FINAL

Water Supply Alternatives Study

Prepared for
City of Pleasanton
Pleasanton, CA
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Project No.: 159224

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List of Abbreviations

AACE	Association for the Advancement of Cost Engineering
AFY	acre-feet per year
BC	Brown and Caldwell
CEQA	California Environmental Quality Act
City	City of Pleasanton
DB	design-build
DBB	design-bid-build
DSRSD	Dublin San Ramon Services District
GAC	granular activated carbon
gpm	gallons per minute
GPQ	groundwater pumping quota
M	million(s)
NEPA	National Environmental Protection Act
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
SRF	State Revolving Fund
Study	Water Supply Alternatives Study
Zone 7	Zone 7 Water Agency

Executive Summary

The City of Pleasanton (City) is a water retailer, meaning it sells water directly to individual water users. The City receives its potable water (i.e., drinking water) supply from two sources: about 80 percent of its potable supply is purchased wholesale supply from Zone 7 Water Agency, while the City typically relies on groundwater for the remaining 20 percent of its supply.

Per- and polyfluoroalkyl substances (PFAS) in drinking water is a serious national issue. Also found in non-stick cookware, firefighting foam, water resistant materials, and many other products, PFAS have leached into the region's groundwater for more than half a century, and new regulatory requirements are forcing the City to either build a treatment system or remove the wells from service. In the meantime, the City has decided to shut off its wells and authorized use of Wells 5 and 6 only on an emergency basis. Zone 7 has agreed to supply Pleasanton with additional water, as available in the interim; however, the ability of Zone 7 to meet Pleasanton's long-term demands is uncertain.

Starting in September 2020, the City initiated the PFAS Treatment and Wells Rehabilitation Project (PFAS Treatment Project) with the goal of extending the life of existing groundwater facilities and providing PFAS treatment. The scope of the PFAS Treatment Project includes:

- Replacing Well 5 with a new Well 9 at Amador Park
- Rehabilitating Well 6 (renamed as Well 10)
- Rehabilitating Well 8
- Constructing and operating a new centralized treatment facility for PFAS treatment, disinfection, and fluoridation
- Constructing a new raw water transmission pipeline and improving treated water distribution piping

As of September 2022, the City had progressed its PFAS Treatment Project through 50 percent design, and the project was in its final phase of design; however, given the increasing costs of PFAS treatment, regulatory uncertainty, and long-term operational commitments, the City decided to pause and consider other water supply alternatives before proceeding with the PFAS Treatment Project. On September 6, 2022, the City Council authorized staff to suspend the PFAS Treatment Project, and in October 2022, the City Council established the Water Supply Alternatives Study (Study) as a new capital improvement project and contracted Brown and Caldwell (BC) to support City staff in conducting the Study.

The Study's purpose is two-fold, including:

- Identify and evaluate alternatives relative to the PFAS Treatment Project for the portion of water supply that has been obtained using the City's GPQ of 3,500 AFY and is critical for meeting peak monthly/daily demands.
- Inform the path forward, including whether the City should proceed with the PFAS Treatment Project or pursue an alternative to produce 3,500 AFY of potable water supply and meet peak monthly/daily demands.

The Study involved a multi-step process to identify and screen an inclusive list of potential water supply options. The initial screening resulted in identifying four alternatives for further consideration:

- Alternative 1 – Baseline Project (PFAS Treatment and Wells 5, 6, & 8 Rehabilitation)
- Alternative 2 – Reduced Baseline (PFAS Treatment for Well 8 only)
- Alternative 3 – Two New City Wells (West of PFAS plume)
- Alternative 4 – 100% purchases from Zone 7

The Study involved an evaluation of relative benefits, costs, and tradeoffs to identify a preferred alternative: Alternative 3 (Two New City Wells). The Study outlines an implementation plan for Alternative 3, as well as a contingency plan for how to proceed if the outcome of predesign activities indicate that implementation of Alternative 3 (Two New Wells) is not feasible or less favorable than anticipated due to cost estimate refinements, groundwater quality issues, and/or production limitations.

Section 1

Introduction

The City of Pleasanton (City) is a water retailer, meaning it sells water directly to individual water users. The City receives its potable water (i.e., drinking water) supply from two sources:

- **Wholesale water purchases from Zone 7 Water Agency (Zone 7).** Zone 7 treated water purchases have typically accounted for approximately 11,000 acre-feet/year (AFY), which is about 80 percent of the City's potable (i.e., drinking) water supply. Zone 7 also sells treated water supply to three other retailers: California Water Service, City of Livermore, and Dublin San Ramon Services District (DSRSD).
- **Local groundwater.** Groundwater has typically been about 20 percent of the City's potable water supply. Groundwater use is limited by the City's groundwater pumping quota (GPQ) of 3,500 AFY. Until recently, the City has pumped groundwater from three wells that the City owns and operates (Well 5, Well 6, and Well 8) to meet peak demands and provide redundancy in the City's water system.

The City owns and operates facilities to store and deliver potable water to its residents and commercial customers, as well as approximately 250 customers in unincorporated Alameda County.

The City also owns and operates a separate storage and pipeline system for recycled water. Recycled water is highly treated wastewater that can be used for non-potable purposes. The City delivers recycled water to a portion of customers within its service area, mainly for landscape irrigation. Recycled water deliveries are approximately 1,200 AFY.

1.1 Background

Per- and polyfluoroalkyl substances (PFAS) in drinking water is a serious national issue. Also found in non-stick cookware, firefighting foam, water resistant materials, and many other products, PFAS have leached into the region's groundwater for more than half a century, and new regulatory requirements are forcing the City to either build a treatment system or remove the wells from service (City of Pleasanton, 2019). In the meantime, the City has decided to shut off its wells and authorized use of Wells 5 and 6 only on an emergency basis. Zone 7 has agreed to supply Pleasanton with additional water, as available in the interim; however, the ability of Zone 7 to meet Pleasanton's long-term demands is uncertain.

Starting in September 2020, the City initiated the PFAS Treatment and Wells Rehabilitation Project (PFAS Treatment Project) with the goal of extending the life of existing groundwater facilities and providing PFAS treatment. The scope of the PFAS Treatment Project includes:

- Replacing Well 5 with a new Well 9 at Amador Park
- Rehabilitating Well 6 (renamed as Well 10)
- Rehabilitating Well 8
- Constructing and operating a new centralized treatment facility for PFAS treatment, disinfection, and fluoridation
- Constructing a new raw water transmission pipeline and improving treated water distribution piping

As of September 2022, the City had progressed its PFAS Treatment Project through 50 percent design, and the project was in its final phase of design; however, given the increasing costs of PFAS treatment, regulatory uncertainty, and long-term operational commitments, the City decided to pause and consider other water supply alternatives before proceeding with the PFAS Treatment Project. On September 6, 2022, the City Council authorized staff to suspend the PFAS Treatment Project, and in October 2022, the City Council established the Water Supply Alternatives Study (Study) as a new capital improvement project and contracted Brown and Caldwell (BC) to support City staff in conducting the Study.

1.2 Purpose

The Study's purpose is two-fold:

- Identify and evaluate alternatives relative to the PFAS Treatment Project for the portion of water supply that has been obtained using the City's GPQ of 3,500 AFY and is critical for meeting peak monthly/daily demands[1].
- Inform the path forward, including whether the City should proceed with the PFAS Treatment Project or pursue an alternative to produce 3,500 AFY of potable water supply and meet peak monthly/daily demands.

The Study is not intended to consider alternatives that would replace or reduce the City's other supply sources (i.e., Zone 7 purchases or recycled water), which are assumed to remain in place.

1.3 Approach to Study

In close coordination with City staff, BC engaged City Council and met with Zone 7 staff while conducting the Study. Feedback from Zone 7 informed the evaluation of water supply options, as several require input and/or Board approval from Zone 7.

1.3.1 City Council Engagement

City Council formed a Water Supply Alternatives Study two-person Ad Hoc Subcommittee (Ad Hoc Subcommittee) to oversee the Study's progression and inform its direction. The Ad Hoc Subcommittee members are Pleasanton Mayor, the Honorable Karla Brown; and City Councilmember Jeff Nibert, who stepped in when Councilmember Kathy Narum's term ended in December 2022. BC and City staff met with the Ad Hoc Subcommittee eight times over the Study's duration, and presented updates at public City Council meetings approximately quarterly, again through the Study's duration (Figure 1-1).

[1] From April 2019 to October 2022, Pleasanton's maximum weekly groundwater pumping rate was 6.2 million gallons per day (mgd) to meet peak water demands in August 2020.

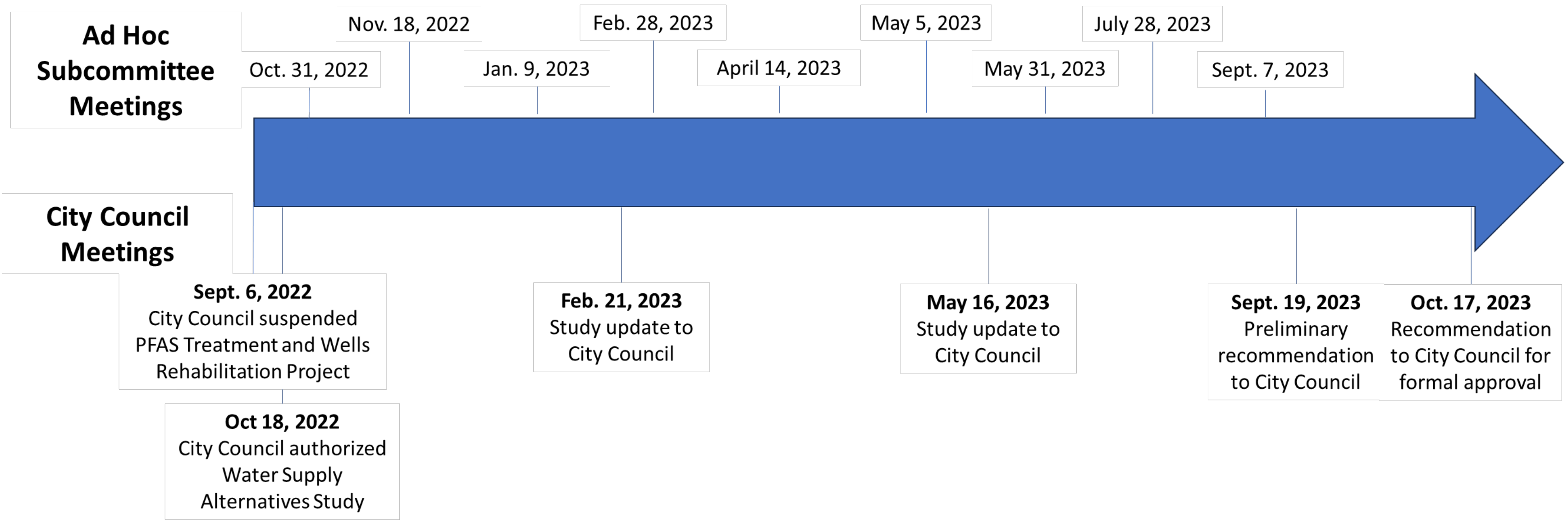

Figure 1-1. City Council engagement throughout the Pleasanton Water Supply Alternatives Study

1.3.2 Zone 7 Coordination

BC and City staff coordinated with Zone 7 management and staff throughout the Study. Zone 7 staff provided BC well data and a copy of its existing groundwater flow and transport model. As described in Appendix D, BC used this existing model in evaluating scenarios as part of the Study. The model was used without modification to determine the potential impact on groundwater quality from the existing PFAS plume in the upper and lower aquifers of the Livermore Valley groundwater basin around the City.

BC and City staff held meetings with Zone 7 management and staff on April 11, 2023, and June 13, 2023. Discussions during those meetings focused on potential water supply options considered in the Study that could involve Zone 7. In addition, the City and Zone 7 communicated throughout the Study to exchange information.

1.3.3 Evaluation Approach

The Study involved a multi-step process for identifying and evaluating potential water supply alternatives, as shown in Figure 1-2. The outcomes from the evaluation are presented in the following sections, with further detail on the methodology included in Appendix A.

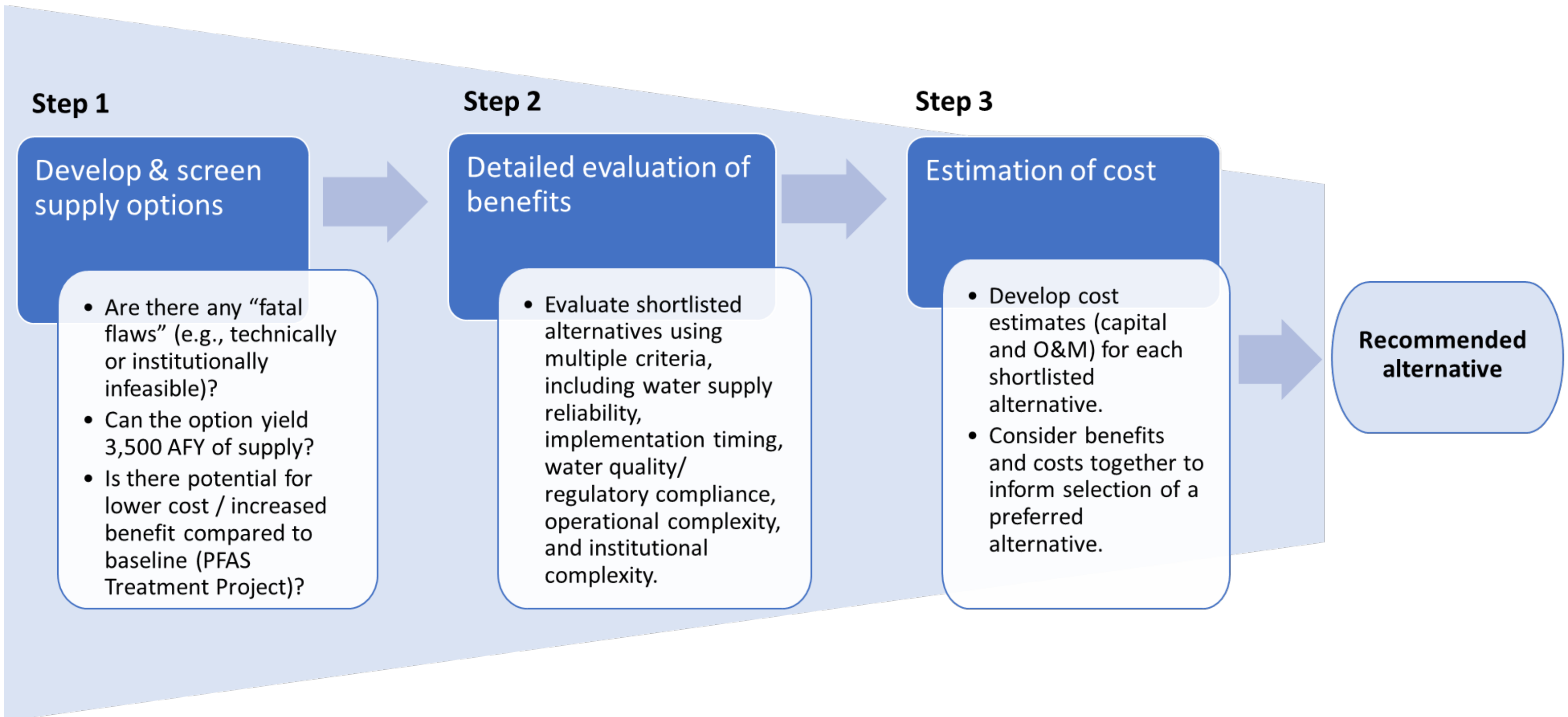

Figure 1-2. Multi-step process for identifying and evaluating potential water supply alternatives

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Section 2

Water Supply Options and Alternatives

This section describes the approach for developing and screening potential water supply options to result in a shortlist of alternatives for further evaluation.

2.1 Options Development and Initial Screening

BC worked closely with City staff to develop an inclusive list of potential water supply options. Table 2-1 summarizes the list of options considered.

Table 2-1. Potential Water Supply Options for Screening

Category	Option	Description
Baseline Project	PFAS Treatment and Wells 5, 6, & 8 Rehabilitation Project	Design and construct a centralized PFAS treatment facility and rehabilitate the City's three existing wells. City Council suspended the baseline project on September 6, 2022, to further evaluate water supply alternatives.
Groundwater Supply Options	Modified PFAS Treatment (Well 8)	Similar to the Baseline Project but involves adding PFAS treatment to Well 8 only (and not Wells 5 and 6).
	New City well(s) outside PFAS plume (west part of the City)	City-owned well(s), with or without treatment for other constituents (non-PFAS).
	Zone 7 pump on City's behalf [a, b]	Zone 7 to pump from new well(s) outside PFAS plume (with or without treatment for other constituents [non-PFAS])
	Regional PFAS Treatment Facility (at Pleasanton's Operations Services Center) [a, c]	New facility constructed by Pleasanton (or jointly constructed by Pleasanton/Zone 7) and operated and maintained by Zone 7 to produce regional water supply, including Pleasanton's GPQ.
	Blending/Dilution	Blend existing well supply with water from Zone 7 to reduce PFAS concentration below future maximum contaminant levels or lower, if possible.
Other Supply Sources	100% purchases from Zone 7[a]	Agnostic of source (i.e., assumed to include some combination of supply from the State Water Project, groundwater, and future additions to Zone 7's supply portfolio).
	Purchases from another agency	Either wheeled through Zone 7's system or direct connection to a wholesaler (e.g., San Francisco Public Utilities Commission) or another retail water supplier (e.g., East Bay Municipal Utility District).
	Local alternative supplies	Includes options such as desalination, stormwater capture, and/or satellite wastewater treatment.
Demand Management	Expansion of non-potable system	Expand non-potable supply beyond what is already projected in the City's 2020 Urban Water Management Plan (~500 AFY), using recycled water and/or non-potable groundwater.
	Long-term water use efficiency (WUE)	Invest in permanent demand reduction measures (e.g., turf replacement), beyond existing/planned WUE including state requirements to meet new standards-based water use objectives[d]. Does not include short-term conservation (i.e., behavioral changes).

a. *Water supply options/alternatives involving Zone 7 require approval from Zone 7's Board of Directors.*
b. *Zone 7 staff confirmed that existing infrastructure does not have adequate capacity to pump groundwater on the City's behalf.*
c. *Zone 7 staff confirmed that expanding PFAS treatment at its Chain of Lakes or Stoneridge sites is not feasible.*
d. *New state requirements for WUE are established under 2018 water conservation legislation, including Assembly Bill 1668 (Friedman) and Senate Bill 606 (Hertzberg).*

In coordination with City staff, BC performed initial screening of the water supply options, as summarized in Table 2-2. To pass initial screening, options needed to meet the annual yield of 3,500 AFY and show early potential for reducing costs compared to the baseline project. Further details on the screening process are included in Appendix A.

Table 2-2. Results of Initial Screening of Potential Water Supply Options

Category	Option	Is there potential for lower cost/increased benefit compared to Baseline Project?	Does the option pass an initial screening for technical and institutional feasibility "fatal flaws"?
Baseline Project	PFAS Treatment and Wells 5, 6, & 8 Rehabilitation Project	Not applicable	Yes
Groundwater Supply Options	Modified PFAS Treatment (Well 8)	Yes	Yes
	New City well(s) outside PFAS plume (west part of the City)	Yes	Yes
	Zone 7 pump on City's behalf	Yes	No – This concept was initially screened out due to Zone 7's anticipated timing for updating its regional groundwater model and Well Siting Master Plan. Zone 7 subsequently decided to accelerate its planning, which makes a joint project potentially viable. The City and Zone 7 will continue to explore this option as Zone 7 progresses its planning.
	Regional PFAS Treatment Facility (at Pleasanton's Operations Services Center)	Yes	No – Zone 7 is not interested in advancing this concept.
	Blending/Dilution	No	No – Based on mass balance calculations, dilution would require substantially more supply from Zone 7 than is available or capable of being delivered to the City.
Other Supply Sources	100% purchases from Zone 7	Maybe	Yes
	Purchases from another agency	No	No – Connections to San Francisco Public Utilities Commission or East Bay Municipal Utility District do not currently exist and are not institutionally feasible. Long-term transfers through Zone 7's system are considered under the option for 100% purchases from Zone 7.
	Local alternative supplies	No	No – High cost of desalination or satellite treatment relative to baseline and seasonality/unpredictability of stormwater availability
Demand Management	Expansion of non-potable system	No	No – Recycled water is supply-limited in the peak season, which is when the City typically relies on groundwater for meeting peak potable demands.
	Long-term WUE	No	Yes – While WUE alone cannot reduce the City's peak demand and annual need for 3,500 AFY within the timeframe desired by the City, WUE is considered an "add-on" that complements all other water supply options.

2.2 Alternatives for Evaluation

The initial screening resulted in identifying four alternatives for further consideration:

- Alternative 1 – Baseline Project (PFAS Treatment and Wells 5, 6, & 8 Rehabilitation)
- Alternative 2 – Reduced Baseline (PFAS Treatment for Well 8 only)
- Alternative 3 – Two New City Wells (West of PFAS plume)
- Alternative 4 – 100% purchases from Zone 7

To meet peak demand requirements, alternatives may require infrastructure improvements, such as booster pumps, pipelines, and/or a new turnout from Zone 7's transmission system. Infrastructure improvements for each alternative were identified through Akel's Water Supply Alternative Improvements summary dated August 2, 2023, and provided in Appendix E. Some near-term infrastructure improvements are required to accommodate future demands regardless of the alternative that moves forward. This Study assumes that the City will fund and address these near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station BS-1 as identified in Akel's Water Supply Alternative Improvements summary dated August 2, 2023 [Appendix E], estimated at ~$10.2M) in advance of implementing water supply alternatives.

As noted in Section 1.1, Alternative 1 (Baseline Project) involves constructing a centralized treatment facility at the City's Operations Services Center for PFAS treatment, disinfection, and fluoridation (Figures 2-1 and 2-2). Based on Carollo's 50 percent design deliverable opinion of probable construction cost, the treatment facility would involve seven treatment trains with two vessels per train and a system peak design flow of 5,800 gallons per minute (gpm), including 3,500 gpm from Well 8 and 2,300 gpm from either Well 9 or Well 10 (Carollo, 2022).

Alternative 1 would involve replacing Well 5 with a new Well 9 at Amador Park, rehabilitating Well 6 (renamed Well 10), and rehabilitating Well 8 to restore pumping capacity. This alternative also requires constructing a new raw water transmission pipeline and improvements to treated water distribution piping.

Figure 2-1. Alternative 1 (Baseline Project) overview

Source: ESA, 2022

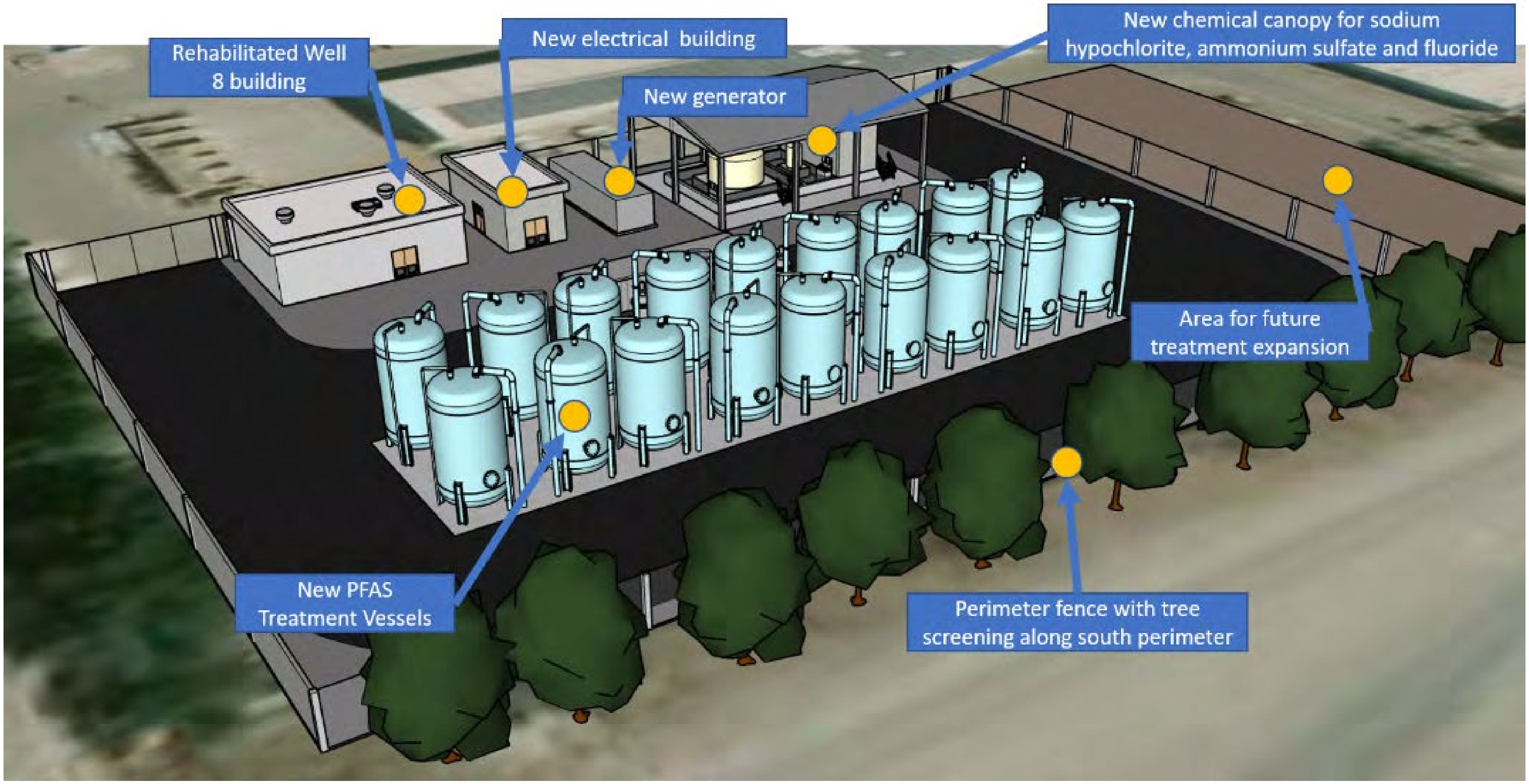

Figure 2-2. Centralized treatment facility isometric

Source: Carollo, 2021

Alternative 2 (Reduced Baseline) is similar to the Baseline Project but involves adding treatment to Well 8 only (and not Wells 5 and 6). The treatment facility would involve four treatment trains with two vessels per train and a system peak design flow of 3,500 gpm from Well 8 (i.e., 2,300 gpm less than Alternative 1). Compared to Alternative 1, this alternative requires the same improvements to treated water distribution piping and a slightly larger booster pump station at Zone 7's Turnout 4 than that required for near-term infrastructure improvements to accommodate future demands (Appendix E).

