Escuela Parks, Main Northgate and Residences of Murieta Hills if needed to a predetermined set point during the golf course irrigation cycle.

2.8.5: Proposed Operating Strategy

The following tables provide a summary of the proposed statuses and actions of the system elements during urban and golf course irrigation cycles.

Table 10. *Proposed Strategy - Phase 1 Operations*

System Element		Urban and Residential Irrigation	Golf Course Supply
	Approximate Timeframe	9 or 10 pm to 6 am	6 am to 9 or 10 pm
1	RWPS PRV	Measure, SCADA Monitors, ≥ 150 psi lower speed, shutdown pumps if required	≥ 150 psi; lower speed, shutdown pumps if required
2	RWPS Flow Meter	Measure and Record	Measure and Record
3	RWPS Pressure Gage	Measure, SCADA Monitor	Measure, SCADA Monitor
4	Lookout Hill Flow Control Valve	Open	Closed
5	Bass Lake Flow Control Valve	Closed	Open
6	Lookout Hill Tank Altitude Valve	Open; Periodically Closed w/Fill	Closed
7	Bass Lake Tank Altitude Valve	*Future*	*Future*
8	Lookout Hill Booster Pumping Station	1,000 gpm @ 150 ft TDH to maintain minimum 40 psi to downstream service	Configured to maintained nominal pressure
9	Bass Lake Booster Pumping Station	*Future*	*Future*
10	Lookout Hill Pressure Gauge	Measure, SCADA Monitors; ≥ 150 psi shutdown Recycled Water Pumping Station pumps	Measure, SCADA Monitor; Turn on Lookout Hill Booster Pumping Station on low pressure set point

Table 11. *Proposed Strategy - Buildout Operations*

System Element		Urban and Residential Irrigation	Golf Course Supply
	Approximate Timeframe	9 or 10 pm to 6 am	6 am to 9 or 10 pm
1	RWPS PRV	Measure , SCADA Monitors, ≥ 150 psi shutdown pumps	≥ 150 psi; shutdown pumps
2	RWPS Flow Meter	Measure and Record	Measure and Record
3	RWPS Pressure Gage	Measure, SCADA Monitor	Measure, SCADA Monitor
4	Lookout Hill Flow Control Valve	Open	Closed
5	Bass Lake Flow Control Valve	Closed	Open
6	Lookout Hill Tank Altitude Valve	Open; Periodically Closed w/Fill	Closed
7	Bass Lake Tank Altitude Valve	Open	Open until tank filled, then Closed
8	Lookout Hill Booster Pumping Station	1,000 gpm @ 150 ft TDH to maintain minimum 40 psi to downstream service	Configured to maintained nominal pressure notaries
9	Bass Lake Booster Pumping Station	1,200 gpm @ 120 ft TDH to maintain minimum 40 psi to downstream service	Configured to maintained nominal pressure
10	Lookout Hill Pressure Gauge	Measure, SCADA Monitors; ≥ 150 psi shutdown Recycled Water Pumping Station pumps	Measure, SCADA Monitor; Turn on Lookout Hill Booster Pumping Station on low pressure set point

2.9: Regulatory Compliance

The following describe the status of the District's Recycled Water Program with respect to environmental (California Environmental Quality Act) and regulatory (Regional Board) review.

2.9.1: Environmental Compliance

The final IS/MND determined that expanding the District's recycled water areas to serve new development within the District's service area would not have any significant adverse effects on the environment based on a specific system configuration and after implementing the following mitigation measures[15]:

AESTHETICS

- **Mitigation Measure AES-1: Replace Landscaping.** District to coordinate with affected landowners to restore or replace plantings consistent with pipeline safety, maintenance, and easement requirements in affected landscape areas.

AIR QUALITY

- **Mitigation Measure AQ-1: Implement Applicable SMAQMD Basic Construction Emission Control Practices.** District to comply with prescribed measures to reduce fugitive dust and construction equipment exhaust emissions.
- **Mitigation Measure AQ-2: Implement SMAQMD Requirements to Reduce Construction-Related NOX Emissions.** District and/or contractor to submit to SMAQMD comprehensive inventory of all off-road diesel construction equipment, equal to or greater than 50 horsepower, that will be used in aggregate of 40 or more hours during any portion of construction.

[15] Complete listing of mitigation measures is provided in this PDR along with brief descriptions. More complete descriptions and information can be obtained from the IS/MND.

BIOLOGY

- **Mitigation Measure BIO-1: Protect Special-status Plant Species.** District and its primary construction contractor shall implement prescribed measures to reduce impacts on special-status plant habitat.
- **Mitigation Measure BIO-2: Protect Valley Elderberry Beetle.** District and its primary construction contractor shall implement prescribed measures to reduce impacts on valley elderberry beetles.
- **Mitigation Measure BIO-3: Protect Western Pond Turtle.** District and its primary construction contractor shall implement Mitigation Measures HYD-1 and HYD-3 to ensure no construction area erosion, sedimentation, or pollution enters any western pond turtle habitat.
- **Mitigation Measure BIO-4: Conduct Pre-Construction Surveys for Swainson's Hawk and Implement Avoidance and Minimization Measures.** District and its primary construction contractor shall implement specific prescribed measures to protect nesting Swainson's hawks.
- **Mitigation Measure BIO-5: Conduct Pre-Construction Surveys for Nesting Raptors and Other Migratory Birds and Implement Avoidance and Minimization Measures.** District and its primary construction contractor shall implement specific prescribed measures to protect nesting raptors and other nesting migratory birds.
- **Mitigation Measure BIO-6: Worker Environmental Awareness Program.** Before start of each new construction season, a worker environmental awareness training program shall be conducted by a qualified biologist.
- **Mitigation Measure BIO-7: Protect Wetlands and Drainages.** District and its primary construction contractor shall implement specific prescribed measures to reduce impacts to wetlands and drainages.
- **Mitigation Measure BIO-8: Comply with Tree Preservation Ordinance.** District and its primary construction contractor shall implement specific prescribed measures to reduce impacts to protected oaks and other native trees.

CULTURAL RESOURCES

- **Mitigation Measure CUL-1: Immediate Halt Construction Activities If Any Cultural Materials Are Discovered.**
- **Mitigation Measure CUL-2: Conduct Construction Personnel Education, Stop Work if Paleontological Resources Are Discovered, Assess the Significant of the Find, and Prepare and Implement a Recovery Plan Required.** To minimize potential adverse impacts on important paleontological resources, District, where construction would occur along or in the immediate vicinity of Stonehouse Road, shall retain qualified paleontologist to train all construction personnel and immediately cease work in the vicinity of the find and notify the Sacramento County Planning and Community Development Department.
- **Mitigation Measure CUL-3: Immediately Halt Construction Activities if Any Human Remains Are Discovered.**

GEOLOGY

- **Mitigation Measure GEO-1: Prepare a Site-Specific Landslide Hazard Evaluation and Implement Engineering Recommendations.** District to hire licensed geotechnical or civil engineer to perform site-specific evaluation of the landslide potential in areas of moderate or steep slopes where each of the proposed storage tanks would be placed.

- **Mitigation Measure GEO-2: Prepare and Implement a Grading and Erosion Control Plan.** Before start of earthmoving activities greater than one acre of disturbance, District to prepare grading and erosion control plan and submit to Sacramento County Planning and Development Department for review before issuance of any grading permit for on-site work.

HAZARDS

- **Mitigation Measure HAZ-1: Implement a Site Investigation to Determine the Presence of Naturally Occurring Asbestos (NOA) and, if necessary, Prepare and Implement Asbestos Dust Control Plan.** District to conduct site investigation to determine whether and where NOA is present in the construction area. If site investigation determines that NOA is present within the proposed construction area then the District to prepare an Asbestos Dust Control Plan for approval by SMAQMD.
- **Mitigation Measure HAZ-2: Prepare and Implement a Construction Traffic Control Plan.** District and its primary construction contractor to prepare and implement traffic control plan for construction activities.

HYDROLOGY AND WATER QUALITY

- **Mitigation Measure HYD-1: Prepare and Implement a Storm Water Pollution Prevent Plan and Associated Best Management Practices.** For activities disturbing 1 or more acres (including phased construction of smaller areas that are part of the District's Recycled Water Program), District and its primary construction contractor to obtain coverage under the SWRCB's NPDES stormwater permit for general construction activities (Order No. 2009-0009-DWQ).
- **Mitigation Measure HYD-2: Evaluate and Implement Construction Site Dewatering Controls.** If construction dewatering is required, District shall evaluate reasonable options for dewatering management and ensure that controls on construction site dewatering are implemented during construction dewatering activities.
- **Mitigation Measure HYD-3: Prepare and Implement a Fac-Out and Undercrossing Contingency Plan.** If drilling mud is needed during construction, the District will develop and follow procedures to prevent the mix that is used during drilling from being discharged onto the ground surface when installing pipelines using trenchless construction methods.

NOISE POLLUTION

- **Mitigation Measure NOI-1: Provide Noise Shielding for Pump Stations.** District to design the proposed pump station with shielding, as needed, to achieve noise levels below 55 dBA at 50 feet.
- **Mitigation Measure NOI-2: Implement Feasible Noise Abatement Measure for Construction Equipment.** District to require contractors to implement feasible noise abatement measures for noise-producing equipment.

RECREATION

- **Mitigation Measure REC-1: Coordinate with RMCC Prior to Construction.** District to coordinate with RMCC at least 30 days prior to construction activities that could affect golf course operations, including access to the course and course play.

2.9.2: Regulatory Requirements

As previously described, the District falls under the jurisdiction of the Regional Board with respect to wastewater and recycled water. A summary of specific requirements related to the District's need to provide sufficient seasonal storage capacity, approval of proposed future WWRP and recycled water system improvements and use areas are described below and were obtained from the District's WDR:

- **Seasonal Storage Capacity:** On or about 1 October of each year, available storage capacity shall at least equal the volume necessary to provide sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, and ancillary inflow and infiltration during the winter while ensuring continuous compliance with all WDR requirements. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.
- **Recycled Water System Improvements and Future Recycled Water Use Areas:** The District shall submit an *Improvements Completion Report* upon completion of any improvements, which may include expansion of the disinfection system, effluent storage, and/or recycled water distribution system and infrastructure improvements to deliver recycled water to the new and expanded recycled water use areas as described in the District's WDR. The *Improvements Completion Report* shall be submitted to the Regional Board for review and approval at least 60 days prior to operational use of such improvements, facilities and/or systems. The report shall document the construction of the improvements, certify that improvements are fully functional, and certify that any new or expanded recycled water use areas are ready to receive recycled water in compliance with the requirements of the District's WDR. The report shall include design parameters (for treatment system), final dimensions and volume at 2-feet of freeboard (for ponds), as-built drawings of the WWRP improvements, and a map showing new recycled water use areas.
- **WWRP:** The District shall submit a *Capacity Increase Report* documenting that the WWRP has sufficient storage and disposal capacity for increasing the WWRP ADWF influent flow to more than 0.5 MGD while being in compliance with all applicable specifications, limitations, and provisions of the District's WDR. The report shall certify that the new recycled water use areas (e.g., existing parks and common area, recycled water residential irrigation developments and/or expanded Van Vleck Ranch Use Area (Sprayfield 4)) are ready to receive recycled water in compliance with the requirements of the WDR. The *Capacity Increase Report* shall be submitted to the Regional Board for review and approval at least 60 days prior to increasing the WWRP influent flow beyond 0.5 MGD.

THIS PAGE INTENTIONALLY BLANK

Section 3: Recommended Improvements

This section presents design features and descriptions for the recommended Phase 1 Recycled Water Improvements Project which is comprised of Phase 1 WWRP Improvements and Phase 1 Recycled Water Conveyance System Improvements. Recommended future Buildout Recycled Water Improvements have also been identified and recommended. The features described in the tables below were developed from the criteria described in Section 2 of this PDR. A summary of Phase 1 and Buildout Recycled Water Improvements are presented in Tables 12 and 13, respectively.

Table 12. *Recommended Phase 1 Recycled Water Improvements Features and Components*

Process / Element		Criteria / Feature
1. Recycled Water SCADA Control System		
	Number of SCADA Terminals	1
	Location	WWRP
	Type Lookout Hill Control Valves	 Programmable Logic Controller (PLC) Remote Terminal Units
	Communication	Radio*
	Control	Pressure
2. Equalization Basin Potable Water Air Gap Connection		
	Flow Rate (maximum)	900 gpm
	Diameter	8-inch
	Material	Ductile Iron
	Air Gap (90º Bend)	16 inches per RW-17
3. Rehabilitate Existing Recycled Water Pumping Station		
	Pump Type	Vertical Turbine
	Number of Pumps	Two (2) duty; one (1) stand by
	Total Dynamic Head	325 feet
	Pump Flow	1,500 gpm
	Motor Horsepower	200 HP
	Backup Power	200 KW Standby Diesel Generator
	Control Method	Pressure
	Chemical Feed System	pH Control/Alkalinity addition
4. District Headquarters Conversion – Recycled Water Irrigation System Connection		
	Site Supervisor	District (Paul Siebensohn)
	Type of Landscape	Grass in front yard and medians
	Type of Irrigation	Spray and drip
	Area (approximate)	1.8 acres
	Water Demand (estimated)	5.4 AFY
	Pipe Diameter	4-inch
	Pipe Material	PVC
5. Northwest Recycled Water Transmission Main		
	Pipeline Length (total)	11,600 lineal feet, total
	Highway 16 Undercrossing	1,000 lineal feet (approximately)
	Legacy Lane to Lookout Hill Tank	2,800 lineal feet (approximately)
	Lookout Hill Tank to 12-inch Forcemain	2,400 lineal feet (approximately)
	12-inch Forcemain along Stonehouse Road to Stonehouse and Escuela Parks	5,400 lineal feet (approximately)
	Diameter	12 inch
	Buried Pipeline Materials	PVC or HDPE pipe

Process / Element		Criteria / Feature
	Above Grade Pipeline Materials	Steel or Ductile Iron pipe
	Pipeline Labeling	"Recycled Water, Do Not Drink"
	Pipe Color or Wrapping	Purple or wrapped with purple tape
	Air and Blowoff Valves	District Standards
	Others	See District Standards
6. Lookout Hill Booster Pumping Station		
	Pump Type	Vertical Turbine
	Number of Pumps	One (1) duty; one (1) stand by
	Total Dynamic Head	150 feet TDH
	Pump Flow	1,000 gpm (maximum)
	Motor Horsepower	50 HP
	Pump Housing	Not required
	Backup Power	50 KW Standby Diesel Generator
	Control Method	Pressure
7. Escuela Park Conversion – Recycled Water Irrigation System Connection		
	Site Supervisor	Rancho Murieta Association (RMA) (TBD)
	Type of Landscape	Plantings and flowers now
	Type of Irrigation	Spray and drip
	Area (approximate)	4 acres
	Water Demand (estimated)	12.1 AFY
	Pipe Diameter	4-inch
	Pipe Material	PVC
8. Stonehouse Park Conversion – Recycled Water Irrigation System Connection		
	Site Supervisor	RMA (TBD)
	Type of Landscape	Grass primarily (fields)
	Type of Irrigation	Spray and drip
	Area (approximate)	12 acres
	Water Demand (estimated)	36.2 AFY
	Pipe Diameter	4-inch
	Pipe Material	PVC
9. Lookout Hill Recycled Water Storage Tank		
	Number of Tanks	1
	Diameter	40
	Height (maximum at sidewall)	26
	Volume (nominal)	200,000 gallons
	Materials of Constructed	Bolted Steel
10. North Maingate Conversion – Recycled Water Irrigation System Connection		
	Site Supervisor	RMA (TBD)
	Type of Landscape	Grass, flower beds, plantings
	Type of Irrigation	Spray and drip
	Area (approximate)	1.2 acres
	Water Demand (estimated)	2.8 AFY
	Pipe Diameter	4-inch
	Pipe Material	PVC

* Wireless I/O can be used alternatively

Table 13. *Recommended Buildout Recycled Water Improvements Features and Components*

Process / Element		Criteria / Feature
A. Disinfection Facilities Upgrade		
	Existing Contact Basin Modal Contact Time	27 minutes at 3.0 MGD[1]
	Required Modal Contact Time	90 minutes (minimum)
	Additional Modal Contact Time Required	63 minute (minimum)
	New Contact Basin Efficiency (Assumed Baffling Factor)	90%
	Required Contact Basin Volume	145,835 gal, minimum; 146,610 gal actual
	Length to Width to Depth Ratios	Target 40:1:1.5; Actual 40:1:1.4
	Length (without walls)	280 ft total (3 passes, each at 93.33 ft long)
	Width (without walls)	21 ft total (3 passes, each at 7 ft wide)
	Depth (without walls)	10 ft
B. North Golf Course Conveyance System Rehabilitation		
	WWRP to Bass Lake	11,200 lineal feet (12- and 8-inch)
	Replacement (allocation)	4,300 lineal feet, 12-inch
	CIPP Rehabilitation (allocation)	3,800 lineal feet, 8-inch
	Replacement	1,900, 8-inch
C. Bass Lake Recycled Water Storage Tank		
	Number of Tanks	1
	Diameter	70
	Height (maximum at sidewall)	22
	Volume (nominal)	500,000 gallons
	Materials of Constructed	Bolted Steel
D. Bass Lake Booster Pumping Station		
	Pump Type	Vertical Turbine
	Number of Pumps	One (1) duty; one (1) stand by
	Total Dynamic Head	120 feet
	Pump Flow	1,200 gpm
	Motor Horsepower	50 HP
	Pump Housing	Not required
	Backup Power	50 KW Standby Diesel Generator
	Control Method	Pressure
E. Seasonal Storage Reservoir		
	Existing Storage Capacity	728.2 AF
	Required Storage Capacity (minimum)	880 AF[2]
	Incremental Capacity Upgrade	900 AF
F. Van Vleck Sprayfield No. 4		
	Extension of Recycled Water Transmission Main	1,000 lineal feet of 12-inch Certa-Loc™
	Sprayfield 4 Transmission Main	5,000 lineal feet of 6-inch Certa-Loc™
	Sprayfield 4 Transmission & Distribution Mains	4,000 lineal feet of 4-inch Certa-Loc™
	Irrigation System	9 K-line Strings
	Depth of Cover	None, all located aboveground
G. Dissolved Air Flotation Feed Pump Improvements		
	Replacement of 3rd Feed Pump	$100,000 Allocation

[1] See Figure 1-3 of *WWRP Modified Chlorine Contact Disinfection System Compliance Report* (HSe, July 2006). Equivalent volume of 56,250 gallons

2 See Buildout water balance in Appendix.

3.1: Recommended Phase 1 WWRP Improvements

The four recommended Phase 1 WWRP improvements are illustrated in Figure 12. Descriptions of each recommended improvement are provided after Figure 12.

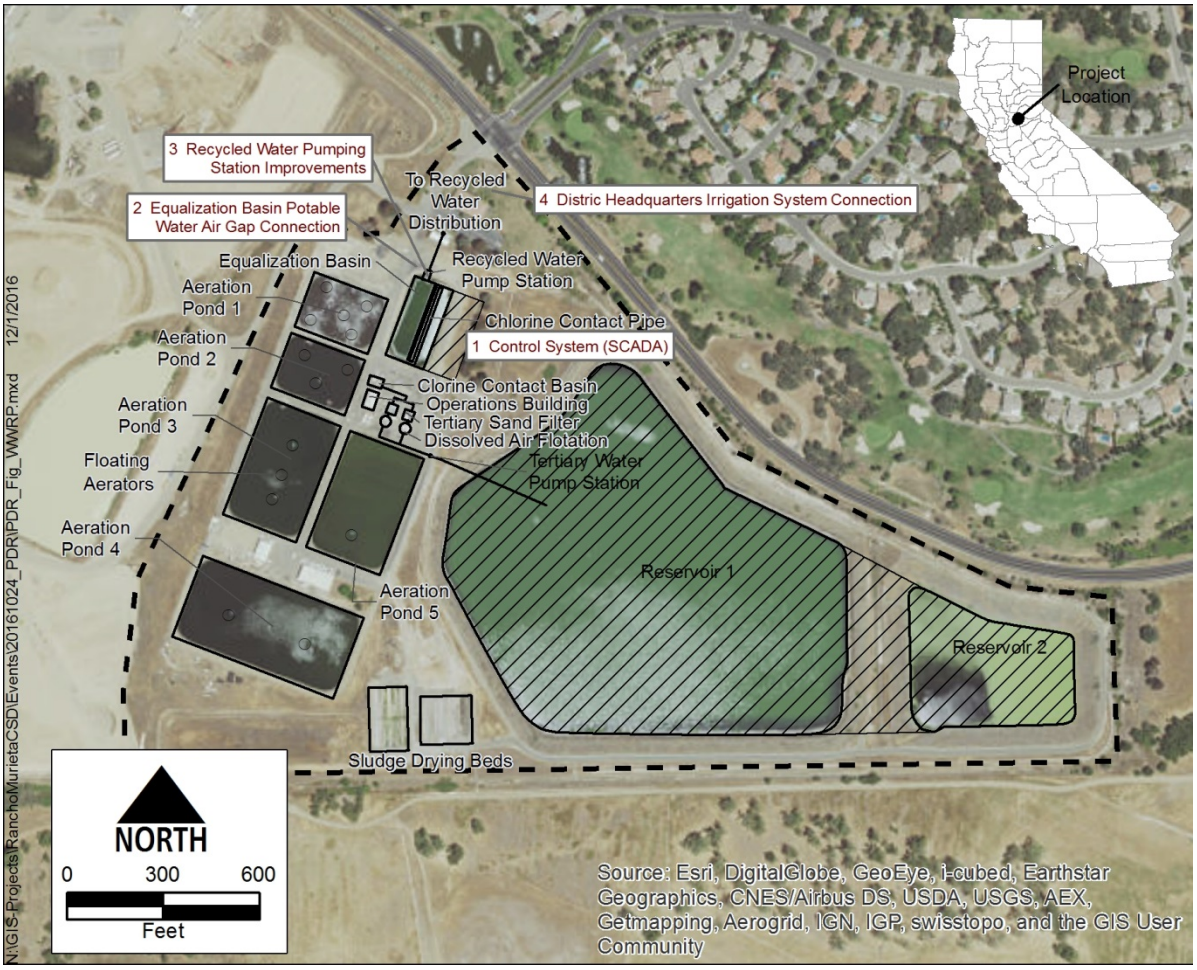


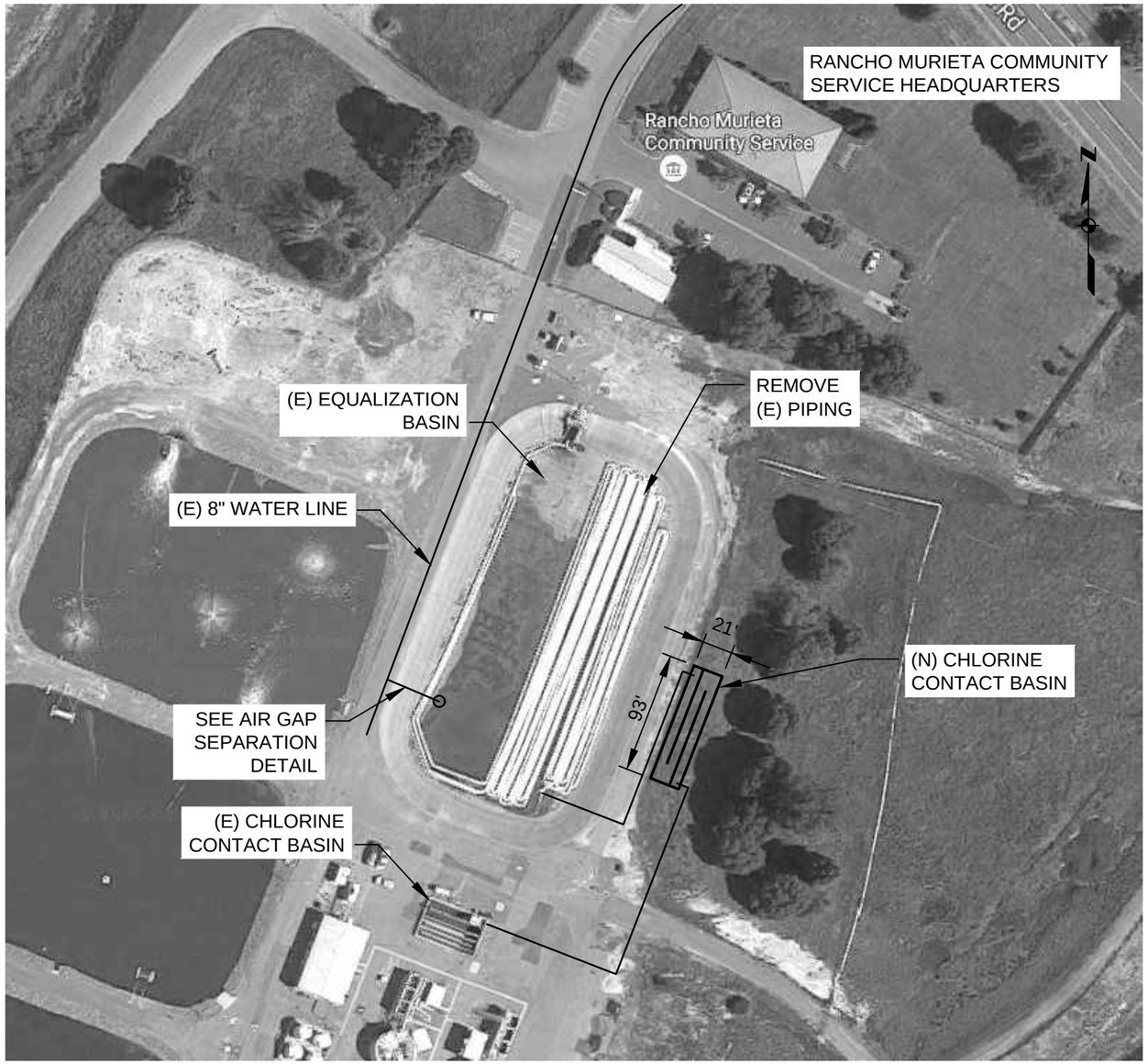
Figure 12. *Proposed Phase 1 WWRP Improvements*

3.1.1: Control System for Recycled Water Conveyance and Storage System

A SCADA system and telemetry is recommended to control delivery of recycled water throughout the existing and proposed recycled water conveyance and storage system. This also includes the installation of the control valves and elements previously described in Section 2.8.4 to manage and monitor recycled water storage, conveyance and distribution.

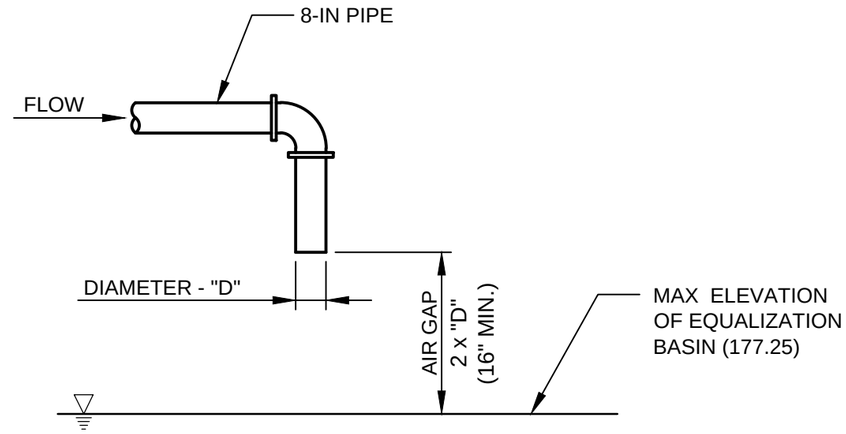
3.1.2: Equalization Basin Potable Water Air Gap Connection

This improvement is required to supplement recycled water with potable water and meet peak recycled water demands while maximizing the use of recycled water within the community. This improvement requires connection to the existing 8-inch (in) potable water pipeline located immediately north of the equalization basin at the WWRP, installing an 8-inch extension to the equalization basin, and installing an 8-in air gap connection to deliver potable water to the equalization basin. Figure 13 shows the proposed pipeline and air gap separation. The connection between the existing potable water pipeline and the air gap will require approximately 20 feet (ft) of 8-in ductile iron pipe (DIP) and a flow meter, isolation and control valves and bends. The existing 8-inch potable water pipeline is assumed to have a capacity of 900 gpm or greater.



PLAN

SCALE: NONE



NOTE:

1. THE TERM "AIR GAP" SHALL MEAN A PHYSICAL SEPARATION BETWEEN THE FREE FLOWING DISCHARGE END AND A RECYCLED WATER SUPPLY PIPELINE AND AN OPEN OR NON-PRESSURE RECEIVING VESSEL. AN "APPROVED AIR GAP" SHALL BE AT LEAST DOUBLE THE DIAMETER OF THE SUPPLY PIPE MEASURED VERTICALLY ABOVE THE OVERFLOW RIM OF THE VESSEL - IN NO CASE LESS THAN 1 INCH.

AIR GAP SEPARATION

SCALE: NONE

1
-

Kennedy/Jenks Consultants

RANCHO MURIETA COMMUNITY
SERVICE DISTRICT

PROPOSED POTABLE WATER AIR GAP AND CHLORINE CONTACT IMPROVEMENTS

K/J 1670011*00
DEC 2016

Figure 13

THIS PAGE INTENTIONALLY BLANK

Projected average and maximum month/maximum day potable water supplementation requirements are summarized in Table 14:

Table 14. *Projected Recycled and Supplemental Potable Water Demands*[b]

Condition	Recycled Water Demands			Supplemental Potable Water Requirements[b]		
	Avg Annual (AFY)[a]	Max Month/Max Day (MGD)	Instan Urban / Golf Course (gpm)	Avg Annual (AFY)[a]	Max Month/Max Day (MGD)	Instan Urban / Golf Course (gpm)
Phase 1	650	2.27	715[c] / 2,010[d]	120	0.30	900 / 310
Buildout	970	3.35	2,955[c] / 2,010[d]	110	0.35	900 / 0

[a] Values rounded to the nearest 5
[b] Derived from calculations; actual supplementation requirements might vary depending on operations and when Phase 1 recycled water system is put into service
[c] Value based on 8-hour urban irrigation demand
[d] Golf course supply assumed to occur over 16 hour period between 6 am and 10 pm

3.1.3: Rehabilitate Recycled Water Pumping Station

The objective of this improvement is to provide adequate pumping capabilities to the North Golf Course Transmission Main through the rehabilitation of the existing Recycled Water Pumping Station. Currently, this facility is configured to pump recycled water to either the North Golf Course or Van Vleck Ranch. Following rehabilitation, this station will continue to operate in this fashion, but with an increased firm capacity to satisfy maximum month / maximum day demands of the North Golf Course and new recycled water use areas with no or minimal booster pumping.

The rehabilitated Recycled Water Pumping Station will be designed to deliver up to 3,000[16] gallons per minute (gpm) to the North Golf Course, new recycled water use areas, Lookout Hill Tank, and other future developments and the future Bass Lake Recycled Water Storage Tank. Each of the new pumps will be equipped with VFDs to minimize energy use and provide the ability to function efficiently under both operating scenarios (urban, residential and golf course irrigation).

Following rehabilitation, the Recycled Water Pumping Station will be used to transport recycled water from the equalization basin to the North Golf Course and to the following other recycled water use areas:

- Phase 1: District Office, Main Northgate, Stonehouse and Escuela Parks, Murieta Gardens and The Retreats
- Buildout: Phase 1, Villages A, B and C, Residences of Murieta Hills, Apartments and Industrial/Commercial/Residential

The pumping station will continue to have 3 vertical turbine pumps (2 duty, one standby). All 3 pumps will be equipped with VFDs to adjust pump speed. The pumping station will be designed to operate efficiently at anticipated modes of operation (i.e., Phase 1 and Buildout;). It has been assumed that the existing electrical service is sufficient to support the increased load, and that the existing motor control centers (MCCs) can house the MCCs for the new pumps. A new electrical service, upgrade or MCC building or structure is not anticipated to be required or included in the cost estimate. A new chemical addition system would also be installed for pH adjust and/or alkalinity addition and would be comprised of a 7,500 gallon tank with containment and equipped

[16] Equal to estimated maximum month / peak day urban recycled water demands. Modeling results indicate that lower capacity pumping station or recycled water storage tanks could be installed. System optimization was considered outside of the scope of work given the amount of work required to update the hydraulic model.

with level monitor and mixer (and potentially insulated and heat traced if caustic is used); flow meter; two chemical feed pumps (one duty, one standby), safety equipment, piping and valves.

3.1.4: District Headquarters Connection Irrigation System

As shown in Figure 14, the two existing potable water irrigation services associated with the District's Administration Building will be disconnected at their Points of Service and connected to the Recycled Water Pumping Station for irrigation supply. Following modification, cross-connection testing will be conducted to verify that only the irrigation system is receiving recycled water and to ensure that potable water facilities are not connected to the recycled water system. As shown in Figure 14, 270 lineal ft of new 4-in PVC pipeline and associated appurtenances are anticipated to be required for this improvement.

3.2: Recommended Phase 1 Conveyance System Improvements

Recommended Phase 1 and Buildout Conveyance System Improvements are illustrated in Figure 15. Descriptions of the recommended Phase 1 Recycled Water Conveyance System Improvements are provided after Figure 16.

3.2.1: Northwest Recycled Water Transmission Main

The Northwest Recycled Water Transmission Main will convey recycled water from the Yellow Bridge (approximately) to Stonehouse and Escuela Parks and will be comprised of the following components (see Figure 15):

a. **Highway 16 Undercrossing and Connection to Existing 12-inch ACP:** A new 12-inch pipeline and Highway 16 undercrossing are required to connect the recently installed 12-inch recycled water pipeline located along Legacy Lane within the Murieta Gardens development. Approximately length of this pipeline is 1,000 feet.

b. **12-inch Legacy Lane Pipeline, Lookout Hill Storage Tank and Booster Pumping Station:** The recently installed Legacy Lane pipeline will be extended northwest, towards Lookout Hill through the installation of a new 12-in pipeline which is proposed to follow Lone Pine Drive then up Lookout Hill to the existing tank site (along the existing roadway). This new pipeline (approximately 2,800 ft, PVC), in conjunction with other 12-inch pipelines shown in Figure 15 will be used to convey recycled water to the new Lookout Hill Tank shown in Figure 16. A new booster pumping station is needed to deliver recycled water to Stonehouse and Escuela Parks, the Main Northgate and in the future Residences of Murieta Hills from the tank. This new pumping station is proposed to be located near the base of Lookout Hill along Highway 16 near the District's Main Lift North and proposed to house two new booster pumps.

c. **Interconnecting Piping Between Booster Pump Station and Existing Forcemain:** A new transmission forcemain (approximately 2,400 ft, PVC) will be installed to connect the new Booster Pumping Station to the existing Stonehouse 12-inch sewer forcemain near the Main Lift North Station site. The proposed alignment of this new pipeline between Lone Pine Drive and the North Main Lift Station is between the hillside and the existing CIA Ditch.

Proposed North Main Gate Conversion

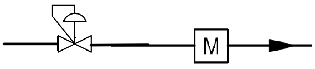
Proposed Stonehouse and Escuela Park Conversions

Proposed District Headquarters Conversion

Legend

- Recycled Water Transmission Main
- Proposed Recycled Water Service Line (4 inch)
- Proposed Recycled Water Irrigation Connection*

*Circle represents:



To be designed and constructed per RMCSD Recycled Water Standards

NORTH

0 200

Feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\GIS-Projects\RanchoMurietaCSD\Events\20161024_PDR\PDR_Fig_Conversionsrr.mxd 1/26/2017

Figure 14: Irrigation System Conversions to Recycled Water

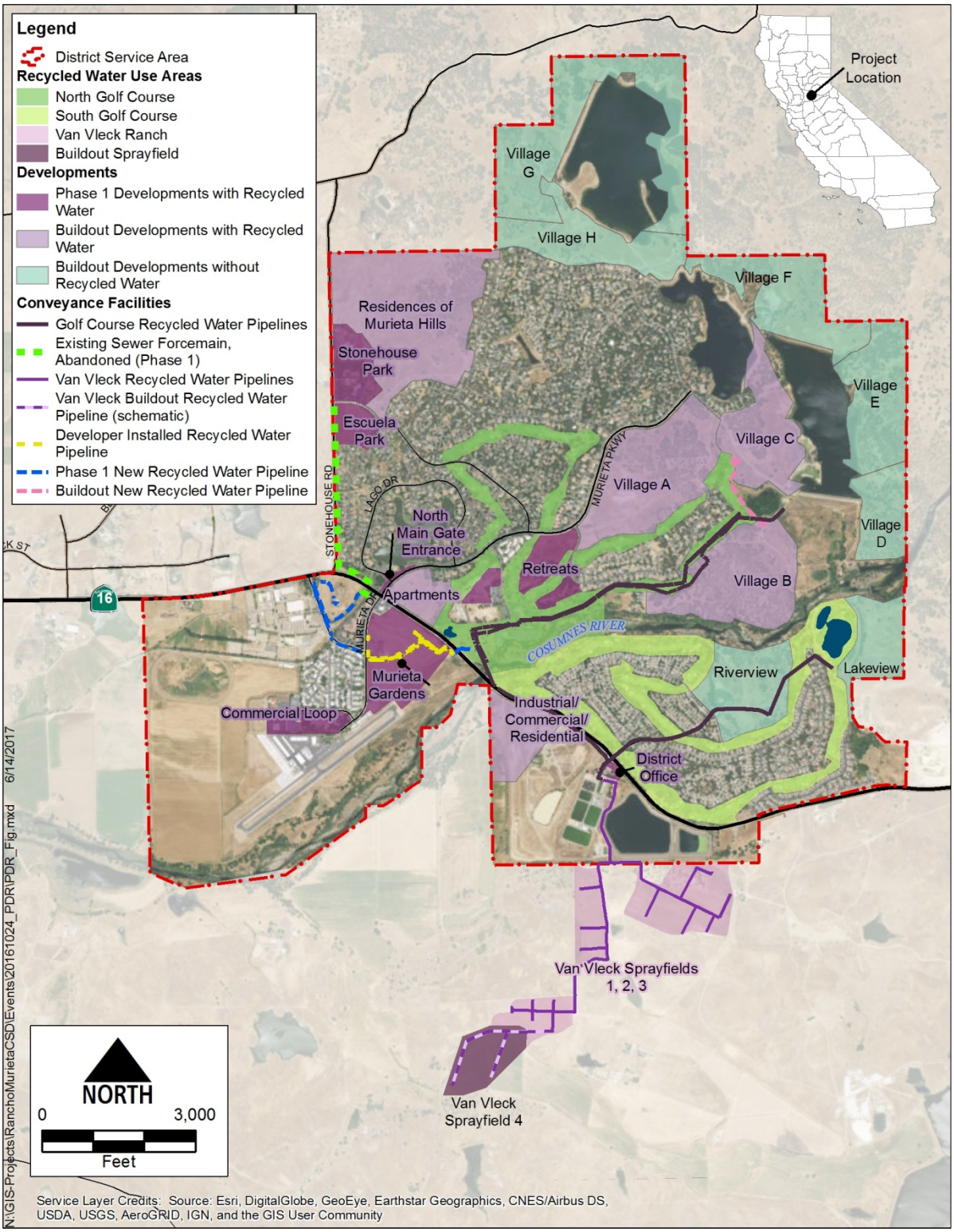
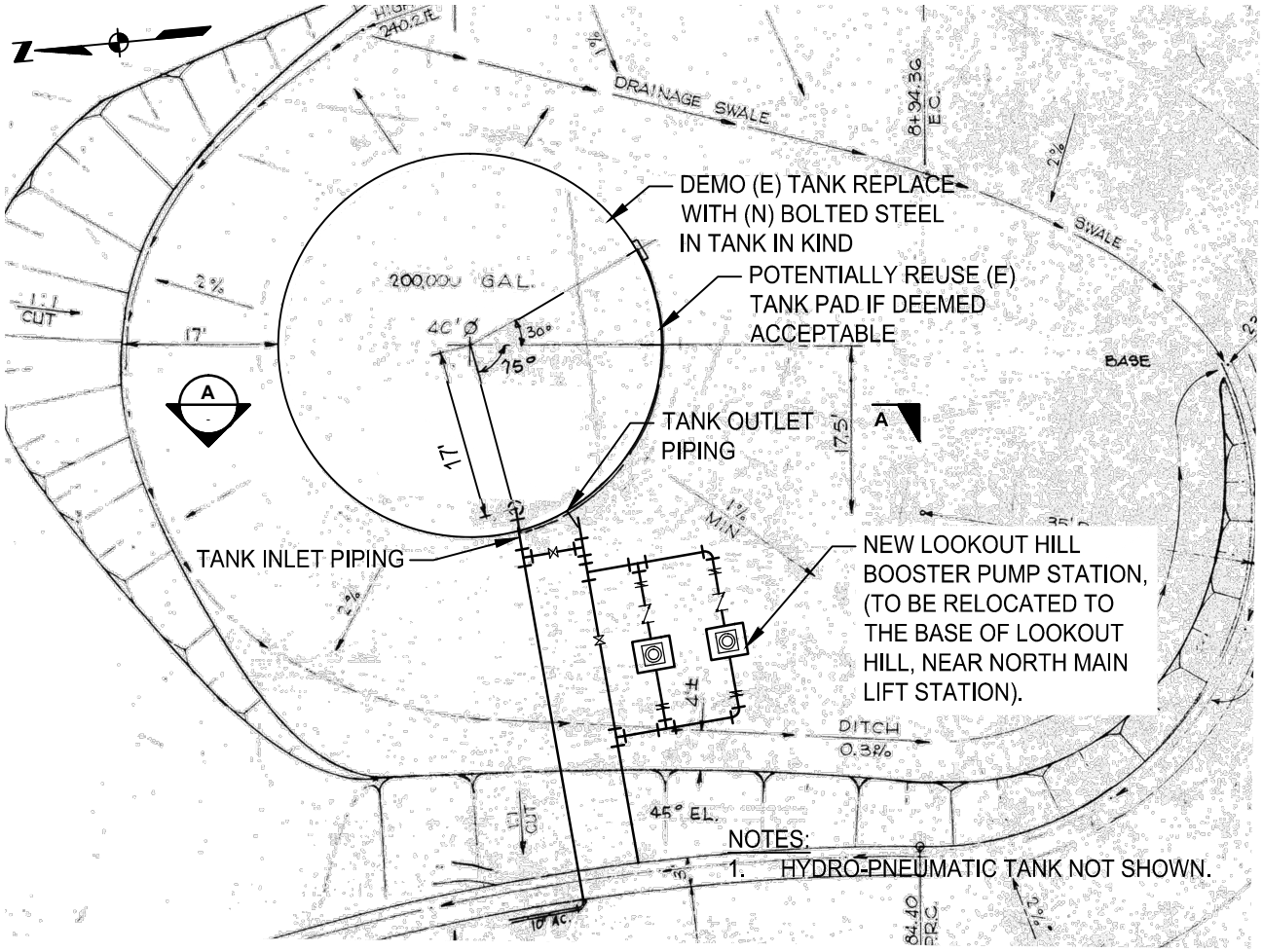


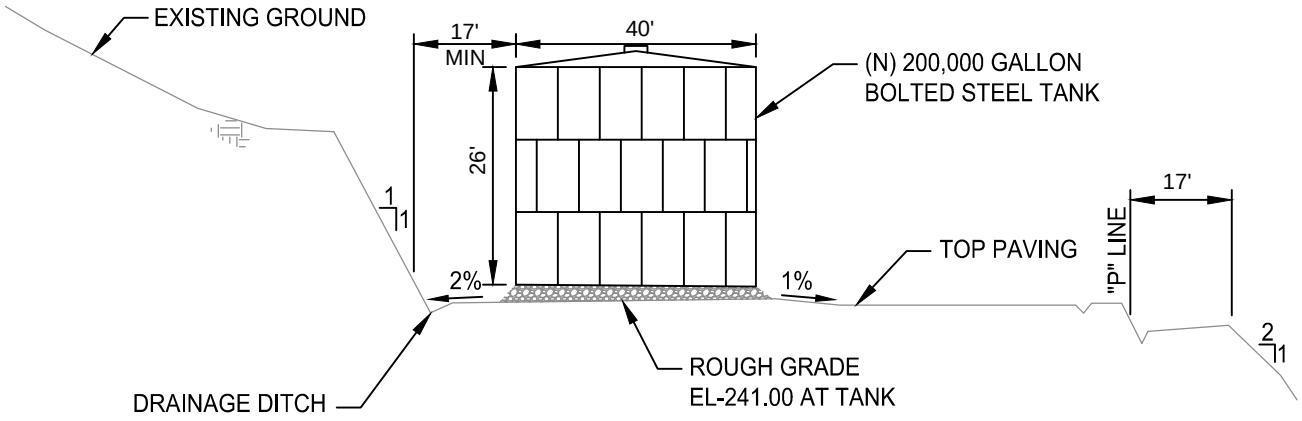
Figure 15. *Recommended Phase 1 and Buildout Recycled Water Conveyance System Improvements*



RECYCLED WATER STORAGE TANK SITE PLAN

0 10 20 30

1"=20'



SECTION A-A

HORIZ. 1"=20'
VERT. 1"=10'

A
-

Kennedy/Jenks Consultants

RANCHO MURIETA COMMUNITY SERVICE DISTRICT

LOOKOUT HILL STORAGE TANK

K/J 1670011*00
JAN 2017

Figure 16

d. **Existing Stonehouse 12-inch Forcemain:** The existing 12-inch forcemain (5,400 ft abandoned sewer forcemain, not in use) that parallels Stonehouse Road and crosses under Highway 16 will be used for recycled water conveyance. It is anticipated that installation and operation of the new chemical feed system will avoid further corrosion. As described in the Stonehouse 12-inch Sewer Forcemain Condition Assessment report, the addition of a corrosion inhibitor, coupled with monitoring, is anticipated to extend the estimated remaining useful life to about 25 years.

3.2.2: Lookout Hill Water Storage Tank

Recycled water storage is required to supplement production capacities and satisfy peak irrigation demands. At this time, it is recommended that a total capacity of 200,000 gallons be provided to satisfy Phase 1 demands. System optimization should be performed using the updated hydraulic model (or something similar) to minimize cost of ownership during detailed design. Clear and specific objectives (e.g., reduce storage tank, operating and/or net present costs) and scenarios (e.g., Buildout, Phase 1, etc.) should be identified, defined and documented prior to initiating hydraulic modeling work.

