Water Rate Study
2021

This Water Rate Study (Study), prepared by Vista Irrigation District (District) staff, resulted in the recommended water rate structure and water rates.

Objectives

Presented Rates are Legal and Defensible – Staff developed the recommended rate structure with no arbitrary attributes or components. Staff was sensitive to the outcomes of recentrate litigation and common law guidance provided by their decisions.

Rates Presented Satisfy the District's Mission Statement and Values – The District's Mission Statement, to provide a reliable supply of high quality water that meets the needs of its present and future customers in an economically and environmentally responsible manner, is achieved through satisfying adopted values, including "reliable facilities, efficient operations and fiscal strength and stability". The revenue requirement covered by the recommended rates includes all operation and maintenance costs as well as a provision for infrastructure replacement and upgrades.

Provide a thorough and understandable administrative record – This Study along with the Rate Model; a spreadsheet documenting methodologies, calculations, and processes; a consumption use analysis; and all presentations to the District's Board of Directors (Board) provide a thorough and understandable administrative record.

Nothing arbitrary (tier levels, cost acceleration from tier to tier, etc.) – Tier levels are tied to historical usage behavior patterns. Costs to provide water within each tier are well documented and based on thecosts of water supply and maintenance costs at various levels of use.

Establish a revenue requirement that exhausts all efforts to cut costs and maintains or increases the current level of service and workforce engagement – This objective is achieved through the participative budget process employed by District staff. Since the introduction of tiers in 2009, the District has continued its analysis of costs and have continued to reduce expenditures when possible; the District has eliminated 14 positions through streamlining of processes and improvements in technology. The District will continue to reduce costs when possible but the current staffing level is required to operate and ensure business continuity for the District.

Water Rate History

2009 Water Rate Public Hearing- In 2009, the District conducted a thorough analysis with the intent to implement tiered water rates due in part to the drought and implementation of mandatory water use reductions. It was decided to implement a three-tier water rate structure. The methodology used to establish the Tier 1 allotment was 50% of the average usage for a 3/4 meter; this average was used with hydraulic capacity of the meter size to establish Tier 1 allotments for all meter sizes. Tiers based on meter size permitted allotments to be established based on the hydraulic capacity that a customer had paid for when originally purchasing their meter. This methodology did not require complex technical billing changes, calculating a separate budget for each individual customer or setting up a process to allow for variances to established budgets based on each household's unique situation. The District determined that implementing a system based on hydraulic capacity as opposed to unique "water budgets" would result in lower costs to the District due to not needing to hire additional staff or implement new software to accommodate the establishment of individual customer water budgets. The theory behind this approach was that larger meters had already paid for more capacity at installation so they were entitled to a tier allotment based on the hydraulic capacity of

the meter size, which was appropriate for the parcel and its development.
Tier 3 was established at volumes that would incur a penalty from the San Diego County Water Authority (Water Authority) for not conserving during the drought. Tier 2 represented the volume between Tier 1 and Tier 3. Tier 3 water use has been billed at Tier 2 rates, except during a period (6 to 9 months) when mandatory water use reductions were implemented in 2009 and 2010.

Participants in the agricultural water rate program (Water Authority's Special Agricultural Water Rate program) pay a water rate that reflects a reduced level of service and supply reliability. Program participants are the first to be cutback in the event of drought or other water shortages. Additionally, current program participants will be required to reduce their water use at a greater level (by a minimum of 5%) than municipal and industrial water users.

The 2009 study is the basis of the tiered water rate structure, including allotments in place today.

At the same time it approved of the 2009 rates, the Board approved a Rate Adjustment Policy. The Policy permitted the automatic pass-through of all Water Authority fees and charges for wholesale water and water related services to District customers; and the adjustment of District water rates to reflect inflationary costs (based on the Consumer Price Index – All Urban Consumers – San Diego) on July 1 of each year. The Policy allowed the above-described adjustments to take place for a period of five years.

2013 and 2017 Water Rate Public Hearings- In 2013 and again in 2017, an analysis of water rates was completed to determine if an increase (beyond what was allowed for by the adopted Rate Adjustment Policy) was necessary. It was determined that the District did not need to increase its water rates and continuation of the existing Rate Adjustment Policy would cover the cost of wholesale water purchases as well as operation and maintenance and infrastructure replacement costs. At the conclusion of the public hearings held in 2013 and 2017, the Board approved the continuation of the Rate Adjustment Policy (Water Authority pass-through and inflationary adjustment) for a period of five years.

Relevant Guidance

The California Constitution provides the highest level ofauthoritative support for California water rate setting. Industry guidance, while not authoritative, is most prevalent in the M1 Manual published by the American Water Works Association.

Statutory Law & California Constitution

The California Constitution has recognized the importance of conserving water since 1925 when Article X, Section 2 was adopted – "The general welfare requires that the water resources of the State be put to beneficial use to the

fullest extent of which they are capable, and that the waste or unreasonable use of water be prevented."
In 1977, California Water Code Section 375 provided that agencies may adopt and enforce a water conservation program. Later amended in 1993, Water Code Section 375 stated that a water conservation ordinance or resolution may encourage conservation through rate structure design.

Proposition 218 (1996) added Articles XIII C and D to the California Constitution, which established procedural and substantive requirements for property related fees. Procedural requirements, Article XIIID Section 6(a), refer to holding a public hearing, the noticing thereof, and majority protests. Section (b) requires that fees not exceed the cost to provide the service, not be used for any other purpose, and notexceed the proportional cost of providing the service attributable to the parcel on which it is imposed.

Water Code sections 370-374 (2008) established volumetric allotments of water, a basic charge, a conservation charge, and proportionality and cost-revenue nexus requirements through tiers and allocations. Conservation and water resource management costs are to be determined and supported.

Proposition 26 (2010) clarified the meaning of "tax" requiring voter approval and identified five specific exceptions, one of which is "A charge imposed for a specific government service or product ... which does not exceed the reasonable costs ... of the service or product …"

Government Code § 53756 authorizes water districts, such as the District to impose automatic adjustments on certain fees over a five-year period to water users, provided it meets the following criteria: (i) the District adopts a schedule of fees or charges for a property-related service for a period not to exceed five years; (ii) the schedule of fees may include a schedule of inflationary adjustments; (iii) the schedule may pass through any increases in the wholesale charges for water; and (iv) provided the District provides 30-day notice of the adjustment.

Industry Guidance

Principles of Water Rates, Fees and Charges, Manual of Water Supply Practices, M1, published by the American Water Works Association, is commonly known as the M1 Manual, and is frequently used as guidance by rate consultants. The M1 Manual is not specific to California rate setting, but most of the larger consulting firms performing cost of service studies in California rely heavily on the M1 Manual andare contributing authors and editors to the publication.

Data Collection and Analysis

Demand Projection

Staff analyzed recent usage behavior trends since the implementation of tiered water rates in 2009. Table 1 below shows the impact of water conservation as sales (in acre-feet) have decreased by 26% using a five-year rolling average; this decrease has occurred while the number of connections has increased by 2.5% (as illustrated in Table 2). The decrease in water consumption is largely related to the implementation of water use efficiency practices and water conservations measures, such as the installation of water-efficient devices and the replacement of lawn with low water use plants. The reduction in water use from these activities is anticipated to yield consistent consumption patterns in future years; appreciable growth in water sales is not anticipated during the five-year period covered by this Study. The District's service area is not built out so growth and new service connections are expected; however, growth is expected to be in-fill development and take place at a rate similar to what is shown in Table 2. This Study is based on Fiscal Year 2022 budget, which uses a three-year average to determine water sales.

Table 1

Fiscal Year	Water Sales af	5 Year Average	Percent Change 5 Year Avg 2009 to 2021
2021	17,322	16,093	**-26%**
2020	15,224	15,503	
2019	15,484	15,882	
2018	16,937	16,610	
2017	15,496	17,004	
2016	14,375	17,353	
2015	17,117	17,996	
2014	19,128	18,227	
2013	18,904	18,575	
2012	17,241	19,266	
2011	17,590	20,352	
2010	18,273	21,245	
2009	20,866	21,893	
2008	22,362		
2007	22,667		
2006	22,057		
2005	21,513		

Table 2

Fiscal Year	Service Connection	Percent change 2010 to 2021
2021	29,007	2.5%
2020	28,879	
2019	28,780	
2018	28,688	
2017	28,622	
2016	28,443	
2015	28,625	
2014	28,580	
2013	28,415	
2012	28,409	
2011	28,313	
2010	28,305	

Defining Customer Classifications - Tiers by Meters

The ideal solution to developing rates for water utility customers is to assign cost responsibility to each individual customer served and to develop rates that reflect that cost. Unfortunately, it is neither economically practical nor often possible to determine the cost responsibility and applicable rates for each individual customer served. However, the cost of providing service can reasonably be determined for groups or classes of customers that have similar water-use characteristics …

American Water Works Association, Principles of Water Rates, Fees, and Charges – M1 Manual

The District's current rate structure establishes customer classifications by meter size. A water rate structure tiered by meter size simulates allotments used in a budget-based system without having to implement resource-intensive methods, procedures and technologies. Customers with larger meters pay higher service charges and pay for greater capacity in the system.

Per the industry standard, as published in the M1 Manual, "In some cases, it may be better to determine customer classes based on meter size. A utility can also implement an increasing block structure by meter size if it can demonstrate a consistent relationship or homogeneous usage pattern by meter size."

Financial Requirement Analysis

Budget Projection

The rate model is based on the Budget for the Fiscal Year Ending June 30, 2022 approved by the Board on June 6, 2021. The Budget is created each year based on historical averages for water sales, water purchases and local water production. Other revenue sources and expenses are based on historical averages or current data if known at the time. The water purchased costs remain constant for all projected years since the District passes-through those costs directly to customers; an increased expense is not recognized for purchased water and additional revenue charged to cover the cost is not recognized. The Budget is projected forward for five-years using an average historical inflationary factor for most items and actual data if known. The budget projection assumes an inflation adjustment (based on the U.S. Department of Labor's Consumer Price Index – All Urban Consumers – San Diego, California) on July 1 to the service charge will continue until Fiscal Year 2027. The budget projection excludes depreciation since it is not a cash flow item and instead incorporates District Capital Project expenditures anticipated through Fiscal Year 2027. Capital expenditures for Fiscal Years 2022 through 2027 are projected to be approximately $78.7 million (see Attachment A, Capital Projects).

Budget projections through Fiscal Year 2027, as previously outlined, are used to determine the surplus or shortfall in revenue and cashflow compared to Board adopted required reserves such as Emergency and Contingency and Working Capital reserves as well as an adequate reserve balance to support funding Capital Improvement reserve desired; Attachment B, Budget Projection through Fiscal Year 2027, shows a decrease in cash at the end of Fiscal Year 2027 of $16.3 million.

Capital Projects Requiring the Rate Adjustment

The anticipated expenditures for Capital Projects during the next five years includes an accelerated timeline on reservoirs and increased costs for the San Pasqual Undergrounding Project as detailed in this section. The Capital Projects list also includes on-going main replacement ($16.3 million through Fiscal Year 2027); the goal of the Main Replacement Program is to replace pipelines before they reach the end of their useful life and become a maintenance liability and to replace pipelines due to street realignments and/or improvements. Proactively replacing aging pipelines reduces the potential for catastrophic breaks and resulting water service outages.

In addition, the District entered into an agreement with Murray Smith for the Four Reservoirs Seismic and Structural Analysis project. The report findings, which included a proposed project schedule for the four reservoir projects, were presented to the Board on November 18, 2020 (see Attachment C, Four Reservoirs Board Report). The findings for the conditions of E, A and Deodar reservoirs (described in Attachment C) resulted in their respective project completion timelines to be accelerated; it is anticipated that the District will spend approximately $19.2 million on these reservoir projects through Fiscal Year 2027.

Similarly, in September 2018, Richard Brady & Associates was hired to perform an inspection, assessment and structural analysis of the Pechstein Reservoir's roof; it was determine that the roof needed to be replaced (see Attachment D, Excerpt from Roof Structural Assessment Report). Pechstein Reservoir is the District's largest at 20 million gallons and is critical to its system operations. In order to replace the roof, Pechstein Reservoir will need to be taken out of service. A new reservoir, Pechstein II, will need to be constructed prior to Pechstein Reservoir being taken out of service; Pechstein II Reservoir will assist with system operations while Pechstein Reservoir is offline and provide additional storage capacity required for outages, as outlined in the District's Water Master Plan (see Attachment E, Excerpt from Potable Water Master Plan). The cost of constructing Pechstein II and the beginning of the new roof will cost approximately $11.9 million through Fiscal Year 2027.

The San Pasqual Undergrounding Project (SPUP) is a project to remove, relocate and replace about 2.5 miles of the Escondido Canal that cross the San Pasqual Indian Reservation. Completion of SPUP is a requirement of the San Luis Rey Indian Water Rights Settlement Agreement, which became effective on May 17, 2017; the project is required to be completed by May 17, 2023 (Attachment F, excerpt from the San Luis Rey Indian Water Rights Settlement Agreement). While both the City of Escondido (City) and the District are jointly responsible to complete the project, the City is responsible for managing the design and construction of the

SPUP. Estimated project costs have risen significantly ($27 to $50 million) since the District's last public hearing on water rates. The District's estimated portion of the project cost (50 percent) was approximately $13.5 million in 2017; the District's share of the project cost has risen to just over $25 million at present.

Reserves

The District maintains the following Reserve Accounts: Emergency and Contingency Reserve, Working Capital Reserve, Water Purchase Stabilization Reserve, and Capital Improvement Reserve.

- The Emergency and Contingency Reserve balance is $10 million as of June 30, 2021 and is calculated as 10% of the District's Net Fixed Assets plus all Capital in Progress accounts. The Emergency and Contingency Reserve is for unanticipated expenses resulting from emergencies including, but not limited to, earthquakes, floods, winds, wildfires, or other unforeseen events that cause damage to District facilities and properties.
- The Working Capital Reserve balance is $10 million as of June 30, 2021 and is calculated as 20% of Water Revenues. The Working Capital Reserve is for operating revenue and expense variances and timing in collections and payments.
- The Water Purchase Stabilization Reserve is contributed to when the District has excess local water over the 60-year average. The Water Purchase Stabilization Reserve is currently zero due to a lack of surplus local water in recent years with any balance from prior years being used in its entirety.
- The Capital Improvement Reserve represents remaining funds available. The purpose of the Capital Improvement Reserve is to fund for the District's Capital Improvement program.

The total cash balance for the District as of Fiscal Year June 30, 2021 was approximately $46.5 million. Surplus Supplemental Water (used to pay the San Luis Rey Indian Water Authority for surplus supplemental water in January each year) and the Water Rebate (used to offset adjustments to the Water Authority's fees and charges for wholesale water and water related services) cannot be expended on operations and/or capital projects. As shown in Table 3, the District's Capital Improvement Reserve as of June 30, 2021 is estimated to be $20.3 million.

Table 3

Cash Balance Actual 06/30/2021	Amount
Emergency and Contingency Reserve	$ 10,000,000
Working Capital Reserve	10,000,000
Surplus Supplemental Water	4,595,222
Water Rebate	1,571,006
Capital Improvement Reserve	20,346,496
Total Cash Balance	**46,512,724**

Based on budget projections through Fiscal Year 2027, and assuming no changes are made to the rate structure (aside from the potential pass-through increased costs/inflation), the Capital Improvement Reserve at June 30, 2027 would be just over $4 million; see Table 4 below.

Table 4

Capital Improvement Reserve 06/30/21	$	20,346,496
Budget Projection to Fiscal Year 2027		(16,262,819)
Remaining Capital Improvement Reserve		4,083,678

Capital Improvement Reserve- The water industry has many long-lived assets; for example, reservoirs have an estimated life of 80 years. While the lives are very long, the initial construction and replacement costs of these assets are high. Large projects cannot reasonably be funded from a single year of customer revenue collection; instead, revenue is collected in smaller amounts over time and held in reserves until the project is ready to be built. Without sufficient reserves, the District would have to finance future large projects and charge customers after the fact at a much higher rate due to the cost of financing, including interest. It is in the best interest of the customers to have capital reserves to help keep costs capital project costs low, when feasible.

The Capital Improvement Reserve does not have a Board established minimum balance. To arrive at a minimum balance to maintain in this account at the end of the five-year rate setting period, a one year value of the District's system depreciation, adjusted for inflation, was calculated using the "Engineering News Record" which maintains a Construction Cost Index (Index). This Index, which contains construction and building components, is used to adjust the District's historical Fixed Assets value to current costs; any material assets not in the District's asset database (existed prior to the maintenance of fixed asset records) were included in the District's Capital Projects list and those values were used.

Using the District's current estimated asset lives, the annual cost of the District's system and assets were calculated at approximately $13.2 million (see Attachment G, Capital Assets Current Value). Collecting revenue using the current water rate structure will result in the Capital Reserve being depleted to a level that will not sustain Pay-go (cash) funding of planned capital projects beyond Fiscal Year 2027, such as rehabilitation of the Warner wellfield and replacement of the 100-year old Vista Flume. Borrowing to fund some of the projects would also require a higher reserve since debt financing requires a debt service reserve be set aside in addition to the monthly payments (including interest). If rates are not adjusted, the resulting shortfall by the end of Fiscal Year 2027 would be approximately $9.1 million, as shown in Table 5.

Table 5

Remaining Capital Improvement Reserve	$	4,083,678
Targeted Capital Reserve		13,230,783
Short Fall by Fiscal Year End 2027		**(9,147,105)**

Water Rate Recommendations

As discussed, budget projections through Fiscal Year 2027 will result in the Capital Improvement Reserve being insufficient to meet future annual capital spending needs. In order to minimize water rate increases, staff recommends utilizing a portion of the current Capital Improvement Reserve Balance (about $7 million) to fund capital projects through Fiscal Year 2027, leaving the Capital Improvement Reserve with a balance of $13.2 million. While there are several additional pressures (e.g., availability of local water that could result in the purchase of higher cost wholesale water, Vista Flume Replacement Project costs, etc.) that could require a greater rate increases, staff recommends that reserves be used to help keep water rates as low as possible.

The District's rate structure is comprised of three separate charges, Emergency Water Storage Fee, Service Charge and Water Usage Charge.

Emergency Water Storage Fee

The Emergency Water Storage Fee (also known as the Infrastructure Access Charge) is a direct cost to the District from the Water Authority and is passed through to District customers. It is recommended that the District continue to pass-through any changes to this fee from the Water Authority to its customers.

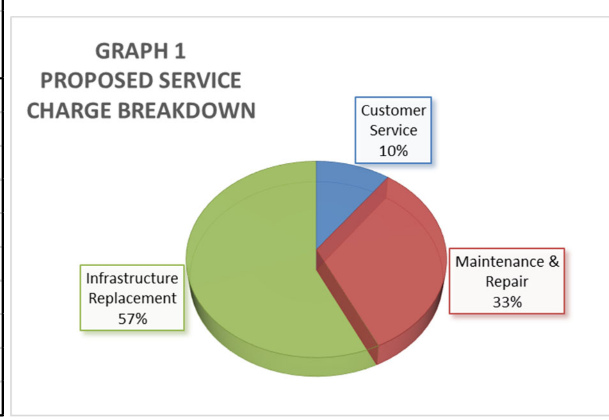
Service Charge

The service charge recovers the District's customer service, repairs and maintenance and the majority of the infrastructure replacement costs, which exists regardless of the amount of water pumped and delivered. These costs continue without regard to the amount of water that a customer uses and are sometimes called "readiness-to-serve" charges. The largest component of the service charge recovers the cost of replacing the District's aging water system infrastructure.

The Board previously approved changes to the service charge, once a year on July 1, to cover inflation on the District's costs (excluding purchased water). In July 1, 2020, the Board elected to forgo the inflationary adjustment due to the impacts of the COVID-19 pandemic; it is recommended that the District increase the service charge at this time to generate sufficient revenue to cover the expense categories described in the previous paragraph. Additionally, it is recommended that, pursuant to Government Code § 53756, the Board approve the pass-through of an inflationary adjustment on July 1 each year for the next five years; since the proposed adjustment to the service charge will generate sufficient revenue through Fiscal Year 2023, the first pass-through inflationary adjustment would be implemented on July 1, 2023. Table 6 illustrates current and proposed service charges; Graph 1 shows the expense categories paid for by revenue generated from the proposed Service Charge.

Table 6

Service Charges		
Meter Size	**Currently Monthly Charge**	**Proposed Monthly Charge**
5/8	$ 31.75	$ 32.82
3/4 & 3/4 1	41.88	43.30
1	61.89	63.98
1.5	112.34	116.14
2	172.66	178.50
3	333.57	344.85
4	514.49	531.89
6	1,218.45	1,259.65
8	1,620.90	1,675.71
10	2,425.46	2,507.47



Water Usage Charges

Water usage charges recover per acre-foot charges from the Water Authority, costs related to the District's local water supply located at Lake Henshaw, costs of treating raw water as well as a portion of transmission and distribution and other costs associated with flow and the engineering of flow. The Tier 2 marginal rate above the Tier 1 rate recovers the cost of conservation, storage expansion, wellfield improvements and some costs associated with the start of the Vista Flume Replacement project.

Water Rate Structure - The District's current water rate structure is made up of a three tiers based on meter size and hydraulic capacity that can be applied to all customer classes regardless of how the water is being used. In 2009, the Tier 1 allotment was set at 50% of average monthly water use for the most common meter size in the District (3/4-inch) and hydraulic capacity, based on meter size, was used to calculate tier allotments for smaller and larger meters. The 50% usage was used to split the usage between Tiers 1 and 2 with Tier 3 added to cover the cost of penalties assessed by the Water Authority should the District exceed its allocation during mandatory water use reductions imposed by the State of California.

To set the new tiers, staff recalculated the average monthly water use for a 3/4-inch meter using Fiscal Year 2019 billing data. The 3/4-inch meter size represents 59% of all meters in use. Fiscal Year 2019 was selected because water sales that year are similar to the projected sales for Fiscal Year 2022. Additionally, Fiscal Year 2019 was prior to the COVID-19 pandemic, which caused unusual activity as many businesses were closed, and most customers were at home.

The analysis showed the average monthly use for a 3/4-inch was 12 units, which is down from 20 units calculated during the adoption of the 2009 water rates. Based on the updated data, staff recommends adjusting the Tier 1 allotment for a 3/4-inch meter to six units (12 units x 50%) and using the hydraulic capacity of other meter sizes to determine their Tier 1 allotments. Table 7 shows the proposed Tier 1 allotments for all meter sizes. Table 8 shows the allotment for all the Tiers (Tier 2's upper allotment limit did not change, Tier 3's allotment did not change). Table 9 shows the distribution of water sales (in acre-feet) between Tier 1 and Tier 2 based on the current and proposed tiered rate structures.

Table 7

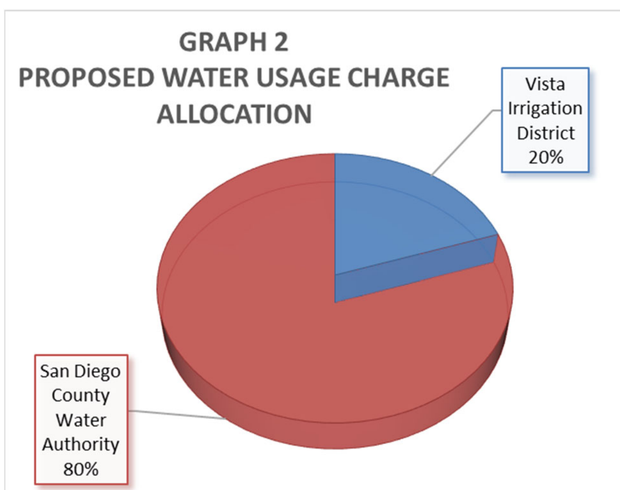
Meter Size	Current Tier 1 Allotment	Proposed Tier 1 Allotment	Difference
5/8	7	4	3
3/4	10	6	4
1	25	15	10
1 1/2	50	30	20
2	80	48	32
3	160	96	64
4	250	150	100
6	500	300	200
8	800	480	320
10	1,150	690	460

Table 8

Proposed Monthly Water Allotments by Tier			
Meter Size	Tier 1 Allotment	Tier 2 Allotment	Tier 3 Allotment
5/8”	0-4	5-42	43+
3/4”	0-6	7-60	61+
1”	0-15	16-150	151+
1 1/2”	0-30	31-300	301+
2”	0-48	49-480	481+
3”	0-96	97-960	961+
4”	0-150	151-1,500	1,501+
6”	0-300	301-3,000	3,001+
8”	0-480	481-4,800	4,801+
10”	0-690	691-6,900	6,901+

Table 9

Water Sales Billed	Current State Acre Feet	Proposed New Tier 1 Allotment Acre Feet
Tier 1	8,354	5,012
Tier 2	6,751	10,093
Tier 3	695	695
Total	15,800	15,800



As illustrated in Graph 2, approximately 20 percent of the revenue generated by water usage charges is utilized by the District to cover operating and maintenance expenses; the remaining 80 percent is used to pay the Water Authority for water purchases.

The Water Authority is responsible for supplying water to 24 member agencies within San Diego County. Not simply a water provider, the Water Authority is also responsible for the construction and maintenance of regional storage, delivery and treatment infrastructure necessary to ensure the reliable delivery of water to local water agencies like Vista Irrigation District.

Tier 1 Water- The Tier 1 rate is equal to the cost of water purchased as well as producing local water plus costs of transmission and distribution, water treatment, tanks and reservoirs, engineering and other costs associated with flow not allocated to the service charge as maintenance and repairs. The Tier 1 rate was calculated by removing the Tier 2 marginal cost (detailed in Table 10) from budget projections through Fiscal Year 2027 and adding in the proposed service charge adjustment. The Tier 1 rate was calculated to be $4.60 per unit. Staff recommends the Tier 1 rate be changed from $4.44 to $4.60. (NOTE: This increase only covers the District's shortfall and does not include the Water Authority's new pass-through increase or the rebate as seen in Table 13.)

Tier 2 Water - The Tier 2 rate equals the Tier 1 rate plus Tier 2 marginal rate. The portion that is Tier 1 covers the same costs outlined in the section describing Tier 1. The Tier 2 marginal rate is used to cover costs associated with above average usage and conservation; those costs include expanding of reservoir storage, improvement of the wellfield to increase local water production and preparations associated with the replacement of the aging Vista Flume. If water usage was below average, these projects may not be needed or could be replaced by a different type of project. The Tier 2 marginal rate was calculated by taking the cost of the projects specific to the Tier 2 marginal rate and dividing it by the amount of expected Tier 2 billings (based on 2019 actual billings as previously noted). Staff recommends the Tier 2 rate be changed from $4.98 to $5.07. (NOTE: This increase only covers the District's shortfall and does not include the Water Authority's new pass-through increase or the rebate as seen in Table 13.)

Table 10

Description	**Annual Cost**
Wells	$ 621,449
Flume	1,064,160
Pechstein II New	300,000
Tier 2 Marginal Capital	1,985,609
Conservation	235,854
Total Tier 2 Marginal Amount	$ 2,221,463
Expected Units Sold Tier 2	4,699,253
Tier 2 Marginal Rate	**$ 0.47**
Tier 1 Rate	4.60
Total Proposed Tier 2 Rate	$ 5.07

Tier 2 Marginal Rate Capital Projects

The District's largest reservoir, Pechstein Reservoir, is in need of a new roof and other improvements; however, Pechstein Reservoir is critical to the District's system operations and cannot be taken out of service without alternative storage to meet peak system demands; construction of the Pechstein II Reservoir is needed before the Pechstein Reservoir can be taken out of service. Above average demand is associated with the need for additional storage, especially during a Water Authority shutdown or emergency event.

Local water from Lake Henshaw provides the District with a lower cost water supply and serves as a diversification of it water resources. The current wellfield, which is reaching the end of its useful life, needs to be rehabilitated/improved to increase production. By rehabilitating existing wells and constructing new ones, local water production could be increased to meet higher demands without purchasing additional water from the Water Authority (see Attachment H, Executive Summary from the Warner Valley Basin Groundwater Flow Model Development and Calibration prepared by Todd Groundwater and Dudek).

The District maintains capacity rights from two sources, raw water treated at the Escondido-Vista Water Treatment Plant (EVWTP) located at Lake Dixon and multiple treated water connections along the Water Authority's aqueducts. To reduce costs, the District typically maximizes the locally treated water supply at EVWTP and relies on the 11-mile Vista Flume to convey it to the District's service area.

The Vista Flume was constructed between 1925 and 1927 and is built through rugged hillside country and snakes through rolling hills and valleys, through avocado groves and residences for 11 miles. In 1947, after 20 years in service, a repair and maintenance program began and seven miles of open bench sections were covered with a reinforced concrete arched cover. The Flume received another upgrade in the late 1990s when the District installed a high-density polyethylene (HDPE) sheet lining system. In 2010, an HDPE pipeline was inserted within a half-mile section. Now after all these years, the Flume is approaching its useful life.

In March 2020, the District prepared a Water Supply Planning Study (WSPS) with the help of Gillingham Water Planning and Engineering, Inc. to evaluate whether the Flume should be replaced or retired and what other water supply alternatives exist. The WSPS weighed a number of factors when comparing the two options including costs, reliability, water quality, environmental protection, existing water supply obligations and assets. As of now, during a planned 10-day shutdown along the Second Aqueduct, the District is dependent on the Vista Flume.