Alternative 3 (Two New City Wells) involves constructing two new wells, each assumed at 3,000 gpm pumping capacity (i.e., total 6,000 gpm), west of the existing PFAS plume. For the purposes of bracketing this concept, this alternative assumes one new well in Del Prado Park and one new well in Bernal Park, as shown in Figure 2-3. New well construction would be comparable to the City's existing wells and include drilling groundwater layers 6 through 9 or 10 at a boring depth of 685 feet (ft) and screening from 150 ft to 650 ft. Compared to Alternatives 1 and 2, this alternative requires more improvements to treated water distribution piping but a slightly smaller booster pump station at Zone 7's Turnout 4 (Appendix E).

Figure 2-3. Alternative 3 (two new wells) overview with assumed well locations to estimate required infrastructure improvements

Alternative 4 involves purchasing 100 percent of the City's supply from Zone 7, regardless of the supply source (i.e., assumed to include some combination of supply from the State Water Project, groundwater, and future additions to Zone 7's supply portfolio). This alternative would require confirmation from Zone 7 regarding agreement terms for Pleasanton's purchase of an additional 3,500 AFY of supply, including:

- Delivery confirmation: either year to year, which is the current interim solution, or longer term, which would require an agreement between the City and Zone 7 similar to the "June 2000 Agreement to Construct and Operate a Municipal Well on the Camp Parks Well Site between DSRSD and Zone 7" and would need to replace the supply from the City's wells while committing to meet peak month and peak day demands (Figure 2-4)
- Cost basis: anticipated to be a variable wholesale rate with an increase to the City's fixed cost, based on a rolling average of the City's water deliveries from Zone 7 over the previous 2 years
- Potential concession for the City not using its GPQ

Zone 7 staff have stated that they do not have redundant capacity within their system to pump the City's GPQ over the long term, which may require capital improvements to secure the 3,500 AF in the same manner as is being considered in the other alternatives. This could increase the cost of Alternative 4, as these costs would likely be passed on directly to the City to avoid redirected impacts on other Zone 7 retailers. However, for this analysis, any City-specific capital improvements by Zone 7 have been excluded since they are not yet well-defined.

Further, of the four shortlisted alternatives, Alternative 4 requires the most extensive infrastructure improvements, including more improvements to treated water distribution piping, a larger booster pump station at Zone 7's Turnout 4 designed at 7,000 gpm capacity, and a new turnout from Zone 7 (Appendix E).

As noted in the City's 2020 Urban Water Management Plan (West Yost, 2021):

> "The City's water supplies consist of purchases from Zone 7 (approximately 80 percent of supply in 2020) and groundwater pumped by the City (approximately 20 percent of supply in 2020). Of Zone 7's supplies, imported water from the State Water Project makes up approximately 80 percent, with the remainder coming from groundwater and local surface water.
>
> The future reliability of Zone 7's imported water is a concern. Drought, sea level rise, and natural disasters threaten the Sacramento-San Joaquin Delta (Delta), a critical component of the delivery system bringing water to Zone 7. As a result, Zone 7 is participating in various projects that would provide alternate water supplies or protect the existing delivery system against threats. These projects include installing a pipeline system beneath the Delta, desalinating brackish water (water with high salt content), reusing highly treated wastewater, and participating in the construction of a new reservoir to store surplus water in wet years."

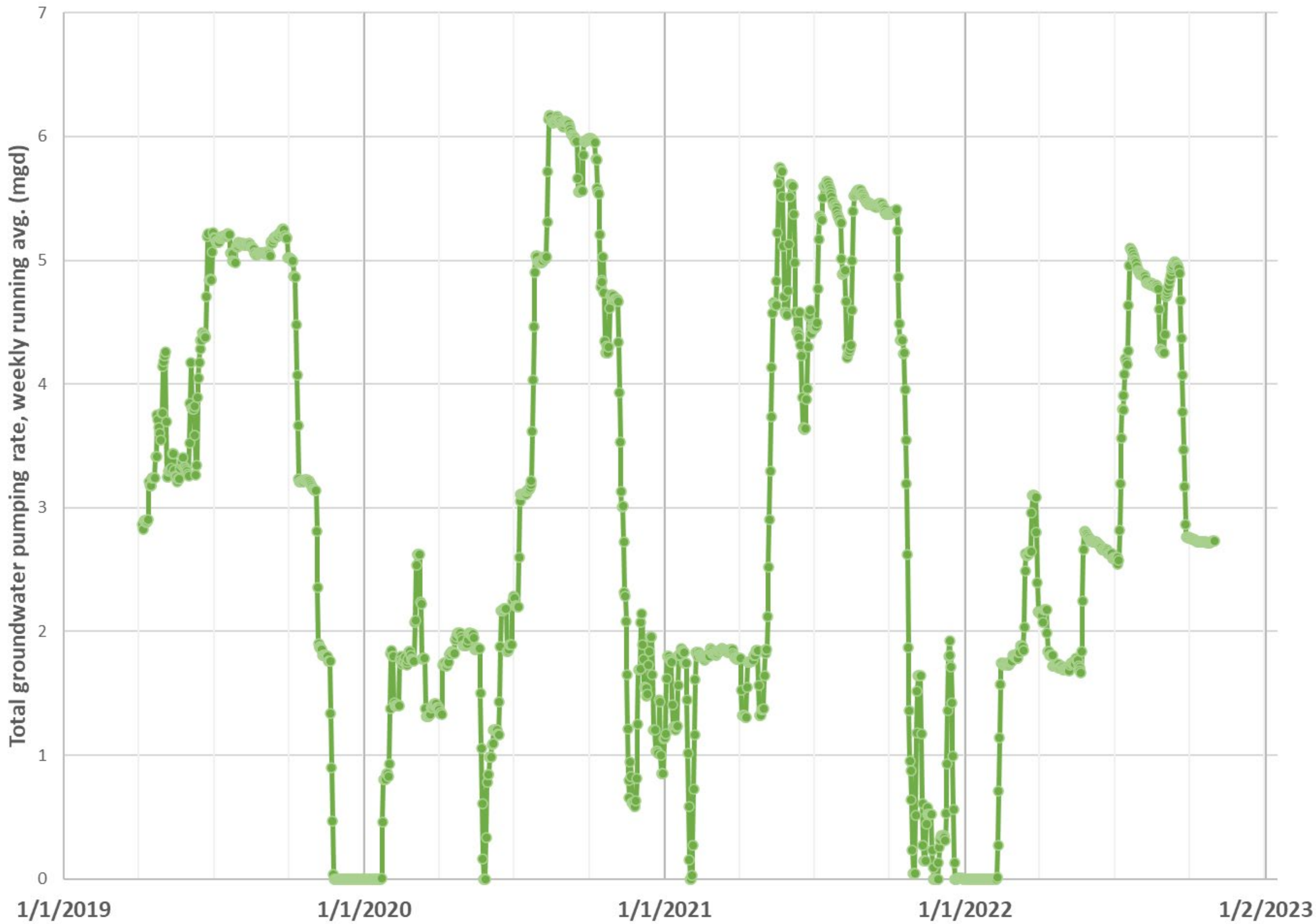

Figure 2-4. Pleasanton's well pumping over time (April 2019-October 2022)

Section 3

Alternatives Evaluation

The process and outcomes of evaluating the four shortlisted alternatives are described in this section, with further detail on assumptions and methodology provided in Appendix A.

3.1 Evaluation Overview

The approach for evaluating the four shortlisted alternatives involved a multi-criteria decision support process. In short, the analysis followed three steps:

1. BC and City staff assessed each alternative relative to the Baseline Project using evaluation criteria and weightings confirmed by the Ad Hoc Subcommittee. Evaluation criteria are framed as benefits (i.e., the higher the score, the greater the benefit) and result in a relative benefits score for each alternative.
2. Estimated capital and annual costs were developed for each alternative.
3. Benefits and costs were presented together to facilitate decision making, considering the tradeoffs among alternatives.

3.2 Evaluation Criteria

BC and City staff proposed evaluation criteria and weightings that the Ad Hoc Subcommittee reviewed and confirmed at its February 28, 2023, meeting. Definitions of the evaluation criteria and weightings are summarized in Table 3-1.

Table 3-1. Evaluation Criteria Definitions and Weightings

Criterion	Definition	Scoring Basis	Weighting
Water Supply Reliability	The ability to predictably, consistently meet water demands, including during dry years. Considers system redundancy and ability to meet demands during peak periods and/or emergency conditions.	Able to meet 3,500 AFY demand with either: sufficient system redundancy that is controlled by City, minimal system redundancy that is controlled by City, or minimal system redundancy that is outside the City's control.	35%
Implementation Timing	The speed at which the alternative can be online, considering timeframe for design, permitting, and construction (if applicable).	Implementation in nearer-term (approx. within 1 year), medium-term (approx. 1 to 2 years), or longer-term (approx. 2 to 3 years).	25%
Water Quality/Regulatory Compliance	Degree of ability to deliver water below all current and anticipated future state and federal drinking water standards.	Water quality standards are met and either have flexibility to also meet more-stringent future regulations or little flexibility to meet more-stringent future regulations. Otherwise, unknown current or future risk of long-term contamination, or known risk of near-term contamination.	15%

Table 3-1. Evaluation Criteria Definitions and Weightings			
Criterion	Definition	Scoring Basis	Weighting
Operational Complexity	Ease of operating and maintaining the system from a technical standpoint, considering organizational readiness and necessary staff qualifications/ certifications (e.g., ability to operate the project with existing staff resources), and the ability to enhance the system in the event of additional and/or more-stringent drinking water regulations.	Changes to existing City operations are not required, minimal, or significant (e.g., new staff and/or certifications needed).	15%
Institutional Complexity	Ease of implementation and management from an institutional standpoint (e.g., willingness of external partners, complexity of agreements and administration).	City can pursue independently (no partners needed and little to no coordination required with other agencies). Otherwise, partner and/or coordination with other agencies is needed. Partner is either confirmed, tentative, or not willing to partner.	10%

Cost metrics used in the alternatives evaluation include capital costs and annual operations and maintenance (O&M) costs.

3.3 Evaluation Results

Evaluation results, discussed in this section, are presented as benefit scores, estimated costs, and combined benefits and costs.

3.3.1 Benefit Scores

Figure 3-1 shows relative benefit for the four shortlisted alternatives in ranked order, based on an aggregate score using the five criteria presented in Table 3-1. Details on the scoring are included in Appendix A.

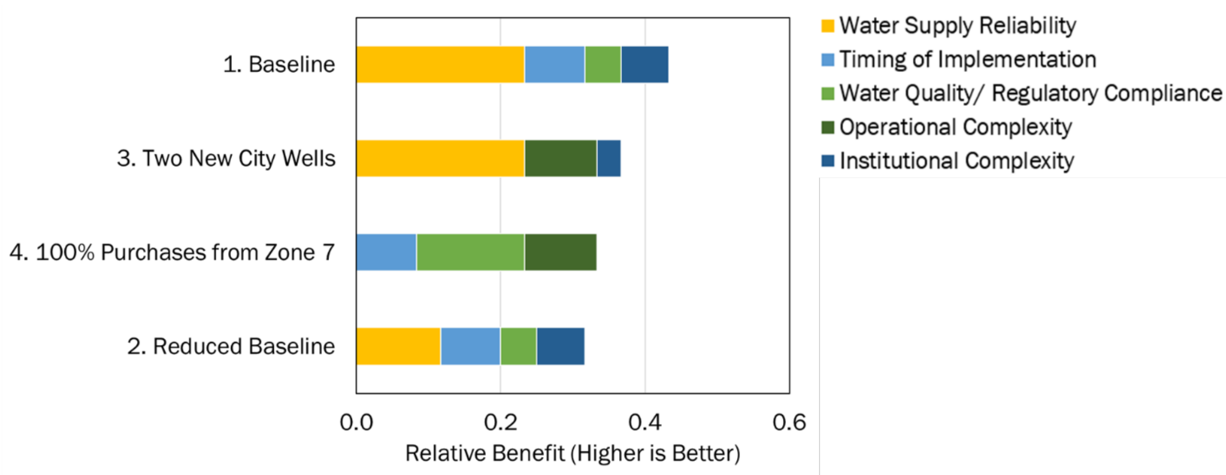

Figure 3-1. Relative benefit scores of each alternative

3.3.2 Costs

The accuracy level of capital costs varies based on the maturity level of a project's design, as depicted in Figure 3-2. Because the City had progressed the PFAS Treatment Project through 50 percent design, capital costs for Alternative 1 (Baseline Project) and Alternative 2 (Reduced Baseline) are estimated at a level consistent with Association for the Advancement of Cost Engineering's (AACE) definition of Class 2, which has an accuracy level of -15 percent to +20 percent. In contrast, Alternative 3 (Two New City Wells) and Alternative 4 (100% Purchases from Zone 7) are planning-level costs, consistent with AACE's definition of Class 5 estimates for screening conceptual projects, which has an accuracy level of -50 percent to +100 percent.

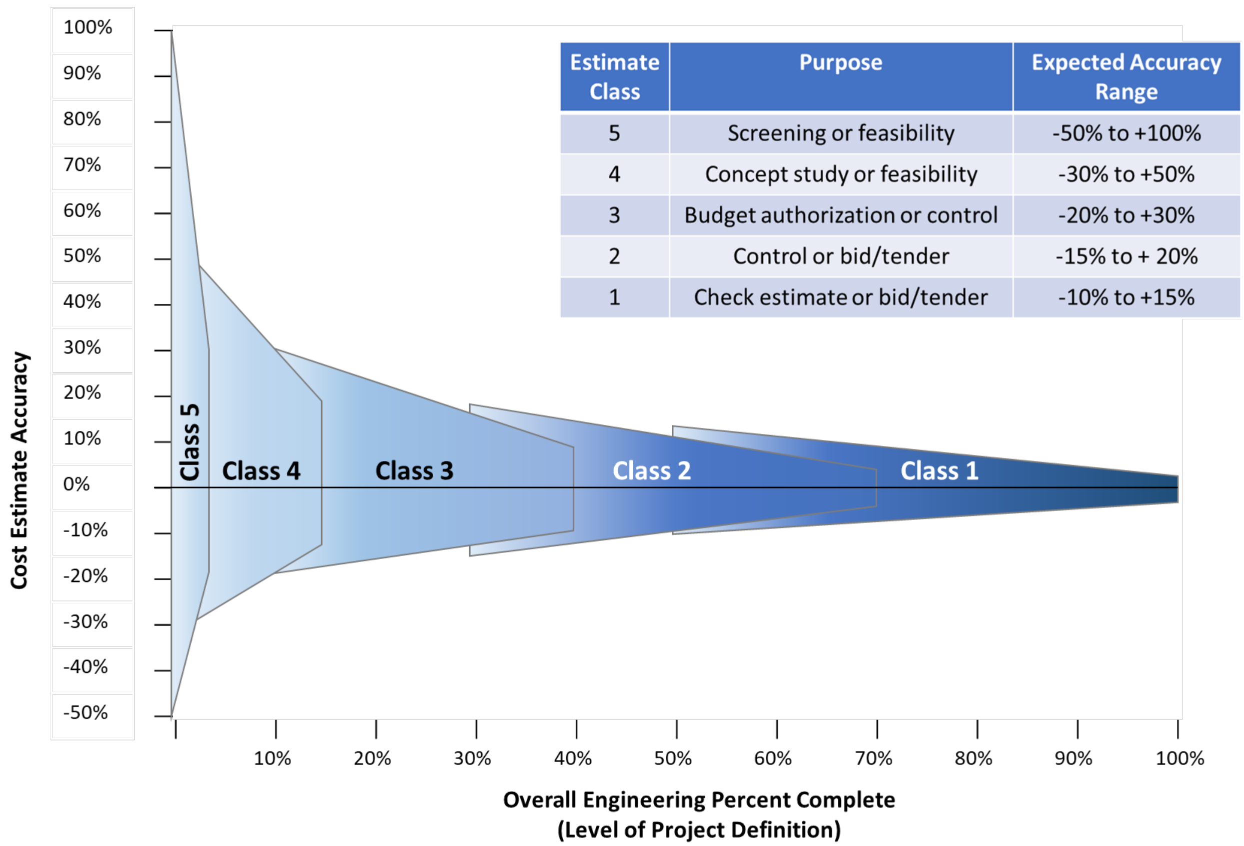

Figure 3-2. Capital cost estimating accuracy improves as the level of project definition improves

Figure 3-3 shows the estimated capital costs of each alternative with its respective accuracy range. Information about the items included in capital costs for each alternative are provided in Appendix B.

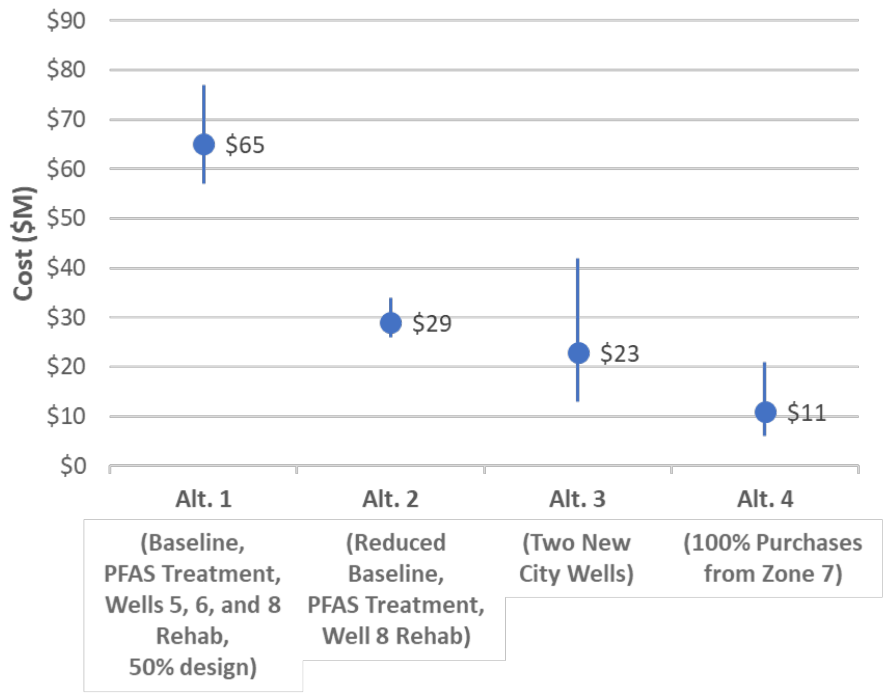

Figure 3-3. Capital cost estimates and ranges for each alternative

Figure 3-4 shows the estimated annual O&M cost of each alternative. Information about the items included in annual O&M costs for each alternative are provided in Appendix B.

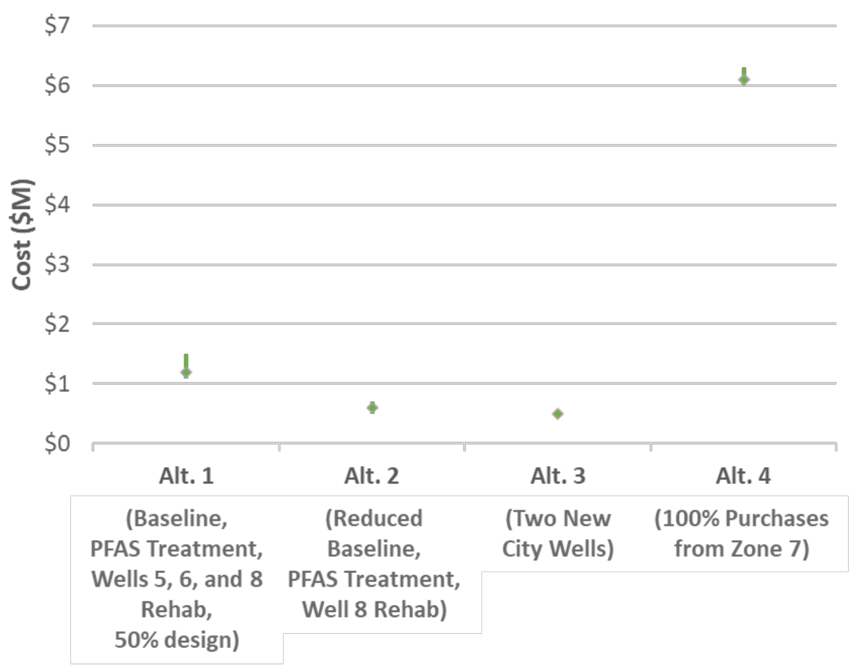

Figure 3-4. Estimated annual O&M costs for each alternative

Estimated capital, O&M, and total annual costs are summarized in Table 3-2.

Table 3-2. Estimated Costs by Alternative

Cost Metric	Alternative 1 (Baseline, PFAS Treatment, 50% design)	Alternative 2 (Reduced Baseline, PFAS treatment, 50% design)	Alternative 3 (Two New City Wells, 2% design)	Alternative 4 (100% Purchases from Zone 7, 2% design)
Capital[a, b] (Range)	$65M ($57M-$77M)	$29M ($26M-$34M)	$23M ($13M-$42M)	$11M ($6M-$21M)
Annual O&M[c, d] (Range)	$1.3M/year ($1M-$1.5M/year)	$0.6M/year ($0.5M-$0.7M/year)	$0.5M/year	$6.5M/year ($6.3M-$6.7M/year)
Total Annual Cost[e]	$5.5M/year	$2.5M/year	$2.0M/year	$7.2M/year

Costs shown in estimated 2024 $ (assuming 5% escalation from 2023 $).

a. *Includes design, construction, contingency, construction support services (construction management [CM] and engineering services during construction [ESDC]), and incremental cost of required infrastructure improvements beyond those identified in footnote (b). Required infrastructure improvements are identified for each alternative in Akel's Water Supply Alternative Improvements summary dated August 2, 2023 (Appendix E).*

b. *Assumes near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station BS-1 as identified in Akel's Water Supply Alternative Improvements summary dated August 2, 2023; Appendix E), estimated at ~$10.2M, will be funded and addressed in advance of implementing water supply alternatives.*

c. *Includes granular activated carbon (GAC) media change-out, hazardous disposal of GAC spent media, chemical (additional costs), electricity (additional costs), and wholesale water supply (assuming 3,500 AFY)*

d. *Not including additional operations staff for PFAS treatment (estimated at 2 to 3 full-time equivalents for Alternatives 1 and 2)*

e. *Includes capital and O&M. Capital cost annualized using a 5% interest rate over a 30-year period.*

3.3.3 Combined Benefits and Costs

Figure 3-5 shows the results of combining the relative benefit scores and estimated project costs for each alternative. Optimal results are closest to the top-left corner of the chart, where the relative benefit is highest and estimated project cost is lowest.

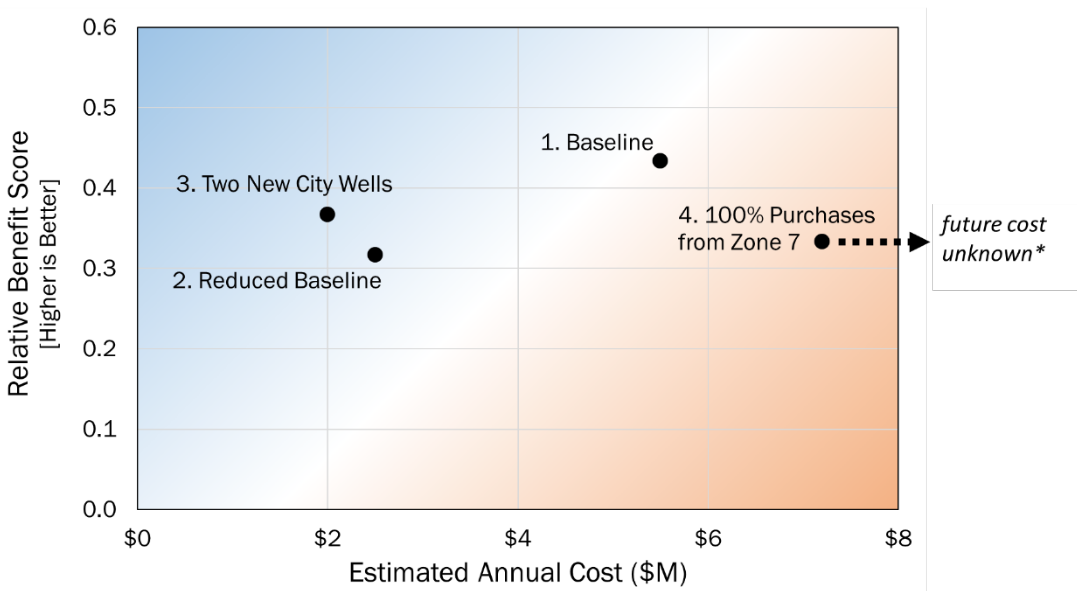

Figure 3-5. Benefit score and estimated annual cost for each alternative

Annual cost includes capital and O&M. Capital cost annualized using a 5% interest rate over a 30-year period.