The existing tank located near the top of Lookout Hill will be demolished and a new tank made of bolted panels with powder coated finish will be erected in its place or next to the existing tank. The external dimensions of this tank are approximately 40 foot diameter and 26 feet side wall height (see Figure 16). A booster pumping station will be located near the base of Lookout Hill to (1) provide adequate pressure to serve Stonehouse and Escuela Parks and Residences of Murieta Hills, in the future, and (2) maintain pressure above a minimum set point (e.g., 40 psi) when recycled water is only being supplied to the golf courses.

3.2.3: Escuela Park Conversion

The irrigation system for Escuela Park will be disconnected at the Point of Service and reconnected to the Northwest Recycled Water Transmission Main for recycled water irrigation supply (see Figure 14). It is assumed that the RMA, or other agency responsible for Escuela Park irrigation and management, will work with the District and submit an Application for Recycled Water Permit and Recycled Water Plan for review, consideration of approval and recycled water service in accordance with the District's Recycled Water Standards. As described in the District's Standards, the Recycled Water Plan shall describe how the proposed system is consistent with District Standards. It has also been assumed that RMA will relocate the Point of Service for recycled water irrigation to that shown in Figure 14 and make improvements necessary to improve their system and comply with recycled water requirements.

Cross connection testing is to be conducted prior to service to verify that only the irrigation system is receiving recycled water and to ensure that any potable water facilities within the proposed reuse area are not connected to the recycled water system. Costs for this conversion are based on installing a portion (up to 200 ft) of the new 4-in PVC pipeline shown in Figure 14 for Stonehouse and Escuela Parks. It is assumed that this pipeline will be supplied by the common 4-inch pipeline located in Escuela Drive and described below in Stonehouse Park Conversion.

3.2.4: Stonehouse Park Conversion

The existing Stonehouse Park potable water irrigation service will be disconnected at the Point of Service and connected to the Northwest Recycled Water Transmission Main for recycled water irrigation supply (see Figure 14). It is assumed that the RMA, or other agency responsible for Stonehouse Park irrigation and management, will work with the District and submit an Application for Recycled Water Permit and Recycled Water Plan for review, approval and recycled water service in accordance with the District's Recycled Water Standards. As described in the District's

Standards, the Recycled Water Plan shall describe how the proposed system is consistent with District Standards. Specific items of relevance to this proposed reuse area include protection of public health through (a) separate and continued potable water service to applicable buildings, structures, etc. (e.g., faucets, urinals, toilets, etc.) and (b) adequate setback for picnic tables, drinking fountains, etc. It has also been assumed that RMA will relocate the Point of Service for recycled water irrigation to that shown in Figure 14 and will make the improvements necessary to improve their system and comply with recycled water requirements.

Cross connection testing will also be required to verify that the irrigation system is only receiving recycled water and to ensure that the potable water system is not connected to the recycled water system. Approximately 275 ft of new 4-in PVC pipeline has been included in the cost estimate for this conversion. This pipe length assumes that the 4-inch recycled water pipeline is routed from Stonehouse Road along Escuela Drive and into Stonehouse Park as indicated in Figure 14.

3.2.5: Main Northgate Conversion

The existing irrigation system for the North Maingate will be disconnected from the potable water system and reconnected to the Northwest Recycled Water Transmission Main (see Figure 14). It is assumed that the RMA, or other agency responsible for irrigation and management at this particular location, will work with the District and submit an Application for Recycled Water Permit and Recycled Water Plan for review, approval and recycled water service in accordance with the District's Recycled Water Standards. As described in the District's Standards, the Recycled Water Plan shall describe how the proposed system is consistent with District Standards. Specific items of relevance to this proposed reuse area include protection of public health by (a) ensuring that storm drains, basins, etc. are located outside of the reuse area and (b) that overspray, runoff, etc. does not have the ability to enter surface water bodies. It has also been assumed that RMA will relocate the Point of Service for recycled water irrigation to that shown in Figure 14 and make other improvements, if necessary, to improve their system and comply with recycled water requirements.

Cross connection tests will be used to verify that only the irrigation system is receiving recycled water and to ensure that potable water facilities are not connected to the recycled water system. Up to 200 ft of new 4-in PVC pipeline and associated appurtenances has been allocated for this effort.

3.2.6: Murieta Gardens

Recycled water infrastructure and irrigations systems to serve the Murieta Gardens development is to be proposed by the developer and submitted to the District in a Recycled Water Plan for review and comment as described in the District's Recycled Water Standards (Section 1.3.4). Specific design requirements, components and elements will be identified as part of the Murieta Gardens Recycled Water Plan review and approval process and are not described in this PDR.

3.2.7: The Retreats

Recycled water infrastructure and irrigations systems to serve The Retreats development is to be proposed by the developer and submitted to the District in a Recycled Water Plan for review and comment as described in the District's Recycled Water Standards (Section 1.3.4). Specific design requirements, components and elements will be identified as part of The Retreats Recycled Water Plan review and approval process and are not described in this PDR.

3.3: Recommended Buildout Improvements

The following are descriptions of the recommended improvements to accommodate Buildout.

3.3.1: Disinfection Facilities Upgrade

Currently, the disinfection facilities have a rated capacity of 2.3 MGD and consist of an existing chlorine contact basin (CCB) and chlorine contact pipe (CCP). The CCP will be removed and an additional chlorine contact chamber will be added to increase disinfection facilities capacity from 2.3 to 3.0 MGD. The proposed chlorine contact chamber is shown in Figure 13.

As described in *WWRP Modified Chlorine Contact Disinfection System Compliance Report* (HSe, July 2006), the CCB was tested in 2003 for actual modal contact time at a flow of 1 and 3 MGD. The estimated modal contact time through the CCB at 3 MGD is 27 minutes. In accordance with Title 22, *disinfected tertiary recycled water* requires a minimum 90 minute modal contact time, therefore the proposed chlorine contact chamber is to have minimum modal contact time of 63 minutes.

A new concrete chlorine contact chamber is proposed to be installed next to the existing equalization basin at the WWRP to increase disinfection capacity. A 90 percent efficiency (e.g., baffling factor) was assumed for sizing of the new contact chamber. The new chlorine contact chamber will provide approximately 146,610 gallons for additional disinfection contact time and will consist of three passes following a serpentine configuration. The proposed chamber dimensions are 280 ft long, 7 ft wide and 10 ft deep,[17] which equate to a length to width to depth ratio of 40:1:1.4, which is close to the target length to width to depth ratio of 40:1:1.5.

The water surface elevation of the new chlorine contact chamber will approximately match the elevation of the existing chlorine contact basin. The water surface elevation immediately downstream of the new chlorine contact chamber will approximately match the elevation of the existing equalization basin.

This improvement also includes the removal and disposal of the existing 20-inch CCP located inside the equalization basin.

Replacement of the third Tertiary Pump Station feed pump to the dissolved air flotation (DAF) units ($100,000 allocation indicated in Table 13) is also required to increase WWRP production capacity from 2.3 to 3.0 MGD.

3.3.2: Existing North Golf Course Conveyance System Rehabilitation

The 12- and 8-inch conveyance pipelines that serves the North Golf Course represents the backbone of the existing recycled water system and are proposed to convey recycled water to additional reuse areas in the future (see Figure 15). Both ACP pipelines have been in service for over 30 years. It is necessary to conduct a condition assessment of these conveyance system assets to determine rehabilitation needs and ensure future performance and continued, uninterrupted service. Condition assessment is recommended to be conducted in two phases. Phase 1 would focus on the existing 12-inch ACP pipeline from WWRP to Yellow Bridge while Phase 2 focused on the existing 8-inch ACP Pipeline to Bass Lake. Although these improvements have been designated as Buildout, the District should conduct assessments as soon as possible to better understand their condition and plan accordingly.

ACP was widely used for water pipelines from the 1940's through the 1960's. ACP was popular due to its light weight, rigidity and ease of handling and installation, low coefficient of friction, and corrosion resistant properties. However, in the early 1970's the installation of ACP ceased due to

[17] Dimensions do not include thickness of contact chamber walls.

health concerns associated with the manufacturing process. In 1973, the United States Environmental Protection Agency (EPA) implemented the National Emissions Standards for Hazardous Air Pollutants (NESHAP), which determined that asbestos was a leading contributor to asbestosis and certain forms of cancer.

In 1991, EPA determined that any location where activities such as cutting, crushing/removing, and disposing of ACP are considered active waste disposal sites and therefore, subject to the requirements and regulations under NESHAP. However, NESHAP does include an exclusion that allows the exposure of up to 260 linear feet of ACP at one time.

Most ACP either has or is reaching the end of what is considered a typical 50 to 70 year useful life for pipelines. Many water industries have found that ACP is failing at a relatively high rate, and are trying to identify feasible and economic ways to replace and/or rehabilitate ACP. Several options for replacing and rehabilitating existing ACP include the following:

- Removal by excavating and bagging the existing ACP for disposal, and installation of a new pipe in the same trench.
- Abandonment of existing ACP in place and installation of a new pipe in parallel or alternative location using open cut construction (also known as by-passing).
- Pipe lining which for the smaller diameter pipelines (6 to 12-inch) would be curing-in-place pipe lining (CIPP). CIPP is the installation of a resin saturated fabric tube that is placed inside the AC pipe and inflated with air or more typically hot water until the resin saturated fabric hardens and creates an interior pipe lining.
- Pipe bursting, which involves pulling or pushing of existing ACP into the surrounding soils through the use of static, pneumatic, or hydraulic equipment that breaks the host pipe.
- Pipe reaming, which uses horizontal directional drilling equipment to grind the ACP into smaller fragments and then pumps drilling fluid into the borehole to flush the smaller fragments into a downstream collection pit for disposal.

NESHAP requires that notification be provided for all of the AC pipe removal and rehabilitation options described above.

3.3.3: Bass Lake Recycled Water Storage Tanks:

Recycled water storage is required to supplement recycled water production capacities needed to satisfy projected Buildout peak irrigation demands. At this time, it has been recommended that a total capacity of 500,000 gallons be provided to satisfy Buildout demands.

3.3.4: Seasonal Storage Reservoir

A minimum of 150 AF of additional seasonal storage for secondary treated effluent is required to accommodate future development through Buildout. This addition could easily be met through expansion of the existing reservoir. Review of the existing ponds and levee system indicate the potential for cost effective expansion. Seasonal storage reservoir cost estimates presented in this PDR are based upon increasing the capacity of the existing storage reservoirs to 900 AF.

3.3.5: Van Vleck Sprayfield No. 4

Additional effluent disposal capacity will be required to accommodate above average levels of precipitation. As described in Table 13, additional recycled water transmission, distribution and irrigation system improvements are proposed into order increase sprayfield capacity on an additional 30 acres to accommodate wet weather scenarios for future growth.

3.3.6: Villages A, B, and C Developments

Recycled water infrastructure and irrigations systems to serve Villages A, B and C developments are to be proposed by the developers and submitted to the District in Recycled Water Plans for review and comment as described in the District's Recycled Water Standards (Section 1.3.4). Specific design requirements, components and elements will be identified as part of the review and approval process and are not described in this PDR.

Section 4: Project Implementation

This section presents the proposed construction sequencing and project scheduling. An estimate of probable construction costs is also included, along with a preliminary table of contents for the Phase 1 Recycled Water Improvements Project specifications and list of drawings.

4.1: Construction Sequencing

The sequence of construction for the majority of the Phase 1 Recycled Water Improvements Project is expected to be relatively straightforward provided that the following tie-ins / connections into existing recycled water infrastructure are conducted during the wet season, when recycled water production and conveyance system are not in operation (typically between October 15 through April). If designed, planned and coordinated properly, each of these tie-ins are expected to be relatively short in duration and can be scheduled during the wet season.

- WWRP Improvements (Wet Season Tie-Ins and Critical Activities)
  - Recycled Water Pumping Station
    - Rehabilitation.
    - Tie into existing Equalization Basin at WWRP.
    - Tie into existing 12-inch ACP North Golf Course Conveyance pipeline at WWRP.
  - Tie in (2) into existing District Headquarters irrigation system and conduct cross-connection testing.
- Northwest Recycled Water Transmission Main (Wet Season Tie Ins and Critical Activities)
  - New Highway 16 undercrossing pipeline tie ins (2) to existing 12-inch ACP North Golf Course Pipeline and recently installed 12-inch Legacy Lane pipeline.
  - New 12-inch Lone Pine Drive / Murieta Drive pipeline tie in to recently installed 12-inch Legacy Lane pipeline.
  - New 12-inch Lone Pine Drive / Murieta Drive pipeline tie in to new Lookout Hill Recycled Water Storage Tank.
  - New 12-inch Lone Pine Drive / Murieta Drive pipeline tie in to new Recycled Water Booster Pump Station.
  - New 12-inch recycled water pipeline tie in to abandoned 12-inch Forcemain.
  - Existing Stonehouse 12-inch Forcemain tie ins (3) to existing Escuela and Stonehouse Park and Main North Gate Entrance irrigation systems.
- Reuse Areas Conversions
  - Existing Main Northgate Irrigation System Modifications
  - Existing District Headquarters Irrigation System Modifications
  - Existing Escuela Park Irrigation System Modifications
  - Existing Stonehouse Park Irrigation System Modifications

4.2: Project Implementation Schedule

A project implementation schedule for Phase 1 Recycled Water Improvements Project is presented in Figure 17. The proposed schedule is based on anticipated timelines for completion of major tasks and activities required for implementation and not on meeting a specific timeline or deadline. The implementation schedule indicates that the Phase 1 recycled water system could be initiated for service mid-2019 and that the Phase 1 improvements are estimate to require about 30 months to complete once this PDR has been finalized. This timeline, which should be verified with an environmental consultant, assumes a maximum 6-month timeline for environment consultation and review.

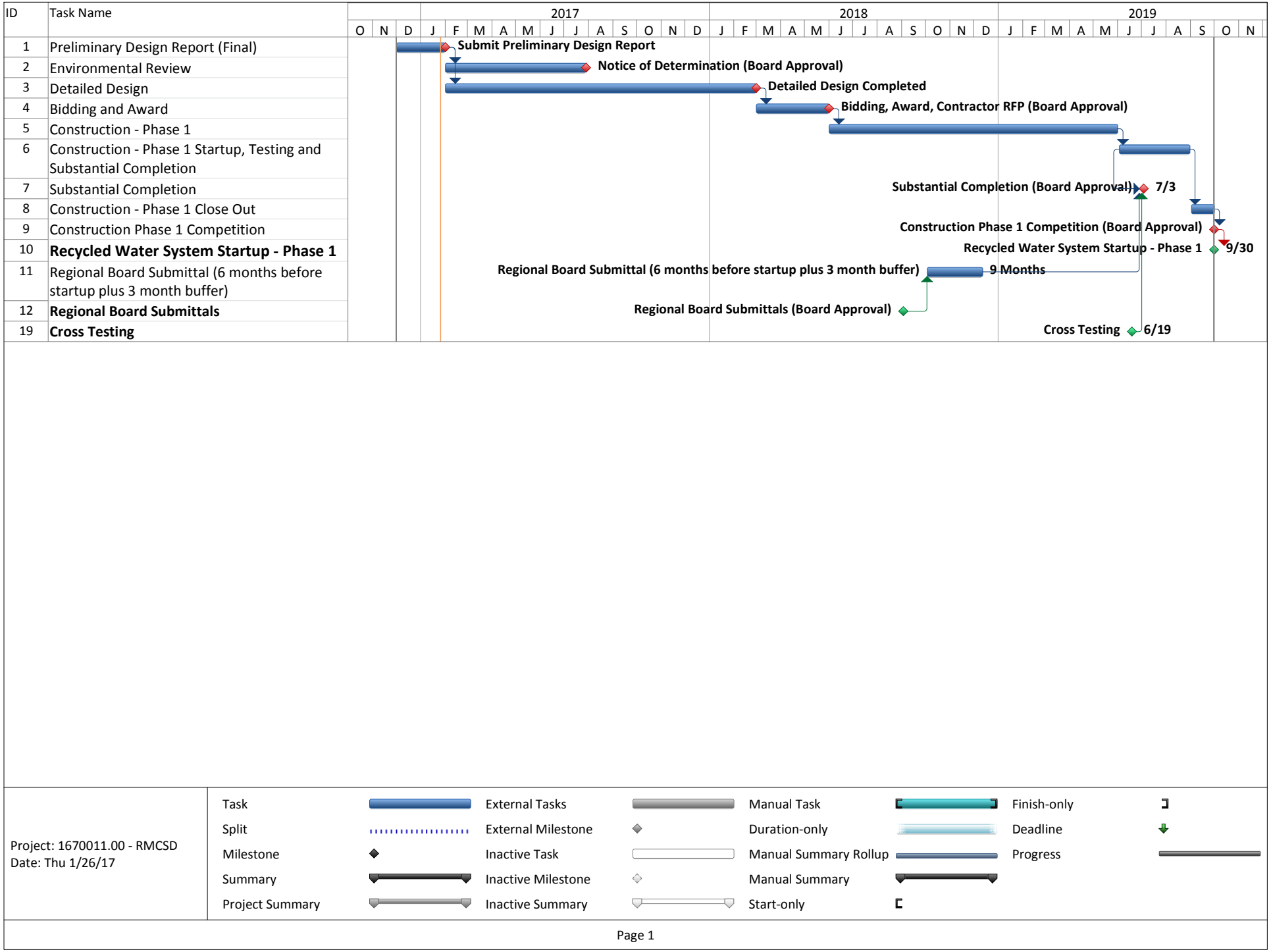


Figure 17. Proposed Phase 1 Implementation Schedule

Buildout improvements are anticipated to require approximately 3 years for completion of all major activities such as preliminary design, environmental review, detailed design, construction, startup and testing and close out. Similar to what is illustrated in Figure 17, it is recommended that future Buildout reuse areas obtain District approval no less than 12 months before system startup. Cross connection testing should be conducted just before startup of the Buildout system startup.

The rated ADWF capacity of the existing seasonal storage reservoirs has been established at 0.65 MGD in the WDR. Review of Figure 6 indicates that the ADWF is projected to approach 0.65 MGD around 2023. The District should initiate the expansion of the seasonal storage reservoir no later than January 2020 based on this development schedule. A construction sequencing plan should be established early in the project to determine the best and most cost effective means for increasing the height of the existing secondary storage reservoir berms while maintaining the District's ability to continuously operate and store secondary effluent.

4.3: Construction Documents

A preliminary list of drawings is shown in Table 15 following by a preliminary list of specifications in Table 16. for the Phase 1 Recycled Water Improvements Project Improvements.

Table 15. *Preliminary List of Drawings – Phase 1 Recycled Water*

Drawing No.	Discipline	Drawing Title
1	General	Title Sheet, Vicinity Map and Drawing List
2		General Notes and Abbreviations
3		Mechanical Legend, Schedules and Notes
4		Electrical Legend, Schedules and Notes
	1	**Recycled Water SCADA Control System**
5		P&ID 1
6		P&ID 2
7		P&ID 3
8		PLC
	2	**Equalization Basin Potable Water Air Gap Connection**
9		Civil Plan and Profile
10		Civil Detail
	3	**Recycled Water Pump Station**
11		Civil - Site Plan
12		Civil Discharge Piping
13		Mechanical - Recycled Water Booster Pump Station
14		Mechanical - Details
15		Electrical - Power, Control, and Instrumentation
	4	**District Headquarters Conversion - Recycled Water Irrigation System Connection**
16		Civil - Site Plan
17		Civil - Details
	5	**Northwest Recycled Water Transmission Main**
18		Civil - Plan and Profile 1
19		Civil - Plan and Profile 2
20		Civil - Plan and Profile 3

Drawing No.	Discipline	Drawing Title
21		Civil - Plan and Profile 4
22		Civil - Plan and Profile 5
23		Civil - Plan and Profile 6
24		Civil - Plan and Profile 7
25		Civil - Plan and Profile 8
26		Civil - Plan and Profile 9
27		Civil - Plan and Profile 10
28		Civil - Plan and Profile 11
29		Civil - Plan and Profile 12
30		Civil - Plan and Profile 13
31		Civil - Plan and Profile 14
32		Civil - Details 1
33		Civil - Details 2
34		Civil - Details 3
	6	**Recycled Water Booster Pumping Station**
35		Civil - Site Plan
36		Civil Discharge Piping
37		Mechanical - Lookout Hill Booster Pump Station
38		Mechanical - Details
39		Electrical - Power, Control, and Instrumentation
	7	**Escuela Park Conversion - Recycled Water Irrigation System Connection**
40		Civil - Site Plan
41		Civil - Details
	8	**Stonehouse Park Conversion - Recycled Water Irrigation System Connection**
42		Civil - Site Plan
43		Civil - Details
	9	**Lookout Hill Recycled Water Storage Tank**
44		Civil - Site Piping Detail Plan
45		Civil - Storage Tank Plan and Section
46		Civil - Storage Tank Details 1
47		Civil - Storage Tank Details 2
48		Mechanical - Storage Tank Details 1
49		Mechanical - Storage Tank Details 2
	10	**Main North Gain Entrance Conversion - Recycled Water Irrigation System Connection**
50		Civil - Site Plan
51		Civil - Details

Table 16. *Preliminary List of Specifications – Phase 1 Recycled Water Improvements*

Spec. No.	Description
Bidding Requirements	
00010	Invitation to Bid
00100	Instructions to Bidders
00200	Information Available to Bidders
00300	Bid Form
00410	Bid Security
00414	Security for Compensation Certificate – California Requirement
00416	Bidder's References
00420	Bidder's Qualifications
00430	Subcontractor List
00480	Noncollusion Affidavit – California Requirement
Contract Forms	
00500	Agreement
00610	Performance Bond – California Version
00620	Payment Bond – California Version
Contract Conditions	
00700	General Conditions – Pre-defined Standard
00800	Supplementary Conditions – California Version
Division 1 – General Requirements	
01010	Summary of the Work and Contract Considerations
01040	Coordination and Project Requirements
01140CA3	Environmental Protection
001300	Submittals
01500	Construction Facilities and Temporary Controls
01550	Traffic Regulation
01650	Facility Startup
01700	Contract Closeout
Division 2 – Site Work	
02050	Demolition
02200	Site Preparation
02302	Earthwork – For Pipelines
02370	Slope Protection
02700	Paving and Surfacing
02775	Concrete Curb, Gutters and Sidewalks
02820	Fences and Gates
02905	Landscape Planting and Irrigation
Division 3 – Concrete	
03200	Reinforcing Steel
03300	Cast-In-Place Concrete
Division 5 – Metals	
05722	Aluminum Handrails, Guardrails and Related Items
Division 9 – Finishes	
09900	Painting
09960	High Performance Coatings
09960A	Appendix A: Standards and References and Mandatory Quality Control Testing
009960B	Appendix B: Coating Detail Sheets, High Performance Coatings
Division 11 – Equipment	
11215	Vertical Turbine Pumps
Division 13 – Special Construction	
13212	Bolted Steel Tank

Spec. No.	Description
Division 15 – Mechanical	
15050	Piping, Valves and Accessories
Division 16 – Electrical	
16000	Electrical Work
16010	General Electrical Requirements
16110	Conduit, Raceways and Fittings
16120	Low Voltage Wire and Cable
16122	Medium Voltage Cable
16124	Signal Cable
16130	Boxes
16140	Wiring Devices
16155	Motor Starters
16160	Panelboards
16165	Load Centers
16180	Protective Devices and Switches
16205	Standby Diesel Engine-Generator Sets
16250	Automatic and Non-Automatic Transfer Switches
16325	Step Voltage Regulator
16330	Capacitor Switchgear
16401	Overhead Electrical Work
16402	Underground Electrical Service System
16405	Switchboards
16406	Medium Voltage Switchgear
16450	Electrical Grounding
16520	Exterior Lighting
16611	Uninterruptible Power Supply (UPS)
16613	Regulated Power Supplies
16615	Power Distribution Units
16760	Plant Communications Systems
16762	Telephone and Paging Systems
16800	Modifications to Existing Facilities
16890	Electric Heaters
16920	Motor Control Center(s)
16923	Slip Energy Recovery Drives (SER)
16929	Medium Voltage Motor Starter(s)
16930	Power Factor Control Equipment
16945	Contactors/Remote Control Relays
16955	Control Devices
16999	Intrinsically Safe Systems
Division 17 – Instrumentation and Controls	
17010	Instrumentation and Controls, General Requirements
17010.1	Figure 1 - Loop Diagram
17010.2	Figures 2 (Interconnection Diagram), 3 (Elementary Diagram), and 4 (Equipment Wiring Diagrams)
17015	Operational Availability Demonstration
17018	Performance (Availability) Warranty
17110	Analytical Instruments
17120	Flow Measurement
17140	Level Measurement
17150	Pressure Measurement
17200	Panel Mounted and Miscellaneous Field Instruments
17320	Process Control System

Spec. No.	Description
17321	Microcomputer Based SCADA System
17330	Programmable Logic Controller
17330.1	Appendix - PLC Process Control Strategies
17335	Process Control Unit
17340	Data Acquisition and Logging System
17341	Data Acquisition and Logging System - Microcomputer Type
17421	Tone Telemetry System
17423	Remote Telemetry Units
17425	Radio Telemetry System
17430	Intelligent Multiplexing System
17510	Panels

4.4: Estimate of Probable Construction Cost

The estimated probable construction and project costs for the recommended Phase 1 improvements are $3,740,000 and $4,960,000, respectively as shown in Table 17. Estimated buildout construction and project costs are $7,990,000 and $10,590,000, respectively. A detailed breakdown of these cost estimates are included in the Appendix.

As shown at the bottom of Table 17, Recycled Water Program costs are estimated to be about $6,395 per equivalent residential home. The following is a listing of current connection fees for other nearby and/or similar agencies for comparison purposes:

- Sacramento Regional CSD: $3,358 infill; $5,523 new areas
- City of Roseville: $7,802
- Calaveras County Water District: $5,500-$17,293 depending on service area

Table 17. *Recommended Recycled Water Improvements and Estimated Costs*

No.	Improvement	Estimated Cost ($)[a]
Phase 1 Recycled Water Improvements		
1	Recycled Water SCADA Control System	250,000
2	Equalization Basin Potable Water Air Gap	76,000
3	Recycled Water Pumping Station	1,165,000
4	District Headquarters Conversion	20,000
5	Northwest Recycled Water Transmission Main	1,006,000
6	Lookout Hill Booster Pumping Station	612,000
7	Escuela Park Conversion	16,000
8	Stonehouse Park Conversion	36,000
9	Lookout Hill Recycled Water Storage Tank	545,000
10	Main Northgate Conversion	18,000
11	Commercial Loop Conversion	*na*
	Phase 1 Subtotal (Estimated Construction Cost)	**3,740,000**
12	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	1,215,500
	Phase 1 Total (Project Cost)	**4,960,000**
Buildout Recycled Water Improvements		
13	SCADA Upgrades	82,000
14	Disinfection Facilities Upgrade	665,000
15	North Golf Course Conveyance System	1,620,000
16	Bass Lake Tank	1,216,000
17	Bass Lake Booster Pumping Station	625,000
18	Seasonal Storage Reservoir Expansion	3,407,000

No.	Improvement	Estimated Cost ($)[a]
19	Van Vleck Sprayfield 4	270,000
20	DAF Pumping Replacement	100,000
	Buildout Subtotal (Estimated Construction Cost)	**7,990,000**
21	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	2,600,000
	Buildout Total (Project Cost)	**10,590,000**
Phase 1 and Buildout Recycled Water Improvements		
	Grand Total (Phase 1 and Buildout)	**15,600,000**
	Estimated Number of New Equivalent Residential Units	2,440
	Estimated Cost per Connection ($/ERU)	**$6,395**

[a] Estimated costs based upon Engineering News Record (ENR) 20 City Average Construction Cost Index (CCI) at 10,385 (August 2016)

na Data not available to make this determination

Appendix

KENNEDY/JENKS CONSULTANTS

OPINION OF PROBABLE CONSTRUCTION COST

BASIS OF ESTIMATE

PROJECT INFORMATION

Client:	Rancho Murrieta
Project:	Recycled Water System
KJ Job No.:	1670011*00
Estimate Date:	12/2/2016
Prepared By:	JLH
Reviewed By:	KAK
Estimate Type:	Preliminary
AACEI Estimate Classification	Class 4

PROJECT DESCRIPTION:

The scope of work for this project includes: Recycled Water System components including water storage tanks, pump stations, new recycled water conveyance, connections to convert existing irrigation systems to recycled water use, and control features as described in the report.

ESTIMATE DOCUMENTS:

DRAWINGS: N/A
DOCUMENTS: Predesign Report & Figures

SOURCE OF COST DATA:

Published cost estimating data, engineers experience on similar projects.

ESTIMATE ASSUMPTIONS:

The followings assumptions were made in the preparation of this estimate:

Project will be publicly bid project.

Native backfill will be suitable for use in utility trenches.

No signficant dewatering of groundwater in excavation will be required.

Additional detail of assumed items is included in detailed estimate breakdown.

SPECIFIC INCLUSIONS:

Soft costs have been included with the following percentages allocations: Administration (5%), Regulatory/ CEQA Compliance(2.5%), Engineering & Construction Management (15%), Soft Cost Contingency (10%)

SPECIFIC EXCLUSIONS:

The estimate does not include the following:
Asbestos / Lead abatement.
Hazardous or Special Waste removal or disposal
Soil remediation

MAJOR CHANGES FROM PREVIOUS ESTIMATE:

DESIGN CONTINGENCY:

A design contingency of 30 % has been included.

Note: This allowance is intended to provide a Design Contingency allowance. It is not intended to provide for a Construction Contingency for change orders during construction or to cover unforeseen conditions.

ESCALATION:

An escalation factor has not been included. The owner is cautioned that the project cost should be adjusted for the project schedule.

Current ENR CCI	Aug-16	10385	
Annual Inflation Escalation Factor:		3.0%	
Time Until Project Midpoint (Months)			Number of months

ACCURACY:

The level of accuracy is commensurate with levels developed by the AACEI, the Association for the Advancement of Cost Engineering International. At increasing levels of design completion, the narrower the range between upper and lower limits and the greater the accuracy of the estimate. This estimate is considered a Class 4 level estimate in accordance with AACEI guidelines. Typically this level of estimate has an expected accuracy range of +50%, -30%. This estimate is based upon competitive bidding, which assumes receipt of multiple bids from five or more General Contractors. Without competitive bidding, pricing can vary significantly from the prices assumed in this estimate.

The enclosed Engineer's Estimate of Probable Construction Cost is only an opinion of possible items that maybe considered for budgeting purposes. This Project Estimate is limited to the conditions existing at issuance and is not a guaranty of actual construction cost or schedule. Uncertain market conditions such as, but not limited to, local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events and developing bidding conditions, etc. may affect the accuracy of this review. Kennedy/Jenks is not responsible for any variance from this Project Estimate or actual prices and conditions obtained.

OTHER COMMENTS:

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta **Prepared By:** JLH/KAK
Date Prepared: 14-Jun-17
Building, Area: Recycled Water **K/J Proj. No.:** 1670011*00

Estimate Type: **Preliminary**

SUMMARY BY AREA

ITEM NO.	ITEM DESCRIPTION		TOTAL
Phase 1			
1	Recycled Water SCADA Control System		250,000
2	Equalization Basin Potable Water Air Gap connection		76,000
3	Recycled Water Pumping Station		1,165,000
4	District Headquarters Conversion Irrigation Connection		20,000
5	NW Recycled Water Transmission Main		1,006,000
6	Lookout Hill Booster Pumping Station		612,000
7	Escuela Park Conversion - Recycled Water Irrigation Connection		16,000
8	Stonehouse Park Conversion - Recycled Water Irrigation Connection		36,000
9	Lookout Hill Water StorageTank		545,000
10	North Main Gate Conversion - Recycled Water Irrigation Connection		18,000
	Phase 1 Subtotal		**3,740,000**
	Soft Costs (Admin, Regulatory, Engineering, CM, Contingency) 33%		1,215,500
	Phase 1 Subtotal		**4,960,000**
Build out			
1B	SCADA Control System Bass Lake Tank Items		82,000
11	Disinfection Facilties Upgrade		665,000
12	North Golf Course Conveyance System Rehabilitation		1,620,000
13	Bass Lake Recyled Water Storage Tank		1,216,000
14	Bass Lake Booster Pump Station		625,000
15	Seasonal Storage Reservior		3,407,000

ITEM NO.	ITEM DESCRIPTION			TOTAL
16	Van Vleck Sprayfield 4			270,000
17	DAF Pump Replacement			100,000
	Buildout Subtotal			**7,990,000**
	Soft Costs (Admin, Regulatory, Engineering, CM, Contingency)	33%		2,600,000
	Phase 1 Subtotal			**10,590,000**
	TOTAL			**15,600,000**

Estimate Accuracy	
+50%	-30%

50%	Total Est.	-30%
$23,400,000	**$15,600,000**	**$10,920,000**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By: JLH

Building, Area: Recycled Water SCADA Control System

Date Prepared:

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Phase 1											
		PLC System at Lookout Hill Booster Pump Station	1	EA							
		RTU/ Wireless I/O	2	LOC					25,000	50,000	50,000
		Control Valves and Control System Elements:									
		Recycled Water Pump Station Pressure Reducing Valve 12"	1	EA	12,000.00	12,000	500.00	500			12,500
		Recycled Water Pump Station Flow Meter 12"	1	EA	8,000.00	8,000	4,500.00	4,500			12,500
		Recycled Water Pump Station Pressure Transmitter	1	EA	3,500.00	3,500	4,500.00	4,500			8,000
		Lookout Hill Flow Control Valve 12" Actuated Valve	1	EA	4,500.00	4,500	4,500.00	4,500			9,000
		Lookout Hill Tank Altitude Valve 12"	1	EA	13,400.00	13,400	500.00	500			13,900
		Lookout Hill Booster Pump Station Pressure Transmitter	1	EA	3,500.00	3,500	4,500.00	4,500			8,000
		Power Drop / Meter at Actuated Valve at Branch	1	EA					5,000	5,000	5,000
		Power to Above Items	6	EA					5,000	30,000	30,000
		Subtotals				44,900		19,000		85,000	148,900
		Division 1 Costs	@	10%		4,490		1,900		8,500	14,890
		Subtotals				49,390		20,900		93,500	163,790
		Taxes - Materials Costs	@	8.75%		4,322					4,322
		Subtotals				53,712		20,900		93,500	168,112
		Taxes - Labor Costs	@	5.00%				1,045			1,045
		Subtotals				53,712		21,945		93,500	169,157
		Contractor Markup for Sub	@	12%						11,220	11,220
		Subtotals				53,712		21,945		104,720	180,377
		Contractor OH&P	@	15%		8,057		3,292			11,348
		Subtotals				61,768		25,237		104,720	191,725
		Estimate Contingency	@	30%							57,518
		Subtotals									249,243
		Escalate to Midpoint of Construct (per year)	@	3%							-
		Estimated Bid Cost									249,243
		Total Estimate									250,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$375,000	**$250,000**	**$175,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: Equalization Basin Potable Water Air Gap connection

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @** _____ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Tapped Connection to Existing Pipe	1	EA	1,475.00	1,475	510.00	510			1,985
		8" DI Pipe incl Trenching	20	LF	34.50	690	30.00	600			1,290
		8" FCA	2	EA	500.00	1,000	200.00	400			1,400
		8" Fittings	4	EA	450.00	1,800	150.00	600			2,400
		8" Butterfly Valve	2	EA	1,000.00	2,000	250.00	500			2,500
		8" Flow Meter	1	EA	6,000.00	6,000	800.00	800			6,800
		8" Actuated Valve	1	EA	5,000.00	5,000	500.00	500			5,500
		Paving Restoration	13	SY					75	1,000	1,000
		Electrical for Meter/ Valve	1	LS					15,000	15,000	15,000
		Underground Electrical Conduit	200	LF					35	7,000	7,000
		Subtotals				17,965		3,910		23,000	44,875
		Division 1 Costs	@	10%		1,797		391		2,300	4,488
		Subtotals				19,762		4,301		25,300	49,363
		Taxes - Materials Costs	@	8.75%		1,729					1,729
		Subtotals				21,491		4,301		25,300	51,092
		Taxes - Labor Costs	@	5.00%				215			215
		Subtotals				21,491		4,516		25,300	51,307
		Contractor Markup for Sub	@	12%						3,036	3,036
		Subtotals				21,491		4,516		28,336	54,343
		Contractor OH&P	@	15%		3,224		677			3,901
		Subtotals				24,714		5,193		28,336	58,244
		Estimate Contingency	@	30%							17,473
		Subtotals									75,717
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									75,717
		Total Estimate									76,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$114,000	**$76,000**	**$53,200**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By: JLH

Date Prepared:

Building, Area: Recycled Water Pumping Station

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @** _____ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Modification to Existing Pump Station Structure	1	LS			50,000.00	50,000			50,000
		Generator Slab	11	CY	250.00	2,667	250.00	2,667			5,333
		Vertical Turbine Pumps	3	EA	47,200.00	141,600	10,000.00	30,000			171,600
		Pump Discharge Piping:									
		10" Fittings/ Spools	12	EA	500.00	6,000	200.00	2,400			8,400
		10" Flex Connector	3	EA	800.00	2,400	250.00	750			3,150
		10" Check Valve	3	EA	3,700.00	11,100	250.00	750			11,850
		10" Butterfly Valve	3	EA	1,200.00	3,600	200.00	600			4,200
		10" FCA	3	EA	800.00	2,400	250.00	750			3,150
		Pipe Supports	6	EA	150.00	900	100.00	600			1,500
		CARV	3	EA	400.00	1,200	200.00	600			1,800
		Tee	3	EA	800.00	2,400	350.00	1,050			3,450
		12" Discharge Header	40	LF	60.00	2,400	25.00	1,000			3,400
		Pressure Gage	3	EA	250.00	750	150.00	450			1,200
		Chemical Feed System	1	LS	60,895.00	60,895	200.00	6,000			66,895
		Electrical / I&C for Pumps (from Existing MCC's)	1	LS					180,000	180,000	180,000
		VFD's 250HP (in Existing MCCs)	3	EA	26,000.00	78,000	3,000.00	9,000			87,000
		Level Transitter	1	EA	4,000.00	4,000	2,500.00	2,500			6,500
		Emergency Generator 250KW w/ ATS & Fuel Tank	1	EA	53,500.00	53,500	11,000.00	11,000			64,500
		Subtotals				373,812		120,117		180,000	673,928
		Division 1 Costs	@	10%		37,381		12,012		18,000	67,393
		Subtotals				411,193		132,128		198,000	741,321
		Taxes - Materials Costs	@	8.75%		35,979					35,979
		Subtotals				447,172		132,128		198,000	777,301
		Taxes - Labor Costs	@	5.00%				6,606			6,606
		Subtotals				447,172		138,735		198,000	783,907
		Contractor Markup for Sub	@	12%						23,760	23,760
		Subtotals				447,172		138,735		221,760	807,667
		Contractor OH&P	@	15%		67,076		20,810			87,886
		Subtotals				514,248		159,545		221,760	895,553
		Estimate Contingency	@	30%							268,666
		Subtotals									1,164,219
		Escalate to Midpoint of Construct	@	3%							
		Estimated Bid Cost									1164219
		Total Estimate									1,165,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$1,747,500	**$1,165,000**	**$815,500**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: District Headquarters Conversion Irrigation Connection

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @** _____ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Connection Piping appurtenances	2	LS	500.00	1,000	500.00	1,000			2,000
		4" PVC Pipeline	270	LF	8.00	2,160	17.00	4,590			6,750
		Lanscaping Restoration	180	SY					10	1,800	1,800
		Cross Connection Testing	1	LS			1,000.00	1,000			1,000
		Subtotals				3,160		6,590		1,800	11,550
		Division 1 Costs	@	10%		316		659		180	1,155
		Subtotals				3,476		7,249		1,980	12,705
		Taxes - Materials Costs	@	8.75%		304					304
		Subtotals				3,780		7,249		1,980	13,009
		Taxes - Labor Costs	@	5.00%				362			362
		Subtotals				3,780		7,611		1,980	13,372
		Contractor Markup for Sub	@	12%						238	238
		Subtotals				3,780		7,611		2,218	13,609
		Contractor OH&P	@	15%		567		1,142			1,709
		Subtotals				4,347		8,753		2,218	15,318
		Estimate Contingency	@	30%							4,595
		Subtotals									19,913
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									19,913
		Total Estimate									20,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$30,000	**$20,000**	**$14,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: NW Recycled Water Transmission Main

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Highway 16 Undercrossing and Connection to Existing 12"ACP											
		Connection to Existing	1	EA	500.00	500	500.00	500			1,000
		12" PVC Pipeline	1,000	LF	23.50	23,500	57.50	57,500			81,000
		12" Fittings Rest Jnt	8	EA	635.00	5,292	125.00	1,042			6,333
		AAV Assembly	1	EA	2,500.00	2,500	500.00	500			3,000
		Paving Removal (legacy lane/ Lon		SY					10		
		Paving Restoration		SY					75		
		Traffic Control		DY	250.00		1,040.00				
Interconnecting piping between Legacy Lane & Lookout Hill Storage Tank (Along Legacy Lane, Lone Pine Drive an											
		Connection to Existing	1	EA	500.00	500	500.00	500			1,000
		12" PVC Pipeline (along Legacy &	2,500	LF	23.50	58,750	26.00	65,000			123,750
		12" PVC Pipeline (up hill)	300	LF	23.50	7,050	26.00	7,800			14,850
		12" Fittings Rest Jnt	21	EA	635.00	13,229	125.00	2,604			15,833
		AAV Assembly	1	EA	2,500.00	2,500	500.00	500			3,000
		Paving Removal (legacy lane/ Lon	1,667	SY					10	16,667	16,667
		Paving Restoration	1,667	SY					75	125,000	125,000
		Traffic Control	25	DY	250.00	6,250	1,040.00	26,000			32,250
Lookout Hill Booster pump Station to Existing FM Connection (down hill , along Lone pine drive, through CIA ditch)											
		Connection at Pump Station	1	EA	500.00	500	500.00	500			1,000
		12" PVC Pipeline	1,550	LF	23.50	36,425	26.00	40,300			76,725
		12" PVC Pipeline (along cia ditch)	850	LF	23.50	19,975	26.00	22,100			42,075
		12" Fittings	20	EA	635.00	12,700	125.00	2,500			15,200
		AAV Assembly	1	EA	2,500.00	2,500	500.00	500			3,000
		Connection to Existing FM	1	EA	500.00	500	500.00	500			1,000
		Ditch Restoration	567	SY			5.00	2,833			2,833
		Traffic Control	16	DY	250.00	3,875	1,040.00	16,120			19,995
Existing 12" Forcemain Rehabilitation (along Stonehouse Road)											
		Pipeline Assesment		LF					10		
		Pipeline Repair - CIPP (66%)		LF					59		
		12" PVC Pipeline (33% replaced)		LF	23.50		26.00				
		12" Pipe Removal		LF			8.00				

		Traffic Control		DY	250.00		1,040.00				
		Subtotals				196,546		247,299		141,667	585,512
		Division 1 Costs	@	10%		19,655		24,730		14,167	58,551
		Subtotals				216,200		272,029		155,833	644,063
		Taxes - Materials Costs	@	8.75%		18,918					18,918
		Subtotals				235,118		272,029		155,833	662,980
		Taxes - Labor Costs	@	5.00%				13,601			13,601
		Subtotals				235,118		285,631		155,833	676,582
		Contractor Markup for Sub	@	12%						18,700	18,700
		Subtotals				235,118		285,631		174,533	695,282
		Contractor OH&P	@	15%		35,268		42,845			78,112
		Subtotals				270,386		328,475		174,533	773,394
		Estimate Contingency	@	30%							232,018
		Subtotals									1,005,412
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									1,005,412
		Total Estimate									1,006,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$1,509,000	**$1,006,000**	**$704,200**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Prepared By: JLH

Building, Area: Lookout Hill Booster Pumping Station

Date Prepared:

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type: ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Misc Sitework	1	LS			60,000.00	60,000			60,000
		Pump Station Foundation(Cans)	12	CY	400.00	4,741	400.00	4,741			9,481
		Pump Station SOG	11	CY	250.00	2,778	250.00	2,778			5,556
		Generator Slab	6	CY	250.00	1,481	250.00	1,481			2,963
		Vertical Turbine Pumps	2	EA	33,002.00	66,004	8,400.00	16,800			82,804
		* Pumps outdoor, no enclosure or building included.									
		10" Butterfly Valve w/ Ext Op	2	EA	1,300.00	2,600	300.00	600			3,200
		10" FCA	2	EA	800.00	1,600	250.00	500			2,100
		Pump Discharge Piping:									
		10" Fittings/ Spools	12	EA	500.00	6,000	200.00	2,400			8,400
		10" Flex Connector	2	EA	800.00	1,600	250.00	500			2,100
		10" Check Valve	2	EA	3,700.00	7,400	250.00	500			7,900
		10" Butterfly Valve	2	EA	1,200.00	2,400	200.00	400			2,800
		10" FCA	2	EA	800.00	1,600	250.00	500			2,100
		Pipe Supports	4	EA	150.00	600	100.00	400			1,000
		CARV	2	EA	400.00	800	200.00	400			1,200
		Tee	2	EA	800.00	1,600	350.00	700			2,300
		12" Discharge Header	20	LF	60.00	1,200	25.00	500			1,700
		Pressure Gage	2	EA	250.00	500	150.00	300			800
		Power Feed to Pump Station	1	LS					25,000	25,000	25,000
		Electrical / I&C	1	LS					80,000	80,000	80,000
		VFD's 50HP	2	EA	10,000.00	20,000	3,000.00	6,000			26,000
		Emergency Generator 50kW w/ ATS & Fuel Tank	1	EA	22,000.00	22,000	6,900.00	6,900			28,900
		Subtotals				144,904		106,400		105,000	356,304
		Division 1 Costs	@	10%		14,490		10,640		10,500	35,630
		Subtotals				159,394		117,040		115,500	391,934
		Taxes - Materials Costs	@	8.75%		13,947					13,947
		Subtotals				173,341		117,040		115,500	405,881
		Taxes - Labor Costs	@	5.00%				5,852			5,852
		Subtotals				173,341		122,892		115,500	411,733
		Contractor Markup for Sub	@	12%						13,860	13,860
		Subtotals				173,341		122,892		129,360	425,593

Contractor OH&P	@	15%	26,001	18,434		44,435
Subtotals			199,343	141,326	129,360	470,028
Estimate Contingency	@	30%				141,009
Subtotals						611,037
Escalate to Midpoint of Construct	@	3%				-
Estimated Bid Cost						611,037
Total Estimate						612,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$918,000	**$612,000**	**$428,400**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By:

Date Prepared: JLH

Building, Area: Escuela Park Conversion - Recycled Water Irrigation Connection

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type:
- ☐ **Conceptual**
- ☐ **Construction**
- ☒ **Preliminary (w/o plans)**
- ☐ **Change Order**
- ☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Connection Piping appurtenances	2	LS	500.00	1,000	500.00	1,000			2,000
		4" PVC Pipeline	200	LF	8.00	1,600	17.00	3,400			5,000
		Lanscaping Restoration	133	SY					10	1,333	1,333
		Paving Restoration									
		Cross Connection Testing	1	LS					1,000	1,000	1,000
		Subtotals				2,600		4,400		2,333	9,333
		Division 1 Costs	@	10%		260		440		233	933
		Subtotals				2,860		4,840		2,567	10,267
		Taxes - Materials Costs	@	8.75%		250					250
		Subtotals				3,110		4,840		2,567	10,517
		Taxes - Labor Costs	@	5.00%				242			242
		Subtotals				3,110		5,082		2,567	10,759
		Contractor Markup for Sub	@	12%						308	308
		Subtotals				3,110		5,082		2,875	11,067
		Contractor OH&P	@	15%		467		762			1,229
		Subtotals				3,577		5,844		2,875	12,296
		Estimate Contingency	@	30%							3,689
		Subtotals									15,984
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									15,984
		Total Estimate									16,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$24,000	**$16,000**	**$11,200**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: Stonehouse Park Conversion - Recycled Water Irrigation Connection

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @** _____ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Connection Piping appurtenances	1	LS	500.00	500	500.00	500			1,000
		4" PVC Pipeline	475	LF	8.00	3,800	17.00	8,075			11,875
		Paving Removal	43	SY					10	433	433
		Paving Restoration	43	SY					75	3,250	3,250
		Lanscaping Restoration	345	SY					10	3,450	3,450
		Cross Connection Testing	1	LS					1,000	1,000	1,000
		Subtotals				4,300		8,575		8,133	21,008
		Division 1 Costs	@	10%		430		858		813	2,101
		Subtotals				4,730		9,433		8,947	23,109
		Taxes - Materials Costs	@	8.75%		414					414
		Subtotals				5,144		9,433		8,947	23,523
		Taxes - Labor Costs	@	5.00%				472			472
		Subtotals				5,144		9,904		8,947	23,995
		Contractor Markup for Sub	@	12%						1,074	1,074
		Subtotals				5,144		9,904		10,020	25,068
		Contractor OH&P	@	15%		772		1,486			2,257
		Subtotals				5,915		11,390		10,020	27,325
		Estimate Contingency	@	30%							8,198
		Subtotals									35,523
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									35,523
		Total Estimate									36,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$54,000	**$36,000**	**$25,200**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: Lookout Hill Water StorageTank

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type:
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @** _____ **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Demo Existing SteelTank	1	EA			40,000.00	40,000			40,000
		Demo Existing Tank foundation	84	CY	75.00	6,332	50.00	4,222			10,554
		New Storage Tank 200,000 gal	1	EA					135,000	135,000	135,000
		Tank Foundation	84	CY	250.00	21,108	250.00	21,108			42,216
		Excavation	84	CY			15.00	1,266			1,266
		Misc Sitework	1	LS			75,000.00	75,000			75,000
		Connection Piping Tank to Booste	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Overflow Piping	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Subtotals				37,440		151,596		135,000	324,036
		Division 1 Costs	@	10%		3,744		15,160		13,500	32,404
		Subtotals				41,184		166,755		148,500	356,440
		Taxes - Materials Costs	@	8.75%		3,604					3,604
		Subtotals				44,788		166,755		148,500	360,043
		Taxes - Labor Costs	@	5.00%				8,338			8,338
		Subtotals				44,788		175,093		148,500	368,381
		Contractor Markup for Sub	@	12%						17,820	17,820
		Subtotals				44,788		175,093		166,320	386,201
		Contractor OH&P	@	15%		6,718		26,264			32,982
		Subtotals				51,506		201,357		166,320	419,183
		Estimate Contingency	@	30%							125,755
		Subtotals									544,938
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									544,938
		Total Estimate									545,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$817,500	**$545,000**	**$381,500**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By: JLH

Date Prepared:

Building, Area: North Main Gate Conversion - Recycled Water Irrigation Connection

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @** _____ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Connection Piping appurtenances	1	LS	500.00	500	500.00	500			1,000
		4" PVC Pipeline	200	LF	8.00	1,600	17.00	3,400			5,000
		Paving Removal	33	SY			10.00	333			333
		Paving Restoration	33	SY					75	2,500	2,500
		Landscaping Restoration	33	LS					20	667	667
		Cross Connection Testing	1	LS					1,000	1,000	1,000
		Subtotals				2100.00		4233.33		4166.67	10500.00
		Division 1 Costs	@	10%		210.00		423.33		416.67	1050.00
		Subtotals				2310.00		4656.67		4583.33	11550.00
		Taxes - Materials Costs	@	8.75%		202.13					202.13
		Subtotals				2512.13		4656.67		4583.33	11752.13
		Taxes - Labor Costs	@	5.00%				232.83			232.83
		Subtotals				2512.13		4889.50		4583.33	11984.96
		Contractor Markup for Sub	@	12%						550.00	550.00
		Subtotals				2512.13		4889.50		5133.33	12534.96
		Contractor OH&P	@	15%		376.82		733.43			1110.24
		Subtotals				2888.94		5622.93		5133.33	13645.20
		Estimate Contingency	@	30%							4093.56
		Subtotals									17738.76
		Escalate to Midpoint of Construct	@	3%							
		Estimated Bid Cost									17,738.76
		Total Estimate									18,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$27,000	**$18,000**	**$12,600**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Building, Area: Recycled Water SCADA Control System

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @** _____ **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Spec. No.	Item No.	Description	Qty		Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Buildout:												
		Bass Lake Flow Control Valve 8" Actuated Butterfly Valve	1		EA	4,300.00	4,300	4,500.00	4,500			8,800
		Bass Lake Tank Altitude Valve 8"	1		EA	800.00	800	500.00	500			1,300
		Power Drop / Meter at Bass Lake	1		EA					25,000	25,000	25,000
		Power to Above Items	2		EA					5,000	10,000	10,000
		Cell Communication	1		LOC					5,000	5,000	5,000
		Subtotals					5,100		5,000		40,000	50,100
		Division 1 Costs		@	10%		510		500		4,000	5,010
		Subtotals					5,610		5,500		44,000	55,110
		Taxes - Materials Costs		@	8.75%		491					491
		Subtotals					6,101		5,500		44,000	55,601
		Taxes - Labor Costs		@	5.00%				275			275
		Subtotals					6,101		5,775		44,000	55,876
		Contractor Markup for Sub		@	12%						5,280	5,280
		Subtotals					6,101		5,775		49,280	61,156
		Contractor OH&P		@	15%		915		866			1,781
		Subtotals					7,016		6,641		49,280	62,937
		Estimate Contingency		@	30%							18,881
		Subtotals										81,818
		Escalate to Midpoint of Construct		@	3%							-
		Estimated Bid Cost										81,818
		Total Estimate										82,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$123,000	**$82,000**	**$57,400**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By: JLH

Building, Area: Disinfection Facilties Upgrade

Date Prepared:

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type: ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Demo Existing 20" CCP	6,600	LF			8.00	52,800			52,800
		Demo Concrete Anchors for CCP	207	CY			150.00	30,979			30,979
		New Chlorine Contact Tank :									
		Excavation	1,441	CY			10.00	14,406			14,406
		Shoring	2,440	VSF	10.00	24,400	12.00	29,280			53,680
		Base Slab	92	CY	250.00	23,111	200.00	18,489			41,600
		Tank Exterior Walls	136	CY	300.00	40,667	400.00	54,222			94,889
		Tank Center Walls	71	CY	300.00	21,333	400.00	28,444			49,778
		Backfill	516	CY			5.00	2,581			2,581
		Chlorine Injection Systems									
		Misc Sitework	1				40,000.00	40,000			40,000
		Subtotals				109,511		271,201		-	380,713
		Division 1 Costs	@	10%		10,951		27,120		-	38,071
		Subtotals				120,462		298,322		-	418,784
		Taxes - Materials Costs	@	8.75%		10,540					10,540
		Subtotals				131,003		298,322		-	429,324
		Taxes - Labor Costs	@	5.00%				14,916			14,916
		Subtotals				131,003		313,238		-	444,240
		Contractor Markup for Sub	@	12%						-	-
		Subtotals				131,003		313,238		-	444,240
		Contractor OH&P	@	15%		19,650		46,986			66,636
		Subtotals				150,653		360,223		-	510,876
		Estimate Contingency	@	30%							153,263
		Subtotals									664,139
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									664,139
		Total Estimate									665,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$997,500	**$665,000**	**$465,500**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By:

Date Prepared: JLH

Building, Area: North Golf Course Conveyance System Rehabilitation

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type:
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @** _____ **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Wastewater Reclamamtion Plant to Bass Lake - 11,200 ft, of which 9,000 ft will be improved. WWRP to Yellow Bridge (12-in, 4,300 ft) to be replaced. Remaining pipe is assumed to be 8-inch; 1/3 of which is to be replaced, the r											
		Condition Assessment 12" AC Pip	1	LS			5,000.00	5,000	25,000	25,000	30,000
		12" PVC Pipe (100% Replaced)	4,300	LF	24.00	103,200	26.00	111,800			215,000
		12" Fittings	36	EA	635.00	22,754	125.00	4,479			27,233
		Connection to Existing Pipes	2	EA	500.00	1,000	500.00	1,000			2,000
		12" PVC Pipe (CIPP lined)		LF					59		
		Remove Existing Pipe	4,300	LF			8.00	34,400			34,400
		Paving Removal	1,911	SY			10.00	19,111			19,111
		Paving Replacement over trench	1,911	SY					75	143,333	143,333
		Traffic Controls	43	DY	200.00	8,600	1,040.00	44,720			53,320
		Condition Assessment 8" AC Pipe	1	LS			10,000.00	10,000	45,000	45,000	55,000
		8" PVC Pipe Replaced	1,900	LF	14.00	26,600	22.00	41,800			68,400
		Remove Existing Pipe	1,900	LF			8.00	15,200			15,200
		Paving Removal	844	SY			10.00	8,444			8,444
		Paving Replacement over trench	844	SY					75	63,333	63,333
		Traffic Controls	19	DY	200.00	3,800	1,040.00	19,760			23,560
		8" PVC Pipe (CIPP Repair)	3,800	LF					55	209,000	209,000
		Subtotals				165954.17		315,715		485,667	967,336
		Division 1 Costs	@	10%		16595.42		31,571		48,567	96,734
		Subtotals				182549.58		347,286		534,233	1,064,069
		Taxes - Materials Costs	@	8.75%		15973.09					15,973
		Subtotals				198522.67		347,286		534,233	1,080,042
		Taxes - Labor Costs	@	5.00%				17,364			17,364
		Subtotals				198522.67		364,651		534,233	1,097,407
		Contractor Markup for Sub	@	12%						64,108	64,108
		Subtotals				198522.67		364,651		598,341	1,161,515
		Contractor OH&P	@	15%		29778.40		54,698			84,476
		Subtotals				228301.07		419,348		598,341	1,245,990
		Estimate Contingency	@	30%							373,797

Subtotals					1,619,788
Escalate to Midpoint of Construct	@	3%			-
Estimated Bid Cost					1,619,788
Total Estimate					1,620,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$2,430,000	**$1,620,000**	**$1,134,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: Bass Lake Recyled Water Storage Tank

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Site Prep	1	LS			10,000.00	10,000			10,000
		New Storage Tank 500,000 gal	1	EA					450,000	450,000	450,000
		Foundation	141	CY	250.00	35,180	250.00	35,180			70,359
		Overflow Piping	1	LS			10,000.00	10,000			10,000
		Misc Sitework:	1	ALL			195,000.00	195,000			195,000
		Subtotals				35,180		250,180		450,000	735,359
		Division 1 Costs	@	10%		3,518		25,018		45,000	73,536
		Subtotals				38,698		275,198		495,000	808,895
		Taxes - Materials Costs	@	8.75%		3,386					3,386
		Subtotals				42,084		275,198		495,000	812,281
		Taxes - Labor Costs	@	5.00%				13,760			13,760
		Subtotals				42,084		288,957		495,000	826,041
		Contractor Markup for Sub	@	12%						59,400	59,400
		Subtotals				42,084		288,957		554,400	885,441
		Contractor OH&P	@	15%		6,313		43,344			49,656
		Subtotals				48,396		332,301		554,400	935,097
		Estimate Contingency	@	30%							280,529
		Subtotals									1,215,626
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									1,215,626
		Total Estimate									1,216,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$1,824,000	**$1,216,000**	**$851,200**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Rancho Murrieta

Building, Area: Bass Lake Booster Pump Station

Prepared By: JLH
Date Prepared:
K/J Proj. No. 1670011*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: ☐ **Conceptual** ☐ **Construction**
☒ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Misc Sitework	1	LS			60,000.00	60,000			60,000
		Pump Station Foundation(Cans)	12	CY	400.00	4,741	400.00	4,741			9,481
		Pump Station SOG	11	CY	250.00	2,778	250.00	2,778			5,556
		Generator Slab	9	CY	250.00	2,222	250.00	2,222			4,444
		Vertical Turbine Pumps	2	EA	34,371.00	68,742	10,000.00	20,000			88,742
		* Pumps outdoor, no enclosure or building included.									
		10" Butterfly Valve w/ Ext Op	2	EA	1,300.00	2,600	300.00	600			3,200
		10" FCA	2	EA	800.00	1,600	250.00	500			2,100
		Pump Discharge Piping:									
		10" Fittings/ Spools	12	EA	500.00	6,000	200.00	2,400			8,400
		10" Flex Connector	2	EA	800.00	1,600	250.00	500			2,100
		10" Check Valve	2	EA	3,700.00	7,400	250.00	500			7,900
		10" Butterfly Valve	2	EA	1,200.00	2,400	200.00	400			2,800
		10" FCA	2	EA	800.00	1,600	250.00	500			2,100
		Pipe Supports	4	EA	150.00	600	100.00	400			1,000
		CARV	2	EA	400.00	800	200.00	400			1,200
		Tee	2	EA	800.00	1,600	350.00	700			2,300
		12" Discharge Header	20	LF	60.00	1,200	25.00	500			1,700
		Pressure Gage	2	EA	250.00	500	150.00	300			800
		Power Feed from Street up to Lookout Hill	1	LS					25,000	25,000	25,000
		Electrical / I&C	1	LS					80,000	80,000	80,000
		VFD's 50HP	2	EA	10,000.00	20,000	3,000.00	6,000			26,000
		Emergency Generator 50KW w/ATS and f	1	EA	22,000.00	22,000	6,900.00	6,900			28,900
		Subtotals				148,383		110,341		105,000	363,723
		Division 1 Costs	@	10%		14,838		11,034		10,500	36,372
		Subtotals				163,221		121,375		115,500	400,096
		Taxes - Materials Costs	@	8.75%		14,282					14,282
		Subtotals				177,503		121,375		115,500	414,378
		Taxes - Labor Costs	@	5.00%				6,069			6,069

Subtotals			177,503	127,444	115,500	420,446
Contractor Markup for Sub	@	12%			13,860	13,860
Subtotals			177,503	127,444	129,360	434,306
Contractor OH&P	@	15%	26,625	19,117		45,742
Subtotals			204,128	146,560	129,360	480,048
Estimate Contingency	@	30%				144,015
Subtotals						624,063
Escalate to Midpoint of Construct	@	3%				-
Estimated Bid Cost						624,063
Total Estimate						625,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$937,500	**$625,000**	**$437,500**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By: JLH

Date Prepared:

Building, Area: Seasonal Storage Reservior

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

Estimate Type:
- ☐ **Conceptual**
- ☐ **Construction**
- ☒ **Preliminary (w/o plans)**
- ☐ **Change Order**
- ☐ **Design Development @** _____ **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Site Prep	1	LS			30,000.00	30,000			30,000
		Cut		CY			5.00				
		Import Fill & Backfill with Compact	37,519	CY	20.00	750,374	3.00	112,556			862,931
		Grading	1,053,363	SY			1.00	1,053,363			1,053,363
		Stormdrainage									
		Paving									
		Site Lighting									
		Fencing									
		Connection Piping									
		Overflow Piping									
		Electrical Service									
		Subtotals				750,374		1,195,919		-	1,946,293
		Division 1 Costs	@	10%		75,037		119,592		-	194,629
		Subtotals				825,412		1,315,511		-	2,140,923
		Taxes - Materials Costs	@	8.75%		72,224					72,224
		Subtotals				897,635		1,315,511		-	2,213,146
		Taxes - Labor Costs	@	5.00%				65,776			65,776
		Subtotals				897,635		1,381,287		-	2,278,922
		Contractor Markup for Sub	@	12%						-	-
		Subtotals				897,635		1,381,287		-	2,278,922
		Contractor OH&P	@	15%		134,645		207,193			341,838
		Subtotals				1,032,281		1,588,480		-	2,620,760
		Estimate Contingency	@	30%							786,228
		Subtotals									3,406,988
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									3,406,988
		Total Estimate									3,407,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$5,110,500	**$3,407,000**	**$2,384,900**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: Rancho Murrieta

Prepared By:

Date Prepared: JLH

Building, Area: Van Vleck Sprayfield

K/J Proj. No. 1670011*00

Current at ENR

Escalated to ENR

Months to Midpoint of Construct

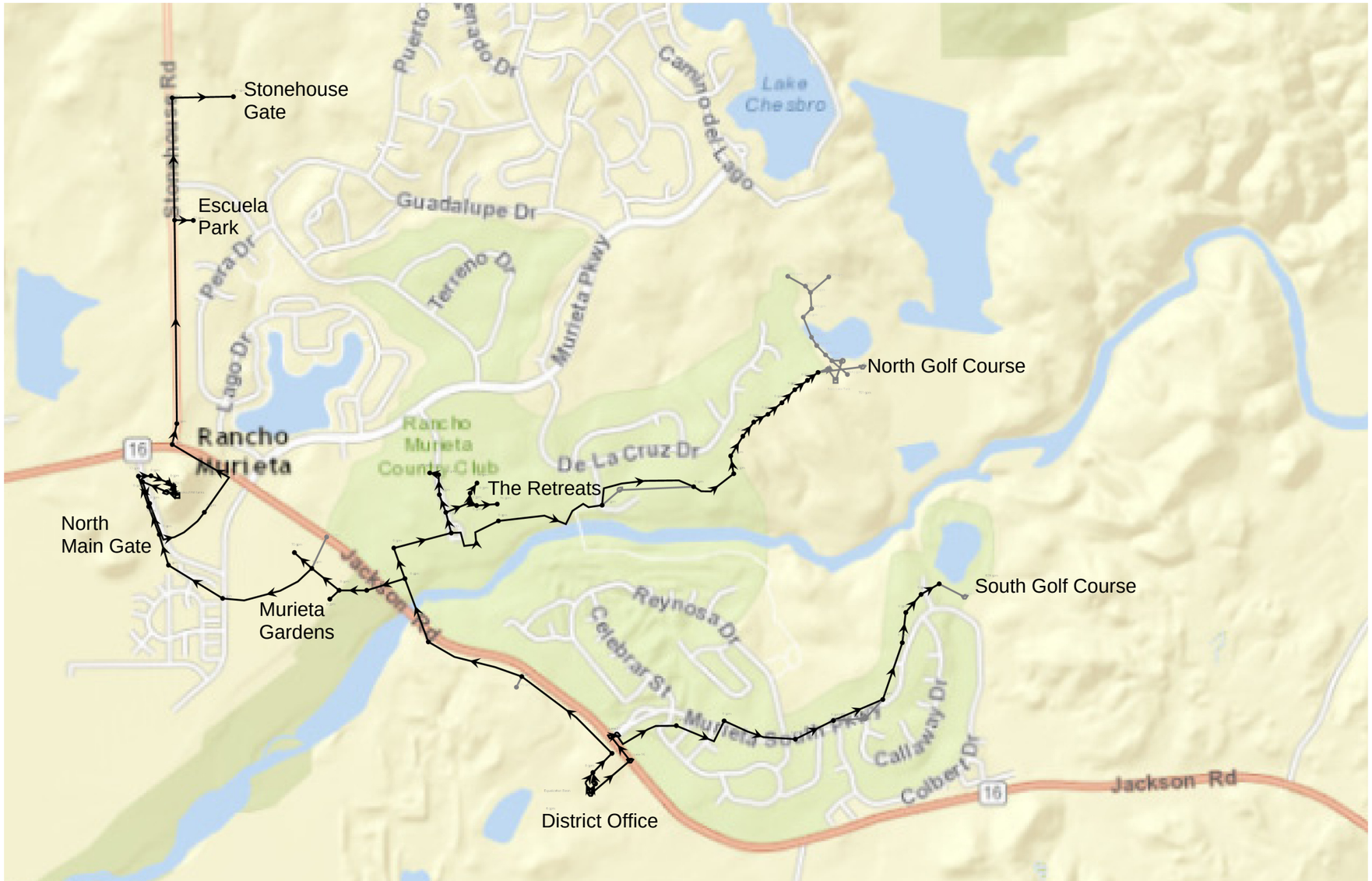
Estimate Type:
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @** _____ **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
		Above ground 12" Irrigation pipe	1,000	LF	20.08	20,075	8.91	8,910			28,985
		Above ground 8" Irrigation pipe		LF	9.90		6.27				
		Above ground 6" Irrigation pipe	5,000	LF	6.44	32,175	5.21	26,070			58,245
		Above ground 4" Irrigation pipe	4,000	LF	3.34	13,376	4.33	17,336			30,712
		Above ground 4" Irrigation pipe		LF	3.34		4.33				
		K Line Irrigation Systems	9	EA	2,600.00	23,400	320.00	2,880			26,280
		Valves	5	EA	1,500.00	7,500	150.00	750			8,250
		Subtotals				96,526		55,946		-	152,472
		Division 1 Costs	@	10%		9,653		5,595		-	15,247
		Subtotals				106,179		61,541		-	167,719
		Taxes - Materials Costs	@	8.75%		9,291					9,291
		Subtotals				115,469		61,541		-	177,010
		Taxes - Labor Costs	@	5.00%				3,077			3,077
		Subtotals				115,469		64,618		-	180,087
		Contractor Markup for Sub	@	12%						-	-
		Subtotals				115,469		64,618		-	180,087
		Contractor OH&P	@	15%		17,320		9,693			27,013
		Subtotals				132,790		74,310		-	207,100
		Estimate Contingency	@	30%							62,130
		Subtotals									269,230
		Escalate to Midpoint of Construct	@	3%							-
		Estimated Bid Cost									269,230
		Total Estimate									270,000

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$405,000	**$270,000**	**$189,000**

Rancho Murieta -
Phase 1 - Proposed Recycled Water Use
Conveyance System



Initial PS Capacity Estimate from Demands

- Based on meeting the demands (not including the North and South GC demands) within the 8-hr irrigation window, the pump station capacity needed is **2,955 gpm** (~1480 gpm per pump, assuming 2 duty pumps).
- If Bass Lake Tank is filled outside the 8-hr irrigation period (i.e., during the hours when Bass Lake is filled for the North GC demands), then the Village A, B, and C demands can be removed from this total. The minimum RWPS capacity needed would then be **1,758 gpm** (~880 gpm per pump, assuming 2 duty pumps).
- The capacity of the RWPS is expected to be between 1,760 and 2,960 gpm.

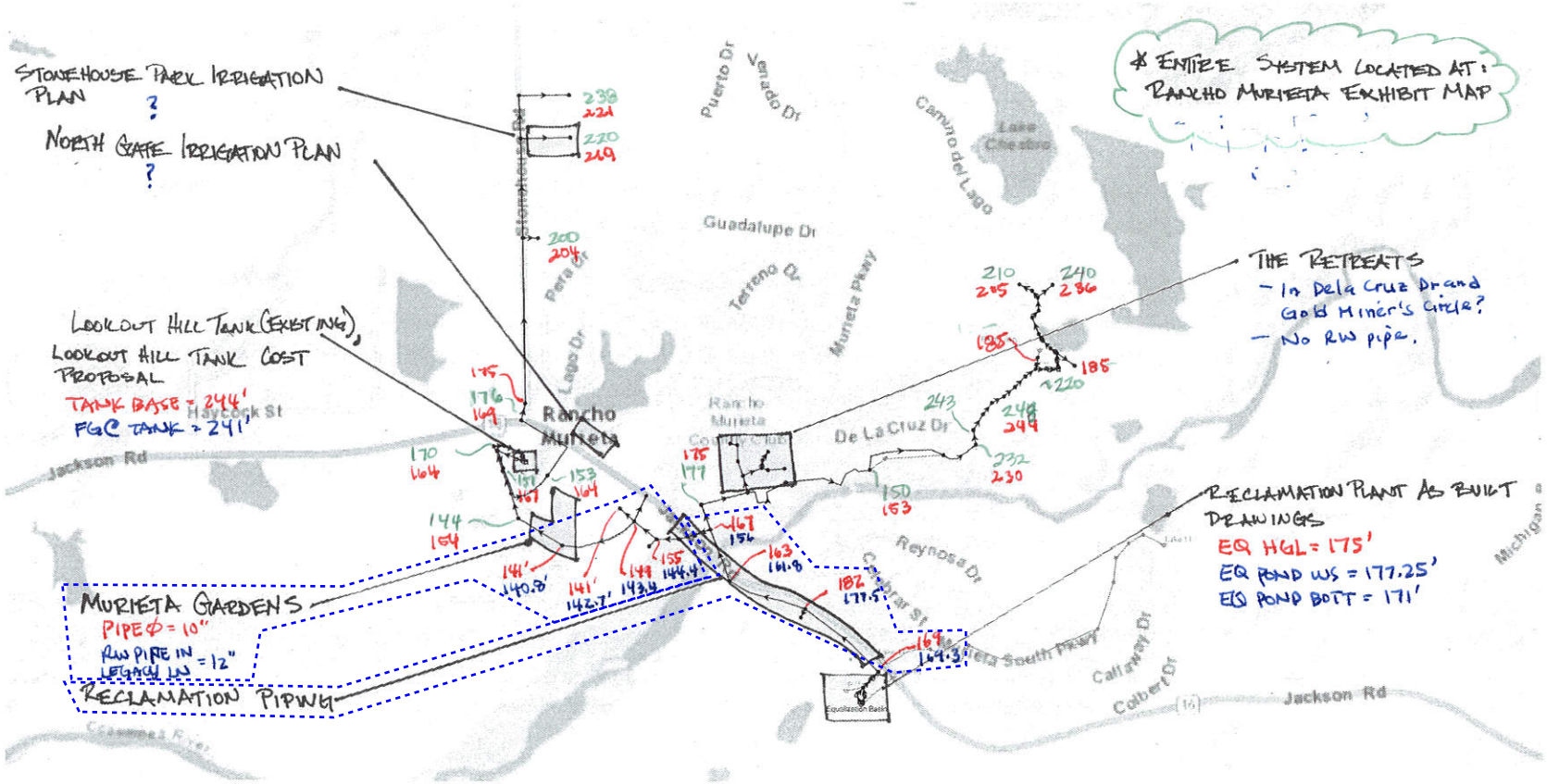
Modeling Results

- Because of pressure limitation of the pipe (criteria is to maintain pressure at Junction N_3 below 150 psi), the flow rate to Bass Lake and Bass Lake Tank is limited to ~1380 gpm. If filling Bass Lake at 1,052 gpm (North GC demand spread over 16 hrs), the maximum rate of filling Bass Lake Tank is 328 gpm (=1,380 gpm - 1,052 gpm) over the 16-hr window.
- Based on the demand downstream of Bass Lake Tank, the tank would need to be filled at a rate of at least 542 gpm during the 8-hr irrigation window. Therefore the RWPS capacity needs to be at least 2,300 gpm (=1,758 gpm + 542 gpm).
- There are two design points for the RWPS, one during the 8-hr irrigation window and one during the 16-hr non-irrigation period. Here are the proposed design points:
    - **2,600 gpm @ 195 ft** for the 8-hr period
    - **1,400 gpm @ 345 ft** for the 16-hr period

(1) CHECK PHYSICAL ATTRIBUTES

Rancho Murieta Recycled Water System:

AS-BUILT DRAWING LOCATIONS

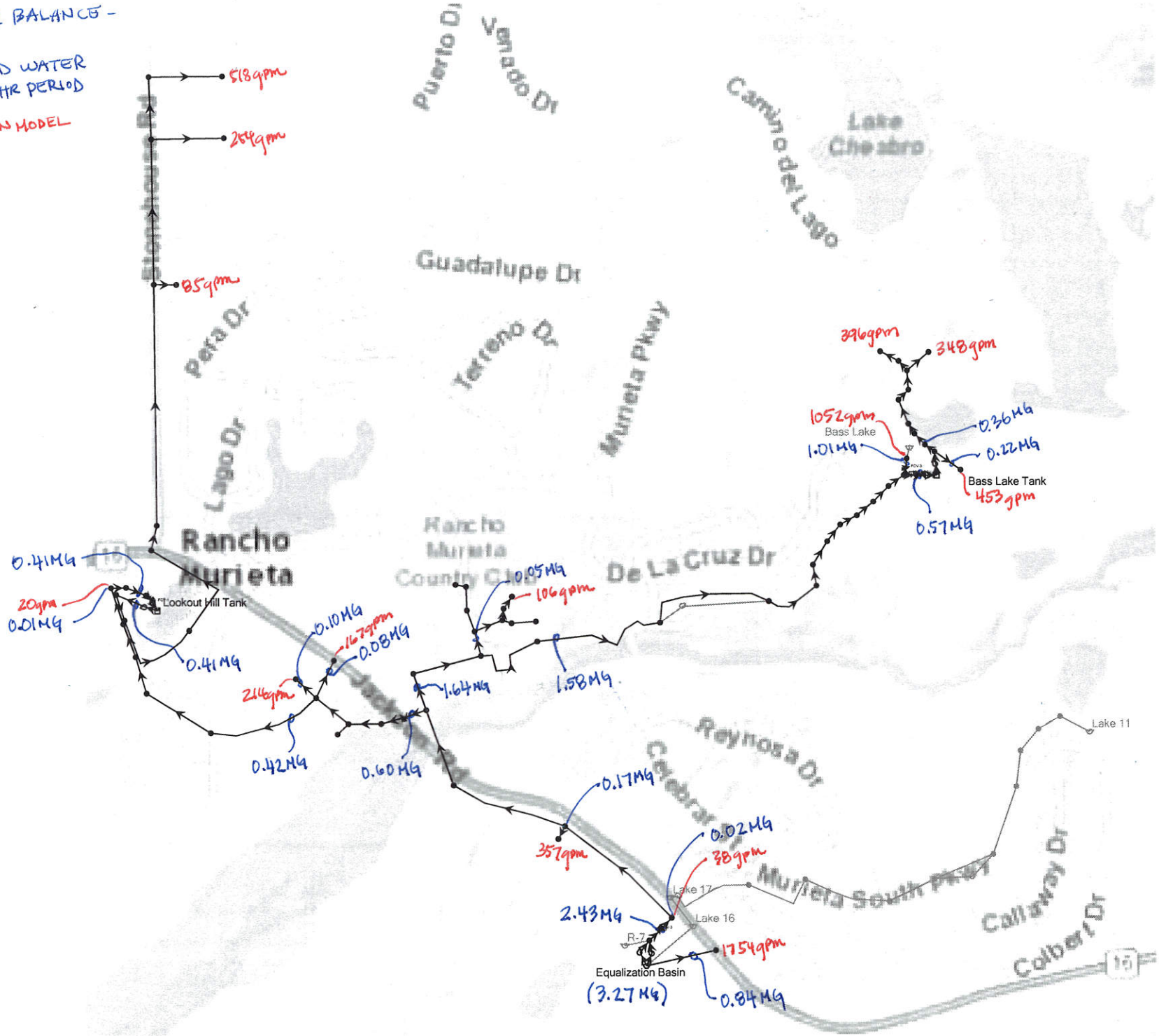


- ALL FOLDERS ARE LOCATED AT:
J:/167001*00/9.09/BACKGROUND INFORMATION

- Model
- Drawing
- Exhibit Map

(2) WATER BALANCE -

- TOTALIZED WATER OVER 24-HR PERIOD
- DEMANDS IN MODEL



G3 Engineering, Inc.

06 Dec 2016

Kennedy Jenks
Sacramento, CA

Quotation number: 480863
Revision:

Attn: Ryan Young

Project: Rancho Murieta
Your reference:

We thank you for your above referenced inquiry, and are pleased to submit our quotation for your consideration.

The following is a budget price summary for this quotation. Please see item specific pages for more details.

Item number	Service	Size	Unit Price	Unit Freight	Qty	Extended Price
010	RW Booster PS (1480 GPM)	14DOL - 5 stage Product lube - Sump Pump	$ 46,167	$ 1,000	3	$ 141,501
011	Lookout Hill BPS (860 GPM)	11JKH - 2 stage Product lube - Barrel Pump	$ 32,002	$ 1,000	2	$ 66,004
012	Bass Lake BPS (1200 GPM)	12JKH - 2 stage Product lube - Barrel Pump	$ 33,371	$ 1,000	2	$ 68,742
					Grand Total	$ 276,247

COMMENTS:
a. Pricing is for budget purposes only.
b. Quote does not include: Installation, Oil or Grease, Valves, Gauges, Anchor Bolts, Soleplates, Spare Parts, Sales Tax.

SHIPMENT AND FREIGHT TERMS: Shipment is quoted with freight term: Per the freight term listed in the Comments and Clarifications Section. Partial shipment allowed. Shipment & invoicing will occur upon shipment of equipment. Shipment schedules are based on factory loading at time of order. Should shipment be postponed due to project or site delays Weir Floway will invoice and hold the shipment. Shipment delays exceeding 30 days from the completed date may be subject to reasonable storage charges.

LEADTIME: Submittal will be approximately 6-8 weeks after order receipt, contingent upon order acceptance within 10 business days of receipt. Orders will be accepted subject to buyer's credit approval and subject to Weir Floway, Inc.'s Terms and Conditions of Sale.

Shipment lead time will be approximately 20-22 weeks after written release to manufacture. Shipment lead times are an estimate at time of quotation and subject to change based on quote validity.

SCOPE OF SUPPLY: Please note any requirements not outlined in the referenced specification sections as noted on the cover page of this quotation will not be the responsibility of Weir Floway. Any separate specifications made reference to within the noted specifications, whether in part or whole, will not be considered in this quotation.

Weir Floway, Inc. Terms and Conditions of Sale per attached will apply to this quotation. If this is not acceptable, mutually agreeable terms and conditions may be negotiated at time of order placement.

SPECIFICATIONS: Written request. No detailed specifications received.

VALIDITY: This offer is valid for 30 days from date issued. Quoted prices will be held firm thru shipment if order is released for manufacture within 60 days from order entry date. Otherwise, a price adjustment may be applied.

In the event that Weir Floway, Inc. is successful in the tender based on this Scope Letter, please issue the formal Purchase Order to the following address:

Weir Floway, Inc.
2494 S. Railroad Ave.
Fresno, CA 93706

PRICE: Quoted prices will be held firm through shipment if order is released for manufacture within 60 days from order entry date, and approved for shipment within the leadtime quoted. Otherwise, a price adjustment may be applied. Price quoted is for all items purchased and shipped at one time. In the event of a partial order, we will review and adjust the freight price accordingly. Freight charges will be those in effect at time of shipment. Due to volatility in the commodities markets, Weir Floway reserves the right to add a material surcharge on pipe, plate, and other materials in line with the commodity indices. Cost surcharges must be agreed to prior to order acceptance.

PAYMENT TERMS: Orders & contracts are subject to approval by Weir Floway prior to acceptance. Standard terms for orders <= $150,000 are net thirty (30) days from date of invoice. For orders >=$150,000, progress payments will apply. Weir Floway's standard progress payment schedule is attached for consideration. Start-up services are included and will be invoiced when services are completed or eight (8) weeks from pump shipment which ever occurs first.

PACKAGING: For domestic shipment via commercial carrier. Export boxing and documentation requirements are an option with price adder.

START-UP: Start-up/assistance by authorized Rep. included. Invoice for start-up services will be issued when services are complete or 8 weeks from pump shipment whichever occurs first.

QUALITY STANDARDS: All our manufacturing locations are ISO 9001-2008 certified.

TERMS AND CONDITIONS: This quotation is based solely upon the terms and conditions set forth herein including attachments. They supersede and reject any conflicting terms and conditions of Purchaser. Any other terms and conditions that Purchaser may propose are subject to requotation.

We hope you find our quotation in line with your requirements. However, if you have any questions, please do not hesitate to contact us.

Sincerely,

Mike Burns
G3 Engineering, Inc.

CC: Jim Billings, G3 Engineering

Richard Plitt, Floway

Pump Performance Datasheet

Customer	: Kennedy Jenks	Quote number	: 480863
Customer reference	:	Size	: 14DOL
Item number	: 010	Stages	: 5
Service	: RW Booster PS (1480 GPM)	Based on curve number	: 14DOL 1770 Rev. 0
Quantity	: 3	Date last saved	: 01 Dec 2016 11:10 AM

Operating Conditions

Flow, rated	: 1,480.0 USgpm
Differential head / pressure, rated (requested)	: 330.0 ft
Differential head / pressure, rated (actual)	: 331.3 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Frequency	: 60 Hz

Performance

Speed, rated	: 1770 rpm
Impeller diameter, rated	: 8.72 in
Impeller diameter, maximum	: 9.13 in
Impeller diameter, minimum	: 6.81 in
Efficiency (bowl / pump)	: 86.46 / 85.38 %
NPSH required / margin required	: 13.58 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 2,908 / 9,030 US Units
MCSF	: 412.4 USgpm
Head, maximum, rated diameter	: 553.0 ft
Head rise to shutoff (bowl / pump)	: 66.70 / 67.56 %
Flow, best eff. point (bowl / pump)	: 1,509.2 / 1,496.6 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 98.07 / 98.89 %
Diameter ratio (rated / max)	: 95.55 %
Head ratio (rated dia / max dia)	: 89.62 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water - Potable
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Solids concentration, by weight	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.00 psi.a

Material

Material selected	: Cast Iron/Bronze

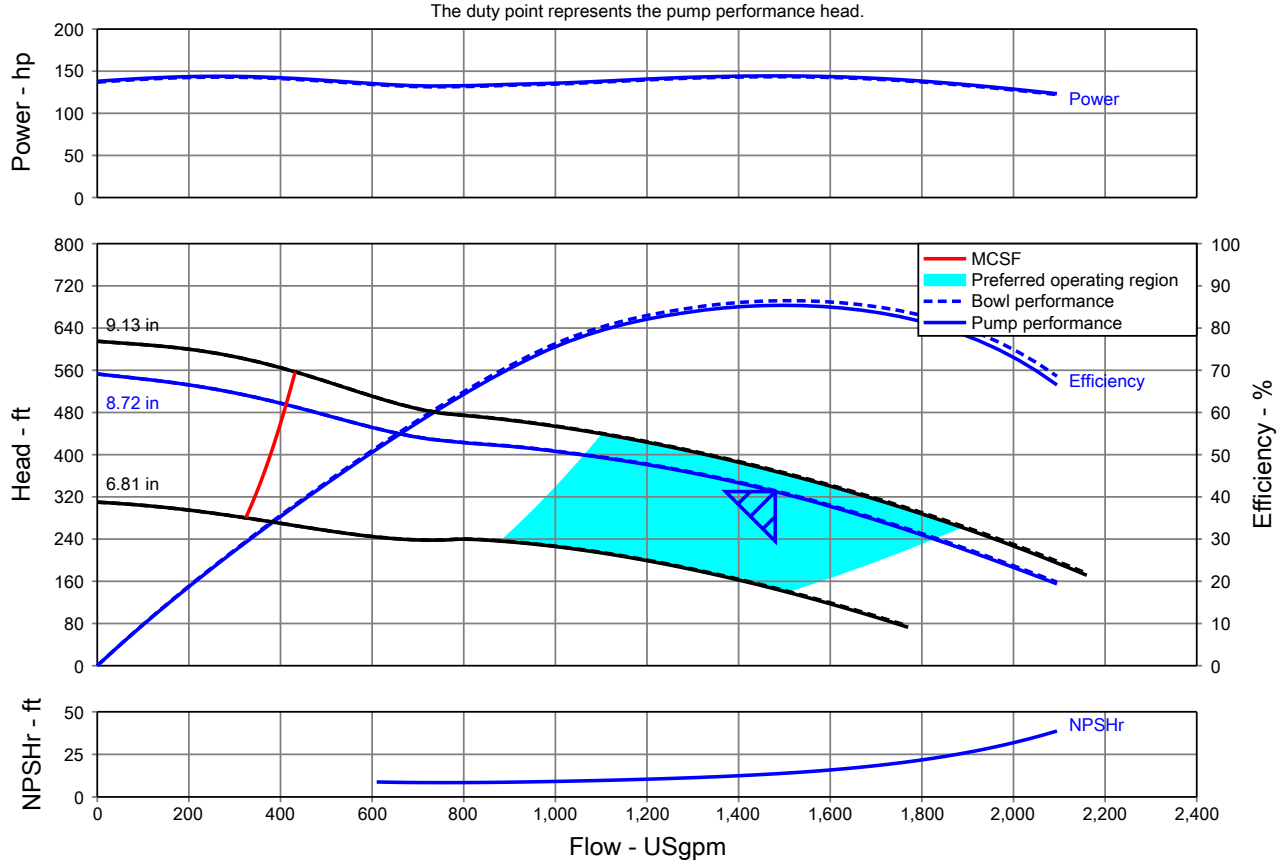
Pressure Data

Maximum working pressure	: See the Additional Data page
Component pressure limit	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data

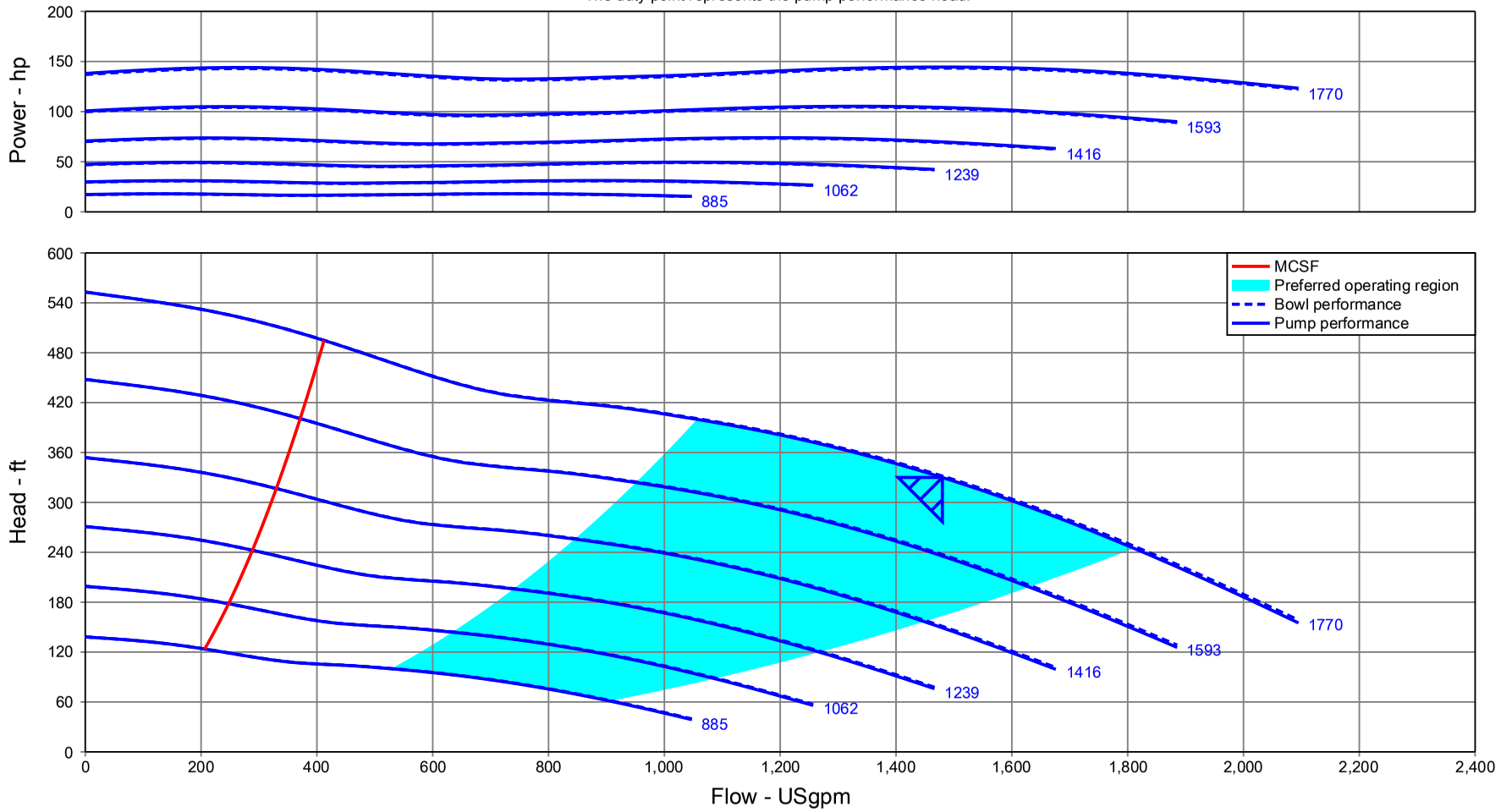
Driver sizing specification	: Max power + 4%
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 124 hp
Power (bowl / pump)	: 143 / 144 hp
Power, maximum, rated diameter	: 144 hp
Minimum recommended motor rating	: 200 hp / 149 kW

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



Multi-Speed Performance Curve

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



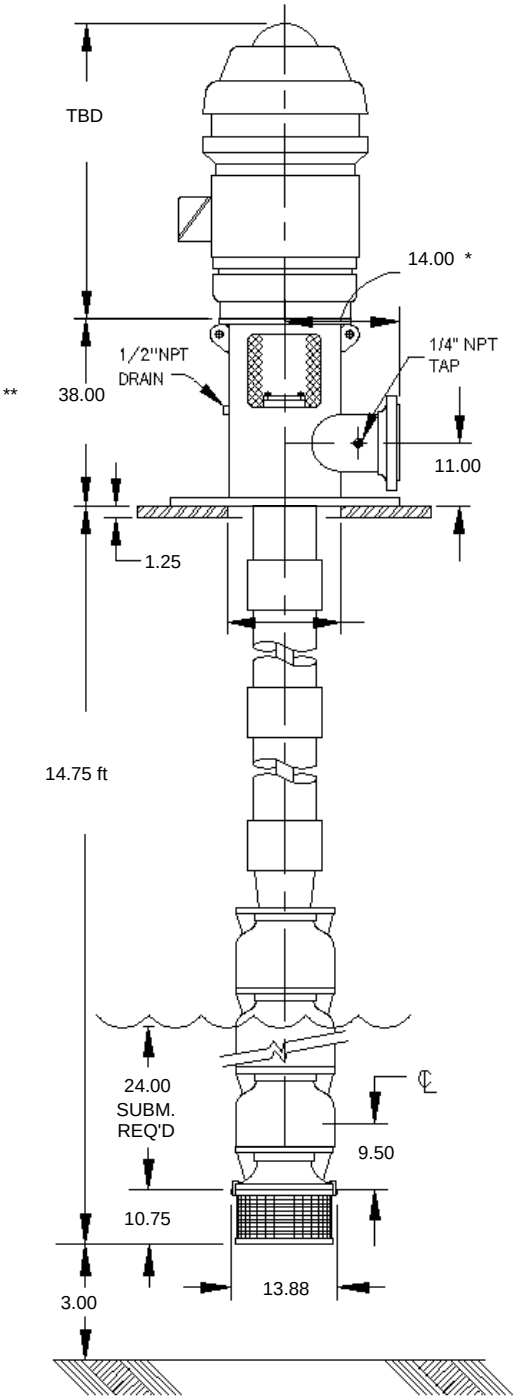
Customer	: Kennedy Jenks	Pump Type	: 14DOL	Quote number	: 480863
Address	: , Sacramento, CA	# of Stages	: 5	Customer PO #	:
Location	:	Quantity	: 3	CO #	:
Project	: Rancho Murieta	Flow	: 1,480.0 USgpm	Item #	: 010
Tag	:	Head	: 330.0 ft	JOL #	:
Bowl/Pump	:	Speed	: 1770 rpm	Serial #	:
Eff (bowl / pump)	: 86.46 / 85.38 %	Fluid Density	: 1.000 / 1.000 SG	Drawing #	:
Power (bowl / pump)	: 143 / 144 hp	Viscosity	: 1.00 cP	Drawn By	:
NPSH required	: 13.58 ft	Impeller Trim	: 8.72 in	Last Modified	: 01 Dec 2016 11:10 AM

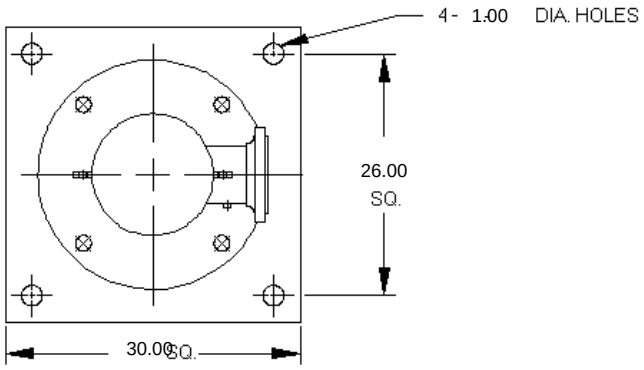
The head and power may be different than that shown in accordance with Hydraulic Institute / API 610 Standards

Additional Notes:

VERTICAL TURBINE PUMP

1,480.0 USgpm 331.7 ft TDH
5 STAGE TYPE 14DOL
10x16.5F DISCHARGE HEAD





Discharge

10 in. 150#RF - ANSI Flange
16 in. Dia. Flange
12 - 1 in. Dia. holes
14.25 in. Bolt circle

* TYPICAL LOCATION FOR DISCHARGE NOZZLE

** FINAL HEAD HEIGHT WILL BE DETERMINED BASED ON INTERNAL ANALYSIS AND SPECIFICATION REVIEW

NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED.