The WSPS estimated the cost to replace the Vista Flume between $120 to $130 million; after much discussion, the Board decided that the preferred project was to replace the Flume (see Attachment I Water Supply Planning Study). District reserves are not sufficient to pay for such a large and costly project; therefore, the District would need to build sufficient reserves to cover the debt service ratio before financing would be able to be obtained and construction could begin. If we assume financing of $60 million and a debt reserve ratio of 2.0, the reserve for debt would need to be approximately $5.3 million. If the District had decided not to replace the Vista Flume, the District would have needed to construct new storage reservoirs and other related capital projects to ensure the water system could be operated during a water shutdown or emergency event. If demand was below average, the replacement of the Vista Flume may be too costly and alternative projects to meet system operations and demands, such as storage, may be constructed at a smaller scale.

Large capital improvement projects are complex and can take years to complete. The District has begun planning efforts to replace the Vista Flume, including the preparation of an alignment study and financial planning.

The District's water conservation program primarily focuses on assisting residents and businesses with using water efficiently, thus reducing demands. Much of the District's conservation efforts center on public outreach and education as well as incentives for devices. However, at times, it is necessary to investigate and cite water users (consistent with the District's Water Supply Response Program) that use water inefficiently (e.g. irrigation run-off, not repair a leak promptly, etc.). These activities resource intensive and may not be needed if large water consumers used water efficiently.

Tier 3 Water – The Tier 3 water rate is implemented when penalties may be assessed by the Water Authority in the event that the District exceeds its allocation during mandatory water use reductions. Staff recommends continuing to charge Tier 3 at Tier 2 rates when no mandatory cutbacks are in place.

Budget Projections through Fiscal Year 2027 after Proposed District Rate Increases

If the Board approves staff's recommendations, at the end of Fiscal Year 2027 Capital Reserves are estimated to be about $13.5 million (see Table 11). Attachment J, Budget Projections through Fiscal Year 2027 after Proposed Rate Increases, shows the updated budget projections with the proposed service charge increase and the changes to the Tier 1 and Tier 2 water rates. The portion of the rate that represents the Water Authority increase and the rebate (credit) is not included in Attachment J (in revenue or expense) since those amounts are passed-through to District customers.

Table 11

	Cash Balance Actual 06/30/2021 Amount	Expected Cash Balance 06/30/2027 Amount
Emergency and Contingency Reserve	$ 10,000,000	$ 10,000,000
Working Capital Reserve	10,000,000	10,000,000
Surplus Water Pass-through	4,595,222	4,595,222
Water Rebate (5 years 2022-2026)	1,571,006	
Capital Improvement Reserve	20,346,496	13,545,982
Total Cash Balance	**46,512,724**	**38,141,204**

Water Rate Increases all Sources

San Diego County Water Authority Increase Pass-through - The Water Authority has provided information related to their January 1, 2022 increases to purchased water that the District would include on billings to customers on and after April 1, 2022 (should the Rate Adjustment Policy be continued as recommended). Most customer bills cover two months in arrears, so water usage in February and March 2022 would be billed in April 2022. This year the Water Authority pass-through increase is 20 cents per unit of water (see Attachment K, Water Authority Pass-Through Calculation). The pass-through increases in revenue and expense are not in the projections in this document because one offsets the other. Pursuant to Government Code § 53756, the District shall continue the practice of automatically passing through all Water Authority fees and charges for wholesale water and water related services to District customers for the five year period following adoption of the new fee schedule.

Rebate - The Water Authority received a $44.4 million rebate from the Metropolitan Water District of Southern California (Metropolitan). On February 25, 2021, the Water Authority's Board of Directors announced a plan to distribute the rebate to its 24 member agencies. The District's pro-rata share of the rebate was $1,570,006; funds were received in April 2021.

The rebate was the result of decade-long rate case litigation between the Water Authority and the Metropolitan; The Water Authority won on several critical issues in the cases covering 2011 to 2014 and was deemed the prevailing party; as such, The Water Authority was owed legal fees and charges in additional to the damages and interest payments. The payment by Metropolitan was a damages award for Water Stewardship Charges that had been unlawfully assessed by Metropolitan on the Water Authority's independent water supplies transported through Metropolitan facilities from 2011 through 2014.

On October 28, 2021 the Water Authority's Board approved an additional $35.9 million rebate for damages and interest from the Metropolitan Water District of California for breach of the parties' Exchange Agreement for years 2015-2017 by charging a Water Stewardship Rate, to be disbursed to the member agencies. The District's pro-rata share of the additional rebate is $1,227,643.

The District has elected to use the rebate to offset the Water Authority rate increases over the next five years beginning February 1, 2022, lessening the impact of future Water Authority pass-through rate increases. The rebate amount starting February 1, 2022 is eight cents, lowering the Water Authority's projected pass-through increase from 20 cents to 12 cents per unit of water consumed.

Final Increases All Sources - Table 12 shows the total proposed increase to commodity rates by source; Table 13 (identical to Table 6) shows the proposed increase to the service charge by meter size.

The "AG Domestic" rate is a flat rate paid by customers that have a residence on a property that participates the Water Authority's Special Agricultural Water Rate program; this is not a discounted rate. Customers participating in the Water Authority's Special Agricultural Water Rate program (shown as "SAWR AG" in the table) pay a water rate (on water used for agricultural purposes) that reflects a reduced level of service and supply reliability; program participants are the first to be cutback in the event of drought or other water shortages.

Table 12

	Current Rates Per Unit	Vista Irrigation District Increase	New Rate Calculated	San Diego County Water Authority Pass-through	Rebate credit applied to Pass-through Increase	Proposed Total Per Unit
Tier 1	$4.44	$0.16	$4.60	$0.20	-$0.08	$4.72
Tier 2/3	4.98	0.09	5.07	0.20	-0.08	5.19
AG Domestic	4.76	0.15	4.91	0.20	-0.08	5.03
SAWR AG Rate	3.91					4.10
Emergency Storage Fee*	4.24					4.24
*Charge per equivalent meter. Part of Pass-through charges.						

Table 13

Service Charges		
Meter Size	**Currently Monthly Charge**	**Proposed Monthly Charge**
5/8	$ 31.75	$ 32.82
3/4 & 3/4 1	41.88	43.30
1	61.89	63.98
1.5	112.34	116.14
2	172.66	178.50
3	333.57	344.85
4	514.49	531.89
6	1,218.45	1,259.65
8	1,620.90	1,675.71
10	2,425.46	2,507.47

Attachment A

Vista Irrigation District
CAPITAL PROJECTS
Projects for Fiscal Years 2022 to 2050

Infrastructure	Allocated by	Current Year Base Cost*	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
E. Reservoir Replacement/Upsize/Pump Station	Tier 1 Rate	11,500,000	3,000,000	2,842,878	4,007,582	2,209,565	-	-
Main Replacement Program	Tier 1 Rate	50,000,000	2,500,000	2,584,435	2,671,721	2,761,956	2,855,238	2,951,670
Vista Flume Rehabilitation	Tier 2 Rate	120,000,000	750,000	723,642	-	-	-	-
Paseo Santa Fe Project	Tier 1 Rate	428,611	225,000	-	-	-	-	-
Well Field Repair/Replacement (65%), Siphon rehal	Tier 2 Rate	6,956,076	200,000	516,887	-	-	-	-
Deodar Reservoir	Tier 1 Rate	1,350,000	135,000	51,689	336,637	939,065	-	-
Calle Maria Pipeline Extension	Tier 1 Rate	200,000	100,000	103,377	-	-	-	-
Pechstein II Reservoir	Tier 2 Rate	9,000,000	-	465,198	480,910	1,789,747	3,700,388	3,825,365
A Reservoir	Tier 1 Rate	5,000,000	-	258,443	267,172	994,304	2,055,771	2,125,203
Pechstein Rehabilitation Roof	Tier 1 Rate	14,100,000	-	-	-	-	799,467	826,468
Pechstein Reservoir Secondary Feed	Tier 1 Rate	5,100,000	-	-	-	-	-	-
CO SD, S. Santa Fe Ave - Widening Project	Tier 1 Rate	4,110,549	-	-	-	-	-	-
San Marcos, S. Santa Fe Wide - Smilax to Bostick	Tier 1 Rate	256,909	-	-	-	-	-	-
Robelini/Buena Creek Pipeline	Tier 1 Rate	3,773,638	-	-	-	-	-	-
Valve Rehab on Dam Outlet	Tier 1 Rate	220,942	-	-	-	-	-	-
Santa Fe - Civic to Postal	Tier 1 Rate	940,000	-	-	-	-	-	-
HB Pipeline	Tier 1 Rate	872,314	-	-	-	-	-	-
H Line Aband. - Pechstein to E Reservoir	Tier 1 Rate	719,346	-	-	-	-	-	-
900 Zone Feed Regulator and Pipe	Tier 1 Rate	600,000	-	-	-	-	-	-
Habitat Conservation Plan	Tier 1 Rate	544,648	-	-	-	-	-	-
637 Zone Feed Vault and Regulator	Tier 1 Rate	300,000	-	-	-	-	-	-
C Reservoir Demo and PRV Feed Upgrade	Tier 1 Rate	800,000	-	-	-	-	-	-
E-1 Reservoir Demo-565 Zone PRV	Tier 1 Rate	1,800,000	-	-	-	-	-	-
Total Infrastructure		238,573,033	6,910,000	7,546,550	7,764,022	8,694,637	9,410,864	9,728,705
Non Infrastructure	Tier 1 Rate	16,076,085	519,000	549,306	567,858	587,037	606,864	627,360
San Pasqual Undergrounding (50%)	Tier 1 Rate	25,051,715	8,000,000	17,162,420	-	-	-	-
Total		279,700,833	15,429,000	25,258,275	8,331,880	9,281,674	10,017,727	10,356,065

*Current Year Base Cost represents the current cost of identified projects to be completed sometime before Fiscal Year 2050. The values starting in Fiscal Year 2023 are adusted for inflation (projected to be 3.38%). Fiscal Years 2028 to 2050 are not shown in detail on this Attachment since this rate increase is designed to only cover capital expenses through Fiscal Year 2027.

Attachment B

Current Budget Projection to Fiscal Year 2027 (includes usual CPI rate increases on Service Fee July 1)

Budget FY22		
Local Water	3,115	18.5%
Purchased Water	13,685	81.5%
Total Budgeted Water Supply	16,800	

Water Sales Billed (Avg FY17-FY20 rounded)		Currrent State Acre Feet	Units	Rate 03/1/21	Amount
Tier 1	53%	**8,354**	3,639,002	$4.44	$ 16,157,171
Tier 2/3	47%	**7,446**	3,243,478	$4.98	16,152,518
Total		15,800	6,882,480		32,309,689

Service Charge (Connections Actual FY21)	Current State Count	Monthly Charge	Annual
5/8	6,832	$ 31.75	$ 2,602,992
3/4 & 3/4 1	17,000	41.88	8,543,520
1	2,880	61.89	2,138,918
1.5	1,318	112.34	1,776,769
2	883	172.66	1,829,505
3	55	333.57	220,156
4	23	514.49	141,999
6	13	1,218.45	190,078
8	2	1,620.90	38,902
10	1	2,425.46	29,106
	29,007		17,511,946

Financial		Budget FY 2022	Projected FY 2023	Projected FY 2024	Projected FY 2025	Projected FY 2026	Projected FY 2027	Total
Revenue Water Sales/Emergency Storage Fee	66%	$ 34,121,000	$ 34,121,000	$ 34,121,000	$ 34,121,000	$ 34,121,000	$ 34,121,000	
Revenue Service Fee	34%	17,500,000	17,957,533	18,491,583	19,107,992	19,744,948	20,403,137	
Revenue All Others		3,241,900	3,473,430	3,548,193	3,635,110	3,724,309	3,815,850	
Revenue Total		54,862,900	55,551,962	56,160,776	56,864,101	57,590,257	58,339,987	
Expenses less Depreciation		44,682,700	45,186,674	45,783,333	46,466,237	47,098,503	47,740,734	
Net		**10,180,200**	**10,365,288**	**10,377,443**	**10,397,865**	**10,491,754**	**10,599,253**	
Captial Projects		15,429,000	25,258,275	8,331,880	9,281,674	10,017,727	10,356,065	
Contribution to or (Use of) Capital Improvement Reserves		(5,248,800)	(14,892,987)	2,045,563	1,116,191	474,027	243,188	**(16,262,819)**

Cash Balance Actual 06/30/2021	Cash Balance Actual 06/30/2021 Amount	Expected Cash Balance 06/30/2027 Amount
Emergency and Contingency Reserve	$ 10,000,000	$ 10,000,000
Working Capital Reserve	10,000,000	10,000,000
Surplus Supplemental Water	4,595,222	4,595,222
Water Rebate	1,571,006	
Capital Improvement Reserve	20,346,496	4,083,678
Total Cash Balance	**46,512,724**	**28,678,900**

Attachment C

Four Reservoirs Board Report

VISTA IRRIGATION DISTRICT **STAFF REPORT**	**Agenda Item: 9** **Board Meeting Date:** **November 18, 2020** **Prepared By:** **Greg Keppler** **Reviewed By:** **Randy Whitmann** **Approved By:** **Brett Hodgkiss**

SUBJECT: FOUR RESERVOIRS SEISMIC/STRUCTURAL ANALYSIS AND RESERVOIR IMPROVEMENT PLANS

RECOMMENDATIONS: Receive informational report on the primary findings and recommendations from the Four Reservoirs Seismic/Structural Analysis and an update on the District's near-term reservoir improvement plans.

PRIOR BOARD ACTION: On March 4, 2020, the Board authorized the General Manager to enter into an Agreement for Professional Services with Murray Smith for the Four Reservoirs Seismic and Structural Analysis project in an amount not-to-exceed $175,739.

FISCAL IMPACT: Planning level rehabilitation, replacement, or demolition construction costs are estimated to be $12.95 million in today's dollars for the recommended alternatives in the Four Reservoirs Seismic/Structural Analysis, which includes the Virginia Place (A), Summit Trail (C), Cabrillo Circle (E-1), and Deodar reservoirs. The District's estimated total construction costs for near-term improvements (within ten years) to system storage are estimated to range between $47.55 million - $55.75 million in today's dollars (see table below).

Storage Project	Estimated Cost
Edgehill (E) Reservoir Replacement (increase from 1.5 million gallon [mg] to 2.9 mg) and New Pump Station	$11.50 million
Deodar Reservoir Rehabilitation (1.0 mg)	$ 1.35 million
New Pechstein II Reservoir (5.0 - 10.0 mg)	$9.0 million – $17.20 million
Pechstein I Reservoir Rehabilitation (20.0 mg)	$14.10 million
Virginia Place (A) Reservoir Replacement (increase from 0.8 mg to 3.0 mg)	$ 9.0 million
Summit Trail (C) Reservoir Demolition (0.8 mg) and Pressure Regulator Upgrades	$ 0.80 million
Cabrillo Circle (E-1) Reservoir Demolition (0.6 mg) and New Pressure Regulator Feed	$ 1.80 million
Total	**$47.55 million - $55.75 million**

SUMMARY: In 2018, the District completed a Water Master Plan (Master Plan) which included a cursory inspection and preliminary condition assessment of all the reservoirs and developed a priority ranking matrix to assist the District in proceeding with further investigations to implement future reservoir improvement and upgrade projects. Since the Master Plan, projects for the highest ranked reservoirs are underway including:

- Rehabilitation of the Buena Creek (HB) Reservoir is currently under construction and expected to be completed by early 2021.
- Design of the Edgehill (E) Reservoir is nearly complete and will be ready for construction by early 2021.
- A seismic/structural analysis and roof rehabilitation/replacement alternatives evaluation have been completed for the Pechstein Reservoir. Temporary short-term repairs to the glulam roof beams are underway and full roof replacement is planned following construction of a new Pechstein II Reservoir.

In addition to the above, Murray Smith has completed a seismic/structural analysis for the Virginia Place (A), Summit Trail (C), Cabrillo Circle (E-1) and Deodar reservoirs, including an evaluation of rehabilitation, replacement and/or demolition alternatives and recommendations for each reservoir. The results of this study are presented below and have assisted District staff in determining the priority and timing of near-term reservoir improvements.

DETAILED REPORT: Virginia Place (A), Summit Trail (C) and Cabrillo Circle (E-1) are all cast-in-place, reinforced concrete reservoirs constructed in the 1920s and are nearly identical in design. Deodar Reservoir is a pre-stressed concrete reservoir, very similar in design to Pechstein Reservoir, constructed in 1978. All reservoirs have a timber framed wood or corrugated metal roof. Based on the preliminary condition assessment in the Master Plan, the possibility of roof retrofits or replacements were identified as was the possibility of needing full reservoir replacement under a worst-case scenario; seismic and structural evaluations were recommended as the next step.

Murray Smith performed the following tasks for the study:

- Conducted interior and exterior inspections at each reservoir to assess overall condition.
- Performed geophysical surveys to ascertain subsurface soil conditions and current seismic design parameters.
- Reviewed original plans of the existing reservoirs to understand design parameters.
- Structurally analyzed and performed building code assessments to determine structural deficiencies.
- Provided rehabilitation requirements to address condition and structural deficiencies.
- Compared rehabilitation needs to building a new reservoir.
- Evaluated operational storage needs based on the Master Plan and developed alternative projects (e.g., construct larger reservoir or decommission reservoir without replacement).

The key findings and results are as follows:

Inspection Findings

Virginia Place (A), Summit Trail (C) and Cabrillo Circle (E-1) reservoirs – The exterior roof top surfaces are in poor to fair condition, while the underside roof framing and sheathing are in serious to poor condition. An assessment on the interior wall, floor slab, and columns were not possible with the reservoirs having urethane/epoxy coatings. The exterior walls are generally in fair condition, although full height vertical cracks are present at various locations.

Deodar Reservoir – Similar to the findings from inspecting the Pechstein Reservoir in 2018, portions of the roof are in serious condition from dry rot occurring from the outside exterior of the valley glulam beams. The interior wall, floor slab, and columns are generally in good condition, and the exterior walls are in fair condition. Hammer testing the exterior gunite identified multiple hollow sounding areas around the reservoir, which the consultant believes to be minor delamination in the gunite material that has not progressed to the circumferential pre-stressed wire wrapping (in which case corrosion would be a concern). The latter typically results in more pronounced delamination and hollow sounds when struck with a hammer.

Seismic/Structural Evaluation

Virginia Place (A), Summit Trail (C) and Cabrillo Circle (E-1) reservoirs – The roof girders and vertical wall reinforcing are substantially overstressed for normal gravity and hydrostatic loading per current design standards. With additional hydrodynamic loading during a design level earthquake, the circumferential wall reinforcing would also become overstressed. Additionally, the reservoir roof design is inadequate to resist and transfer seismic loading, making it susceptible to damage and partial or total collapse. These seismic deficiencies would transfer down the walls, columns and connecting foundation elements and damage and partial collapse of the reservoir would be likely.

Deodar Reservoir – The circumferential pre-stressed wire wrapping is slightly under-designed for normal gravity and hydrostatic loading per current design standards when evaluated with the reservoir completely full at the overflow elevation (water level at 30 feet). This deficiency is eliminated when the operational water level is reduced to a maximum of 26 feet (note the District's typical operating high-water elevation is 23 feet). Under additional hydrodynamic loading during a design level earthquake, the roof design is inadequate to resist and transfer the seismic loading, making it susceptible to damage and partial or total collapse. The remaining reservoir elements meet current seismic standards with a maximum operating water level of 26 feet.

Reservoir Alternatives and Costs

As indicated in the inspection and seismic/structural evaluation, the improvements required for the Deador Reservoir are minimal and only a new roof is recommended. However, the improvements required to rehabilitate the Virginia Place (A), Summit Trail (C) and Cabrillo Circle (E-1) reservoirs are extensive and would require full roof/column replacement and wall/base slab strengthening. The planning level estimated cost per reservoir for rehabilitation is $3.9 million, slightly less expensive than an estimated full replacement cost of $4.1 million (for a same sized reservoir). Alternative projects are proposed for these reservoirs based on a review of system storage needs.

The District's storage requirements for the entire system and per pressure zone are dependent on the large, high-elevation storage reservoirs (herein referred to as "regional storage") including Pechstein, Buena Creek (HB) and Edgehill (HP). From the analysis in the Master Plan, there is only a 4 mg system-wide deficit at build-out (which would be met by Pechstein II). However, many individual pressure zones have deficits and therefore rely on regional storage. This works when there is adequate conveyance capacity to deliver peak flows from the regional reservoir to the lower zone. If there is not adequate capacity, the lower zones become more dependent on closer, lower-elevation reservoirs (herein referred to as "local storage"). Based on this concept and hydraulic analyses performed by staff for this study, the alternates developed include expansion of the Virginia Place (A) Reservoir and decommissioning the Summit Trail (C) and Cabrillo Circle (E-1) reservoirs without replacement.

The recommended projects for each reservoir are summarized below:

Virginia Place (A) Reservoir – This 0.8 mg reservoir provides local storage to the 707 Pressure Zone and is subject to significant water level fluctuations due to demand peaking and the existing lack of regional storage support (future pipeline upgrades to the area would be required). With the current dependence on local storage in this pressure zone, it is desired to increase the existing 0.8 mg storage volume. The existing site and surrounding same-elevation parcels were evaluated for the ability to construct a new, larger reservoir. Of the many alternatives evaluated, the following project is recommended:

- Replace the existing reservoir with a 3.0 mg circular pre-stressed concrete reservoir on a combined parcel consisting of the existing District-owned site and an acquired adjacent parcel to the north and east. The planning level estimate for this improvement is $9.0 million including property acquisition costs. Should the adjacent parcel not be available for purchase, it is estimated that a new 1.1 mg reservoir can be constructed on the existing site with an estimated cost of $4.9 million.

Summit Trail (C) Reservoir – This 0.8 mg reservoir provides local storage for the 637 Pressure Zone and has significant support from regional storage; hydraulic modeling indicates this pressure zone can operate without a reservoir. The following project is recommended:

- Decommission and demolish the existing reservoir without replacement. Prior to decommissioning, upgrade the existing pressure regulator feed to the reservoir to increase capacities for peak flows. The planning level estimate for this project is approximately $800,000. Construction of a third pressure regulator feed to this zone, as recommended in the Master Plan, to increase supply reliability should also be made prior to decommissioning the reservoir.

Cabrillo Circle (E-1) Reservoir – This 0.6 mg reservoir along with the 3.1 mg San Luis Rey Reservoir provides local storage for the 565 Pressure Zone and they have significant support from regional storage; hydraulic modeling indicates this pressure zone can operate with only the San Luis Rey Reservoir in service. The following project is recommended:

- Decommission and demolish the existing reservoir without replacement. Prior to decommissioning and to increase supply reliability, install another pressure regulator feed to the pressure zone near the San Luis Rey Reservoir including approximately 2,000 feet of new transmission main. The planning level estimate for this project is approximately $1.8 million.

Deodar Reservoir – Replace the existing roof with an aluminum dome roof. Planning level roof replacement and other needed improvements are estimated to be $1.35 million.

Schedule

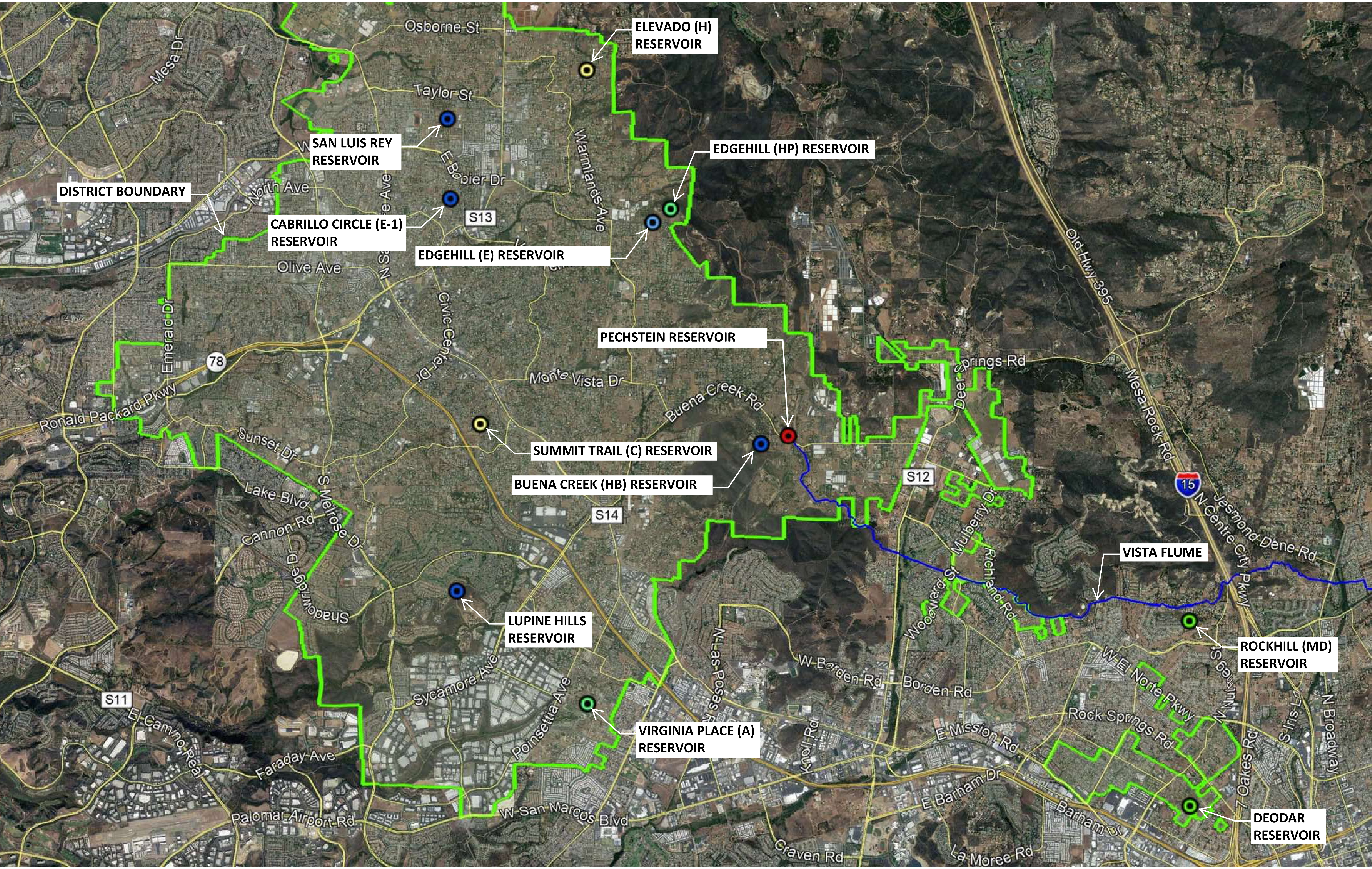
The proposed project schedule below was developed by Murray Smith; it contemplates completing all of the District's near-term reservoir projects using a phased approach based on the various factors, including inspection findings, documented deficiencies, project prioritization, and input from staff regarding engineering and operational constraints. The District's scheduling of these projects in a future fiscal year will largely depend on the availability of financial and staff resources; staff is currently updating its long-term capital project summary to determine timing and funding recommendations.