**Zone 7's wholesale rate will likely increase over time with development of new supplies.*

3.4 Tradeoffs

Each alternative offers a unique mix of opportunities and challenges, as summarized in Table 3-3. These tradeoffs were considered along with the analysis of benefits and cost to inform selection of a preferred alternative. The City will need to consider the cons, challenges, and risks while advancing next steps, as further discussed in Section 4.

Table 3-3. Tradeoffs Associated with Shortlisted Alternatives

Alternative	Pros and Opportunities	Cons, Challenges, and Risks
Alternative 1 – Baseline Project	• City retains its GPQ • Reliability (water supply and system) • National Environmental Protection Act (NEPA) and California Environmental Quality Act (CEQA) requirements already complete • Required permits identified and design advanced to 50% • State Revolving Fund (SRF) and grant funding ($5M to $10M)	• Requires distribution system upgrades for peaking ability to meet future demands • Fixed high cost • Operation of a treatment facility • Potential future regulations for media disposal and additional PFAS compounds • Access to SRF and grant funding may change
Alternative 2 – Reduced Baseline	• City retains its GPQ • Less costly than Baseline Project • NEPA/CEQA already complete • Required permits identified and design advanced to 50% • SRF and grant funding ($5M to $10M) • Opportunity for phased approach to address source water reliability issue if combined with Alt. 3 or Alt. 4	• Lacks redundancy (only one well) • Requires distribution system upgrades for peaking ability to meet future demands • Fixed cost • Operation of a treatment facility • Potential future regulations for media disposal and additional PFAS compounds • Access to SRF and grant funding may change
Alternative 3 – Two New City Wells	• City retains its GPQ • Least costly alternative • Opportunity for phased approach to address source water reliability issue if combined with Alt. 2 or Alt. 4 • Aligns with existing operating competency of City staff • Likely continued eligibility for State Revolving Fund and grant funding	• Requires test wells to confirm production rates and water quality • Requires completion of NEPA/CEQA requirements and more complex new well permitting • Requires distribution system upgrades for peaking ability to meet future demands • Requires ongoing monitoring and coordination with Zone 7 to reduce risk of mobilizing the PFAS plume • Higher degree of cost uncertainty

Alternative 4 – 100% Purchases from Zone 7	• Zone 7 has more technical/managerial capacity to handle future regulatory challenges
	• Volumetric cost (mostly)
	  • Low capital cost, and City may not need to purchase 3,500 AFY every year
	• Opportunity to leverage foregone GPQ in contract negotiation
		• Lacks local supply (within Pleasanton's control)
		• Requires distribution system upgrades for peaking ability to meet future demands
		• Potential loss of groundwater pumping rights (or pushback from other Zone 7 retailers)
		• Dry year uncertainty:
		  • Zone 7 may not guarantee delivery of 3,500 AFY
		• Unknown escalation of wholesale supply rate:
		  • Zone 7 may increase the price of purchase at their discretion
		• Potential SRF and grant funds ($5M to $10M) may dwindle if this path is pursued

Section 4

Preferred Alternative and Implementation Plan

This section presents the preferred project alternative, project delivery approaches, and a preliminary implementation plan.

4.1 Preferred Alternative

Alternative 3 (Two New City Wells) is the preferred alternative as it provides significant benefits at the lowest cost, with relatively straightforward operations, i.e., groundwater pumping is already within the City's expertise, in contrast to treatment. Alternative 3 is anticipated to yield high-quality drinking water, drawn in a manner that is unaffected by and does not disturb the PFAS plume.

4.2 Project Delivery Approaches

The City could implement Alternative 3 on its own. Otherwise, project delivery for Alternative 3 could involve a regional project in partnership with Zone 7 and/or use of an alternative project delivery method for saving cost and/or time.

4.2.1 Potential Regional Project

Zone 7 has recently decided to accelerate its groundwater modeling update and is currently exploring accelerated installation of new wells in similar areas and on the same timeline as Pleasanton's possible sites for its need for new well capacity. The City's initial step toward constructing two new wells is dependent upon Zone's 7 efforts to update its regional groundwater model. The City and Zone 7 will coordinate closely during this process. Once completed, City staff will evaluate joint implementation of a new well with Zone 7, which may result in cost savings for the City and Zone 7. In preparation for this evaluation and in parallel with Zone 7's modeling work, City staff will engage with Zone 7 to define key terms for an agreement to implement a joint project so that these conditions can be part of the evaluation.

4.2.2 Delivery Method

The traditional method of project delivery the City employs is design-bid-build (DBB). When using DBB, the project owner (i.e., City) selects an engineer to design the project, develop plans and specifications, and evaluates contractor bids. For DBB, the construction contract is awarded to the lowest responsive, responsible bidder, and the engineer or a construction manager monitors construction. DBB typically works best when:

- The owner has specific quality requirements and desires extensive involvement in design
- Achieving competitive pricing is a priority
- The project requires a high degree of public engagement

While the DDB delivery method is well understood and practiced by the City, there is a higher potential for claims and change orders (resulting in later certainty of construction cost), more City staff is required to manage the work, and the City retains most project risks.

Other alternative delivery methods are available and may offer unique benefits compared to traditional delivery using DBB. Of the various alternative delivery methods, performance-based fixed-price design-build (DB) may be a viable approach for Alternative 3 implementation. When using DB, a project owner selects an Owner Advisor (OA) to prepare performance-based project requirements and competitively procures a design-builder using a best-value evaluation process (typically firm qualifications, proposed design solution, and price). This approach typically works best when:

- The project owner's priorities are early price certainty and schedule acceleration
- The project owner has limited staff resources and can accept less oversight
- The project owner seeks innovation and early contractor involvement in design
- Project involves performance risk (i.e., treatment performance) that owner wishes to transfer to design-builder

The City is authorized to use the DB method of project delivery under Chapter 4 of California's Public Contract Code (PCC) 22160-22169[2], as excerpted below.

> 22160(a) The Legislature finds and declares that the design-build method of project delivery, using a best value procurement methodology, has been authorized for various agencies that have reported benefits from such projects including reduced project costs, expedited project completion, and design features that are not achievable through the traditional design-bid-build method.
>
> 22160(b) It is the intent of the Legislature that the following occur:
>
> > (1) This chapter provides general authorization for local agencies to use design-build for projects, excluding projects on the state highway system.
>
> 22161 For the purposes of this chapter, the following definitions apply:
>
> > (f) "Local agency" means the following:
> >
> > > (1) A city, county, or city and county.

Further, the Legislature recently enacted Senate Bill (SB) 991 to amend Chapter 4.1 of the PCC explicitly authorize local agencies' use of progressive design-build as a method of project delivery[3], This measure authorizes local agencies, defined as any city, county, city and county, or special district authorized by law to provide for the production, storage, supply, treatment, or distribution of any water from any source, to use the progressive design-build process until January 1, 2029 for up to 15 public works projects in excess of $5,000,000 for each project.

Given the above authorizations, the City likely has few limitations to what delivery method it can leverage to best deliver this work. However, the appropriate delivery method and the City's ability to take advantage of the benefits each offers should be evaluated in parallel with Zone 7's groundwater modeling efforts during predesign, and selected prior to starting design.

[2] https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PCC&division=2.&title=&part=3.&chapter=4.&article=

[3] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB991

4.3 Implementation Plan

Figure 4-1 summarizes the preliminary schedule for implementing Alternative 3 (Two New Wells) in terms of major project elements and milestones. The four major project elements identified in the figure include:

1. **Predesign.** Predesign activities involve:
   - Siting of two well locations, including the City's planned exploratory wells to test groundwater production rates and water quality and Zone 7's planned update of its regional groundwater model and Well Siting Master Plan
   - Seeking/securing external funding through grants and/or low-interest loans.
2. **Design and Construction of Two New Wells.** DBB is the assumed delivery method for the wells' design and construction. Activities related to this element include:
   - Engineer procurement for well drilling and facility design
   - Permitting, including NEPA/CEQA and permits required through Bay Area Air Quality Monitoring District (air quality permits for generators), Pacific Gas & Electricity (new/modified service applications), Zone 7[4] (well drilling and abandonment permits), and the State Water Resources Control Board (construction stormwater).
   - Well drilling, including driller procurement and drilling of two wells in series (i.e., one after the other)
   - Well equipping, including contractor procurement and construction of well facilities
3. **Design and Construction of Pipelines and Connecting Infrastructure.** DBB is the assumed delivery method for design and construction of the new pipelines and connecting infrastructure required to tie the new wells into the City's existing potable water distribution system. Activities related to this element include:
   - Engineer procurement for design of pipelines and connecting infrastructure
   - Permitting, including NEPA/CEQA
   - Utility investigations, including potholing and geotechnical borings
   - Design of pipelines and connecting infrastructure
   - Contractor procurement
   - Construction of pipelines and connecting infrastructure
4. **Finance.** The estimated total project cash flow requirements are shown in Figure 4-1 by fiscal year (i.e., July 1 to June 30).

[4] Zone 7 is the Groundwater Sustainability Agency lead for the Livermore Valley Groundwater Basin.

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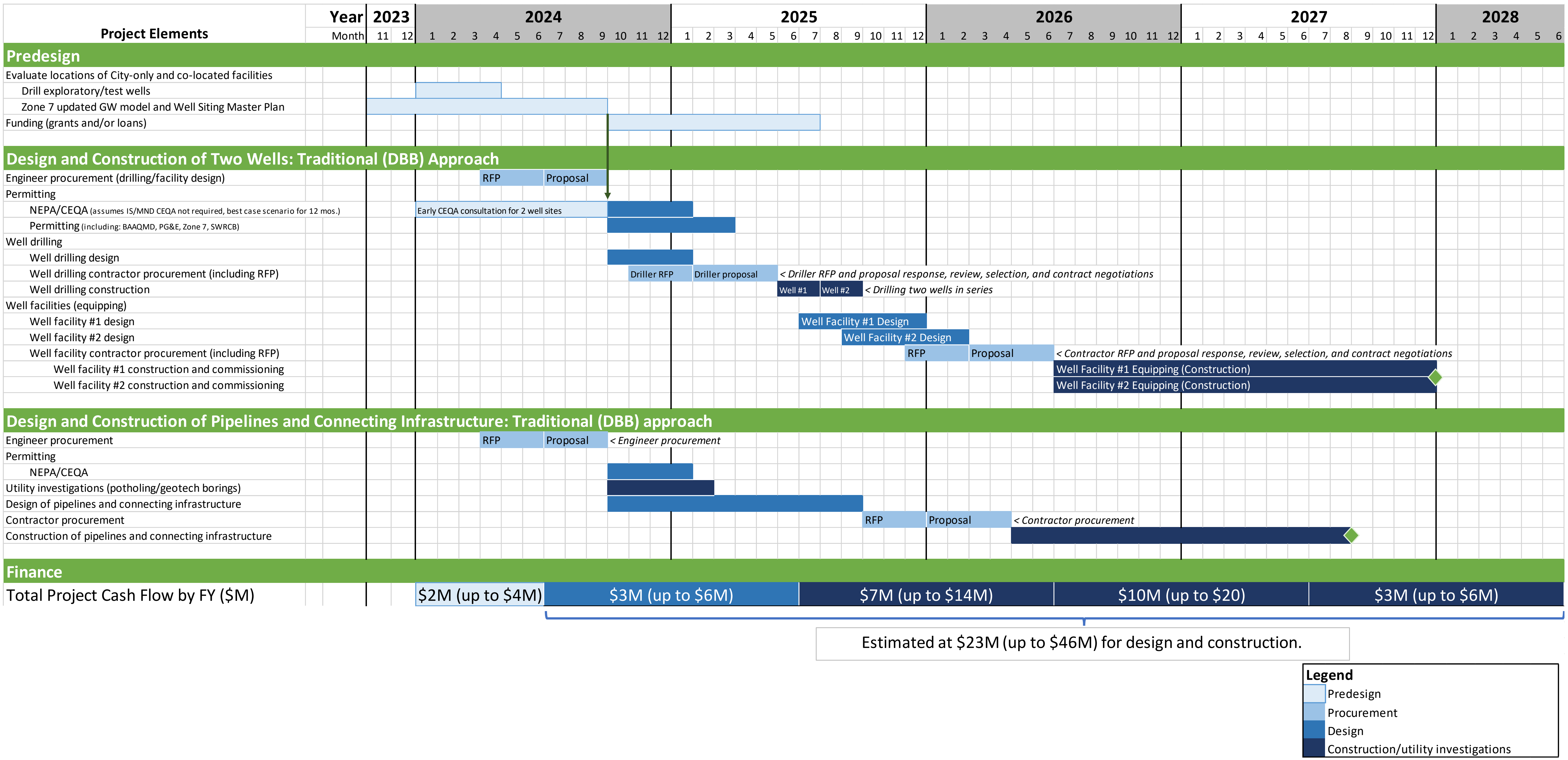

Figure 4-1. Draft timeline for implementing Alternative 3 (Two New Wells)

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4.4 Contingency Plan

The City needs a contingency plan for how to proceed if the outcome of predesign activities indicate that implementation of Alternative 3 (Two New Wells) is less favorable than anticipated or not feasible due to groundwater quality issues and/or production limitations. For example, the City's exploratory wells and/or Zone 7's modeling may identify challenges related to siting new wells capable of meeting the City's required production rates and water quality standards and preclude the implementation of Alternative 3.

In that event, the City may pivot to its efforts to the next lowest cost option, which involves completing the remaining design for PFAS treatment under Alternative 2 (Reduced Baseline). Previous work progressed the design to a 50% level. Thus, this shift, if necessary, can occur without impacting the overall schedule to getting an additional water supply into service as quickly as possible. Figure 4-2 summarizes the preliminary schedule for the contingency plan to shift from Alternative 3 implementation to Alternative 2 in terms of major project elements and milestones. The four major project elements identified in the figure include:

1. **Predesign.** Predesign activities are same as those for implementing Alternative 3 and involve:
   - Siting of two well locations, including the City's planned exploratory wells to test groundwater production rates and water quality and Zone 7's planned update of its regional groundwater model and Well Siting Master Plan
   - Seeking/securing external funding through grants and/or low-interest loans.
2. **Design and Construction of the PFAS Treatment Facility and Well 8 Rehab.** DBB is the assumed delivery method for design and construction of the treatment facility and Well 8 rehab. Activities related to this element include:
   - Permitting, including NEPA/CEQA and the same permits as those required for Alternative 3, including permits through Bay Area Air Quality Monitoring District (air quality permits for generators), Pacific Gas & Electricity (new/modified service applications), Zone 7 (well drilling and abandonment permits), and the State Water Resources Control Board (construction stormwater). In addition, Alternative 2 requires agreements with DSRSD for PFAS treatment backwash disposal and Pleasant Unified School District (PUSD) for use as a construction staging area.
   - Field investigations/special design coordination
   - PFAS media prequalification
   - PFAS vessel prepurchase
   - PFAS treatment facility and Well 8 site design completion (i.e., remaining 50 percent of design) and construction
3. **Design and Construction of Pipelines and Connecting Infrastructure.** DBB is the assumed delivery method for design and construction of the new pipelines and connecting infrastructure required to tie the new wells into the City's existing potable water distribution system. Activities related to this element include:
   - Engineer procurement for design of pipelines and connecting infrastructure
   - Permitting, including NEPA/CEQA
   - Utility investigations, including potholing and geotechnical borings
   - Design of pipelines and connecting infrastructure

- Contractor procurement
- Construction of pipelines and connecting infrastructure

4. **Finance.** The estimated total project cash flow requirements are shown in Figure 4-2 by fiscal year (i.e., July 1 to June 30).

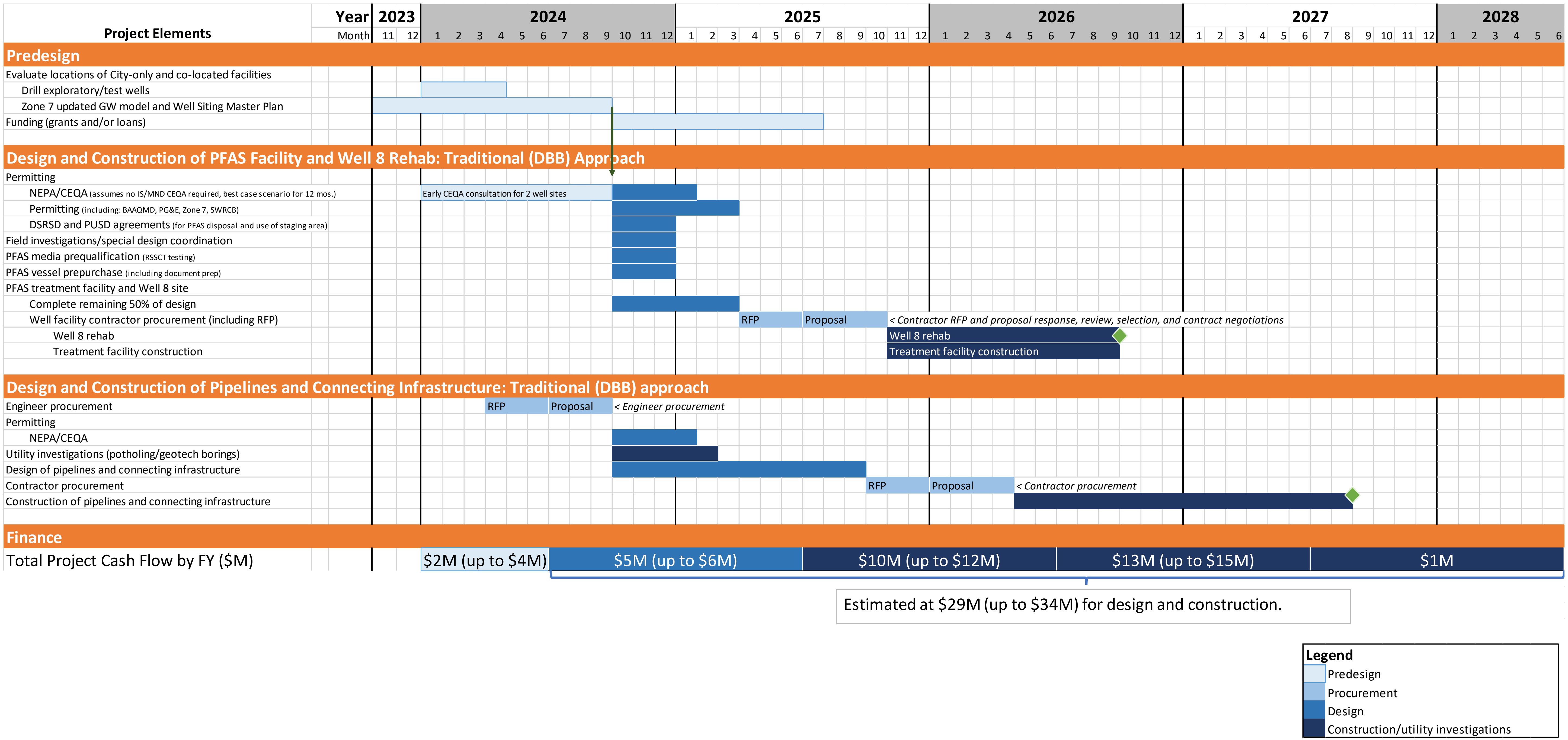

Figure 4-2. Draft timeline for contingency plan to pivot from implementing Alternative 3 (Two New Wells) to Alternative 2 (Reduced Baseline)

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Section 5

Limitations

This document was prepared solely for the City of Pleasanton in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Pleasanton and Brown and Caldwell dated October 21, 2022. This document is governed by the specific scope of work authorized by the City of Pleasanton; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Pleasanton and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Section 6

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Appendix A: Alternatives Evaluation

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Appendix A: Alternatives Evaluation

The Water Supply Alternatives Study involved a multi-step process for developing and screening potential water supply options to result in a shortlist of alternatives for further evaluation and a recommended alternative, as shown in Figure A-1. The shortlist of alternatives defined in Step 1 were evaluated through Steps 2 and 3, and the results of Steps 2 and 3 informed the selection of the recommended alternative. This document describes the methodology and results for each step of the process.

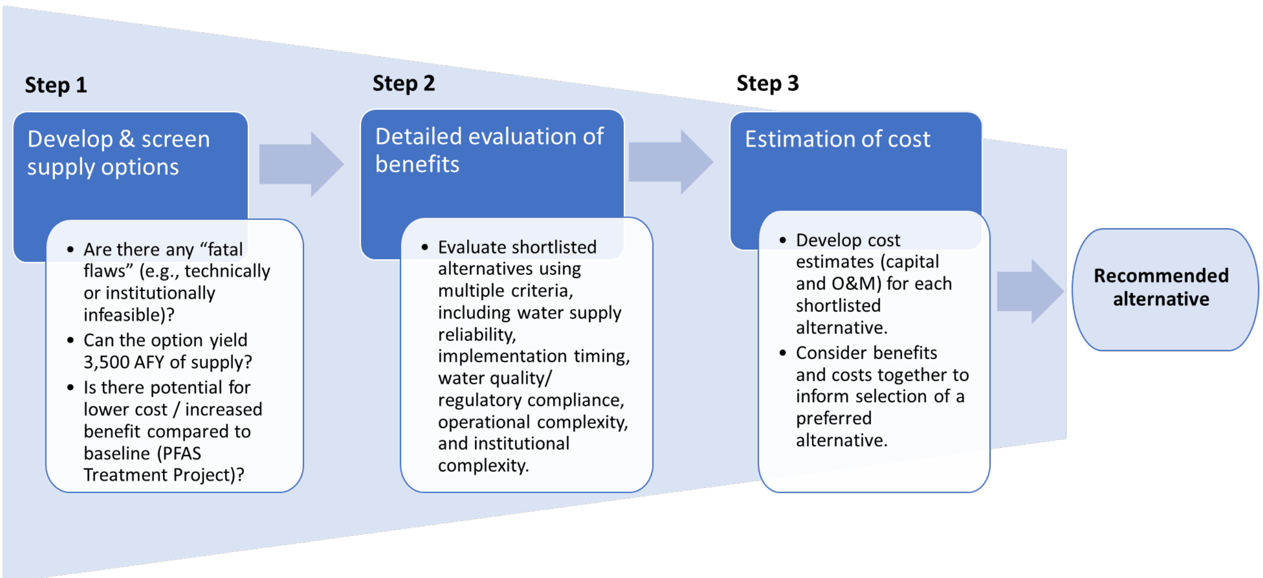

Figure A-1. Multi-step process for identifying and evaluating potential water supply alternatives

PFAS = perfluoroalkyl and polyfluoroalkyl substances

AFY = acre-feet per year

O&M = operations and maintenance

A.1 Initial Screening

Brown and Caldwell (BC) worked closely with City of Pleasanton (City) staff to prepare an inclusive list of water supply options for consideration. Table A-1 summarizes the list of options considered.

Table A-1. Potential Water Supply Options for Screening		
Category	**Option**	**Description**
Baseline Project	PFAS treatment and Wells 5, 6, and 8 rehabilitation	Design and construct a centralized PFAS treatment facility and rehabilitate the City's three existing wells. City Council suspended the Baseline Project on September 6, 2022, to further evaluate water supply alternatives.
Groundwater Supply Options	Reduced PFAS treatment (Well 8)	Similar to the Baseline Project but involves adding PFAS treatment to Well 8 only (and not Wells 5 and 6).
	New City well(s) outside PFAS plume (west part of the City)	City-owned well(s), with or without treatment for other constituents (non-PFAS).
	Zone 7 Water Agency (Zone 7) pump on City's behalf [a, b]	Zone 7 to pump from new well(s) outside PFAS plume (with or without treatment for other constituents [non-PFAS])
	Regional PFAS treatment facility (at Pleasanton's Operations Services Center) [a, c]	New facility constructed by Pleasanton (or jointly constructed by Pleasanton/Zone 7) and operated and maintained by Zone 7 to produce regional water supply, including Pleasanton's groundwater pumping quota.
	Blending/Dilution	Blend existing well supply with water from Zone 7 to reduce PFAS concentration below future maximum contaminant levels or lower, if possible.
Other Supply Sources	100% purchases from Zone 7[a]	Agnostic of source (i.e., assumed to include some combination of supply from the State Water Project, groundwater, and future additions to Zone 7's supply portfolio).
	Purchases from another agency	Either wheeled through Zone 7's system or direct connection to a wholesaler (e.g., San Francisco Public Utilities Commission) or another retail water supplier (e.g., East Bay Municipal Utility District).
	Local alternative supplies	Includes options such as desalination, stormwater capture, and/or satellite wastewater treatment.
Demand Management	Expansion of non-potable system	Expand non-potable supply beyond what is already projected in the City's 2020 Urban Water Management Plan (~500 acre-feet per year), using recycled water and/or non-potable groundwater.
	Long-term water use efficiency (WUE)	Invest in permanent demand reduction measures (e.g., turf replacement), beyond existing/planned WUE, including state requirements to meet new standards-based water use objectives.[d] Does not include short-term conservation (i.e., behavioral changes).

a. Water supply options/alternatives involving Zone 7 require approval from Zone 7's Board of Directors.
b. Zone 7 staff confirmed that existing infrastructure does not have adequate capacity to pump groundwater on the City's behalf.
c. Zone 7 staff confirmed that expanding PFAS treatment at its Chain of Lakes or Stoneridge sites is not feasible.
d. New state requirements for WUE are established under 2018 water conservation legislation, including Assembly Bill 1668 and Senate Bill 606.