NOTES:
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
DRAWING NOT TO SCALE.

REV.	BY	DATE	DESCRIPTION

Customer: Kennedy Jenks
Customer Reference:
Item Number: 001
Curve Number: 14DOL 1770
Date: 01 Dec 2016

OUTLINE DRAWING

DRAWING

Item number	010	Size / Stages	14DOL / 5
Quote number	480863	Nominal pump speed	1770 rpm

Totals

Grand Total	$ 141,502

Pump

Qty	Description
3	*Units - 14DOL - 5 stage Product lube - Sump Pump*

Pump selection criteria

Speed operation: Variable speed operation

Lubrication type

Lubrication type: Product lube

Bowl Assembly - 5 Stage

Bowl size: 14DOL bowl assembly - 5 stage
Bowl Materials: Cast iron (ASTM A48 cl 30-enamel lined)
Bowl connection type: Flanged
Bowl Bolting Material: 304SS (ASTM F593 Gr CW1), Floway material code - 106
Bowl bearing material: Bismuth tin bronze bowl bearings (UNS C89835)
Impeller Material: Bronze (ASTM B584 C90300)
Collet Material: Steel (ASTM A108-90a Gr 1215)
Bowl Shaft Size: 1.9375" (Standard)
Bowl Shaft Material: 416SS (ASTM A582-88a Type 416)
Suction type: Suction bell
Suction type bearing: Bismuth tin bronze (UNS C89835)
Suction Strainer: Clip on basket strainer 14DO
Suction Strainer Material
Strainer material - Galvanized steel
Bowl assembly type: Fully assembled

Column assembly - 1.5 x 10 in. - Threaded

Column

Column Size: Column 10" - (0- 20' and 0- 10' and 1- 5' and 1 - 2.58' Top)
Column pipe material: ASTM A53 Gr. B rolled and welded steel
Column pipe schedule: Floway standard .279" wall thickness
Column Connection Type: Threaded
Bearing Retainer material: Ductile iron (ASTM A536-84 Gr 60-40-18)

Lineshaft

Lineshaft Size: 1.5"
Lineshaft Material: 416SS (ASTM A582-88a Type 416)
Lineshaft Coupling Material: 416SS (ASTM A582-88a Type 416)
Line shaft bearing material: Styrene Butadiene Rubber(SBR) (Qty 1 per pump)

Discharge head assembly - 10x16.5 "F"

Discharge head material: Steel (A36 plt, A105 flg, A53-Gr B pipe)
Discharge Head Size: 10x16.5 "F"
Discharge size: 10"
Discharge Connection Type/Rating: 150# flange (Stl. std.)
Shaft sealing arrangement: Mechanical seal
Mechanical seal construction: Single unbalanced mechanical seal

Pump

Qty	Description
	Mechanical seal type: John Crane type 5611 mechanical seal
	Seal flush piping plan-Primary: Plan 13 Seal flush piping
	Seal flush piping material - primary seal: 316SS tubing-Primary SFP
	Top Line Shaft Straightness: Floway Standard
	Stuffing box / Seal housing bearing material: Bismuth tin bronze seal housing bearing (UNS C89835)
	Head shaft couplings: Type CPAT flanged adjustable spacer coupling
	Coupling guard material / construction: Aluminum
	Protective coatings
	Protective coating - Discharge head: Carboguard 891 epoxy coating - Disch. head - interior and exterior
	Protective coating - Column: Carboguard 891 epoxy coating - Column - interior and exterior
	Protective coating - Bowl assembly: Carboguard 891 epoxy coating - Bowls, exterior only
	Protective coating - Soleplate: Carboguard 891 epoxy coating - Soleplate top side only
	Miscellaneous coating options
	NSF certified
	Assembly type - Unit
	Assembly type - Unit: Factory assembled (bowl, head, and column only) shipped assembled
	Start-up/Overage
	Start-up options
	Start up by Distributor/Manufacturer's Rep.
	Packaging and Shipping
	Packaging options
	Domestic packaging

Testing

Qty	Description
3	**Testing and Inspection options**
	Performance / NPSH testing
	Factory performance test acceptance criteria for rated condition per: ANSI/HI 14.6 grade 1U (Floway standard)
	Performance test options
	Bowl assembly performance test - 3 units
	Performance test witnessing
	Non-witnessed
	Hydro testing
	Hydrotest - Discharge Head options: Non witnessed hydrotest - discharge head - 3 units
	Inspection and Analysis
	Analysis
	Seismic analysis of anchorage
	Structural natural frequency analysis (head/motor only), stamped by Floway P.E. - 1 units

Sole Plate

Qty	Description
3	**Discharge head assembly - 10x16.5 "F"**
	Soleplate type: Fabricated steel
	Soleplate size: 30"x30"x1.25"

Anchor Bolt

Qty	Description
3	**Discharge head assembly - 10x16.5 "F"**
	Soleplate anchor bolts with nuts: No soleplate anchor bolts

Driver

Qty	Description
3	**Driver**
	Electric motor driver
	Motor size selection: US 200HP 460v/3ph/60hz 1800 RPM WPI
	Motor efficiency type: Premium efficient
	Motor shaft
	Motor shaft type: Motor vertical solid shaft
	Reference head shaft diameter: For reference:1.5" Top line shaft diameter
	Motor thrust design
	High thrust
	Motor bearing life options: 1 yr. min. / 5 yr. average
	Motor enclosure: WPI
	Motor service factor: 1.15
	Starting method: Across the line starting
	Motor BD: Motor BD 16.5 in.
	Miscellaneous motor options
	Thermostats
	Inverter duty motor
	Non-reverse device: No non-reverse device on motor
	Motor testing options
	Motor complete test - unwitnessed
	Conduit box size: Standard conduit box
	Elevation: Motor suitable for elevation <= 3300'
	Ambient temperature: Motor suitable for ambient temperature <= 104 F (40 C)
	UL labeled motor: Not UL labeled
	Motor packaging options: Motor domestic packaging
	Driver design: NEMA
	Driver shipping options: Motor NOT to be shipped to Floway factory

Pump Performance Datasheet

Customer	: Kennedy Jenks	Quote number	: 480863
Customer reference	:	Size	: 11JKH
Item number	: 011	Stages	: 2
Service	: Lookout Hill BPS (860 GPM)	Based on curve number	: 11JKH 1770 Rev. 0
Quantity	: 2	Date last saved	: 06 Dec 2016 7:07 AM

Operating Conditions

Flow, rated	: 860.0 USgpm
Differential head / pressure, rated (requested)	: 140.0 ft
Differential head / pressure, rated (actual)	: 141.1 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Frequency	: 60 Hz

Performance

Speed, rated	: 1770 rpm
Impeller diameter, rated	: 8.31 in
Impeller diameter, maximum	: 8.31 in
Impeller diameter, minimum	: 7.20 in
Efficiency (bowl / pump)	: 82.84 / 81.47 %
NPSH required / margin required	: 9.84 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 2,285 / 8,978 US Units
MCSF	: 298.4 USgpm
Head, maximum, rated diameter	: 154.3 ft
Head rise to shutoff (bowl / pump)	: 9.00 / 10.18 %
Flow, best eff. point (bowl / pump)	: 939.7 / 921.6 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 91.52 / 93.31 %
Diameter ratio (rated / max)	: 100.00 %
Head ratio (rated dia / max dia)	: 99.22 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water - Potable
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Solids concentration, by weight	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.00 psi.a

Material

Material selected	: Cast Iron/Bronze

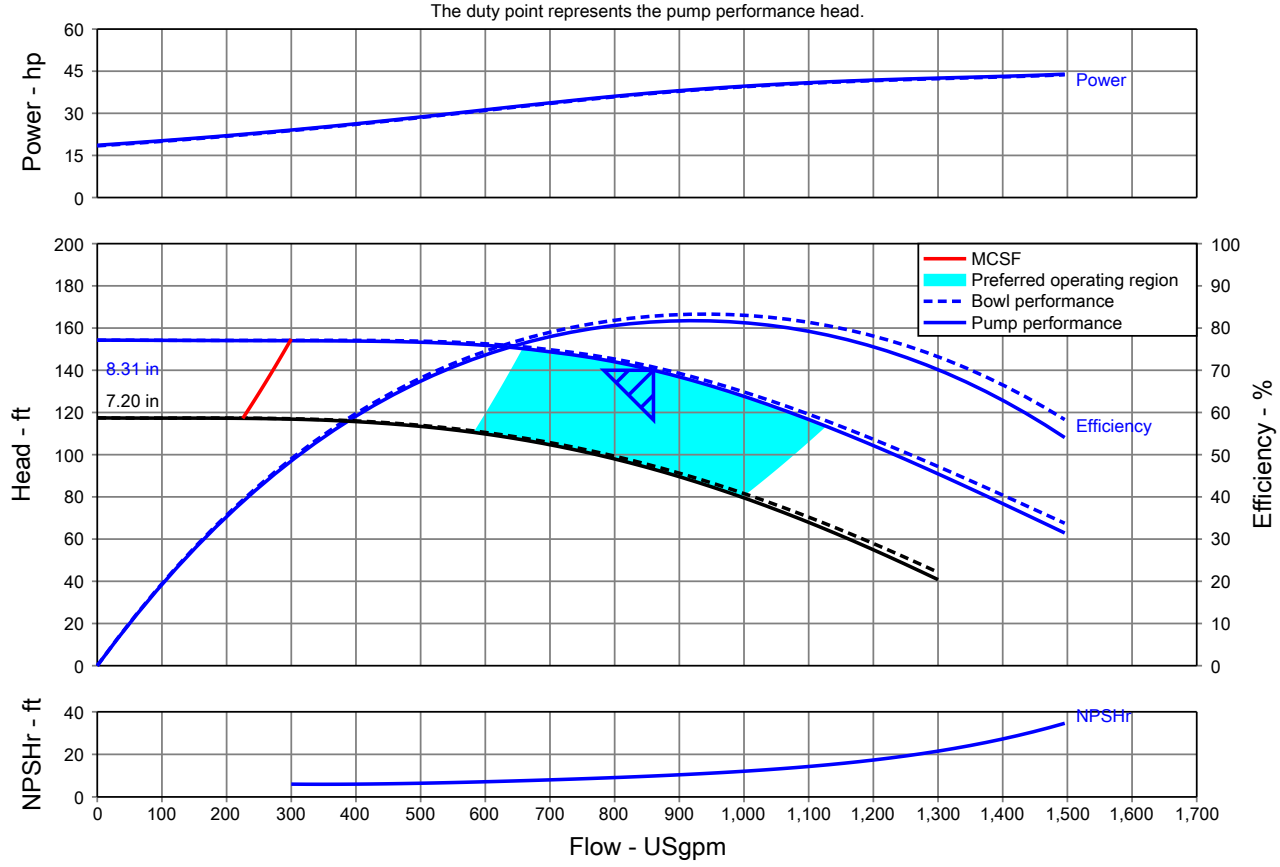
Pressure Data

Maximum working pressure	: See the Additional Data page
Component pressure limit	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data

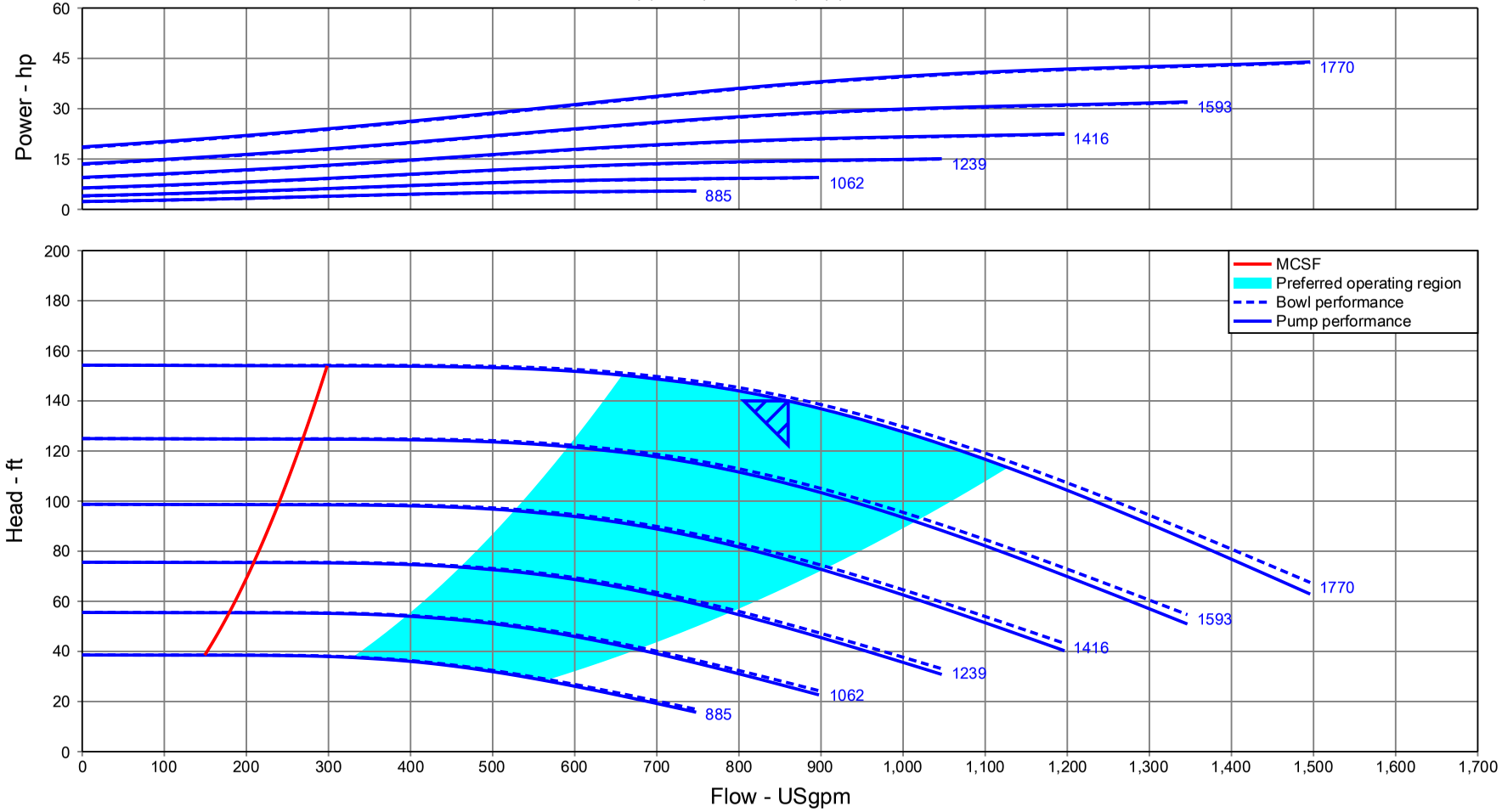
Driver sizing specification	: Max power + 4%
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 30.74 hp
Power (bowl / pump)	: 37.10 / 37.32 hp
Power, maximum, rated diameter	: 43.94 hp
Minimum recommended motor rating	: 50.00 hp / 37.29 kW

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



Multi-Speed Performance Curve

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



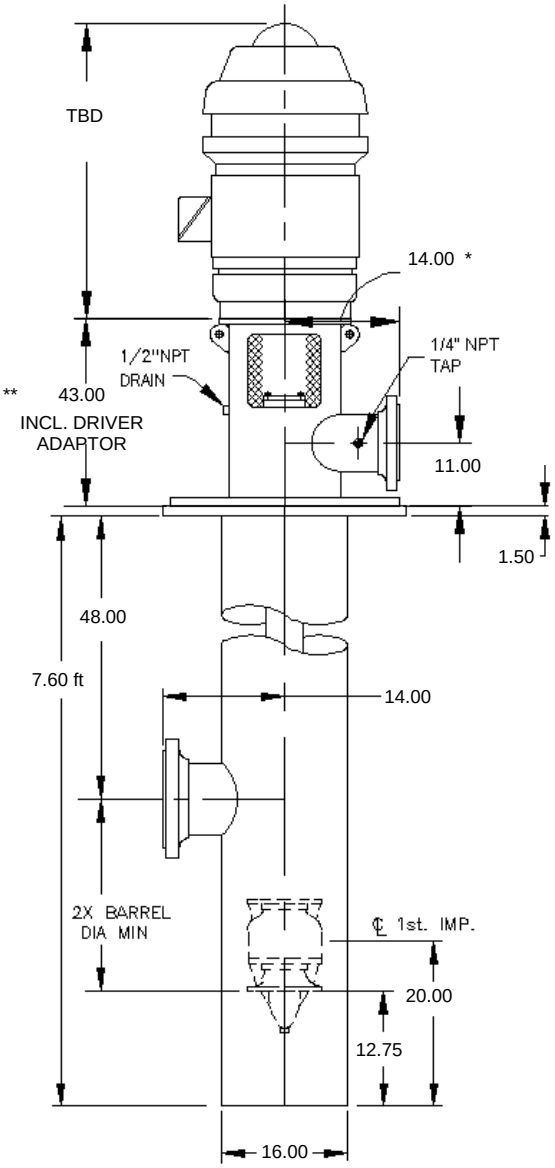
Customer	: Kennedy Jenks	Pump Type	: 11JKH	Quote number	: 480863
Address	: , Sacramento, CA	# of Stages	: 2	Customer PO #	:
Location	:	Quantity	: 2	CO #	:
Project	: Rancho Murieta	Flow	: 860.0 USgpm	Item #	: 011
Tag	:	Head	: 140.0 ft	JOL #	:
Bowl/Pump	:	Speed	: 1770 rpm	Serial #	:
Eff (bowl / pump)	: 82.84 / 81.47 %	Fluid Density	: 1.000 / 1.000 SG	Drawing #	:
Power (bowl / pump)	: 37.10 / 37.32 hp	Viscosity	: 1.00 cP	Drawn By	:
NPSH required	: 9.84 ft	Impeller Trim	: 8.31 in	Last Modified	: 06 Dec 2016 7:07 AM

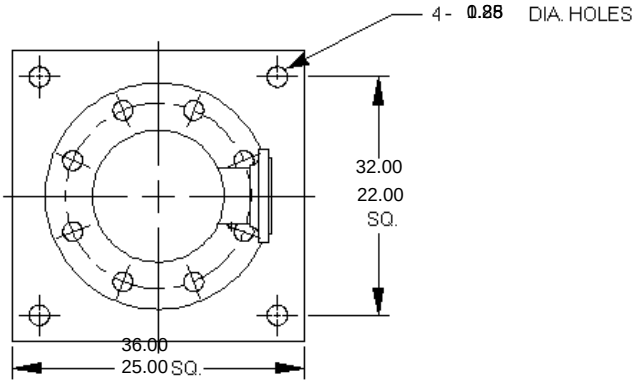
The head and power may be different than that shown in accordance with Hydraulic Institute / API 610 Standards

Additional Notes:

VERTICAL TURBINE PUMP

860.0 USgpm 141.5 ft TDH
2 STAGE TYPE 11JKH
10x16.5x16VF DISCHARGE HEAD





Discharge	Suction
10 in. 150#RF - ANSI Flange	10 in. 150#RF - ANSI Flange
16 in. Dia. Flange	16 in. Dia. Flange
12 - 1 in. Dia. holes	12 - .75 in. Dia. holes
14.25 in. Bolt circle	14.25 in. Bolt circle

* TYPICAL LOCATION FOR DISCHARGE NOZZLE

** FINAL HEAD HEIGHT WILL BE DETERMINED BASED ON INTERNAL ANALYSIS AND SPECIFICATION REVIEW

NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED.

NOTES:
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
DRAWING NOT TO SCALE.

REV.	BY	DATE	DESCRIPTION

Customer: Kennedy Jenks
Customer Reference:
Item Number: 011
Curve Number: 11JKH 1770
Date: 06 Dec 2016

OUTLINE DRAWING

DRAWING

Item number	011	Size / Stages	11JKH / 2
Quote number	480863	Nominal pump speed	1770 rpm

Totals

Grand Total	$ 66,004

Pump

Qty	Description
2	*Units - 11JKH - 2 stage Product lube - Barrel Pump*

Pump selection criteria

Speed operation: Variable speed operation

Lubrication type

Lubrication type: Product lube

Bowl Assembly - 2 Stage

Bowl size: 11JKH bowl assembly - 2 stage
Bowl Materials: Cast iron (ASTM A48 cl 30-enamel lined)
Bowl connection type: Flanged
Bowl Bolting Material: 304SS (ASTM F593 Gr CW1), Floway material code - 106
Bowl bearing material: Bismuth tin bronze bowl bearings (UNS C89835)
Impeller Material: Bronze (ASTM B584 C90300)
Collet Material: Steel (ASTM A108-90a Gr 1215)
Bowl Shaft Size: 1.6875" (Standard)
Bowl Shaft Material: 416SS (ASTM A582-88a Type 416)
Suction type: Suction bell
Suction type bearing: Bismuth tin bronze (UNS C89835)
Suction Strainer: Clip on basket strainer 11JK
Suction Strainer Material
Strainer material - Galvanized steel
Bowl assembly type: Fully assembled

Column assembly - 1 x 8 in. - Threaded

Column

Column Size: Column 8" - (0- 20' and 0- 10' and 0- 5' and 1 - 3.48' Top)
Column pipe material: ASTM A53 Gr. B rolled and welded steel
Column pipe schedule: Schedule 30 .277" wall thickness
Column Connection Type: Threaded

Lineshaft

Lineshaft Size: 1"
Lineshaft Material: 416SS (ASTM A582-88a Type 416)
Lineshaft Coupling Material: 416SS (ASTM A582-88a Type 416)
Line shaft bearing material: Styrene Butadiene Rubber(SBR) (Qty 0 per pump)

Discharge head assembly - 10x16.5x16 "VF"

Discharge head material: Steel (A36 plt, A105 flg, A53-Gr B pipe)
Discharge Head Size: 10x16.5x16 "VF"
Discharge size: 10"
Discharge Connection Type/Rating: 150# flange (Stl. std.)
Shaft sealing arrangement: Mechanical seal
Mechanical seal construction: Single unbalanced mechanical seal
Mechanical seal type: John Crane type 5611 mechanical seal

Pump

Qty	Description
	Seal flush piping plan-Primary: Plan 13 Seal flush piping
	Seal flush piping material - primary seal: 316SS tubing-Primary SFP
	Top Line Shaft Straightness: Floway Standard
	Stuffing box / Seal housing bearing material: Bismuth tin bronze seal housing bearing (UNS C89835)
	Head shaft couplings: Type CPAT flanged adjustable spacer coupling
	Coupling guard material / construction: Aluminum
	Protective coatings
	Protective coating - Discharge head: Carboguard 891 epoxy coating - Disch. head - interior and exterior
	Protective coating - Column: Carboguard 891 epoxy coating - Column - interior and exterior
	Protective coating - Bowl assembly: Carboguard 891 epoxy coating - Bowls, exterior only
	Protective coating - Barrel: Carboguard 891 epoxy coating - Barrel - interior only (exterior Carboline 635 primer)
	Protective coating - Soleplate: Carboguard 891 epoxy coating - Soleplate top side only
	Miscellaneous coating options
	NSF certified
	Assembly type - Unit
	Assembly type - Unit: Factory assembled (bowl, head, and column only) shipped assembled
	Start-up/Overage
	Start-up options
	Start up by Distributor/Manufacturer's Rep.
	Packaging and Shipping
	Packaging options
	Domestic packaging

Testing

Qty	Description
2	**Testing and Inspection options**
	Performance / NPSH testing
	Factory performance test acceptance criteria for rated condition per: ANSI/HI 14.6 grade 1U (Floway standard)
	Performance test options
	Bowl assembly performance test - 2 units
	Performance test witnessing
	Non-witnessed
	Hydro testing
	Hydrotest - Discharge Head options: Non witnessed hydrotest - discharge head - 2 units
	Hydrotest - Suction barrel options: Non witnessed hydrotest - suction barrel - 2 units
	Inspection and Analysis
	Analysis
	Seismic analysis of anchorage
	Structural natural frequency analysis (head/motor only), stamped by Floway P.E. - 1 units

Sole Plate

Qty	Description
2	**Discharge head assembly - 10x16.5x16 "VF"**
	Soleplate type: Fabricated steel
	Soleplate size: 36"x36"x1.25"

Anchor Bolt

Qty	Description
2	**Discharge head assembly - 10x16.5x16 "VF"**
	Soleplate anchor bolts with nuts: No soleplate anchor bolts

Barrel

Qty	Description
2	**Suction barrel 16 in. x 7.6 ft.**
	Suction barrel: Standard pressure suction barrel
	Barrel diameter: 16" diameter suction barrel x 7.6 ft.
	Barrel material: Steel barrel - ASTM A53 pipe A240 plate
	Barrel suction nozzle: 10" suction nozzle and flange on barrel
	Barrel suction flange rating: 150# suction flange

Driver

Qty	Description
2	**Driver**
	Electric motor driver
	Motor size selection: US 50HP 460v/3ph/60hz 1800 RPM WPI
	Motor efficiency type: Premium efficient
	Motor shaft
	Motor shaft type: Motor vertical solid shaft
	Reference head shaft diameter: For reference:1" Top line shaft diameter
	Motor thrust design
	High thrust
	Motor bearing life options: 1 yr. min. / 5 yr. average
	Motor enclosure: WPI
	Motor service factor: 1.15
	Starting method: Across the line starting
	Motor BD: Motor BD 12 in.
	Miscellaneous motor options
	Thermostats
	Inverter duty motor
	Non-reverse device: No non-reverse device on motor
	Motor testing options
	Motor complete test - unwitnessed
	Conduit box size: Standard conduit box
	Elevation: Motor suitable for elevation <= 3300'
	Ambient temperature: Motor suitable for ambient temperature <= 104 F (40 C)
	UL labeled motor: Not UL labeled
	Motor packaging options: Motor domestic packaging
	Driver design: NEMA
	Driver shipping options: Motor NOT to be shipped to Floway factory

Pump Performance Datasheet

Customer	: Kennedy Jenks	Quote number	: 480863
Customer reference	:	Size	: 12JKH
Item number	: 012	Stages	: 2
Service	: Bass Lake BPS (1200 GPM)	Based on curve number	: 12JKH 1770 Rev. 0
Quantity	: 2	Date last saved	: 06 Dec 2016 7:36 AM

Operating Conditions

Flow, rated	: 1,200.0 USgpm
Differential head / pressure, rated (requested)	: 120.0 ft
Differential head / pressure, rated (actual)	: 121.2 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Frequency	: 60 Hz

Performance

Speed, rated	: 1770 rpm
Impeller diameter, rated	: 8.28 in
Impeller diameter, maximum	: 9.06 in
Impeller diameter, minimum	: 7.69 in
Efficiency (bowl / pump)	: 82.49 / 80.90 %
NPSH required / margin required	: 10.64 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 2,348 / 10,219 US Units
MCSF	: 324.3 USgpm
Head, maximum, rated diameter	: 154.1 ft
Head rise to shutoff (bowl / pump)	: 25.88 / 27.74 %
Flow, best eff. point (bowl / pump)	: 1,101.5 / 1,075.2 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 108.94 / 111.61 %
Diameter ratio (rated / max)	: 91.44 %
Head ratio (rated dia / max dia)	: 75.44 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water - Potable
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Solids concentration, by weight	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.00 psi.a

Material

Material selected	: Cast Iron/Bronze

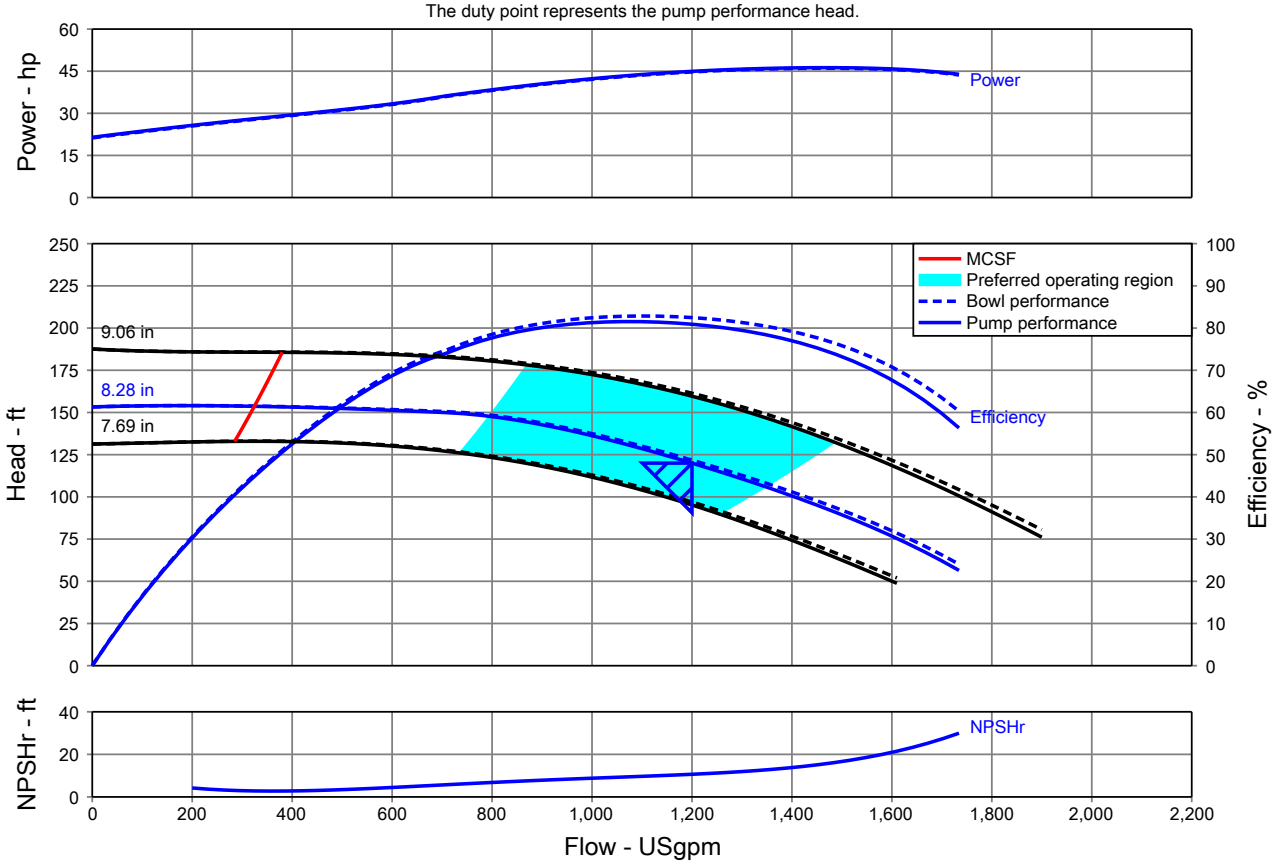
Pressure Data

Maximum working pressure	: See the Additional Data page
Component pressure limit	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data

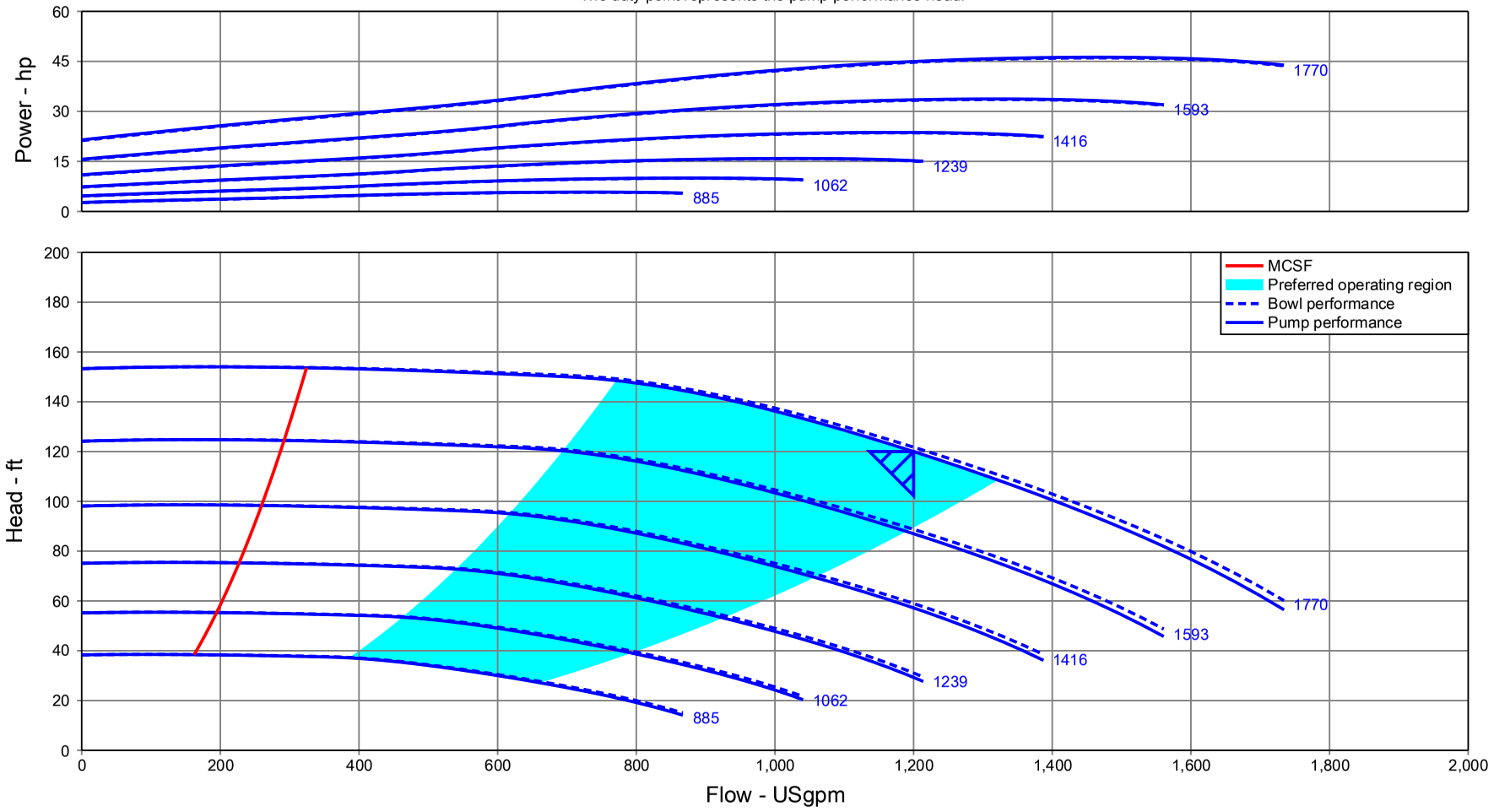
Driver sizing specification	: Max power + 4%
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 36.90 hp
Power (bowl / pump)	: 44.73 / 44.95 hp
Power, maximum, rated diameter	: 46.26 hp
Minimum recommended motor rating	: 50.00 hp / 37.29 kW

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



Multi-Speed Performance Curve

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



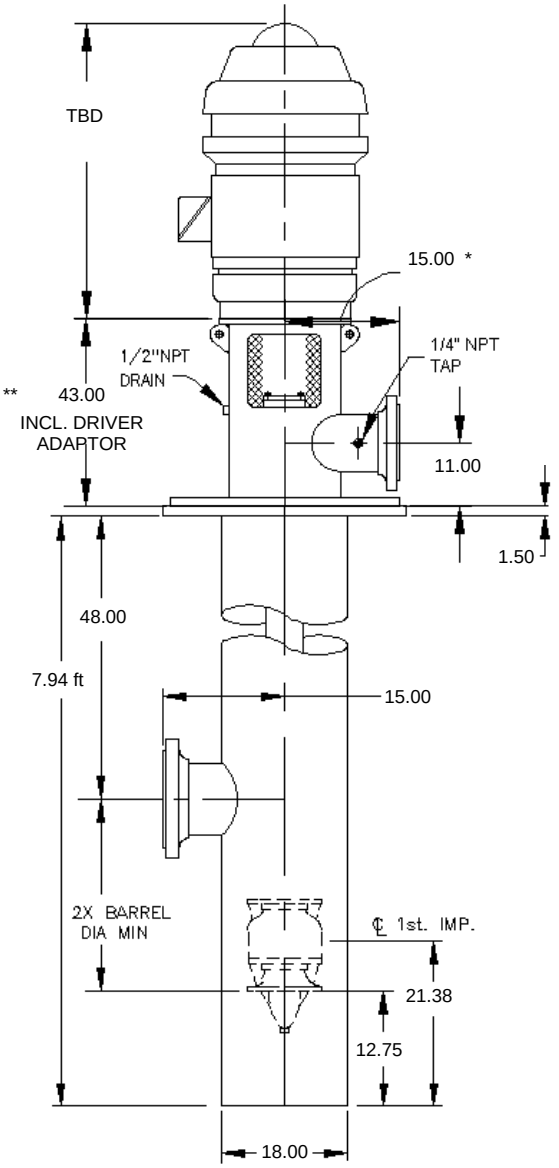
Customer	: Kennedy Jenks	Pump Type	: 12JKH	Quote number	: 480863
Address	: , Sacramento, CA	# of Stages	: 2	Customer PO #	:
Location	:	Quantity	: 2	CO #	:
Project	: Rancho Murieta	Flow	: 1,200.0 USgpm	Item #	: 012
Tag	:	Head	: 120.0 ft	JOL #	:
Bowl/Pump	:	Speed	: 1770 rpm	Serial #	:
Eff (bowl / pump)	: 82.49 / 80.90 %	Fluid Density	: 1.000 / 1.000 SG	Drawing #	:
Power (bowl / pump)	: 44.73 / 44.95 hp	Viscosity	: 1.00 cP	Drawn By	:
NPSH required	: 10.64 ft	Impeller Trim	: 8.28 in	Last Modified	: 06 Dec 2016 7:36 AM

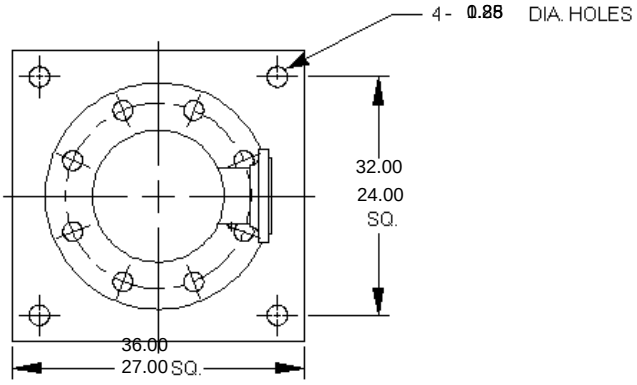
The head and power may be different than that shown in accordance with Hydraulic Institute / API 610 Standards

Additional Notes:

VERTICAL TURBINE PUMP

1,200.0 USgpm 121.8 ft TDH
2 STAGE TYPE 12JKH
10x16.5x18VF DISCHARGE HEAD





Discharge	Suction
10 in. 150#RF - ANSI Flange	12 in. 150#RF - ANSI Flange
16 in. Dia. Flange	19 in. Dia. Flange
12 - 1 in. Dia. holes	12 - .75 in. Dia. holes
14.25 in. Bolt circle	17 in. Bolt circle

* TYPICAL LOCATION FOR DISCHARGE NOZZLE

** FINAL HEAD HEIGHT WILL BE DETERMINED BASED ON INTERNAL ANALYSIS AND SPECIFICATION REVIEW

NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED.

NOTES:
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
DRAWING NOT TO SCALE.