Reservoir	FY* 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
E										
Deodar										
Pechstein II										
A										
Pechstein I										
C										
E-1										

*FY – Fiscal Year

ATTACHMENTS:

- Reservoir Summary Map
- Aerial Vicinity Maps
- Murray Smith Visual Condition Assessment
- Virginia Place (A) Reservoir Replacement Alternatives


ELEVADO (H) RESERVOIR
SAN LUIS REY RESERVOIR
EDGEHILL (HP) RESERVOIR
DISTRICT BOUNDARY
CABRILLO CIRCLE (E-1) RESERVOIR
EDGEHILL (E) RESERVOIR
PECHSTEIN RESERVOIR
SUMMIT TRAIL (C) RESERVOIR
BUENA CREEK (HB) RESERVOIR
VISTA FLUME
LUPINE HILLS RESERVOIR
ROCKHILL (MD) RESERVOIR
VIRGINIA PLACE (A) RESERVOIR
DEODAR RESERVOIR
Osborne St
Taylor St
Mesa Dr
North Ave
Olive Ave
Warmlands Ave
Civic Center Dr
Monte Vista Dr
Buena Creek Rd
Deer Springs Rd
Old Hwy 395
Mesa Rock Rd
Emerald Dr
Ronald Packard Pkwy
Sunset Dr
Lake Blvd
Cannon Rd
S Melrose Dr
Shadowridge Dr
Jesmond Dene Rd
N Centre City Pkwy
Mulberry Dr
Richland Rd
Woodward St
W Borden Rd
Borden Rd
W El Norte Pkwy
Rock Springs Rd
E Mission Rd
Knoll Rd
N Las Posas Rd
Sycamore Ave
Poinsettia Ave
El Camino Real
Faraday Ave
Palomar Airport Rd
W San Marcos Blvd
E Barham Dr
Barham Dr
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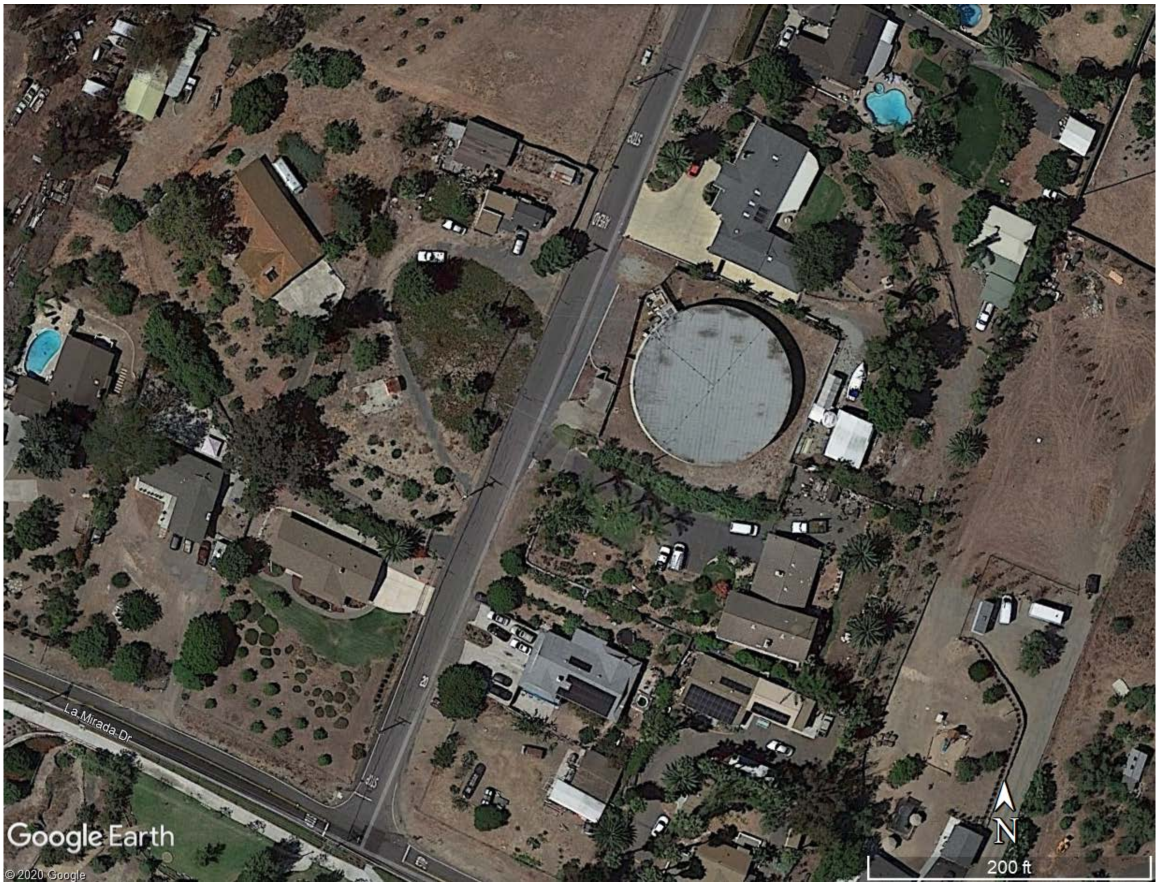
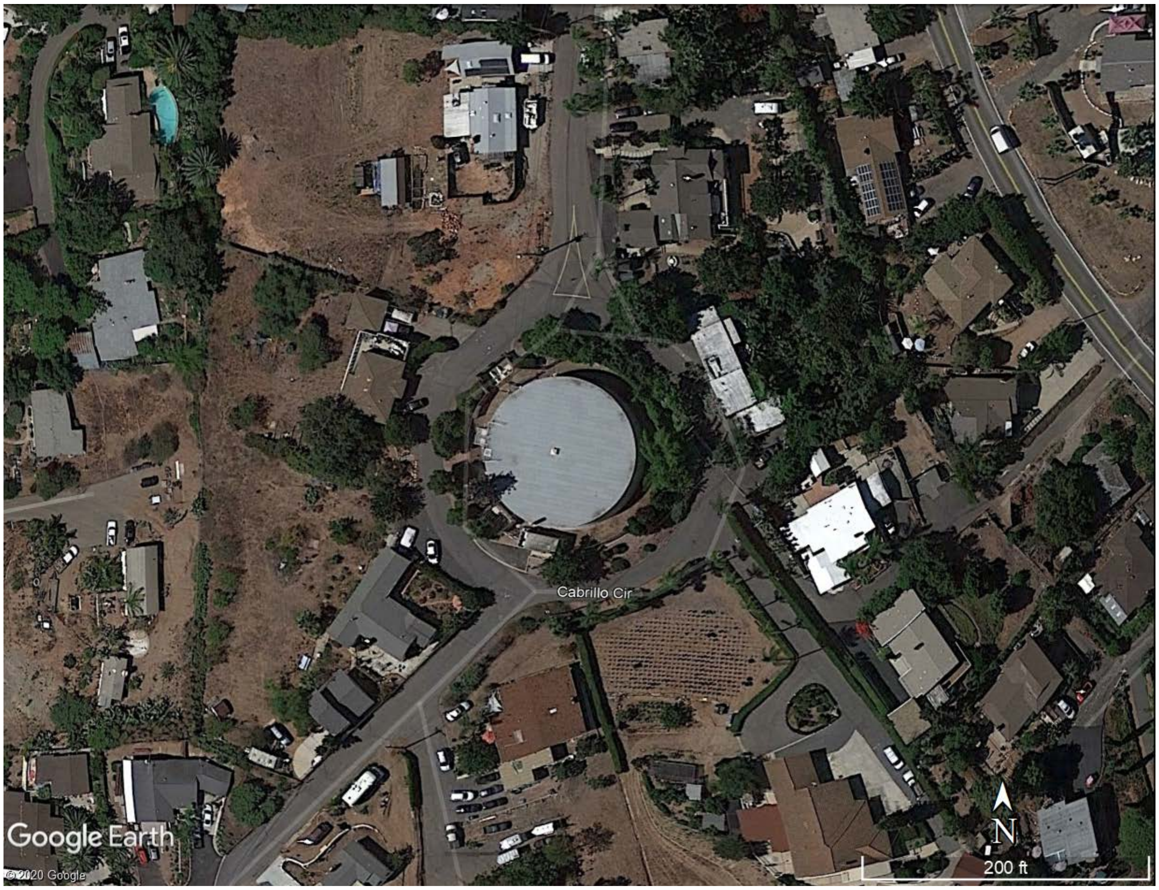
La Moree Rd
7 Oakes Rd
N Broadway
78
S11
S12
S13
S14
15

Virginia Place (A) Reservoir



Summit Trail (C) Reservoir

Cabrillo Circle (E-1) Reservoir



Deodar Reservoir

4 VISUAL CONDITION ASSESSMENT

PSE, Murraysmith, and Group Delta performed site visits to observe the current as-built condition of the interior, exterior, and surrounding sites of A, C, E-1, and Deodar Reservoirs. The dates of inspection and inspection type are shown in Table 4-1 below.

Table 4-1
Planned Inspection Dates for A, C, E-1, and Deodar Reservoirs

Reservoir	Date of Inspection	Inspection Condition
A	05/20/2020	Interior and Exterior, Dry
C	05/14/2020	Interior and Exterior, Dry
E-1	05/14/2020	Interior and Exterior, Dry
Deodar	05/27/2020	Interior and Exterior, Dry
Deodar	05/20/2020	Interior, Wet

4.1 Purpose

The purpose of an on-site visual condition assessment is to verify general conformance of existing construction and/or identify significant alterations to those described in available documents, supplement any information not made available, and observe the general condition of the existing reservoirs. For efficiency, thumbnails of photographs are shown in the body of the report. Larger versions of the photographs shown can be seen in APPENDIX D.

4.2 Schmidt Rebound Hammer Results

To assess the general condition of the concrete strength of the reservoirs, PSE performed non-destructive in-situ testing of the structures with use of a Proceq silver-schmidt rebound hammer. A schmidt hammer measures the rebound of a spring-loaded mass impacting against the surface of a sample and converts the measured rebound to determine a calculated compressive strength for the material. A Schmidt hammer is intended to be calibrated to tested sample specimens of the in-place concrete. Use on existing concrete is less reliable and can be affected by a number of parameters (cement type, aggregates, surface calcification or weathering, carbonation of the concrete, etc.). As such, in-situ estimates of strength by rebound hammer method should not be used exclusively for analysis purposes but are useful for providing an expected upper limit of the compressive strength and identifying regions of deviation within a structure. A summary of schmidt hammer testing results are shown in Table 4-2 below.

Table 4-2
Schmidt Rebound Hammer Results

Compressive Strength (psi)				
Reservoir	**Min**	**Max**	**Average**	**Standard Deviation**
A	3700	8150	5800	2200
C	2600	7600	5350	1800
E-1	5100	6300	5550	700
Deodar	7200	10000	8000	1400

4.3 A, C, and E-1 Reservoir Inspections

PSE performed the inspection of A, C, and E-1 Reservoirs on the dates shown in Section 4 of this report. The reservoirs were drained/dry at the time of the inspections.

4.3.1 Exterior Backfill

Based on exterior and interior measurements, PSE was able to estimate an approximate backfill range at each reservoir, which has been summarized in the Table 4-3 below:

Table 4-3
A, C, and E-1 Reservoirs Backfill Summary

	A Reservoir	C Reservoir	E-1 Reservoir
Maximum	5'-6"	4'-0"	2'-0"
Minimum	2'-0"	3'-0"	1'-0"

4.3.2 Roof Exterior

In general, the roof top surfaces were noted to be in poor to fair condition. The roofs are flat and consists of a built-up membrane. Visible sagging and evidence of ponding along the roof edge was observed throughout the roofs (see Photographs 1-3 below). When walking on each of the roof surfaces, it was noted to be very "springy" with areas of excessive deflection, indicating the sheathing is undersized for the framing spans or there may be damage to the sheathing or underlying framing. A Reservoir was noted to be considerably more springy than C and E-1 Reservoirs. The underlaying diaphragms as observed from the interiors comprised of straight lumber sheathing on C and E-1 Reservoirs which likely contributed to the more firm walking surface, as the diaphragm at A Reservoir was observed to consist of structural sheathing. Based on the provided Santa Fe Roofing invoice number 2646 dated 6/19/2006, we understand the roof of C Reservoir should consist of 7/16" roof sheathing panels with a three-ply built-up hot mopped roof system. As part of work, we understand District Staff repaired damaged roof members prior to the installation of the new roof system atop the straight lumber sheathing of C Reservoir in 2006.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 1	Photograph 2	Photograph 3

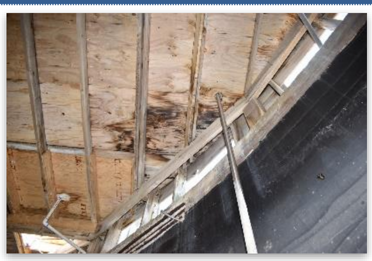
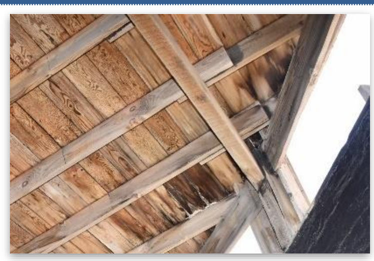
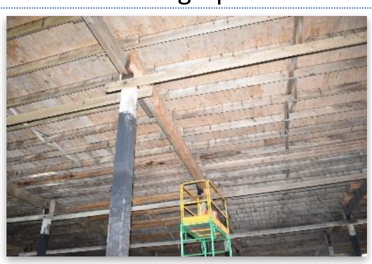
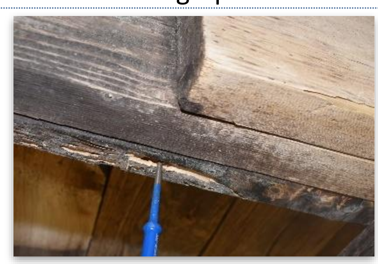
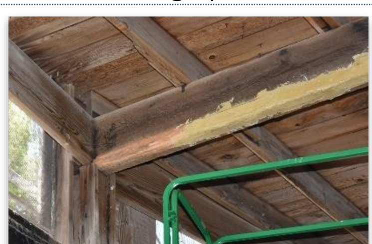
4.3.3 Roof Underside and Framing (interior)

In general, the roof framing and sheathing was noted to be in serious to poor condition. The 1x bridging between rafters was noted in a few locations (see Photographs 4 -7 below). Typically, this bridging would be installed between all roof rafters. That only a few areas of bridging were observed indicates that these members may have been removed or separated since original construction. The roof framing appears to be in general conformance with the historical drawings, with the exception of E-1 Reservoir where two 2x6 knee braces where observed between the girders and posts, one on each side (see Photograph 7).

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 4	Photograph 5	Photograph 6
		
		Photograph 7

Staining, areas of wood distress, and deterioration were noted throughout the underside of the sheathing and framing of the roof structures. Leakage through the roof membrane is evident based on the wood staining and deterioration observed (see Photographs 8-15 below). Previous replacement and/or modifications of existing roof framing members were noted at multiple locations throughout the roofs. Many of the existing roof members had been mechanically attached to new 2x wood members (a strengthening technique commonly to referred to as "sistering"), indicating that original framing members had previously required strengthening.

At the time of the inspection of A Reservoir, new 2x wood members had recently been sistered to an existing deteriorating girder and we understand additional strengthening was to be performed on a different deteriorating girder (see Photograph 10) following our inspection. Similarly, at the time of the inspection of C Reservoir, water putty was being applied to deteriorated girders, primarily as a protective coating from what appeared to be termite damage. Ends of many of the original rafters have been cut indicating previous deterioration, and subsequent alterations and strengthening, mostly by sistering of new wood members. Moisture readings taken of the wood roofs ranged from 16% to 24% at A Reservoir, 8% to 16% at C Reservoir, and 19% to 23% at E-1 Reservoir. Deterioration appears to be a combination of moisture damage and termite damage. In conjunction with the sagging observed from the rooftop, noticeable bowing of the rafters and girders was noted during the inspection. Overall, the roof framing at A Reservoir was observed to be in overall worse condition than observed at C Reservoir and E-1 Reservoir. Physical inspection of the interior roof members was limited to areas that could be accessed from a platform that was in place at the time of the inspection at A Reservoir. Close up physical inspection of the interior roof members was not performed due to accessibility and safety concerns at C and E-1 Reservoirs.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 8	Photograph 11	Photograph 14
		
Photograph 9	Photograph 12	Photograph 15
		
Photograph 10	Photograph 13	

4.3.4 Infill Wall

The Infill walls were noted to be in generally poor to fair conditions. The infill walls consist of a 2x8 sill plate, 8x8 posts (6x6 post at C Reservoir), and 2x studs that attach to the 2x exterior sheathing and metal cloth screen (see Photographs 16 – 18 below). While probing the wall members with a scratch awl, it was noted that the wood was "soft", indicating that the exterior surface of the members have exhibited decay and deterioration, which may result in a loss of structural capacity of the members.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 16	Photograph 17	Photograph 18

With the exception of E-1 Reservoir, the sill plate appeared to be anchored with a 5/8" diameter bolt and spaced on average at approximately 4' on center as indicated in the historical drawings. At E-1 Reservoir, the anchors appeared to be spaced well in excess of 4' on center and without the use of a nut or washer to create a positive connection to the wall below, indicating that the nuts may have either been lost/removed over time or potentially were not installed during construction. Surface rust and deterioration was noted at the bolts and nuts (see Photographs 19-21 below). In addition, what appeared to be signs of a termite infestation and corresponding damage was observe at the infill wall framing.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 19	Photograph 20	Photograph 21

Where the 4x12 roof girders bear on the notched 8x8/6x6 wall posts, it was noted that the available notched space provided little to no bearing area for the perimeter 2x12 girders. In some cases, the 2x12 girders rely almost exclusively on nailing to the ends of the interior girders for transfer of roof loads to the posts (see Photographs 22 – 24 below). Given the deterioration of the 4x12 girder ends and the exposed shank, the connections do not appear adequate to transfer the roof loads to the posts and are a structural concern.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 22	Photograph 23	Photograph 24

4.3.5 Columns

The interior concrete columns were confirmed to be 8" square in section as indicated in the historical drawings. Due to the presence of the liner around all the posts, we were not able to visually observe the condition of the concrete. The liner covers the entire column surface, thereby obstructing views to any cracking or minor deformations that may be present in the columns. However, it was noted that several of the posts had been modified/repaired or showed loss of section, which appear to have occurred prior to, or at the time the reservoir walls and columns were lined (see Photograph 25 – 27 below).

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 25	Photograph 26	Photograph 27

4.3.6 Slab Floor

Similar to the columns, the top surface of the interior floor slabs was observed to be coated with an interior liner, obstructing view to any minor cracking or deformations that may be present. Areas of bubbling, delamination, and patching of the liner was noted at various locations along the floors of A and C Reservoirs, typically near the base of the columns or perimeter wall (see Photographs 28 - 30). With the exception of a few areas of blistering near the perimeter wall, the liner at E-1 Reservoir appears in generally good condition.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 28	Photograph 29	Photograph 30

4.3.7 Reservoir Walls

Based on the areas that could be observed, the reservoir walls were noted to be in generally fair condition. The interior of the reservoir walls was observed to be coated with the same liner as the columns and slab which obstructs view to any minor cracking or deformations that may be present. Areas of bubbling, delamination, and patching of the liner was noted at various locations along the interior walls (see Photographs 31 - 33 below). The wall liner at E-1 Reservoir appeared in better condition than at A and C Reservoirs.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 31	Photograph 32	Photograph 33

From the exterior, full height vertical cracks were noted in various locations along the walls, typically spaced at intervals of 8 to 10 feet on center and measured to be approximately 0.006 inches thick. Based on observations made, the cracks do not appear to be newly formed and are likely a result of temperature expansion and contraction of the concrete. Wall staining was also observed from the exterior of the reservoirs (see Photographs 34 – 39 below). This staining was determined to likely be a result of runoff from ponding and drainage issues observed at the roof, causing streaking and staining onto the exterior wall surfaces. In addition, it appears a flexible crack sealant had been previously installed at areas along some of the cold joints prior to application of the exterior paint layer, indicating active leakage may have been present or this sealant could have been installed as a preventative measure. Water staining was also noted at the south-west quadrant of the exterior wall at A Reservoir, along the bottom horizontal cold joint, approximately 24" above grade (see Photograph 35), indicating potential active leakage. The water staining was felt to be dry to the touch. However, the reservoir had been drained when this stain was observed. In addition, efflorescence (a sign of dried water seepage) was noted at the north quadrant of the exterior wall of E-1 Reservoir, along the bottom horizontal cold joint, approximately 30” above grade (see Photograph 39). Similar efflorescence was noted in the HDR condition assessment in 2017.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 34	Photograph 36	Photograph 38
		
Photograph 35	Photograph 37	Photograph 39

4.3.8 Control Box

The condition of the reservoir control boxes varied and were noted to be in generally serious to fair conditions. With the exception of the roof framing members, the control box at A Reservoir was noted to be in serious to poor condition. Based on conversations with District staff, we understand the control box roof framing at A Reservoir was recently replaced and based on PSE’s observations, appears in good condition. Concrete spalling was observed at the top of the interior control box wall (see Photograph 40), at the overflow opening (see Photograph 41) during the inspection of A Reservoir. In addition, concrete staining and discoloration was observed near the top of the exterior control box walls of A Reservoir (See Photograph 42). We understand that when the existing roof was removed, concrete was formed and poured around the top of the existing wall as part of the installation of the new roof which is the likely cause for the staining and discoloration. The rebar was exposed at the overflow opening and showed significant deterioration.

The control box interior of C Reservoir, including portions of the steel roof framing was coated with a CIM liner, visibly obstructing ability to view any cracking or deformations that may be present. However, significant cracking at the overflow opening was noted during the inspection (see Photograph 43). While the CIM liner provides a protective coating, exposed areas of steel roof framing were noted to exhibit signs of moderate deterioration (see Photograph 44).

The control box interior of E-1 Reservoir was also coated with an epoxy liner, obstructing ability to view any cracking or deformations that may be present. However, moderate to severe corrosion and section loss of the control box roof framing was noted at the time of the observation (see Photograph 45).

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 40	Photograph 43	Photograph 45
		
Photograph 41	Photograph 44	
		
Photograph 42		

4.3.9 Appurtenances

Based on the site observations, appurtenances were found to be in generally good condition. No separation or failure of the elements were noted during the site visit, and coatings appeared intact. As such, the existing interior appurtenances appear to be functional and in good condition. Minor corrosion blooms and rusting were noted at the fixed ladders at control boxes and at the reservoir roof hatches, but the exterior appurtenances appeared in overall good condition.

4.3.10 Liner/ Coating

During the interior inspection of A, C, and E-1 Reservoirs, observations of the interior coating condition were made as follows:

A Reservoir: The existing CIM coating applied by Guardian Waterproofing & Caulking in 2007 has widespread small bubbling across the entire extent of the floor area, and also in the lower portions of the walls within about 4 vertical feet of the floor. Overall, however, the coating is in very good condition, with minimal delamination observed. See Photographs 46 and 47 below, which show the bubbling. Bubbles over ½-inch in diameter were observed only in a small number of locations along floor joints between interior columns. Annual spot repairs are recommended until such time as the reservoir is demolished in the near future.

C Reservoir: The existing CIM coating applied in 2014 is in adequate condition for approximately 90% of the interior surface area of the walls and floors. The remaining 10% of the interior surface area has the following two main issues:

- Around the entire circumference of the entire floor area, coating patching has taken place. The coating appears to have been ponded in excessive amounts to “push” the coating into the scrim along the joint between the floor slab and the base of the wall. Thus, there is a two to three-foot wide band of built up coating around the outer portion of the floor, along the entire wall circumference. Much of this coating is cracked or delaminated. See Photograph 49 below.
- The coating is delaminated at the base of several of the interior columns. See Photograph 48 below.

Although this tank is slated for near-term demolition, it is recommended that the damaged 10% of interior concrete surface area be repaired, if the District plans to continue use of this tank past January 2021.

E-1 Reservoir: The existing Warren Environmental Epoxy applied in 2016 is in very good condition. There was only one location of observed coating delamination (less than 0.5 square feet in area). Less than 5 percent of the floor area has bubbling in the floor, but the bubbling has not resulted in any delamination. See Photographs 50 and 51 below.

A Reservoir	C Reservoir	E-1 Reservoir
		
Photograph 46	Photograph 48	Photograph 50
		
Photograph 47	Photograph 49	Photograph 51

4.4 Deodar Reservoir

PSE performed the first inspection of Deodar Reservoir on May 20th, 2020. The reservoir was full at the time and the inspection was performed from an inflatable raft to observe the interior condition of the roof framing. PSE also performed a second inspection of Deodar Reservoir on May 27th, 2020. The reservoir was drained/dry at the time of the second inspection.

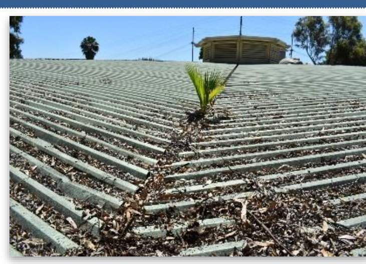
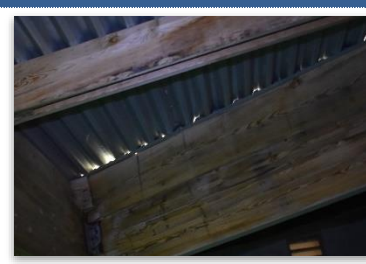
4.4.1 Exterior Backfill

Exterior measurements estimated a backfill range of approximately 11'-2" inches to approximately 20'-8" +/- 6 inches around the reservoir. The reservoir is located on a sloped site, and can be accessed via private road that adjoins Deodar Road in Escondido, California.

4.4.2 Roof Exterior

In general, the roof top surface and center vent was noted to be in fair condition. Isolated damage/denting of the aluminum roof decking was noted. This damage is likely due to routine use by District staff indicating the support conditions and strength of decking is under designed for operational use. Corroded deck fasteners were noted throughout the roof structure. In addition, at ridge seams, elongated, missing, and/or sheared fasteners (see Photograph 52) were observed indicating damage due to thermal expansion of the aluminum deck.

At the drain channels, a build up of debris has formed at the perimeter ends which has allowed for growth of plant life and is impeding the drainage of the roof (see Photograph 53). In its observed condition, the drain can be expected to overflow during times of heavy rainfall, allowing for water intrusion of the exterior portions of the valley glulam beams (shown later in the report). We understand that shortly after PSE's site visit, leaves and debris were cleaned out of the drain channels. In addition, light was observed at deck seams from the interior (see Photograph 54), indicating weatherproofing and water quality concerns.

Deodar		
		
Photograph 52	Photograph 53	Photograph 54

4.4.3 Roof Framing (interior)

Per the original roof system specification "all wooden roofing and roof framing material, including rafters, glue laminated beams and plywood, shall be pressure treated with pentachlorophenal". This could not be verified based on visual observations, however the use of this preservative, while common during the era of original construction, is not permitted per current design and water quality standards.

4.4.3.1 Ridge Glulam Beams

In general, the roof ridge beams as observed from the interior of the reservoir appeared in good condition. Minor water staining of the beam and CMU wall was observed (see Photograph 55) but overall the ridge beam and ridge beam connectors were noted to be in better condition than the valley and lateral Beams (described below).

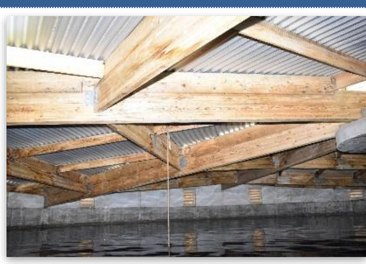
Deodar

Photograph 55

4.4.3.2 Valley Glulam Beams

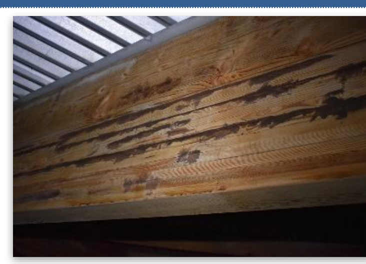
In general, the roof valley beams as observed from the interior of the reservoir appeared in fair condition. Water staining was observed and appeared to get progressively more severe moving from the center column to exterior wall (see Photograph 56), indicating potential drainage and/or ventilation concerns. Minor delamination was observed at the valley beams but appears to mostly be present near the wall (see Photograph 57). In some cases, it appears the laminations were strengthened by means of epoxy injection (see Photograph 58). Moisture readings of the valley beams typically ranged from 13% - 18% with the exception of the valley beam east of the entry hatch opening which, measured a moisture content of approximately 23%. While probing the beams with an awl during the full/wet inspection, the wood that could be accessed was noted to be competent.

Deodar



Photograph 56

Photograph 57



Photograph 58

4.4.3.3 Lateral Glulam Beams

In general, the roof lateral beams as observed from the interior of the reservoir appeared in fair condition. Water staining was observed primarily at rafter intersections and appeared to get progressively more severe moving from ridge to valley (see Photograph 59), indicating potential drainage and/or ventilation concerns. Lateral beam hardware and connections appeared in generally good condition. However, minor deterioration was noted at some of the lateral beam hardware (see Photograph 60). Minor delamination was observed at the valley beams. In some cases, it appears the laminations were strengthened by means of epoxy injection (see Photograph 61). Moisture reading taken of lateral beams ranged from 14% - 25%.

Deodar		
		
Photograph 59	Photograph 60	Photograph 61

4.4.3.4 Rafters

In general, the roof rafters as observed from the interior of the reservoir appeared in poor to fair condition. Due to the limitations of the wet/full inspection, we were unable to closely examine the condition of all the existing rafters. Water staining and deterioration was observed and appeared to be concentrated at laps above lateral beams (see Photograph 62). Rafter hardware and connections appeared in generally poor conditions with moderate deterioration noted at most connections (see Photograph 63). In some extreme cases the hardware and connections have failed completely (see Photograph 64).

Deodar		
		
Photograph 62	Photograph 63	Photograph 64

4.4.4 Roof Framing (Exterior)

Close up physical observations of the exterior roof framing were limited to areas that could be safely and easily accessed with an extension ladder.

4.4.4.1 Ridge Glulam Beams

In general, the roof ridge beams as observed from the exterior of the reservoir appeared in fair condition. Checks and delamination were noted (see Photograph 65), but no visual signs of overstress were observed.

Deodar

Photograph 65

4.4.4.2 Valley Glulam Beams

In general, the roof valley beams as observed from the exterior of the reservoir appeared in serious to poor condition. The beam ends were observed to show signs of severe deterioration with active moisture and algae growth (see Photograph 66). When probed with a scratch awl, the beam ends were noted to be very soft, allowing the awl to penetrate in excess of 1-inch. In addition, moisture readings were measured to be in excess of 39% at the beam ends. This appears to be a result of the poor drain design mentioned earlier in this report. The beams were determined to be in fair condition approximately 1-foot from the ends based on probing and moisture readings of less than 19%. However, the top surface of the glulam beam that supports the drains was not able to be observed due to the presence of wood framing (see Photograph 67) and this area may be subject to similar damage as observed at the beam ends based upon the drainage design. It was noted that the downspouts are located at the reservoir face, interior from the ends of the valleys, so the overhang portions of the valley gutter do not have any method to allow it to drain without overflowing over the end of the beam or along the length of the gutter channel. It is probable that areas of additional damage may be hidden along the top of this valley beam overhang that cannot be observed without removing the roofing in this area.

Deodar	
	
Photograph 66	Photograph 67

4.4.4.3 Exterior Framing

In general, the roof framing as observed from the exterior of the Reservoir appeared in poor condition with the exception of where the rim boards bear on the valley beams where signs of severe deterioration with active moisture and algae growth were observed (see Photograph 68), likely a result of the poor drain design mentioned earlier in this report. In addition, minor to moderate deterioration was noted at the overlook framing in contact with the aluminum deck (see Photograph 69). Damage at the reservoir wall blocking was also observed from what appears to be a result of termites or local wildlife (see Photograph 70).