These options underwent an initial screening process that considered whether projects would be able to produce 3,500 acre-feet per year (AFY) and showed potential for reduced costs compared to the Baseline Project (PFAS treatment and Wells 5, 6, and 8 rehabilitation). The following water supply options were screened out during this process:

- Zone 7 Water Agency (Zone 7) pumping groundwater on City's behalf
- Regional PFAS treatment facility
- Blending/dilution
- Purchases from another agency
- Local alternative supplies
- Expansion of non-potable system
- Long-term water use efficiency (note: while WUE alone cannot reduce the City's peak demand and annual need for 3,500 AFY within the timeframe desired by the City, WUE is considered an "add-on" that complements all other water supply options.).

The reasoning for screening out these options is described below, followed by a summary of the shortlisted alternatives that passed through initial screening.

A.1.1 Zone 7 Pumping Groundwater on City's Behalf

The City considered an option that would involve Zone 7 Water Agency, Pleasanton's wholesale water provider, pumping groundwater on the City's behalf from an existing or new well(s) outside the PFAS plume. In early discussions with Zone 7 staff, it became clear that Zone 7 does not have capacity to pump on the City's behalf within existing infrastructure, and the feasibility and timing for a potential new well(s) is dependent on Zone 7's regional groundwater model and Well Siting Master Plan (currently in progress). Therefore, rather than advancing this as a standalone alternative, the City considered it as part of an alternative that involves 100 percent purchases from Zone 7 (which may involve new groundwater wells and/or other sources of supply developed by Zone 7).

A.1.2 Regional PFAS Treatment Facility

This option was conceptualized as a new facility that would be constructed by Pleasanton (or jointly constructed by Pleasanton/Zone 7) and operated and maintained by Zone 7 to produce regional water supply, including Pleasanton's groundwater pumping quota. BC explored three potential locations for this regional facility, including Zone 7's existing PFAS treatment sites (Chain of Lakes and Stoneridge) and Pleasanton's Operations Service Center (the location of the treatment facility for the Baseline Project). Zone 7 staff confirmed that expanding PFAS treatment at its Chain of Lakes or Stoneridge sites is not feasible due to site constraints and other limitations; therefore, this option would be located at the City's Operations Service Center.

Ultimately, this option was screened out as it requires approval from Zone 7, and Zone 7 is not interested in advancing this concept at this time. However, if the City moves forward with constructing a PFAS treatment facility, Zone 7 may be interested in exploring a potential expansion of this facility (for regional benefit) in the future.

A.1.3 Blending and Dilution

BC evaluated the option of diluting untreated well water below PFAS notification levels by blending with water delivered by Zone 7. If a notification level is exceeded, the drinking water agency must notify the local governing body of the agency, and the State Water Resources Control Board recommends informing customers of the presence of the contaminant and health risks associated with its exposure. Using historical quarterly samples for four PFAS compounds (PFBS, PFHxS, PFOS, and PFOA), historical well flow rates, and PFAS notification levels, BC determined flow rates required for each well to achieve concentrations below the notification levels (Equation A-1).

$$C_1V_1 = C_2V_2 \qquad \text{Equation A-1}$$

Where:

C_1 = Historical PFAS concentrations from City well (nanograms per liter [ng/L])

V_1 = Historical daily City well flow (million gallons per day [mgd])

C_2 = PFAS notification level, EPA Method 537.1 (ng/L)

V_2 = Flow needed to reach notification level (mgd)

Figure A-2 shows historical concentrations of PFBS, PFHxS, PFOS, and PFOA measured at Well 6 relative to the respective notification levels (Well 6 shown as an example). A similar analysis was also performed at Well 5 and Well 8. As shown in Figure A-2, PFHxS and PFOS have been present at concentrations well above the current notification levels (based on 2019-2022 sample data).

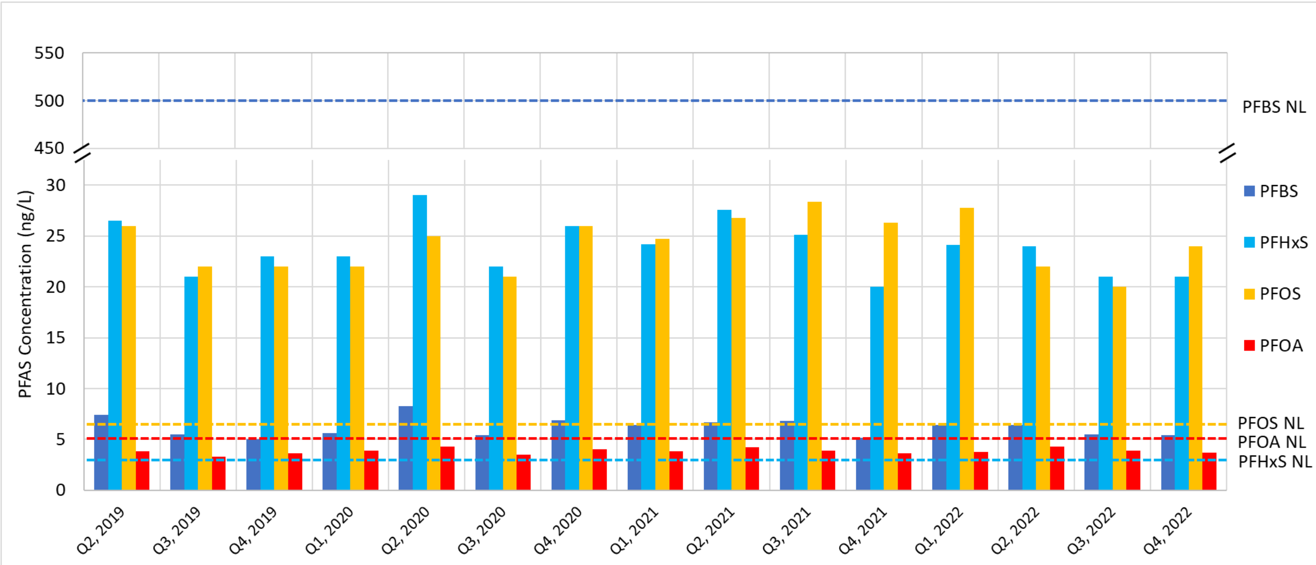

Figure A-2. PFAS concentrations compared to notification levels in Well 6 from 2019 to 2022

Figure A-3 shows the amount of flow needed from Zone 7 to dilute each PFAS compound below its respective notification level (results for Well 6 shown for example). The required flow is shown as a constant value over each quarter, based on the quarterly sample result and assuming a constant concentration during the quarter. For comparison, the black line represents the historical weekly running average (WRA) flow the City received through its Zone 7 turnouts. Results located above the black line indicate that Zone 7 cannot deliver the amount of flow needed to reduce the concentration below that compound's notification level. Also as shown in Figure A-3, the City would not be able to consistently dilute PFHxS and PFOS below the notification level at Well 6, and the same is true of Well 5 and Well 8. Thus, blending is not a safe nor realistic option for the City.

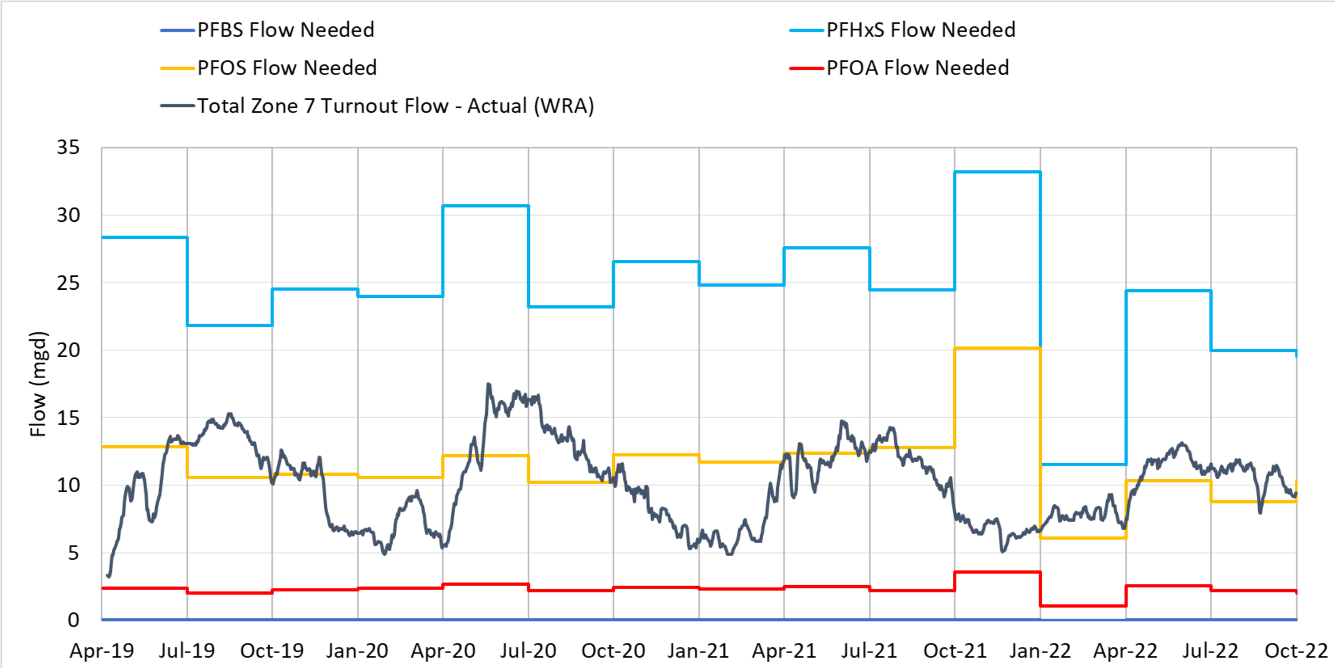

Figure A-3. Required dilution rates by compound compared to Zone 7 WRA flows for Well 6

A.1.4 Purchases from Another Agency

BC explored the option of the City purchasing water from another supplier, either wheeled through Zone 7's system or via direct connection to another agency (e.g., San Francisco Public Utilities Commission [SFPUC] or East Bay Municipal Utility District [EBMUD]). Long-term transfers through Zone 7's system are considered as part of the alternative that involves 100 percent purchases from Zone 7, as securing transfer supply falls under the purview of Zone 7 as the regional water wholesaler. Connections to SFPUC and EBMUD do not currently exist and were determined to be infeasible in the near term due to the reasons below.

SFPUC. SFPUC owns and operates the Hetch Hetchy Regional Water System that serves 2.7 million customers in the San Francisco Bay Area. As a retail water supplier, SFPUC provides water directly to customers in San Francisco. As a regional water wholesaler, SFPUC also delivers water to 26 water agencies (i.e., wholesale customers through the Regional Water System in Alameda, Santa Clara, and San Mateo counties). As shown in Figure A-4, the Regional Water System passes through Alameda County just a few miles south of Pleasanton.

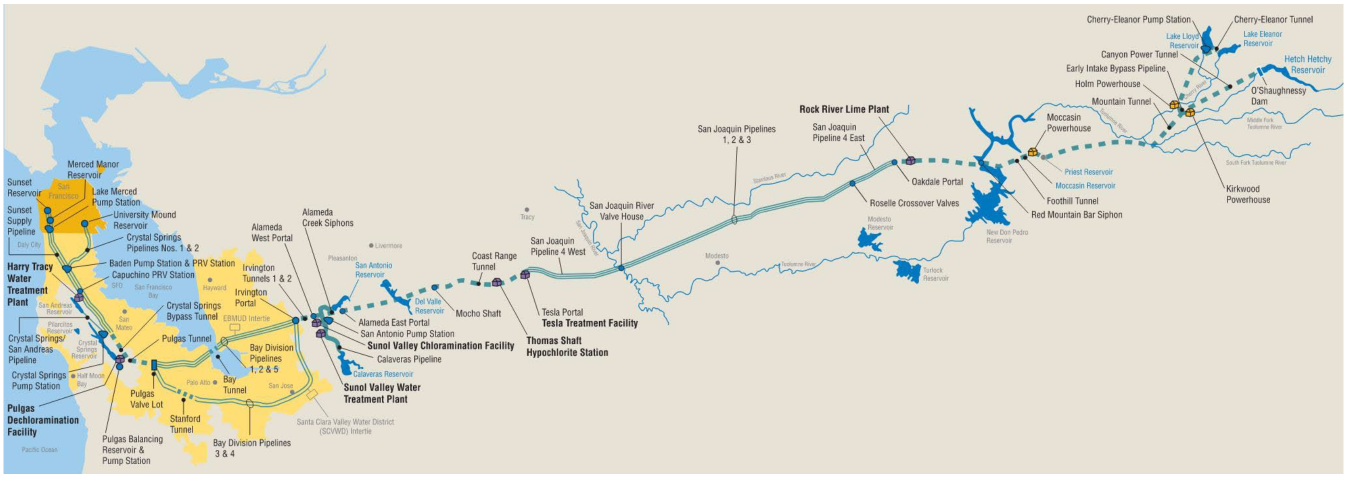

Figure A-4. SFPUC's Regional Water System

Source: SFPUC, 2023

Although a connection to SFPUC's system would be technically feasible, there are institutional barriers to doing so. As discussed in the Draft Alternative Water Supply Plan (June 2023), SFPUC anticipates a supply shortfall of up to 122 mgd in 2045 to meet current customer obligations. To address this supply gap, SFPUC is exploring several alternative water supplies. SFPUC's planning priorities, as described in the June 2023 Alternative Water Supply Planning Quarterly Report, are to:

1. Meet regulatory requirements, including instream flow releases *(obligatory)*
2. Meet existing obligations to existing permanent customers *(obligatory)*
3. Make current interruptible customers permanent *(policy decision)*
4. Meet increased demands of existing and interruptible customers *(policy decision)*

SFPUC would not consider adding a new customer, such as Pleasanton, until the above criteria are met, which is well beyond the timeframe of this study.

EBMUD. EBMUD is a water retailer and does not sell water on a wholesale basis. However, EBMUD is exploring the possibility of wheeling water through its system to facilitate future water transfers between agencies. Currently, EBMUD's system is not designed for wheeling, so this option would require various agreements and capital improvements (including a new intertie between EBMUD and Zone 7) and is not technically nor institutionally feasible in the near term.

A.1.5 Local Alternative Supplies

BC considered other local supplies, such as stormwater capture, desalination, and/or satellite wastewater treatment. Unlike many other regions in the U.S., California's climate generally produces rain in the winter and not in the summer, when water demands are highest (Figure A-5). Therefore, runoff must be captured in the wet season and stored for later use in the dry season. The City's lack of storage capacity makes stormwater capture an infeasible solution. Additionally, the unpredictability of precipitation year-over-year would make this an unreliable supply source.

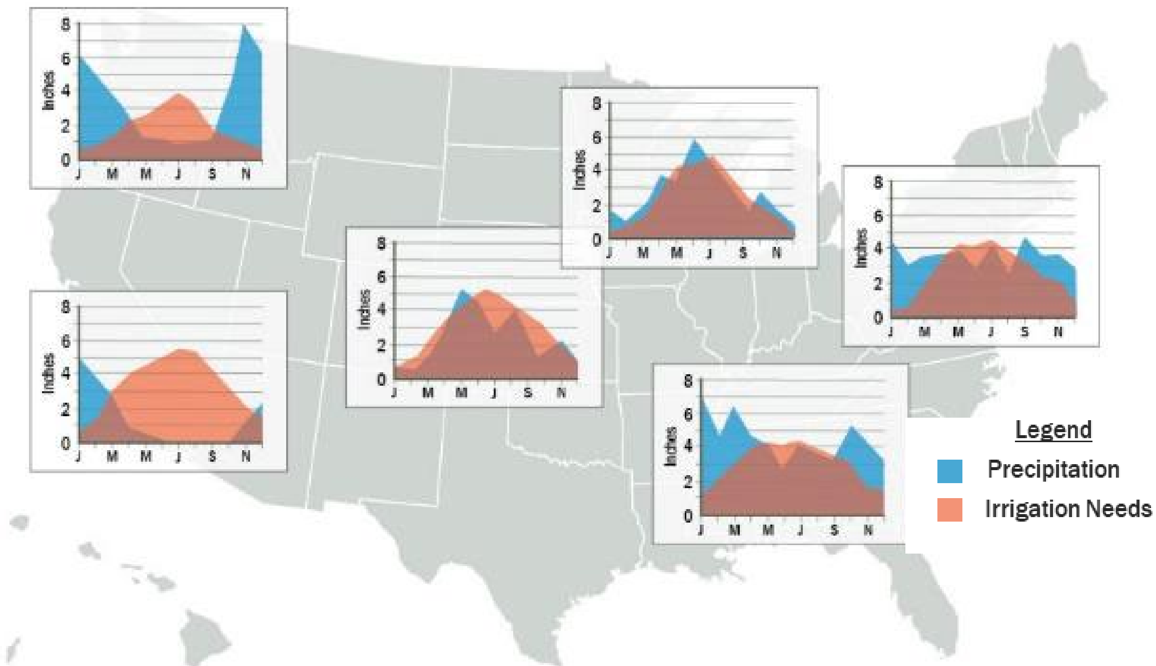

Figure A-5. Monthly irrigation demands relative to average monthly precipitation

Source: National Academies of Sciences, Engineering, and Medicine. 2015.

Other alternative supply sources, such as desalination and satellite wastewater treatment (for water reuse) were considered relative to the Baseline Project. Since both desalination and water reuse would require construction of a new advanced treatment facility, these alternatives would not provide cost savings relative to the Baseline Project. Desalination requires reverse osmosis, a treatment method that was determined to be cost-prohibitive in the City's evaluation of treatment technologies for PFAS treatment (Carollo, 2020). Furthermore, since Pleasanton is not a coastal community, desalination would also require construction of a large pipeline and pump station to transport desalinated water from San Francisco Bay.

In addition to being costly, satellite wastewater treatment was screened out due to Pleasanton voters' decision on Measure J (2000), which advised against injecting purified water (i.e., wastewater that is purified through advanced treatment using reverse osmosis) into the groundwater basin that serves as a potable (i.e., drinking) water supply for Pleasanton and the Livermore-Amador Valley. Recycled water for non-potable uses was considered as part of a separate alternative (see Section A.1.6).

A.1.6 Expansion of Non-potable System

The City receives recycled water for non-potable uses (i.e., landscape irrigation) from Livermore and through the San Ramon Valley Recycled Water Program (SRVRWP). The SRVRWP is operated by a joint powers authority between Dublin San Ramon Services District (DSRSD) and EBMUD, i.e., the DSRSD-EBMUD Recycled Water Authority (DERWA).

Most of the wastewater produced in Pleasanton is treated at DSRSD's wastewater treatment plant, which feeds the SRVRWP. The City has first rights to use the recycled water produced from its wastewater; however, the amount of recycled water that the City can purchase is limited by the current rated capacity of the treatment plant. Furthermore, the SRVRWP is currently supply limited, as most of the wastewater is already recycled in the summer months. DERWA is exploring ways to augment the recycled water supply with supplemental sources (e.g., local groundwater or wastewater from a neighboring agency); in the meantime, the potential for increasing recycled water deliveries is limited.

The amount of recycled water that the City receives from Livermore is based on the amount of wastewater produced by the City's Ruby Hill development, which is sent to Livermore for wastewater treatment. As part of this arrangement, Livermore supplies recycled water for Pleasanton customers in the eastern portion of the City. Expanding recycled water deliveries from Livermore to Pleasanton is one of the options DERWA is exploring, as receiving more supply from Livermore would free up some supply for the SRVRWP.

Although there is potential to expand recycled water purchases from DERWA and/or Livermore in the future, these expansions are already being considered as ways to meet the City's future recycled water demands (estimated at 1,800 AFY by 2040 in Pleasanton's 2020 Urban Water Management Plan [West Yost, 2021]). To offset the 3,500 AFY potable supply gap, the recycled water system would need to expand beyond the 1,800 AFY already projected. This expansion would require securing additional supply as well as constructing new infrastructure to serve new irrigation customers, many of which are far from the existing system. This option was screened out as a solution for achieving 3,500 AFY in the near term due to the long lead time, cost, and uncertainty around expanding the recycled water system; however, the City is separately exploring the possibility of expanding the recycled water system in the future.

A.1.7 Long-term Water Use Efficiency

Long-term water use efficiency (WUE) involves permanent demand reduction measures, such as replacing turf with drought-resilient landscape to reduce the need for irrigation. California is in the process of setting regulatory standards for WUE, following 2018 legislation that requires development of urban water use objectives (Senate Bill 606 and Assembly Bill 1668). This alternative would involve reducing demands beyond existing/planned WUE to help fill the 3,500 AFY supply gap.

Outdoor water use provides the greatest potential for WUE savings since indoor water use is already relatively efficient and largely used for health and safety purposes. Furthermore, outdoor water use is highly seasonal, with irrigation mostly occurring in the summer months (when the water system is most constrained).

Based on an assessment of the City's current potable water uses, approximately 3,000 AFY is used for landscape irrigation (Figure A-6). Of this 3,000 AFY, about 900 AFY is within the City's control (i.e., used on City property or by the Pleasanton Unified School District). This includes a mix of "functional" (e.g., recreational parks, sports fields) and "non-functional" (e.g., median strips) applications of turf, and only "non-functional" turf would be eligible for a landscape retrofit. This alternative was screened out as a standalone solution as it cannot achieve 3,500 AFY nor meet peak month/day demands. However, long-term WUE can still be pursued in conjunction with other alternatives, and the City is conducting a separate turf reduction study to inform potential water savings and associated costs.

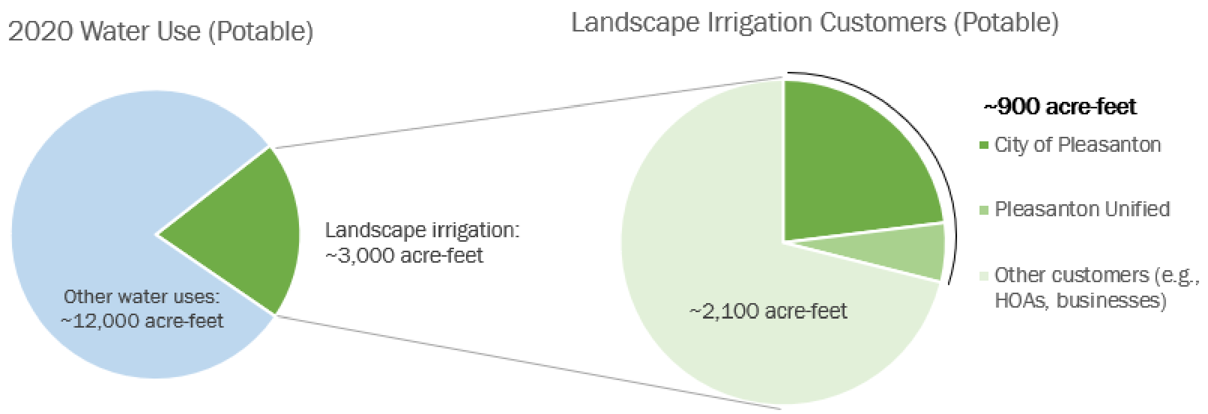

Figure A-6. Breakdown of potable water use within the City (2020)

Source: West Yost, 2021

A.1.8 Shortlisted Alternatives

Four alternatives passed the initial screening:

- Alternative 1 – Baseline Project (PFAS treatment and Wells 5, 6, and 8 rehabilitation)
- Alternative 2 – Reduced Baseline (PFAS treatment for Well 8 only)
- Alternative 3 – Two New City Wells (west of PFAS plume)
- Alternative 4 – 100% purchases from Zone 7

These alternatives underwent detailed evaluation, as described in the following sections.

A.2 Detailed Evaluation Framework

To provide a recommendation for preferred alternatives, BC performed a multi-criteria decision analysis (MCDA) that encourages stakeholder engagement in the decision-making process. The steps of the MCDA process are outlined in Figure A-6.

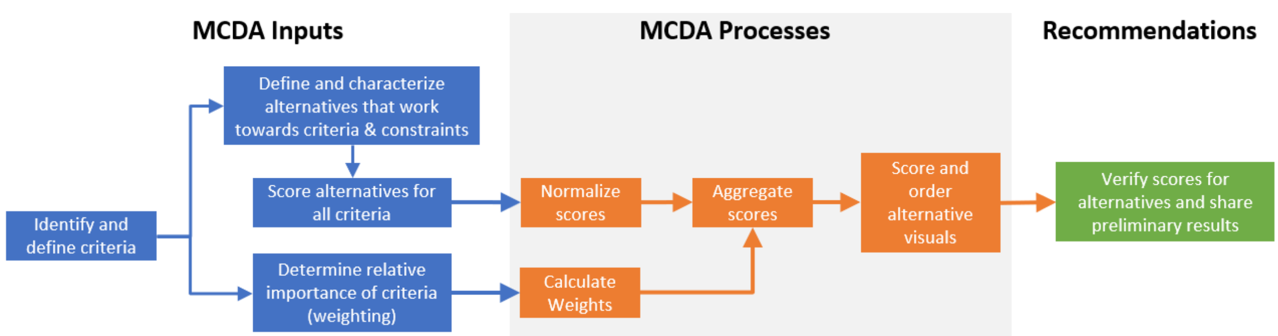

Figure A-6. Decision support process flow diagram

A.3 Decision Criteria and Weightings

Decision criteria were identified to differentiate and prioritize the shortlisted alternatives (presented in Section A.1.8). Non-monetary criteria are critical to project success and require a defensible, repeatable approach that makes use of project information available at the time.

A.3.1 Criteria Descriptions

City staff identified a list of five criteria to highlight the benefits associated with alternatives compared to one another, which together represent non-monetary benefit. The descriptions associated with decision criteria are shown in Table A-2. Capital and operational and maintenance costs (O&M) were developed separately and later compared against benefits to facilitate the decision-making process (see Section A.5). The Water Supply Alternatives Ad Hoc Subcommittee (Ad Hoc Subcommittee) confirmed the criteria and definitions at its February 28, 2023, meeting.