REV.	BY	DATE	DESCRIPTION

Customer: Kennedy Jenks
Customer Reference:
Item Number: 012
Curve Number: 12JKH 1770
Date: 06 Dec 2016

OUTLINE DRAWING

DRAWING

Item number	012	Size / Stages	12JKH / 2
Quote number	480863	Nominal pump speed	1770 rpm

Totals

Grand Total	$ 68,741

Pump

Qty	Description
2	*Units - 12JKH - 2 stage Product lube - Barrel Pump*

Pump selection criteria

Speed operation: Variable speed operation

Lubrication type

Lubrication type: Product lube

Bowl Assembly - 2 Stage

Bowl size: 12JKH bowl assembly - 2 stage
Bowl Materials: Cast iron (ASTM A48 cl 30-enamel lined)
Bowl connection type: Flanged
Bowl Bolting Material: 304SS (ASTM F593 Gr CW1), Floway material code - 106
Bowl bearing material: Bismuth tin bronze bowl bearings (UNS C89835)
Impeller Material: Bronze (ASTM B584 C90300)
Collet Material: Steel (ASTM A108-90a Gr 1215)
Bowl Shaft Size: 1.6875" (Standard)
Bowl Shaft Material: 416SS (ASTM A582-88a Type 416)
Suction type: Suction bell
Suction type bearing: Bismuth tin bronze (UNS C89835)
Suction Strainer: Clip on basket strainer 12JK
Suction Strainer Material
Strainer material - Galvanized steel
Bowl assembly type: Fully assembled

Column assembly - 1 x 8 in. - Threaded

Column

Column Size: Column 8" - (0- 20' and 0- 10' and 0- 5' and 1 - 3.85' Top)
Column pipe material: ASTM A53 Gr. B rolled and welded steel
Column pipe schedule: Schedule 30 .277" wall thickness
Column Connection Type: Threaded

Lineshaft

Lineshaft Size: 1"
Lineshaft Material: 416SS (ASTM A582-88a Type 416)
Lineshaft Coupling Material: 416SS (ASTM A582-88a Type 416)
Line shaft bearing material: Styrene Butadiene Rubber(SBR) (Qty 0 per pump)

Discharge head assembly - 10x16.5x18 "VF"

Discharge head material: Steel (A36 plt, A105 flg, A53-Gr B pipe)
Discharge Head Size: 10x16.5x18 "VF"
Discharge size: 10"
Discharge Connection Type/Rating: 150# flange (Stl. std.)
Shaft sealing arrangement: Mechanical seal
Mechanical seal construction: Single unbalanced mechanical seal
Mechanical seal type: John Crane type 5611 mechanical seal

Pump

Qty	Description
	Seal flush piping plan-Primary: Plan 13 Seal flush piping
	Seal flush piping material - primary seal: 316SS tubing-Primary SFP
	Top Line Shaft Straightness: Floway Standard
	Stuffing box / Seal housing bearing material: Bismuth tin bronze seal housing bearing (UNS C89835)
	Head shaft couplings: Type CPAT flanged adjustable spacer coupling
	Coupling guard material / construction: Aluminum
	Protective coatings
	Protective coating - Discharge head: Carboguard 891 epoxy coating - Disch. head - interior and exterior
	Protective coating - Column: Carboguard 891 epoxy coating - Column - interior and exterior
	Protective coating - Bowl assembly: Carboguard 891 epoxy coating - Bowls, exterior only
	Protective coating - Barrel: Carboguard 891 epoxy coating - Barrel - interior only (exterior Carboline 635 primer)
	Protective coating - Soleplate: Carboguard 891 epoxy coating - Soleplate top side only
	Miscellaneous coating options
	NSF certified
	Assembly type - Unit
	Assembly type - Unit: Factory assembled (bowl, head, and column only) shipped assembled
	Start-up/Overage
	Start-up options
	Start up by Distributor/Manufacturer's Rep.
	Packaging and Shipping
	Packaging options
	Domestic packaging

Testing

Qty	Description
2	**Testing and Inspection options**
	Performance / NPSH testing
	Factory performance test acceptance criteria for rated condition per: ANSI/HI 14.6 grade 1U (Floway standard)
	Performance test options
	Bowl assembly performance test - 2 units
	Performance test witnessing
	Non-witnessed
	Hydro testing
	Hydrotest - Discharge Head options: Non witnessed hydrotest - discharge head - 2 units
	Hydrotest - Suction barrel options: Non witnessed hydrotest - suction barrel - 2 units
	Inspection and Analysis
	Analysis
	Seismic analysis of anchorage
	Structural natural frequency analysis (head/motor only), stamped by Floway P.E. - 1 units

Sole Plate

Qty	Description
2	**Discharge head assembly - 10x16.5x18 "VF"**
	Soleplate type: Fabricated steel
	Soleplate size: 36"x36"x1.25"

Anchor Bolt

Qty	Description
2	**Discharge head assembly - 10x16.5x18 "VF"**
	Soleplate anchor bolts with nuts: No soleplate anchor bolts

Barrel

Qty	Description
2	**Suction barrel 18 in. x 7.94 ft.**
	Suction barrel: Standard pressure suction barrel
	Barrel diameter: 18" diameter suction barrel x 7.94 ft.
	Barrel material: Steel barrel - ASTM A53 pipe A240 plate
	Barrel suction nozzle: 12" suction nozzle and flange on barrel
	Barrel suction flange rating: 150# suction flange

Driver

Qty	Description
2	**Driver**
	Electric motor driver
	Motor size selection: US 50HP 460v/3ph/60hz 1800 RPM WPI
	Motor efficiency type: Premium efficient
	Motor shaft
	Motor shaft type: Motor vertical solid shaft
	Reference head shaft diameter: For reference:1" Top line shaft diameter
	Motor thrust design
	High thrust
	Motor bearing life options: 1 yr. min. / 5 yr. average
	Motor enclosure: WPI
	Motor service factor: 1.15
	Starting method: Across the line starting
	Motor BD: Motor BD 12 in.
	Miscellaneous motor options
	Thermostats
	Inverter duty motor
	Non-reverse device: No non-reverse device on motor
	Motor testing options
	Motor complete test - unwitnessed
	Conduit box size: Standard conduit box
	Elevation: Motor suitable for elevation <= 3300'
	Ambient temperature: Motor suitable for ambient temperature <= 104 F (40 C)
	UL labeled motor: Not UL labeled
	Motor packaging options: Motor domestic packaging
	Driver design: NEMA
	Driver shipping options: Motor NOT to be shipped to Floway factory

RMCC RECLAIMED/RAIN/RIVER WATER used FOR GOLF COURSE IRRIGATION														
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL	AC Feet
2004	0	0	0	0	0	0	0	32,271,664	24,124,682	12,042,621	0	0	68,438,967	210.0
2005	0	0	0	0	16,630,838	26,814,512	36,402,337	34,133,912	22,205,988	8,775,311	0	0	144,962,898	444.9
2006	0	0	0	0	6,766,725	33,466,274	34,890,191	29,922,670	25,027,177	4,124,965	251,454	0	134,449,456	412.6
2007	0	0	8,028,234	12,384,053	25,061,082	35,457,957	34,901,154	31,926,322	20,635,416	8,307,235	5,527,905	677,308	182,906,666	561.4
2008	1,659,642	3,416,483	7,124,928	18,287,541	29,461,199	34,964,198	33,603,413	31,014,257	24,379,703	9,898,221	558,332	0	194,367,917	596.5
2009	52,784	0	2,975,658	16,717,552	22,729,582	32,833,243	46,776,756	43,909,242	28,182,762	11,666,411	3,933,034	262,164	210,039,188	644.6
2010	597,420	531,726	519,342	1,149,164	12,408,766	37,970,917	46,140,605	40,058,609	27,082,893	11,123,674	3,537,359	175,506	181,295,981	556.4
2011	872,560	713,619	1,313,020	8,984,949	18,274,385	27,470,149	46,391,726	40,394,603	29,335,909	9,066,660	597,141	995,453	183,414,721	562.9
2012	878,154	2,778,006	1,196,596	7,361,960	32,770,815	45,143,654	47,147,006	42,805,041	28,569,713	12,850,329	492,614	15,155	221,993,888	681.3
2013	106,349	1,341,286	8,606,675	18,332,384	35,468,226	41,821,801	48,030,013	43,806,357	22,120,481	20,445,260	5,670,447	156,796	245,749,279	754.2
2014	3,376,895	770,891	5,676,877	15,768,648	32,126,458	43,082,072	45,349,608	44,684,082	26,637,494	12,584,964	757,116	148,932	230,815,105	708.4
2015	328,082	431,985	7,101,232	16,684,761	26,270,887	42,472,558	45,059,817	39,039,324	28,975,721	13,805,881	256,034	33,022	220,426,282	676.5
2016	13,823	0	0	0	0	0	0	0	0	0	0	0	13,823	0.0

From Master Wastewater Data Spreadsheet

Irrigation Season	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Total
2004-2005	0	32,271,664	24,124,682	12,042,621	0	0	0	0	0	0	16,630,838	26,814,512	111,884,317
2005-2006	36,402,337	34,133,912	22,205,988	8,775,311	0	0	0	0	0	0	6,766,725	33,466,274	141,750,547
2006-2007	34,890,191	29,922,670	25,027,177	4,124,965	251,454	0	0	0	8,028,234	12,384,053	25,061,082	35,457,957	175,147,783
2007-2008	34,901,154	31,926,322	20,635,416	8,307,235	5,527,905	677,308	1,659,642	3,416,483	7,124,928	18,287,541	29,461,199	34,964,198	196,889,331
2008-2009	33,603,413	31,014,257	24,379,703	9,898,221	558,332	0	52,784	0	2,975,658	16,717,552	22,729,582	32,833,243	174,762,745
2009-2010	46,776,756	43,909,242	28,182,762	11,666,411	3,933,034	262,164	597,420	531,726	519,342	1,149,164	12,408,766	37,970,917	187,907,704
2010-2011	46,140,605	40,058,609	27,082,893	11,123,674	3,537,359	175,506	872,560	713,619	1,313,020	8,984,949	18,274,385	27,470,149	185,747,328
2011-2012	46,391,726	40,394,603	29,335,909	9,066,660	597,141	995,453	878,154	2,778,006	1,196,596	7,361,960	32,770,815	45,143,654	216,910,677
2012-2013	47,147,006	42,805,041	28,569,713	12,850,329	492,614	15,155	106,349	1,341,286	8,606,675	18,332,384	35,468,226	41,821,801	237,556,579
2013-2014	48,030,013	43,806,357	22,120,481	20,445,260	5,670,447	156,796	3,376,895	770,891	5,676,877	15,768,648	32,126,458	43,082,072	241,031,195
2014-2015	45,349,608	44,684,082	26,637,494	12,584,964	757,116	148,932	328,082	431,985	7,101,232	16,684,761	26,270,887	42,472,558	223,451,701
2015-2016	45,059,817	39,039,324	28,975,721	13,805,881	256,034	33,022	13,823						
Average	42,829,029	38,756,051	26,094,727	11,387,360	2,158,144	246,434	788,571	1,109,333	4,726,951	12,852,335	26,063,489	37,912,950	

AF/Month

Irrigation Season	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Total
2004-2005	0	99	74	37	0	0	0	0	0	0	51	82	343
2005-2006	112	105	68	27	0	0	0	0	0	0	21	103	435
2006-2007	107	92	77	13	1	0	0	0	25	38	77	109	538
2007-2008	107	98	63	25	17	2	5	10	22	56	90	107	604
2008-2009	103	95	75	30	2	0	0	0	9	51	70	101	536
2009-2010	144	135	86	36	12	1	2	2	2	4	38	117	577
2010-2011	142	123	83	34	11	1	3	2	4	28	56	84	570
2011-2012	142	124	90	28	2	3	3	9	4	23	101	139	666
2012-2013	145	131	88	39	2	0	0	4	26	56	109	128	729
2013-2014	147	134	68	63	17	0	10	2	17	48	99	132	740
2014-2015	139	137	82	39	2	0	1	1	22	51	81	130	686
2015-2016	138	120	89	42	0.786	0.101	0.042						
Average	131	119	80	35	7	1	2	3	15	39	80	116	627

Irrigation Season	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Total
2004-2005	0	99	74	37	0	0	0	0	0	0	51	82	**343**
2005-2006	112	105	68	27	0	0	0	0	0	0	21	103	**435**
2006-2007	107	92	77	13	1	0	0	0	25	38	77	109	**538**
2007-2008	107	98	63	25	17	2	5	10	22	56	90	107	**604**
2008-2009	103	95	75	30	2	0	0	0	9	51	70	101	**536**
2009-2010	144	135	86	36	12	1	2	2	2	4	38	117	**577**
2010-2011	142	123	83	34	11	1	3	2	4	28	56	84	**570**
2011-2012	142	124	90	28	2	3	3	9	4	23	101	139	**666**
2012-2013	145	131	88	39	2	0	0	4	26	56	109	128	**729**
2013-2014	147	134	68	63	17	0	10	2	17	48	99	132	**740**
2014-2015	139	137	82	39	2	0	1	1	22	51	81	130	**686**
2015-2016	138	120	89	42	0.786	0.101	0.042						
Average of last 10 yr	130	120	80	35	5	0	0	5	15	40	80	115	**625**
Maximum	145	135	90	65	15	5	10	10	25	55	110	140	740
Minimum	105	90	65	15	0	0	0	0	0	5	40	85	**535**

AVERAGE

2006-2008	107	95	70	19	9	1	3	5	23	47	84	108	**571**
2008-2010	123	115	81	33	7	0	1	1	5	27	54	109	**557**
2010-2012	142	123	87	31	6	2	3	5	4	25	78	111	**618**
2012-2014	146	133	78	51	9	0	5	3	22	52	104	130	**734**
2014-2016	139	128	85	40	2	0	1	1	22	51	81	130	**686**
AVERAGE	130	120	80	35	5	0	0	5	15	40	80	120	**635**
Maximum	146	133	87	51	9	2	5	5	23	52	104	130	**734**
Minimum	107	95	70	19	2	0	1	1	4	25	54	108	**557**

SUM

2006-2008	214	190	140	38	18	2	5	10	47	94	167	216	**1,142**
2008-2010	247	230	161	66	14	1	2	2	11	55	108	217	**1,113**
2010-2012	284	247	173	62	13	4	5	11	8	50	157	223	**1,236**
2012-2014	292	266	156	102	19	1	11	6	44	105	207	261	**1,469**
2014-2016	277	257	171	81	3	1	1	1	22	51	81	130	**686**
AVERAGE	265	240	160	70	15	0	5	5	25	70	145	210	**1,130**
Maximum	292	266	173	102	19	4	11	11	47	105	207	261	**1,469**
Minimum	214	190	140	38	3	1	1	1	8	50	81	130	**686**

*Peak month is July according to the Averages outlined in blue

IrrigationSeason	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Total
PERCENTAGE													
2006-2008	18.76	16.62	12.27	3.34	1.55	0.18	0.45	0.92	4.07	8.24	14.66	18.93	
2008-2010	22.16	20.66	14.49	5.95	1.24	0.07	0.18	0.15	0.96	4.93	9.69	19.52	
2010-2012	22.98	19.98	14.01	5.01	1.03	0.29	0.43	0.87	0.62	4.06	12.68	18.03	
2012-2014	19.89	18.10	10.59	6.96	1.29	0.04	0.73	0.44	2.98	7.13	14.12	17.74	
2014-2016	40.46	37.47	24.89	11.81	0.45	0.08	0.15	0.19	3.18	7.47	11.76	19.01	
AVERAGE	24.85	22.57	15.25	6.61	1.11	0.13	0.39	0.51	2.36	6.36	12.58	18.65	
Maximum													
Minimum													

NUMBER OF CONNECTIONS TIMELINE

		Number of Connections		Development Timeline								Source
	Developments	Residential	Commercial	**2016**	**2018**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	
	Existing (Current)	2,502										
Phase 1	Infill	238			238	0.05						See AD Demand and Sources; 0.5 MGD allocation for infill
	Retreats North and East	62			62	0.01302						Draft Sewer Study May 6, 2016 & Preliminary Sewer Study May 31, 2016
	Retreats West	22			22	0.00462						Final Sewer Study, May 3, 2016
	Murieta Gardens	78	227		78	0.06416						Draft Sewer Study, May 15, 2016; Commercial connections based on 0.04774 MGD and 210 gpd/connection (Table 2)
	Phase 1 Alone	400				0.1318						
	Total (Phase 1)	2,902				0.4718						
	% Increase from Current	16%										
Phase 2												
	Village A	167				117	25	12	13			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village B	167				17	50	50	50			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village C	130				13	52	52	13			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village D	42				0	11	11	21			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village E	43				0	0	9	34			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village F	95				0	2	36	57			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village G	53				0	0	5	48			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Village H	122				0	12	31	79			Prelim Sewer Study, March 31, 2016, Section 5. Development Timeline per page 4 of RMCSD Water Supply Assessment TM
	Riverview	140				140						Title XVI Recycled Water Feasibility Study, June 2014. Page 2-5, Table 2-1
	Lakeview	99				99						Title XVI Recycled Water Feasibility Study, June 2014. Page 2-5, Table 2-2
	Apartments	170				119	26	12	14			Title XVI Recycled Water Feasibility Study, June 2014. Page 2-5, Table 2-3
	Residences of Murieta Hills	198				198						Preliminary Sewer Study, March 31, 2016, Section 5
	Industrial/Commercial/Residential	160				24	48	48	40			Title XVI Recycled Water Feasibility Study, June 2014. Page 2-5, Table 2-3
	Phase 2 Alone	1,586		2,502	400	727	225	265	369	0	0	
	Total (Phase 2)	4,488		2,502	2,902	3,629	3,854	4,119	4,488	4,488	4,488	
	% Increase from Current	79%										
			ADWF (MGD)	0.3400	0.4718	0.624346	0.671649	0.727233	0.80482	0.80482	0.80482	

RECYCLED WATER DEMAND TIMELINE

	RW Annual Demand (AFY)		Development Timeline 2016	2018	2020	2025	2030	2035	2040	2045	
North & South Golf Courses (Current)	550		550	550	550	550	550	550	550	550	
Infill	0			0	0	0	0	0	0	0	
North Main Gate Entrance (Phase 1)	2.8				2.8	2.8	2.8	2.8	2.8	2.8	
District Office	5.4				5.4	5.4	5.4	5.4	5.4	5.4	
Retreats (Phase 1)	15.1			15.1	15.1	15.1	15.1	15.1	15.1	15.1	
Murieta Gardens (Phase 1)	30.5			30.5	30.5	30.5	30.5	30.5	30.5	30.5	
Stonehouse Park (Phase 1)	36.2				36.2	36.2	36.2	36.2	36.2	36.2	
Escuela Park (Phase 1)	12.07				12.07	12.07	12.07	12.07	12.07	12.07	
Phase 1 Alone	**102.07**		550.00	595.60	652.07	652.07	652.07	652.07	652.07	652.07	
Total (Phase 1)	**652.07**										
Village A (Phase 2)	56.5				39.56107	8.477373	3.956107	4.521266			56.51582
Village B (Phase 2)	64.6				6.457333	19.372	19.372	19.372			64.57333
Village C (Phase 2)	49.6				4.963636	19.85455	19.85455	4.963636			49.63636
Village D (Phase 2)	0.00				0	0	0	0			0
Village E (Phase2)	0.00				0	0	0	0			0
Village F (Phase 2)	0.00				0	0	0	0			0
Village G (Phase 2)	0.00				0	0	0	0			0
Village H (Phase 2)	0.00				0	0	0	0			0
Riverview	0.00				0	0	0	0	0		0
Lakeview	0.00				0	0	0	0	0		0
Apartments (Phase 2)	23.8				16.66	3.57	1.666	1.904			23.8
Residences of Murieta Hills (Phase 2)	73.8				73.8	0	0.00	0.00	0	0	73.8
Industrial/Commercial/Residential (Phase 2)	50.9				7.64	15.27	15.27	12.73			50.9
Phase 2 Alone	**319.2**		0.0	0	149.077	66.54392	60.12	43.49	0	0	
Total (Phase 2)	**971.29**	**SUM**	550	595.60	801.14	718.61	712.19	695.55	652.07	652.07	
		COMPOUNDING SUM	550	595.60	801.14	867.69	927.81	971.29	971.29	971.29	

	2020	2025	2030	2035	2040	2045
Village A	70%	15%	7%	8%		
Village B	10%	30%	30%	30%		
Village C	10%	40%	40%	10%		
Village D	0%	25%	25%	50%		
Village E	0%	0%	20%	80%		
Village F	0%	2%	38%	60%		
Village G	0%	0%	10%	90%		
Village H	0%	10%	25%	65%		
Riverview	100%	0%	0%	0%	0%	0%
Lakeview	100%	0%	0%	0%	0%	0%
Apartments	70%	15%	7%	8%		
Residences of Murieta Hills	100%	0%	0%	0%	0%	0%
Industrial/Commercial/Residential	15%	30%	30%	25%		

Existing Wastewater Flow (ADWF MGD)	0.3400

WASTEWATER PRODUCTION TIMELINE

	Waswater Production (AFY)		Development Timeline 2016	2018	2020	2025	2030	2035	2040	2045
North & South Golf Courses (Current)	380.87		380.87	380.87	380.87	380.87	380.87	380.87	380.87	380.87
Infill	56.0			56.0	56.0	56.0	56.0	56.0	56.0	56.0
North Main Gate Entrance (Phase 1)	0.0				0.0	0.0	0.0	0.0	0.0	0.0
District Office	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Retreats (Phase 1)	19.8			19.8	19.8	19.8	19.8	19.8	19.8	19.8
Murieta Gardens (Phase 1)	71.9			71.9	71.9	71.9	71.9	71.9	71.9	71.9
Stonehouse Park (Phase 1)	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Escuela Park (Phase 1)	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Phase 1 Alone	**147.6**		380.87	528.51	528.51	528.51	528.51	528.51	528.51	528.51
Total (Phase 1)	**528.5**									
Village A (Phase 2)	39.3				27.50	5.89	2.75	3.14		
Village B (Phase 2)	39.3				3.93	11.79	11.79	11.79		
Village C (Phase 2)	30.6				3.06	12.23	12.23	3.06		
Village D (Phase 2)	9.9				0.00	2.47	2.47	4.94		
Village E (Phase 2)	10.1				0.00	0.00	2.02	8.09		
Village F (Phase 2)	22.3				0.00	0.45	8.49	13.41		
Village G (Phase 2)	12.5				0.00	0.00	1.25	11.22		
Village H (Phase 2)	28.7				0.00	2.87	7.18	18.66		
Riverview	32.9				32.93	0.00	0.00	0.00	0.00	
Lakeview	21.4				21.40	0.00	0.00	0.00	0.00	
Apartments (Phase 2)	23.3				16.30	3.49	1.63	1.86		
Residences of Murieta Hills (Phase 2)	46.6				46.58	0.00	0.00	0.00	0.00	0.00
Industrial/Commercial/Residential (Phase 2)	37.6				5.65	11.29	11.29	9.41		
Phase 2 Alone	**354.5**		0.0	0.00	157.35	50.48	61.10	85.58	0.00	0.00
Total (Phase 2)	**883.0**	**SUM**	380.87	528.51	685.86	578.99	589.61	614.09	528.51	528.51
		COMPOUNDING SUM	380.87	528.51	685.86	736.34	797.44	883.02	883.02	883.02

Table 1. Projected Average Annual Recyled Water Demands and Scenarios

Proposed Developments and Reuse Area	Projected RW Demand (AFY)	Scenarios (AFY)		
		1- WDR and RW Standards	2- Public Area Focus, Limited to Most Cost Effective	3-Scenario 2 Plus Riverview and Lakeview
North and Sourth Golf Courses (Current)	550	550	550	550
North Main Gate Entrance (Phase 1)	2.8	2.8	2.8	2.8
District Office (Phase 1)	5.4	5.4	5.4	5.4
Stonehouse Park (Phase 1)	36.2	36.2	36.2	36.2
Escuela Park (Phase 1)	12.1	12.1	12.1	12.1
Commercial Loop (TBD)			10	10
Retreats (Phase 1)	15.1	15.1	15.1	15.1
Murieta Gardens (Phase 1)	30.5	30.5	30.5	30.5
Village A (Phase 2)	56.5	56.5		
Village B (Phase 2)	64.6	64.6		
Village C (Phase 2)	49.6	49.6	49.6	49.6
Apartments (Phase 2)	23.8	23.8	23.8	23.8
Residences of Murieta Hills (Phase 2)	73.8	73.8	73.8	73.8
Industrial/Commercial/Residential (Phase 2)	50.9	50.9	50.9	50.9
Village D				
Village E				
Village F				
Village G				
Village H				
Riverview	*22.4*			22.4
Lakeview	*15.8*			15.8
Sum of Proposed Reuse Area Demands		971	860	898
Projected Recycled Water Production		883	883	883
Difference (Excess Recycled Water		-88	23	-15

Notes:

Developments with phase descriptions (i.e., Phase 1 and 2) reflect proposed reuse areas described in the District's Waste Discharge Requirements and Recycled Water Standards

ADWF and Developments Comparison

OLD - From Park and Common Area Irrigation Demands spreadsheet

Conditions	Source		Number of Connections	Wastewater Flow, (ADWF MGD)	Recycled Water Demand (AFY)				
Existing	District Engineer RFP		2500	0.37653	0				
Phase 1 - Connected Prior to 2020	Current Activities								
Murieta Gardens		305							
The Retreats		84							
Infill - 0.05 MGD ADWF		238							
Phase 2 - Per WSA	per Water Supply Assessment, Table 2-1								
	2016	**2018**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	
Village A			117	25	12	13			167
Village B			17	50	50	50			167
Village C			13	52	52	13			130
Village D			0	10	11	21			42
Village E			0	0	9	34			43
Village F			0	2	36	57			95
Village G			0	0	5	48			53
Village H			0	13	32	85			130
Industrial/Commercial/Residential			4	8	7	6			25
Residences of MH			0	0	20	79	79	20	198
Riverview			0	14	42	42	42		140
Lakeview			0	9	30	30	30		99
Apartments			119	25	12	14			170
		627	270	208	318	492	151	20	
	2500	3,127	3397	3605	3923	4415	4566	4586	
existing ADWF +									
Proposed Connection ADWF									
(compounded each 5 years)	0.37653	0.50825	0.56495	0.60863	0.67541	0.77873	0.81044	0.81464	

NEW

connections	2,502	2,902	3,629	3,854	4,119	4,488	4,488	4,488
ADWF	0.3400		0.6243	0.6716	0.7272	0.8048	0.8048	0.8048
Connections DIFFERENCE	-2		-231	-249	-195	-73	78	98
ADWF DIFFERENCE	0.03653		-0.05939	-0.06302	-0.05182	-0.02609	0.00562	0.00982

Projections to 2020

assumption 9.75%

year	connections
2016	2,502
2017	2,745.95
2018	3,013.67
2019	3,307.51
2020	3,629.99
differemce	1,128

Projections from 2020 to 2030

assumption 1.25%

year	connections
2020	3,629.00
2021	3,674.36
2022	3,720.29
2023	3,766.80
2024	3,813.88
2025	3,861.55
2026	3,909.82
2027	3,958.70
2028	4,008.18
2029	4,058.28
2030	4,109.01
differemce	480

Projections from 2030 to 2035

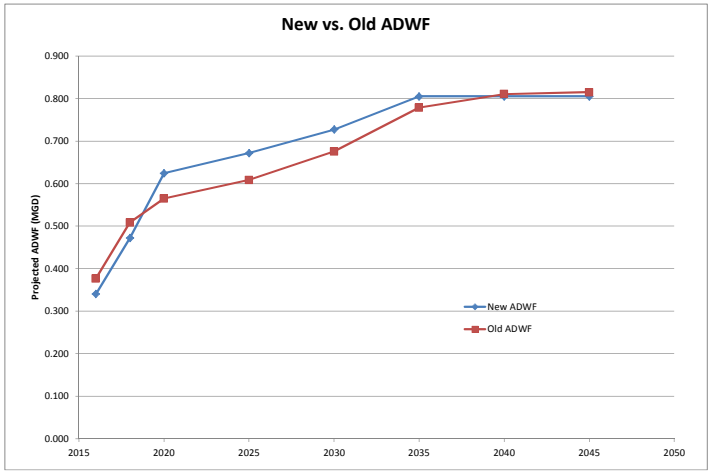
assupmtion 1.65%

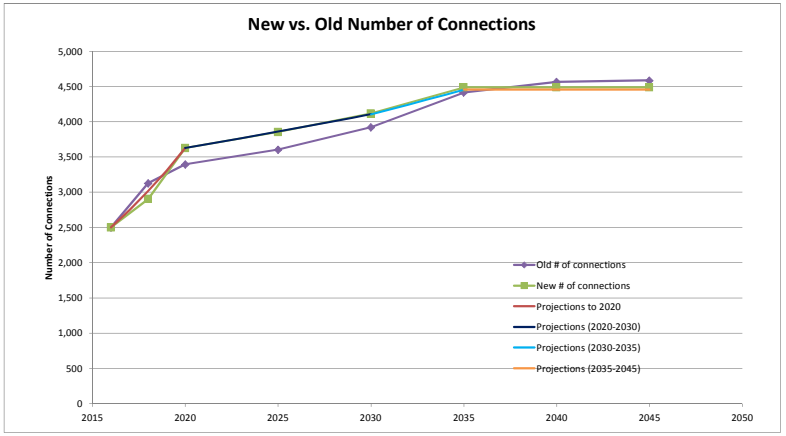
year	connections
2030	4,107.00
2031	4,174.77
2032	4,243.65
2033	4,313.67
2034	4,384.84
2035	4,457.19
differemce	350

Projections from 2035 to 2045

assumption 0.00%

year	connections
2035	4,458.00
2036	4,458.00
2037	4,458.00
2038	4,458.00
2039	4,458.00
2040	4,458.00
2041	4,458.00
2042	4,458.00
2043	4,458.00
2044	4,458.00
2045	4,458.00





		Recycled Water Demands		8-hr	9-hr
Phase 1	North	North Main Gate Entrance	9,428	37	33
Equalization Basin		District Office	9,120	19	17
	North	Retreats	63,360	132	117
	North	Murieta Gardens	101,280	211	188
	North	Stonehouse Park	120,480	251	223
	North	Escuela Park	120,480	251	223
	North	North Golf Course		2,104	1,871
	South	South Golf Course		1,915	1,703
			Phase 1 Demand	**4,920**	**4,375**
			Capacity	6,246	5,552
Phase 2					
	North	Village A	214,080	446	396
	North	Village C	165,120	344	306
	North	Village B	188,160	392	348
	North	Apartments	80,160	167	148
	North	Residences of Murieta Hills	248,640	518	460
	North	Industrial/Commercial/Residential	171,360	357	317
			Phase 2 Subtotal	**2,224**	**1,975**
			Phase 1 and 2 Total	7,144	6,350
			Capacity	6,246	5,552
			Difference (Supplemental Potable Water), gpm	898	798
			Difference (Supplemental Potable Water), gallons	431,258	430,718

RW Production Sources			
WWRP	2,082	2,082	
Potable Water Supplementation	896	796	
Subtotal	2,978	2,878	
Reduced GC Demand (assumed)	1000	1000	
	943	496	
	452,458	268,018	Phase 1
	3,167	2,471	Phase 2
	1,519,978	1,186,238	

RW Annual and Average Day RW Demands and Wastewater Production

		RW Annual Demand (AFY)	RW Average Day Demand (AF/day)	RW Average Day Demand (MGD)	Waswater Production (AFY)	Area (AC)
1	North & South Golf Courses (Current)	550	2.782	0.9065	381	
2	Infill	0			56	
3	North Main Gate Entrance (Phase 1)	2.8	0.014	0.0046	0	
4	District Office	5.4	0.027	0.0089	0	
5	Retreats (Phase 1)	15.1	0.076	0.0249	19.8	
6	Murieta Gardens (Phase 1)	30.5	0.154	0.0503	71.9	
7	Stonehouse Park (Phase 1)	36.2	0.183	0.0597	0	
8	Escuela Park (Phase 1)	12.07			0	
	Phase 1 Alone	**102**			**148**	
	Total (Phase 1)	**652**		**1.05**	**529**	
	% Increase from Current	19		16	39	
9	Village A (Phase 2)	56.5	0.286	0.0931	39.3	94.5
10	Village B (Phase 2)	64.6	0.327	0.1064	39.3	81.7
11	Village C (Phase 2)	49.6	0.251	0.0818	30.6	63.3
12	Village D (Phase 2)	0		0	9.9	107.6
13	Village E (Phase 2)	0		0	10.1	
14	Village F (Phase 2)	0		0	22.3	77.1
15	Village G(Phase 2)	0		0	12.5	182.3
16	Village H (Phase 2)	0		0	28.7	
17	Riverview	0	0.000	0	32.9	57.4
18	Lakeview	0	0.000	0	21.4	41.6
19	Apartments (Phase 2)	23.8	0.120	0.0392	23.3	17.8
20	Residences of Murieta Hills (Phase 2)	73.8	0.373	0.1216	46.6	168.7
21	Industrial/Commercial/Residential (Phase 2)	50.9	0.257	0.0839	37.6	39.5
	Phase 2 Alone	**319**			**355**	
	Total (Phase 2)	**971**		**1.58**	**883**	
	% Increase from Current	77		74	132	

Balance of Average Day Demands and Sources

	MGD
WWRP Capacity (Current)	2.3
WWRP Capacity (Phase 1)	3.0
Min. Supplemental Potable Water Requirements (AFY)	
Current	169
Phase 1	124
Phase 2	88
WWRP Capacity Difference after Phase 1	**1.95**
WWRP Capacity Difference after Phase 2	**1.42**

Notes

1 Current golf course demands and ADWF of 0.34 MGD as described in Retreats West Capacity Certification Letter
2 To be determined; 0.05 MGD ADWF allocation
3 RW Demand obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report
4 RW Demand obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report
5 Values obtained from latest K/J comments on Retreatas North and East Sewer Study (July 19, 2016) and Retreats West Capacity Certification Letter
6 Values obtained from May 15, 2016 Murieta Gardens I & II Sewer Study currently under review
7 Value obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report
8 RW obtained from Table 5; Escuela Park does not include any homes and occupies the entire site; wastewater production = 0

---

9 Recycled Water Demand derived from Table 5-1 of the Title XVI Recycled Water Feasibility Study and ratio of current (167) to previous (177) future number of residential homes. Wastewaster production based on 210 gpd/connection
10 Recycled Water Demand derived from Table 5-1 of the Title XVI Recycled Water Feasibility Study and ratio of current (167) to previous (120) future number of residential homes. Wastewaster production based on 210 gpd/connection
11 Recycled Water Demand derived from Table 5-1 of the Title XVI Recycled Water Feasibility Study and ratio of current (130) to previous (110) future number of residential homes. Wastewaster production based on 210 gpd/connection
12 N/A
13 N/A
14 N/A
15 N/A
16 N/A
17 RW Demand obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report. Wastewater production value obtained from Table 5
18 RW Demand obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report. Wastewater production value obtained from Table 5
19 Values obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report
20 Values obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report
21 Values obtained from Table 5 of the June 2016 Recycled Water Modeling Study Report

Maximum Month/Day Demands

	MGD	AF/Month		
North&South Golf Courses (Current)	1.852	172.9		
North Main Gate Entrance (Phase 1)	0.009	0.9		
District Office	0.018	1.7		
Retreats (Phase 1)	0.051	4.7		
Murieta Gardens (Phase 1)	0.103	9.6		
Stonehouse Park (Phase 1)	0.122	11.4		
Escuela Park (Phase 1)	0.041	3.8		
Total (Phase 1)	**2.20**	205.0	6.73848	16 Percent increase over existing GC demands
Village A (Phase 2)	0.190	17.8	204.241	
Village B (Phase 2)	0.217	20.3		
Village C (Phase 2)	0.167	15.6		
Apartments (Phase 2)	0.080	7.5		
Residences of Murieta Hills (Phase 2)	0.248	23.2		
Industrial/Commercial/Residential (Phase 2)	0.171	16.0		
Total (Phase 2)	**3.27**	305	10.03737	43 Percent increase over existing GC demands
			304.2292	

Maximum Month/Day Sources

	MGD		
WWRP Capacity (Current)	2.3		
WWRP Capacity (Phase 1)	3.0		
Supplemental Potable Water Requirements (MGD)			
Current	0.000		No supplemental water required
Phase 1	0.00	0	Production (2.3 MGD) > Demand (2.2 MGD); no supplemental water required
Phase 2	0.27		Production (3.0 MGD) < Demand (3.27 MGD); supplemental water required
			-> 230,000 gallons per day or 21.5 AF/month

430000

1.319711 30.30966

IRRIGATION DEMANDS AND SOURCES

Sources of Recycled Water

Location	Volume (MG)	Capacity (MGD) 8-hr IRR	Capacity (MGD) 9-hr IRR	Notes
WWRP - Equalization Basin / North RW Pump Station (Current)	1.8	1,596	1,596	
WWRP - Equalization Basin / North RW Pump Station (Phase 1)	1.8	2,082	2,082	
Lookout Hill Tank (Phase 1)	0.1	104	93	Standards: 50% avaliable for production/meeting IRR demand
Bass Lake Tank (Phase 2)	0.5	521	463	Standards: 50% avaliable for production/meeting IRR demand
Supplemental Potable Water Supply (Phase 1)		898	798	
Golf Course Ponds (reduced rate of RW supply during IRR)				
Bass Lake (Phase 1)	12.1	2,104	1,870	6.2 acres, 6 ft average depth. Capacity based on 6 in draw down (happens to balance with feed rates)
Lakes 10, 11, 16 and 17 (Phase 2)	15.6	1,878	1,669	8.3 acres total, various depths. Capacity based on 4 inch draw down (close to balancing with feed rates)
Total (Current)		**1,596**	**1,596**	
Total (Future - Phase 1)		**5,189**	**4,843**	
Total (Future - Phase 2)		**7,588**	**6,975**	

Peak Demands of Recycled Water

	Volume (gpd)	Demand (gpm) 8-hr IRR	Demand (gpm) 9-hr IRR
North Golf Course (Current)	1,010,138	2,104	1,871
South Golf Course (Current)	841,782	1,754	1,559
North Main Gate Entrance (Phase 1)	9,428	20	17
District Office	18,182	38	34
Retreats (Phase 1)	50,844	106	94
Murieta Gardens (Phase 1)	102,697	214	190
Stonehouse Park (Phase 1)	121,890	254	226
Escuela Park (Phase 1)	40,630	85	75
Total (Phase 1)		**4,574**	**4,066**
Village A (Phase 2)	190,296	396	352
Village B (Phase 2)	217,427	453	403
Village C (Phase 2)	167,132	348	310
Apartments (Phase 2)	80,138	167	148
Residences of Murieta Hills (Phase 2)	248,494	518	460
Industrial/Commercial/Residential (Phase 2)	171,387	357	317
Total (Phase 1 and 2)		**6,813**	**6,056**

Kevin Kennedy

From: Paul Siebensohn <psiebensohn@ranchomurietacsd.com>
Sent: Tuesday, July 19, 2016 3:46 PM
To: Kevin Kennedy
Subject: Pond volumes

fyi..I put this together a while ago for all of our bodies of water.

Name		Surface Area (acres)
1)	Calero	110 -114 acres, 2622 acre-feet volume
2)	Chesbro	62- 64 acres, 1130.7 acre-feet
3)	Clementia	71-76 acres, 907.1 acre-feet
4)	Laguna Joaquin	21.53 – 24.07 acres, 122 acre-feet
5)	Basin 5	1.3 acres at 16.5 foot average depth
6)	Guadalupe	1.3 acres
7)	Bass Lake	6.2 acres, 6 foot average depth
8)	Hole 10 North Pond	1.0 acres, 4 foot average depth
9)	6B Basin	0.2 acres, 4.6 foot average depth
10)	South Hole 10 Pond	1.4 acres, 5 feet average depth
11)	South Hole 11 Pond	6.3, 5.5 foot average depth
12)	South Hole 6 North Pond	0.4 and 0.28 acres
13)	South Hole 16 Pond	0.34 acres, >10 foot depth
14)	South Hole 17 Pond	0.27 acres, >10 foot depth
15)	North Hole 2 Pond	0.34 acres, 3.4 foot average depth

area, acres	ave depth,	vol, AF	vol, MG
6.2	6	37.2	12.1
1.4	5	7	2.3
6.3	5.5	34.65	11.3
0.34	10	3.4	1.1
0.27	10	2.7	0.9
8.3			15.6

Paul Siebensohn
Director of Field Operations
Rancho Murieta CSD
ph.(916)354-3700

Obtained from Recycled Water Feasiblity Study (HDR, June 2009) Figure 3

	Monthly AF Demand	% of Total Demand	AF/Mnth	# days/Mnth	MGD
15-Jan	0	0.0	0.0	31	0
14-Feb	0	0.0	0.0	28	0
15-Mar	2.5	1.8	15.3	31	0.160641
15-Apr	5	3.5	30.6	30	0.331991
15-May	15	10.6	91.7	31	0.963845
15-Jun	23	16.3	140.6	30	1.527159
15-Jul	27.5	19.5	168.1	31	1.767049
14-Aug	28	19.9	171.2	31	1.799177
14-Sep	20	14.2	122.3	30	1.327964
14-Oct	12.5	8.9	76.4	31	0.803204
14-Nov	7.5	5.3	45.9	30	0.497987
14-Dec	0	0.0	0.0	31	0
	141	100	862	365	

Rancho Murieta
Community Services District

Recycled Water Program

Preliminary Design Report

January 30, 2017 Workshop

1

Topics of Discussion (Recycled Water)

- Purpose and Status
- Development and Timelines
- Production and Demand Projections
- Conveyance Systems and Use Areas
- Recommendations, Schedule and Costs
- Questions, Answers and Discussion
- Next Steps

2

Purpose and Status

Describe Phase 1 and Buildout of District's Recycled Water Program with respect to existing and future conditions; development projections, phasing and recycled water use areas; recommended improvements and descriptions (including costs and timeline) and implementation plan.

- Draft Report: Review and comment
- Board Approval: February or March, 2017

Proposed Developments and Timelines

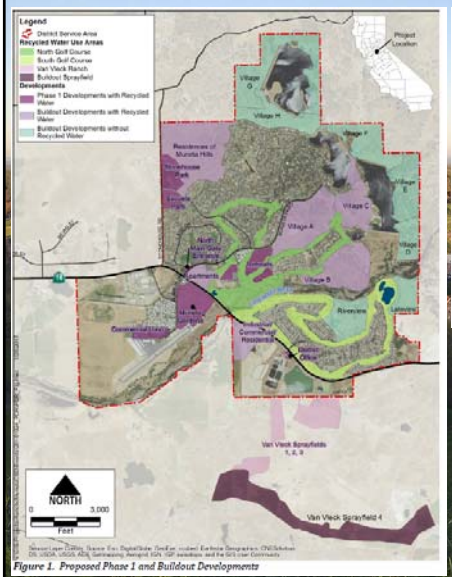


Figure 1. Proposed Phase 1 and Buildout Developments

Table 2. Summary of Future Development Timelines[1]

Development and Phase[1]		Percent of Future Homes Occupied (%)[1]						
		2018	2020	2025	2030	2035	2040	2045
Murieta Gardens (305)	Phase 1	100						
The Retreats (88)	Phase 1	100						
Village A (167)	Buildout		70	15	7	8		
Village B (167)	Buildout		10	30	30	30		
Village C (130)	Buildout		10	40	40	10		
Village D (42)	Buildout			25	25	50		
Village E (43)	Buildout				20	80		
Village F (95)	Buildout			2	38	60		
Village G (53)	Buildout				10	90		
Village H (122)	Buildout			10	25	65		
Apartments (170)	Buildout		70	15	7	8		
Residences of Murieta Hills (198)	Buildout		100					
Lakeview (99)	Buildout		100					
Riverview (140)	Buildout		100					
Industrial/Commercial/ Residential (160)	Buildout		15	30	30	25		

Developments to be served recycled water
Developments not to be served recycled water

[1]Values shown are percentages and represent the percent of total number of equivalent residential units estimated to be constructed and/or occupied by the referred date. Values shown in parentheses () represent the number of equivalent residential units to be added.

Timeline Data Sources

- Sewer Studies & Responses (*thru 2016*)
  - The Retreats
  - Retreats
  - *Murieta Gardens*
  - Rancho Murieta North
- Discussions with Developer's Engineer
- Water Supply Assessment
- Title XVI Report

Proposed Developments and Use Areas

Table 1. Proposed Developments and Recycled Water Use Areas

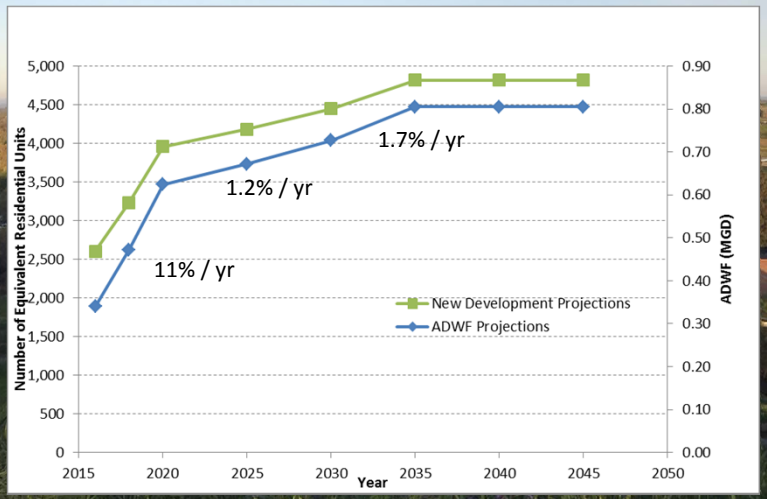
Phase	Proposed Developments	Proposed Recycled Water Use Areas
Phase 1	Murieta Gardens Retreats (North, West and East)	Murieta Gardens[a] [U, R] Retreats[a] (North, West and East) [U] Stonehouse Park[b] (existing) [U] Escuela Park[b] (existing) [U] Main Northgate [b] (existing) [U] District Office[b] (existing) [U] *Commercial Loop*[c]
Buildout	Residences of Murieta Hills Apartments Industrial/Commercial/Residential Village A Village B Village C Village D Village E Village F Village G Village H Riverview Lakeview	Residences of Murieta Hills[a] [U,R] Apartments[a] [U] Industrial/Commercial/Residential[a] [U,R] Village A[a] [R] Village B[a] [R] Village C[a] [R]

(U) = Future recycled water irrigation of existing parks, common areas and other landscaping
(R) = Future recycled water front and backyard irrigation of residential developments

5

Development and ADWF Projections

Figure 2



6

Recycled Water Production and Demand Projections

Table 5. Existing and Proposed Recycled Water Production and Demand Projections

Development/Proposed Recycled Water Use Area	Description	Projected RW Demand (AFY)	Wastewater Production (AFY)
Existing Recycled Water Use Areas			
Existing Development			
Rancho Murieta North & South Golf Courses	18-hole golf courses (~250 ac)	550	380.9
Van Vleck Ranch	Field 1 (~49ac), Field 2 (~25ac), Field 3 (~22 ac)	215	
Sub Total		**550* / 765****	**380**
Phase 1 Proposed Expanded Recycled Water Use Areas (~2016-2020)			
Infill	0.05 MGD allocation assumed	0	56.0
Main Northgate	Conversion to recycled water	2.8	0.0
District Office+	Conversion to recycled water	5.4	0.0
Retreats (North, East and West)	84 residential units	15.1	19.8
Murieta Gardens	78 residential units, commercial equivalent to 227 residential units	30.5	71.9
Stonehouse Park (4-acre park)	Conversion to recycled water	36.2	0.0
Escuela Park (4-acre park)	Conversion to recycled water	12.1	0.0
Commercial Loop (to be developed)	*Potential conversion to recycled water; could be 20 to 30 AFY demand; require coordination with Owner to proceed*		
	Phase 1 Sub Total	**102**	**148**
	Sub Total	**650* / 865****	**530**
Phase 2 Proposed Expanded Recycled Water Use Areas (~2020-2025)			
Village A	167 residential units	56.5	39.3
Village B	167 residential units	64.6	39.3
Village C	130 residential units	49.6	30.6
Village D	42 residential units	0	9.9
Village E	43 residential units	0	10.1
Village F	95 residential units	0	22.3
Village G	53 residential units	0	12.5
Village H	122 residential units	0	28.7
Riverview	140 residential units	0	32.9
Lakeview	99 residential units	0	21.4
Apartments	170 residential units	23.8	23.3
Residences of Murieta Hills	198 residential units	73.8	46.6
Industrial/Commercial/Residential	160 equivalent residential units	50.9	37.6
Van Vleck Ranch	Sprayfield 4	410	
	Phase 2 Sub Total	**320* / 730****	**355**
	Grand Total	**970* / 1,595****	**885**

* Beneficial reuse
** Beneficial reuse plus Van Vleck sprayfield disposal demands

Current Capacity: 3,265 ERUs

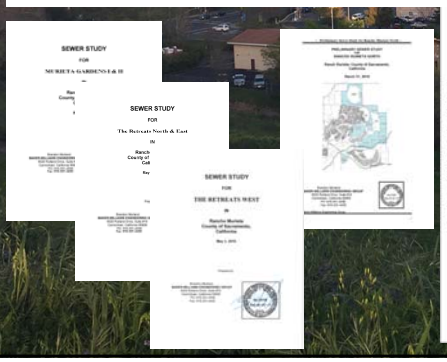
Existing 2,604 ERUs

Development (Sewer Studies)
- Murieta Gardens
  - Residential *78* ERUs
  - Commercial *227* ERUs
- Retreats *84* ERUs
- Subtotal *389* ERUs

Remaining *272* ERUs
- *Infill (PDR assumption)* *238 ERUs (0.05 MGD)*

Production and Demand Projections

Sources of Data:
- Sewer Studies & Responses (thru 2016)
  - The Retreats
  - Retreats
  - Murieta Gardens
  - Rancho Murieta North
- Discussions with Developer's Engineer
- Title XVI Report



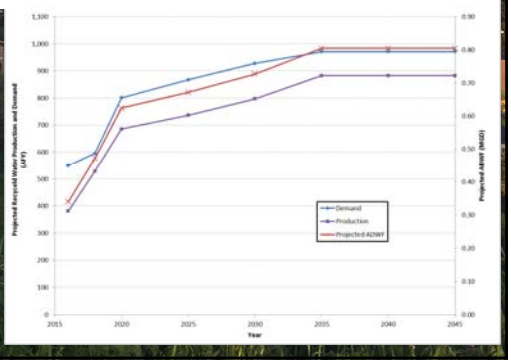


Figure 6.