Deodar		
		
Photograph 68	Photograph 69	Photograph 70

4.4.5 Column

The column was confirmed to be 30” in diameter as indicated in the historical drawings. Based on observations made during the inspection, the column appears in generally good condition (see Photograph 71).

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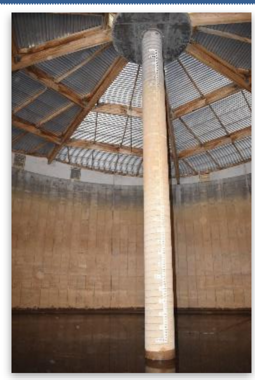

Photograph 71

4.4.6 Slab Floor

Based on observations made during the inspection, the base slab appears in generally good condition. However, it was noted that the slab joint filler was protruding from the joints and has likely reached the end of its useful life (see Photograph 72).

Deodar

Photograph 72

4.4.7 Concrete Masonry Unit (CMU) Walls

The CMU walls were noted to be in generally good condition. Surface staining from the interior (see Photograph 73) was noted, indicating potential drainage and/or ventilation concerns of the roof framing.

Deodar

Photograph 73

4.4.8 Reservoir Walls (interior)

The prestressed concrete core wall was observed from the interior and was determined to be in generally good condition. Areas of pitting/bug holes (see Photograph 74) were noted during the drained inspection. In addition, water staining was noted below valley beams (see Photograph 75), indicating potential drainage and/or ventilation concerns of the roof framing.

Deodar

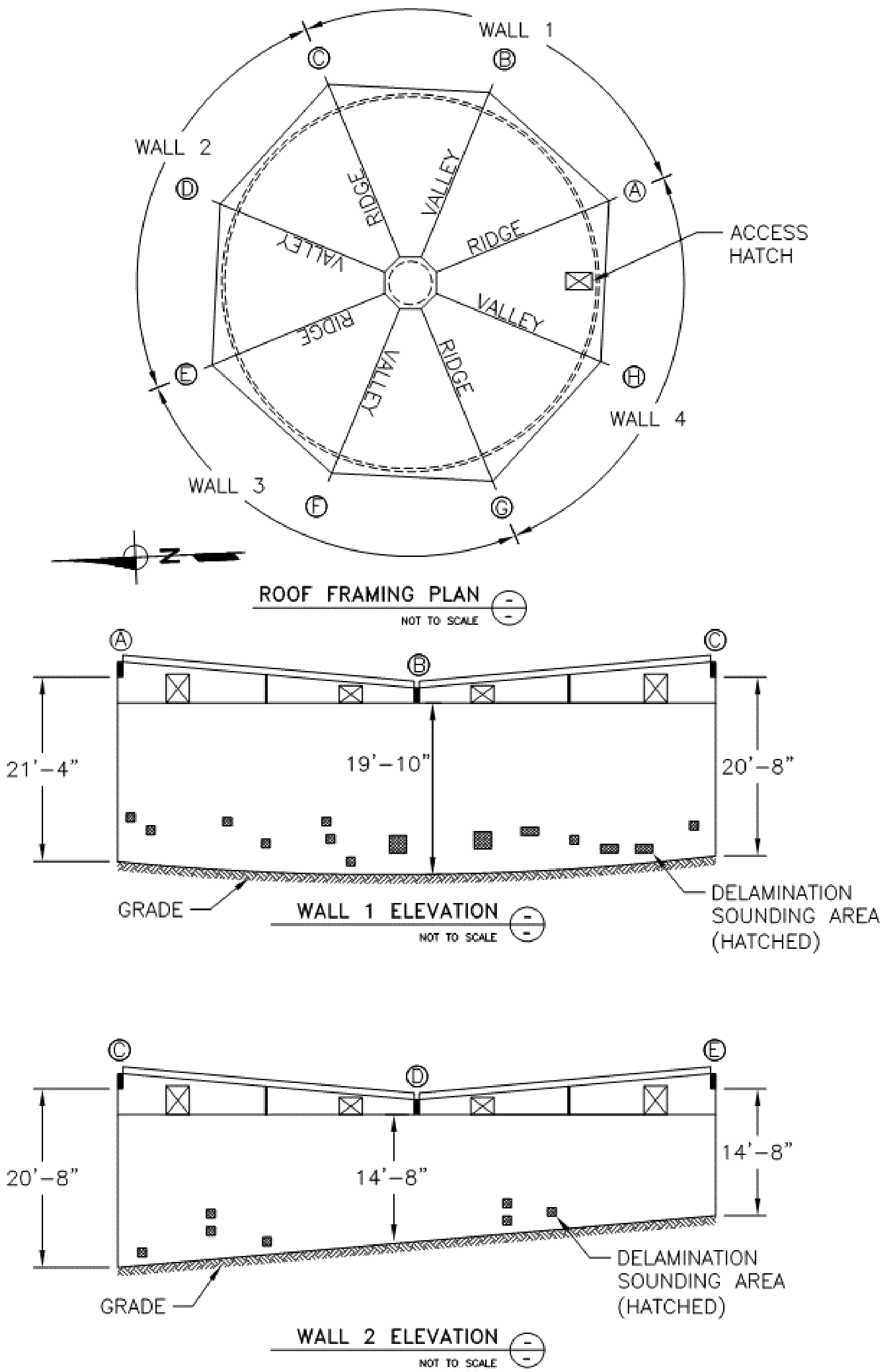
Photograph 74

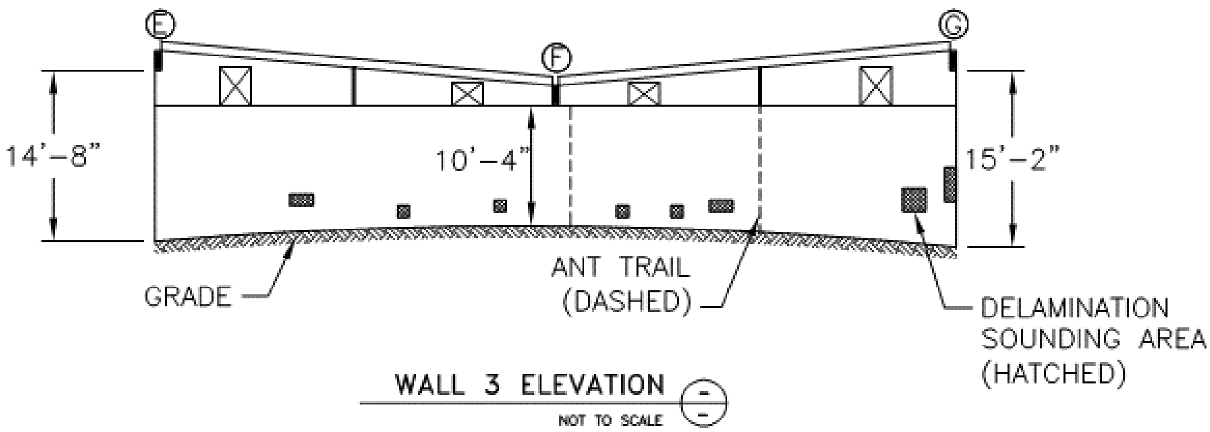
Photograph 75

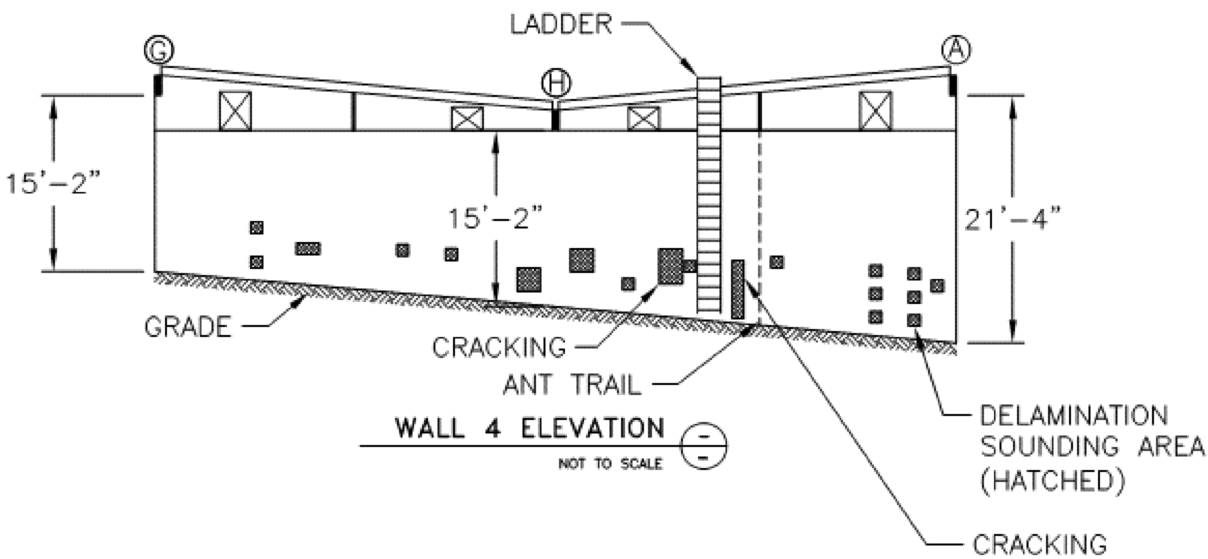
4.4.9 Reservoir Walls (exterior)

The exterior gunite wall layer was visually inspected and the bottom 7-feet sounded with a rock hammer during the drained/dry inspection of Deodar and was noted to be in generally fair condition. "Hollow" sounding areas (which identify possible gunite delamination and/or spalling that could allow water intrusion and corrosion of the circumferential prestressing wire) were noted throughout the reservoir and were observed more frequently on the south-east quadrant of the reservoir (see Figure 4-1). Additionally, minor surface cracking (see Photograph 76) was noted at some of the hollow sounding areas. Based on experience with structures of similar age and construction, the sounding results indicated that delamination has likely occurred between gunite layers and has not progressed to the prestressed galvanized strands. This delamination is likely a result of temperature expansion and contraction of the gunite and/or the result of initial imperfections during the gunite application. Delamination that is present at the prestressing material typically materializes in more significant spalling of the gunite than was observed at Deodar. Additionally, such extent of delamination is typically results in more pronounced hollow sounds when struck with a hammer. Full height vertical ant trails were noted along the wall, indicating a potential infestation of organisms that could affect the quality of the reservoir's contents. Additionally concrete staining below CMU expansion joints (see Photograph 77) was observed indicating a potential ventilation and/or drainage concern.

Figure 4-1: Deodar Reservoir Sounding Map







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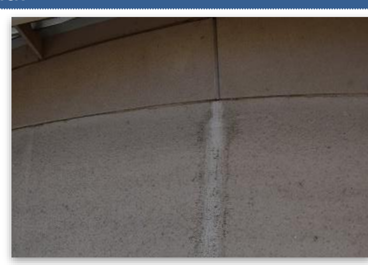
	
Photograph 76	Photograph 77

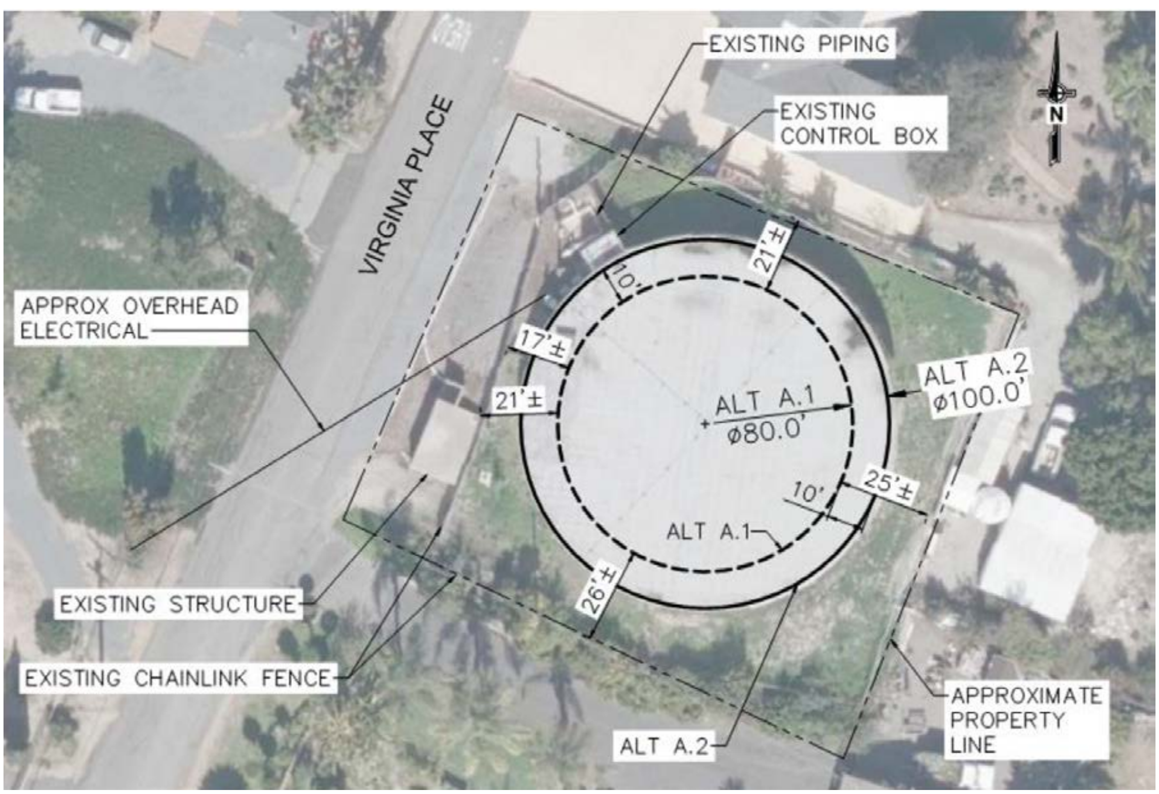
4.4.10 Appurtenances

Based on our observations, the condition of appurtenances varied but was noted to be in generally fair conditions. While inside the reservoir during the dry/drained inspection, moderate surface deterioration and what appeared to be previous repair work of the overflow pipe was observed (see Photograph 78). Cathodic protection has been installed to control the corrosion of the overflow pipe and other metal surfaces and we understand new anodes were to be installed following our inspection. The overflow pipe was noted to be braced near the base slab. As the base slab is seismically isolated from the tank walls, this bracing condition could result in damage to the overflow pipe if the flexible coupling joint can't accommodate the imposed seismic deflections in a large seismic event which could significantly limit the capacity or results in the loss of the full storage capacity of the reservoir in immediate post-earthquake applications. Other metal surfaces had been coated with a protective layer (see Photograph 79), obstructing the condition of these elements. With the exception of these items, the internal appurtenances appeared in generally fair condition with some minor surface corrosion noted (see Photograph 80). Valves in the valve pit are in good condition. The sacrificial anodes appear to be working well in minimizing corrosion of the valves (see Photograph 81). The exterior appurtenances were found to be in generally good condition. No separation or failure of the elements were noted during the site observation, and coatings appeared intact. Minor corrosion blooms and rusting were noted at the fixed ladder (see Photograph 82).

Deodar		
		
Photograph 78	Photograph 79	Photograph 80
		
Photograph 81	Photograph 82	

New 3.0 mg Virginia Place (A) Reservoir

New 0.8 – 1.1 mg Virginia Place (A) Reservoir



Attachment D

Excerpt from Roof Structural Assessment Report

ROOF STRUCTURAL ASSESSMENT REPORT
20 MILLION GALLON PECHSTEIN RESERVOIR

VISTA IRRIGATION DISTRICT

SEPTEMBER 2018 REPORT

Prepared by:

BRADY

2655 Camino del Rio North, Suite 100
San Diego, California 92108
(858) 496-0500

BRADY

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858/496-0500
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September 28, 2018

Vista Irrigation District
1391 Engineer Street
Vista, CA 92081

Attention: Mr. Greg Keppler, PE QSD, Engineering Project Manager

Subject: **Roof Structural Assessment Report**
20 Million Gallon Pechstein Reservoir
Vista, CA

Dear Mr. Keppler,

In accordance with the contract Scope of Work, field investigation and an assessment of the subject facility has been completed. Richard Brady & Associates (BRADY) personnel performed an inspection of the roof at Pechstein Reservoir on the dates of July 12 and 17, 2018. The field investigation was performed by Amanda Del Bello, P.E., Engineer-Diver, and Garrett Murawsky, E.I.T.

EXECUTIVE SUMMARY

Inspection, assessment and structural analysis was performed by BRADY to support the development of repair recommendations related to the roof and/or complete roof replacement. This inspection and assessment was initiated based on recommendations made in the District's 2018 Master Plan. The Master Plan contained a Reservoir Condition Assessment of Pechstein Reservoir which included recommendations for further investigation which included the following: "Perform a detailed condition assessment of the reservoir interior, …reservoir roof replacement [investigation], and perform a seismic evaluation of the reservoir to determine…compliance with current seismic code." As a result BRADY was tasked with conducting a visual inspection of the roof interior as it relates to repair or replacement of the roof, review of historical documents and a structural evaluation to assess whether the reservoir meets current structural/seismic design code requirements. This reports presents the findings and includes recommendations for roof replacement, a cost estimate and anticipated schedule.

This inspection and assessment determined the existing roof system is structurally deficient. Structural analysis was performed on the reservoir walls and foundations to determine whether the existing reservoir meets current code requirements. The analysis determined that the reservoir perimeter wall and foundation do not meet the requirements of the current code. Although deficiencies were found, it is our opinion that the reservoir has adequate structural capacity below the existing roof to support an aluminum dome roof.

The reservoir prestressed walls are in good condition overall and are capable of providing an additional 50 years of service life, provided the existing roof is replaced with a lighter aluminum dome replacement roof.

A cost estimate was performed for demolition of the existing roof system and costs associated with installation of a new aluminum dome roof only. This cost for the recommended roof replacement work is $11.05 million and the expected out of service construction time is 10 months. These costs do not include any other improvements needed for the reservoir including those identified in the Master Plan. The recommendations made in the Master Plan would require further investigation as part of an overall design for the roof replacement project. Temporary repairs could be made to maintain the reservoir in service until a long term improvement can be made. Further investigation would be required, including core sampling of the glulam valley beams near the perimeter wall in order to come up with a temporary repair design. Maintenance repairs can also be made including replacing simpson connectors and patching the roof deck. No costs are provided for these repairs because it was not included in the scope of this effort.

REFERENCE DOCUMENTS

The following documents were considered as part of this investigation:

1. Record drawings titled, "Filtered Water Storage Project of 1976", dated October 1976, prepared by James M. Montgomery, Consulting Engineers, Inc. See Appendix D for excerpts from the full set of drawings pertinent to this assessment.
2. Geotechnical report titled, "Geotechnical Investigation for 20 Million Gallon Pechstein Reservoir San Marcos, California, dated April 1976, prepared by Robert Prater Associates.
3. Appendix B of the District's 2018 Master Plan titled, "Reservoir Condition Assessment, Vista Irrigation District", dated October 26, 2017, prepared by HDR Engineers.
4. Miscellaneous historical documents related to previous investigations and repairs provided by Vista Irrigation District, see Appendix E for documents and "Background Information and History" section of this report for a summary.
5. Original construction shop drawings titled, "20 MG Reservoir", dated March 1, 1976, prepared by DYK BBR Prestressed Tanks, Inc. Included in Appendix D – Record Documents.

DESCRIPTION OF FACILITY

Pechstein Reservoir is a 20 million gallon (MG) reservoir owned and operated by the Vista Irrigation District (VID) and is located at 3784 Bluebird Canyon Road, Vista, CA, see Figure 1 of Appendix A – Location and Vicinity Map. The reservoir, designed in 1976, is a partially buried, prestressed concrete reservoir with a 355-ft interior diameter according to Reference Document No. 1 (Reference Document No. 5 indicates 351-ft interior diameter); see Photo 1. The reservoir perimeter wall is an 18-in. thick cast-in-place (CIP) concrete core wall with a 2-in. thick layer of shotcrete on the exterior. The CIP wall incorporates 1.25-in. diameter prestressed vertical tendons in the center of the wall and 3/8-in. diameter seven wire strand seismic restraint cables located 5-in. from the exterior face of the CIP wall. Circumferential prestressing reinforcement (3/8-in. diameter seven wire strands) surrounds the CIP walls which are covered by the 2-in. thick layer of shotcrete. The spacing and quantity of circumferential prestressed reinforcement is determined as a function of the wall height and required prestress per foot of wall height.

The CIP core wall is 28 feet tall of which approximately 21-ft is buried. Above the CIP wall is a nominal 8-in. reinforced concrete masonry unit (cmu) wall with ¾-in. thick stucco exterior and louvers spaced every 14 feet. The wall elevation varies (3 courses high to 11 courses high) to support eight valley and eight ridge roof beams, see Photo 2. At the center of the reservoir there is a roof vent cupola structure, the highest point at 24.33-ft above the finished grade around the reservoir.

The valley and ridge roof beams are glued laminated (glulam) timbers placed in a radial direction around a 4-ft diameter center CIP concrete column and a 20-ft diameter CIP concrete platform, see Photo 3. The glulam ridge and valley beams extend from the center platform of the reservoir to the exterior of the perimeter wall (Photo 4) and are supported intermediately by three concentric circles of 2-ft diameter CIP concrete columns. Mid-way between the ridge and valley beams there are a total of 16 glulam beams extending between the exterior concentric circle of columns and the cmu wall.

The ridge and valley beams support 12 glulam purlins in the transverse direction. The purlins support 2”x10” rafters at 7-ft on center and corrugated aluminum roofing. The glulam framing plan can be seen in Figures 2 and 3 of Appendix A where the radial glulam beams are labeled one through 32 and transverse purlins A through L. This nomenclature system will be used to identify location of defects in this report.

Attachment E

Excerpt from Potable Water Master Plan

Potable Water Master Plan

Vista Irrigation District

Committed to Supplying High Quality Water in an Economically and Environmentally Responsible Way

April 9, 2018

Executive Summary

The purpose of this Potable Water Master Plan is to provide a comprehensive review of the Vista Irrigation District's potable water supply and distribution system and develop a structured program to identify system improvements necessary to meet existing and future demand conditions. System improvements are identified through a condition assessment of existing facilities and distribution system hydraulic analyses. This effort includes an updated and calibrated hydraulic model that accurately reflects the current distribution system demands and operating parameters.

Service Area and Water Demands

The District's service area encompasses property within the City of Vista, the City of San Marcos, and the County of San Diego. Each of these agencies has adopted a General Plan document that is incorporated into a regional planning database. This database is utilized in this Master Plan for understanding water usage based on land-use and developing unit demand factors for estimating future water demands.

The District's historical water use has varied significantly over the past 30 years, reaching a peak in 2004, with current demands dropping below those seen in 1986. The downward trends over the past 10 years can be attributed to a number of factors ranging from economics, weather, adoption of increased water conservation measures, and mandated restrictions. Due to these factors, the build-out demand projection in this Master Plan is 25 percent less than that estimated in the 2000 Master Plan; and as a result, very little expansion based projects are identified and the Capital Improvement Program instead focuses on system reliability and redundancy, in addition to pipeline replacements.

Water Supply Reliability

The District maintains capacity rights from two sources, raw water treated at the Escondido-Vista Water Treatment Plant located at Lake Dixon and multiple treated water connections along the San Diego County Water Authority's aqueducts. Due to reduced costs, the District typically maximizes the locally treated water supply and relies on the 11-mile Vista Flume for conveyance into the District. During a planned 10-day shutdown along the Second Aqueduct, the District is dependent on the Vista Flume. With the Flume approaching its useful life, this Master Plan reviews and outlines a number of recommended alternative projects for further study that can add redundancy, reliability, and operational flexibility to offset the Flume being out of service either short term or long term.

Pipeline Condition Assessment and Replacement Strategy

A detailed pipeline condition assessment is presented in this Master Plan that provides an overall system risk assessment along with several investment scenarios that estimate how various funding levels will impact future service levels. This assessment provides a tool for the District to strike the appropriate balance between affordability and sustaining desired service levels and also focus those investments to ensure ratepayers realize the greatest return on their investment.

Reservoir Condition Assessment

Condition assessment inspections of 10 of the District's 12 potable water reservoirs were completed to document the current condition of the civil site, corrosion, and structural aspects of the reservoirs. The findings of the inspection of the District's reservoirs were used to recommend and prioritize improvements for the rehabilitation or replacement of reservoir equipment and identify any additional assessments required.

Capital Improvement Program

An updated Capital Improvement Program has been developed based on redundancy or replacement and rehabilitation improvements for the existing distribution system and an ultimate system based on projected buildout demands. The recommended projects are shown in **Figure ES-1**, and estimated costs are provided in **Table ES-1**.

Resulting System Deficiencies

Implementing the VID 9 and VID 11 redundant water supply alternatives results in acceptable operating pressures but also creates pipe velocities above the evaluation criteria of 8 fps under ultimate PHD conditions. Further study is required to assess specific demand conditions and mitigation measures that could alleviate these high velocities. Pipes experiencing high velocities include the following.

- 18-inch diameter pipe in Edgehill Road
- 20-inch diameter pipe Mango Glen to Catalina Heights Way
- Various pipes in Buena Creek Road
- 14-inch feed into HB Reservoir

8.3 Storage Assessment

The required reservoir storage based on ultimate system demands and the storage criteria defined in **Chapter 4** is presented in **Table 8-3**. The storage assessment is based on ultimate demands and storage for each zone. Projected ultimate demands were estimated using the methodology discussed in **Chapter 3** and allocated to pressure zones based on land use type. It was also assumed that zones with excess capacity would supplement storage deficiencies in other zones. As with the existing storage assessment discussed in **Chapter 7**, the ultimate system storage assessment presented in **Table 8-3** does not account for storage required during Water Authority aqueduct shutdowns.

Based on the required storage calculations, the ultimate system is projected to have a storage deficit of 3.88 MG. As with the existing system storage assessment, the 707, 637, 752, and 565 zones are projected to have insufficient storage based on projected demands. The remaining zones have excess capacity, notably the 837 zone has significant excess storage capacity in Pechstein Reservoir.

The 2000 Master Plan recommended the construction of a 20 MG Pechstein II Reservoir to address the projected ultimate system deficiency and additional emergency storage. The proposed Pechstein II location, adjacent to the existing Pechstein Reservoir location, is advantageous based on the availability of District owned land to accommodate such a large reservoir, and its elevation. This would also allow the District to take the existing Pechstein Reservoir off line for rehabilitation. Additional storage serving the 837/810 zone would provide flows to all the lower zones projected to have storage deficiencies in the ultimate system. Any additional storage would need to have an operational capacity of at least 3.88 MG in order to offset the projected ultimate system storage deficiency.

Reservoir E is being considered for near term replacement. In 1995, the proposed replacement project consisted of a 146-diameter, 38-foot-high, 4.4 MG prestressed concrete reservoir, as discussed in **Chapter 4**. This reservoir would enhance emergency supply within the E zone, which requires 4.98 MG in the ultimate system. However, this site is significantly constrained by neighboring residences and sensitive habitat. Alternatively, the District's total storage deficit would be offset with the addition of a Pechstein II Reservoir project.

Table 8-3. Ultimate System Storage

Major Pressure Zone	Zone Grade (Feet)	AAD[1]		MDD[2] (MGD)	Storage Criteria[3]						Reservoir	Existing Operational Storage (MG)	Surplus (Deficit) (MG)
		(gpm)	(MGD)		Operational (Gallons) +	Fire (Gallons)	or	Emergency (Gallons)	=	Total (MG)			
HB Zone	984, 900	1,233	1.78	3.55	355,029	300,000		3,550,286		3.91	HB	4.05	0.14
HP Zone	976	212	0.31	0.61	61,098	300,000		610,980		0.67	HP	4.30[4]	3.63
AB/HL Zone	837	2,770	3.99	7.98	797,722	540,000		7,977,218		8.77	Pechstein	18.50	9.73
810, F Zone	810, 668	1,136	1.64	3.27	327,179	540,000		3,271,790		3.60	H	5.00	1.40
707 Zone	707, 630	1,890	2.72	5.44	544,197	735,000		5,441,972		5.99	A	0.60	(5.39)
CX Zone	637	1,237	1.78	3.56	356,209	540,000		3,562,086		3.92	C	0.60	(3.32)
E Zone	752	1,571	2.26	4.52	452,444	540,000		4,524,438		4.98	E	1.20	(3.78)
550 Zone	550	711	1.02	2.05	204,855	735,000		2,048,550		2.25	LH	3.00	0.75
E-1, E-2 Zone	565, 486	3,154	4.54	9.08	908,438	735,000		9,084,379		9.99	SLR, E1	3.20	(6.79)
Totals		13,914	20.04	40.07	4,007,170	4,965,000		40,071,700		44.08		40.45	(3.63)

[1] Buildout demands based on SANDAG Series 13 Planned Land Use and Unit Demand Factors rounded up to the nearest 50.
Projected demands represent increased demand density compared with existing demands.

[2] MDD = 2 x ADD

[3] Total = Operational + larger of Fire or Emergency Storage Criteria'
Operational = 0.1 x MDD
Fire = Fire flow and duration per requirements in **Table 4-3**, including 2,500 gpm for 2 hours (300,000 gallons) in wild fire interface areas.
Emergency = 2 x AAD

[4] HP Reservoir volume, as rehabilitated in 2017.

AAD – average annual demand; MDD – maximum day demand; gpm - gallons per minute; MG – million gallons; MGD – million gallons per day

Attachment F

Excerpt from San Luis Rey Indian Water Rights Settlement Agreement

4(e) of the Federal Power Act [16 U.S.C. §797(e)] and under any other applicable law and that no other conditions are required or shall be imposed.