Table A-2. Decision Criteria and Associated Descriptions

Criterion	Description
Water Supply Reliability	The ability to predictably and consistently meet water demands, including during dry years. Considers system redundancy and ability to meet demands during peak periods and/or emergency conditions.
Implementation Timing	The speed at which the alternative can be online, considering timeframe for design, permitting, and construction (if applicable).
Water Quality/Regulatory Compliance	Degree of ability to deliver water below all current and anticipated future state and federal drinking water standards.
Operational Complexity	Ease of operating and maintaining the system from a technical standpoint, considering organizational readiness and necessary staff qualifications/certifications (e.g., ability to operate the project with existing staff resources), and the ability to enhance the system in the event of additional and/or more-stringent drinking water regulations.
Institutional Complexity	Ease of implementation and management from an institutional standpoint (e.g., willingness of external partners, complexity of agreements and administration).

A.3.2 Criteria Weightings

City staff recommended criteria weighting to the Ad Hoc Subcommittee in February 2023. Criteria weighting defines the relative importance of each criterion and is expressed as a percentage. The Ad Hoc Subcommittee confirmed the criteria weighting, shown in Figure A-7, at the February 28, 2023, Ad Hoc Subcommittee meeting,.

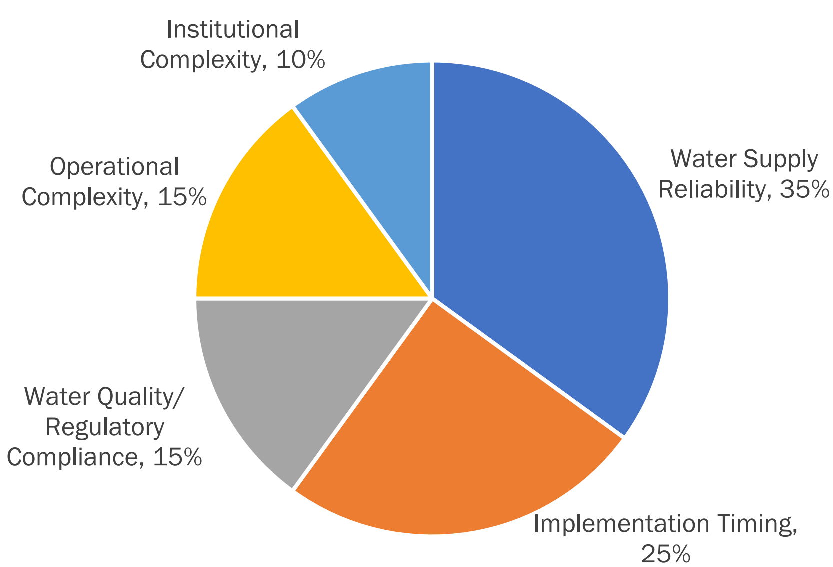

Figure A-7. Criteria weighting breakdown

A.4 Alternative Scores

With criteria defined and weighted, the next step was to develop a scoring rubric and assign scores to each alternative. A scoring approach was developed for each criterion, data was gathered to score qualitative measures, and the BC team presented preliminary scores with the City team during the Ad Hoc Subcommittee meeting on July 28, 2023. BC updated scores at the subcommittee's September 7, 2023, meeting after receiving hydraulic analysis results from Akel Engineering in late August. These scores were used as a starting point to facilitate conversation among the subcommittee group to settle on relative benefits for each alternative across all criteria. The final scoring approach and alternative scores are presented in this section for each criterion.

A.4.1 Water Supply Reliability

Water Supply Reliability was scored qualitatively to differentiate alternatives based on their ability to meet water supply needs with redundancy and level of City control (Table A-3). All alternatives except purchases from Zone 7 provide City control and ability to reliably provide 3,500 acre-feet (AF). Reduced Baseline scored lower given no infrastructure redundancy with only one operating well. Table A-4 presents alternative scores.

Table A-3. Water Supply Reliability Scoring

Score	Differentiating Details
1	Able to meet 3,500 AF demand with minimal redundancy that is outside City control.
2	Able to meet 3,500 AF demand with minimal redundancy that is controlled by the City.
3	Able to meet 3,500 AF demand with sufficient redundancy that is controlled by the City.

Table A-4. Alternative Scores for Water Supply Reliability

No.	Alternative	Qualitative Score	Scoring Comments
1	Baseline Project	3	Under City control with three operating wells.
2	Reduced Baseline	2	Under City control with only one operating well.
3	Two New City Wells	3	Under City control with two operating wells.
4	100% Purchases from Zone 7	1	Out of City control with unknown dry year and long-term reliability.

A.4.2 Implementation Timing

Implementation Timing was scored qualitatively on an alternative's ability to bring a project online within 3 years (Table A-5). Table A-6 presents scoring and justification. No alternative can be implemented in less than a year, and drilling two new wells is expected to have the longest schedule. While Baseline and Reduced Baseline are complex projects, significant progress on permitting and funding has already been completed.

Table A-5. Timing of Implementation Scoring

Score	Differentiating Details
1	Longer-term implementation (approx. 2 to 3 years).
2	Medium-term implementation (approx. 1 to 2 years).
3	Nearer-term implementation (approx. within 1 year).

Table A-6. Alternative Scores for Timing of Implementation			
No.	Alternative	Qualitative Score	Scoring Comments
1	Baseline Project	2	Timeline shortened due to City's progress on CEQA permitting and grant funding.
2	Reduced Baseline	2	Timeline shortened due to City's progress on CEQA permitting and grant funding.
3	Two New City Wells	1	CEQA permitting, grant funding, and siting efforts not started yet.
4	100% Purchases from Zone 7	2	Supply is immediately available (pending approval from Zone 7) but infrastructure upgrades are required first.

CEQA = California Environmental Quality Act

A.4.3 Water Quality/Regulatory Compliance

Water Quality/Regulatory Compliance was scored qualitatively to differentiate alternatives based on the risk of contamination and ability to meet future drinking water regulations (Table A-7). The water quality of the two new wells is uncertain until test wells are drilled. The other alternatives will confidently meet drinking water quality standards, although the 100% Purchases from Zone 7 alternative can adapt to future regulations with their water treatment plant (Table A-8).

Table A-7. Water Quality/Regulatory Compliance Scoring	
Score	Differentiating Details
1	Known risk of near-term exceedance of drinking water standards.
2	Unknown current or future risk of long-term exceedance of drinking water standards.
3	Drinking water quality standards are met with little flexibility to meet more-stringent future regulations.
4	Drinking water quality standards are met and have flexibility to also meet more-stringent future regulations.

Table A-8. Alternative Scores for Water Quality/Regulatory Compliance			
No.	Alternative	Qualitative Score	Scoring Comments
1	Baseline Project	3	City does not have additional treatment facilities to meet future regulations beyond PFAS.
2	Reduced Baseline	3	City does not have additional treatment facilities to meet future regulations beyond PFAS.
3	Two New City Wells	2	Uncertain water quality results until a test well is drilled.
4	100% Purchases from Zone 7	4	Zone 7's water treatment plant allows for flexibility to meet future regulations.

A.4.4 Operational Complexity

Operational Complexity was scored qualitatively based on impact to City staff and operations (Table A-9). The Baseline and Reduced Baseline projects would require significant operational changes, while Two New City Wells and 100% Purchases from Zone 7 would have no impact on operations (Table A-10).

Table A-9. Operational Complexity Scoring	
Score	Differentiating Details
1	Significant operational changes required (e.g., new staff and/or certifications needed).
2	Minimal changes to existing City operations.
3	No changes to existing City operations.

Table A-10. Alternative Scores for Operational Complexity			
No.	Alternative	Qualitative Score	Scoring Comments
1	Baseline Project	1	Adding treatment to the City's portfolio would require additional staff and certifications.
2	Reduced Baseline	1	Adding treatment to the City's portfolio would require additional staff and certifications.
3	Two New City Wells	3	New wells provides no change to existing City operations.
4	100% Purchases from Zone 7	3	Additional Zone 7 water provides no change to existing City operations.

A.4.5 Institutional Complexity

Institutional Complexity was scored qualitatively to differentiate alternatives based on partnership willingness and commitment level (Table A-11). 100% Purchases from Zone 7 is fully reliant on a partnership with Zone 7, while the City can pursue the PFAS treatment alternatives independently (Table A-12).

Table A-11. Institutional Complexity Scoring	
Score	Differentiating Details
1	No willing partner.
2	Potential partner (tentative interest but no commitment).
3	Confirmed partner and/or potential coordination needed with other agencies.
4	No partners needed (City can pursue independently).

Table A-12. Alternative Scores for Institutional Complexity			
No.	Alternative	Qualitative Score	Scoring Comments
1	Baseline Project	4	City owned and operated.
2	Reduced Baseline	4	City owned and operated.
3	Two New City Wells	3	City owned and operated, but well location impacts neighboring agencies.
4	100% Purchases from Zone 7	2	Uncertainty about a long-term agreement with Zone 7.

A.5 Evaluation Results

Scores vetted during the September 7, 2023, Ad Hoc Subcommittee meeting were normalized and multiplied by their component weights and summed to represent their aggregate benefit (Equation A-2). The equation is used to normalize scores across criteria, bounding them between 0, the least benefit, and 1, the most benefit. This orients the analysis so maximum normalized scores are associated with maximum benefit. This approach allowed for differentiation of relative project performance, which highlights benefits across each of the alternatives. Figure A-8 presents rank-ordered alternatives from highest benefit to lowest benefit.

$$A_i = \Sigma N_{score,j} = \Sigma \frac{r_j}{r_{max,benefit}} * W_j \qquad \text{Equation A-2}$$

Where:

A_i = aggregate alternative score for i[th] alternative

$N_{score,j}$ = normalized criterion score for j[th] criterion

r_j = raw criterion score for j[th] criterion

$r_{max,benefit}$ = maximum benefit raw criterion score

W_j = weight for j[th] criterion

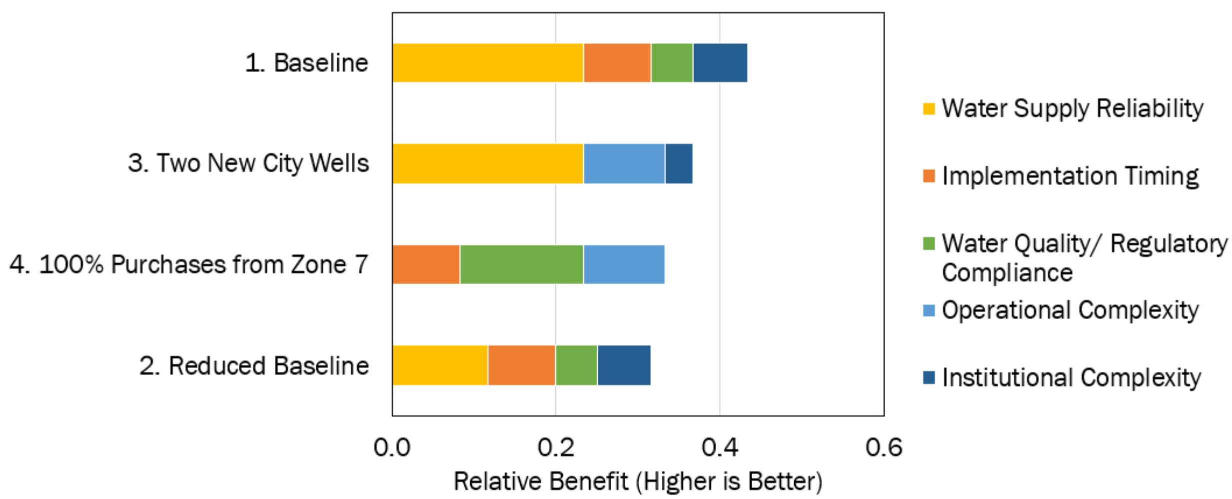

Figure A-8. Relative benefit results by alternative

Figure A-9 presents relative benefit scores against total annual cost (capital and O&M), to highlight project alternatives with high benefit and low cost. A detailed cost estimate is included in Appendix B.

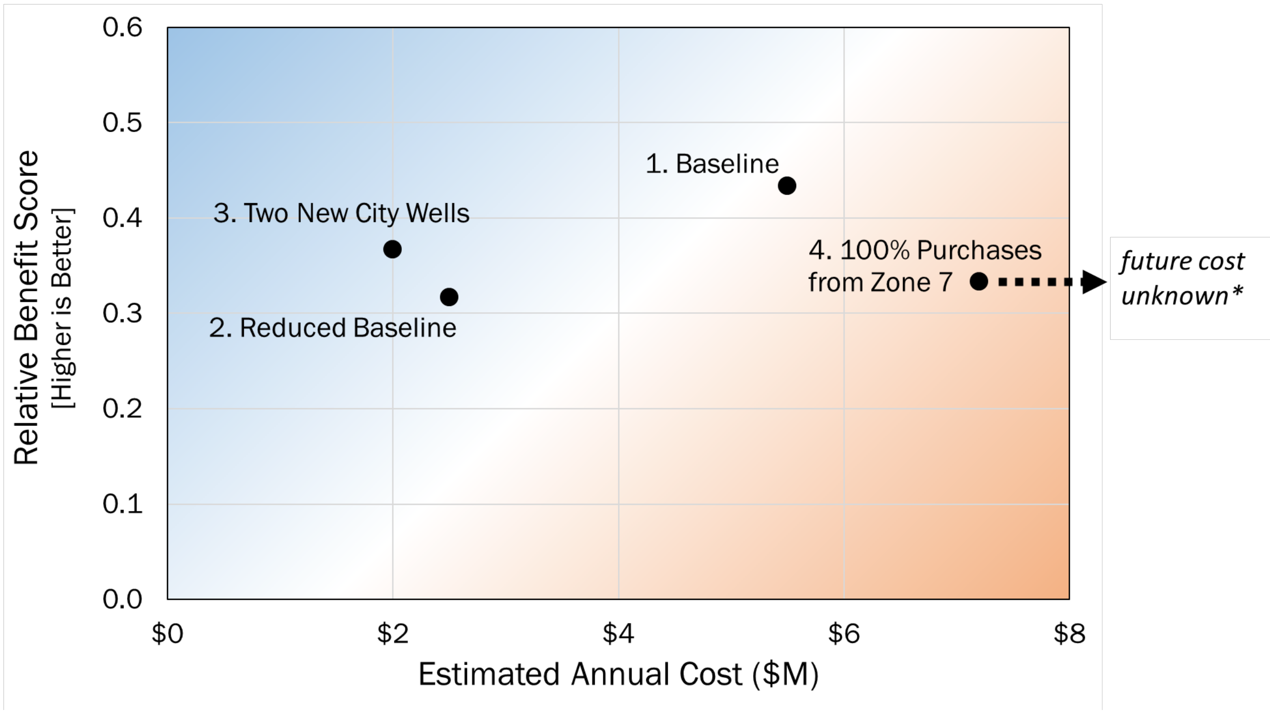

Figure A-9. Benefit score and estimated annual cost for each alternative

Annual cost includes capital and O&M. Capital cost annualized using a 5% interest rate over a 30-year period.

**Zone 7's wholesale rate will likely increase over time with development of new supplies.*

Evaluation of costs and benefits, along with considering the tradeoffs among alternatives, helped to inform selection of Alternative 3 as the preferred alternative, with Alternative 2 considered as a contingency.

References

Carollo Engineers, 2020. PFAS Treatment Alternatives, Technical Memorandum. Prepared for the City of Pleasanton. March 2020.

National Academies of Sciences, Engineering, and Medicine, 2016. Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits. Washington, DC: The National Academies Press.

San Francisco Public Utilities Commission (SFPUC), 2023. San Francisco Regional Water System Map: https://www.sfpuc.org/about-us/our-systems/water-system. Accessed on October 10, 2023.

West Yost, 2021. City of Pleasanton 2020 Urban Water Management Plan (UWMP). Prepared for the City of Pleasanton. June 2021.

Appendix B: Cost Estimates

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Appendix B: Cost Estimates

The Water Supply Alternatives Study (Study) included the development of estimated costs to implement the four shortlisted alternatives. This document summarizes the basis for costs presented in the Study.

The accuracy level of capital costs varies based on the maturity level of a project's design, as depicted in Figure 3-2 of the Study. Because the City had progressed the PFAS Treatment Project through 50% design, capital costs for Alternative 1 (Baseline Project) and Alternative 2 (Reduced Baseline) are estimated at a level consistent with Association for the Advancement of Cost Engineering's (AACE) definition of Class 2, which has an accuracy level of -15 percent to +20 percent. In contrast, Alternative 3 (Two New City Wells) and Alternative 4 (100% Purchases from Zone 7) are planning-level costs that have been prepared for this Study and are consistent with AACE's definition of Class 5 estimates for screening conceptual projects, which has an accuracy level of -50 percent to +100 percent.

B.1 Alternative 1: Baseline Project (PFAS Treatment and Wells 5, 6, and 8 Rehabilitation)

Carollo Engineers prepared estimated capital costs for Alternative 1, the Baseline Project, as part of the PFAS Treatment and Wells 5, 6, and 8 Rehabilitation Basis of Design Report (BODR) at 10% design. They updated the estimates as part of the Opinion of Probable Construction Costs (OPCC) at 50% design (Carollo Engineers, 2021; Carollo Engineers, 2022).

Estimated capital costs presented in the Study report, summarized in Table B-1, are based on the OPCC (50% design), input from City staff, and the Water Supply Alternative Improvements Summary draft report prepared by Akel Engineering Group (Akel 2023). Costs are presented in 2024 dollars.

Table B-1. Capital Cost Estimates for Alternative 1
(Baseline Project: PFAS Treatment and Wells 5, 6, and 8 Rehabilitation)

Category	Item	Cost	
Preliminary Design [a]	Basis of Design Report	$0	$0
Final Design [b]	Prepare Main Project Construction Documents	$1,700,000	$2,775,000
	Prepare Well 9 and 10 Casing Construction Documents	$200,000	
	Prepare Well 9 and 10 Facility/Equipping Construction Documents	N/A	
	Prepare PFAS Treatment Media Pre-purchase	$75,000	
	Prepare PFAS Treatment Vessel Pre-purchase	$50,000	
	Field Investigations to Support Design	$250,000	
	Well 9 Test Hole	$150,000	
	Perform CEQA	$200,000	
	Outside Agency Permitting/Reviews Assistance	$50,000	
	Bidding Assistance	$50,000	
	Permit Fees (PG&E included in construction)	$50,000	

Table B-1. Capital Cost Estimates for Alternative 1 (Baseline Project: PFAS Treatment and Wells 5, 6, and 8 Rehabilitation)			
Category	**Item**	**Cost**	
Construction [b]	Pre-construction Procurement of PFAS Media	$1,040,000	$48,600,000
	Pre-construction Procurement of PFAS Vessels	$5,040,000	
	Well 9 Casing Construction	$1,120,000	
	Well 10 Casing Construction	$1,120,000	
	Centralized Treatment Facility (CTF) Construction (5,800 gpm capacity)	$23,940,000	
	CTF Pipeline Construction	$4,590,000	
	Well 9 Facility Construction	$3,940,000	
	Well 10 Facility Construction	$3,300,000	
	Well Abandonment	$340,000	
	Santa Rita Pipeline Replacement	$1,210,000	
	Well 9 and 10 Portable Generators	$1,330,000	
	Desanders	$1,230,000	
	Surge Tank	$400,000	
Construction Change Order [c]	10% Contingency	$4,860,000	$4,860,000
Construction Support Services [c]	Construction Management (third party)	$3,100,000	$4,600,000
	Engineering Services During Construction	$1,500,000	
Infrastructure Improvements [d]	Pipelines F-2 and F-3	$3,970,000	$3,970,000
Total (AACE Class 2 Range, -15% to +20%))		$64,810,000 ($56,200,000 to $76,300,000)	

a. *Not applicable; Carollo Engineers has already prepared the BODR for Alternative 1 (Carollo Engineers, 2021).*
b. *Source: Carollo Engineers, 2022*
c. *Source: City of Pleasanton, 2022*
d. *Source: Akel Engineering Group, Inc., 2023. Includes cost of constructing Pipelines F-2 and F-3. (Note: Increased costs from source document by 5 percent to escalate to 2024 dollars.) Assumes the City will fund and address near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station, BS-1), which are estimated at ~$10.2M, in advance of implementing water supply alternatives.*

Table B-2 summarizes annual operations and maintenance (O&M) costs and staffing requirements provided to Brown and Caldwell (BC) by City of Pleasanton staff for Alternative 1 (Pleasanton, 2023).

Table B-2. Annual O&M Cost Estimates and Staffing Requirements for Alternative 1 (Baseline Project: PFAS Treatment and Wells 5, 6, and 8 Rehabilitation) [a]				
Category	**Item**	**Low Estimate**	**High Estimate**	**Notes**
Non-labor	Granular Activated Carbon (GAC) Media Change Out	$275,000	$520,000	Refer to Section 4 of the BODR (Carollo Engineers, 2021). Annual cost range is based on lead vessel trigger and first PFAS to breakthrough (as opposed to just PFOS and PFOA). If lag vessel trigger is the basis, the range is reduced to $240k to $330k.
	Hazardous Disposal of GAC Spent Media	$275,000	$520,000	If classified as hazardous by the Environmental Protection Agency (EPA), annual media change-out costs (Item 1) may increase by a factor of 2. EPA's decision is pending.
	Chemical (Additional Costs)		$40,000	FY20/21 Well 5/6/8 Chemical Costs = $130k New centralized treatment facility (CTF) chemical cost estimate = $170k
	Electricity (Additional Costs)		$320,000	The additional energy cost is the difference between $775k and $455k (i.e., difference between estimated electricity cost for a new CTF at 5,800 gpm capacity and recent cost to pump 3,500 AFY). In FY20/21, the City pumped ~3,500 AF from Well 5/6; Well 8 was out of service. Energy cost for Wells 5/6 from FY20/21: 1,622,000 kilowatt hours (kWH) @ $0.28/kWH = $455k. New CTF electricity estimate: 2,777,000 kWH @ $0.28/kWH = $775k. New CTF electricity use is estimated to be about 1.7 times greater than FY20/21 from Wells 5/6 due to increased pumping requirements.
Subtotal: Non-labor		**$1,000,000**	**$1,500,000**	
Labor	Full-time Equivalents (FTE) for Additional O&M	1	2	
	Utilities System Chief Operator (change job requirement from T2 to T3 certification)			Required. State requires Chief Operator to have a T3 certification for a T3 treatment facility.
	Utilities System Maintenance Supervisor (change job requirement from T2 to T3 certification)			Recommended. Position serves as an extended backup to the Utilities System Chief Operator.
	Either: • Utilities System Operator II (change job requirement from T1 to T2 certification to Serve as Shift Operator) • Lead Utilities Systems Operators (to serve as Shift Operator)			State requires a T2-certified Shift Operator for a T3 treatment facility. A Shift Operator must always be on site, or be on call if State allows facility to be unstaffed during non-business hours. Either: • For Utilities System Operator II staff to serve as a certified Shift Operator, a change in job requirement from T1 to T2 certification would be necessary. • For Lead Utilities Systems Operator to serve as certified Shift Operator, no change of job requirement is needed (already T2); however, this would require a Lead Utilities Systems Operator to be on site or on call at all times.
	24-hour Staff Operation	1	1	It is unclear if State will continue to allow the treatment facility to remain unstaffed during non-business hours. Determination will be made during the DDW permitting process, which includes submittal of an operational plan. This will occur during the final design phase (approximately 95% design submittal). If 24-hour staff operation is required, one additional FTE is estimated.
Subtotal: Labor FTEs		**2**	**3**	

a. *Source: City of Pleasanton, 2023*

B.2 Alternative 2: Reduced Baseline (PFAS Treatment for Well 8 Only)

To support the evaluation of Alternative 2, BC prepared a capital cost estimate and an O&M cost estimate based on information presented in the BODR and OPCC prepared by Carollo Engineers (Carollo Engineers, 2021; Carollo Engineers, 2022).

BC assumed the same PFAS treatment objectives presented in the BODR for treating Well 8 groundwater, i.e., the Consumer Confidence Report Detection Levels (CCRDL) established in the State of California State Water Resources Control Board Division of Drinking Water General Order DW-2020-0003-DDW. BC compared the CCRDL PFAS treatment objectives established in the BODR to the proposed U.S. Environmental Protection Agency's (EPA) maximum contaminant levels (MCL) for PFOA, PFOS, and the Hazard Index MCL for GenX, PFNA, PFBS, and PFHxS. The CCRDLs proposed in the BODR meet the treatment criteria of EPA's proposed MCLs.

The Alternative 2 cost estimate was derived exclusively from cost information developed in the BODR for the recommended Centralized Treatment Facility (CTF) for Alternative 1, which is designed for a capacity of 5,800 gallons per minute (gpm) with 7 treatment trains and 2 vessels per train. Because Alternative 2 is not as well defined as Alternative 1, the Alternative 2 cost estimate assumes an additional level of uncertainty. Regardless, the Alternative 2 cost estimate is sufficient for comparison purposes in the context of this Study.

In developing the Alternative 2 cost estimate, BC assumed the City of Pleasanton would rehabilitate Well 8 per the recommendations in the BODR to restore the Well 8 pumping capacity to 3,500 gpm. Similarly, BC adopted the overall site improvements at the Well 8 facility to bring a dedicated treatment system online. The Alternative 2 cost estimate, as presented in Table B-3, is limited to capital investment. Costs are presented in 2024 dollars.