Existing Recycled Water Conveyance Systems and Use Areas

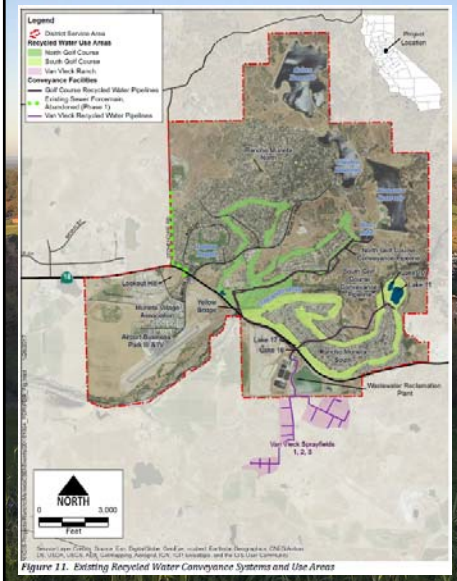


Figure 11. Existing Recycled Water Conveyance Systems and Use Areas

Table 6. Recycled Water Conveyance System Roles and Responsibilities[a]

System and Facility	Ownership and O&M Costs		
	District	RMPI[b]	RMCC
Equalization Basin	X		
South Golf Course			
Equalization Basin – Lakes 16 & 17 Pipeline	c		c
Lake 16 & 17 – Lake 10 & 11 Pipeline		D	d
North Golf Course			
Recycled Water Pump Station	e		e
North Golf Course Force Main to Yellow Bridge Pipeline	c	C	
North Golf Course Force Main from Yellow Bridge to Bass Lake Pipeline		E	e

[a] Adapted from Agreement for Availability and Use of Reclaimed Water (May 17, 1988) and the Amendment to Agreement for Availability and Use of Reclaimed Water (May 4, 1994)
[b] Rancho Murieta Properties, Inc. (RMPI) was the original owner. current owner is Rancho North Properties, LLC.
[c] RMCSD to own, operate and maintain; operation and maintenance costs to be split 50/50 between RMCSD and RMCC.
[d] RMPI to own, RMCC to operate and maintain; operation and maintenance costs to be split 50/50 between RMPI and RMCC.
[e] RMPI to own. RMCC to operate and maintain.

Condition Assessment: *High Risk*
Other Concerns: Location or condition unknown, potential change in ownership

Impacts rehabilitation strategy for existing 12-inch sewer force main

9

Hydraulic Modeling (Buildout Only)

Condition Assessment; Not PDR

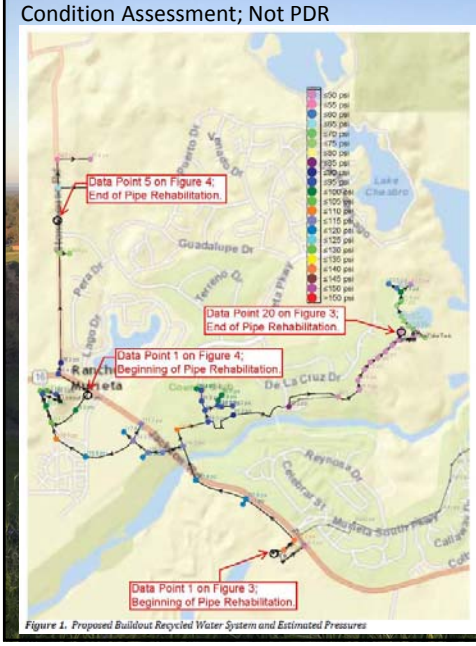


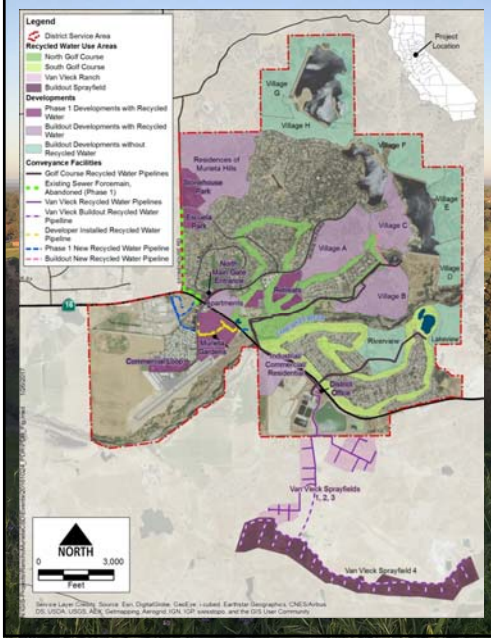
Figure 1. Proposed Buildout Recycled Water System and Estimated Pressures

Impacts both condition assessment & PDR

Next Steps (Separate from PDR): Expand model capabilities, optimize system, surge & detail design

10

Recycled Water Conveyance Future



Use of System (limitations)

- Separate timeframes for golf course supply and U & R irrigation
- Dictates max operating pressures & flow
- Requires additional supplies (storage tanks) and controls
- Unknown condition, location & potential change in ownership

Next Step: Phase 2 condition assessment

11

Recommended Improvements – Phase 1

Table 10. Recommended Phase 1 Recycled Water Improvements Features and Components

Process / Element	Criteria / Feature
1. Recycled Water SCADA Control System	
Number of SCADA Terminals	1
Location	WWRP
Type	
Lookout Hill	Programmable Logic Controller (PLC)
Control Valves	Remote Terminal Units
Communication	Radio*
Control	Pressure
2. Equalization Basin Potable Water Air Gap Connection	
Flow Rate (maximum)	900 gpm
Diameter	8-inch
Material	Ductile Iron
Air Gap (90◦ Bend)	16 inches per RW-17
3. Rehabilitate Existing Recycled Water Pumping Station	
Pump Type	Vertical Turbine
Number of Pumps	Two (2) duty; one (1) stand by
Total Dynamic Head	325 feet
Pump Flow	1,500 gpm
Motor Horsepower	200 HP
Backup Power	200 KW Standby Diesel Generator
Control Method	Pressure
4. District Headquarters Conversion – Recycled Water Irrigation System Connection	
Site Supervisor	District (Paul Slebensohn)
Type of Landscape	Grass in front yard and medians
Type of Irrigation	Spray and drip
Area (approximate)	168 acres
Water Demand (estimated)	3.4 AFY
Pipe Diameter	4-inch
Pipe Material	PVC
5. Northwest Recycled Water Transmission Main	
Pipeline Length (total)	11,600 lineal feet, total
Highway 16 Undercrossing	1,000 lineal feet (approximately)
Legacy Lane to Lookout Hill Tank	2,800 lineal feet (approximately)
Lookout Hill Tank to 12-inch Force Main	2,400 lineal feet (approximately)
12-inch Force Main along Stonehouse Road to Stonehouse and Escuela Parks	5,400 lineal feet (approximately)
Replace	1,200 lineal feet of 12-inch
CIPP Rehabilitation	2,400 lineal feet of 12-inch
Diameter	12 inch
Buried Pipeline Materials	PVC or HDPE pipe
Above Grade Pipeline Materials	Steel or Ductile Iron pipe
Pipeline Labeling	"Recycled Water, Do Not Drink"
Pipe Color or Wrapping	Purple or wrapped with purple tape
Air and Blowoff Valves	District Standards
Others	See District Standards
6. Lookout Hill Booster Pumping Station	
Pump Type	Vertical Turbine
Number of Pumps	One (1) duty; one (1) stand by
Total Dynamic Head	150 feet TDH
Pump Flow	1,000 gpm (maximum)
Motor Horsepower	50 HP
Pump Housing	Not required
Backup Power	50 KW Standby Diesel Generator
Control Method	Pressure
7. Escuela Park Conversion – Recycled Water Irrigation System Connection	
Site Supervisor	Rancho Murieta Association (RMA) (TBD)
Type of Landscape	Plantings and flowers now
Type of Irrigation	Spray and drip
Area (approximate)	4 acres
Water Demand (estimated)	12.1 AFY
Pipe Diameter	4-inch
Pipe Material	PVC
8. Stonehouse Park Conversion – Recycled Water Irrigation System Connection	
Site Supervisor	RMA (TBD)
Type of Landscape	Grass primarily (fields)
Type of Irrigation	Spray and drip
Area (approximate)	4 acres
Water Demand (estimated)	36.2 AFY
Pipe Diameter	4-inch
Pipe Material	PVC
9. Lookout Hill Recycled Water Storage Tank	
Number of Tanks	1
Diameter	40
Height (maximum at sidewall)	26
Volume (nominal)	200,000 gallons
Materials of Constructed	Bolted Steel
10. North Maingate Conversion – Recycled Water Irrigation System Connection	
Site Supervisor	RMA (TBD)
Type of Landscape	Grass, flower beds, plantings
Type of Irrigation	Spray and drip
Area (approximate)	12.1 acres
Water Demand (estimated)	2.8 AFY
Pipe Diameter	4-inch
Pipe Material	PVC

* Wireless I/O can be used alternatively

12

Recommended Improvements – Phase 1

Figure 12. Proposed Phase 1 WWRP Improvements

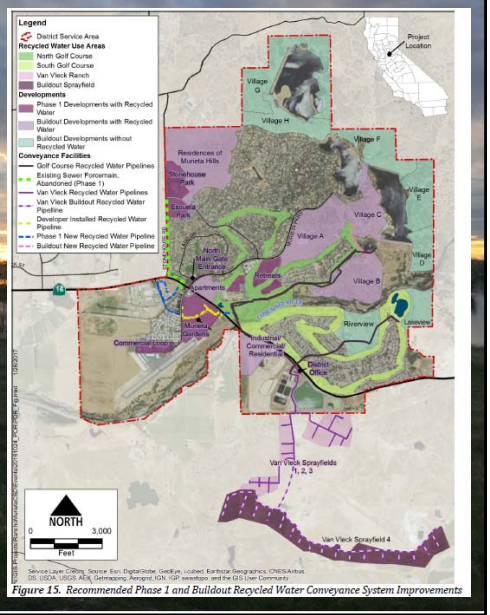
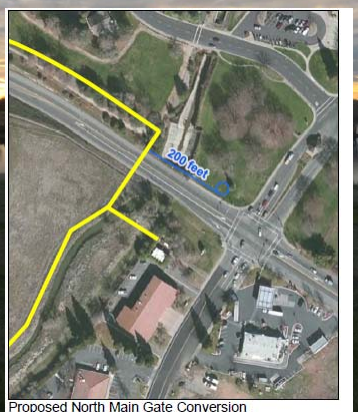


Figure 15. Recommended Phase 1 and Buildout Recycled Water Conveyance System Improvements

Conversions from Potable to Recycled Water

Figure 14

Proposed District Headquarters Conversion



Proposed North Main Gate Conversion

14

Recommended Improvements – Buildout

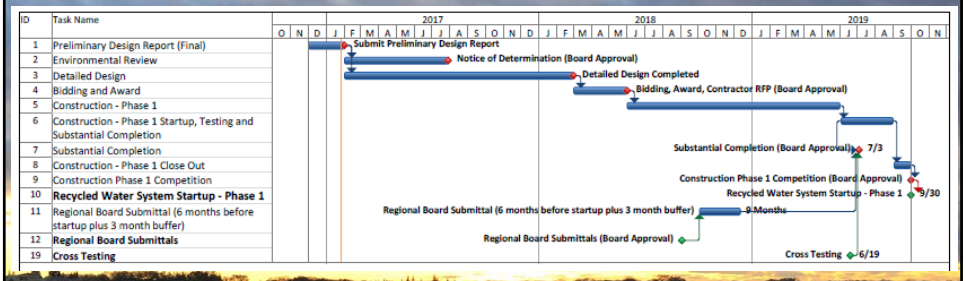
Table 11. Recommended Buildout Recycled Water Improvements Features and Components

Process / Element	Criteria / Feature
A. Disinfection Facilities Upgrade	
Existing Contact Basin Modal Contact Time	27 minutes at 3.0 MGD[1]
Required Modal Contact Time	90 minutes (minimum)
Additional Modal Contact Time Required	63 minute (minimum)
New Contact Basin Efficiency (Assumed Baffling Factor)	90%
Required Contact Basin Volume	145,835 gal. minimum; 146,610 gal actual
Length to Width to Depth Ratios	Target 40:1:1.5; Actual 40:1:1.4
Length (without walls)	280 ft total (3 passes, each at 93.33 ft long)
Width (without walls)	21 ft total (3 passes, each at 7 ft wide)
Depth (without walls)	10 ft
B. North Golf Course Conveyance System Rehabilitation	
WWRP to Bass Lake	11,200 lineal feet (12- and 8-inch)
Replacement	4,300 lineal feet, 12-inch
CIPP Rehabilitation	3,800 lineal feet, 8-inch
Replacement	1,900, 8-inch
C. Bass Lake Recycled Water Storage Tank	
Number of Tanks	1
Diameter	70
Height (maximum at sidewall)	22
Volume (nominal)	500,000 gallons
Materials of Constructed	Bolted Steel
D. Bass Lake Booster Pumping Station	
Pump Type	Vertical Turbine
Number of Pumps	One (1) duty; one (1) stand by
Total Dynamic Head	120 feet
Pump Flow	1,200 gpm
Motor Horsepower	50 HP
Pump Housing	Not required
Backup Power	50 KW Standby Diesel Generator
Control Method	Pressure
E. Seasonal Storage Reservoir	
Existing Storage Capacity	728.2 AF
Required Storage Capacity (Buildout)	765 AF
Incremental Capacity Upgrade	40 AF
F. Van Vleck Sprayfield No. 4	
Extension of Recycled Water Transmission Main	1,000 lineal feet of 12-inch Certa-Loc™
Sprayfield 4 Transmission Main	5,000 lineal feet of 8-inch Certa-Loc™
Sprayfield 4 Transmission Main	5,000 lineal feet of 6-inch Certa-Loc™
Sprayfield 4 Transmission & Distribution Mains	16,250 lineal feet of 4-inch Certa-Loc™
Irrigation System	55 K-line Strings
Depth of Cover	None, all located aboveground
G. Dissolved Air Flotation Feed Pump Improvements	
Replacement of 3rd Feed Pump	$100,000 Allocation

[1] See Figure 1-3 of *WWRP Modified Chlorine Contact Disinfection System Compliance Report* (MSe, July 2006). Equivalent volume of 86,250 gallons

15

Proposed Implementation Schedule



Recommended Next Steps:

- Review and comment
- Adopt PDR
- Initiate Phase 2 condition assessment
- Initiate environmental review and detailed design
- Continued development submittal reviews (sewer studies & irrigation plans)

16

Estimated of Probable Construction Costs

Table 15. Recommended Recycled Water Improvements and Estimated Costs

No.	Improvement	Estimated Cost ($)[a]
	Phase 1 Recycled Water Improvements	
1	Recycled Water SCADA Control System	250,000
2	Equalization Basin Potable Water Air Gap	76,000
3	Recycled Water Pumping Station	1,045,000
4	District Headquarters Conversion	20,000
5	Northwest Recycled Water Transmission Main	1,441,000
6	Lookout Hill Booster Pumping Station	612,000
7	Escuela Park Conversion	16,000
8	Stonehouse Park Conversion	36,000
9	Lookout Hill Recycled Water Storage Tank	545,000
10	Main NorthgateConversion	18,000
11	Commercial Loop Conversion	*TBD*
	Phase 1 Subtotal (Estimated Construction Cost)	**4,060,000**
12	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	1,319,500
	Phase 1 Total (Project Cost)	**5,380,000**[b]
	Buildout Recycled Water Improvements	
13	SCADA Upgrades	82,000
14	Disinfection Facilities Upgrade	665,000
15	North Golf Course Conveyance System	1,620,000
16	Bass Lake Tank	1,216,000
17	Bass Lake Booster Pumping Station	625,000
18	Seasonal Storage Reservoir Expansion	839,000
19	Van Vleck Sprayfield 4	890,000
20	DAF Pumping Replacement	100,000
	Buildout Subtotal (Estimated Construction Cost)	**6,030,000**[c]
21	Soft Costs – 32.5% (Admin., Reg., Eng., Construct Man.)	1,960,000
	Buildout Total (Project Cost)	**7,990,000**
	Phase 1 and Buildout Recycled Water Improvements	
	Grand Total (Phase 1 and Buildout)	**13,400,000**[d]
	Estimated Number of New Equivalent Residential Units	2,213
	Estimated Cost per Connection ($/ERU)	**$6,055**

[a] Estimated costs based upon Engineering News Record (ENR) 20 City Average Construction Cost Index (CCI) at 10,385 (August 2016)
[b] Compared to $10,014,000 ($9,100,000 adjusted for inflation) as described previously in the District's Title XVI Recycled Water Feasibility Study
[c] Compared to $15,055,000 as described previously in the District's Title XVI Recycled Water Feasibility Study
[d] Compared to $25,070,000 as described previously in the District's Title XVI Recycled Water Feasibility Study

Phase 1 ($M):
- Construction: 4.06
- Project: 5.38

Buildout ($M)
- Construction: 6.03
- Project: 7.99

Total Combined ($M): 13.40

Future ERUs: 2,213

Est. Cost per ERU: $6,055

17

Recommended Next Steps

Obtain Board feedback and adoption (February / March, 2017)

Input regarding the following next:

- Phase 2 condition assessment
- Hydraulic modeling
- Environmental review and detailed design timeline

18


Questions, Answers and Discussion
• Comments due?
19

Table A5. Recycled Water Production and Demand Estimate Details									
		Recycled Water Production Estimates							
		Connections		Unit Flow Factor	Source				Demand
Condition and Description		Residential	Commercial	(gpd/day residential unit)		(MGD)		(AFY)	(AFY)
Existing (Current)		**2,604**				**0.34**	**381**	**381**	**550**
Phase 1 (Future)	Infill	238		165	District Standard	0.04		44.0	
	Stonehouse Park Conversion	0		Existing	Not applicable				36.2
	Escuela Park Conversion	0							12.1
	Main Northgate Conversion	0							2.8
	District Office Conversion	0							5.4
	Retreats North and East	62		165	District Standard/Draft Sewer Study	0.010		11.5	11.9
	Retreats West	22		165	District Standard/Approved Sewer Study	0.004		4.1	3.2
	Murieta Gardens	78	227	165	District Standard/Draft Sewer Study	0.05		56.4	30.5
	Phase 1 Subtotal	**627**				**0.10**	**116**	**116**	**102**
Phase 2 (Future)	Village A	167		165	District Standard/Preliminary Draft Sewer Study	0.03		**30.9**	61.4
	Village B	167		165		0.03		**30.9**	64.6
	Village C	130		165		0.02		**24.0**	49.6
	Village D	42		165		0.01		**7.8**	0
	Village E	43		165		0.01		**7.9**	0
	Village F	95		165		0.02		**17.6**	0
	Village G	53		165		0.01		**9.8**	0
	Village H	122		165		0.02		**22.6**	0
	Riverview	140		165		0.02		**25.9**	0
	Lakeview	99		165		0.02		**18.3**	0
	Apartments	170		120		0.02		**23.3**	23.8

		Recycled Water Production Estimates							
		Connections		Unit Flow Factor	Source				Demand
Condition and Description		**Residential**	**Commercial**	**(gpd/day residential unit)**		(MGD)		**(AFY)**	**(AFY)**
	Residences of Murieta Hills	198		165		0.03		**36.6**	73.8
	Industrial/Commercial/Residential	160		165		0.03		**29.6**	50.9
	Phase 2 Subtotal	**1,586**		165		**0.25**	**285**	**285**	**324**
Combined Total (Existing, Phase 1 and 2)		**5,044**				**0.70**	**781**	**782**	**976**

a. Preliminary Sewer Study for Rancho Murieta North (March 31, 2016) describes that these developments will serve recycled water for irrigation purposes in accordance with the District's Recycled Water Program. H

Phase 1 Developments							
OLD METHODOLOGY		Residential Outdoor Irrigation					
Development	**Number of Lots**	**Estimating Methodology**	**Demand**	**Development RW Demand**	**Development WW Production**	**Occupancy Timeline**	**Recycled Water Service Region**
Riverview - RD 5 (could be RD 4)	149	Historic adjusted for AB 1881 Compliance	0.30 AFY	44.7 AFY	7.0 AFY	2016 - 2020 or 2016-2025	A
Lakeview - RD 5 (Could be RD 4)	99	Historic adjusted for AB 1881 Compliance	0.30 AFY	29.7 AFY		2016 - 2020 or 2016-2025	A
Residences of MH East	99	Historic adjusted for AB 1881 Compliance	0.30 AFY	29.7 AFY		2016 - 2020 or 2016-2025	D
Residences of MH West	99	Historic adjusted for AB 1881 Compliance	0.30 AFY	29.7 AFY		2016 - 2020 or 2016-2025	D
Retreats	84	400 gpd water allocation; 50% outdoor	200.0 gpd/unit	18.8 AFY		2016 - 2020 or 2016-2025	B or C
Murieta Gardens I (Commercial)	1 acre park	New MAWA allocation	2.93 ft/yr	2.9 AFY		2016 - 2020 or 2016-2025	D
Murieta Gardens II (Residential)	95	MAWA calculation; 8600 SF/lot; 1200 - 1500 SF homes; 1500 - 2000 sf hardscape; 500 sf LA average	0.37 AFY	35.2 AFY		2016 - 2020 or 2016-2025	B
		Total Estimated Development Demand		**190.7 AFY**			
PROPOSED METHODOLOGY		Residential Outdoor Irrigation					
Development	**Number of Lots**	**Estimating Methodology**	**Demand**	**Development RW Demand**	**Development WW Production**	**Occupancy Timeline**	**Recycled Water Service Region**
Riverview - RD 5 (could be RD 4)	149	LU Designations Unit Demands, MAWA	0.16 AFY	23.8 AFY	32.2 AFY	2016 - 2020 or 2016-2025	A
Lakeview - RD 5 (Could be RD 4)	99	LU Designations Unit Demands, MAWA	0.16 AFY	15.8 AFY	21.4 AFY	2016 - 2020 or 2016-2025	A
Residences of MH East - RD 3	95	LU Designations Unit Demands, MAWA	0.37 AFY	35.2 AFY	20.6 AFY	2016 - 2020 or 2016-2025	D
Residences of MH East - RD 1	4	LU Designations Unit Demands, MAWA	0.51 AFY	2.0 AFY	0.9 AFY	2016 - 2020 or 2016-2025	D
Residences of MH West - RD 3	99	LU Designations Unit Demands, MAWA	0.37 AFY	36.6 AFY	21.4 AFY	2016 - 2020 or 2016-2025	D
Retreats	84	400 gpd water allocation; 50% outdoor	200 gpd/unit	18.8 AFY	18.2 AFY	2016 - 2020 or 2016-2025	B or C
Murieta Gardens I (Commercial)	1 acre park	New MAWA allocation, 95% landscaped area	2.93 ft/yr	2.8 AFY	0.0 AFY	2016 - 2020 or 2016-2025	D
Murieta Gardens II (Residential)	95	LU Designations Unit Demands, MAWA	0.17 AFY	16.2 AFY	20.6 AFY	2016 - 2020 or 2016-2025	B
		Total Estimated Development Demand		**151.3 AFY**	**135.3 AFY**		
Phase 2 Developments							
		Residential Outdoor Irrigation					
Development	**Number of Lots**	**Estimating Methodology**	**Demand**	**Development RW Demand**	**Development WW Production**	**Occupancy Timeline**	**Recycled Water Service Region**
River Canyon - Estates	80	LU Designations Unit Demands, MAWA	0.51 AFY	40.8 AFY	17.3 AFY		
River Canyon - TH/Condo/Apts	40	250 gpd water allocation; 50% outdoor	125 gpd/unit	5.6 AFY	8.7 AFY		
Highlands - Estates	59	LU Designations Unit Demands, MAWA	0.51 AFY	30.1 AFY	12.8 AFY		
Highlands - RD 3	21	LU Designations Unit Demands, MAWA	0.37 AFY	7.8 AFY	4.5 AFY		
Highlands - TH/Condo/Apts	30	250 gpd water allocation; 50% outdoor	125 gpd/unit	4.2 AFY	6.5 AFY		
Terrace - Large Estate	14	LU Designations Unit Demands, MAWA	0.51 AFY	7.1 AFY	3.0 AFY	60.0 AFY	
Terrace - Estate	22	LU Designations Unit Demands, MAWA	0.51 AFY	11.2 AFY	4.8 AFY	177	
Terrace - RD 3	102	LU Designations Unit Demands, MAWA	0.37 AFY	37.7 AFY	22.1 AFY		
Terrace - RD 5 (small)	9	LU Designations Unit Demands, MAWA	0.13 AFY	1.2 AFY	1.9 AFY		
Terrace - Triplex	30	LU Designations Unit Demands, MAWA	0.09	2.7 AFY	6.5 AFY		
Apartment 17	170	250 gpd water allocation; 50% outdoor	125 gpd/unit	23.8 AFY	36.8 AFY		
Esquela - RD 3	40	LU Designations Unit Demands, MAWA	0.37 AFY	14.8 AFY	8.7 AFY		
Esquela - Park	4 acre park	95% landscaped area	2.93 ft/yr	11.1 AFY	0.0 AFY		
E of Lake Clementia - Estates	54	LU Designations Unit Demands, MAWA	0.51 AFY	27.5 AFY	11.7 AFY		
E of Lake Clementia - TH/Condo/Apts	30	250 gpd water allocation; 50% outdoor	125 gpd/unit	4.2 AFY	6.5 AFY		
E of Lake Chesbro - Estate	10	LU Designations Unit Demands, MAWA	0.51 AFY	5.1 AFY	2.2 AFY		
E of Lake Chesbro - RD 3	58	LU Designations Unit Demands, MAWA	0.37 AFY	21.5 AFY	12.6 AFY		

		Residential Outdoor Irrigation					
Development	**Number of Lots**	**Estimating Methodology**	**Demand**	**Development RW Demand**	**Development WW Production**	**Occupancy Timeline**	**Recycled Water Service Region**
E of Lake Chesbro - TH/Condo/Apts	20	250 gpd water allocation; 50% outdoor	125 gpd/unit	2.8 AFY	4.3 AFY		
E of Lake Calero - Estate	38	LU Designations Unit Demands, MAWA	0.51 AFY	19.4 AFY	8.2 AFY		
E of Lake Calero - RD 3	81	LU Designations Unit Demands, MAWA	0.37 AFY	30.0 AFY	17.5 AFY		
E of Lake Calero - TH/Condo/Apts	20	250 gpd water allocation; 50% outdoor	125 gpd/unit	2.8 AFY	4.3 AFY		
	1,553	**Total Estimated Development Demand**		**311.3 AFY**	**200.8 AFY**		
		Overall Estimated Demand		**0.29 AFY/lot**			

Land Use Designation	Lot Area	Roads/Right of Ways	Lot Area	Building Coverage	Hardscape Coverage	Landscape Coverage	Irrigation Demand[a]	References[b]
	(sf)	(%)	(sf)	(sf)	(sf)	(sf)	(AFY)	
Estate								
RD 1 / Estates	43,560						0.51	Limit based on 650 gpd/day allocation minus historic indoor use of 195.2 gpd (502.2-307 gpd)
RD 3 - Low	14,520	25	10,890	3,800	2,700	4,390	0.30	Folsom Water Supply Assessment; 20% Building and 20% Hardscape Coverage; Sac County building coverage limited to 50%
RD 3 - High	14,520	25	10,890	2,200	2,200	6,490	0.44	Hardscape Coverage; Sac County building coverage limited to 50% > 35% for Folsom
RD 5 - Low	8,700	30	6,090	2,400	1,800	1,890	0.13	Folsom Water Supply Assessment SFHD (6,000 sf lots)
RD 5 - High	8,700	30	6,090	1,500	1,800	2,790	0.19	Folsom Water Supply Assessment SFHD (6,000 sf lots)
Murieta Gardens II - Low	8,600	35	5,590	1,500	2,000	2,090	0.14	Tentative Subdivision Maps, Information from Mike Robertson (building coverage), and Opitz and Hauer, 1995
Murieta Gardens II - High	8,600	35	5,590	1,200	1,400	2,990	0.20	Tentative Subdivision Maps, Information from Mike Robertson (building coverage), and Opitz and Hauer, 1995
Triplex							0.09	Folsom Water Supply Assessment, assumed to be equal to MFLD, did not use MAWA
[a.] Obtained from MAWA, assume 100% turf irrigation								
b. MAWA used in all cases except as noted (Folsom used 85% of ET, rather than 70%)								

Rancho Murieta Community Services District
Water Balance - Buildout

100-YR Modifiers		WWRP Influent Flows & Site Info																	100	Ave
100-yr Return Ratio	1.84 unitless	Influent Flow- avg.	314.00 mg/yr	Pan Evaporation Coefficient	0.75 unitless	Reservoir Watershed Area	40 acres	Maximum Storage of Reservoirs (1&2)	859.9 ac-ft	RMCC Lake Water Surface Area	11.2 acres	**Demand Info**		
100-yr modifier - Pan Evaporation	0.8 unitless	ADWF (June-Sep)	0.79 mgd	WWRP Site Area	7.5 acres	Run-off Coefficient for Reservoirs	0.9 unitless	ge Volume of Reservoirs w/ 2ft FB (1&2)	728.2 ac-ft	RMCC Contributing Watershed	15.0 acres	RMCC Demand	550 AFY	550 AFY
Normalized I&I	61.74 mg/MGD/yr	Beginning Water Volume in Res.	65 ac-ft	Run-off Coefficient for WWRP	0.9 unitless	Proportion in Reservoir #1	0.81 %	Water Balance Max Volume	882.1 ac-ft	Run-off Coefficient	0.2 unitless	Van Vleck Ranch	280 AFY	0 AFY
100-yr I/I Volume	66.3 mg			WWRP Pond Area Total	10.7 acres	Proportion in Reservoir #2	0.19 %					Residential Irrigation	387 AFY	387 AFY
Average-yr I/I Volume	7.0 mg												1217	937

100-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	25.0	24.6	30.3	27.8	24.5	31.1	27.8	26.2	24.2	24.6	24.5	23.4	314.00	
Wastewater Influent	ac-ft	76.6	75.5	92.8	85.3	75.2	95.5	85.4	80.5	74.3	75.5	75.1	71.8	963.63	1167.00
100-YR I/I Estimate	ac-ft	16.2	15.9	19.6	18.0	15.9	20.2	18.0	17.0	15.7	15.9	15.9	15.2	203.37	
Average-YR I/I Estimate	ac-ft														
Site Run-off	ac-ft	1.9	5.1	5.0	6.6	6.4	6.3	2.7	0.8	0.5	0.2	0.1	0.7	36.34	
Pond Precipitation (direct)	ac-ft	2.2	5.7	5.6	7.3	7.1	7.1	3.0	0.9	0.5	0.2	0.2	0.7	40.38	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	52.7	92.1	191.9	309.8	430.6	537.7	658.6	714.5	683.4	530.6	303.5	136.5	4642.04	
Reservoir # 1 Depth	ft	6.2	8.6	14.2	20.1	25.3	29.1	32.6	34.0	33.3	28.9	19.8	11.2	263.19	
Reservoir # 1 Surface Area	acre	18.8	19.6	21.5	23.5	25.3	26.6	27.8	28.2	28.0	26.5	23.4	20.5	289.85	
Reservoir #2 Vol	ac-ft	12.4	21.6	45.0	72.7	101.0	126.1	154.5	167.6	160.3	124.5	71.2	32.0	1088.87	
Reservoir # 2 Depth	ft	4.7	7.2	13.0	19.1	24.3	28.2	31.6	32.9	32.2	27.9	18.8	9.9	249.72	
Reservoir # 2 Surface Area	acre	3.4	3.8	4.6	5.4	6.2	6.7	7.2	7.4	7.3	6.7	5.4	4.1	68.00	
Total Water Surface Area	acre	22.2	23.4	26.1	29.0	31.4	33.3	35.0	35.6	35.3	33.2	28.8	24.6	357.85	
Contributing Water Shed Area	acre	17.8	16.6	13.9	11.0	8.6	6.7	5.0	4.4	4.7	6.8	11.2	15.4	122.15	
Reservoir Run-off	ac-ft	3.2	8.0	6.5	6.8	5.1	4.0	1.3	0.3	0.2	0.1	0.2	1.0	36.60	
Reservoir Precip (direct)	ac-ft	4.5	12.4	13.6	19.8	20.9	22.0	9.9	2.8	1.7	0.6	0.4	1.7	110.27	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-2.0	-1.7	-3.7	-7.2	-11.4	-18.0	-21.8	-23.1	-17.9	-11.5	-128.05	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.2	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.81	
Lake Precipitation (direct)	ac-ft	2.3	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	42.41	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
		218.8	211.8	218.8	218.8	199.4	218.8	211.8	218.8	211.8	218.8	218.8	211.8		
Disposal		-44.9	0.0	0.0	0.0	0.0	-1.7	-36.2	-112.5	-246.6	-334.7	-266.7	-173.7		
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-14.3	0.0	0.0	0.0	0.0	-0.5	-11.5	-35.8	-78.4	-106.4	-84.8	-55.2	-387.00	
Van Vleck Ranch Demand	ac-ft	-10.3	0.0	0.0	0.0	0.0	-0.4	-8.3	-25.9	-56.7	-77.0	-61.4	-40.0	-280.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	113.7	237.0	382.5	531.6	663.9	813.1	882.1	843.7	655.1	374.7	168.5	5730.92	
Change in Water Volume	ac-ft	48.7	123.2	145.6	149.1	132.2	149.2	69.0	-38.3	-188.6	-280.4	-206.2	-103.5	0.01	
Final Water Volume in Reservoirs	ac-ft	113.7	237.0	382.5	531.6	663.9	813.1	**882.1**	843.7	655.1	374.7	168.5	65	5730.93	

Average-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	25.0	24.6	30.3	27.8	24.5	31.1	27.8	26.2	24.2	24.6	24.5	23.4	314.00	
Wastewater Influent	ac-ft	76.6	75.5	92.8	85.3	75.2	95.5	85.4	80.5	74.3	75.5	75.1	71.8	963.63	Should be 885; 78.7 AFY too high; reduce average I/I to 21.4 AFY compensate
100-YR I/I Estimate	ac-ft														
Average-YR I/I Estimate	ac-ft	1.7	1.7	2.1	1.9	1.7	2.1	1.9	1.8	1.6	1.7	1.7	1.6	21.36	984.99
Site Run-off	ac-ft	1.1	2.8	2.7	3.6	3.5	3.5	1.5	0.4	0.2	0.1	0.1	0.4	19.75	
Pond Precipitation (direct)	ac-ft	1.2	3.1	3.0	4.0	3.9	3.8	1.6	0.5	0.3	0.1	0.1	0.4	21.94	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	52.7	83.5	160.2	252.6	345.4	426.5	518.8	562.6	539.2	420.9	245.3	116.9	3724.59	
Reservoir # 1 Depth	ft	6.2	8.1	12.5	17.3	21.7	25.1	28.5	29.9	29.2	24.9	17.0	10.0	230.39	
Reservoir # 1 Surface Area	acre	18.8	19.4	20.9	22.6	24.1	25.2	26.4	26.9	26.6	25.2	22.5	20.1	278.71	
Reservoir #2 Vol	ac-ft	12.4	19.6	37.6	59.3	81.0	100.0	121.7	132.0	126.5	98.7	57.5	27.4	873.67	
Reservoir # 2 Depth	ft	4.7	6.6	11.2	16.3	20.7	24.2	27.5	29.0	28.2	23.9	15.9	8.7	216.95	
Reservoir # 2 Surface Area	acre	3.4	3.7	4.3	5.0	5.7	6.1	6.6	6.8	6.7	6.1	5.0	4.0	63.42	
Total Water Surface Area	acre	22.2	23.1	25.3	27.6	29.7	31.4	33.0	33.7	33.3	31.3	27.5	24.1	342.13	
Contributing Water Shed Area	acre	17.8	16.9	14.7	12.4	10.3	8.6	7.0	6.3	6.7	8.7	12.5	15.9	137.87	
Reservoir Run-off	ac-ft	1.8	4.4	3.7	4.1	3.3	2.8	1.0	0.2	0.2	0.1	0.1	0.5	22.23	
Reservoir Precip (direct)	ac-ft	2.4	6.7	7.1	10.3	10.8	11.2	5.1	1.5	0.9	0.3	0.2	0.9	57.33	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-2.0	-1.6	-3.5	-6.8	-10.7	-17.0	-20.6	-21.7	-17.0	-11.2	-122.01	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.1	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.74	
Lake Precipitation (direct)	ac-ft	1.2	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	41.38	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Disposal															
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-14.3	0.0	0.0	0.0	0.0	-0.5	-11.5	-35.8	-78.4	-106.4	-84.8	-55.2	-387.00	
Van Vleck Ranch Demand	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	103.1	197.8	311.9	426.4	526.5	640.5	694.6	665.7	519.7	302.9	144.3	4598.25	
Change in Water Volume	ac-ft	38.1	94.7	114.1	114.5	100.1	114.0	54.1	-28.9	-146.0	-216.8	-158.5	-78.7	0.61	
Final Water Volume in Reservoirs	ac-ft	103.1	197.8	311.9	426.4	526.5	640.5	**694.6**	665.7	519.7	302.9	144.3	65.6	4598.85	

Rancho Murieta Community Services District
Water Balance - Buildout at Reduced 155 gpd per Customer

100-YR Modifiers		**WWRP Influent Flows & Site Info**																100	Ave
100-yr Return Ratio	1.84 unitless	Influent Flow- avg.	270.00 mg/yr	Pan Evaporation Coefficient	0.75 unitless	Reservoir Watershed Area	40 acres	Maximum Storage of Reservoirs (1&2)	859.9 ac-ft	RMCC Lake Water Surface Area	11.2 acres	**Demand Info**							
100-yr modifier - Pan Evaporation	0.8 unitless	ADWF (June-Sep)	0.68 mgd	WWRP Site Area	7.5 acres	Run-off Coefficient for Reservoirs	0.9 unitless	ge Volume of Reservoirs w/ 2ft FB (1&2)	728.2 ac-ft	RMCC Contributing Watershed	15.0 acres	RMCC Demand	550 AFY	550 AFY					
Normalized I&I	61.74 mg/MGD/yr	Beginning Water Volume in Res.	65 ac-ft	Run-off Coefficient for WWRP	0.9 unitless	Proportion in Reservoir #1	0.81 %	Water Balance Max Volume	824.8 ac-ft	Run-off Coefficient	0.2 unitless	Van Vleck Ranch	295 AFY	0 AFY					
100-yr I/I Volume	75.5 mg			WWRP Pond Area Total	10.7 acres	Proportion in Reservoir #2	0.19 %					Residential Irrigation	265 AFY	265 AFY					
Average-yr I/I Volume	11.2 mg												1110	815					

100-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	21.5	21.2	26.0	23.9	21.1	26.8	23.9	22.5	20.8	21.1	21.0	20.1	270.00	1098.60
Wastewater Influent	ac-ft	65.9	64.9	79.8	73.4	64.6	82.1	73.4	69.2	63.9	64.9	64.6	61.8	828.60	761.7
100-YR I/I Estimate	ac-ft	18.4	18.2	22.3	20.5	18.1	23.0	20.5	19.4	17.9	18.2	18.1	17.3	231.84	1060.44
Average-YR I/I Estimate	ac-ft														298.69
Site Run-off	ac-ft	1.9	5.1	5.0	6.6	6.4	6.3	2.7	0.8	0.5	0.2	0.1	0.7	36.34	
Pond Precipitation (direct)	ac-ft	2.2	5.7	5.6	7.3	7.1	7.1	3.0	0.9	0.5	0.2	0.2	0.7	40.38	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	52.7	88.5	181.5	291.1	404.2	504.6	617.1	668.1	638.0	496.4	286.7	132.1	4361.02	
Reservoir # 1 Depth	ft	6.2	8.4	13.7	19.2	24.2	28.0	31.5	32.9	32.1	27.7	19.0	10.9	253.80	
Reservoir # 1 Surface Area	acre	18.8	19.5	21.3	23.2	24.9	26.2	27.4	27.9	27.6	26.1	23.2	20.4	286.66	
Reservoir #2 Vol	ac-ft	12.4	20.7	42.6	68.3	94.8	118.4	144.8	156.7	149.7	116.4	67.2	31.0	1022.95	
Reservoir # 2 Depth	ft	4.7	7.0	12.4	18.2	23.3	27.1	30.5	31.8	31.1	26.8	18.0	9.6	240.40	
Reservoir # 2 Surface Area	acre	3.4	3.7	4.5	5.3	6.0	6.5	7.0	7.2	7.1	6.5	5.3	4.1	66.70	
Total Water Surface Area	acre	22.2	23.3	25.8	28.5	30.9	32.8	34.4	35.1	34.7	32.6	28.4	24.5	353.36	
Contributing Water Shed Area	acre	17.8	16.7	14.2	11.5	9.1	7.2	5.6	4.9	5.3	7.4	11.6	15.5	126.64	
Reservoir Run-off	ac-ft	3.2	8.0	6.6	7.1	5.4	4.3	1.4	0.4	0.2	0.1	0.2	1.0	37.88	
Reservoir Precip (direct)	ac-ft	4.5	12.4	13.4	19.5	20.6	21.6	9.7	2.8	1.6	0.6	0.4	1.7	108.85	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-2.0	-1.6	-3.7	-7.1	-11.2	-17.7	-21.5	-22.7	-17.6	-11.4	-126.36	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.2	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.81	
Lake Precipitation (direct)	ac-ft	2.3	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	42.41	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
		218.8	211.8	218.8	218.8	199.4	218.8	211.8	218.8	211.8	218.8	218.8	211.8		
Disposal		-40.9	0.0	0.0	0.0	0.0	-1.5	-33.0	-102.6	-224.9	-305.3	-243.3	-158.5		
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-9.8	0.0	0.0	0.0	0.0	-0.4	-7.9	-24.5	-53.7	-72.9	-58.1	-37.8	-265.00	
Van Vleck Ranch Demand	ac-ft	-10.9	0.0	0.0	0.0	0.0	-0.4	-8.8	-27.3	-59.8	-81.1	-64.7	-42.1	-295.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	109.2	224.1	359.4	499.0	623.0	761.9	824.8	787.7	612.9	353.9	163.1	5383.97	
Change in Water Volume	ac-ft	44.2	114.9	135.3	139.7	124.0	138.9	62.9	-37.1	-174.8	-258.9	-190.8	-96.1	2.00	
Final Water Volume in Reservoirs	ac-ft	109.2	224.1	359.4	499.0	623.0	761.9	**824.8**	787.7	612.9	353.9	163.1	67	5385.97	

Average-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	21.5	21.2	26.0	23.9	21.1	26.8	23.9	22.5	20.8	21.1	21.0	20.1	270.00	
Wastewater Influent	ac-ft	65.9	64.9	79.8	73.4	64.6	82.1	73.4	69.2	63.9	64.9	64.6	61.8	828.60	
100-YR I/I Estimate	ac-ft														
Average-YR I/I Estimate	ac-ft	2.7	2.7	3.3	3.1	2.7	3.4	3.1	2.9	2.7	2.7	2.7	2.6	34.52	863.12
Site Run-off	ac-ft	1.1	2.8	2.7	3.6	3.5	3.5	1.5	0.4	0.2	0.1	0.1	0.4	19.75	
Pond Precipitation (direct)	ac-ft	1.2	3.1	3.0	4.0	3.9	3.8	1.6	0.5	0.3	0.1	0.1	0.4	21.94	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	54.3	79.3	148.3	231.2	315.2	388.6	471.4	509.6	487.4	382.0	226.3	112.1	3405.65	
Reservoir # 1 Depth	ft	6.3	7.8	11.8	16.3	20.4	23.6	26.8	28.2	27.4	23.3	16.0	9.8	217.57	
Reservoir # 1 Surface Area	acre	18.8	19.4	20.7	22.2	23.6	24.7	25.8	26.3	26.0	24.6	22.1	20.0	274.36	
Reservoir #2 Vol	ac-ft	12.7	18.6	34.8	54.2	73.9	91.2	110.6	119.5	114.3	89.6	53.1	26.3	798.86	
Reservoir # 2 Depth	ft	4.8	6.4	10.5	15.1	19.3	22.6	25.9	27.2	26.5	22.3	14.9	8.4	203.99	
Reservoir # 2 Surface Area	acre	3.4	3.7	4.2	4.9	5.5	5.9	6.4	6.6	6.5	5.9	4.8	3.9	61.61	
Total Water Surface Area	acre	22.3	23.0	25.0	27.1	29.1	30.6	32.2	32.8	32.5	30.5	27.0	24.0	335.97	
Contributing Water Shed Area	acre	17.7	17.0	15.0	12.9	10.9	9.4	7.8	7.2	7.5	9.5	13.0	16.0	144.03	
Reservoir Run-off	ac-ft	1.8	4.4	3.8	4.3	3.6	3.0	1.1	0.3	0.2	0.1	0.1	0.5	23.14	
Reservoir Precip (direct)	ac-ft	2.4	6.7	7.0	10.1	10.5	11.0	4.9	1.4	0.8	0.3	0.2	0.9	56.32	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-1.9	-1.6	-3.5	-6.6	-10.5	-16.6	-20.1	-21.2	-16.7	-11.2	-119.62	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.1	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.74	
Lake Precipitation (direct)	ac-ft	1.2	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	41.38	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Disposal															
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-9.8	0.0	0.0	0.0	0.0	-0.4	-7.9	-24.5	-53.7	-72.9	-58.1	-37.8	-265.00	-815.00
Van Vleck Ranch Demand	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	97.9	183.0	285.4	389.1	479.8	582.0	629.1	601.8	471.6	279.4	138.4	4202.50	
Change in Water Volume	ac-ft	32.9	85.2	102.3	103.7	90.7	102.2	47.1	-27.4	-130.2	-192.2	-141.0	-70.3	3.02	
Final Water Volume in Reservoirs	ac-ft	97.9	183.0	285.4	389.1	479.8	582.0	**629.1**	601.8	471.6	279.4	138.4	68.0	4205.52	