5.C. San Pasqual Undergrounding Project. The San Pasqual Undergrounding Project will remove, relocate, and replace with an underground pipeline most or all of that portion of the Escondido Canal and its appurtenant structures, facilities, and rights-of-way that currently occupy land within the San Pasqual Reservation. The San Pasqual Undergrounding Project includes reclamation of the land occupied by the replaced canal by means of demolition, debris removal, grading, and reestablishment of drainage, as well as any associated mitigation of environmental impacts that may be required.

5.C.1. Local Entities to Implement. Escondido and Vista shall be jointly responsible for implementing the San Pasqual Undergrounding Project, the cost of which will be equally divided between them.

5.C.2. Cooperation by San Pasqual and Grant of Easement. San Pasqual will cooperate with and support Escondido and Vista in the implementation of the San Pasqual Undergrounding Project. In addition, San Pasqual will consent to the grant of an easement for the portion of the San Pasqual Undergrounding Project that will occupy San Pasqual Reservation land. There will be no charge for the easement.

5.C.3. Local Entities to Provide Access. In order to provide San Pasqual access to Local Exchange Water from the San Pasqual Undergrounding Project, during construction of the San Pasqual Undergrounding Project Escondido and Vista will install at their expense four stub sections of pipeline capped with blind flanges. The location of the four stub sections will be determined by San Pasqual in consultation with the Local Entities. In addition, San Pasqual will otherwise be provided access to Local Exchange Water from the Escondido Canal and the San Pasqual Undergrounding Project pipeline south of the northern boundary of the San Pasqual Reservation pursuant to the terms of this Agreement.

5.C.4. Schedule for Completion of Project and Remedies. Subject to Uncontrollable Force, the Local Entities shall implement the San Pasqual Undergrounding

Project in good faith and with reasonable diligence. The Local Entities shall use their best efforts to complete the San Pasqual Undergrounding Project not later than six years from the Effective Date. If the Local Entities have not completed the San Pasqual Undergrounding Project within six years of the Effective Date, and to the extent that they have not been impaired by Uncontrollable Force, the Local Entities agree to compensate San Pasqual at the rate of $1,000 per day from the expiration of the six-year deadline. Upon completion of the San Pasqual Undergrounding Project, no further charges shall be paid by the Local Entities to San Pasqual.

5.D. Indian Water Authority to Receive Parker-Davis Benefits for First 20 Years. The Indian Water Authority is entitled to all of the economic benefits from the initial 20 year allotment of Parker-Davis power from the Western Area Power Administration commencing October 1, 2008. Subsequent to the Effective Date, these economic benefits will be used for water supply, quality, infrastructure and other water-related operations and improvements.

5.D.1. Allocation of Parker- Davis Benefits After the First 20 Years. At the end of the initial 20 year term, the Indian Water Authority, the Bands, Escondido and Vista will jointly apply in good faith for a renewal of the Parker-Davis allotment. Whatever allotment is obtained, the economic benefits will be divided 50% to the Indian Water Authority and Bands, 25% to Escondido, and 25% to Vista. The Indian Water Authority will use its and the Bands' share of the economic benefits for water supply, quality, infrastructure and other water-related operations and improvements and Escondido and Vista will each use their shares of the economic benefits for the Local Water System. In addition to this joint application for Parker-Davis power, each Party may make and pursue its own separate application(s) for any other allotments of Parker-Davis power after the initial 20 year allotment that commences October 1, 2008. This section 5.D.1 shall not apply if and when the Local Entities exercise their right under Article XI to discontinue their responsibility to operate the Local Water System.

Attachment G

Capital Assets Current Value

Annual ENR cost Tier 1 Rate

Type	Annual Cost
Bldg	970,972
Canals	380,262
Const	356,268
Copiers	7,026
Dam	1,067,362
Filt Plant	819,423
IT	118,860
Land	
Misc	116,708
Pipe	3,886,379
Pipe Contr	1,905,077
Pump Sta	109,779
Reg Sta	100,534
Res	671,692
SCADA	57,526
Trt Plant	60,974
Trucks	565,722
Valves	13,088
Vehicles	37,522
Total	11,245,174

Annual ENR cost Tier 2 Rate

Type	Annual Cost
Wells	621,449
Flume	1,064,160
Pechstein II New	300,000
Tier 2 additional	1,985,609
Total All	**13,230,783**

Attachment H

Executive Summary from Warner Valley Basin Groundwater Flow Model Development and Calibration

Executive Summary

Vista Irrigation District (District) is the largest landowner and water user in the Warner Valley Groundwater Basin (Basin), located in the interior mountains of northern San Diego County (**Figure 1**). The District also owns and operates Lake Henshaw Dam and Reservoir at the downgradient end of the Basin. Groundwater interacts with Lake Henshaw by two pathways: 1) a direct hydraulic connection between groundwater and the lake across the lakebed, and 2) discharge from tens of wells that the District operates in the Basin and pumps into the lake to supplement water supply releases. Those releases serve customers in the District's service area, the City of Escondido (City), the Rincon Band of Mission Indians, and other smaller users along the San Luis Rey River.

The District and the City initiated this study of Warner Basin groundwater to improve estimates of existing and potential future yield and to evaluate the effects of proposed increases in pumping by the other major Basin user, Warner Springs Ranch Resort (WSRR). The scope of the investigation included an updated analysis of Basin hydrogeology, development of a numerical groundwater flow model, and simulation of scenarios including climate change, increased WSRR pumping and increased District pumping.

Major Findings

The sustainable yield of the Basin was investigated relative to the record historical drought period of 1945 through 1977, followed by the recovery period 1978 through 1986. District pumping began in 1953, and average pumping through 1986 was 7,604 acre-feet per year (AFY). Modelling demonstrated that pumping could have been increased by at least 20 percent (to 9,125 AFY) and still allowed groundwater levels to fully recover (although not until 1998 in some locations). For this study, sustainability is defined by complete water-level recovery between droughts. The simulation assumed that existing wells would be capable of producing the same amount of water at water levels up to 60 feet below historical minimums. This is not the case. Obtaining the additional yield and optimizing the use of groundwater storage would require additional wells, different pumps and an evaluation of alternative pumping locations that minimize well interference. Additional factors that would need to be considered include the capacity of the wellfield water conveyance system (ditches and siphons) and any concurrent changes in the operation of Lake Henshaw.

Modeling the interaction of pumping within WSRR with yield within the District area shows that an increase in consumptive use within the WSRR area caused an equal decrease in the conjunctive use yield available to the District. The limiting factor for sustainable yield available to WSRR during the drought of record was not storage recovery, but limited storage due to the relatively small basin thickness near WSRR. The model showed that WSRR consumptive use could successfully be increased to 1,100 AFY. Higher rates caused model cells to go dry, even when additional wells were introduced to spread the pumping stress over a broader area. Although dry cells are partly an artifact of model layering, they correctly reflect the real concern that insufficient saturated thickness could constrain yield during droughts.

Model Development

Basic data were compiled and reviewed for the study. Four different delineations of Basin boundaries have been previously published, for different purposes. Two geologically-based delineations from the 1960s were deemed most suitable for the modeling work, and minor differences between them were reconciled into a new boundary delineation. Previously published contour maps of average annual rainfall were similarly found to have substantial discrepancies. One was selected as most consistent with data from the two long-term stations in the Basin, and minor adjustments were also implemented to improve model calibration. Other basic data included geologic and geophysical logs from wells and boreholes, pumping and water levels from District wells, operations data for Lake Henshaw, and long-term stream flow records for gages on two streams that enter the Basin.

Geologic and geophysical data were imported to a geospatial database that supported preparation of seven cross sections that crossed the Basin along various alignments. The cross-sections confirmed that Basin fill deposits are generally coarse-grained without regional confining layers and that faults divide the Basin into blocks with variable depths to bedrock. Basin thickness is greatest at a down-dropped block in the south-central part of the Basin, where it exceeds 900 feet. Of the roughly ten identified faults crossing the Basin, several have demonstrable effects on groundwater levels.

Hydrologic modeling included rainfall, soil moisture, runoff, stream flow and groundwater processes over the entire watershed tributary to Lake Henshaw, including the Basin and upland areas. A 78-year simulation period of water years 1939-2016 was selected for analysis in order to include the prolonged dry period from 1945-1977. Surface hydrology was simulated on a daily basis.

The groundwater flow model used the MODFLOW 2005 software developed by the U.S. Geological Survey (USGS). The model grid contains three layers and in plan view is divided into uniform 1,000 x 1,000 foot cells. The topmost layer covers the entire Basin area. Layers 2 and 3 are progressively smaller, active only in the deeper parts of the Basin. Where the Basin is sufficiently thick that two or three layers are active, the bottom of layer 1 was set at an elevation approximately equal to the lowest historical water levels to prevent cells from going dry during the calibration simulation.

The groundwater model dynamically simulates flow between streams and groundwater based on the width and permeability of stream channels and the relative difference between the water level in the stream and the adjacent water table elevation. Stream flow is routed from reach to reach (one reach per model cell) from the peripheral boundaries of the Basin to Lake Henshaw. Lake Henshaw was similarly simulated as a surface water body hydraulically coupled to streams and groundwater.

Model parameters were calibrated to achieve reasonable similarity between measured and simulated historical groundwater levels, lake levels and stream flow.

The potential effect of climate change was investigated by running the 1939-2016 calibration simulation with adjustments to reflect future climatic conditions. Monthly factors for adjusting rainfall and reference evapotranspiration were taken from figures developed by the California Department of Water Resources (DWR) by down-scaling global circulation models for the year 2070. The results showed small changes in the groundwater balance and water levels. Relative to the future baseline scenario, groundwater elevations at almost all wells in almost all stress periods changed by less than 2 feet. Overall, the analysis concludes that, while climate change is expected to bring higher evapotranspiration rates and more intense drought and storm cycles, the net effect on sustainable yield in the Warner Basin is expected to be small into the foreseeable future.

An estimate of groundwater yield available to WSRR was obtained by defining a subarea of the Basin around WSRR and calculating the water balance within the subarea with existing amounts of WSRR pumping and hypothetical increases in pumping. Increases in pumping were distributed among existing WSRR wells and two additional hypothetical WSRR wells in such a way that drawdown was relatively uniform throughout the WSRR area. When pumping was increased from the baseline rate of 405 AFY to 1,100 AFY, water level declines during droughts were greater by as much as 40 feet at some WSRR wells but recovered rapidly during wet periods. The increase in pumping by WSRR decreased yield in the rest of the Basin by an equal amount via reductions in groundwater outflow from the WSRR area and changes in stream flow gains and losses.

A simulation in which District pumping was increased by 20 percent over historical amounts during 1953-1995 lowered the minimum water levels (in 1977) by 60 feet in the main District well field, decreasing to 10 feet at distant District wells. Recovery was complete by 1986 in the main well field but not until 1998 in some areas.

District yield could also be increased by maintaining a lower average elevation of Lake Henshaw. A simulation in which the average elevation of Lake Henshaw was decreased by 7 feet increased yield by approximately 2,750 AFY from reduced evaporation losses and by an additional 260 AFY from reduced spill volumes. The District's ability to maintain Lake Henshaw at these lower levels, however, will depend on the wellfield's capacity to increase production during the summer delivery season and possible reoperation of water treatment and delivery infrastructure downstream of the lake.

Attachment I

Waer Supply Planning Study

AGENDA
SPECIAL MEETING OF THE BOARD OF DIRECTORS
WEDNESDAY, MARCH 11, 2020 – 9:00 AM
1391 Engineer Street, Vista, CA 92081
Phone: (760) 597-3100

In compliance with the Americans with Disabilities Act, if special assistance is needed to participate in the Board meeting, please contact the Board Secretary during regular business hours at (760) 597-3128. Notification received 48 hours before the meeting will enable the District to make reasonable accommodations.

1. **CALL TO ORDER**

2. **ROLL CALL – DETERMINATION OF QUORUM**

3. **PLEDGE OF ALLEGIANCE**

4. **CONSIDER APPROVAL OF AGENDA**
   The Board may take action on any item appearing on the agenda.

5. **ORAL COMMUNICATIONS**
   Members of the public may address the Board on items not appearing on the posted agenda, which are within the subject matter jurisdiction of the Board. Speakers are asked to limit their comments to five (5) minutes; the total time allowable for all public comment on items not appearing on the agenda at any one meeting may be limited. Comments on items listed on the agenda will be taken before or during discussion of the agenda item. Members of the public desiring to address the Board are asked to complete a speaker's slip available on the table near the entrance of the Boardroom and present it to the Board Secretary prior to the meeting.

6. **WATER SUPPLY PLANNING STUDY**
   Recommendation: Conduct Water Supply Planning Study workshop.

7. **COMMENTS BY DIRECTORS**
   This item is placed on the agenda to enable individual Board members to convey information to the Board and the public not requiring discussion or action.

8. **COMMENTS BY GENERAL MANAGER**
   Informational report by the General Manager on items not requiring discussion or action.

9. **ADJOURNMENT**

- *The agenda package and materials related to an agenda item submitted after the packet's distribution to the Board, are available for public review in the lobby of the District office during normal business hours.*
- *Agendas and minutes are available at www.vidwater.org.*
- *VID Board meetings are generally held on the first and third Wednesday of each month.*

AFFIDAVIT OF POSTING

I, Lisa R. Soto, Board Secretary of the Vista Irrigation District, hereby certify that I posted a copy of the foregoing agenda in the lobby of the District office at 1391 Engineer Street, Vista, California at least 24 hours prior to the meeting, in accordance with Govt. Code Sec. 54956.

Date: February 27, 2020

Lisa R. Soto, Board Secretary

VISTA IRRIGATION DISTRICT	Agenda Item: 6
STAFF REPORT	**Board Meeting Date:** **March 11, 2020** **Prepared By:** **Randy Whitmann** **Approved By:** **Brett Hodgkiss**

SUBJECT: WATER SUPPLY PLANNING STUDY

RECOMMENDATION: Conduct Water Supply Planning Study workshop.

PRIOR BOARD ACTION: On April 18, 2019, the Board participated in the first workshop to review and reach preliminary consensus on the project objectives, evaluation criteria and 'long-list' of alternatives to advance to a course screening analysis. On August 8, 2019, the Board participated in the second workshop to review the preliminary results of the course screening analysis and provide input on the recommended 'short-list' of alternatives to advance to the final fine screening process.

FISCAL IMPACT: Flume replacement is estimated to cost $120,000,000 and be the least costly water supply alternative for the District. The cost comparison in the study is as follows:

Option	First-Year Unit Cost	30-Year Present-Worth Cost
To Flume	$2,000/acre-foot	$240 million
Not To Flume	$2,200/acre-foot	$350 million

SUMMARY: The District maintains capacity rights from two sources, raw water treated at the Escondido-Vista Water Treatment Plant (EVWTP) located at Lake Dixon and multiple treated water connections along the San Diego County Water Authority's aqueducts. To reduce costs, the District typically maximizes the locally treated water supply at EVWTP and relies on the 11-mile Flume for conveyance into the District. During a planned 10-day shutdown along the Second Aqueduct, the District is dependent on the Flume. With the Flume approaching its useful life, completing the Water Supply Planning Study will evaluate replacing the Flume and other potential alternatives.

DETAILED REPORT: The Water Supply Planning Study is designed to support a decision by the District as to the future of the Flume. Many factors weigh in the comparison of alternatives. The evaluation of alternatives related to replacing the Flume will seek to account for the full current and future cost of the District's local water supply operation as well as the benefits to the District afforded by access to and management of its own local water supply. Likewise, the analysis of alternatives related to retiring the Flume altogether will seek to account for the current and future costs of purchasing additional imported water, the possible need for additional treated water storage and/or other delivery reliability improvements, the future of the Boot and Bennett areas, and options to exchange the District's local water. The comparison of alternatives and the selection of a preferred alternative is guided by criteria of costs, reliability, water quality, environmental protection, existing water supply obligations and assets, and other factors.

The attached review package summarizes the final fine screening analysis performed on the 'short-list' of alternatives; the workshop will afford the Board the opportunity to provide input on the findings and select a preferred project alternative for implementation.

ATTACHMENTS: Workshop Agenda and Reference Materials

AGENDA

VID Water Supply Planning Study

Board Planning Workshop No. 3
Fine Screening: Findings, Recommendations, and Next Steps

9:00 a.m. Wednesday March 11, 2020
VID Offices

PURPOSE:

- Review results of Fine Screening, with an emphasis on what has changed from Coarse Screening
- Review project recommendations and Next Steps for project implementation

AGENDA:

1) INTRODUCTION
    a. Summary: Why the balance tips To Flume, and what that means for the District
    b. Refresher: Study overview and highlights of Board Workshops 1 and 2
    c. Workshop purpose

2) FINE SCREENING FINDINGS
    a. Box 3: Raw Water System and Treatment
    b. Box 4: Local Water Exchange Options
    c. Box 2: System Improvements / Boot and Bennett
    d. Box 1: Flume Rehab/Replacement Findings
    e. Initial Conclusions
    f. Sensitivity Analysis
    g. – Variables and scenarios that alter the balance scale

3) NEXT STEPS FOR PROJECT ADVANCEMENT
    a. Next Steps for Not To Flume option
    b. Next Steps for To Flume option
    c. Offramps and Opportunities

4) ACTION ITEMS

5) ADJOURNMENT

Water Supply Planning Study

Workshop No. 3 Briefing Document – FINE SCREENING

February 2020

Prepared by:

Gillingham Water Planning and Engineering, Inc.

VISTA IRRIGATION DISTRICT

Water Supply Planning Study

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Thank you also to the following for providing valuable data and information for use in the Study:

City of Escondido (Escondido):

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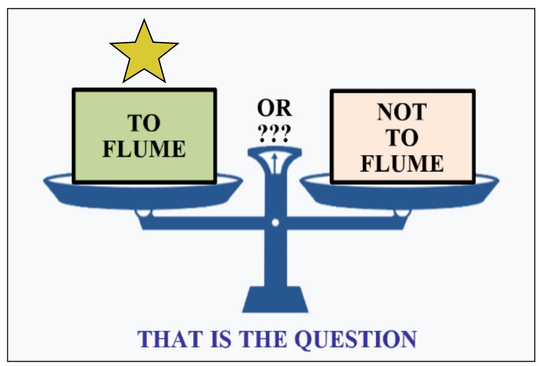
1. Overview / Introduction

Summary:

- **To Flume Ascendant:** At the Fine-Screening level of assessment, the balance scale tips in favor of the To Flume option. This is true even though the option will entail a capital investment on the order of $120 million.
- **Board Workshop No. 3:** The workshop will review the key findings of Fine Screening, and explore the sensitivity of the findings to assumptions about current and future conditions.
- **Next Steps:** Should the District elect to proceed with the To Flume option, its next steps would be to undertake a detailed alignment investigation, environmental documentation, and financial planning.

1.1. The balance scale tips in favor of To Flume.



At the conclusion of the fine-screening level of review, the Flume balance scale, which had been relatively even at the end of coarse screening, now tips in favor of the **To Flume option.** Considering present-worth costs over the next 30 years and beyond, the To Flume option achieves cost savings of more than 30 percent in comparison to the Not To Flume option and also scores favorably on non-cost evaluation factors. We'll provide more detail in the body of this document, but here are a few summary points to keep in mind:

- **Significant capital investment required:** The finding in favor of To Flume holds even though the option entails a capital investment on the order of $120 million. Costs for the Not To Flume option, driven in large part by the need to purchase additional water from the Water Authority at progressively increasing rates, are even higher.
- **The finding is sensitive to assumptions:** The balance scale is sensitive to many project variables for which a change in assumptions could tip the outcome. We'll review the most significant of those sensitivities with you later in the document.
- **Next Steps, Commitments, and Offramps:** The District's next steps will be to undertake advanced planning for either a Flume Replacement Project (To Flume) or retirement of the Flume and a transition to full reliance on Water Authority deliveries (Not To Flume). Should that work identify costs or conditions different than presented here, the District will have the option at that time to revisit and refine the direction as appropriate.

1.2. Here is a summary of what has changed subsequent to the previous round of review.

Fine-Screening Key Changes and Updates

Topic	Change / Update	Significance
Long-Term Financial Analysis	• Thirty-Year Cost Analysis: In addition to examining the First-Year costs of each option, the analysis now presents a 30-Year net-present-value cost review. • Differences in Cost Escalation Rates: The 30-year review accounts for differences in cost escalation rates. 30-year financing of a Flume Replacement project would utilize level payments that do not increase over time. In comparison, we project Water Authority rates will escalate at a rate faster than inflation. • Interest Rates: We have researched the availability of State and Federal low-interest loans, and concluded a Flume Replacement Project would be a likely recipient, thereby lowering the District's cost of capital.	The changes provide a more complete picture of the District's long-term costs for each option. This accounting is to the significant advantage of the To Flume option.
Local Water System (Box 3)	• Confirmation of Approach: We have consulted with a national level Asset Management expert relative to budgeting approaches, a national dam expert relative to long-term cost exposure at Henshaw Dam, and with Escondido's Canal Maintenance Superintendent relative to long-term maintenance of the Escondido Canal.	The additional reviews have provided overall confirmation of our budgeting approach. Costs have increased, but not significantly.
Local Water Exchange Options (Box 4)	• Limitations on Available Exchange Partners: The District has determined the Settlement Agreement restricts the list of eligible exchange partners, leaving Escondido as the only practicable partner. • Escondido Exchange Prospects: The District has worked with Escondido to review exchange opportunities and prospects for a Local Water Purchase agreement. An agreement appears achievable, but water treatment and demand constraints would leave Escondido able to utilize only a portion of the District's allocation.	The changes reduce the cost recovery potential for the Not To Flume option, increasing its overall cost.
System Improvements (Box 2)	• Incorporation of Pumping Cost Savings: The analysis now includes the pumping cost savings the District would realize with the Not To Flume option.	Provides a modest cost credit to the Not To Flume option
Flume Replacement Options (Box 1)	• Hybrid Alignment Lengthened / All-New Alignment Appears Preferred: We reconfigured the Hybrid alignment, including bypassing the Borden bench, adding length and cost to the alignment. At this conceptual level of review, an All-New alignment now appears preferred. Actual alignment determination would be made as part of a subsequent Alignment Study and Environmental Documentation process. • Confirmation of Costs and Use of Welded Steel Pipe: We undertook additional review of pipeline costs and pipe materials, and confirmed the use of welded-steel as the most appropriate pipe material as a basis for our planning-level cost estimates of the project.	Cost estimates for a Flume Replacement project remain relatively unchanged, at approximately $120 million.

1.3. Refresher: The primary goal of the project is to answer the To Flume or Not To Flume question. The evaluation criteria in play mirror the District's mission statement (economy, reliability, quality), and the long-list of initial alternatives is comprehensive.

BACKGROUND AND OVERVIEW

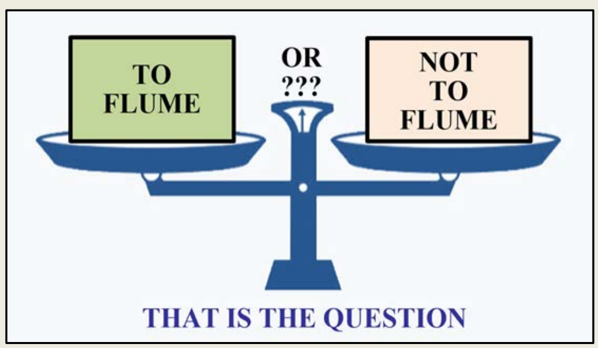
The Vista Flume (Flume) is nearing the end of its functional service life. The Flume is an integral component of the District's water supply system, providing for delivery of the District's historical rights to water from the San Luis Rey River to the District service area. Local water is blended with raw imported water and treated at the Escondido-Vista Water Treatment Plant (EVWTP), where it feeds the Flume.

The capital investment needed to replace or rehabilitate the Flume will be significant. Accordingly, prior to making an investment decision, the District wishes to weigh carefully the merits of investing in the Flume against the merits of other water supply alternatives, including that of retiring the Flume altogether and relying on deliveries from the Water Authority in its place. To support its decision, the District is conducting the Water Supply Planning Study to develop an objective and complete evaluation and comparison of alternatives.

PROJECT OBJECTIVES

The goals of the study are as follows:

1) **Alternatives Evaluation (To Flume or Not To Flume):** Identify and evaluate alternatives for rehabilitating or replacing the Flume, and weigh these against alternatives for retiring the Flume, including options for exchanging the District's local water.
2) **Decision Support:** Provide analysis and recommendations that are clear, complete, and objective, and conduct planning workshops with District staff and the Board to facilitate project understanding and support the District's decision process.



The overarching question. The principal goal of the Water Supply Study is to weigh the alternatives and answer the question, and to do so based on analysis that is clear, complete, and trusted.

EVALUATION CRITERIA

The study will weigh both cost and non-cost factors of the To Flume and Not To Flume alternatives. Costs will be a significant driver of preferences, but non-cost factors of service reliability and operational flexibility, water quality, environmental protection, agency relationships, and other factors will weigh on the balance scale. Evaluation criteria established at the beginning are subject to refinement as the study progresses. Non-cost criteria are summarized in the graphic below.

NON-COST CRITERIA
Maximize Service Reliability and Operational Effectiveness
Minimize Environmental Impacts / Protect Environmental Resources
Maximize Implementability
Intrinsic Values

Draft Scoring Rubric:

- Significantly Preferred / Advantageous
- Preferred / Advantageous
- Constrained / Not Preferred
- Significantly Disadvantaged / Potential Fatal Flaw
- Neutral / Meets objectives

Many of the non-cost factors can be at least partially equalized between alternatives with additional costs. For example, the potentially negative service reliability aspects of a Not To Flume alternative, in which the District would no longer be largely immune from the effects of Water Authority treated water aqueduct shutdowns, can be mostly overcome with capital and operational expenditures to provide additional treated water storage or other reliability enhancements. This has the consequence of raising the profile of costs as an evaluation factor.

LONG-LIST ALTERNATIVES

The list of alternatives is summarized in the Investigation Box graphic in **Section 1.4.** At Workshop No. 1, the Board asked that the long-list also include consideration of the following:

- Out-of-the-box, comprehensive, holistic consideration of possible project configurations and of possible deals and arrangements with other agencies, e.g. exchange with other member agencies or the Water Authority, exchange via groundwater recharge, etc.
- Adherence to the District's Mission Statement
- Careful consideration of the domino effect of a Not To Flume (e.g. cost of stranded assets, impact to other agencies, other uses for local supply, etc.)
- Consideration of alternative Flume capacities

These requests have been incorporated into the Coarse and Fine Screening reviews.

1.4. Study Process: The study is organized into four Investigation Boxes, and sequenced into three phases. Workshop No. 3 will review the results and recommendations of the final study phase, fine screening.

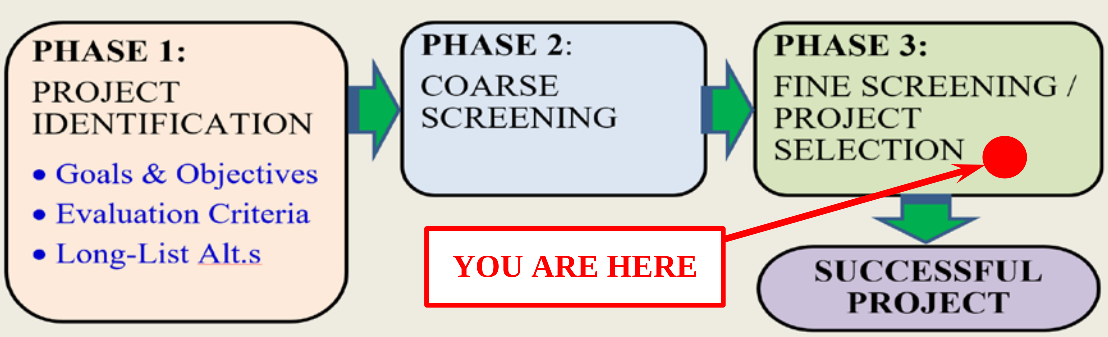
WATER SUPPLY STUDY INVESTIGATION BOXES

Box 1: Flume Rehab Options	Box 2: System Improvements (w/o Flume)	Box 3: Raw Water Supply/Treatment (w/ and w/o Flume)	Box 4: Local Water Exchange Options (w/o Flume)

Contents: • **Alternatives:** o HDPE Reline o New pipe in place o New pipe, new alignment o Mix and match o Other • **Sizing / Capacity** • **Hydraulic Design** (options to pressurize) • **Demolition** (of retired Flume sections, if any)	Contents: • **10-Day Outage reliability options:** o Water Authority isolation valves o New treated water storage o Weese supply o Vallecitos supply o Other • **Boot and Bennet** o Transition to Vallecitos o Other • **PS Avoided Costs**	Contents: • **Differences between w/ and w/o Flume options:** o Warner Ranch o Henshaw dam o Escondido Canal o EVWTP o Settlement obligations o Etc.	Contents: • **Exchange Alternatives:** o Escondido (raw) o Rincon del Diablo (treated) o Other (treated) o Water Authority (raw) o Indian Bands (raw) o Environmental (raw) o Other • **EV-WTP Blending Requirements**

Categorizing the issues / structuring the analysis. The study contains more than the usual number of moving parts. To manage the complexity of the charge, the study has organized the analysis into four main Investigation Boxes as listed above.