Table B-3. Capital Cost Estimates for Alternative 2 (Reduced Baseline: PFAS Treatment at Well 8 Only)			
Category	Item	Cost	
Preliminary Design [a]	Basis of Design Report	$0	$0
Final Design [b]	Prepare Main Project Construction Documents	$1,700,000	$2,279,000
	Prepare Well 9 and 10 Casing Construction Documents	N/A	
	Prepare Well 9 and 10 Facility/Equipping Construction Documents	N/A	
	Prepare PFAS Treatment Media Pre-purchase	$75,000	
	Prepare PFAS Treatment Vessel Pre-purchase	$50,000	
	Field Investigations to Support Design	$170,000	
	Well 9 Test Hole	N/A	
	Perform CEQA	$134,000	
	Outside Agency Permitting/Reviews Assistance	$50,000	
	Bidding Assistance	$50,000	
	Permit Fees (PG&E included in construction)	$50,000	
Construction [b]	Pre-construction Procurement of PFAS Media	$770,000	$18,710,000
	Pre-construction Procurement of PFAS Vessels	$3,340,000	
	Well 9 Casing Construction	N/A	
	Well 10 Casing Construction	N/A	
	Treatment Facility Construction (3,500 gpm capacity)	$12,680,000	
	CTF Pipeline Construction	N/A	
	Well 9 Facility Construction	N/A	
	Well 10 Facility Construction	N/A	
	Well Abandonment	$290,000	
	Santa Rita Pipeline Replacement	N/A	
	Well 9 and 10 Portable Generators	N/A	
	Desanders	$1,230,000	
	Surge Tank	$400,000	
Construction Change Order [c]	10% Contingency	$1,871,000	$1,871,000
Construction Support Services [c]	Construction Management (third party)	$1,300,000	$1,900,000
	Engineering Services During Construction	$600,000	
Infrastructure Improvements [d]	Pipelines F-2 and F-3; increase capacity of BS-1	$4,170,000	$4,170,000
Total (AACE Class 2 Range, -15% to +20%))		$28,930,000 ($25,230,000 to $33,890,000)	

a. *Not applicable; Carollo Engineers has already prepared the BODR for Alternative 1 (Carollo Engineers, 2021), which provides the basis for Alternative 2.*

b. *Source: Carollo Engineers, 2022*

c. *Source: City of Pleasanton, 2022*

d. *Source: Akel Engineering Group, Inc., 2023. Includes cost of constructing Pipelines F-2 and F-3 and cost differential of increasing BS-1 capacity. (Note: Increased costs from source document by 5 percent to escalate to 2024 dollars.) Assumes the City will fund and address near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station, BS-1), which are estimated at ~$10.2M, in advance of implementing water supply alternatives.*

To develop O&M estimates for Alternative 2, BC scaled the annual O&M estimates and staffing requirements provided by City of Pleasanton staff for Alternative 1 (Pleasanton, 2023), as summarized in Table B-4.

Table B-4. Annual O&M Cost Estimates and Staffing Requirements for Alternative 2 (Reduced Baseline: PFAS Treatment at Well 8 Only) [a]

Category	Item	Low Estimate	High Estimate	Notes
Non-labor	GAC Media Change Out	$120,000	$230,000	Maintained BODR GAC design providing 11.1 minutes of equalization basin contact time (reduction of total GAC volume by 56.8 percent). Assuming the same GAC changeout frequency as specified in BODR. Adjusted costed based on reduction of GAC media volume (i.e., 56.8 percent).
	Hazardous Disposal of GAC Spent Media	$120,000	$230,000	Similar assumptions as above and as BODR for hazardous disposal classification.
	Chemical (Additional Costs)		$40,000	Chemical costs for systemwide total flow should not change. All the water will still require chlorine, ammonia, and fluoride dosing regardless of GAC treatment size.
	Electricity (Additional Costs)		$115,000	The additional energy cost is the difference between $570k and $455k (i.e., difference between estimated electricity cost for new treatment and recent cost to pump 3,500 AFY). In FY20/21, the City pumped ~3,500 AF from Wells 5/6; Well 8 was out of service. Energy cost for Wells 5/6 from FY20/21: 1,622,000 kilowatt hours (kWH) @ $0.28/kWH = $455k. New treatment facility electricity estimate: 2,030,000 kWH @ $0.28/kWH = $570k. New treatment facility electricity use is estimated to be about 1.25 times greater than FY20/21 from Wells 5/6 due to increased pumping requirements.
Subtotal: Non-labor		**$500,000**	**$700,000**	
Labor	Full-time Equivalents (FTE) for Additional O&M	1	2	Same as Alternative 1 (Baseline Project).
	Utilities System Chief Operator (change job requirement from T2 to T3 certification)			
	Utilities System Maintenance Supervisor (change job requirement from T2 to T3 certification)			
	Either: • Utilities System Operator II (change job requirement from T1 to T2 certification to Serve as Shift Operator) • Lead Utilities Systems Operators (to serve as Shift Operator)			
	24-hour Staff Operation	1	1	
Subtotal: Labor FTEs		**2**	**3**	

a. *Scaled based on information provided by City staff for Alternative 1 (City of Pleasanton, 2023)*

B.3 Alternative 3: Two New City Wells

BC prepared this feasibility-level construction cost estimate with associated engineering design fees and O&M costs to install two water supply wells with pumping stations. These facilities would provide water for potable use in the Pleasanton service area. The preliminary locations for the two new city wells (one in Del Prado Park and one in Bernal Park) are shown in figure B-1. The new wells would be constructed in the lower aquifer of the Livermore Valley Groundwater Basin (Main Basin) and more specifically in the Bernal Subbasin. The cost estimates provided in Table B-5 are considered Class 5 (screening level, rough order-of-magnitude for feasibility purposes) and rely on costs from other BC projects of similar scope in the region as well as the City's PFAS Treatment Project BODR. Consistent with an AACE Class 5 capital cost estimate, Alternative 3 capital costs have an expected accuracy cost range of -50 percent to +100 percent.

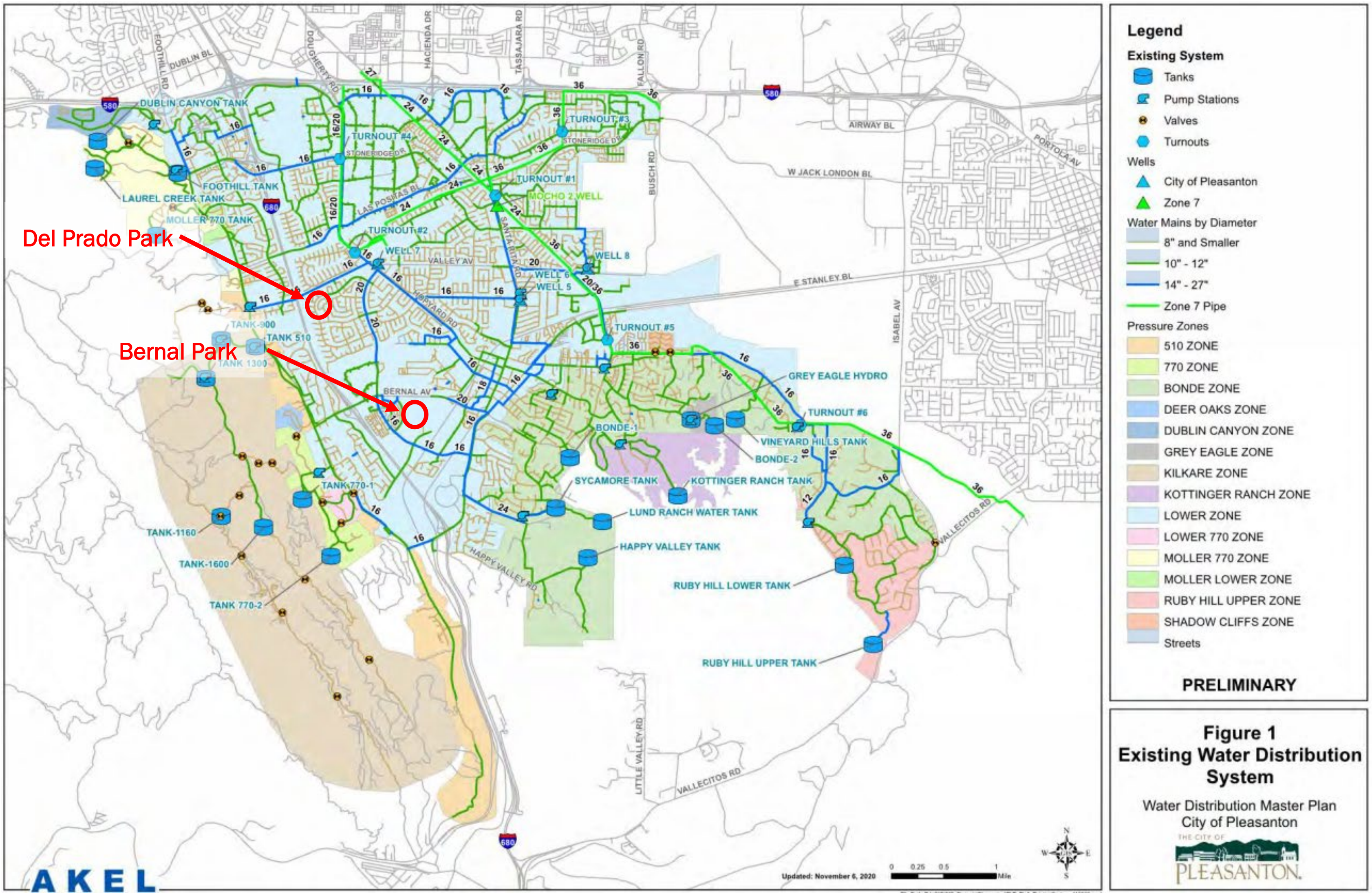

Figure B-1. Existing water distribution system and assumed locations of proposed city wells for cost estimating purposes

Estimated capital costs for Alternative 3 are summarized in Table B-5. The capital cost estimate is supported by the following narrative scope summary:

1. **Preliminary Design.** The estimated cost of preliminary design assumes basic geotechnical study, topographic surveying, and updating of the BODR for the two well sites from 2% design to 30% design.
2. **Drilling Design, Bid Documents, and Permitting Support.** The estimated cost for this item assumes development of well drilling and installation design documents for bidding, support services for contractor procurement and bid, and basic well permitting support for two wells. Details of these services include:
   - Plans and Specifications: Prepare one complete set of contract documents, including well drawing details and site-specific well drilling technical specifications. The plans and specifications can be used again for future well installations. Minimum project-specific criteria will be prepared to ensure that only a qualified bidder is awarded the project.
   - Contractor Procurement and Bid Support Services: Provide engineering services during the contractor procurement period that include:
     - Responses to Questions: Receive and respond to questions concerning clarifications to the bid documents.
     - Evaluation of Bidders: Receive and review bid packages from bidders for evaluation of award.
     - Recommendation of Award: Prepare a bid award recommendation based on the bidder meeting all qualifications as set forth in the contract documents.
   - Well Construction Permitting: Obtain applicable well drilling and construction permits from Zone 7 and/or other agencies.
3. **Equipping Design, Bid Documents, and Permitting Support.** Engineering design services include sizing the pump and motor with supporting calculations/hydraulic modeling; completing 60%, 90%, and final drawing sets with specifications; and contractor procurement and bid support services with basic permitting support.
4. **Drilling Construction.** Drilling and installation construction of two new supply wells assumes a total depth of 650 feet, 302 feet of 18-inch-diameter stainless-steel casing, and 350 feet[1] of stainless-steel well screen. The estimate breakdown for well drilling and installation includes:
   - Drill rig mobilization
   - Drilling fluid management (assumes on-site disposal; off site is higher cost)
   - Surface casing/sanitary seal
   - Pilot borehole drilling
   - Pilot borehole geophysical logging, including standard suite plus nuclear magnetic resonance (NMR)
   - Zonal sampling (up to six isolated zones) for aquifer water quality and productivity characterization
   - Ream borehole to production diameter (28 inches)

---

[1] To maximize potential productivity from wells in the Bernal Subbasin (Figure B-1) we included total depth of 650 feet with a total screen interval of 350 feet, which is both deeper and longer than nearby wells and based off the design of City Well 7, which is assumed to be representative of the lower aquifer in the Bernal Subbasin.

- Well casing, screen, and ancillary pipe installation, including annular materials (e.g., filter pack, bentonite, cement grout)
- Rig development
- Pumping development and test pumping with composite water quality sample
- Downhole video and alignment (gyro) test

The subtotal estimated drilling construction costs include the same markups as Carollo's BODR (20 percent contingency, 5 percent escalation, and 9.25 percent sales tax).

5. **Well Equipping/Facility Construction.** The estimated cost for well equipping/facility construction includes costs for a contractor to furnish and install pump/motor and ancillary equipment capable of a minimum design flow rate of 2,200 gpm, as well as site facility improvements for two new well sites. The estimate includes markups from Carollo's BODR of 4 percent site/civil multiplier, 10 percent electrical multiplier, 10 percent instrumentation and controls multiplier, 30 percent contingency, 12 percent general construction (GC) overhead and profit (OH&P), 8 percent general conditions, 8 percent escalation, and pro-rated sales tax. The equipping construction work includes:
   - Mechanical work, including cost allowances for equipment (not including pump), yard pipe/mechanical pipe, pump control valves, HVAC, and below-grade piping
   - Site work/construction, including cost allowances for access gate, landscaping, paving, and chain link fence
   - Specialties during construction (i.e., temporary construction features), including sound attenuation panels
   - Special construction (i.e., permanent construction features), including chemical storage tanks, chemical feed tubing, and fiberglass-reinforced plastic grating in chemical containment area
   - Electrical work, including power distribution panel, Pacific Gas and Electric (PG&E) transformers, emergency generator, programmable logic controller/remote terminal unit panel, switchboard and lighting panel, electrical gear/panels, 350-horsepower (hp) variable-frequency drive (VFD), and conduit
   - Concrete masonry unit well building (fully furnished)
   - Equipment (e.g., vertical turbine pump and motor and disinfection equipment), and chemical metering pump skids
   - Site instrumentation and controls, including cost allowances for magnetic flow meters, fiber optic cable, security, and connection to the City's supervisory control and data acquisition (SCADA) system
6. **Construction Support Services.** Construction support services include both construction management (i.e., inspection) and engineering services during construction (e.g., office engineering, submittal reviews, and requests for information). The estimated cost for construction support services to drill/install and equip/construct the well facilities above ground assumes:
   - Drilling Oversight: Field/office engineering and inspection services during drilling, zone sampling, casing and annular material installation, mechanical/rig and pump development, and test pumping of the wells. An experienced field geologist, engineer, or inspector will provide part/full-time oversight of the drilling contractor providing the tasks described above.

- Equipping/Facility Oversight: Field engineering and inspection services during well site construction, to include equipment installation and startup/testing. An experienced field inspector or engineer will provide part-time oversight of the contractor providing the tasks described above.

7. **Infrastructure Improvements.** The cost estimates in Table B-5 include the cost of constructing Pipelines F-2, F-3, F-8, F-9, and F-10, as well as savings from the reduced capacity requirement of BS-1, as described in Appendix E (Akel, 2023). BC increased costs from Akel's Water Supply Alternative Improvements Summary prepared in August 2023 by 5 percent to escalate to 2024 dollars. The cost estimate assumes the City will fund and address near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station, BS-1), which are estimated at ~$10.2M, in advance of implementing water supply alternatives.
8. **Assumptions.** The cost estimates in Table B-5 and described herein are based on the following assumptions:
   - The City will directly contract the selected contractors and administer those contracts separate from the design and construction management contract; therefore, it does not include markup for contracting the driller or pump/general contractors.
   - The new well designs will be based on the City's Well 7 construction details. Like Well 7, the new wells will be located in the Bernal Subbasin (Figure B-1), but to maximize potential productivity will have a deeper total depth with 18-inch casing to a total depth of 650 feet and longer screen interval with total screen length of 350 feet. The most probable design flow rate is subject to change based on information obtained during drilling of the well pilot boreholes, a separate test borehole, and/or current aquifer conditions or detailed well siting study (out of scope for alternatives analysis). The City's targeted/desired flow rate from each new well is a minimum of 2,200 gpm, but ideally would be 3,000 gpm. Based on limited information it is moderately likely the minimum flow rate is attainable given existing well information.
   - The new well permits would come from Zone 7 and Division of Drinking Water (DDW). The permit application requires a site map, an application form, a supply well supplemental form, and fees of approximately $400 per well. There is no requirement for well drilling specifications in the application. City will need to file a well completion report with DWR as well.
   - Pumping equipment is assumed to include a line shaft turbine pump with a 350-hp, 460-volt motor and VFD based on Well 8 equipment details provided in the BODR.
   - Wellhead chemical feeds (chlorination/disinfection, ammonia, fluoride) are based on the centralized treatment facility chemical feed costs in the BODR applied to each well site. No other treatment will be needed at the new well sites.
   - Estimated non-labor operational costs (power/electricity) were provided by City operations staff based on FY20/21 power usage at City Wells 5 and 6.
   - Cost estimates are based on a 0 to 2 percent project definition with a low range of -50 percent to a high range of +100 percent.

- Markups are assumed to be the same as reported in the BODR cost estimate: site/civil multiplier, electrical, instrumentation and control multiplier, contingency, GC OH&P, general conditions, escalation, and sales tax (pro-rated, as not all costs are taxable). Additional construction change order contingency was applied to construction costs only at 10 percent.
- Specific City preferences are based on the referenced BODR and are subject to change with corresponding costs changes.
- New Well 9 is assumed to be located at Bernal Park and new Well 10 is assumed to be located at Del Prado Park, but locations are subject to change based on a future detailed/comprehensive well siting study performed later. If other (non-City) locations are selected for the new wells, land acquisition costs are not included.
- Well drilling/installation costs assume on-site disposal of drilling fluid waste. Off-site drill fluid and cutting disposal costs can be significantly higher.
- Geophysical logs include electrical resistivity, gamma ray, sonic/acoustic, caliper, spontaneous potential, and magnetic deviation with an NMR add-on specific to this project.
- Length of pipelines (listed in Table 5 of Appendix E) are subject to change depending on final location of wells and tie-in/ connection to Pleasanton or Zone 7 distribution system.
- Primary electric is available nearby (within at least 100 feet). The primary power cost could be less depending on PG&E providing power to the site, or higher depending on how far the primary power is from the well sites.
- Mechanical and structural design will be similar to existing City Wells 5, 6, and 8.
- The estimate provided as part of the evaluation is based on a Class 5 estimate. Opinions of probable construction cost, financial analyses, and feasibility projections are subject to many influences, including but not limited to price of labor and materials, unknown or latent conditions of existing equipment or structures, supply and demand, contractor and supplier backlog, and time or quality of performance by third parties. Such influences may not be precisely forecasted and are beyond the control of BC; actual costs incurred may vary substantially from the estimate prepared by BC.

Table B-5. Capital Cost Estimates for Alternative 3 (Two New Wells)			
Category	**Item**	**Cost**	
Preliminary Design	Basis of Design Report	$150,000	$150,000
Final Design	Prepare Casing Construction Documents for Two New Wells	$200,000	$950,000
	Prepare Facility/Equipping Construction Documents for Two New Wells	$750,000	
Construction	Casing Construction (New Well 1)	$1,320,000	$11,680,000
	Casing Construction (New Well 2)	$1,320,000	
	Facility Construction (New Well 1)	$4,520,000	
	Facility Construction (New Well 2)	$4,520,000	
Construction Change Order	10% Contingency	$1,168,000	$1,168,000
Construction Support Services	Construction Management (third party)	$750,000	$1,150,000
	Engineering Services During Construction	$400,000	
Infrastructure Improvements [a]	Pipelines F-2, F-3, F-8, F-9, and F-10; reduced capacity of BS-1	$6,910,000	$6,910,000
Total (AACE Class 5 Range, -50% to +100%)		$22,008,000 ($12,140,000 to $41,770,000)	

a. *Source: Akel Engineering Group, Inc., 2023. Includes cost of constructing Pipelines F-2, F-3, F-8, F-9, and F-10, as well as savings from the reduced capacity requirement of BS-1. (Note: Increased costs from source document by 5 percent to escalate to 2024 dollars.) Assumes the City will fund and address near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station, BS-1), which are estimated at ~$10.2M, in advance of implementing water supply alternatives.*

Table B-6 summarizes annual O&M estimates for Alternative 3. The non-labor operational cost estimates are based on costs provided by City operations staff for existing Wells 5 and 6. Non-labor operational costs per year include power/electricity to run the pumps at two new City wells (estimated at $455k based on the Alternative 1 estimates for Wells 9 and 10). The non-labor operational costs exclude labor, extensive rehabilitation or cleaning of the wells, pump replacement/motor rebuild, or chemicals for treatment.

Table B-6. Annual O&M Cost Estimates for Alternative 3 (Two New Wells)			
Category	**Item**	**Estimate**	**Notes**
Non-labor	Chemical (Additional Costs)	N/A	Chemical costs (e.g., chlorine, ammonia, fluoride) are not expected to increase compared to the City's typical groundwater operations.
	Electricity (Additional Costs)	$455,000	In FY20/21, the City pumped ~3,500 acre-feet from Well 5/6; Well 8 was out of service. Energy cost for Wells 5/6 from FY20/21: 1,622,000 kilowatt hours (kWH) @ $0.28/kWH = $455k.

B.4 Alternative 4: 100% Purchases from Zone 7

BC prepared a feasibility-level cost estimate for Alternative 4. Zone 7's wholesale water charges include two components:

1. **Fixed charge**, which is allocated to Zone 7's retailers (including the City) based on a rolling average of actual water use over the two previous calendar years.
2. **Volumetric charge**, which is a per-unit cost (i.e., dollars per hundred cubic feet [CCF] of water delivered to the retailer's turnouts from Zone 7's transmission system).

The Alternative 4 cost estimates rely on information provided in several Zone 7 memorandums to treated water retailers and in Board resolutions regarding wholesale water rates for 2019 through 2026. They include:

- Zone 7 Board Resolution No. 18-74, Adoption of the Treated Water Service Rates for Calendar Years (CY) 2019, 2020, 2021, and 2022, which includes:
  - CY 2019 volume-based rates
  - Annual fixed charge per retailer for CY 2019
- Zone 7 memorandum to treated water customers on October 31, 2019, which includes:
  - The 2-year rolling average of Fiscal Year (FY) 2017-18 and FY 2018-19 actual water use for Pleasanton and Zone 7's other retailers and direct customers
  - CY 2020 volume-based rates
  - Annual fixed charge per retailer for CY 2020
- Zone 7 memorandum to treated water customers on October 23, 2020, which includes:
  - The 3-year rolling average of FY 2018-19 and FY 2019-20 actual water use for Pleasanton and Zone 7's other retailers and direct customers
  - CY 2021 volume-based rates
  - Annual fixed charge per retailer for CY 2021
- Zone 7 memorandum to treated water customers on October 21, 2021, which includes:
  - The 2-year rolling average of FY 2019-20 and FY 2020-21 actual water use for Pleasanton and Zone 7's other retailers and direct customers
  - CY 2022 volume-based rates
  - Annual fixed charge per retailer for CY 2022
- Zone 7 Board Resolution No. 22-93, Adoption of the Treated Water Service Rates for Calendar Years 2023, 2024, 2025, and 2026, which includes:
  - Annual volume-based rates for CY 2023 through CY 2026
  - Annual fixed charge per retailer for CY 2023

To prepare this Alternative 4 estimate, BC reviewed the City's 2-year rolling average water use from FY 2017-18 and FY 2018-19, FY 2018-19 and FY 2019-20, and FY 2019-20 and FY 2020-21 and calculated an increased fixed charge based on adding 3,500 acre-feet per year (AFY) to fully replace the annual supply that the City typically pumps from groundwater.

The fixed charge component of the rate structure is estimated at ~$2M per year. The volumetric charge component of the rate structure is estimated using Zone 7's CY 2026 rate ($2.47/CCF) and is estimated at ~$4M per year for 3,500 AFY. In total, the annual cost of purchasing an additional 3,500 AFY is about $6M per year. This cost is not reflective of future increases to Zone 7's wholesale rates that are likely to occur over time with development of new supplies and increasing service costs.

In addition to the annual cost of purchasing additional wholesale supply from Zone 7, Alternative 4 requires the most extensive infrastructure improvements of the four alternatives evaluated for the Study, estimated at about $11M. Infrastructure improvements include the cost of constructing Pipelines F-2, F-3, F-6, and F-7 and new Turnout 8; cost differential of increasing BS-1 capacity; and 5 percent escalation to bring the value into 2024 dollars. Consistent with the other alternatives, this cost assumes the City will fund and address near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station, BS-1), which are estimated at ~$10.2M, in advance of implementing water supply alternatives.

Table B-6. Capital and O&M Cost Estimates for Alternative 4 (100% Purchases from Zone 7)

Cost Type	Estimate	Notes
Capital	$11M	Infrastructure improvements include the cost of constructing Pipelines F-2, F-3, F-6, and F-7 and new Turnout 8; cost differential of increasing BS-1 capacity; and 5 percent escalation to bring the value into 2024 dollars.
Annual O&M	$6M/year	Assumes purchase of 3,500 AFY. This cost is not reflective of future increases to Zone 7's wholesale rates that are likely to occur over time with development of new supplies and increasing service costs.

References

Akel Engineering Group, Inc., 2023. Water Supply Alternative Improvements Summary. Prepared for the City of Pleasanton. August 2023.

Carollo Engineers, 2022. 50% Design Deliverable Opinion of Probable Construction Cost (OPCC), PFAS Treatment and Wells Rehabilitation Project. Prepared for the City of Pleasanton. September 2022.

Carollo Engineers, 2021. Basis of Design Report, PFAS Treatment and Wells Rehabilitation Project. Prepared for the City of Pleasanton. August 2021.

City of Pleasanton, 2023. Personal communication from Pleasanton staff (Todd Yamello) regarding project cost estimates for PFAS Treatment and Wells 5, 6, & 8 Rehabilitation. Received March 1, 2023.