Rancho Murieta Community Services District
Water Balance - Buildout at Reduced 165 per Customer

100-YR Modifiers		**WWRP Influent Flows & Site Info**																		100	Ave
100-yr Return Ratio	1.84 unitless	Influent Flow- avg.	277.00 mg/yr	Pan Evaporation Coefficient	0.75 unitless	Reservoir Watershed Area	40 acres	Maximum Storage of Reservoirs (1&2)	859.9 ac-ft	RMCC Lake Water Surface Area	11.2 acres	**Demand Info**									
100-yr modifier - Pan Evaporation	0.8 unitless	ADWF (June-Sep)	0.70 mgd	WWRP Site Area	7.5 acres	Run-off Coefficient for Reservoirs	0.9 unitless	ge Volume of Reservoirs w/ 2ft FB (1&2)	728.2 ac-ft	RMCC Contributing Watershed	15.0 acres	RMCC Demand	550 AFY	550 AFY							
Normalized I&I	61.74 mg/MGD/yr	Beginning Water Volume in Res.	65 ac-ft	Run-off Coefficient for WWRP	0.9 unitless	Proportion in Reservoir #1	0.81 %	Water Balance Max Volume	837.3 ac-ft	Run-off Coefficient	0.2 unitless	Van Vleck Ranch	295 AFY	0 AFY							
100-yr I/I Volume	76.2 mg			WWRP Pond Area Total	10.7 acres	Proportion in Reservoir #2	0.19 %					Residential Irrigation	290 AFY	290 AFY							
Average-yr I/I Volume	11.2 mg												1135	840							

100-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	22.0	21.7	26.7	24.5	21.6	27.4	24.6	23.1	21.4	21.7	21.6	20.7	277.00	
Wastewater Influent	ac-ft	67.6	66.6	81.9	75.3	66.3	84.2	75.3	71.0	65.6	66.6	66.3	63.4	850.08	1083.96
100-YR I/I Estimate	ac-ft	18.6	18.3	22.5	20.7	18.2	23.2	20.7	19.5	18.0	18.3	18.2	17.4	233.87	
Average-YR I/I Estimate	ac-ft														
Site Run-off	ac-ft	1.9	5.1	5.0	6.6	6.4	6.3	2.7	0.8	0.5	0.2	0.1	0.7	36.34	
Pond Precipitation (direct)	ac-ft	2.2	5.7	5.6	7.3	7.1	7.1	3.0	0.9	0.5	0.2	0.2	0.7	40.38	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	52.7	89.2	183.8	295.2	410.0	511.9	626.2	678.2	647.8	503.6	289.7	132.2	4420.43	
Reservoir # 1 Depth	ft	6.2	8.4	13.8	19.4	24.5	28.3	31.8	33.1	32.4	28.0	19.2	10.9	255.80	
Reservoir # 1 Surface Area	acre	18.8	19.6	21.4	23.3	25.0	26.3	27.5	28.0	27.7	26.2	23.2	20.4	287.34	
Reservoir #2 Vol	ac-ft	12.4	20.9	43.1	69.2	96.2	120.1	146.9	159.1	152.0	118.1	67.9	31.0	1036.89	
Reservoir # 2 Depth	ft	4.7	7.0	12.6	18.4	23.5	27.3	30.8	32.1	31.3	27.0	18.1	9.6	242.39	
Reservoir # 2 Surface Area	acre	3.4	3.7	4.5	5.3	6.0	6.6	7.1	7.2	7.1	6.5	5.3	4.1	66.97	
Total Water Surface Area	acre	22.2	23.3	25.9	28.6	31.1	32.9	34.6	35.2	34.8	32.7	28.5	24.5	354.32	
Contributing Water Shed Area	acre	17.8	16.7	14.1	11.4	8.9	7.1	5.4	4.8	5.2	7.3	11.5	15.5	125.68	
Reservoir Run-off	ac-ft	3.2	8.0	6.6	7.0	5.4	4.2	1.4	0.3	0.2	0.1	0.2	1.0	37.60	
Reservoir Precip (direct)	ac-ft	4.5	12.4	13.5	19.6	20.7	21.7	9.8	2.8	1.7	0.6	0.4	1.7	109.17	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-2.0	-1.6	-3.7	-7.1	-11.3	-17.8	-21.6	-22.8	-17.7	-11.4	-126.71	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.2	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.81	
Lake Precipitation (direct)	ac-ft	2.3	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	42.41	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
		218.8	211.8	218.8	218.8	199.4	218.8	211.8	218.8	211.8	218.8	218.8	211.8		
Disposal		-41.8	0.0	0.0	0.0	0.0	-1.6	-33.8	-104.9	-230.0	-312.2	-248.8	-162.0		
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-10.7	0.0	0.0	0.0	0.0	-0.4	-8.6	-26.8	-58.8	-79.8	-63.6	-41.4	-290.00	
Van Vleck Ranch Demand	ac-ft	-10.9	0.0	0.0	0.0	0.0	-0.4	-8.8	-27.3	-59.8	-81.1	-64.7	-42.1	-295.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	110.2	226.9	364.4	506.2	632.0	773.1	837.3	799.8	621.7	357.6	163.2	5457.33	
Change in Water Volume	ac-ft	45.2	116.7	137.6	141.8	125.8	141.2	64.2	-37.5	-178.1	-264.1	-194.5	-98.0	0.19	
Final Water Volume in Reservoirs	ac-ft	110.2	226.9	364.4	506.2	632.0	773.1	**837.3**	799.8	621.7	357.6	163.2	65	5457.52	

Average-yr Level of Annual Precipitation

		October	November	December	January	February	March	April	May	June	July	August	September	Total	
Climate Inputs	**Units**														
Precipitation (Average)	in	1.32	3.47	3.39	4.46	4.34	4.30	1.84	0.52	0.31	0.11	0.10	0.45	24.61	
Precipitation (100-YR)	in	2.43	6.38	6.24	8.21	7.99	7.91	3.39	0.96	0.57	0.20	0.18	0.83	45.28	
Pan Evaporation	in	4.89	2.06	1.25	0.92	1.90	3.47	5.21	8.07	9.91	11.12	9.93	7.45	66.18	
Effective Lake Evaporation	in	3.67	1.55	0.94	0.69	1.43	2.60	3.91	6.05	7.43	8.34	7.45	5.59	49.64	
Lake Evap - 100- yr Effective	in	3.67	1.55	0.75	0.55	1.14	2.08	3.13	6.05	7.43	8.34	7.45	5.59	47.72	
Percolation	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RMCSD WWRP															
WW Influent - Monthly-Daily Flow	%	8%	8%	10%	9%	8%	10%	9%	8%	8%	8%	8%	7%	100%	
# Days in Month	days	31	30	31	31	28	31	30	31	30	31	31	30	365	
Wastewater Influent	MG	22.0	21.7	26.7	24.5	21.6	27.4	24.6	23.1	21.4	21.7	21.6	20.7	277.00	
Wastewater Influent	ac-ft	67.6	66.6	81.9	75.3	66.3	84.2	75.3	71.0	65.6	66.6	66.3	63.4	850.08	884.5976
100-YR I/I Estimate	ac-ft														
Average-YR I/I Estimate	ac-ft	2.7	2.7	3.3	3.1	2.7	3.4	3.1	2.9	2.7	2.7	2.7	2.6	34.52	
Site Run-off	ac-ft	1.1	2.8	2.7	3.6	3.5	3.5	1.5	0.4	0.2	0.1	0.1	0.4	19.75	
Pond Precipitation (direct)	ac-ft	1.2	3.1	3.0	4.0	3.9	3.8	1.6	0.5	0.3	0.1	0.1	0.4	21.94	
Pond Evaporation	ac-ft	-3.3	-1.4	-0.8	-0.6	-1.3	-2.3	-3.5	-5.4	-6.6	-7.4	-6.6	-5.0	-44.26	
RMCSD Secondary Storage Reservoirs															
Reservoir # 1 Vol	ac-ft	52.8	79.9	150.3	234.9	320.4	395.2	479.7	518.8	496.1	387.8	227.9	110.5	3454.28	
Reservoir # 1 Depth	ft	6.2	7.8	11.9	16.5	20.6	23.8	27.1	28.5	27.7	23.5	16.1	9.7	219.49	
Reservoir # 1 Surface Area	acre	18.8	19.4	20.8	22.3	23.7	24.8	25.9	26.4	26.1	24.7	22.2	20.0	275.01	
Reservoir #2 Vol	ac-ft	12.4	18.7	35.3	55.1	75.2	92.7	112.5	121.7	116.4	91.0	53.4	25.9	810.26	
Reservoir # 2 Depth	ft	4.7	6.4	10.7	15.3	19.6	22.9	26.2	27.5	26.8	22.6	15.0	8.3	205.93	
Reservoir # 2 Surface Area	acre	3.4	3.7	4.3	4.9	5.5	6.0	6.4	6.6	6.5	5.9	4.9	3.9	61.88	
Total Water Surface Area	acre	22.2	23.0	25.0	27.2	29.2	30.8	32.3	33.0	32.6	30.6	27.0	23.9	336.89	
Contributing Water Shed Area	acre	17.8	17.0	15.0	12.8	10.8	9.2	7.7	7.0	7.4	9.4	13.0	16.1	143.11	
Reservoir Run-off	ac-ft	1.8	4.4	3.8	4.3	3.5	3.0	1.1	0.3	0.2	0.1	0.1	0.5	22.99	
Reservoir Precip (direct)	ac-ft	2.4	6.7	7.1	10.1	10.6	11.0	5.0	1.4	0.8	0.3	0.2	0.9	56.49	
Reservoir Evaporation	ac-ft	-6.8	-3.0	-2.0	-1.6	-3.5	-6.7	-10.5	-16.6	-20.2	-21.3	-16.8	-11.1	-119.96	
RMCC Irrigation Lakes															
Lake Water Shed Run-off	ac-ft	0.1	0.4	0.4	0.5	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.1	2.74	
Lake Precipitation (direct)	ac-ft	1.2	6.0	5.8	7.7	7.5	7.4	3.2	0.9	0.5	0.2	0.2	0.8	41.38	
Irrig. Lake Evaporation	ac-ft	-3.4	-1.4	-0.9	-0.6	-1.3	-2.4	-3.7	-5.7	-7.0	-7.8	-7.0	-5.2	-46.49	
Supplemental Water															
Supplemental Water	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Disposal															
RMCC Golf Course Demand	ac-ft	-20.3	0.0	0.0	0.0	0.0	-0.8	-16.4	-50.8	-111.4	-151.3	-120.5	-78.5	-550.00	
Residential Irrigation	ac-ft	-10.7	0.0	0.0	0.0	0.0	-0.4	-8.6	-26.8	-58.8	-79.8	-63.6	-41.4	-290.00	
Van Vleck Ranch Demand	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	
Effluent Storage															
Beginning Water Volume in Res.	ac-ft	65	98.7	185.5	289.9	395.6	487.9	592.2	640.4	612.5	478.8	281.3	136.5	4264.35	
Change in Water Volume	ac-ft	33.7	86.9	104.4	105.6	92.3	104.3	48.3	-27.9	-133.7	-197.5	-144.9	-72.3	-0.82	
Final Water Volume in Reservoirs	ac-ft	98.7	185.5	289.9	395.6	487.9	592.2	**640.4**	612.5	478.8	281.3	136.5	64.2	4263.52	

Rancho Murieta
Community Services District

Stonehouse 12-inch Sewer Forcemain Condition Assessment

Kennedy/Jenks Consultants

June 2017

Stonehouse 12-inch Sewer Forcemain Condition Assessment

June 2017

06/30/2017

Prepared under the responsible charge of:

Kevin Kennedy
Registration No. C61206

Kennedy/Jenks Consultants
10850 Gold Center Drive, Suite 350
Rancho Cordova, California 95670

Table of Contents

List of Tables

List of Figures

Appendix

Executive Summary

The objective of this condition assessment is to analyze the existing Stonehouse 12-inch sewer forcemain, which runs from Murieta Drive to Stonehouse Park, and identify the most cost effective way it can be leveraged to convey recycled water to the Stonehouse and Escuela Parks and Residences of Murieta Hills. Historical information and records were reviewed along with recycled water quality analysis, projected operational parameters and other information provided by the Rancho Murieta Community Services District (District).

A risk assessment was conducted to determine the appropriate level of condition assessment to conduct. Assessment results place the Stonehouse 12-inch sewer forcemain in the High Risk Level, which results in recommending a proactive and detailed assessment, including systematic pipe testing. The high risk level assignment was due to the recycled water being considered highly aggressive. Even though the Stonehouse 12-inch sewer forcemain has not been put into service, and has not conveyed recycled water, Phenolphthalein dye test, Shore D and other tests indicate significant wear and reduced useful life. The estimated remaining useful life of the Stonehouse 12-inch sewer forcemain is about 19 years based on specific and assumed service conditions as compared to about 50 to 70 years for a new asbestos cement (AC) forcemain.

A comparison of potential corrosion management alternatives indicated that chemical addition (pH and/or alkalinity addition) is the lowest cost alternative and is thus recommended. Other alternatives considered included non-structural liners and/or forcemain replacement. Results and recommendations described in this report will be incorporated into the District's Recycled Water Program Preliminary Design Report (Final, anticipated June 2017).

THIS PAGE INTENTIONALLY BLANK

Section 1: Introduction and Purpose

Recent developer-submitted sewer studies for The Retreats, Murieta Gardens and Rancho Murieta North, coupled with development timelines described in the Board of Director's approved Water Supply Assessment Technical Memorandum (RMCSD, 2016d), indicate that the Rancho Murieta Community Services District's (District's) recycled water disposal capacity is projected to be exceeded in 2019. In accordance with the District's Recycled Water Standards (RMCSD, 2013), beneficial reuse of recycled water via irrigation at Stonehouse and Escuela Parks, The Retreats, Murieta Gardens, the Residences of Murieta Hills and other future developments are required to accommodate projected future wastewater flows associated with proposed future development within Rancho Murieta.

The key objective of this effort is to conduct a sufficient level of condition assessment of the Stonehouse 12-inch sewer forcemain to determine the most cost effective way to use this asset to convey recycled water to specific recycled water use areas in the near future. Preliminary cost estimates indicate construction and program costs associated with the installation of a new 12-inch diameter pipeline, similar to the Stonehouse 12-inch sewer forcemain and Highway 16 undercrossing, is expected to be about $1.7 and 2.3 million, respectively. Costs associated with delivery of recycled water to Stonehouse and Escuela Parks and North Main Gate Entrance could be significantly reduced if the Stonehouse 12-inch sewer forcemain condition assessment finds that it is capable of conveying recycled water and has significant remaining useable life. Results and recommendations described in this report will be incorporated into the District's final Recycled Water Program Preliminary Design Report (PDR) which is anticipated to be completed in July 2017.

THIS PAGE INTENTIONALLY BLANK

Section 2: Initial Assessment

2.1: Existing Conditions

Historical information and record drawings provided by the District were reviewed. Key data pertaining to the Stonehouse 12-inch sewer forcemain are summarized below[1]:

- ***Age, Material, Pressure Class, and Standard -*** Installed in 1973 and estimated to be about 43 years old. Material and pressure class were obtained from record drawings, which indicate the forcemain is pressure Class 150, Type II Asbestos Cement (AC) Pipe conforming to ASTM C-296 Standard.
- ***Operating Conditions –*** Operated from date of installation through 1982 and then abandoned in place.
- ***Operating Requirements*** – see hydraulic model described later in this section. Model was revised[2] to support this condition assessment and has been used to estimate future pressure and flow requirements necessary to satisfy future Buildout demands.
- ***Maintenance History*** - There are no known repairs on this forcemain or records besides the record drawings.
- ***Plans*** - The following information helped to define the parameters by which the analysis was performed:
  - Murieta Drive Sewer Lift Station and Force Main Plan Set (RMCSD, 1973)
  - North Golf Course Irrigation System Map (RMCSD, 2016c)
  - El Dorado Irrigation District (EID) plans for sewer force main along Stonehouse Road (RMCSD, 1980)
  - District Service Area Map (RMCSD, 2016b)
  - RMCSD Service Area Buildout Map (RMCSD, 2016a)

2.2: Surrounding Soils Parameters

Soil aggressiveness is measured in terms of pH and corrosivity. Aggressive soils (pH ≤ 5.5) can cause leaching of the Portland cement from the pipe exterior, and deterioration of AC pipes. California Laboratory Services (CLS) conducted laboratory testing of the soils adjacent to the Stonehouse 12-inch sewer forcemain. Data obtained from the tests was used to establish the risk of chemical attack that can lead to leaching of calcium from the pipes outer walls. The preliminary risk analysis can be found in Table 1 (presented in Section 3).

Laboratory test results from soil samples taken by the District on December 16, 2016 indicate that soil adjacent to the Stonehouse 12-inch sewer forcemain has a pH of approximately 5.9 standard units and a specific conductance of 12 µmhos/cm. It rained on December 15, 2016, which could have impacted the laboratory results. Moisture content is the largest contributing factor in soil corrosivity, as water is the conductor to mobilize sulfides and sulfates in the soil. Corrosion (degeneration of pipe wall) does not occur if the soil is completely dry (Arbabi, 2017). The laboratory report is included in the Appendix for reference.

[1] Analysis of the key data is presented in the following section

[2] K/J's scope was limited to review, however, K/J had to significantly modify the hydraulic model at their expense to describe Buildout conditions.

2.3: Recycled Water Quality Analyses and Assumed Operation

Another potential corrosion factor affecting AC pipe is water quality, specifically its aggressiveness. All aggressive water will leach mortar from the pipe wall. Water aggressiveness can be measured in terms of the Langelier Index (LI) or the aggressive index (AI). Waters with a LI of less than -2.0 or an AI of less than 10.0 are considered highly aggressive. Both indices are used to indicate the degree of saturation of calcium carbonate in water. For this application, indices represent the District's recycled water's ability to dissolve or deposit calcium carbonate from existing concrete structures (including mortar from AC pipe), and are often used as an indicator of corrosivity. Calcium carbonate can be calculated using pH, alkalinity and calcium concentration. Recycled water quality testing was performed by CLS; results are included in Table 1 (presented in Section 3). Recycled water quality results are also part of the analysis used to estimate remaining useful life calculations described in Section 4.

The District sent a recycled water sample to CLS on September 2, 2016. Results indicate elevated levels of bicarbonate and a resulting LI value of -2.41. The quality of the District's recycled water is considered highly aggressive. The laboratory report is included in the Appendix for reference.

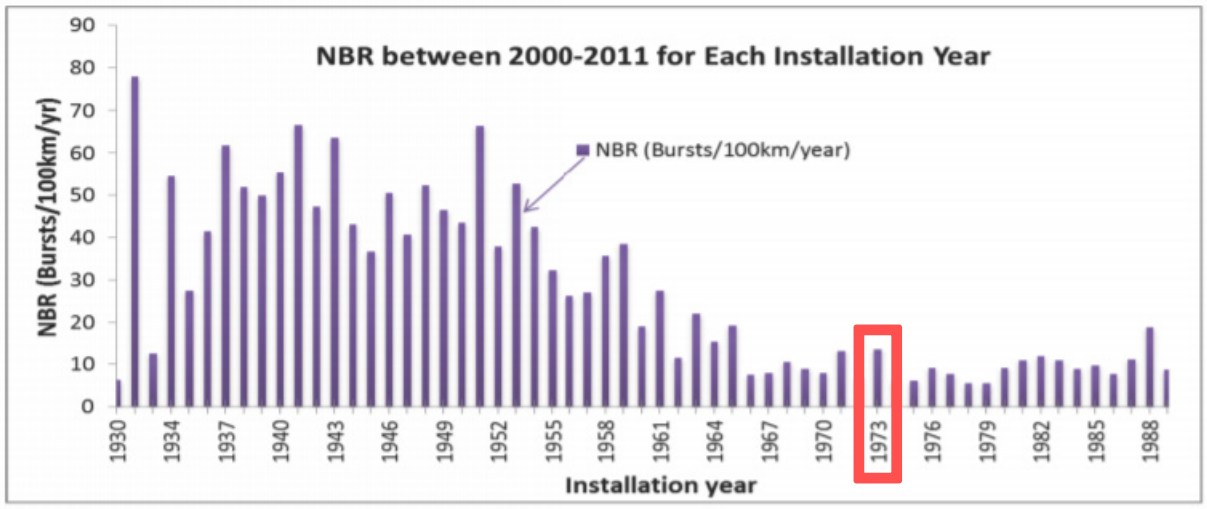
The Stonehouse 12-inch sewer forcemain has never been used to convey recycled water and is currently not in operation. When, and if it is used to convey recycled water, it will be subjected to the recycled water quality at that time. Analysis results in Table 1 and Table 2 and useful life estimations (described later in this report) assume that recycled water is being conveyed through the Stonehouse 12-inch sewer forcemain. It is understood and recognized that this situation does not reflect existing conditions. However, if the analysis was to assume existing conditions (no flow), the results and useful life estimations would become out date and require modification when recycled water was first conveyed through the pipeline.

2.4: Operational Parameters

To help define conditions of both external and internal physical impacts , which create degradative conditions that could affect the useful structural life of the Stonehouse 12-inch sewer forcemain, this section considers items associated with pipe age, traffic loading, pressure and water surge and thrust. Based on historical data and record drawings, the known risks which could be assigned to the pipe are pipe age and traffic loads at specific, limited locations (i.e., Highway 16). Analysis of these items will help further define potential rehabilitation methods.

2.4.1: Age

The pipe was constructed in 1973. Increased age, in general, has a direct correlation with AC pipe failure, and therefore should be taken into account as a relevant consideration. A normalized burst rate (NBR) has been observed in the industry with increased pipe age. Figure 1 illustrates the State of Washington's NBR per pipe installation year (D. Wang, 2012). As shown, AC pipes over 50 years of age show significant increase in failure rate partially due to age and partially due to a lower standard of care during manufacturing. The Stonehouse 12-inch sewer forcemain is estimated to be 43 years old.



(Wang, 2012)

Figure 1. *Normalized Burst Rate*

2.4.2: Traffic Loads

The Stonehouse 12-inch sewer forcemain is located within a 24-inch steel casing, a minimum of 3.5 to 5.5 ft. below Highway 16. Traffic loads can be problematic for pipes buried beneath roadway surfaces, depending on several factors. Water mains buried less than 4.5 feet below the surface of a road with high volumes of traffic and heavy trucks can have a significantly increased likelihood of failure (Y.Hu, 2013). The majority of the Stonehouse 12-inch sewer forcemain is not located beneath roadways; rather it is located along undeveloped lands located between Stonehouse Road and existing homes. However, as indicated in Figure 2, there is an existing undercrossing beneath Highway 16 (Jackson Highway). The initial risk assessment has determined that because the existing pipe crosses beneath a busy thoroughfare with moderate to heavy traffic volume, the risk category rating for this item is considered moderate.

2.4.3: Surge and Thrust

Other risks involve the design, construction and operation of the Stonehouse 12-inch sewer forcemain and the associated pumping surge and thrust forces created during operations. These risks can be mitigated through proper design and analysis through the application of soft start pumping systems and surge protection valves or tanks. It has been assumed that these and other current best practices will be applied during the design process to mitigate surge or thrust impacts, therefore this risk factor has been deemed moderate until system has been in operation and proven to be low.

2.5: Hydraulic Modeling Results

A hydraulic model of the proposed Buildout recycled water system (which includes the Stonehouse 12-inch sewer forcemain) was created using the Bentley WaterGEMS v8i platform. The model can operate as a stand-alone application or from within ArcGIS, AutoCAD and MicroStation. Figure 2 and Figure 3 show the proposed configuration of the Buildout recycled water system, as well as the location of the Stonehouse 12-inch sewer forcemain location relative to other components of the proposed recycled water system. Figures 2 and 3 reflect Buildout conditions and an 8-hour urban irrigation period.

The model was created to estimate hydraulic gradelines and operating pressures for Buildout conditions and is not configured to reflect Phase 1 (see Figures 2 and 3) conditions. Estimated operating pressures to satisfy projected urban (non-golf course) recycled water demands are shown in Figure 2. Estimated lengths of pipe between nodes as estimated by the hydraulic model are shown in Figure 3.

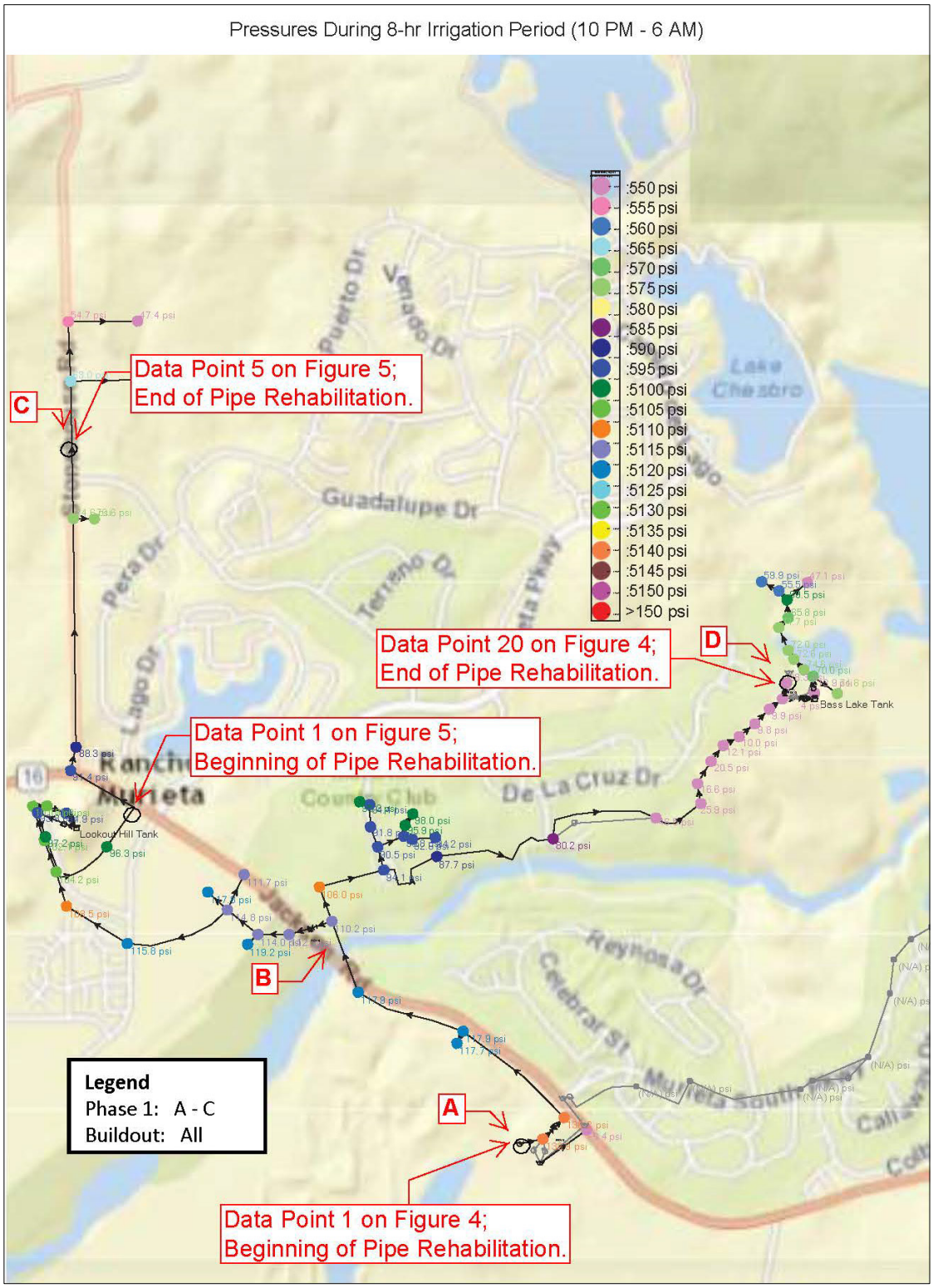


Figure 2. *Proposed Buildout Recycled Water System and Estimated Pressures*

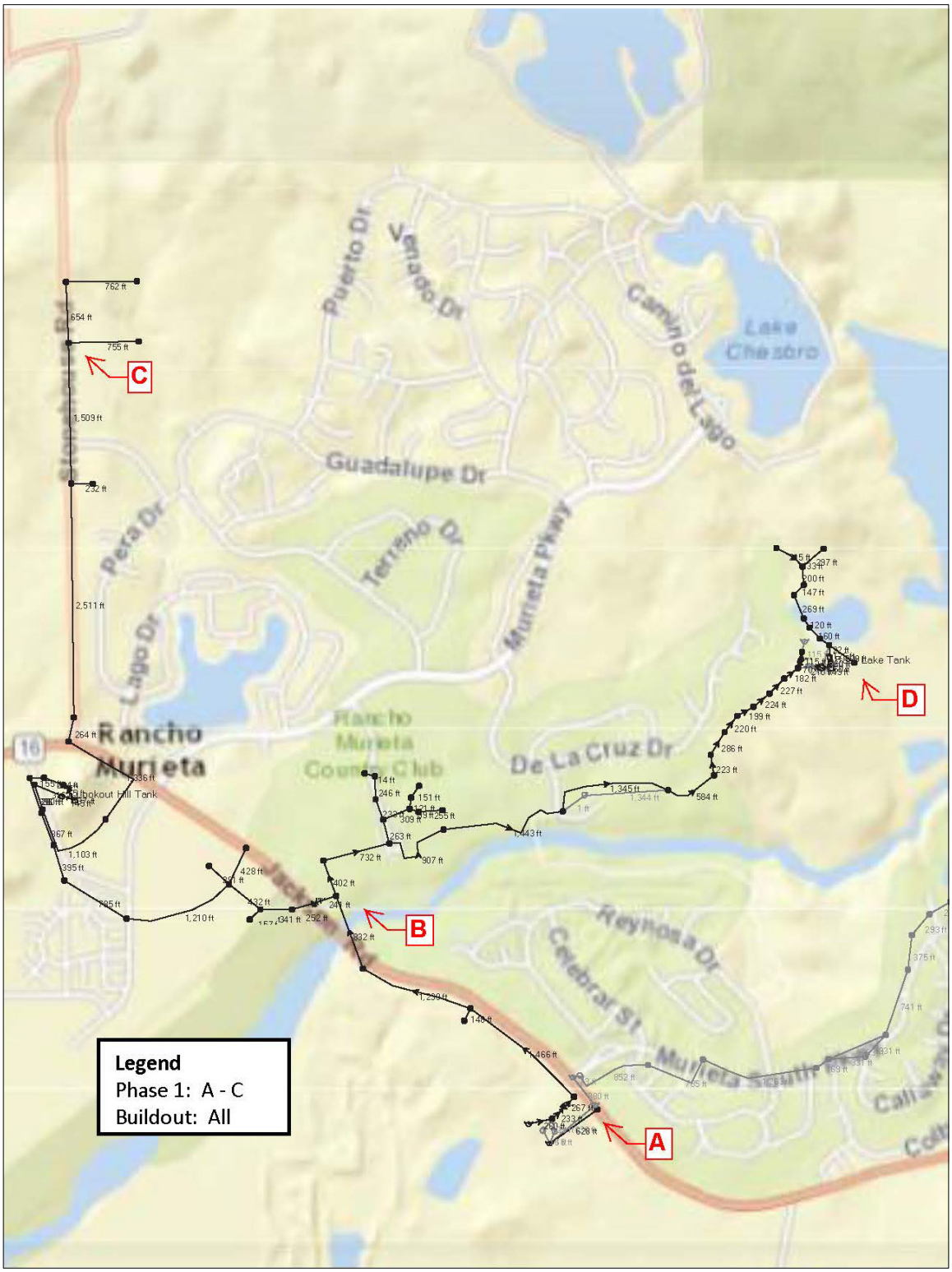


Figure 3. *Estimated Pipeline Lengths between Nodes*

Section 3: Preliminary Risk Assessment

For the purposes of this assessment, risk has been defined as the product of the probability of an event occurring multiplied by the consequence of that event. A preliminary risk assessment was conducted to determine the appropriate level of condition assessment to conduct.

AC pipes can deteriorate from a variety of physical, operational and environmental factors. Physical factors include material, thickness and age; operational factors include pressure, flow, maintenance and conveyed water quality; and environmental factors include surrounding soil, traffic loads and groundwater and conveyed fluid quality. The criteria and scoring system used to perform the preliminary risk assessment for the Stonehouse 12-inch sewer forcemain were developed using the Guidance Manual for Managing Long Term Performance of Asbestos Cement Pipe (Y.Hu, 2013). Preliminary risk assessment results and assigned scores are shown in red font in Table 1 and Table 2.

Table 1. *Stonehouse 12-inch Sewer Forcemain Risk Assessment Worksheet*

	A		B		C		D		E	F		G
1	**Risks**		**Contribution to deterioration or pipe loading**							**Weighted Score**		**Notes**
			Low (0.2)		**Moderate (0.5)**		**High (0.8)**		**Weight**			
2	Type 1 AC pipe?		No ✓	0.2			Yes		0.5	0.1		As Builts
3	Pipe age		< 40		≥ 40, < 60 ✓	0.5	≥ 60		0.8	0.4		43 years
4	Soil pH or wetlands or contaminated soil		pH > 6.3		5.5 < pH ≤ 6.3 ✓	0.5	pH ≤ 5.5		0.8	0.4		Lab Results
			No ✓				Yes					
5	Soil sulfate (in mg/L) with soil pH ≥ 7		< 1000		≥ 1000, < 5000		≤ 5000		0.4	NA		Lab Results
6	Conveyed water quality	$CaCO_3$ Concentration*	LI > 0		-2.0 ≤ LI ≤ 0		LI < -2.0 ✓	0.8	1	0.8		-2.41
7			AI > 12		10 < AI < 12		AI < 10 ✓	0.8				9.18
8		Hardness* (mg/L)					< 100 ✓	0.8				40
9		Alkalinity* (mg/L)					< 60 ✓	0.8				6
10	Traffic loading	DoB** < 1.5m	Light traffic ✓	0.2	Heavy trucks		High volumes		0.2	0.04		
11		DoB** ≥ 1.5m	Light traffic ✓	0.2	High volumes		High volume, heavy trucks		0.2	0.04		
12	Frost penetration		Frost depth/ DoB < 0.5 ✓	0.2	0.5 ≤ frost depth/DoB <1		History of frozen pipes		0.2	0.04		
13	Working pressures*		Balanced		Moderate differences ✓	0.5	Large differences		0.5	0.25		(Est.) Model
14	Pressure fluctuations*		Few, slight		Some, moderate ✓	0.5	Many, severe		1	0.5		(Est.) Model
15	Softening of external pipe wall in any AC pipe		No				Yes ✓	0.8	0.8	0.64		Lab Results
16	Network failure rate Breaks/100 km/Year		< 4 ✓	0.2	4 ≤ rate < 10		≥ 10		1	0.20		Assumed Unavailable
☐ - Assumed / Est. ☐ - Tested / Measured							17	Total Score		3.41		

Table 2. *Risk Assessment Score Sheet*

Total Score	Risk Profile	Recommended Action Plan
0 to 3	Low	No immediate action required, reevaluate in 5 years
3 to 5 or any contributions in the High column by factors with a weight of 0.4 or 0.5	Moderate	More frequently monitoring, including opportunistic pipe testing
5 to 6 **or any contributions in the High column that are multiplied by factors with a Weight of 0.8 or 1**	High	**Proactive and detailed assessment, including systematic pipe testing**

To multiply the probability of risk by the consequence of the event, a risk scoring system was used. To use the risk scoring system:

- Risks (column A) are assigned a level of probability; either high, moderate or low (columns B, C or D, respectively) based on risks listed.
- Each level of probable risk is assigned a value: high = 0.8, moderate = 0.5, and low = 0.2.
    - A pipe age of 43 years (row 3, column C) scores 0.5 for moderate risk.
- The score for probability of risk is multiplied by the assigned weight (magnitude of consequence) for that risk.
    - For a pipe of 43 years, moderate risk [column C] = 0.5, and weight (row 3, column E) = 0.8. The weighted score [row 3, column F] = 0.5 X 0.8 = 0.4
- Individual weighted scores (column F) are summed to find the total score = 3.41 (row 17, column F).

For some risks there is more than one consideration. Row 4 for example considers soil pH, wetlands and contaminated soil; rows 6, 7, 8, and 9 consider conveyed water quality; and rows 10 and 11 consider traffic loading. Although multiple factors are considered, the weighted score is calculated one time using the highest score. For example, conveyed water quality can be measured 4 different ways (Rows 6, 7, 8, and 9); however, only a single score, representing a relatively high level of probable risk, 0.8, is applied to the total score.

Once all weighted scores are calculated and summed, the total score is used to find the risk profile and recommended action plan using Table 2. The preliminary risk assessment results indicate a total score in the range between 3 and 4 (i.e., 3.41). As indicated in Table 2, scores for conveyed water quality (Row 6-9) govern the recommended action plan and the preliminary risk assessment places the existing Stonehouse 12-inch sewer forcemain into the high risk profile and recommends a proactive and detailed assessment, including systematic pipe testing.

3.1: Recommended Assessment Plan

Preliminary risk assessment results indicate that the Stonehouse 12-inch sewer forcemain falls within the moderate range of 'Likelihood of Failure' based solely upon the risk assessment worksheet weighted score. However, because of the aggressive recycled water quality (Table 1, rows 6, 7, 8 and 9), and resulting high weighted score specific to water quality as indicated in Table 2, the Stonehouse 12-inch sewer forcemain is elevated into the high range of 'Likelihood of Failure'. Therefore, the recommended action plan is for a "Proactive and detailed assessment of the pipe", which coincides with the pipeline rehabilitation plan currently underway.

Section 4: Stonehouse 12-inch Sewer Forcemain Condition Assessment

The District conducted field work to gather information directly from the Stonehouse 12-inch sewer forcemain and the surrounding soils through sampling, physical inspection, and/or cutting a segment from the Stonehouse 12-inch sewer forcemain. Three cut segments were sent to a laboratory for mechanical and chemical testing (two from the forcemain along Jackson Highway and one from the forcemain going to Stonehouse Road). Information and data gathered from the field, and test results received from the lab were analyzed to provide remaining useful life calculations and develop rehabilitation recommendations.

4.1: Hydrostatic Pressure Testing[3]

Hydrostatic pressure testing typically involves filling and applying a predetermined amount of water pressure to the Stonehouse forcemain to help define pressure capacity and identify potential leak locations (if present). It has been reported that testing included cutting into the Stonehouse forcemain (near its northern end along Stonehouse Road) and obtaining a segment (sample), sealing and capping the Stonehouse forcemain and installing fill and drain ports at the ends. The District was asked to locate air release valves along the forcemain and verify their operational condition.

Review of the Buildout hydraulic model (see Figure 2 results) indicated that the projected operating pressure at the lowest point of the existing Stonehouse 12-inch sewer forcemain (where the highest pipeline pressure was expected to occur) was about 95 psi. AWWA C600 guidelines recommend testing at a minimum of 1.25 times the operating pressure and monitoring and holding this pressure for 2 hours (minimum). Actual hydrostatic pressure measured at the lowest pipeline elevation was 160 psi or 1.68 times the anticipated operating pressure. This pressure was held for 2 hours; only a 2 psi decrease was measured during the 2 hours. A pressure measurement of 124 psi was also recorded in the forcemain during testing along Stonehouse Drive near its highest elevation. This test was deemed a passing pressure test.

AWWA C600 guidelines were followed for pressure testing of the Stonehouse 12-inch sewer forcemain. To prepare for the test, District staff located, exposed, cut, and capped the bottom and top portions of the Stonehouse forcemain, where future connections would assume to be near. The top section is at approximately half way up the east side of Stonehouse Park and the bottom section on the west side of the Laguna Joaquin drainage ditch below Lookout Hill. The bottom and top of the pipeline caps were installed with ports for filling and air relief, gauges for pressure monitoring, and then set with a sand slurry concrete mix to hold them in place but allow for future removal. An air relief valve along this run of pipe was found to not be operating properly and was then isolated via an existing valve for the pressure testing. After District staff performed cursory low pressure testing of the pipe and found it to hold pressure they brought in contractor JD Pasquetti.

[3] Information provided by District.

Photo of Stonehouse 12-inch sewer forcemain pipeline

Photo of pressurization of line for integrity test

4.2: Pipe Material Testing

The District sent three samples of the Stonehouse 12-inch sewer forcemain to MEIC-Charlton, Inc. for laboratory testing. Phenolphthalein dye, scratch and hardness tests were performed to determine the AC pipe's physical and chemical properties. Copies of laboratory sampling results are attached in the Appendix.

4.2.1: Phenolphthalein Dye Testing

Phenolphthalein dye testing is a chemical analysis process in which a pH indicator (dye) is applied over the thickness of a pipe wall to estimate remaining structural thickness. Aggressive water[4] causes calcium to leach out of cement, resulting in softness of the AC pipe walls. The Phenolphthalein dye test indicates pH, turning pink if the cement remains basic (pH>7). The pink indicates the presence of calcium, and the thickness of pink is measured and used to estimate the remaining structural thickness of the AC pipe.

The three pipe pieces sent from the District to the laboratory were stained using Phenolphthalein dye. Results are generally consistent between all three samples. Figure 4 is a picture of a sample after it has been dyed with phenolphthalein. Of the original 1-inch wall thickness, approximately 0.5-inch of structural thickness remains (50%). White areas show the loss of alkalinity from the AC pipe structure. Additional pictures are included in the Appendix for reference.

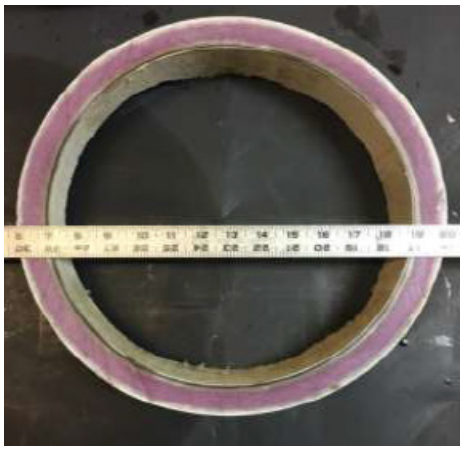


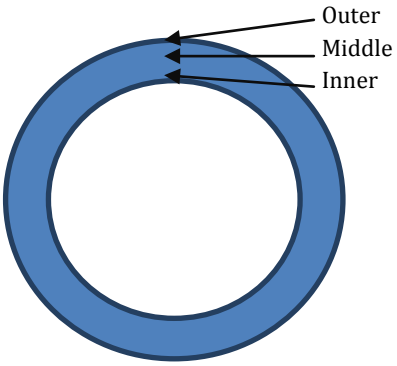
Figure 4. *Phenolphthalein Dye Test Results*

4.2.2: Shore Durometer

The Shore Durometer (Shore D) is an instrument that uses pressure to measure hardness. The instrument is firmly pressed against the AC pipe and the gauge uses a spring-loaded needle to measure resistance. Shore D results range from 0 to 100, 100 being the hardest. A typical Shore D measurement for a new (unused) Type II AC pipe is approximately 90 (EPA, 1985).

For each of the 3 samples, hardness was measured in Shore D units at 6 locations along the length of the wall at the:

- outside pipe surface;
- inside pipe surface; and



across the thickness of the wall at the:

- inner side;
- middle; and
- outer side.

[4]Aggressive Risk (AI) < 10 (AI is calculated from water pH, Alkalinity (mg/L$CaCo_3$) and Hardness (mg/L $CaCo_3$) with the formula AI = pH + Alkalinity + Hardness).

Shore D tests results measured across the thickness of each of the three samples are summarized in Table 3. The remaining Shore D test results and pictures are attached to the Appendix for reference.

Table 3. *Pipe Hardness Measurements in Shore D across the Thickness of the Pipe Wall*

	Sample 1			**Sample 2**			**Sample 3**		
Location	Inner	Middle	Outer	Inner	Middle	Outer	Inner	Middle	Outer
1	52	89	65	50	88	68	62	89	71
2	60	90	68	51	89	71	62	88	72
3	58	88	70	46	90	71	63	90	80
4	61	88	71	51	91	70	61	88	68
5	63	91	68	52	88	72	61	90	70
6	61	88	78	48	90	70	60	90	70
Average	59	89	70	50	89	70	62	89	72

The inner wall of the pipe showed lower hardness values as compared to the outer wall in all three cases. The middle wall showed higher hardness than either the inner or the outer wall in all three cases. The inner, outer, and middle wall hardness was consistent between the three samples.

4.2.3: Scratch Test

A scratch test was performed by using a small splinter cut out of a hard plastic piece that was 1/8 inch thick and 4 inch long. The tip of the piece was tapered into a needle shape. The plastic needle tip was firmly placed on the surface to be tested and slowly moved in a straight line (at an angle of 45-75 degree) under constant pressure during the travel. Resistance to the motion was assessed as soft, medium and hard. Scratch tests on the outer surface of the sample revealed medium to hard scratch in all three cases. Inner surface of the pipe pieces was found to be softer than the outer surface.