PLANNING PHASES



1.5. Water Authority water rates play a key role in the Study. Those rates are likely to escalate faster than inflation.

The Water Authority's average "All-In" treated water rate for calendar year 2020 is $1,686 per acre-foot ($/AF), which for planning purposes we will round to an even **$1,700/AF**. This price point provides a useful reference point for the Water Supply Planning Study as we evaluate the costs of other attributes of the District's long-term water supply options and the future of the Flume.

The Water Authority only projects future rates for a five-year forecast window; its most recent forecast for 2023 shows a low-band rate of approximately $1,700/AF (as already reached), and a high-band rate of approximately $2,200/AF.

Work being undertaken by study team member Ken Weinberg Water Resources Consulting is investigating long-term rate forecast scenarios on behalf of a group of Water Authority member agency managers and others. This work indicates that over the long-term, there is more upward pressure on Water Authority water rates than there is mitigating downward pressure. The largest upward pressure is the need to fund fixed costs, including the Water Authority's $1.5 billion outstanding debt and its take-or-pay purchase commitments, on a base of reduced water sales.

Upward and Downward Pressures on Future Water Authority Rates

Upward Rate Pressures (factors favoring higher annual rate increases)	**Downward Rate Pressures** (factors favoring more moderate annual rate increases)
• Reduced sales due to conservation and local supply development • Greater portion of total supply derived from most expensive sources, Desal and IID • WaterFix and other MWD Capital Costs on Transportation rate component • Increasing power costs • Potential Salton Sea Mitigation cost greater that contractual Environmental Cap • Low utilization of Twin Oaks Water Treatment Plant	• IID Transfer purchase price could increase at rate less than CPI • Costs for WaterFix, if implemented, allocated to RTS Charge and not all to Transportation • MWD Treatment Surcharge appears to have stabilized

A preliminary finding of this work is that a reasonable mid-range forecast of Water Authority rates through 2045 shows those rates increasing at an average rate faster than base inflation. This would mean that on a current-dollar, inflation adjusted basis, the long-term average unit cost of Water Authority water is higher than the current $1,700/AF rate.

The Water Authority Board has formed a Fiscal Sustainability Taskforce made up of Board members and member agency managers to better define and address the long range impact that these factors have on Water Authority costs and the rate structure's current ability to equitably manage these expected rate pressures. Metropolitan Water District of Southern California (MWD) has started a similar process as the same factors the Water Authority faces are being faced by MWD. The Water Authority expects its Fiscal Sustainability process to conclude before the end of the current fiscal year. That process should provide greater clarity to member agencies on where Water Authority water rates are trending in the long term.

For the fine screening review, we will utilize the following range of escalation assumptions:

Water Authority Rate Escalation Assumptions

Scenario	Description
Low (Optimistic)	Rates escalate at 1.0% above water system inflation for next 5 years, thereafter at rate of inflation
Mid-Range	Rates escalate at 1.5% above water system inflation the next 10 years, thereafter at rate of inflation
High (Pessimistic)	Rates escalate at 2.5% above water system inflation for next 10 years, thereafter at rate of inflation

1.6. Market interest rates are already low. Project interest rates could be further lowered through State or Federal low-interest loan programs.

The economic comparison of the To Flume and Not To Flume options entails a comparison of merits of capital outlays with long-term annual costs. Equating these two, in terms of Net Present Values or Equivalent Annual Costs, is done based on an interest rate that reflects the District's cost of funds. Lower interest rates decrease the annual costs of capital financing and increase the present-worth value of future annual costs; higher interest rates do the opposite.

The prior coarse-screening review utilized the long-term (30 to 40 years) interest rates summarized in the table below:

District Finance Rates and Terms (Unaided)

Scenario	Description	**Interest Rate** (%/yr)
Low (Optimistic)	Reflects continuation of low interest rates into the future	**3.0**
Mid-Range	Projected mid-range market conditions	**3.5**
High (Pessimistic)	Less favorable market conditions	**4.0**

For the fine-screening review, we have expanded on the previous work by evaluating the project's potential to qualify for and receive low-interest financing through available State and/or Federal programs. The most likely sources for low-interest financing for the project are the State Water Resources Control Board's Drinking Water State Revolving Fund (DWSRF), and the Federal Water Infrastructure Financing Innovation Act (WIFIA) Credit Assistance Program, summarized below:

DWSRF and WIFIA Low-Interest Loan Program Summaries

Program	Description	Interest Rate[1] (%/yr)
DWSRF	Credit assistance for drinking water infrastructure projects. • Up to 100% funding available • Up to 30-year loan repayment term • Fixed interest rate set at 50% of the average interest rate paid by the State on general obligation bonds issued the prior year • No interest payments during construction	**1.4**
WIFIA	Credit assistance for water and wastewater systems. • Up to 49% of total eligible project costs • Up to 35-year loan repayment term • Fixed interest rate tied to treasury securities rate for similar maturity date	**2.3**

1. Interest rates are as of January 2020, and are subject to change

Based on our review, we believe it reasonable to assume the project would be eligible for and would be likely to receive funding from one or both programs. We believe a reasonable mid-range assumption is that the project would be awarded a DWSRF loan covering 50 percent of the project's capital cost, effectively lowering the project's average cost of financing by a considerable margin[1]. Combining Optimistic, Mid-Range, and Pessimistic financial assistance assumptions with the previous market interest rate assumptions results in the following range of project finance rates (Weighted Average Cost of Capital).

Project Finance Rates and Terms Inclusive of Programs

Scenario	Description	Melded Interest Rate (%/yr)
Low (Optimistic)	Reflects continuation of low interest rates into the future, and an optimistic assumption that the project would receive DWSRF funding covering **75%** of project capital costs.	**1.8**
Mid-Range	Reflects projected mid-range market interest rates, and a mid-range assumption that the project would receive DWSRF funding covering **50%** of project capital costs.	**2.5**
High (Pessimistic)	Reflects less favorable market interest rate conditions, and a pessimistic assumption that the project would not be awarded any low-interest loans.	**4.0**

For the fine-screening analysis, we will use the mid-range adjusted rate of 2.5 percent, and an assumed finance period of 30 years. This results in a capital recovery factor (A/P) of 0.0478, meaning that every $1 million in capital financed would incur an annual repayment of $47,800 fixed over the 30-year repayment term.

[1] Actual loan awards are subject to funding availability and to year-to-year variation in the level of competition for available funds, and there is no guarantee the project would be awarded financing.

1.7. We assume most water system costs will inflate at the District's budgeted rate of 3.0 percent per year.

The rate of inflation of water system related costs will affect the economic comparison of the To Flume and Not To Flume options. For a mid-range assumption, we will use the rate used by the District in its budget projections, 3.0 percent per year. Water system cost inflation rates for use in the Study are summarized in the table below.

Water System Cost Inflation

Scenario	Description	Inflation Rate (%/yr)
Low (Optimistic)	Reflects a rate lower than that used by the District in its budget projections	**2.0**
Mid-Range	The rate used by the District in its budget projections	**3.0**
High (Pessimistic)	Reflects a rate higher than that used by the District in its budget projections	**4.0**

1.8. We estimate the long-term average annual yield of the system as currently operated is 5,000 acre-feet per year. The amount is important, and variable.

The delivery of local yield is the primary benefit of the Flume and the primary reason to consider capital investment in Flume rehabilitation or replacement. The average annual yield of the local water system is therefore a key study variable: higher yield averages would warrant additional capital investment, lower yields less.

The study team has worked with District staff to review historical system yields and adjust these to current conditions of District demands, local water blending requirements at EVWTP, terms of the San Luis Rey Indian Water Rights Settlement Agreement (Settlement Agreement), and other factors. Based on this review, we estimate the long-term average annual yield of the system, as currently operated, is 5,000 acre-feet per year (AF/yr). Probable long-term averages, for periods of 50 years and more, are summarized in the table below.

Local System Future Average Annual Yield

Scenario	Description	Yield (AF/yr)
Low	Reflects dryer than historical average hydrology, and continuation of existing local water blend limits at the EVWTP	**4,000**
Mid-Range	Reflects current 60-year average hydrology (1960-2019), and continuation of existing local water blend limits at the EVWTP	**5,000**
High	Reflects one or more of wetter than historical average hydrology, Warner Basin wellfield expansion, and relaxation of local water blend limits	**6,500**

In addition to the yield range presented in the table, the historical record indicates system yield over shorter periods of even thirty years is subject to even wider ranges than in the table. The next thirty years could be a repeat of the driest 30-year period of record, or of the wettest. We'll review the risks and opportunities inherent in this at the upcoming board workshop.

1.9. Document Outline

The remainder of this briefing document is organized into the following five sections. Yes, the Investigation Boxes are out of order . . . bear with us, there's a method to our madness.

2. Local Water System (Box 3)

Summary:

1) Increased investment will be needed for long-term sustainability.
2) System costs on a dollars per acre-foot basis are approximately one-half of the all-in Water Authority raw water cost.
3) Under a Not To Flume alternative, most of the District's system costs would continue unless another party assumed ownership.

2.1. Long-term sustainable maintenance and operations of the local water system will require additional investment beyond current budgeted levels of repair and replacement.

Over the long-term, sustaining the functionality of the local water system requires ongoing maintenance, repair, and sometimes replacement of system components. The District's current budget covers portions of what is needed in the long term, but has deferred some costs while the District was still engaged in negotiation of the Settlement Agreement, and while the District was uncertain as to the future of the Flume. Additional investment will be needed for long-term sustainability.

The study team has taken an Asset Management approach to budgeting for each component category of the system. Applying known conditions, industry experience, and professional judgement, the team has estimated three budgetary levels of investment: low, middle, and high (or optimistic, mid-range, and pessimistic). Some components, including the Escondido Canal, are budgeted for perpetual repair but not replacement; others for replacement on varying intervals. The resulting budgetary levels, inclusive of current budget items, and with accounting for cost-sharing arrangements with Escondido, are summarized in the table below.

Annual Operation, Maintenance, Repair, and Replacement Costs (District Share)

Scenario	Well + Ditches	Henshaw Dam	Escondido Canal (EC)	S.P. Under-grounding[1]	Bear Valley	Other Budget[2]	Total
2019 Budget	$554,000	$214,000	$375,000	$20,000	Included with EC	$459,000	**$1.6M**
A) Low[3]	$795,000	$374,000	$435,000	$956,000	$342,000	$459,000	**$3.4M**
B) Middle[3]	$834,000	$484,000	$455,000	$956,000	$399,000	$459,000	**$3.6M**
C) High[3]	$891,000	$794,000	$477,000	$956,000	$479,000	$459,000	**$4.1M**

1. The scenario costs assume the District's share of costs at $20 million, financed over 30 years at i = 2.5%/yr
2. Includes costs not assigned to a facility such as buildings and grounds, legal services, consultants, and insurance
3. Total spending levels, inclusive of existing budget

The above costs are exclusive of Warner Ranch lease revenues. For this review, we have treated the District's ownership of the Ranch and the revenues it derives as independent of to the Flume or Not To Flume question.

2.2. The costs of the local water system, on a dollars per acre-foot basis, are modest in comparison to imported water costs, and appear affordable over the long term.

Assuming an average annual local yield of to the District of 5,000 AF/yr (see **Section 1.8**), the District's existing budget for the local system equates to approximately $325/AF exclusive of treatment costs. The three asset management ranges increase this cost to a new total of between $670 and $810/AF, exclusive of treatment. Treatment costs at the EVWTP add approximately $200/AF, $250/AF for asset management scenario C. Equivalent unit costs are summarized in the table below.

Summary of Annual Cost Per Acre-Foot of Water Produced

Scenario	Total Annual Cost	Average Yield (AF/yr)	Unit Cost Before Treatment	Average Treatment Cost	Unit Cost With Treatment
2019 Budget	$1,622,000	5,000	$325	$200/AF	**$535/AF**
A) Low	$3,361,000	5,000	$670	$200/AF	**$870/AF**
B) Middle	$3,587,000	5,000	$720	$200/AF	**$920/AF**
C) High	$4,056,000	5,000	$810	$250/AF	**$1,060/AF**

The Middle Range estimate with treatment of **$920/AF** represents a 70 percent increase to existing budgeted spending levels. Nevertheless, viewed in comparison to current "All-In" Water Authority treated water rate of approximately **$1,700/AF**, the local system costs are modest.

2.3. Opportunities to reduce the District's share of local system costs as part of a Not To Flume alternative are limited.

Under a Not To Flume option, the EVWTP volumetric treatment cost component might[2] drop from the tally, but most of the rest of the District's cost obligations for the local water system facilities would continue unless another party assumed ownership of the facilities. This arises in part from the terms of the Settlement Agreement, which requires the parties to operate the local water system as it has been historically, and to deliver water to the Indian Bands when requested. Also, because most of the ongoing costs are fixed, being independent of the volume of water produced and delivered, the mere reduction of the District's use of local water would not alter the costs.

[2] The District's continuing treatment cost obligations if it terminated the Water Filtration Plant Joint Powers Agreement are not clearly defined. Section 8 of the Agreement requires the District to pay 20 percent of the costs of future capital improvements, revisions, and replacements not undertaken to increase Plant capacity. Termination of the Agreement is by mutual consent, so it appears the obligations would be negotiated. We have assumed these negotiations would absolve the District from responsibility for future costs.

2.4. Methodology Notes: Different facilities require different budgeting approaches

The Study team evaluated the District's existing budget levels along with three asset management scenarios for replacing the well field, conveyance ditches, the Hellhole Siphon, and the Bear Valley conveyance facilities upstream of the EVWTP**.** Costs for the Henshaw Dam were estimated by an HDR national dam expert (HDR, 2019). Costs for the Escondido Canal were estimated by combining current repair budgets with estimated extraordinary expenses, and after thorough review with Escondido staff including the Canal team field superintendent. The San Pasqual Undergrounding project converts a portion of the Escondido Canal to a pipeline, as required by the Settlement Agreement.

As shown in the previous table, the District's existing annual investment is approximately $1.6 million, while the three scenarios resulted in costs of between $3.4 and $4.1 million per year. The "Other Budget" column includes buildings and grounds, legal, consultant, and insurance costs in the District's 2019 Budget that were not assigned to a specific facility. This indicates the District should make additional investments in the system. The costs presented in **Section 2.1** are preliminary suggested budgets.

The table below lists the assumptions for the facilities and scenarios.

Table 2: Summary of Assumed Replacement Frequencies and Added Costs

Scenario	Well + Ditches	Henshaw Dam	Escondido Canal	San Pasqual Undergrounding	Bear Valley Conveyance
A) Low	70 Years	Budget	$150,000	$20M, 30 yrs, 2.5%	70 Years
B) Middle	60 Years	30% Replace	$300,000	$20M, 30 yrs, 2.5%	60 Years
C) High	50 Years	100% Replace	$450,000	$20M, 30 yrs, 2.5%	50 Years

In general, Scenario A assumed all facilities are replaced in 70 years, Scenario B 60 years, and Scenario C, 50 years. The Henshaw Dam and appurtenances maintenance, repair, and replacement costs were estimated by HDR based on two reports by Findlay Engineering (2012, 2018) and costs for similar projects. The range of costs was developed based on the damage caused by low, moderate, or extreme earthquakes, floods, or other events. Given the Escondido Canal is generally excavated through rock on the side of a mountain, and through discussions with Escondido, the Canal will likely be maintained and repaired in its existing alignment and not replaced. However, additional budget is warranted to account for occasional extraordinary costs such as failures of sections or replacement of the Hellhole Siphon.

The Bear Valley conveyance facilities include the penstock, power plant, and conveyance facilities to the P1/P2 Pump Station at the headworks to the EVWTP. The cost of the Penstock was taken from the 2004 replacement project escalated to current costs. Cost of the Power Plant was taken from damages paid to Escondido in 1983 as a result of flooding.

Costs for the wellfield and ditches are shared by Escondido, which reimburses the District for 35.2 percent of these costs.

The following table summarizes the facility maintenance and replacement assumptions of asset management scenarios A, B, and C.

Raw Water Facility Operation, Maintenance, Repair & Replacement Costs

System Component	ASSET MANAGEMENT ASSUMPTION SETS [1] (Additional Costs Beyond Current Budget Levels)		
	A) Low (Optimistic) Current + 70-Year Replacement + Historical Extraordinary	**B) Middle Ground** Current + 60-Year Replacement + Historical Extraordinary	**C) High (Pessimistic)** Current + 50-Year Replacement + Historical Extraordinary
a) Well Field	Replace within 70 Years or 1 New Well per 4.4 Years	Replace within 60 Years or 1 New Well per 3.8 Years	Replace within 50 years or 1 New Well per 3.1 Years
b) Ditches	Replace within 70 Years or 1,300 Feet per Year Average	Replace within 60 Years or 1,520 Feet per Year Average	Replace within 50 Years or 1,820 Feet per Year Average
c) Henshaw Dam	Current Expenses	Current + 30% of Replacement Cost	Current + 100% of Replacement Cost
d) Diversion Dam	$50,000 Extraordinary Expense Every 5 Years	$100,000 Extraordinary Expense Every 5 Years	$150,000 Extraordinary Expense Every 5 Years
e) Escondido Canal	$150,000 Extraordinary Expense Every 20 Years	$300,000 Extraordinary Expense Every 20 Years	$450,000 Extraordinary Expense Every 20 Years
f) Rincon Penstock	No District Responsibility	No District Responsibility	No District Responsibility
g) Bear Valley Penstock	Replace within 70 Years	Replace within 60 Years	Replace within 50 Years
h) Bear Valley Power Plant	Replace within 70 Years	Replace within 60 Years	Replace within 50 Years
i) Conveyance to EVWTP	Replace within 70 Years	Replace within 60 Years	Replace within 50 Years

(1) The age and condition of existing facilities vary. A typical life of 50 to 70 years for water facilities was assumed to develop a range of annual costs. Replacement costs for pipelines and wells are based on current cost to construct. Replacement costs for 1) Henshaw Dam based on the 1981 Buttress Cost, 2) Bear Valley Penstock based on the 2004 replacement cost, and 3) Bear Valley Power Plant based on the 1983 costs of damages from flooding. We have assumed the Escondido Canal would not be replaced but would be rehabilitated and repaired as needed.

3. Local Water Exchange Options (Box 4)

Summary:

- The Settlement Agreement limits the list of possible exchange partners to the Agreement parties.
- It appears likely the District could strike a mutually beneficial exchange deal with Escondido, but Escondido would be able to utilize only a portion of the District's allocation.
- The net economic benefit to the District would cover only a portion of the District's local system costs, and would not generate any additional revenue to offset Flume replacement costs.

3.1. The Settlement Agreement effectively leaves Escondido as the District's only practicable exchange partner.

A key component of the Study's investigation of the Not To Flume option has been the evaluation of possible local water exchange agreements, under which the District would lease or exchange its allocation of local water to a partner agency. The Study's original scope of work presumed a long list of agencies with whom the District might be able to negotiate such an exchange agreement. We reported such during the Coarse Screening review, noting however that:

- the opportunities were constrained by the need for expensive conveyance facilities;
- none of the target agencies had been beating down our door to sign on; and
- Escondido appeared to be the most promising candidate.

Subsequent to the Coarse Screening review, the District has confirmed its position that the Settlement Agreement limits the use of local water to the sole and exclusive use of the Agreement parties. This constrains the list of potential exchange partners to Escondido and the Indian Bands. Because the Coarse Screening review had already determined that an exchange agreement with the Indian Bands was unlikely to generate revenue[3] for the District, this leaves Escondido as the only practicable exchange partner.

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[3] The Settlement Agreement defines the Indian Bands' water entitlements and effectively removes any incentive for them to pay for such a transfer. The transfer is certainly possible, but not in a manner that would generate revenue for the District.

3.2. Opportunities exist for a win-win exchange agreement with Escondido.

Under a possible exchange agreement with Escondido, Escondido would purchase some or all of the District's allocation of local water at a price less than what it would pay for raw water from the Water Authority. The District in turn would benefit by selling its water at a price higher than its unit cost of the local water system. If the parties were to split the benefits, the District's sales price to Escondido would be as presented in the table below.

Local Water Purchase Agreement Sales Price Example

	Description	Unit Cost
District Local System Costs	District mid-range costs for long-term operations, maintenance, and replacement of the local water system, per **Section 2.2**	$720/AF
Water Authority Raw Water Purchases	Water Authority's All-In price for raw water, CY 2020. Escondido would avoid this cost for every acre-foot it purchased from the District.	$1,400/AF
Possible Sales Price	The sales price could be set at the mid-point of the District's unit costs of the local system, and Escondido's avoided cost of Water Authority raw water purchases. This is just an example; actual price TBD.	**$1,060/AF**

In early December of last year, the District sent a white paper to Escondido outlining the terms and benefits of a possible Local Water Purchase Agreement that could be implemented if the District were to proceed with the Not To Flume option. Subsequently, District staff met with Escondido staff to provide background on the Flume study, answer questions about the white paper, and explore Escondido's interest in advancing the development of a purchase agreement. The results of those discussions are summarized below:

- **Need for Careful Review:** Escondido staff advised that any agreement would be subject to considerable Escondido review, including legal review and careful evaluation of the costs and conceptual terms presented by the District.
- **Schedule for Review:** Escondido staff suggested the depth of review needed would require more time than available in advance of the Study's Workshop No. 3 Board meeting. Staff suggested the District proceed with its schedule using its best assumptions, and that should the District Board elect to pursue a Flume retirement option, the parties could then undertake further review and negotiations.
- **Prospect for Review:** Escondido staff advised that they were unable to offer an official Escondido position on the likelihood of an agreement, but noted that if in fact there were opportunities for Escondido to save money in the long-term, and without incurring exposure to new liabilities, then this seemed reasonable cause for Escondido to engage in good-faith review and negotiations with the District in pursuit of a deal.

In addition, Escondido noted that owing to the need to limit the blend of local water at the EVWTP to no more than 40 to 50 percent of total plant inflow, and owing to projected declines in its potable water demands, it was unlikely to be able to utilize the District's full allocation of local water. This reduces the net economic benefit available to the District, as described below.

3.3. The District's net economic benefits of an exchange agreement are limited by Escondido's inability to utilize all of the District's local water allocation.

As noted, the combination of local water blending requirements at the EVWTP, and Escondido's projected declining potable water demands, limits Escondido's ability to utilize the full amount of the District's local water allocation. Absent significant improvements in water quality at Lake Wohlford, or treatment capabilities at the EVWTP, or both, these limitations will result in Escondido being able to utilize at most approximately one-half of the District's allocation.

The table below summarizes our assessment of unit revenues available from an Escondido water purchase agreement. Our mid-range expectation is that an agreement would cover approximately 60 percent of the District's local water system costs. As described in **Section 2.2**, the District's mid-range unit cost for the local water system, exclusive of treatment costs, is approximately $720/AF.

Water Purchase Agreement Revenue Projections

Scenario	Description	Unit Revenue[1]
Low (Pessimistic)	• Escondido average annual utilization: 1,500 AF/yr. • Unit Purchase Price: mid-point between local water system costs and Water Authority rate, per **Section 3.2**.	**$320/AF**
Mid-Range	• Escondido average annual utilization: 2,000 AF/yr. • Unit Purchase Price: mid-point between local water system costs and Water Authority rate, per **Section 3.2**.	**$420/AF**
High (Optimistic)	• Escondido average annual utilization: 2,500 AF/yr. • Unit Purchase Price: mid-point between local water system costs and Water Authority rate, per **Section 3.2**.	**$530/AF**

1. Unit revenues are expressed on the basis of the District's full 5,000 AF/yr of average annual yield.

4. System Improvements Without Flume (Box 2)

Summary:

For a Not To Flume option, the following findings apply:

- Delivery reliability concerns will be largely mitigated by a planned Water Authority isolation valve project, such that large volumes of new treated water storage will not be required.
- The Boot and Bennett areas would transfer to Vallecitos, with the District incurring significant annexation and capacity fees.

4.1. The delivery reliability consequences of a Not To Flume option will be largely (but not entirely) mitigated by a planned Water Authority isolation valve project.

During Water Authority aqueduct shutdowns, the District has always relied on the Flume to maintain full delivery reliability to the District service area. Retirement of the Flume would require compensating measures to maintain appropriate levels of delivery reliability.

The District's 2017 Master Plan identified possible compensating measures to maintain reliability with the Flume retired. Among the measures was the prospect of needing to construct up to 70 million gallons of new treated water storage, at a concept-level cost of up to $100 million. Upon further review, the study team has determined that other alternatives identified in the Master Plan will be able to compensate for the loss of the Flume at much more modest costs.

The primary mitigation for the loss of the Flume will be the Water Authority's planned Aqueduct Isolation Valve Project. With the proposed valves in place, the Water Authority will be able to limit future scheduled treated water aqueduct shutdowns to one or the other of the two treated water aqueduct pipelines south of Twin Oaks, maintaining full service to the District.

Although the isolation valve project will provide mitigation for scheduled aqueduct shutdowns, it still leaves the District at a disadvantage during rare *unscheduled* outages resulting from aqueduct facility failures and other catastrophic events. In these situations, the District could be reliant on its treated water storage, its access to water from the Oceanside Weese Water Treatment Plant, and its interconnections with Vallecitos for periods of up to 10 days. To supplement these capabilities, the study team recommends the District upsize its planned Pechstein II reservoir by approximately 10 million gallons beyond the capacity it would otherwise build, at an additional cost of approximately $15 million.

Delivery reliability compensation measures are summarized in the table below. The Water Authority isolation valve project is the linchpin of the package of mitigation measures. The other measures marked as "Included in Option" in the rightmost column are supplemental to the isolation valve project, to address unscheduled aqueduct outage scenarios not fully addressed by the isolation valve project. We recommend all measures so indicated be included as components of the Not To Flume option.

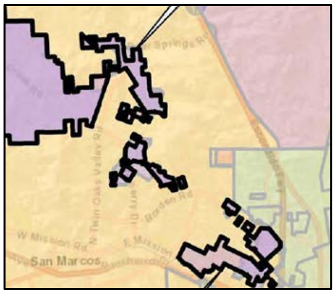
Delivery Reliability Compensation Measures (for Not To Flume Option)

Option	Description	Included in Option?
Water Authority Aqueduct Isolation Valves[1]	Will allow Water Authority to operate the Twin Oaks Water Treatment Plant during a treated water shutdowns, with supply south continuing via one or the other of P3 and P4. This would immunize the District from the effects of scheduled treated water shutdowns.	**Yes.** Project had originally been planned for Water Authority 2020-21 budget cycle, but was deferred during budget review. The District should continue to monitor status and encourage timely project implementation.
District Treated Water Storage[1]	Build treated water storage to compensate for loss of Flume deliveries. Assuming Water Authority isolation valve project proceeds, need for additional treated water storage is modest. Assume 10 MG addition to District's planned Pechstein II reservoir.	**Yes.** Include 10 MG at cost to District of **$15M.**
Oceanside Weese Water Treatment Plant[1]	The District can access up to 5 mgd by agreement, and likely more in an emergency.	**Yes.** If District selects Not To Flume option, it should consider updates and/or revisions to existing agreement.
Interagency Connections[2]	The District has emergency interties in place, the most significant being with Vallecitos. Availability to the District during a shortage or emergency would likely be limited by agencies prioritizing service to their own customers.	**Yes.** Additional arrangements unnecessary with above measures.
New Water Treatment Plant at Pechstein	The District would build a new water treatment plant adjacent to Pechstein, served by a new raw water connection to the Second Aqueduct. Reliability benefits beyond above measures would be minimal, as the same catastrophic events causing outages of the treated pipelines would also likely affect the raw water pipeline.	**No.** Project costs appear unwarranted assuming above measures in place.

1. The District's existing agreement with the City of Oceanside (Oceanside) provides the District access to up to 5 mgd of capacity from the Weese plant, but only on a surplus, "as-available" basis. Oceanside's projected usage of the plant indicates a high likelihood of surplus capacity remaining available for use by the District, but there remains the possibility Oceanside demands could increase or that the city could commit its surplus capacity to others (including the Rainbow Municipal Water District) through agreements. Additional capacity beyond the 5 mgd limit of the current agreement may be available during an emergency situation, but this is not guaranteed.
2. Vallecitos maintains considerable treated water storage reserves, and also has direct access to supply from the Water Authority's Carlsbad Seawater Desalination Facility. Vallecitos would naturally prioritize use of these assets for service to its own customers, but there could be emergency situations where a share of these assets could be made available to the District.

The full package of compensation measures would provide adequate delivery reliability safeguards for the District, although possibly not quite to the level of delivery redundancy provided by the Flume in combination with the District's treated water connections. This diminishment of delivery reliability is scored as a Non-Cost Evaluation Criteria factor later in **Section 6**.

4.2. The Boot and Bennett areas would transfer to Vallecitos, with the District incurring significant annexation, capacity, and infrastructure transfer fees.



The Boot and Bennett areas of the District service area are dependent on deliveries from the Flume, with backup service available from Vallecitos. Although in the District service area, these parcels are within the Local Area Formation Commission (LAFCO) designated sphere of influence of Vallecitos, meaning that LAFCO favors their eventual transfer to Vallecitos. In recent years, some parcels in the Boot area have annexed to Vallecitos at the behest of the parcel owners in order to obtain sewer service for planned development, and with all transfer costs paid by the property owner. The District anticipates this trend will continue, with most of the Boot area eventually transferring to Vallecitos service at no cost to the District.

If the Flume were retired, the presumption is that the Boot and Bennett area reorganization process with LAFCO and Vallecitos would be accelerated, and that the District might incur significant costs for annexation, capacity, and infrastructure transfer fees.