Zone 7, 2022. Board Resolution No. 22-93, Adoption of the Treated Water Service Rates for Calendar Years 2023, 2024, 2025, and 2026.

Appendix C: Well Inventory and Data Review

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Appendix C: Bernal Subbasin Well Inventory and Records Review

Brown and Caldwell (BC) performed a cursory well inventory and record review for the overall Water Supply Alternative Study for Alternative 3, which includes the installation of two new City of Pleasanton (City) wells outside a known PFAS plume. This work was completed to understand the potential productivity of installing new City wells in the Bernal Subbasin, based on review of existing well records, data, construction, operation, and logs.

The City and Zone 7 Water Agency (Zone 7) provided well data to BC for review.[1] The Livermore Valley Groundwater Basin (No. 2-010) Bernal Subbasin, specifically the Lower Aquifer, extends from depths of 190 feet (ft) to up to 800 ft below ground surface. Through a groundwater modeling exercise, the Bernal Subbasin was selected as the preferred location for the new wells. At the Lower Aquifer depths, this subbasin does not contain known PFAS contamination and has the potential to provide unimpacted water for the City's needs.

As informed by City staff, specific areas of interest for two new wells include Del Prado Park, Bernal Park, and/or Hansen Park, all of which fall in the Bernal Subbasin (Figure C-1).

The findings from the well inventory and record review indicate that:

- Drilling and installing two new wells in the Lower Aquifer of the Bernal Subbasin would likely meet the City's minimum desired capacity of 2,200 gallons per minute (gpm) for each well. To further confirm these findings, additional work is recommended, including (but not limited to) drilling exploration/test boreholes and performing a comprehensive groundwater and well siting study.
- Drilling the new wells deeper may increase production rates, but borehole characterization work during and after drilling the pilot boreholes would be needed to verify improved production.

Information gleaned from the review of well construction information was used in the preliminary well design for cost estimating purposes.

[1] From Zone 7 DataMart and e-mail communications; City of Pleasanton databases, records, reports

Figure C-1. Study area and wells of interest

C.1 Well Summary/Overview

This section summarizes information that BC obtained from well logs and reports for seven wells in the study area, including four wells in the Bernal Subbasin and three in the adjacent Amador Subbasin. These wells, which are a small sample of the dozens of wells in the study area, are local production wells in the study area. Construction information and other data were available for six of the wells, including Hopyard 6, Hopyard 9, Fairgrounds (potable), Pleasanton 5, Pleasanton 6, and Pleasanton 7 (Table C-1). These wells range in annual productivity. For example, groundwater production in 2021 ranged from 353 acre-feet per year (AFY) from the Fairgrounds potable well to 3,461 AFY from Hopyard 6. Pleasanton Well 8, which is in the Amador Subbasin, is included in Table C-1 for comparison purposes but was not included in the detailed well record review. The distance of Well 8 from the new well locations in the Bernal Subbasin would result in increased uncertainty when estimating a firm range of potential well productivity.

Table C-1. Summary of Well Construction and Other Information [a]

Well Details		Selected Existing Wells in the Study Area						
		Well 5	Well 6	Well 7	Well 8 [b]	Hopyard 6	Hopyard 9	Fairgrounds (potable)
Owner		Pleasanton	Pleasanton	Pleasanton	Pleasanton	Zone 7	Zone 7	Alameda County
Year Constructed		1962	1965	1967	1992	1987 (estimated)	1999 (estimated)	NA
Well Casing Depth (ft)		647	647	440	500	500	315	500
Well Borehole Depth (ft)		702	647	750	525	NA	NA	NA
Screen Interval (ft)		149 to 650	165 to 625	117 to 386	200 to 490	158 to 490	235 to 310	218 to 500
Screen Type		Louvers	Louvers, Saw Cut	NA	Wire Wrapped	Unknown	Unknown	Unknown
Pump Type		Submersible	Vertical Line Shaft	NA	Vertical Turbine	NA	NA	NA
Pump Depth (ft)		200	200	NA	264	NA	NA	NA
Motor	(horsepower)	200	200	NA	350	NA	NA	NA
	(volts)	460	460	NA	NA	NA	NA	NA
Typical Pumping Rates (gpm)		1,900 to 2,400	2,000 to 2,300	~2,000	2,000 to 3,500	3,750	1,100	NA
Maximum Yield (gpm)		3,120	3,052	~4,000	3,800	NA	NA	NA
Estimated Pumping Specific Capacity (gpm/ft)		115	109	~175 to 300+	53	NA	11.5	NA

a. *Information from Carollo's Basis of Design Report, August 2021 and City of Pleasanton records.*
b. *Well 8 was not used to determine potential yield due to its distance from the study area.*

BC reviewed well construction data, including total cased depths and screen intervals, and confirmed that well production data represent the Lower Aquifer based on well depths and screen intervals. BC reviewed well logs to better understand the lithology of the Lower Aquifer and characterize aquifer materials below the well depths to evaluate the potential for well deepening as an option to increase production rates. Where available, pump test information was reviewed to understand yields and pumping specific capacity. Pumping specific capacity is calculated as the flow rate divided by the drawdown at that flow rate after groundwater level stabilization is achieved. It is expressed in units of gpm/ft (of drawdown). These values are a good representation of the aquifer screen interval's productivity and can be transposed reasonably to other parts of the basin.

C.1.1 Pleasanton Well 5

Well 5 was installed in 1962 just outside the Bernal Subbasin in the Amador Subbasin (Figure C-1). The well log in Figure C-2 indicates the borehole was drilled to 702 ft and the well was completed to 647 ft. The aquifer material below the completed depth is fine-grained clays to 702 ft with unknown material below that depth. To determine if potentially productive aquifer material exists below this depth, an exploratory test borehole would need to be drilled and logged.

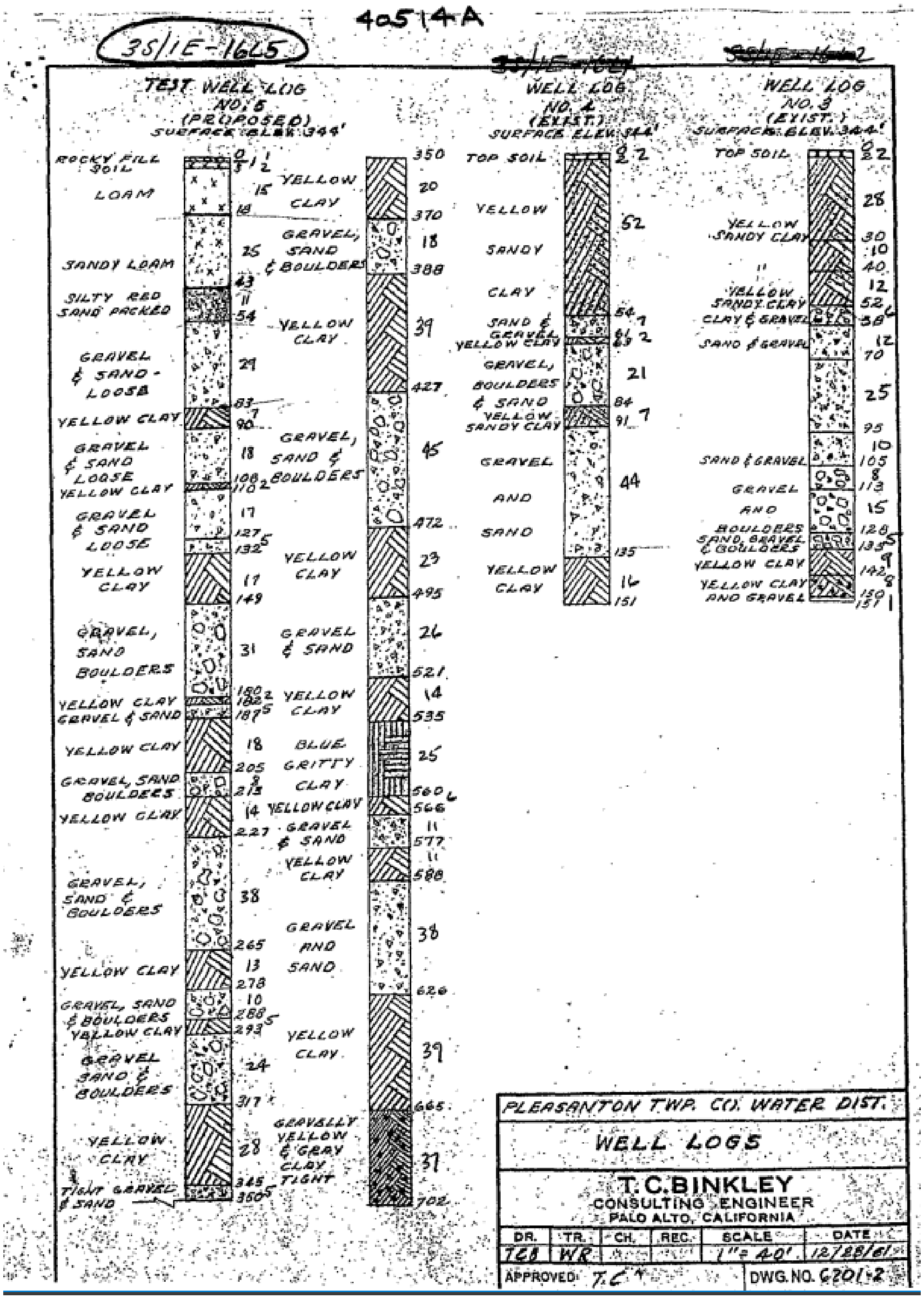


Figure C-2. Pleasanton Well 5 log

From well reports (Figure C-3), historical pumping rates for Pleasanton 5 were 2,820 gpm for 100 hours with 22-ft drawdown at the time of installation with a maximum yield of 3,120 gpm with 27-ft drawdown.

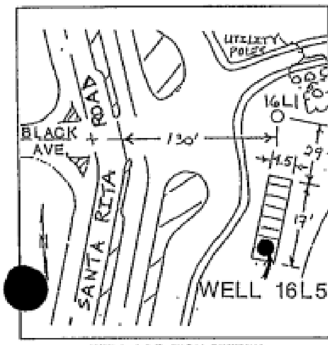
ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 40514A
State Well No. 3S/1E 16L5
Other Well No. Pleasanton 5

ice of Intent No. ____
l Permit No. or Date ____

(2) LOCATION OF WELL (See instructions):
County Alameda Owner's Well Number ____
Well address if different from above ____
Township 3S Range 1E Section 16
Distance from cities, roads, railroads, fences, etc. South and east of Santa Rita Road and Black Avenue intersection in Pleasanton.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☒
Other ☐
(Describe)

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size ¼ x 1/8
Diameter of bore See reverse
Packed from ____ to ____ ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	135	30	¼
0	325	18	5/16
325	650	12	¼

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
149	180	2½x1/8
201	212	2½x1/8
See reverse		

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 0 – 135 ft.
Were strata sealed against pollution? Yes ☒ No ☐ Interval ____ ft.
Method of sealing cemented, 36" OD, 30" ID

(10) WATER LEVELS:
Depth of first water, if known ____ ft.
Standing level after well completion 88 ft.

(11) WELL TESTS: See reverse
Was well test made? Yes ☒ No ☐ If yes, by whom? Driller
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 22 ft. drawdown At end of test ____ ft.
Discharge 2820 gal/min after 100 hours Water temperature ____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? ____
Was electric log made? Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 685 ft. Completed depth 650 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	1	Fill, rocky.
1	3	Soil.
3	18	Loam.
18	43	Sandy loam.
43	54	Silty red sand.
54	83	Gravel and sand, loose.
83	90	Yellow clay.
90	108	Gravel and sand.
108	110	Yellow clay.
110	132	Gravel and sand.
132	149	Yellow clay.
149	180	Gravel, sand, boulders.
180	201	Yellow clay.
201	212	Gravel, sand, boulders.
212	220	Yellow clay.
220	228	Blue clay and rotten logs.
228	265	Gravel, sand, boulders.
265	278	Yellow clay.
278	288	Gravel, sand, boulders.
288	293	Yellow clay.
293	317	Gravel, sand, boulders.
317	342	Yellow clay.
342	348	Gravel, boulders.
348	370	Yellow clay.
370	388	Gravel, sand, boulders.
388	427	Yellow clay.
427	472	Gravel, sand, boulders
472	495	Yellow gravelly clay.
495	521	Gravel, sand.
521	535	Yellow clay.
535	560	Blue clay, gritty.
560	566	Yellow clay.
566	577	Gravel, sand.
577	588	Yellow clay.
588	595	Gravel, sand.
595	602	Yellow gravelly clay.
602	630	Gravel, sand.
630	652	Yellow gravelly clay.
652	685	Tight gravelly yellow and blue clay.

Work started 3 Feb 1962 Completed 4 Apr 1962

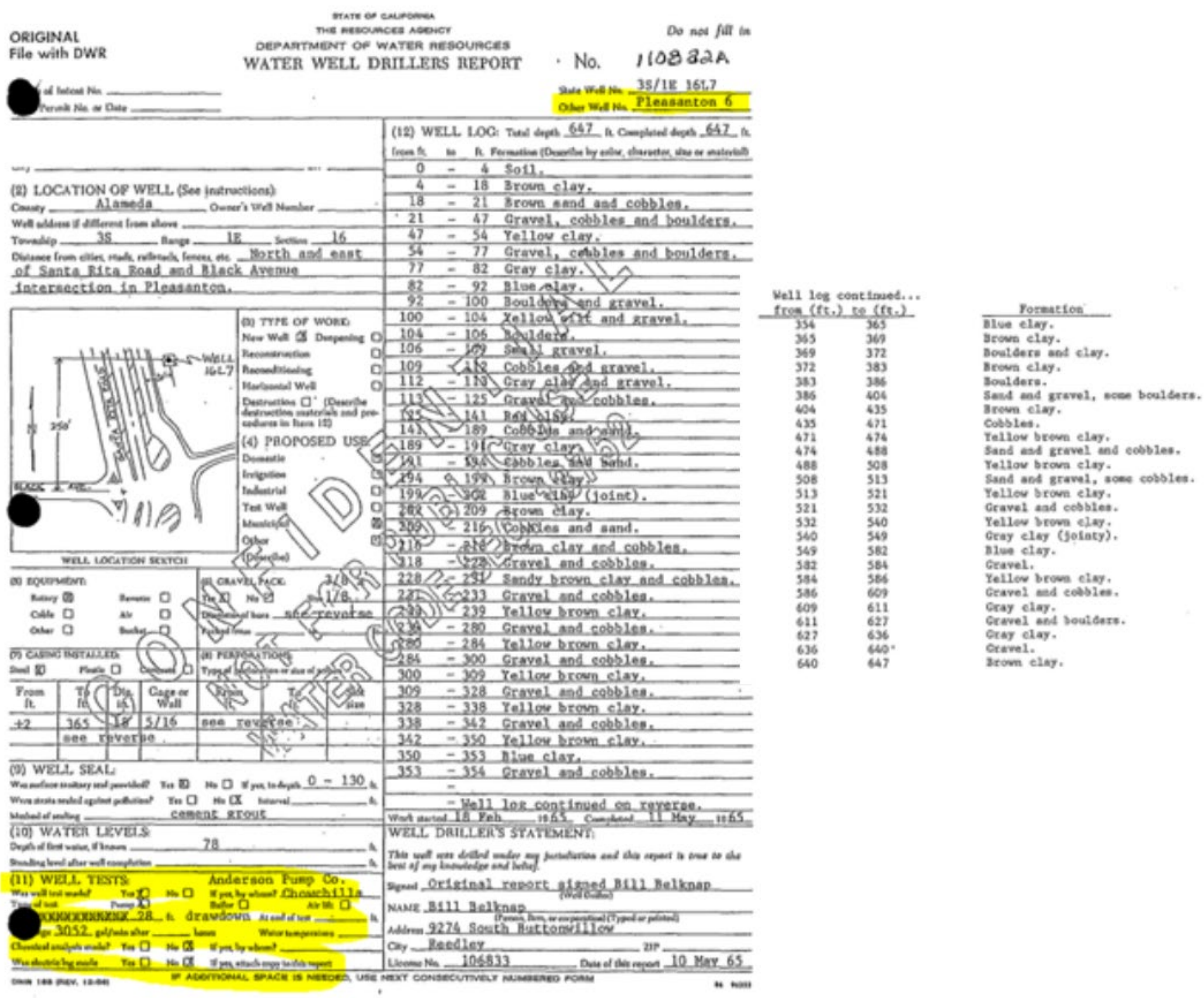
WELL DRILLER'S STATEMENT:
Driller: Berlin Robinson
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed Original report signed unreadable Burdin (Well Driller)
NAME C & N Pump and Well Company (Person, firm, or corporation) (Typed or printed)
Address 1901 Washington Street
City Santa Clara ZIP ____
License No. 68648 Date of this report 1 Jul 62?

DWR 188 (REV. 12-68) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Figure C-3. Pleasanton Well 5 report

C.1.2 Pleasanton Well 6

Well 6 was installed in 1965 just outside the Bernal Subbasin in the Amador Subbasin (Figure C-1). The well log (Figure C-4) indicates the borehole was drilled to a depth of 647 ft and terminated in clay material. To characterize aquifer materials and potential productivity thereof, an exploratory borehole would need to be drilled in the area. Following installation, the well was pump tested at 3,052 gpm with 28-ft drawdown.



ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 110882A
State Well No. 3S/1E 16L7
Other Well No. Pleasanton 6

(2) LOCATION OF WELL (See instructions):
County Alameda
Township 3S Range 1E Section 16
Distance from cities, roads, railroads, fences, etc. North and east of Santa Rita Road and Black Avenue intersection in Pleasanton.

WELL LOCATION SKETCH

(3) TYPE OF WORK: New Well ☒

(4) PROPOSED USE: Municipal ☒

(5) EQUIPMENT: Rotary ☒

(6) GRAVEL PACK: Yes ☒ Size 3/8 x 1/8 Diameter of bore see reverse

(7) CASING INSTALLED: Steel ☒

From ft.	To ft.	Dia. in.	Gage or Wall
+2	365	18	5/16
	see reverse		

(8) PERFORATIONS: see reverse

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ If yes, to depth 0 - 130 ft.
Were strata sealed against pollution? No ☒
Method of sealing cement grout

(10) WATER LEVELS:
Depth of first water, if known 78 ft.

(11) WELL TESTS: Anderson Pump Co.
Was well test made? Yes ☒ If yes, by whom? Chowchilla
Type of test: Pump ☒
28 ft. drawdown
3052 gal/min
Chemical analysis made? No ☒
Was electric log made? No ☒

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 (REV. 12-64)

(12) WELL LOG: Total depth 647 ft. Completed depth 647 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	4	Soil.
4	18	Brown clay.
18	21	Brown sand and cobbles.
21	47	Gravel, cobbles and boulders.
47	54	Yellow clay.
54	77	Gravel, cobbles and boulders.
77	82	Gray clay.
82	92	Blue clay.
92	100	Boulders and gravel.
100	104	Yellow silt and gravel.
104	106	Boulders.
106	109	Small gravel.
109	112	Cobbles and gravel.
112	113	Gray clay and gravel.
113	125	Gravel and cobbles.
125	141	Red clay.
141	189	Cobbles and sand.
189	191	Gray clay.
191	194	Cobbles and sand.
194	199	Brown clay.
199	202	Blue clay (joint).
202	209	Brown clay.
209	216	Cobbles and sand.
216	218	Brown clay and cobbles.
218	228	Gravel and cobbles.
228	231	Sandy brown clay and cobbles.
231	233	Gravel and cobbles.
233	239	Yellow brown clay.
239	280	Gravel and cobbles.
280	284	Yellow brown clay.
284	300	Gravel and cobbles.
300	309	Yellow brown clay.
309	328	Gravel and cobbles.
328	338	Yellow brown clay.
338	342	Gravel and cobbles.
342	350	Yellow brown clay.
350	353	Blue clay.
353	354	Gravel and cobbles.

Well log continued on reverse.

Work started 18 Feb 1965. Completed 11 May 1965

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed Original report signed Bill Belknap (Well Driller)
NAME Bill Belknap
Address 9274 South Buttonwillow
City Reedley
License No. 106833 Date of this report 10 May 65

Well log continued...

from (ft.)	to (ft.)	Formation
354	365	Blue clay.
365	369	Brown clay.
369	372	Boulders and clay.
372	383	Brown clay.
383	386	Boulders.
386	404	Sand and gravel, some boulders.
404	435	Brown clay.
435	471	Cobbles.
471	474	Yellow brown clay.
474	488	Sand and gravel and cobbles.
488	508	Yellow brown clay.
508	513	Sand and gravel, some cobbles.
513	521	Yellow brown clay.
521	532	Gravel and cobbles.
532	540	Yellow brown clay.
540	549	Gray clay (jointy).
549	582	Blue clay.
582	584	Gravel.
584	586	Yellow brown clay.
586	609	Gravel and cobbles.
609	611	Gray clay.
611	627	Gravel and boulders.
627	636	Gray clay.
636	640	Gravel.
640	647	Brown clay.

Figure C-4. Pleasanton Well 6 Report

A well pump efficiency test was performed at Well 6 in 2019.[2] The well pumped 2,113 gpm with a pumping specific capacity of 119 gpm/ft drawdown.

C.1.3 Pleasanton Well 7

BC reviewed City-provided Well 7 reports and records, including a 1992 well assessment report prepared by Luhdorff and Scalmanini Consulting Engineers (LSCE, 1992). Well 7 was installed in 1967 in the Bernal Subbasin (Figure C-1). The historical pumping rates from Well 7 ranged from 2,000 gpm during a constant-rate pumping test as reported in LSCE (1992) to 4,000 gpm as the maximum well capacity during development after installation (see excerpt below). The well log (Figure C-5) indicates potentially productive aquifer material (sand and gravel) below the completed depth of the well (440 feet), specifically between approximately 465 ft to 495 ft and 600 ft to 650 ft. However, zone sampling was not conducted during drilling of this borehole and so the groundwater quality from these potentially productive intervals is unknown. Prior to including these potentially productive intervals (if present) in the final well screen intervals at the new well sites, each interval would need to characterized by zone sampling to quantify productivity and water quality.

2 See Pumping Efficiency Testing Services (PETS) report

Brown AND Caldwell

During the initial development pumping of Well 7, it was reported that fine sand was continuously produced in small amounts. Development records indicate that the well was pumped at rates as high as 4,000 gpm and was continuously pumped for several days at a constant rate of 2,000 gpm. The sand production was evident during the long constant rate pumping at 2,000 gpm and subsequently, after development, the well produced sand at 400 gpm with a temporary pump installation. The development records indicate that the well had specific capacities of approximately 175 gpm/ft at a rate of 3,000 gpm, and greater than 300 gpm/ft at 1,000 gpm.

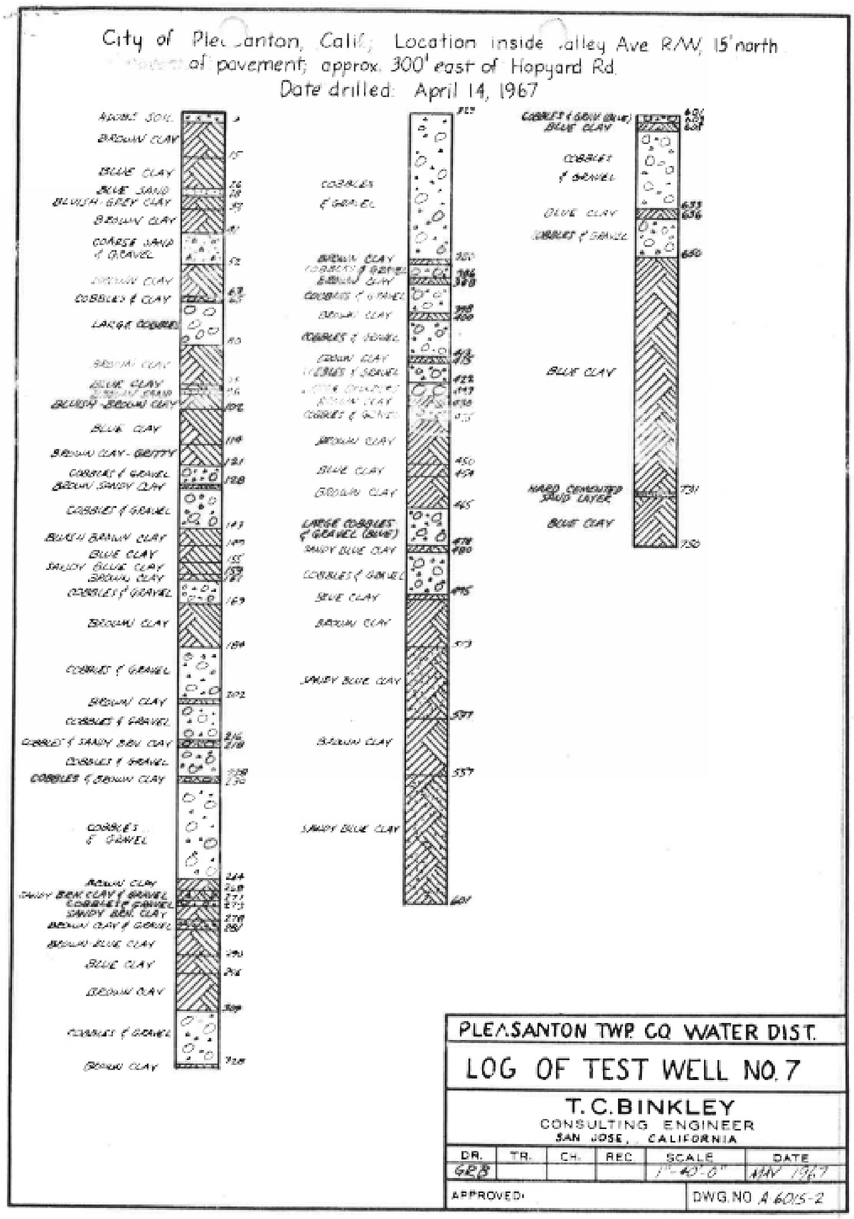


Figure C-5. Pleasanton Well 7 log

In 1991, a pump test was conducted at 1,700 gpm, but given the lack of decline in pumping specific capacity the reduction in yield was determined to be the result of pump wear. In 1992, LSCE performed two pumping tests at 1,300 and 1,370 gpm with pumping specific capacity of approximately 340-gpm/ft drawdown, which is comparative to the values from test pumping, post installation.