Section 5: Stonehouse 12-inch Sewer Forcemain Useful Life Estimation

5.1: Remaining Useful Life Estimation

The remaining useful life (RUL) is an opinion of the estimated number of years the Stonehouse 12-inch sewer forcemain will continue to operate without failing under the anticipated service conditions. The method used to determine the RUL is based on concepts developed by the United States Environmental Protection Agency (USEPA), and follows a 6-step approach:

1) Determine Asset Age
2) Identify Base Effective Life
3) Determine Adjusted Effective Life
4) Determine Effective Remaining Life
5) Identify Residual Life Factor
6) Calculated Remaining Useful Life

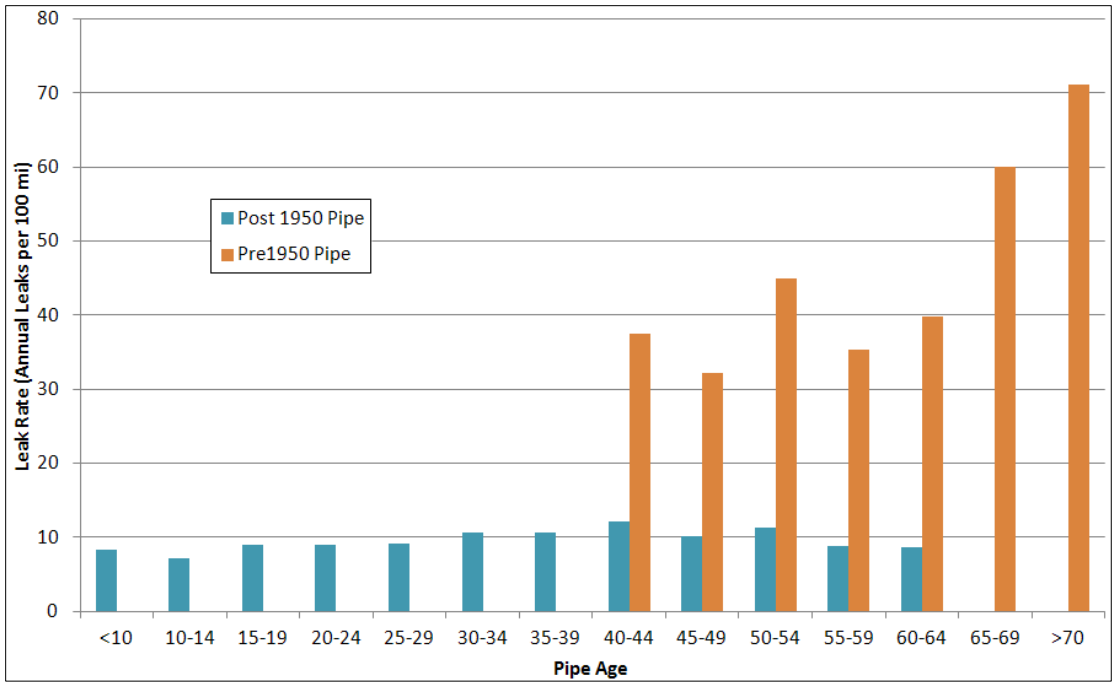
Step 1. Determine Asset Age: The Stonehouse 12-inch sewer forcemain was constructed in 1973; the age of the asset (Step 1) is approximately 43 years.

Step 2. Identify Base Effective Life: The Chrysotile Institute (chrysotile asbestos fibres are added to Portland cement to construct AC pipes) estimates the base effective life (Step 2) of an AC pipe to be 70 years (Exponent, 2016).

Step 3. Determine Adjusted Effective Life: The adjusted effective life is equal to the base effective life multiplied by an adjustment factor (0.8 to 1.4). The adjustment factor increases/decreases according to (a) the design standards in place at the time of construction, (b) apparent quality of construction or (c) installation and general operational environment.

a) Design Standards : Pressure Class 150, Type II Asbestos Cement (AC) Pipe conforming to ASTM C-296 Standard.

ASTM Standard C-296 was originally approved in 1952, prior to the construction of the Stonehouse 12-inch sewer forcemain. The current version was reapproved in 2009. The standard covers asbestos-cement pipes used to carry water or sewage under pressure and addresses: material, manufacture, seals, hydrostatic strength, flexural strength, crushing strength, chemical requirements, sampling, sizes and dimensions, workmanship and finish, marking and shipping, and inspection and rejection. Figure 5 is from a study conducted by East Bay Mud Utilities District (EBMUD, 2013). Design standards changed around 1950, and the leak rate significantly decreased. The adjustment factor for 3(a), determine adjusted effective life, is 1.4.



Source: EBMUD, 2013

Figure 5. *Leak Rates Pre and Post 1950 AC Design Standard Change*

b) Laboratory results indicate uniform shape, hardness, and structural integrity.

The Stonehouse 12-inch sewer forcemain appears to be in good condition. Structural thickness and hardness are uniform across the three samples. However, there have been no recent improvements to the forcemain, and data is limited to existing conditions (there is no historical evidence to illustrate trends in performance/condition). The adjustment factor for 3(b) is 1.0.

c) The general operational environment is poor. The surrounding soil and conveyed water quality (future) have a low pH, which is aggressive and causes cement to corrode.

The operational environment is considered poor because of the surrounding soil and the quality of water to be conveyed in the future. Laboratory results indicate the soil has a pH of 5.91, and a pH of less than 5.5 is considered aggressive. It rained the day before the samples were collected, which may have decreased the pH, however cement leaching from the outside of the pipe as indicated in Figure 4 is a good indication of the corrosivity of the surrounding soils. The adjustment factor for 3(c) is (0.8).

The arithmetic average of the adjustment factors for (a = 1.4), (b = 1.0) and (c = 0.8) is equal to 1.1. Therefore, the adjusted effective life is = 70 × (1.1) = 77.

Step 4. Determine Effective Remaining Life: The effective remaining life is equal to the adjusted effective life minus the pipe age. The effective remaining life is = 77 – 43 = 34.

Step 5. Identify Residual Life Factor: The residual life factor is a grading system ranging from very good to very poor. Laboratory test results and data collected in the field were used to determine the residual life factor. The pipe was assigned a grade for structural integrity and a grade for environment. Considering the consistency and thickness of structural soundness and the relative

hardness of the pipe, the pipe was given a score of good for structural integrity. This is considered conservative; testing more frequently, in terms of both space and time, could improve the grade for structural integrity. Considering the aggressive quality of conveyed water and the soil surrounding the pipe, the pipe was given a score of poor for environment.

Table 4. *Residual Life Factor - Estimated Useful Life*

	Very Good 1.0	**Good 0.77**	**Fair 0.55**	**Poor 0.33**	**Very Poor 0.10**
Structural Integrity: • Hydrostatic Pressure Test • Phenolphthlalein Dye Test • Hardness Test		0.77			
Environment: • Surrounding Soils • Conveyed Water Quality				0.33	

The arithmetic average of the residual life factors is = 0.55.

Step 6. Calculate Estimated Remaining Useful Life: The estimated remaining useful life is equal to the effective remaining life multiplied by the residual life factor. The estimated remaining useful life is = 34 × 0.55 = 18.7.

Estimated Remaining Useful Life: 18.7 years.

THIS PAGE INTENTIONALLY BLANK

Section 6: Stonehouse 12-inch Sewer Forcemain Rehabilitation Plan

Corrosion is a significant concern for water and wastewater utilities. Corrosion management measures, such as the addition of chemical additives that adjust pH and/or add alkalinity, can reduce the effects of corrosion. Asset protection and corrosion management should be considered for all alternatives. The three alternatives considered for the Stonehouse 12-inch sewer forcemain are pH control and/or alkalinity addition, an interior liner and replacement as described below.

6.1: Alternative 1. pH Control and/or Alkalinity Addition

Many water utilities have used zinc orthophosphate as a corrosion inhibitor for waters with low alkalinity; however, zinc is expensive and may be problematic with respect to environmental concerns. Non- and reduced-zinc orthophosphates can be just as effective at preventing corrosion in metal pipes. The additive reacts with dissolved metal to form a metal-phosphate coating on the interior walls of the pipe. For cement pipes, the zinc additive is responsible for reacting with the orthophosphate to form the metal –phosphate coating around the inside surface of the pipe. Orthophosphate additives are classified as corrosion inhibitors. Other additives used to increase alkalinity include calcium hydroxide, sodium hydroxide, and sodium carbonate.

Because phosphate is a nutrient and of concern if discharged into a surface water body, sodium hydroxide (i.e., caustic soda), lime, soda ash, and magnesium hydroxide are chemicals often used for pH adjustment and/or alkalinity adjustment in wastewater treatment and recycled water applications. A local chemical supply was contacted for a budgetary quote for sodium hydroxide (reference Table 5). The estimated dosage (based on current flows and pH adjustment from 6.4 to 8.0 in sampled drinking water) is approximately 96 gallons per day of 50% caustic soda.

Chemical addition would require a 7,500 gallon tank with containment, equipped with level monitor and mixer (and potentially insulated, and heat traced if caustic used); flow meter; two chemical feed pumps (one duty, one standby), safety equipment, piping and valves. The addition of a corrosion inhibitor is anticipated to extend the estimated remaining useful life by about 7.5 years (40% increase).

6.2: Alternative 2. Non-Structural Reinforcement

The addition of an internal, non-structural liner could extend the life of the Stonehouse 12-inch sewer forcemain by approximately 50 years. A non-structural liner acts solely as a corrosion barrier; it relies on the host pipe for support. Semi-structural liners can be used to cover small holes, but still rely on the host pipe for support. Specific locations for installation of the liner would be governed by estimated operating pressures as measured by an updated and refined Phase 1 and Buildout hydraulic model. In general, the liner would be located where the highest operating pressures were expected to occur as described previously in Section 2.

6.3: Alternative 3. Structural Reinforcement

Replacing the Stonehouse 12-inch sewer forcemain with a structural reinforced liner is anticipated to increase the remaining useful life to about 70 years. In addition, chemical addition (see Alternative 1) is recommended as a proactive asset management strategy for this alternative.

6.4: Cost Comparison and Recommended Alternative

A comparison of the estimate of probable capital, operations and maintenance (O&M) and amortized costs are presented in Table 5 along with the alternative's estimated useful life.

Table 5. *Comparison of Alternatives*[a]

Alternative	Capital Cost ($)	O & M Cost ($)	Amortized Cost ($/yr)	Estimated Useful Life (yr)
1	66,894[a]	34,600	38,900	25
2	949,900	9,000	61,000	50
3	1,000,300	31,600	85,200	70

[a] Estimated costs represent mutually exclusive items specific to each alternative and include future condition assessments (at either 5 or 10 year intervals), improvements specific to each alternative (e.g., tanks and pumps, liners, or pipe replacement) and, except for Alternative 2, chemical feed.

As shown in Table 5, Alternative 1 (pH/alkalinity addition) is the lowest cost alternative and is thus the recommended alternative. This recommendation will be incorporated into the District's Recycled Water Program Preliminary Design Report along with the recommended steps described in the next section. A more detailed breakdown of costs is attached in the Appendix for reference.

References

Arbabi, Hossein. Corrosive Soils: Causes, Effects and Mitigations. 2017. Online. Available: http://www.testing-engineers.com/case1.html.

California Laboratory Services. (2016). CLS Work Order #: CZ10097, Rancho Murieta Community Services District. Rancho Cordova, CA

Carol H. Tate et al. "Controlling Asbestos Loss from Asbestos-Cement Pipe in Aggressive Waters," EPA. Rep. EPA/600/s2-85/042, 1985.

D. Wang et al. "Evaluation of Asbestos Cement Pipe Condition," in the CEED Seminar Proc., University of Western Australia. 2012. Available: http://www.ceed.uwa.edu.au/__data/page/189986/Wang.pdf.

Exponent. Asbestos-Cement (Transite) Pipe in Water Distribution Systems. Online. Available: http://www.exponent.com/services/practices/engineering/buildings--structures/capabilities/asbestoscement-transite-pipe-in-water-distributi__/?serviceId=962f01e0-65f2-41ec-b20e-940340a4ab50&loadAllByPageSize=true&knowledgePageSize=3&knowledgePageNum=0&newseventPageSize=3&newseventPageNum=0&showAllProfessionals=4

EBMUD. "Asbestos Cement Pipe Study," 2013.

J. L. Parks et al. "Effect of Zinc and Orthophosphate Corrosion Inhibitors on Cement-Based Pipes," Journal - American Water Works Association, vol. 104, no. 1, p. 37, January, 2012.

MEI-Charlton, Inc. (2016). MEIC Reference #: 8222001-RMCSD, Rancho Murieta Community Services District. Rancho Cordova, CA

Y. Hu et al. (2013). Guidance Manual for Managing Long Term Performance of Asbestos cement Pipe, Water Research Foundation. U.S.A.

Rancho Murieta Community Services District. 1973. "Plans for the Construction of Murieta Drive Sewer Lift Station & Force Main." Prepared by Raymond Vail Associates.

Rancho Murieta Community Services District. 1980 (May). "System Map." Prepared by El Dorado Irrigation District.

Rancho Murieta Community Services District. 2013 (October). Rancho Murieta Community Services District Recycled Water Standards.

Rancho Murieta Community Services District. 2016a (January). RMCSD Recycled Water Program Preliminary Design Report, "Figure 1." Prepared by Kennedy/Jenks Consultants.

Rancho Murieta Community Services District. 2016b (January). RMCSD Recycled Water Program Preliminary Design Report, "Figure 3." Prepared by Kennedy/Jenks Consultants.

Rancho Murieta Community Services District. 2016c (January). RMCSD Recycled Water Program Preliminary Design Report, "Figure 16." Prepared by Kennedy/Jenks Consultants.

Rancho Murieta Community Services District. 2016d (January). RMCSD Water Supply Assessment Technical Memorandum, Prepared by Maddaus Water Management.

THIS PAGE INTENTIONALLY BLANK

Appendix

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

December 27, 2016

CLS Work Order #: CZL0915
COC #: 177850

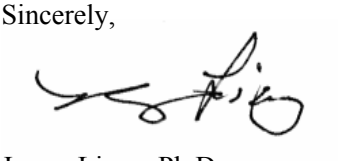
Paul Siebensohn
Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project Name: 12'' F. Main

Enclosed are the results of analyses for samples received by the laboratory on 12/19/16 17:00. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,



James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: 12" F. Main
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZL0915
COC #: 177850

CLS - Labs CHAIN OF CUSTODY CLS ID No.; CZL0915. LOG NO. 177850

REPORT TO:
NAME AND ADDRESS: Paul Siebensohn, 15160 Jackson Rd, Rancho Murieta, CA 95683
PROJECT MANAGER: Paul S. PHONE#: (916) 354-3700
PROJECT NAME: 12" F. Main
SAMPLED BY: Ron Greenfield /CX
JOB DESCRIPTION:
SITE LOCATION:

CLIENT JOB NUMBER:
DESTINATION LABORATORY:
☒ CLS (916) 638-7301, 3249 FITZGERALD RD., RANCHO CORDOVA, CA. 95742
☐ OTHER

PRESERVATIVES

ANALYSIS REQUESTED: Sulfate, Chloride, PH, Conductivity

GEOTRACKER:
EDF REPORT ☐ YES ☐ NO
GLOBAL ID: _____
COMPOSITE:
FIELD CONDITIONS:

TURN AROUND TIME: 1 DAY, 2 DAY, 3 DAY, 5 DAY
SPECIAL INSTRUCTIONS OR ALT. ID:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	Sulfate	Chloride	PH	Conductivity	5 DAY
12/16/16	9:30	Soil	Soil	1	Poly	3	x	x	x	x	X

INVOICE TO:
P.O. #
QUOTE #

SUSPECTED CONSTITUENTS

PRESERVATIVES: (1) HCL, (2) HNO_3, (3) = COLD, (4) = NaOH, (5) = H_2SO_4, (6) = $Na_2S_2O_3$, (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
Cory Vance	Cory Vance / Rancho Murieta CSD	12/19/16 @ 1700		

REC'D AT LAB BY: DATE / TIME: 12-19-16 1700. CONDITIONS / COMMENTS: 16.2.

SHIPPED BY: ☐ FED X ☐ UPS ☐ OTHER _____ AIR BILL #

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: 12" F. Main
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZL0915
COC #: 177850

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Soil (CZL0915-01) Soil Sampled: 12/16/16 09:30 Received: 12/19/16 17:00									
Chloride	**14**	5.0	mg/kg	1	CZ09372	12/20/16	12/20/16	EPA 300.0	
pH	**5.91**	1.00	pH Units	"	CZ09375	12/20/16	12/20/16	EPA 9045C	
Specific Conductance (EC)	**12**	1.0	µmhos/cm	"	CZ09450	12/22/16	12/22/16	EPA 120.1	
Sulfate as SO4	**110**	5.0	mg/kg	"	CZ09372	12/20/16	12/20/16	EPA 300.0	

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: 12" F. Main
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZL0915
COC #: 177850

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CZ09372 - General Prep										
Blank (CZ09372-BLK1)				Prepared & Analyzed: 12/20/16						
Sulfate as SO4	ND	5.0	mg/kg							
Chloride	ND	5.0	"							
LCS (CZ09372-BS1)				Prepared & Analyzed: 12/20/16						
Sulfate as SO4	48.2	5.0	mg/kg	50.0		96	75-125			
Chloride	49.6	5.0	"	50.0		99	75-125			
LCS Dup (CZ09372-BSD1)				Prepared & Analyzed: 12/20/16						
Sulfate as SO4	53.5	5.0	mg/kg	50.0		107	75-125	10	25	
Chloride	50.3	5.0	"	50.0		101	75-125	2	25	
Matrix Spike (CZ09372-MS1)	**Source: CZL0787-01**			Prepared & Analyzed: 12/20/16						
Sulfate as SO4	86.4	5.0	mg/kg	50.0	34.5	104	75-125			
Chloride	123	5.0	"	50.0	76.9	93	75-125			
Matrix Spike Dup (CZ09372-MSD1)	**Source: CZL0787-01**			Prepared & Analyzed: 12/20/16						
Sulfate as SO4	86.6	5.0	mg/kg	50.0	34.5	104	75-125	0.2	30	
Chloride	124	5.0	"	50.0	76.9	93	75-125	0.2	30	
Batch CZ09450 - General Preparation										
Blank (CZ09450-BLK1)				Prepared & Analyzed: 12/22/16						
Specific Conductance (EC)	ND	1.0	µmhos/cm							

CALIFORNIA LABORATORY SERVICES

12/27/16 09:16

Rancho Murieta Comm. Srvs. Dis	Project: 12" F. Main	
P.O. Box 1050; 15160 Jackson Road	Project Number: [none]	**CLS Work Order #: CZL0915**
Rancho Murieta, CA 95683	Project Manager: Paul Siebensohn	COC #: 177850

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit (or method detection limit when specified)
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

September 12, 2016

CLS Work Order #: CZI0097
COC #: 174022

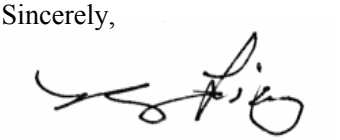
Paul Siebensohn
Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project Name: WWRP

Enclosed are the results of analyses for samples received by the laboratory on 09/02/16 15:20. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,



James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

09/12/16 14:09

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: WWRP
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZI0097
COC #: 174022

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CZI0097 LOG NO. 174022

REPORT TO:
NAME AND ADDRESS: Rancho Murieta CSD
POB 1050
RM Ca 95683
PROJECT MANAGER: DAVE PHONE# 870-5368
PROJECT NAME: WWRP
SAMPLED BY: Mike
JOB DESCRIPTION: Lanealiereedy
SITE LOCATION: WWRP CCP

CLIENT JOB NUMBER

DESTINATION LABORATORY
☒ CLS (916) 638-7301
3249 FITZGERALD RD.
RANCHO CORDOVA, CA.
95742
☐ OTHER

PRESERVATIVES: Lanealiereedy

ANALYSIS REQUESTED

GEOTRACKER:
EDF REPORT ☐ YES ☐ NO
GLOBAL ID: _____

COMPOSITE:

FIELD CONDITIONS:

TURN AROUND TIME: 1 DAY | 2 DAY | 3 DAY | 5 DAY

SPECIAL INSTRUCTIONS
OR
ALT. ID:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	ANALYSIS REQUESTED	5 DAY
9216	1120	Tertiary Eff	H_2O	1	PL	3	X	X

INVOICE TO:

P.O. #

QUOTE #

SUSPECTED CONSTITUENTS

PRESERVATIVES: (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
Michael Miller	Michael M. Iber RMCSD	9-2-16/1141	Tyler D	Tyler D. CLS
Tyler D	CLS	9-2-16 1520		

REC'D AT LAB BY: DATE / TIME: 9-2-16 1520 (1.3)

CONDITIONS / COMMENTS:

SHIPPED BY: ☐ FED X ☐ UPS ☐ OTHER _____ AIR BILL #

Rancho Murieta Comm. Srvs. Dis	Project: WWRP	
P.O. Box 1050; 15160 Jackson Road	Project Number: [none]	**CLS Work Order #: CZI0097**
Rancho Murieta, CA 95683	Project Manager: Paul Siebensohn	COC #: 174022

CLS LABS
SAMPLE RECEIVING EXCEPTION REPORTS

CLS Labs Job # CZI0097-pink

Problem discovered by: Devon **Date:** 9/12/16

Nature of problem

Sulfite **Chlorine, Total** **Chlorine, Residual** **pH** **Dissolved O2**

(Circle analysis above) **Received out of HOLD time.**

Client contacted? Yes _____ **No** _____ **Spoke With:** _____

By whom: _____ **Date:** ___/___/___ **Time:** _____ **HRS**

Client instructions:

Resolution of problem:

Logged in regardless and will be ran for analysis requested.

H:\Will\Orellana\SampleException.Doc

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: WWRP
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZI0097
COC #: 174022

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Tertiary Eff. (CZI0097-01) Water	**Sampled: 09/02/16 11:20**	**Received: 09/02/16 15:20**							
Bicarbonate as CaCO3	**40**	5.0	mg/L	1	CZ06494	09/07/16	09/07/16	SM2320B	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Langlier Index	**-2.41**		Std. Units	"	CZ06600	09/09/16	09/09/16	SM 203, 16th Ed.	
pH	**6.38**	0.01	pH Units	"	CZ06399	09/02/16	09/02/16	SM4500-H B	HT-F
Total Alkalinity	**40**	5.0	mg/L	"	CZ06494	09/07/16	09/07/16	SM2320B	
Total Dissolved Solids	**350**	10	"	"	CZ06495	09/07/16	09/08/16	SM2540C	

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: WWRP
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZI0097
COC #: 174022

Metals by EPA 200 Series Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Tertiary Eff. (CZI0097-01) Water Sampled: 09/02/16 11:20 Received: 09/02/16 15:20									
Calcium	**28**	1.0	mg/L	1	CZ06530	09/08/16	09/08/16	EPA 200.7	

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: WWRP
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZI0097
COC #: 174022

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CZ06494 - General Preparation										
Blank (CZ06494-BLK1)				Prepared & Analyzed: 09/07/16						
Total Alkalinity	ND	5.0	mg/L							
Bicarbonate as CaCO3	ND	5.0	"							
Carbonate as CaCO3	ND	5.0	"							
Hydroxide as CaCO3	ND	5.0	"							
Duplicate (CZ06494-DUP1)	**Source: CZI0070-28**			Prepared & Analyzed: 09/07/16						
Total Alkalinity	615	5.0	mg/L		626			2	20	
Bicarbonate as CaCO3	552	5.0	"		566			2	20	
Carbonate as CaCO3	63.0	5.0	"		60.0			5	20	
Hydroxide as CaCO3	ND	5.0	"		ND				20	
Batch CZ06495 - General Preparation										
Blank (CZ06495-BLK1)				Prepared: 09/07/16 Analyzed: 09/08/16						
Total Dissolved Solids	ND	10	mg/L							
Duplicate (CZ06495-DUP1)	**Source: CZI0155-01**			Prepared: 09/07/16 Analyzed: 09/08/16						
Total Dissolved Solids	1190	10	mg/L		1140			4	20	

Rancho Murieta Comm. Srvs. Dis
P.O. Box 1050; 15160 Jackson Road
Rancho Murieta, CA 95683

Project: WWRP
Project Number: [none]
Project Manager: Paul Siebensohn

CLS Work Order #: CZI0097
COC #: 174022

Metals by EPA 200 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CZ06530 - EPA 3010A										
Blank (CZ06530-BLK1)				Prepared & Analyzed: 09/08/16						
Calcium	ND	1.0	mg/L							
LCS (CZ06530-BS1)				Prepared & Analyzed: 09/08/16						
Calcium	5.20	1.0	mg/L	5.00		104	85-115			
Matrix Spike (CZ06530-MS1)	**Source: CZI0222-01**			Prepared & Analyzed: 09/08/16						
Calcium	32.0	1.0	mg/L	5.00	26.7	107	70-130			
Matrix Spike (CZ06530-MS2)	**Source: CZI0221-01**			Prepared & Analyzed: 09/08/16						
Calcium	91.2	1.0	mg/L	5.00	88.7	49	70-130			QM-4X

CALIFORNIA LABORATORY SERVICES

09/12/16 14:09

Rancho Murieta Comm. Srvs. Dis	Project: WWRP	
P.O. Box 1050; 15160 Jackson Road	Project Number: [none]	**CLS Work Order #: CZI0097**
Rancho Murieta, CA 95683	Project Manager: Paul Siebensohn	COC #: 174022

Notes and Definitions

QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
HT-F	This is a field test method and it is performed in the lab outside holding time.
A-RES	-2.41
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit (or method detection limit when specified)
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

TO:	**Rancho Murieta Community Services District**	**Client PO No:**	N/A
Address:	**Attention: Mr Paul Siebensohn** P.O. Box 1050 15160 Jackson Road Rancho Murieta, CA 95683	**Reference No:**	MEIC-8220001-RMCSD
Tel No.:	916-354-7000	**Date:**	February 8, 2017
Email:	psiebensohn@ranchomurietacsd.com		

SUBJECT: Asbestos Cement (AC) Pipe Sections Testing

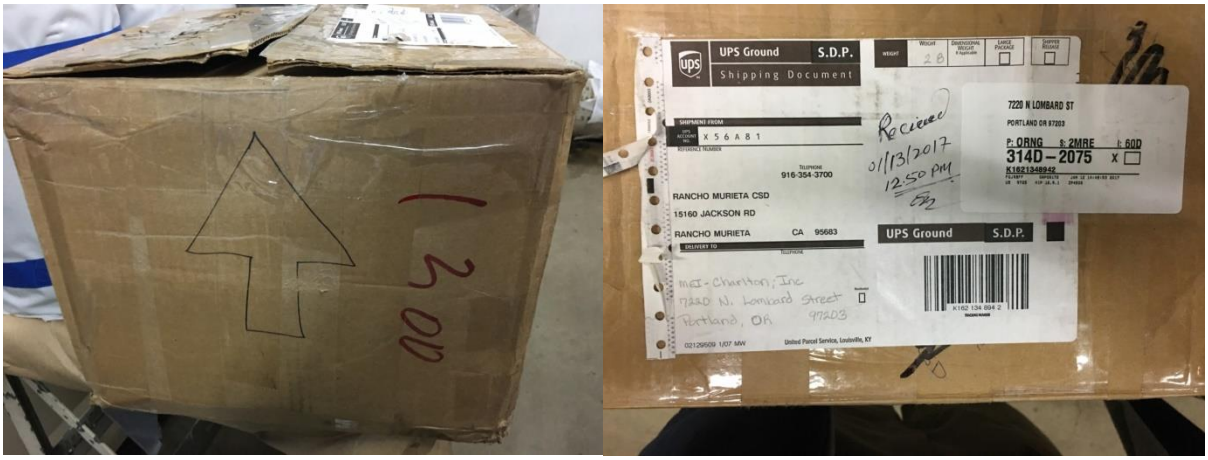
Dear Mr Paul Siebensohn,

MEI-Charlton, Inc. (MEIC) was retained by the Rancho Murieta Community Services district (RMCSD) to investigate the condition of the asbestos cement (AC) pipe in the RMCSD's water distribution and wastewater collection system, collectively referred to as 'systems'. No maintenance, repair or leak/failure data were reported to MEIC. In order to determine the AC pipes' physical and chemical properties and evaluate their condition, MEI-Charlton, Inc. (MEIC) was retained by the RMCSD to perform various tests as identified in the Scope of Work (SOW) and summarized below:

- Scratch and hardness testing with Type Shore D Durometer of ACP section
- Phenolphthalein indicator staining test performed on ACP section

1. Introduction

A total of three asbestos cement pipes (ACP) pieces were received (shown in Figure 1) by MEIC for testing in accordance with the agreed SOW. All ACP sections received were labeled by the RMCSD as (i) Force Main Jackson High (two pieces) and (ii) Old Sewer Force main going upto Stone House and were subsequently assigned an MEIC label (Pipe Sample #s 1, 2 and 3).



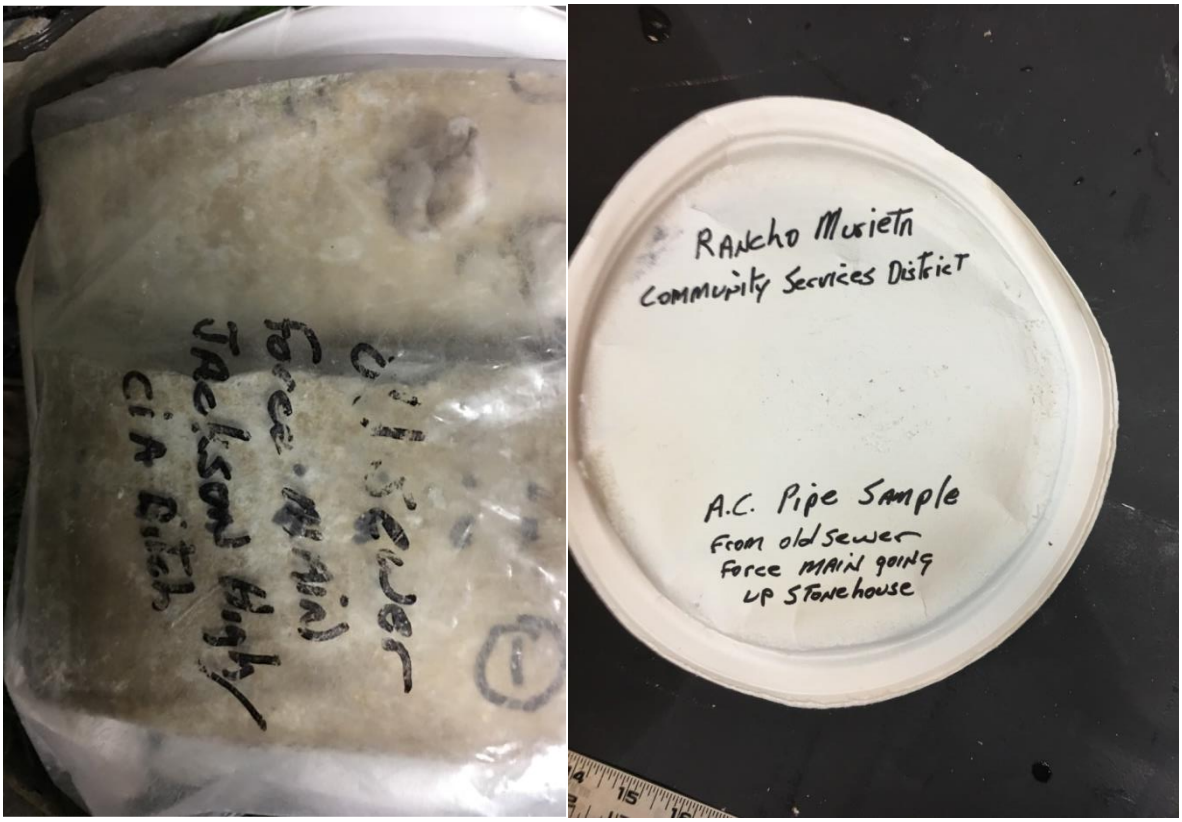


Figure 1: Photographs showing Sample 1-3 as received

Pipe section 1 and 2 were from the same piece (broken from the same large piece) and had length of 5 inch and 6 inches respectively for sample 1 and Sample 2. The thickness of the wall was 1 inch in each case.

2. Mechanical Tests

Scratch test was performed by using a small splinter cut out of a hard plastic piece that was 1/8 inch thick and 4 inch long. The tip of the piece was tapered. This plastic needle tip was then firmly placed on the surface to be tested and slowly moved in a straight line (at an angle of 45-75 degree) under constant pressure during the travel. Resistance to the motion was assessed as soft, medium and hard. Scratch tests on the outer surface of sample revealed medium to hard scratch in all three cases. Inner surface of the pipe pieces was softer than the outer surface.

Hardness measurements were performed using a Shore D durometer. The measurement surface was cleaned before making the measurement.

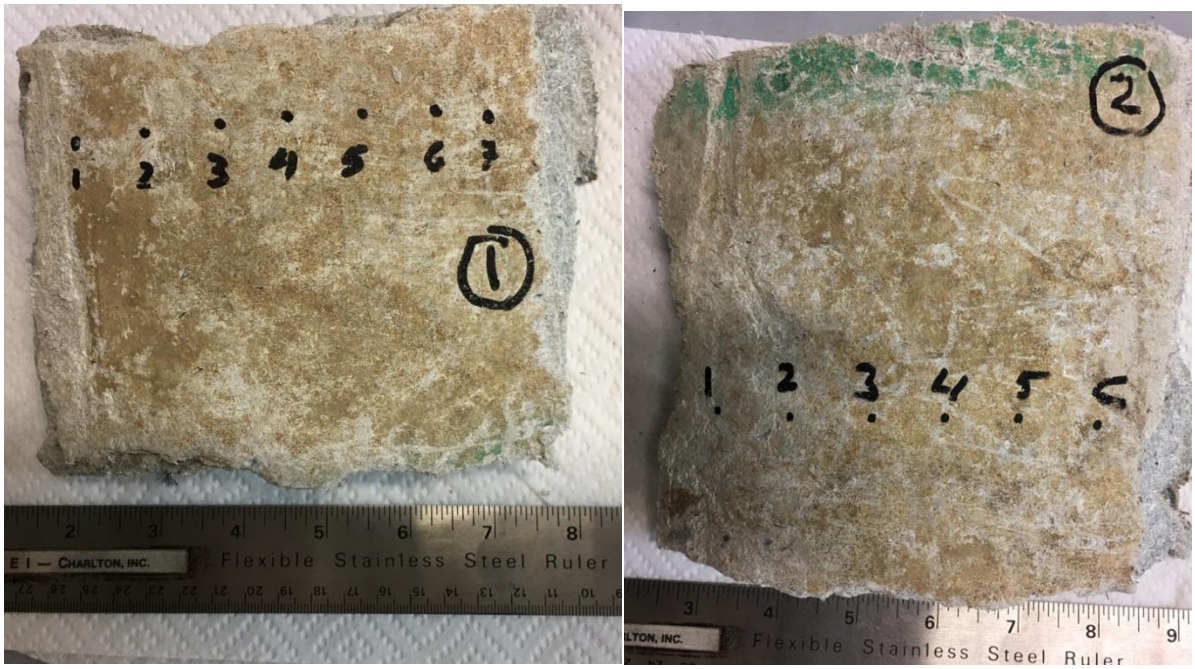


Figure 2a: Outside view of the pipe section wall of Sample 1 (left) and Sample 2 (right)

Figure 2b: Inside view of the pipe section wall of Sample 1 (left) and Sample 2 (right)

Figure 3a: Inside and outside views of sample 3 pipe section.

Figure 3b: Photograph of Sample 3 side wall showing delamination of the interior wall

Figure 4: Photographs showing Samples 1 and 2 after cutting. Seen are outside (Top) and inside (bottom) surfaces.

Hardness Measurements

Hardness was measured in Shore D units at 6 locations on (i) the outside, (ii) inside of the pipe surface of the pipe along the length of the section (Table – 1). In addition the Shore d hardness was measured across the thickness of the pipe wall at the (i) inner side, (ii) middle and (ii) outer side of the wall. Results of the measurements are given in Table - 2 below.

Table 1a: Pipe hardness measurements in Shore D along the pipe wall (outside surface)

Specimen	Hardness (Shore D) Measured on Pipe Wall (outside) Along the Axis						Average
Location	1	2	3	4	5	6	
Pipe 1	71	68	70	70	72	71	70
Pipe 2	65	71	72	70	68	71	70
Pipe 3	74	80	68	72	74	72	73

Table 1b: Pipe hardness measurements in Shore D along the pipe wall (inside surface)

Specimen	Hardness (Shore D) Measured on Pipe Wall (inside) Along the Axis						Average
Location	1	2	3	4	5	6	
Pipe 1	60	62	62	63	58	60	61
Pipe 2	61	62	60	61	61	58	61
Pipe 3	62	63	61	62	60	61	62

Table – 2: Pipe hardness measurements (Shore D) across the thickness of the pipe wall (Cross Section)

Measurement No	Hardness Shore D Pipe Sample 1			Hardness Shore D Pipe sample 2			Hardness Shore D Pipe Sample 3		
Location	**Inner**	**Middle**	**Outer**	**Inner**	**Middle**	**Outer**	**Inner**	**Middle**	**Outer**
1	52	89	65	50	88	68	62	89	71
2	60	90	68	51	89	71	62	88	72
3	58	88	70	46	90	71	63	90	80
4	61	88	71	51	91	70	61	88	68
5	63	91	68	52	88	72	61	90	70
6	61	88	78	48	90	70	60	90	70
Average	59	89	70	50	89	70	62	89	72

The inner wall of the pipe showed lower hardness values as compared to the outer wall hardness. The middle of the wall thickness had higher hardness than either of the inner or outer wall of the pipe. In all three cases the inner hardness of the pipe along the pipe segment axis was relatively constant with an average of 61 Shore D for the sample 1, and the outside ranged from 65 to 88 Shore D

3. **Phenolphthalein Indicator Staining Test**:

Submitted AC pipe segments were cut and polished (100 micron grit paper) for phenolphthalein staining tests for assessment of extent of leaching of calcium. The pipe wall cross section conditions were photographically documented (Figures 5, 6 and 7).

Figure 5: Photographs of Sample 1 wall cross section after staining with phenolphthalein. Note the white areas showing loss of alkalinity

Figure 6: Photographs Sample 2 wall cross section after staining with phenolphthalein. Note the white areas showing loss of alkalinity

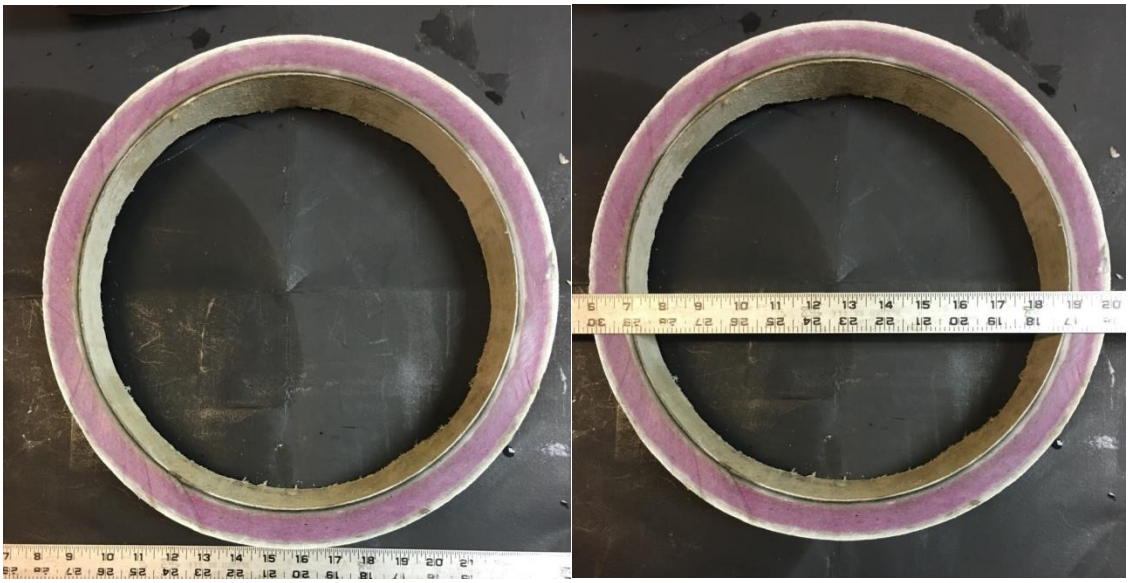


Figure 7: Photographs of sample 3 wall cross section after staining with phenolphthalein. Note the white areas showing loss of alkalinity

Figure 8: Photograph of Sample 3 wall cross section showing maximum attack depth locations

Table – 3: Attack depth of the pipe samples using the phenolphthalein test

	outside depth (inches0	Inside depth (inches)	Total Depth (inches)	remaining depth of pipe wall (inches)
Sample 1	0.25	0.1875	0.4375	0.5625
Sample 2	0.25	0.1875	0.4375	0.5625
Sample 3	0.375	0.25	0.625	0.375

4. Conclusions

1) Hardness was uniform across the inner and outer surface and along the central area of the pipe segment cross sections. Some exceptions were noticed.
2) The calcium leaching is fairly uniform inside of the wall while the outside wall showed variable leaching depth.

It should be noted that only one representative specimen was submitted for investigation and these pipe specimens may not accurately represent the condition of the whole pipeline.

Please do not hesitate to contact us with any questions.

Report Released By:

Business and Contracts

Disclaimer:

Table 5 - Comparison of Alternatives - Detail

Interest= 5%

	Capital [$]	O & M [$/yr]	Useful Life Expectancy [years]	NPW [$]	Annual Cost [$]
Alternative 1 - Chemical Addition			**20**		
Condition Assessment	--	6,000			5,000
Chemical Feed System	66,894		20	66,894	5,368
Chemical Demand (0.34 MGD flow)	--	28,569			28,569
Total	**66,894**	**34,569**			**38,936**
Alternative 2 - Non-Structural Rehabilitation (Liner)			**50**		
Condition Assessment		9,000			9,000
CIPP	949,944	--	50	949,944	52,035
Total	949,944	9,000			**61,035**
Alternative 3 - Structural Rehabilitation			**70**		
Condition Assessment	--	3,000			3,000
Replacement	933,420	--	70	933,420	48,257
Chemical Addition	66,894	28,569			33,936
Total	**1,000,314**	**31,569**			**85,193**

From: Kevin Kennedy
To: Chantelle Garvin; Kevin Kennedy; Beverly Eklund
Subject: FW: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks
Date: Friday, March 31, 2017 9:30:00 AM

Ok here's the chemical costs:

Dosage = 96 gallons per day (conservative) x 365 days/yr = 35,040 gallons per year

Deliveries = 48,000 pounds (5500 gallons or about 8.7 lbs/gal – slightly higher than water, makes sense)

Cost = 35,040 gallons per year x 8.72 lbs/gallon x $0.165/ wet lb = $50,415/yr

---

From: Clare Walker [mailto:CWalker@northstarchemical.com]
Sent: Friday, March 31, 2017 8:54 AM
To: Kevin Kennedy; Robert Heller
Cc: Chantelle Garvin; Clare Walker
Subject: RE: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks

Kevin:

Caustic soda has been increasing in price consistently since Nov 2016.

Current budget pricing I recommend for

Caustic soda 50%
48,000 lbs minimum per load
Delivered to Rancho Murrietta
$660/dry ton delivered or $.165/wet lb

Thank you,

Clare Walker
Director of Sales

NORTHSTAR CHEMICAL
Cell:: 925-787-5864
Email: cwalker@northstarchemical.com
Website: www.northstarchemical.com
-

From: Kevin Kennedy [mailto:KevinKennedy@kennedyjenks.com]
Sent: Thursday, March 30, 2017 7:17 PM

To: Robert Heller <RHeller@northstarchemical.com>
Cc: Chantelle Garvin <ChantelleGarvin@kennedyjenks.com>; Clare Walker <CWalker@northstarchemical.com>
Subject: Re: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks

Thanks Rob. I appreciate you going to this s length to get the dosage.

Clare can you provide quote for bulk deliveries?
Thank you

Sent from my iPhone

On Mar 30, 2017, at 6:59 PM, Robert Heller <RHeller@northstarchemical.com> wrote:

> Hello Kevin, I made a lab batch of water to match your water analysis and then adjusted it with caustic soda from a pH of 6.4 to 8.0
>
> For 600,000 gallons per day flow, it will require approximately 96 gallons of 50% caustic soda to raise the pH to 8.0.
>
> We currently do not have any product available for sale to adjust the alkalinity. As we discussed, soda ash (sodium carbonate) may be a good choice.
>
> I have Clare Walker copied on this message. She can get you a quote for bulk 50% caustic soda deliveries to Rancho Murieta if you require one.
>
> Regards,
>
> Robert Heller
> Industry Technical Manager
> Northstar Chemical
> Modesto, CA
>
> 530.263.5448
> rheller@northstarchemical.com

> **From:** Kevin Kennedy [mailto:KevinKennedy@kennedyjenks.com]
> **Sent:** Thursday, March 30, 2017 11:04
> **To:** Robert Heller <RHeller@northstarchemical.com>
> **Cc:** Chantelle Garvin <ChantelleGarvin@kennedyjenks.com>
> **Subject:** RE: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks
>
> Hi Rob

I left you a voicemail. I wanted to estimate chemical dosage based on changing the pH and alkalinity from 6.4 and 40 mg/L as CaCO3 (as indicated in the attached lab analysis) to around 7.8 – 8 and 200 mg/L as CaCO3.

This is for the Rancho Murieta Community Services District wastewater treatment plan so delivery would be to Rancho Murieta, CA in 5500 gallon bulk delivery.

Sorry I misquoted flow (was thinking of another plant). Average flow is projected to be about 0.6 mgd.

I would like to get chemical quote as soon as possible.

Thanks Kevin

Kevin A. Kennedy, P.E. | Principal, Senior Project Manager
Kennedy/Jenks Consultants
10850 Gold Center Drive, Suite 350 | Rancho Cordova, CA 95670
P: 916.858.2700 | Cell: 530.363.8800 | Direct: 916.858.2740

From: Robert Heller [mailto:RHeller@northstarchemical.com]
Sent: Thursday, March 30, 2017 8:54 AM
To: Kevin Kennedy
Subject: FW: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks

---

From: Clare Walker
Sent: Wednesday, March 29, 2017 11:53
To: Robert Heller <RHeller@northstarchemical.com>
Cc: Clare Walker <CWalker@northstarchemical.com>
Subject: FW: Rancho Murieta Chemical Addition - for recycled water for Kennedy Jenks

Rob:
Can you get with this Kevin and Kennedy Jenks on amount of Caustic needed to adjust PH and alkalinity?

He was asking about mag too, but told him we do not sell Mag hydroxide.

They are looking at a Bulk system up there.

Not sure how much value there is for us in doing this kind of thing? Thoughts?

Hello Kevin, Clare Walker forwarded the attached water analysis to me, but there was no other information in your message below.

Please advise if I may be of assistance.

Regards,

Robert Heller
Industry Technical Manager
Northstar Chemical
Modesto, CA

530.263.5448
rheller@northstarchemical.com

From: Kevin Kennedy
Sent: Wednesday, March 29, 2017 10:29 AM
To: Kevin Kennedy; Chantelle Garvin
Subject:

Rancho Murieta
Community Services District