District staff has conducted a high-level assessment of the situation, and conferred with the study team on their findings. Based on that preliminary review, the study will utilize the following cost range for the transfer:

Boot and Bennett De-annexation Costs to District

Scenario	Description	Cost		
		Boot	Bennett	Total
Low (Optimistic)	Vallecitos waives capacity and annexation fees, but District and Vallecitos split infrastructure transfer fees.	$2M	$4M	**$6M**
Mid-Range	Vallecitos and District split annexation, capacity, and infrastructure fees.	$5M	$12M	**$17M**
High (Pessimistic)	District pays full annexation, capacity, and infrastructure fees	$9M	$24M	**$33M**

The District has also considered the following two options for maintaining service to the Boot and Bennett areas:

- **Extend District facilities:** The District has determined that extension of District facilities to serve the areas independent of the Flume would be impractical to due cost and other factors. LAFCO has placed the areas within the Sphere of Influence of Vallecitos.
- **Interagency Service Agreement with Vallecitos:** The District has determined that permanent service to these areas by Vallecitos, while keeping the areas within the District, is unlikely due to Vallecitos disfavoring such an arrangement. Notwithstanding Vallecitos's stated position, this option has successful precedent elsewhere in the County of San Diego and staff still believes the option is worth keeping alive.

4.3. The Not To Flume option would reduce the District's pumping costs.

The existing Flume feeds the District's central storage reservoir, Pechstein, at a high water elevation of 837 feet (above sea level). During normal operations with the Flume in service, the District pumps water out of Pechstein to its 976 / 984 zone, which in turn feeds the 900 zone. This constitutes the bulk of the District's pumping, both by volume and by cost.

If the Flume were retired from service, as under the Not To Flume option, the District would replace deliveries from the Flume with increased purchases at its VID3 connection to Water Authority pipelines 3 and 4 in the Second Aqueduct. Water delivered at the VID3 connection can feed the District's 976 / 984 zone by gravity, substantially reducing the District's pumping costs. Pumping cost savings are summarized in the table below.

Summary of Avoided Pumping Costs (Not To Flume Option)

Component	Description	Unit Cost Savings
Power	Based on recent historical operations, the District estimates it would reduce its pumping power consumption by approximately 765,000 kWh per year, which at an average total cost of $0.17/kWh amounts to approximately $130,000/yr of cost savings.	$25/AF[1]
O&M	In addition to power costs, the District estimates it would realize other O&M cost savings of approximately $80,000/yr.	$15/AF[1]
Capital	The District estimates it would avoid approximately $5M in future capital costs for pump station rehabilitation and replacement.	$50/AF[2]
Total		**$90/AF**

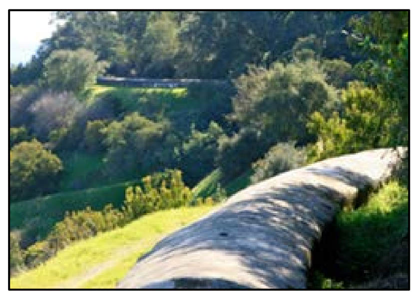
1. Unit revenues are expressed on the basis of the District's 5,000 AF/yr of average annual yield
2. Capital costs are amortized at 2.5 percent over 30 years (A/P = .0478), and converted to unit cost using the District's 5,000 AF/yr average annual yield of the local water system.

5. Flume Replacement Options (Box 1)

Summary:

- Achieving a long-term Flume replacement will be an even larger and more expensive endeavor than previously thought. This is because:
  - Most of the bench sections cannot be economically rehabilitated or replaced in their existing easements.
  - The age of many of the siphon sections is such that they must be presumed to require structural rehabilitation or replacement over the 50-year planning horizon.
- An All-New option, entailing an entirely new pipeline in a new alignment, appears preferred both economically and operationally.
- Final decisions on the alignment of a Flume Replacement Project would be undertaken during a subsequent Alignment Study.

5.1. Rehabilitating/Replacing the Flume will require a substantial capital investment.



We wish we could report otherwise, but achieving a long-term Flume rehabilitation or replacement will be an expensive proposition for the District, perhaps representing its largest capital investment ever.

Previous cost estimates extrapolated from the MW Bench high-density polyethylene (HDPE) slip-lining project, the Baumgartner Bench replacement, and other data points to generate a construction cost range of 35 million to 75 million dollars. That analysis was predicated on two key assumptions: 1) that HDPE slip-lining would be found feasible for most of the bench sections, and 2) that the siphon sections would require new mortar lining but little additional work. Upon further review, and with consideration to the project objective of achieving a long-term Flume replacement, **we find that both assumptions need to be abandoned**. Further details are provided in the subsections that follow.

5.2. The existing concrete bench structures are unsuitable for reuse and will need to be demolished.

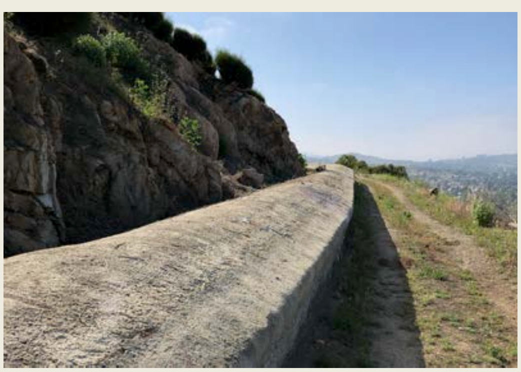
The concrete canals that make up the bench sections of the Flume were old and decaying the last time the District looked at them in 2012, and they are even older and more decayed now in 2020. Roof sections are structurally weak and separating from the sidewalls, floor sections are being undercut by erosion, and whatever tiny amount of steel that was included in the original construction has corroded.


Not suitable for reuse. Left: Roof separation, Borden Bench; Right: Erosion under Daley Bench

The study team has consulted with structural engineers, condition assessment experts and District staff. Based on this review, our preliminary conclusion for coarse screening is that the bench structures have no reliable usable strength remaining, and are not suitable for reuse as part of a long-term Flume replacement project. The structures will need to be demolished.

5.3. Most of the bench section easements are so poorly suited for pipeline construction that it will be more economical to bypass them with pipelines in roads.

Even with the existing concrete bench structures unsuitable for reuse, the bench easements themselves provide a path for construction of a new pipeline. However, for many of the bench section easements, pipeline constructability is hampered by limited and difficult access, constrained working space, rock outcroppings, and other difficulties. For these sections, the study team has determined it will be more economical to vacate the existing easement and construct new pipeline in roads, bypassing the bench sections. For other bench sections the opposite holds, with pipeline construction within the existing easement preferred over available bypass routes.




Challenging Construction Conditions. Narrow access & tight bends on: Left: Tunnel Bench, and Right: Twin Oaks Bench

This mixing and matching of bench segments and bypasses gives rise to what we term the Hybrid alignment alternative. More on that in a minute.

Our preliminary constructability assessment of each bench section is summarized in the table below:

Bench Section Constructability Assessment Summary

Bench*	Length (ft.)	Age (yrs.)	Constructability Notes	Use or Bypass?
Jack Creek	490	94	Assume aboveground pipeline due to rock conditions. Reach will be difficult to construct, but is short and achievable. Bypass route would add considerable distance.	**Use**
Tunnel	3,765	94	Difficult access and slope conditions with tight bends. A bypass spanning both Tunnel and Daley appears preferred.	**Bypass**
Daley	3,340	94	Difficult access and slope conditions with tight bends. A bypass spanning both Tunnel and Daley appears preferred.	**Bypass**
Kornhauser	1,325	94	Difficult access, from one side only. Bypass via future development preferred.	**Bypass**
Finkbinder	3,895	94	Tight bends. There is a preferred bypass route nearby. Use with above-grade piping could be an alternative.	**Bypass**
MD	3,275	94	Tight bends. There is a preferred bypass route nearby spanning both MD and Pearson benches.	**Bypass**
Pearson	370	94	Short reach. There is a preferred bypass route nearby spanning both MD and Pearson benches.	**Bypass**
Beehive	470	94	Easy access and short reach. Replace-in-place with buried pipe assumed.	**Use**
Borden	6,250	94	Use of the alignment may be possible, but would be constrained by habitat, easement width, and access issues. There is a feasible bypass route.	**Bypass**
Twin Oaks	4,975	94	Very difficult access and slope conditions with tight bends. Bypass is preferred.	**Bypass**
MW	2,115	9	No replacement or bypass needed. Bench was recently rehabbed with full structural solution.	**Use**
TOTALS	**30,270**			
-- Use	3,075		10 percent of total bench length	
-- Bypass	27,195		90 percent of total bench length	

* See **Figure 1** for bench section locations

5.4. Over the long-term, most of the siphon sections may need to be structurally relined or replaced. Internal inspections may be needed to refine this analysis.

Concerning the siphons, we are faced with considerable unknowns. For the 90 percent of the siphon footage that is steel, we know the mortar lining needs to be replaced, and we know that cathodic protection reports have indicated favorable protection status. However, most of the lines have never been subject to internal inspection, and we do not know the thickness of steel remaining, nor whether it has suffered corrosion pitting or other deterioration. Absent this level of thorough condition assessment, we are led to a conservative assumption that most of these sections will require replacement or structural relining over the 50-year planning horizon of the study. A thorough condition assessment, consisting of internal inspection using an electro-magnetic measuring tool or similar non-destructive testing device, might produce results that supported a less conservative assessment, and hence a less costly estimate of Flume replacement.

Our preliminary assessment of each of the siphon sections is summarized in the table below.

Siphon Section Condition and Replacement Schedule Summary

Siphon	Length (ft.)	Age (yrs.)	Material	Condition Notes	Replace?
Pleasant Valley	2,085	94	Steel	Age indicates probable need for structural relining or replacement. Replacement could be accomplished as part of bypass of Tunnel and Daley benches.	**Yes**
Baum-gartner	3,340	2	HDPE	Section recently replaced in new alignment during development. No further improvements needed.	**No**
Rincon	4,465	17	Steel	Recently replaced section. Subject to condition assessment review, no further improvements needed.	**No**
	900	94	Steel	Age indicates probable need for structural relining or replacement.	**Yes**
Caldwell	555	10	PVC	PVC portion of this siphon recently replaced. No further improvements needed.	**No**
	840	47	Steel	Subject to condition assessment review, replacement or structural rehabilitation assumed to be needed in future, but not urgent.	**TBD**
Pearson	600	94	Concrete	Age indicates probable need for structural relining or replacement. Replacement could be accomplished in conjunction with bypass of MD and Pearson benches.	**Yes**
Jones	2,370	64 and 94	Steel	Age indicates probable need for structural relining or replacement. A 660-ft portion would be replaced as part of bypass of the MD and Pearson benches.	**Yes**
Beehive	770	30	Concrete	Previous studies indicate replacement would be needed to accommodate pressurization.	**Yes**
Twin Oaks	5,745	27 and 94	Steel	Age indicates probable need for structural relining or replacement for all but the newer sections. All but 1,720-ft of siphon, including the more recently replaced sections, would be replaced as part of the Twin Oaks bench bypass.	**Yes**
Meyers	1,285	94	Concrete	Age indicates probable need for structural relining or replacement. Replacement for an 880-ft portion would be accomplished as part of the bypass of the Twin Oaks bench.	**Yes**
TOTALS	**22,955**				
-- Replace	13,755			60 percent of total siphon length	
-- Keep	8,360			36 percent of total siphon length	
-- TBD	840			4 percent of total siphon length	

* See **Figure 1** for siphon section locations

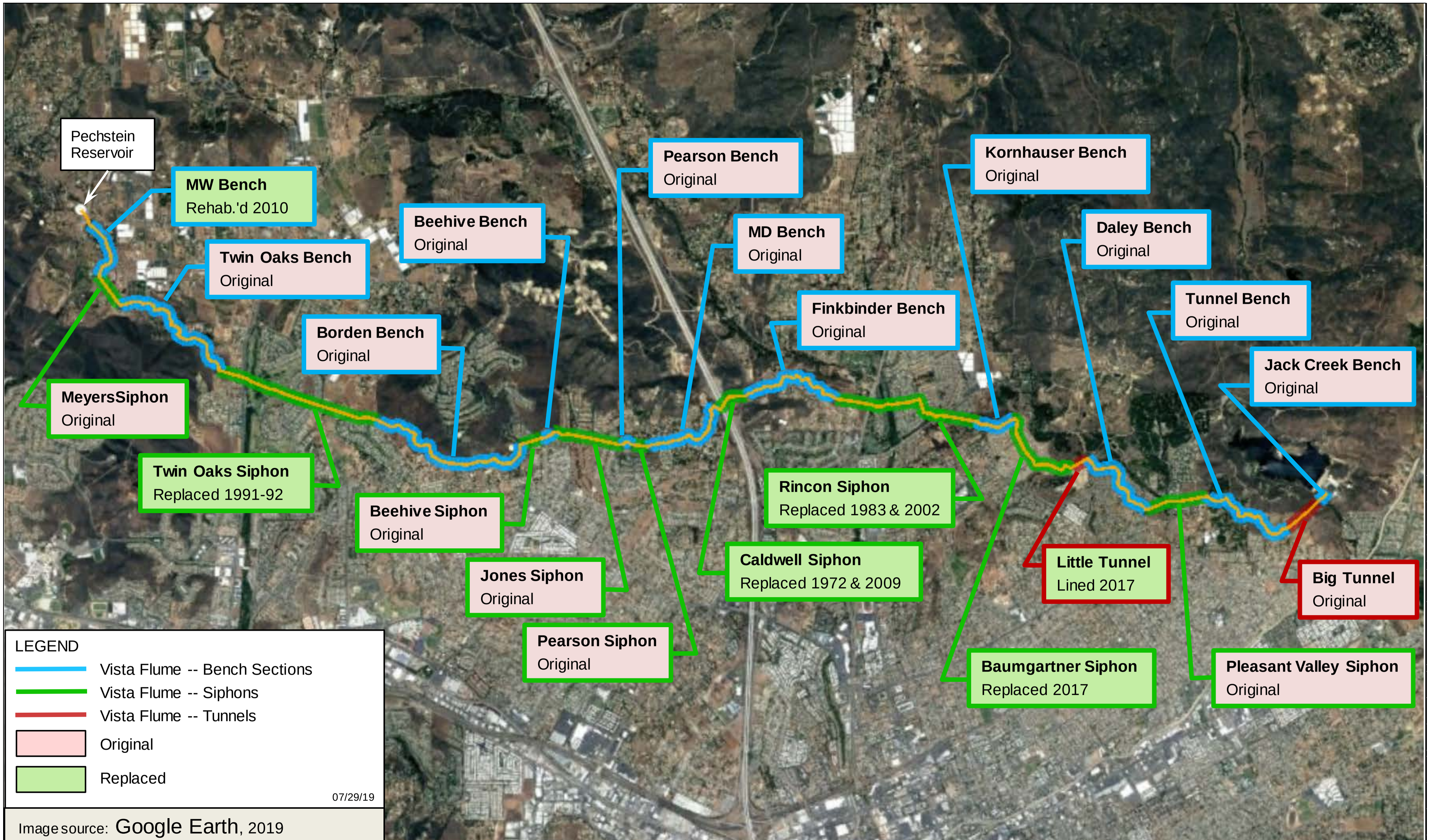


Figure 1

Water Supply Planning Study

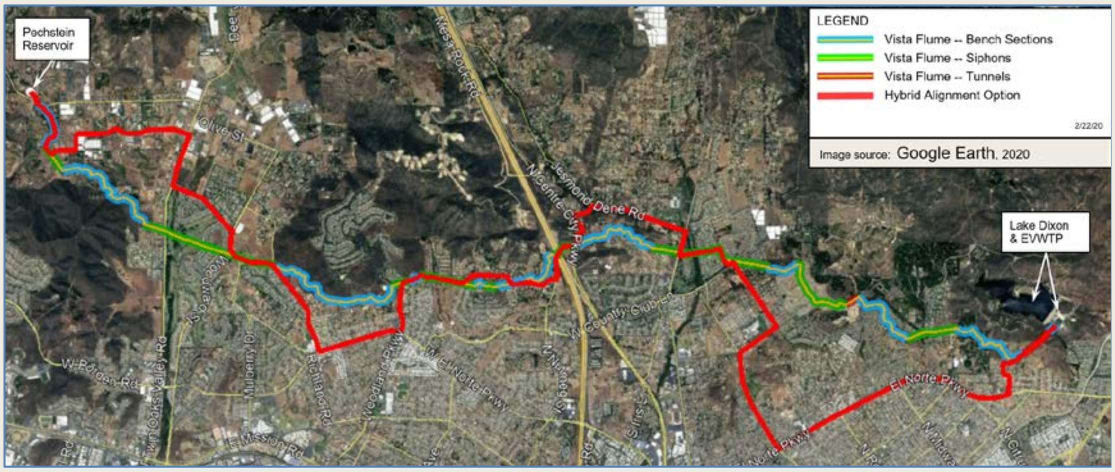
VISTA FLUME EXISTING BENCH, SIPHON, AND TUNNEL REACHES

VISTA IRRIGATION DISTRICT

GILLINGHAM WATER
Gillingham Water Planning and Engineering, Inc.

5.5. A Hybrid alignment is possible, but likely not preferred.

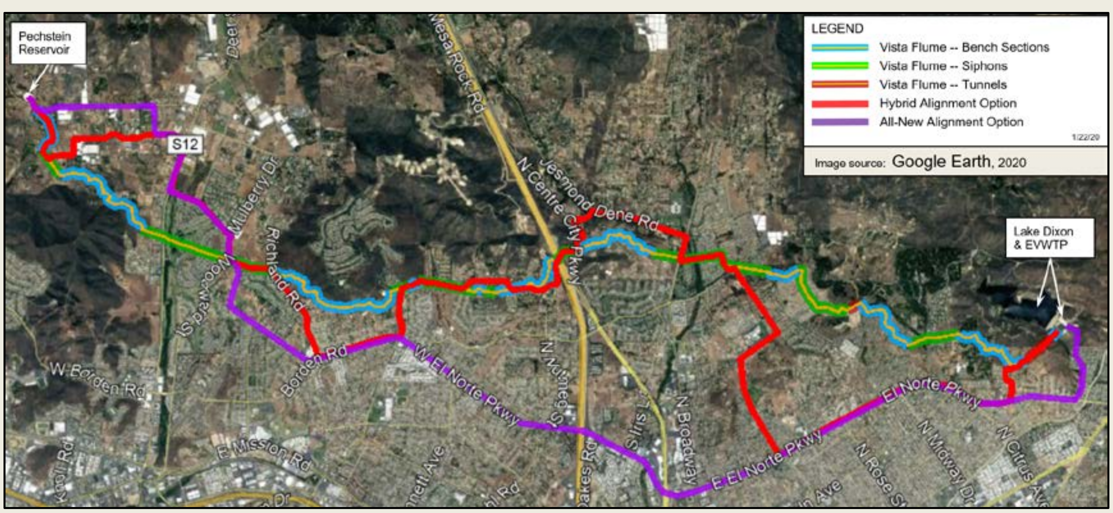
As reviewed above, project costs and other factors favor bypassing most reaches of the existing Flume alignment. Consequently, an alignment that sought to utilize as much of the existing Flume right-of-way and facilities as possible, which we dub a Hybrid alignment, would consist mostly of new bypass pipelines. A conceptual Hybrid alignment is illustrated in red in the figure below, and in **Figure 2** on the next page. All that zig-zagging around adds distance, and costs.



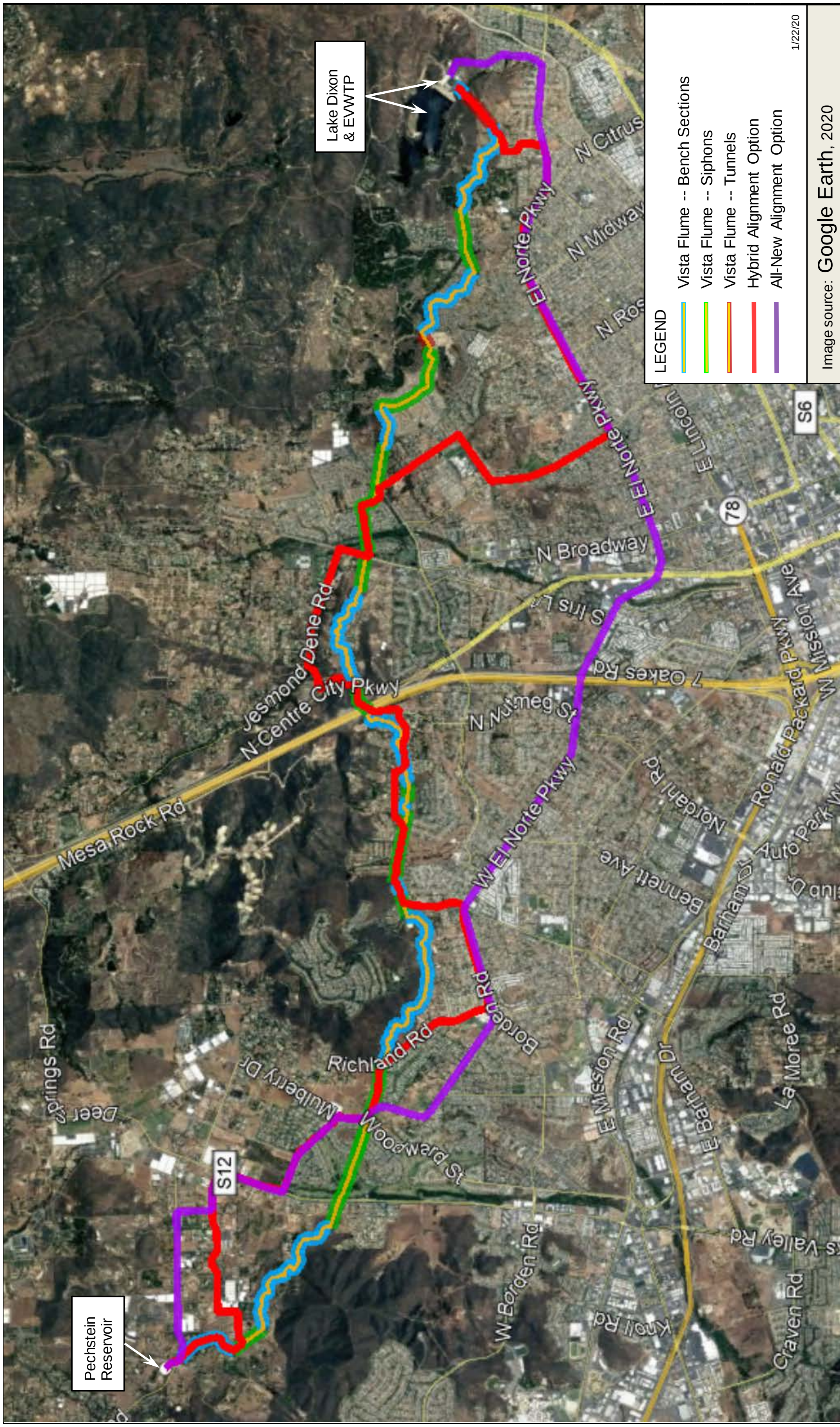
Hybrid Alignment Option. A conceptual Hybrid alignment (in red), mixing existing and new alignment reaches, appears the least-cost flume replacement alternative.

5.6. An All-New alignment appears economically preferred.

Although it may have seemed unlikely at the beginning of the Study, we now conclude that the most economical option for replacing the Flume will be an All-New alignment, consisting of pressurized pipeline in, or mostly in, public rights-of-way. A conceptual version of such an alignment is illustrated in purple in the figure below, and in **Figure 2** on the next page.



All-New Alignment Option. A conceptual All-New alignment (purple line) may be more expensive than a Hybrid alignment, but offers advantages that may warrant the additional cost.



Water Supply Planning Study

VISTA FLUME REPLACEMENT ALIGNMENT ALTERNATIVES

Figure 2

VISTA IRRIGATION DISTRICT

GILLINGHAM WATER
Gillingham Water Planning and Engineering, Inc.

5.7. An All-New alignment also provides water quality and security advantages.

The operation of the existing bench sections of the Flume is unpressurized. Industry practice favors the use of pressurized facilities for conveyance of treated water, so as to minimize the potential for intrusion of contaminants. The study team believes pressurization is a preferred component of a Flume replacement project. This factor favors the All-New alignment with its capability to provide full pressurization. The Hybrid alignment allows for some improvement in pressurization relative to existing operations, but to a lesser degree than the All-New option.

The District mitigates for its current unpressurized operation through the use of on-line monitoring of disinfectant residual. Residual is monitored at the start, mid-point (VID1), and terminus of the Flume. In the event monitoring detected a loss of residual, system operators would halt flow in the Flume and if necessary isolate Pechstein reservoir. The District system was reviewed and approved for permit renewal by the California Division of Drinking Water (DDW) in 2017, with no additional conditions being applied to operation of the Flume.

In the event the District elects to proceed with the To Flume option, the Study team recommends it coordinate with DDW during the Alignment Study phase of work to address these issues and ease the way for ultimate DDW approval of the project.

5.8. Pipeline sizing will maintain existing capacity.

The District estimates the current capacity of the Flume to be 21.5 mgd. A Flume replacement pipeline sized at 36-inches internal diameter would maintain and slightly increase that capacity, providing for delivery of up to 25 mgd as indicated in the table below. A larger pipe would provide additional but seldom needed capacity, at additional costs that exceed the modest value of the additional capacity. A smaller pipe would reduce project costs, but would also constrain the ability of the District to deliver local water during wet years.

Flume capacities at alternative pipeline diameters are summarized in the table below. The All-New alignment is shorter in length than the Hybrid alignment and as a result provides for slightly greater capacity at the same pipe diameter.

Pipeline Sizing and Delivery Capacity

Pipeline Internal Diameter	Capacity [1]		Discussion
	Hybrid (71,100 ft.)	All-New (58,900 ft.)	
Small – 30 in.	14 mgd	15 mgd	Undersized relative to District demands and wet-year yield of local water system, but would reduce capital costs.
Mid-Range – 36-in.	22 mgd	24 mgd	Approximately matches existing Flume capacity of 21.5 mgd. Provides adequate capacity for serving all but peak District demands, and provides sufficient capacity to fully utilize wet-year yields of the local water system.
Large – 42-in.	33 mgd	36 mgd	Oversized capacity provides modest benefits of operational flexibility, but incurs additional capital costs.

1. Calculations based on Hazen-Williams "C" factor (pipeline roughness coefficient) = 130, and available pipeline headloss = 130 ft. (978.5 ft. @ EVWTP filter effluent weir, less 837 ft. Pechstein HWL, less 9.5 ft. minor losses and flow control = 132 ft.) The resulting energy slope = 1.86 ft./1,000 ft. for the Hybrid alignment, and 2.24 ft./1,000 ft. for the All-New alignment.

5.9. Planning-level total project costs are approximately $120 million. We have assumed the use of welded steel pipe.

The study team has engaged a group of professional cost estimators to generate preliminary opinions of probable construction and total project costs for both the All-New and Hybrid alignment alternatives. Our work has included analysis of recent San Diego area construction bid data for similar pipeline projects built under similar conditions. The bid data reflects real-world conditions and are inclusive of all construction contingencies including miscellaneous appurtenances, utility relocations, traffic control, trenching, and other conditions that would be expected to be encountered on a Flume replacement project.

Our preliminary estimate of project costs for the All-New alignment alternative is summarized in the table below.

Preliminary Concept-Level Capital Cost Estimates – All-New Alignment

Item	Unit	Quantity		Unit Cost	Cost[1]
Pipeline					
Major Arterial	$/in./ft.	36 in.	17,500 ft.	$36.00	$22,680,000
Minor Arterial	$/in./ft.	36 in.	24,800 ft.	$25.00	$22,320,000
Collector	$/in./ft.	36 in.	13,100 ft.	$22.00	$10,380,000
Open Space	$/in./ft.	36 in.	3,500 ft.	$25.00	$3,150,000
			58,900 ft.	*$27.60*	*$58,530,000*
EVWTP Connection	LS	1		$2,000,000	$2,000,000
I-15 Crossing Surcharge	$/ft.	1000		$1,500	$1,500,000
Jack and Bore Surcharge	$/ft.	1000		$1,000	$1,000,000
Boot & Bennett Connections	LS	2		$750,000	$1,500,000
Isolation Valves	LS	2		$250,000	$500,000
Flow Control Facility / Pechstein Connection	LS	1		$2,000,000	$2,000,000
Instrumentation	LS	1		$1,000,000	$1,000,000
Easements / Land Acquisition	$/acre	0.0		$500,000	$0
Subtotal Pipeline					$68,000,000
Flume Demolition					
Bench Sections	$/ft.	30,270		$150	$4,540,000
Siphon Sections	$/ft.	22,995		$150	$3,450,000
Tunnel Sections	$/ft.	2,010		$150	$300,000
Subtotal Flume Demolition		*55,275*			*$8,300,000*
Mark-ups and Other Costs					
Subtotal					*$76,300,000*
Contingency	%			25%	$19,100,000
Subtotal Construction Cost					*$95,400,000*
Design / Administration / Environmental / Permitting	%			23%	$21,900,000
TOTAL PROJECT COST					**$117,300,000**
TOTAL PROJECT COST (rounded)					**$120,000,000**

1. Costs in 2020 dollars. (January 2020 ENR LA CCI = 12,144)

In comparison, we estimate the cost of the Hybrid alternative to be approximately $10 million higher, for a total cost of approximately $130 million. The higher cost of the Hybrid alternative, at the conceptual level of cost review, arises primarily due to its longer length. The cost includes approximately $2 million to account for the probability-weighted cost of lost local water deliveries and local treatment benefits during extended Flume shutdowns.

Our cost estimates are for welded steel pipe. The Study team has evaluated the possible use of alternative pipe materials, including PVC and Ductile Iron, and determined that at the assumed diameter of 36-inches, and for construction in urban arterial roads, these materials are unlikely to achieve significant cost savings, while lacking the long-term durability and resiliency of welded steel. Alternative pipe materials should be further considered during the preliminary and final design phases of the project, but for the current purposes of project planning we recommend the estimates of project costs assume the use of welded steel.

The estimates reflect the current San Diego area bidding climate, which is high in comparison to historical conditions. Assuming a Flume project were bid a few years in the future, the bidding climate in effect at that time will influence the project costs.

The estimates are preliminary, based not on detailed construction drawings but rather on professional judgement of the construction conditions and methods likely to be applicable to each reach of the alignment as depicted in **Figure 1**. The estimates are Class 5 planning level estimates; we estimate their accuracy range at approximately -35 to +50 percent.

5.10. A final determination of alignment, pipe material, pipeline diameter, and other factors would be made as part of Alignment and Preliminary Design studies.

The Study's review of Flume replacement options, including alignments, pipe materials, pipeline diameters, and other factors has advanced only to a degree sufficient to confirm overall feasibility and to generate a range of probable costs. Our alignment options in particular are conceptual only, and are not intended to imply preference for routing decisions. Those decisions are in the future. Should the District elect to proceed with the To Flume option, it would undertake Alignment Study and Environmental Documentation efforts that would evaluate multiple alternatives and identify, and document, preferred project solutions.

Those future studies would also give further consideration to the following issues relative to differences between Hybrid and All-New alignments:

- **Right-of-Way Issues:** The District's easement holdings for the existing Flume pre-date almost every other utility in the area, meaning any relocation of Flume facilities required by others is paid for by others. This factor advantages the Hybrid alignment over the All-New alternative. At the same time, the existing Flume easements require ongoing maintenance and inspection, adding operating costs. This factor advantages the All-New alignment.
- **Capital Outlay Programming:** The Hybrid alignment option allows for phased construction, spreading out capital outlay spending over a longer time. In particular, future condition assessment work on the siphon sections may support deferring structural relining of those reaches for additional decades. In comparison, the All-New alignment option could at most be broken into two reaches (in **Figure 1**, these are delineated by the point where the purple All-New line crosses the Flume), and these phased a few years apart, with only modest attenuation of capital outlay spending levels.

6. Conclusions and Next Steps

6.1. First-Year Cost Review: Modest favor the To Flume option.

First-year unit costs of the Not To Flume and To Flume options are summarized in the tables below. The comparison does not account for differences in cost escalation over time.

First-Year Costs for Not To Flume Option

Cost Component	Description	Equivalent Unit Cost[1]
Increased Water Authority Purchases	Purchase an additional 5,000 AF/yr, on average, of treated Water Authority water at a first year "all-in" rate of $1,700, as presented in **Section 1.5.**	$1,700/AF
Local System O&M	Operate and maintain the local water system on a long-term, asset management driven basis as described in **Section 2.**	$720/AF
Exchange Benefit	Sale of local water to Escondido, per **Section 3.** The benefit is expressed on the basis of 5,000 AF/yr of local system yield.	($420/AF) (benefit)
Delivery Reliability Mitigation	To compensate for reduction in delivery reliability absent the Flume, increase storage of planned Pechstein II reservoir by 10 MG, at a capital cost of $15M[2], as described in **Section 4.1.**	$140/AF
Boot and Bennett Transfer	Transfer Boot and Bennett areas to Vallecitos, incurring a mid-range capital cost of $17M[2] as presented in **Section 4.2.**	$160/AF
Reduced Pumping Costs	By taking water at its VID3 connection rather than from the Flume, the District achieves annual pumping cost savings of $210,000 and capital cost savings of $5M[2], as presented in **Section 4.3.**	($90/AF) (benefit)
TOTALS	(Rounded)	**$2,200/AF**

First-Year Costs for To Flume Option

Cost Component	Description	Equivalent Unit Cost[1]
Local Water System O&M	Operate and maintain the local water system on a long-term, asset management driven basis as described in **Section 2.**	$720/AF
Water Treatment	Treatment of local water at the EVWTP, as described in **Section 2.**	$200/AF
Flume Replacement	Replace the Flume at a total capital cost of $120M[2] as described in **Section 5.**	$1,150/AF
Flume O&M	Operate and maintain the Flume, per **Section 5.** (Asset management costs do not begin until after the 30 year finance period.)	$20/AF
Self-Treatment Benefit	Operation of the Flume allows the District to use approximately 7,500 AF/yr of Water Authority raw water, which it treats at a cost approximately $75/AF less than the Water Authority treated water rate differential. The equivalent unit benefit is expressed on the basis of 5,000 AF/yr of local system yield.	($110/AF) (benefit)
TOTALS	(Rounded)	**$2,000/AF**

1) Equivalent unit costs in 2020 dollars, for 5,000 AF/yr average annual yield of the local water system.

2) Capital costs are amortized at 2.5 percent over 30 years (A/P = .0478), and converted to unit cost using the District's 5,000 AF/yr average annual yield of the local water system.

6.2. 30-Year Cost Review: Differences in cost escalation rates result in pronounced advantage to the To Flume option.

The first-year costs presented in **Section 6.1** do not account for differences in the rates of cost escalation between the options over time. We expect most of the cost components listed will inflate over time at the assumed mid-range rate of 3.0 percent per year, as described in **Section 1.7**. We expect however that the two largest cost line items, Water Authority treated water rates and Flume Replacement amortized costs, will escalate at rates different than inflation with significant consequences to the overall cost comparison.

Regarding Water Authority treated water rates, the best available forecast as described in **Section 1.5** indicates rates are likely to increase faster than inflation for approximately the next 10 years, and thereafter equal to inflation. In contrast, Flume Replacement amortized costs, assuming the use of conventional level 30-year financing, would remain steady over the period with no escalation. This combination of escalating Water Authority rates and steady Flume Replacement amortization costs weighs to the significant advantage of the To Flume option.

The resulting thirty-year costs are summarized in the tables below.

Thirty-Year Present-Worth Costs[1] for Not To Flume Option

Cost Component	Annual Cost Escalation	30-Year Costs[2]
Increased Water Authority Purchases	Years 1-10: Mid-Range Inflation + 1.5% Years 11-30: Mid-Range Inflation	$287M
Local System O&M	Mid-Range Inflation	$108M
Exchange Benefit	Mid-Range Inflation	($63M)
Delivery Reliability Mitigation	None	15M
Boot and Bennett Transfer	None	17M
Reduced Pumping Costs	O&M Portion: Mid-Range Inflation Capital Portion: Zero (level financing)	($11M)
TOTALS	(Rounded)	**$350M**

Thirty-Year Present-Worth Costs[1] for To Flume Option

Cost Component	Annual Cost Escalation	30-Year Costs[2]
Local Water System O&M	Mid-Range Inflation	$108M
Water Treatment	Mid-Range Inflation	$30M
Flume Replacement	None	$113M[3]
Flume O&M	Mid-Range Inflation	$3M
Self-Treatment Benefit	Mid-Range Inflation	($17M)
TOTALS	(Rounded)	**$240M**

1. All annual cost items are inflated as noted over 30 years, then brought back to present worth at a discount rate of 3.0%/yr.
2. Costs in 2020 dollars
3. That's not a typo. The assumption that the project will receive low-interest financing results in an effective subsidy in its present-worth cost. The subsidy for $120M of capital financed at 2.5% interest over a 30- year period, and brought back to present worth at a discount rate of 3.0%, amounts to approximately $7M.

Beyond the 30-year finance period, all of the costs for the Not To Flume option continue to accrue, while costs for the To Flume option decrease with the retirement of the capital debt. At that time the District would begin accruing a sinking fund for long-term maintenance and repair of the new Flume, but the annual cost for this fund would be considerably less than the bond payment amount. **This suggests the long-term cost advantages of the To Flume option would likely continue beyond the 30-year finance period and into the future.**

6.3. Sensitivity Analysis: The cost comparison can be altered by changes to individual assumptions; however, getting the scale to tip the other way requires changes to multiple assumptions.

The cost comparisons presented in **Sections 6.1** and **6.2** utilize the Mid-Range estimates for all cost components and financing terms. The Mid-Range assumptions reflect the Study team's best estimates and professional judgements; we think those are the best numbers to use for the current planning purposes. Nevertheless, we recognize that our estimates and assumptions about future conditions are imperfect, and that actual costs and actual future conditions could vary. Having demonstrated that the cost balance scale tips in favor of the To Flume option using the Mid-Range estimates, it is prudent to consider the sensitivity of that outcome to changes in the assumptions.

The Sensitivity Analysis table on the next page summarizes the effects on the thirty-year cost comparison of making one-at-a-time changes to key individual assumptions. For example, what is the effect on the cost comparison of changing the project interest rate from the Mid-Range value to a higher rate, or what is the effect of assuming Water Authority rates will escalate at a pace lower than the Mid-Range assumption? For comparison, the first row of the table lists what we have labeled as the Baseline Condition, the costs that result from consistent application of the Mid-Range assumptions as detailed in the previous subsection.

Because the cost balance scale for the Baseline Condition tilts so prominently in favor of the To Flume option, the Sensitivity Analysis table presents only changes made in the direction of advantaging the Not To Flume option at the expense of the To Flume option (e.g., adjusting project interest rates to make financing of a Flume Replacement project more expensive than for the Mid-Range condition). It is important to keep in mind that for every changed assumption presented in the direction of advantaging the Not To Flume option, there is an equal and opposite change that would further advantage the To Flume option (e.g., we could change the interest rate assumption the other direction to make the financing of a Flume Replacement project less expensive than the Mid-Range condition).

Sensitivity Analysis for Changes to Individual Cost Variables

(With all adjustments made in the direction of advantaging the Not To Flume option)

Cost Variable	Assumption	Effect	30-Yr. Costs[1]	
			Not To Flume	To Flume
Baseline Condition	Baseline costs using all Mid-Range assumptions, per **Section 6.2**.		**$350M**	**$240M**
1. Interest Rates	Increase project interest rate from the Mid-Range value of 2.5% (melded) to Pessimistic range value of 4.0%	Increases present-worth cost of Flume replacement by ~$22M	$350M	⇧ $260M (+$20M)
2. Rate Escalation	Reduce the pace of rate escalation from Mid-Range (inflation + 1.5% next 10 years, thereafter at inflation), to Optimistic (inflation + 1% for next 5 years, thereafter at inflation)	Reduces cost of Water Authority purchases for local yield replacement water by ~$20M	⇩ $330M (-$20M)	$240M
3. Exchange Opportunities	Increase the exchange revenue from Mid-Range ($420/AF) to Optimistic ($530/AF)	Reduces net cost of Not To Flume option by ~$20M	⇩ $330M (-$20M)	$240M
4. System Improvements	Change Boot and Bennet transfer cost from Mid-Range ($17M) to Optimistic ($6M)	Reduces cost of Not To Flume option by ~$10M (rounded)	⇩ $340M (-$10M)	$240M
5. Flume Replacement	Assume replacement costs 25% above budget	Increases costs of Flume replacement by ~$30M	$350M	⇧ $270M (+$30M)
6. Average Local Yield	Reduce the average yield of the local water system from Mid-Range (5,000 AF/yr) to Pessimistic (4,000 AF/yr) (Note: Less yield would mean less replacement water would be required.)	Reduces cost of Water Authority purchases for local yield replacement water by ~$60M Reduces costs for local water treatment by ~$10M	⇩ $290M (-$60M)	⇩ $230M (-$10M)

1. Costs in 2020 dollars

It is apparent from the table that the long-term cost advantages of the To Flume option are robust, in that changes to individual assumptions alone are not sufficient to tip the balance scale the other way. Of the six variables presented, changes to the last, Average Local Yield, result in the largest swing in costs ($50M net) between the To Flume and Not To Flume options.

To further test sensitivity, the table on the next page presents the results of applying multiple changed assumptions simultaneously, all in the direction of advantaging the Not To Flume option.

Sensitivity Analysis for Changes to Multiple Cost Variables, Case 1

(With all adjustments made in the direction of advantaging the Not To Flume option)

Cost Variable	Assumption	30-Yr. Costs[1]	
		Not To Flume	To Flume
Baseline Condition	Baseline costs using all Mid-Range assumptions, per **Section 6.2**.	**$350M**	**$240M**
First Five of Six (1. Interest Rates, 2. Rate Escalation, 3. Exchange Opportunities, 4. System Improvements, 5. Flume Replacement)	Assumes the first five of the assumptions change, in unison, from their Mid-Range values to those most favorable to the Not To Flume option.	⇩ $300M (-$50M)	⇧ $290M (+$50M)
All Six (The first five above, plus: 6. Average Local Yield)	Assumes all six of the assumptions change in unison from their Mid-Range values to those most favorable to the Not To Flume option.	⇩ $240M (-$110M)	⇧ $280M (+$40M)

The table demonstrates that with enough changes to the Mid-Range assumptions, all made in the direction of favoring the Not To Flume option, it is possible to bring the long-term costs of the two options to parity, and in the extreme to gain modest comparative cost advantage (on the order of $1.5 million per year over thirty years) for the Not To Flume option. **We consider this scenario unlikely, but do not deny it is possible.**

On the topic of what is possible, remember the above sensitivity analysis tables are intentionally biased in favor of lending advantage to the Not To Flume option. If we instead adjusted the sensitivity variables in the other direction, in favor of the To Flume alternative, the cumulative results would be as presented in the table below.

Sensitivity Analysis for Changes to Multiple Cost Variables, Case 2

(With all adjustments made in the direction of advantaging the To Flume option)

Cost Variable	Assumption	30-Yr. Costs[1]	
		Not To Flume	To Flume
Baseline Condition	Baseline costs using all Mid-Range assumptions, per **Section 6.2**.	**$350M**	**$240M**
First Five of Six (1. Interest Rates, 2. Rate Escalation, 3. Exchange Opportunities, 4. System Improvements, 5. Flume Replacement	Assumes the first five of the assumptions change in unison from their Mid-Range values to those most favorable to the To Flume option.	⇧ $400M (+$50M)	⇩ $205M (-$35M)
All Six (The first five above, plus: 6. Average Local Yield)	Assumes all six of the assumptions change in unison to those most favorable to the To Flume option.	⇧ $485M (+$135M)	⇩ $215M (-$25M)

The table above and the one prior demonstrate the swing between wildly pessimistic and wildly optimistic assumptions. We think the actual numbers are most likely to be closer to the middle of this range.

6.4. Review of Non-Cost Factors: Both options have comparative advantages and disadvantages. We think To Flume comes out ahead, but the evaluations here are subjective. Your call.

Major non-cost attributes of the Not To Flume option are summarized in the table below. The evaluations presented here are preliminary and subject to Board refinement.

Major Non-Cost Components for Not To Flume Option

Evaluation Factor	Discussion	Rating	
		To Flume	Not To Flume
Maximize Service Reliability and Operational Effectiveness	Without the Flume, the District would incur loss of an increment of delivery reliability provided by the Flume. Delivery reliability in the Not To Flume option is mostly compensated for as described in **Section 4.1**, but not entirely.	↑	→
Minimize Environmental Impacts / Protect Environmental Resources	Potential adverse environmental effects of a Flume replacement project appear mitigable, with costs included in the estimate. Environmental management of the Warner Basin could continue under either option.	→	→
Implementability – Capital Outlay Expenditures	Even though equivalent unit costs are level between the options, the To Flume option requires large capital financing, while the Not To Flume option does not.	↓	↑
Implementability – Other Risks and Opportunities	Each option leads to its own set of risks and opportunities. The To Flume option incurs risk of hydrologic uncertainty as to future yield, but that uncertainty is as likely to be favorable and unfavorable. The To Flume option leaves open the potential opportunity of an expanded Warner Basin wellfield, but that opportunity has not yet been evaluated for economic merit.	↑	→
Regional Cooperation	The existing Flume provides valuable supply redundancy to the Rincon del Diablo, via an intertie utilized by Rincon del Diablo during Water Authority aqueduct shutdowns. Rincon del Diablo is hoping the District chooses To Flume.	↑	↓
Intrinsic Values	For board discussion	?	?

6.5. Course Corrections and Offramps: For either option, the District will have a period of further planning and design prior to going all-in. You will have opportunities for course corrections and offramps along the way.

The Water Supply Planning Study is not the final word on To Flume or Not To Flume. Rather, the results of the Study will inform the District's decision as to whether to proceed with the next steps for preliminary design and environmental documentation for one option or the other. Either path provides ample time and opportunity for further review and refinement of the findings of the work presented here, and we recommend that periodic overview assessments be built into the scope of work for either path.

If for example you elect to proceed with planning for a Flume Replacement Project, and if in the course of that planning you determined that all six of the cost variables from the prior table had shifted in favor of the Not To Flume option, you could change course at that time. We hope that takes a bit of the pressure off the current To Flume or Not To Flume decision.

6.6. Next Steps: To Flume

If the District chooses To Flume, its next steps will include the major items summarized in the table below.

Next Steps – To Flume Option

Action	**Description**	**Schedule and Budget**
1. Alignment Study	Conduct a thorough Alignment Study for a Flume Replacement Project. Evaluate alternative alignments, define key design parameters, refine project costs, and provide engineering support to the Environmental Documentation process	18-24 months $0.75M - $1.25M
2. Environmental Documentation	Conduct environmental documentation and preparation for project permitting	18-24 months $0.75M - $1.25M
3. Financial Planning	Develop project financing plans; prepare and apply for grants (depending on project eligibility) and low-interest loans	12-18 months $0.1M - $0.25M
4. Miscellaneous	• Average Local Yield: Refine estimates	12-18 months $0.1M - $0.25M
Total		24-36 months $1.7M - $3M

6.7. Next Steps: Not To Flume

If the District chooses Not To Flume, its next steps will include the major items summarized in the table below.

Next Steps – Not To Flume Option

Action	Description	Schedule and Budget
1. Flume Retirement Planning	Define timing and process for Flume retirement and demolition, including environmental review	12-24 months $0.5M - $0.75M
2. Boot and Bennett Transition	Prepare necessary agreements and studies with Vallecitos and LAFCO for transition of the Boot and Bennett areas to the Vallecitos service area.	12-24 months $0.25M - $0.75M
3. Delivery Reliability / Pechstein II	• Prepare formal plan for delivery reliability upon retirement of the Flume • Prepare preliminary design and environmental documentation for Pechstein II • Coordinate with the Water Authority to monitor implementation of their Isolation Valves project	12-24 months $0.25M - $0.75M
4. Escondido Water Purchase Agreement	• Coordinate with Escondido to formalize terms • Work with Escondido to explore opportunities for water quality and treatability improvements at Lake Wohlford and the EVWTP	12-24 months $0.25M - $0.5M
Total		12-24 months $1.25M - $3M

6.8. We'll see you at Workshop No. 3.

These are challenging and exciting issues for the District. We look forward to reviewing them with you at Workshop No. 3.

Attachment J

Budget Projection through Fiscal Year 2027 after Proposed Rate Increases

All Sources except Service Charge	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Total
Water Rates Sales Tier 1 (Tier 1 Rate)	$ 17,410,120	$ 17,701,240	$ 17,701,240	$ 17,701,240	$ 17,701,240	$ 17,701,240	
Water Rates Sales Tier 2/3 (Tier 1 Rate)	14,564,739	13,948,479	13,948,479	13,948,479	13,948,479	13,948,479	
Emergency Storage Pass-through	1,821,000	1,821,000	1,821,000	1,821,000	1,821,000	1,821,000	
Revenue All Others	3,241,900	3,473,430	3,548,193	3,635,110	3,724,309	3,815,850	
All Expenses excl Depr and CS RM	36,814,349	37,200,242	37,590,773	38,062,228	38,477,588	38,897,316	
Total	223,411	(256,094)	(571,861)	(956,400)	(1,282,561)	(1,610,747)	
Service Charge							
Service Revenue	17,796,294	18,092,589	18,613,032	19,213,736	19,834,463	20,475,883	
Customer Service	1,871,702	1,835,010	1,882,372	1,930,955	1,980,793	2,031,917	
Repairs and Maintenance	5,760,795	5,909,480	6,062,003	6,218,462	6,378,959	6,543,599	
Capital	**10,163,797**	**10,348,098**	**10,668,658**	**11,064,319**	**11,474,711**	**11,900,367**	
Total	-	-	-	-	-	-	
Marginal Tier 2							
Marginal Tier 2 Revenue	1,110,731	2,221,463	2,221,463	2,221,463	2,221,463	2,221,463	
Cost of Conservation	235,854	241,941	248,186	254,591	261,162	267,903	
Tier 2 Marginal for Capital	874,878	1,979,522	1,973,277	1,966,872	1,960,301	1,953,560	
Capital Sources							
Capital Sources Top Section	223,411	(256,094)	(571,861)	(956,400)	(1,282,561)	(1,610,747)	
Capital Sources Service Charge	10,163,797	10,348,098	10,668,658	11,064,319	11,474,711	11,900,367	
Capital Sources Tier 2 Marginal	874,878	1,979,522	1,973,277	1,966,872	1,960,301	1,953,560	
Available for Capital	**11,262,085**	**12,071,526**	**12,070,074**	**12,074,791**	**12,152,451**	**12,243,180**	
Capital Project	(15,429,000)	(25,258,275)	(8,331,880)	(9,281,674)	(10,017,727)	(10,356,065)	
Amount Left over (Negative decreases reserves)	(4,166,915)	(13,186,749)	3,738,194	2,793,117	2,134,724	1,887,115	(6,800,514)

	Cash Balance Actual 06/30/2021 Amount	Expected Cash Balance 06/30/2027 Amount
Emergency and Contingency Reserve	$ 10,000,000	$ 10,000,000
Working Capital Reserve	10,000,000	10,000,000
Surplus Water Pass-through	4,595,222	4,595,222
Water Rebate (5 years 2022-2026)	1,571,006	
Capital Improvement Reserve	20,346,496	13,545,982
Total Cash Balance	**46,512,724**	**38,141,204**

Capital Improvement Reserve 06/30/2021	$ 20,346,496
Proposed Budget Projection to Fiscal Year 2027	(6,800,514)
Projected Capital Improvement Reserve Balance as of 06/30/2027	13,545,982

Attachment K

Vista Irrigation District
Water Authority Pass-through Calculation

Overview

The San Diego County Water Authority (Water Authority) is responsible for supplying water to 24 member agencies within San Diego County. Not simply a water provider, the Water Authority is also responsible for the construction and maintenance of regional storage, delivery and treatment infrastructure necessary to ensure the reliable delivery of water to local water agencies like Vista Irrigation District (District). The District seeks to pass-through any increases or decreases in the cost of purchased water directly to the ratepayer when the changes occur.

The Water Authority has both fixed and variable costs. Fixed costs are allocated to member agencies based on each agency's percentage of demand in prior years, which are updated annually. Variable costs are charged based on actual water purchased by a member agency and have separate charges for raw melded supply, treatment and transportation.

The District uses a fiscal year ending June 30; The Water Authority uses a calendar year with increases effective January 1 each year. The District typically increases its rates for the pass-through on March 1 because the District bills the majority of its customers every two months and usage starting January 1 would be seen on billings mailed on or after March 1.

The calculation for the pass-through compare the increases/decreases in fixed and variable charges against the volume of water purchased to create a per unit charge.

Explanation of Pass-through Calculation

Water Authority Fixed Costs - The Water Authority typically calculates fixed costs that will be charged to each member agency effective January 1 each year. The fixed charges are divided by 12 months and billed to member agencies regardless of the volume of water purchased in the calendar year. This part of the calculation totals the fixed costs.

Prior Fiscal Year True Up Between Budget and Actual for Fixed Costs - The pass-through must be spread across the volume of water purchased to get to an amount per unit. The budgeted water volume (in acre-feet) is used to determine the fixed costs per unit. Once actual units are known, the rate is adjusted in the current year to make up for the difference between budgeted and actual volumes. If the amount results in a large increase, the District spreads the amount across several years to help stabilize the increase/decrease to ratepayers. The line "i prior" presents any amounts not adjusted for in the prior year in order to smooth rates.

Fixed Costs Change between Prior Actual and Current Budget - The section above adjusts the rate from prior year's budget to prior year's actual volume purchased. This section takes the prior year actual volume and adjusts it to the District's current year budgeted volume.

Water Authority Variable Costs - Each year, the Water Authority calculates variable costs for actual water purchased. This section compares the prior calendar year costs of raw water, treatment of water and transportation of water against the current year costs per unit. Since the District has its own local water supply (Lake Henshaw), it calculates the percentage of purchased water against total water and adjusts the amount per unit lower to account for the volume of local water delivered.

Summary - The summary adds up the various increases and decreases and then adjusts for lost water; every year the District must buy more water than is sold because of water loss. Starting in 2022 and for the next 5 years, the District will be applying a rebate against the rate increases (see below); the difference between the calculation and the rebate is rounded to the nearest cent. This increase/decrease is added to billings starting March 1 of each year. If the Water Authority was to increase/decrease at another point in time during the year, the District would also complete that calculation and adjust rates accordingly.

Rebate (Credit) Details - The Water Authority received a $44.4 million rebate from the Metropolitan Water District of Southern California (Metropolitan). On February 25, 2021, the Water Authority's Board of Directors announced a plan to distribute the rebate to its 24 member agencies. The District's pro-rata share of the rebate was $1,570,006; funds were received in April 2021.

The rebate was the result of decade-long rate case litigation between the Water Authority and the Metropolitan; The Water Authority won on several critical issues in the cases covering 2011 to 2014 and was deemed the prevailing party; as such, The Water Authority was owed legal fees and charges in additional to the damages and interest payments. The payment by Metropolitan was a damages award for Water Stewardship Charges that had been unlawfully assessed by Metropolitan on the Water Authority's independent water supplies transported through Metropolitan facilities from 2011 through 2014.

On October 28, 2021, the Water Authority's Board approved an additional $35.9 million rebate for damages and interest from the Metropolitan Water District of California for breach of the parties' Exchange Agreement for years 2015-2017 by charging a Water Stewardship Rate, to be disbursed to the member agencies. The District's pro-rata share of the additional rebate is $1,227,643.

The District has elected to use the rebates to offset the Water Authority rate increases over the next five years beginning January 1, 2022, lessening the impact of future Water Authority pass through rate increases.

VISTA IRRIGATION DISTRICT
2022 WATER AUTHORITY PASS THROUGH CALCULATION

WATER AUTHORITY FIXED COSTS		**Calendar 2021**	**Calendar 2022**	
(a)	MWD - Net Ready to Service	$ 418,777	$ 366,837	
(b)	MWD - Capacity Reservation	280,284	349,692	
(c)	CWA - Customer Service	938,328	843,729	
(d)	CWA - Storage	2,370,300	2,124,313	
(e)	CWA - Supply Reliability Charge	1,490,039	1,474,004	
(f)	**Total Fixed Costs (a) + (b) + (c) + (d) + (e)**	**$ 5,497,728**	**$ 5,158,575**	
			-6.2%	

PRIOR FY TRUE UP BETWEEN BUDGET AND ACTUAL FOR FIXED COSTS		**Budgeted 2021**	**Actual 2021**	
(g)	FY Water Sales (Budgeted/Actual)	15,900	17,322	
(h)	FY Fixed Costs to Rate Per AF (f) / (g)	345.77	317.38	
(i)	FY True Up Pass Through Per HCF ((h) Actual - (h) Budgeted) / 435.6		$ (0.065)	
(i prior)	Prior Year Calculation hold over		$ 0.025	
(i.1)	**True Up**			**(0.040)**

FIXED COSTS CHANGE BETWEEN PRIOR ACTUAL AND CURRENT BUDGET		**FY 21 Actual**	**FY 22 Budgeted**	
(j)	FY Actual & FY Budgeted Water Sales	17,322	15,800	
(k)	Fixed Costs to Rate Per Acre Foot (f) / (j)	317.38	326.49	
(l)	**Fixed Cost Pass Through Per HCF ((k) Budget- (k) Actual) / 435.6**			**$ 0.021**

WATER AUTHORITY VARIABLE COSTS		**Prior FY 2021**	**Current FY 2022**	
(m)	Raw Melded Supply (A/F)	$ 940	$ 1,009	
(n)	Treatment (A/F)	295	310	
(o)	Transportation (A/F)	150	173	
(p)	Total Variable Charges Per AF (m) + (n) + (o)	$ 1,385	$ 1,492	
			7.7%	
(q)	**Variable Costs Per HCF ((p) Current - (p) Prior) / 435.6**		**$ 0.246**	
(r)	10 Year Average Local Water Production	2,507	15%	
(s)	Imported Water	14,293	85%	
	FY 2022 Budgeted Total Water Supplied	16,800	100%	
(t)	**Variable Cost Pass Through - HCF (q) x (s)**			**$ 0.209**

SUMMARY

(u) Pass Through Per HCF (i.1) + (l) + (t)	**$ 0.190**
Adjusted for 6% Water Loss (u) / .94	**$ 0.202**
Rebate Credit Refund	**$ (0.081)**
Total Adjusted for Water Loss	**$ 0.121**
Pass Through Per HCF Rounded	**$ 0.120**

Rebate Calculation		
Amount Received 04/21	$	1,571,006
Amount Expected Second Rebate	$	1,227,643
Total Rebate	$	2,798,649
Amount Per year (5 years)	$	559,730
Current Year Budget af		15,800
Amount Per AF	$	35.43
Amount Per Unit		0.081
Year 1 Rebate Amount		559,730
Rebate Amount Remaining		2,238,919.26