C.1.4 Zone 7 Hopyard 6

Hopyard 6 was installed in 1987 and is located in the Bernal Subbasin (Figure C-1). Well construction information summarized below is from DataMart (2023). Hopyard 6 is constructed in the Lower Aquifer. The constructed well depth is 500 ft with an 18-inch-diameter casing. The top of screen is 158 ft depth and bottom of screen is 490 ft depth. Limited well production data was available from Zone 7 and included an operational pumping flow rate of 3,750 gpm with no water level information.

C.1.5 Zone 7 Hopyard 9

Hopyard 9 was installed in 1999 and is located in the Bernal Subbasin (Figure C-1). Well construction information summarized below is from DataMart (2023). Hopyard 9 is constructed in the Lower Aquifer. The constructed well depth is 315 ft with an 18-inch-diameter casing. Post installation depth to water was 57 ft. The top of screen is 235 ft depth and bottom of screen is 310 ft depth. Recent well production data was available from Zone 7 and included an operational pumping flow rate of 1,100 gpm with a pumping water level of 160 ft. Static (non-pumping) water level was 65 ft and is slightly deeper than when the well was installed (57 ft.).

C.2 Pumping Specific Capacity

Wells in the Bernal Subbasin typically have pumping specific capacity values >100-gpm/ft drawdown and up to 300+ gpm/ft drawdown (Table C-1). The exception is Hopyard 9 with a pumping specific capacity of ~10-gpm/ft drawdown; however, this could be due to the wells shorter screened interval as compared with other wells in Table C-1.

C.3 Reported Groundwater Levels

Historical groundwater levels were obtained from LSCE, DWR, and the Alternative Groundwater Sustainability Plan (Alternative GSP). Significant aquifer water level declines were reported by LSCE (1992) for the Bernal Subbasin based on observed water levels at Pleasanton Well 7 for a limited period (Figure C-6). BC searched the DWR's groundwater live portal and found groundwater level data from a well in the Amador Subbasin just north of Pleasanton Well 5 and 6 (Station 376820N1218701W001) which covers a longer period (Figure C-7). The same decline was observed in the late 1980s and early 1990s at this well, however, water level data is observed to recover in the 2000s with cyclical declines in between.

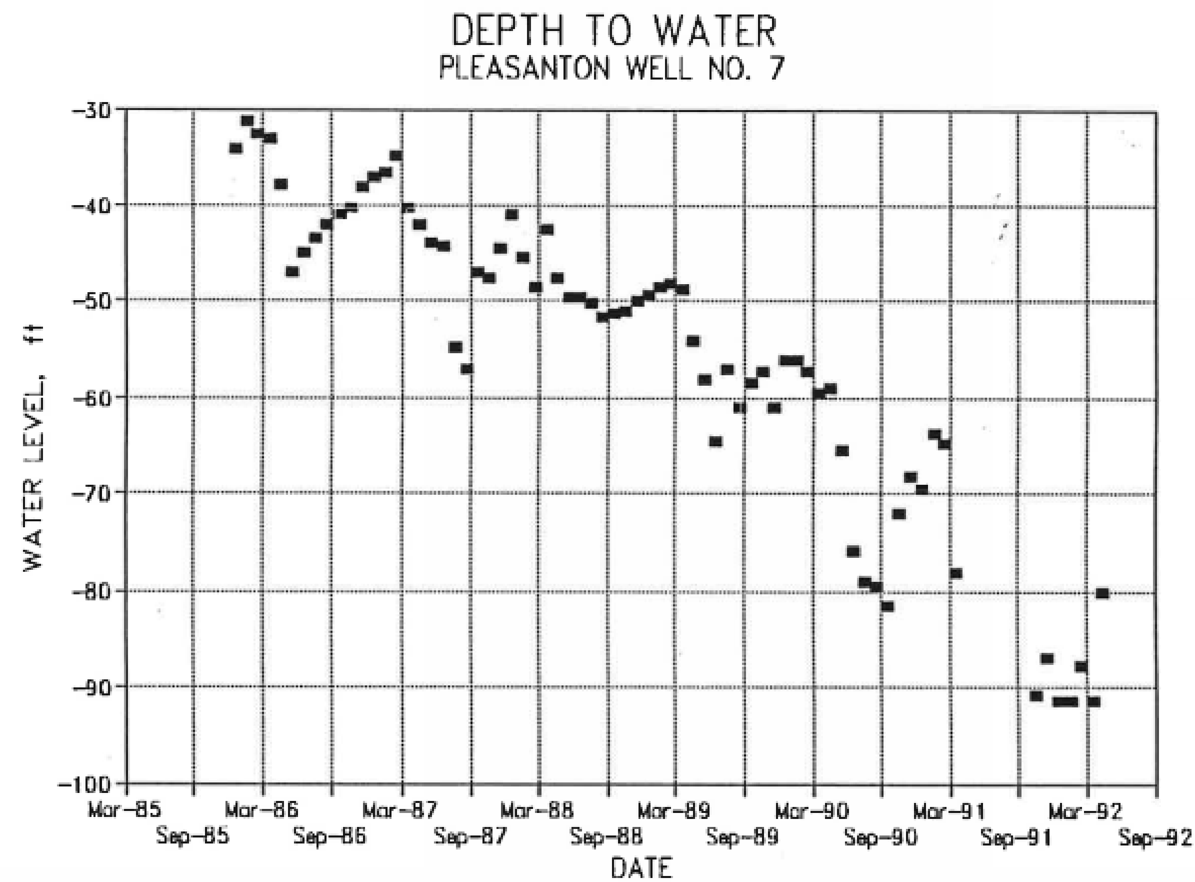


Figure C-6. Depth to Water at Well 7 taken from LSCE, 1992

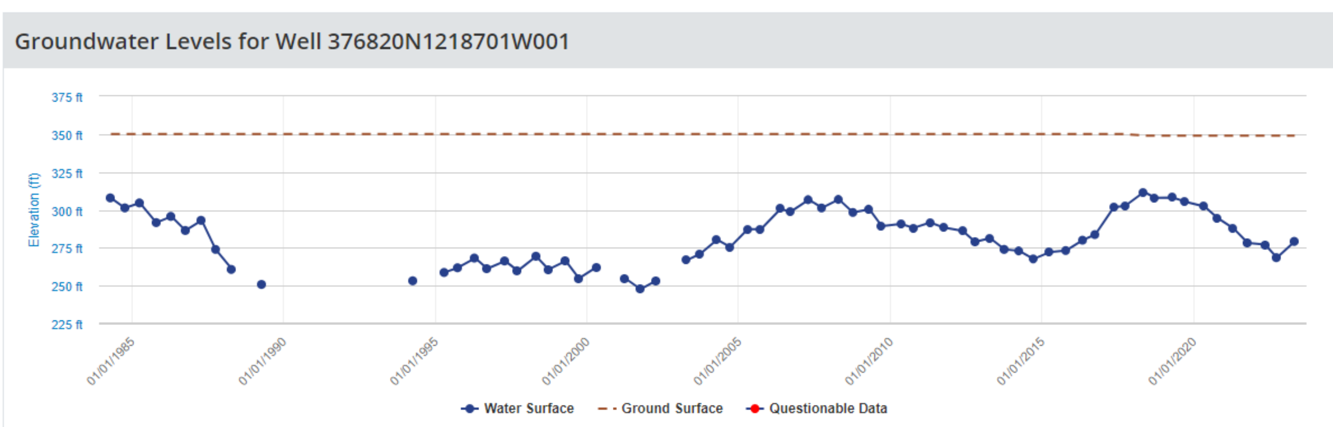


Figure C-7. Depth to Water at Well 376820N1218701W001 taken from DWR data portal

The 20-year Groundwater Level Trends map (created by DWR) was utilized to review groundwater level trends within the Livermore Valley Groundwater Basin. In total, nine monitoring wells are included in the dataset. The data indicates seven shallow monitoring wells (<180 ft depth) have no trend in groundwater levels over the last 20 years. However, the two deepest monitoring wells (>300 ft) in the database both show declining groundwater levels; one declining at a rate up to 2.5 feet/year and one declining at greater than 2.5 feet/year. These two deep monitoring wells are located in the central part of the basin.

Additionally, BC reviewed the Alternative GSP for the Livermore Valley Groundwater Basin prepared by Zone 7 (2021) and specifically the key wells hydrographs for 1975-2020. This review concluded that most short-term fluctuations in groundwater levels in the Main Basin, which encompasses the Bernal Subbasin, are attributed to seasonality. However, longer duration cycles of water level declines and increase are reflective of sustainable groundwater management practices within the basin.

Despite the magnitude of wells assigned no trend in the 20-year Groundwater Level Trends map and the findings from the Alternative GSP, water level declines are a major consideration and factor particularly for the Lower Aquifer and are recommended for additional analysis in the comprehensive well siting study. If they are occurring, water level declines in the Lower Aquifer could have a negative impact on potential productivity for any new wells drilled and installed in the area. This is one reason for drilling the new wells deeper and characterizing the potential productivity and water quality below the current well depths in the Lower Aquifer.

References

Luhdorff and Scalmanini Consulting Engineers (LSCE), 1992. Well Assessment Report for Pleasanton Well 7. Prepared for the City of Pleasanton.

Pumping Efficiency Testing Report (PETS), 2019. Pleasanton Well 6. November 13, 2019.

Datamart, 2023. Zone 7 well database.

California Department of Water Resources, 2023. California's Groundwater Live maps (https://sgma.water.ca.gov/CalGWLive/#groundwater). Visited October 25, 2023.

Carollo, 2021. City of Pleasanton PFAS Treatment and Wells Rehabilitation Project Basis of Design Report.

Zone 7 Water Agency, 2021. Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin.

Appendix D: Groundwater Modeling

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Appendix D: Groundwater Modeling Analysis

D.1 Introduction

Brown and Caldwell (BC) performed solute transport modeling described in this report on behalf of the City of Pleasanton (City). BC performed the modeling using a pre-existing groundwater flow and transport model developed by others and provided to BC by Zone 7 Water Agency (Zone 7) (Kennedy Jenks, 2022). BC used this pre-existing model in evaluating pumping scenarios as part of the City's Water Supply Alternatives Study (Study). The model was used without modification to evaluate potential effects of the pumping scenarios from the distribution of the existing per- and polyfluoroalkyl substances (PFAS) plume in the upper and lower aquifers of the Livermore Valley groundwater basin (LVGB) in the vicinity of the City. This appendix describes the methods and results of this evaluation.

D.1.1 Model Objectives

The objectives of the modeling analysis are to:

- Update the existing groundwater flow and solute transport model to reflect potential revisions to existing City well pumping rates, and to include additional potential pumping well locations in the western portion of the LVGB that are being considered as potential new well locations.
- Use the updated model to assess the potential degree of impact over time on groundwater levels and groundwater quality from PFAS migration to the potential new well locations.

D.1.2 Background

In 2014, California enacted the Sustainable Groundwater Management Act. This legislation designated Zone 7 as the exclusive Groundwater Sustainability Agency for groundwater basins within its boundaries. Zone 7 has a role in all or portions of three groundwater basins. The LVGB (DWR 2-10) spans the central part of the valley, and portions of the basin exist under the cities of Dublin, Livermore, and Pleasanton. Zone 7 has prepared a 5-year updates of the Alternative Groundwater Sustainability Plan (Alternative GSP) for the LVGB (Zone 7, 2021).

The Livermore Valley groundwater model (LVGM) is a regional-scale groundwater flow and solute transport model originally created by CH2M Hill in 1996. The original LVGM was created from a finite difference model developed in the 1980s for groundwater management purposes (CH2M Hill, 2003). In 2014, HydroMetrics Water Resources Inc. (HydroMetrics) revised the original three-layer CH2M Hill LVGM to 10 layers to provide representation of the underlying aquifer-aquitard structure of the LVGB and to allow for solute transport modeling (HydroMetrics, 2017). Kennedy Jenks adapted the model from HydroMetrics in 2022 for further flow and solute transport analysis for Zone 7 (Kennedy Jenks, 2022).

The previous groundwater models were developed using available hydrogeologic data in the area and information obtained from the prior modeling efforts (Kennedy Jenks, 2022). Figure D-1 denotes the LVGB vicinity and municipal well locations for various municipal supply well owners, including the City, Zone 7, San Francisco Water District (i.e., San Francisco Public Utilities Commission), and Cal Water Service. It also displays two potential additional pumping well location options in the west and southwest portion of the LVGB, and surface water bodies simulated in previous modeling (Kennedy Jenks, 2022).

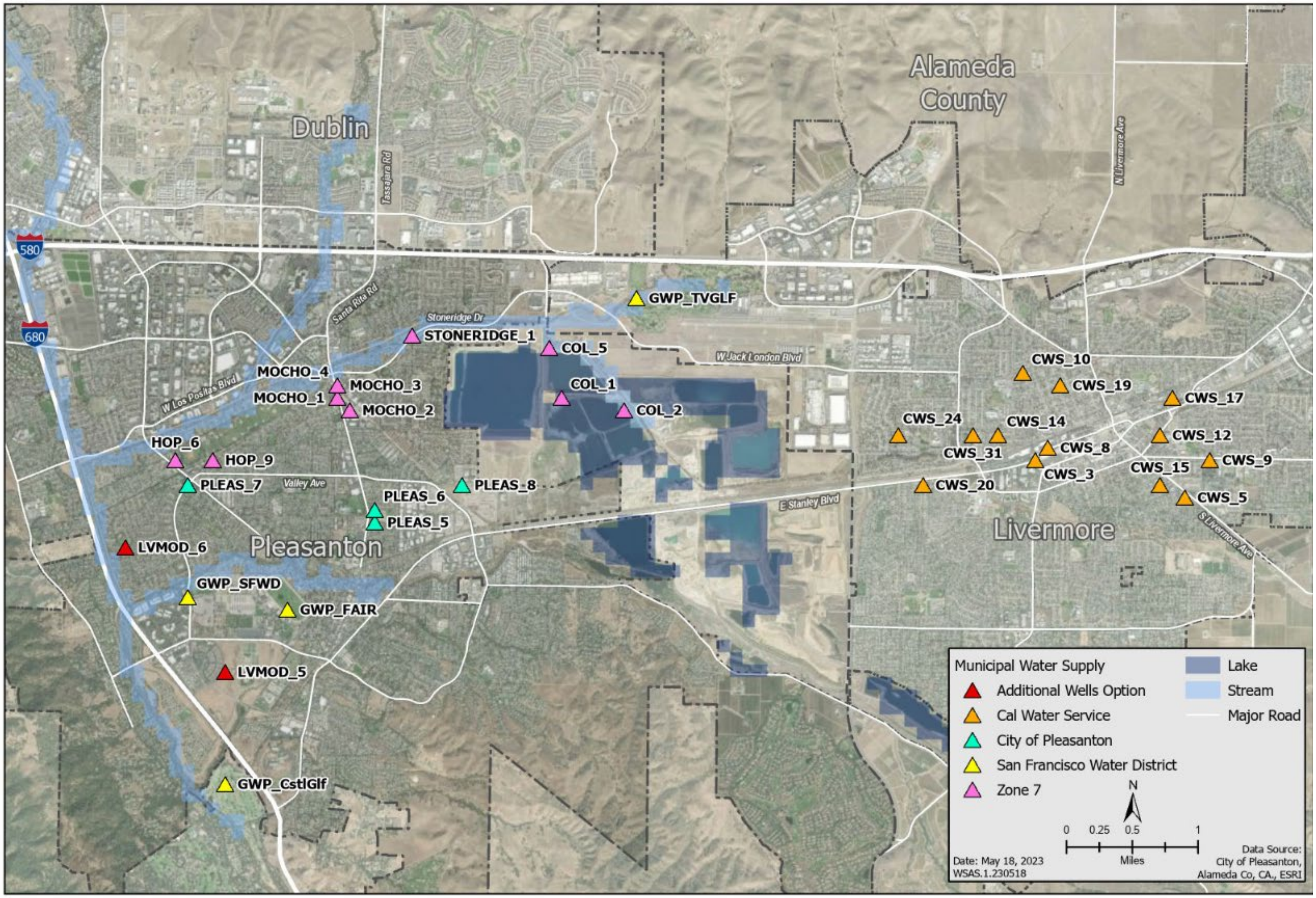

Figure D-1. Livermore Valley groundwater basin site map

D.1.3 2022 Zone 7 Pumping Scenarios

The Kennedy Jenks (2022) modeling for Zone 7 included evaluation of five pumping scenarios, of which three are relevant to the City evaluations (Table D-1):

- Scenario 1: Baseline
- Scenario 4: Pump and treat PFAS wells with reinjections
- Scenario 5: Pump and treat PFAS wells

Zone 7's 2022 modeling of each scenario consistently assumed a 3-year drought at the beginning of the simulation for comparison purposes (Kennedy Jenks, 2022). Scenario 1 reflects average pumping conditions for Zone 7 wells over the 20-year simulation period. The PFAS pump-and-treat system at Zone 7's Chain of Lakes facilities is also included in Scenario 4, along with the addition of re-injection of water extracted at the Mocho 4 well into the Mocho 1 well. Scenario 4 also includes an increased pumping rate over the entire 20-year period. Scenario 5 increases the Zone 7 pumping rate during the 3-year drought period followed by average pumping for 17 years, and includes treatment for Zone 7 wells at a PFAS pump-and-treat system at Zone 7's Chain of Lakes and at the Mocho Groundwater Demineralization Plant. The three Zone 7 pumping scenarios were simulated with modifications related to potential City well operations (referred to as City 2023 Pumping Scenarios), as described further in Section D.2.9. Modifications were not made to the Zone 7 assumptions for the scenarios, which are summarized in Table D-1.

Table D-1. Kennedy Jenks (2022) Pumping Scenarios

Scenario	Title	Description	Recharge (AFY)	Zone 7 Pumping Rate (AFY)
1	Baseline	Zone 7's 5-year average well production (2016-2020)	---	20 years of average pumping rate (6,900 AFY)
4	Pump + treat PFAS wells with reinjection	Treatment of PFAS at Chain of Lakes and injection of water from Mocho 4 into Mocho 1	5,400 AFY at Mocho 1	20 years of higher pumping rate (15,360 AFY)
5	Pump + treat PFAS wells	Treatment of PFAS at Chain of Lakes and at the Mocho Groundwater Demineralization Plant	---	3 years higher rate (24,000 AFY) + 17 years average (6,900 AFY)

AFY = acre-feet per year

D.2 Model Construction

The following section describes the LVGM construction based on previous reports from Kennedy Jenks (2022) and HydroMetrics (2017), unless otherwise noted in the following sections. The previous model construction and calibration were not revised or updated for this evaluation. As such, limitations and assumptions described in the Kennedy Jenks (2022) and HydroMetrics (2017) reports for the LVGM are applicable to this modeling evaluation.

D.2.1 Modeling Codes and Simulation Time Period

Groundwater flow was simulated using MODFLOW-NWT (Niswonger et al., 2011) to remain consistent with previous modeling work. The United States Geological Survey (USGS) MODFLOW-NWT is based on the USGS finite difference code MODFLOW (McDonald and Harbaugh, 1988) with an improved solver for unconfined groundwater flow problems. The transport of dissolved constituents was simulated using MT3D-USGS, as consistent with previous modeling (Bedekar et al., 2016). MT3D-USGS simulates groundwater solute transport using a modified version of the advection-dispersion equation. The transport simulation is linked to the groundwater flow simulation by reading an output file from MODFLOW-NWT that contains groundwater flow and velocity data.

Each City model scenario simulates a period of 10 years of pumping. This is reduced from the Kennedy Jenks model 20-year simulation period. This reduction allows management of model run times, while meeting the City's modeling objectives. To evaluate projected areas of impact from the simulated PFAS plume, a 10-year simulation was determined to be sufficient.

D.2.2 Model Domain and Grid

The Kennedy Jenks model domain and grid spacing was not changed for this analysis. The grid spacing consists of a uniform 500-foot (ft) by 500-ft grid throughout the LVGB (Kennedy Jenks, 2022). Figure D-2 illustrates the LVGM domain and grid spacing with various analytical elements, including lakes, rivers, and municipal wells. The small area in the eastern portion of the LVGM domain represents an area where no groundwater flow is present due to rock outcropping, and is not included in the active model domain. The outer boundaries of the LVGM encompass the Bernal, Amador, Mocho II, Castle, Dublin, Camp and Bishop subbasins.

D.2.3 Model Layering

The LVGM consists of 10 layers, as summarized below and shown in Figure D-3:

- Layer 1 represents a lacustrine clay deposit present only on the western side of the basin.
- Layers 2 and 4 represent the coarse-grained upper aquifer.
- Layer 3 represents a thin, fine-grained unit within the upper aquifer.
- Layer 5 represents the main aquitard dividing the upper and lower aquifers.
- Layers 6, 8, and 10 are coarse-grained, lower aquifer units.
- Layers 7 and 9 represent thin, fine-grained units within the lower aquifer.

The thin, fine-grained units in the upper and lower aquifers aid in resistance to vertical solute transport (HydroMetrics, 2017). BC did not alter these layering assumptions for this analysis.

D.2.4 Hydraulic Boundary Conditions

The Kennedy Jenks boundary conditions were unchanged for this analysis. The edges of the model are represented as no-flow boundaries due to the presence of bedrock. The top of the model is set to a specified flux to represent natural recharge into the groundwater basin (HydroMetrics, 2017).

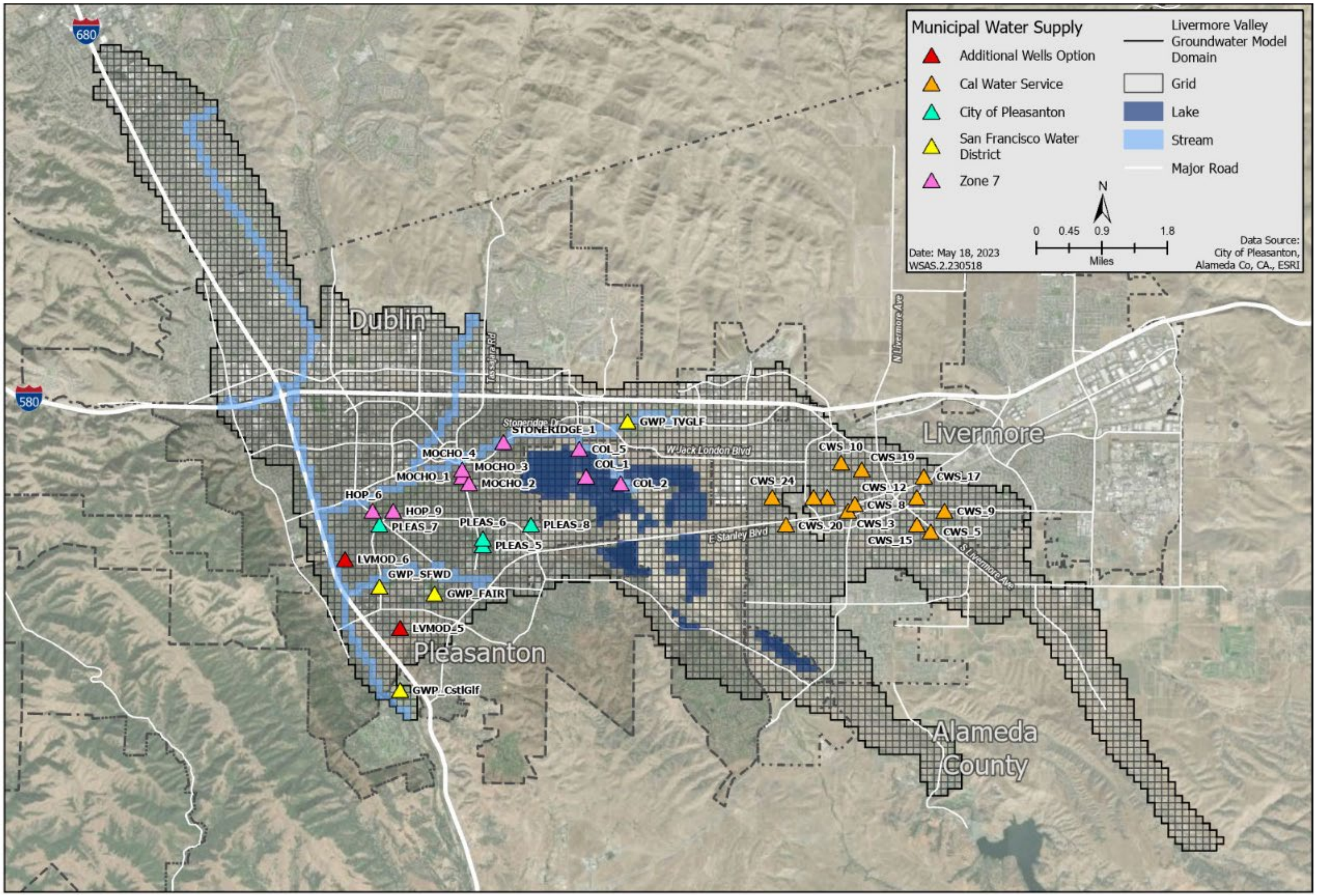

Figure D-2. Livermore Valley groundwater model domain and grid

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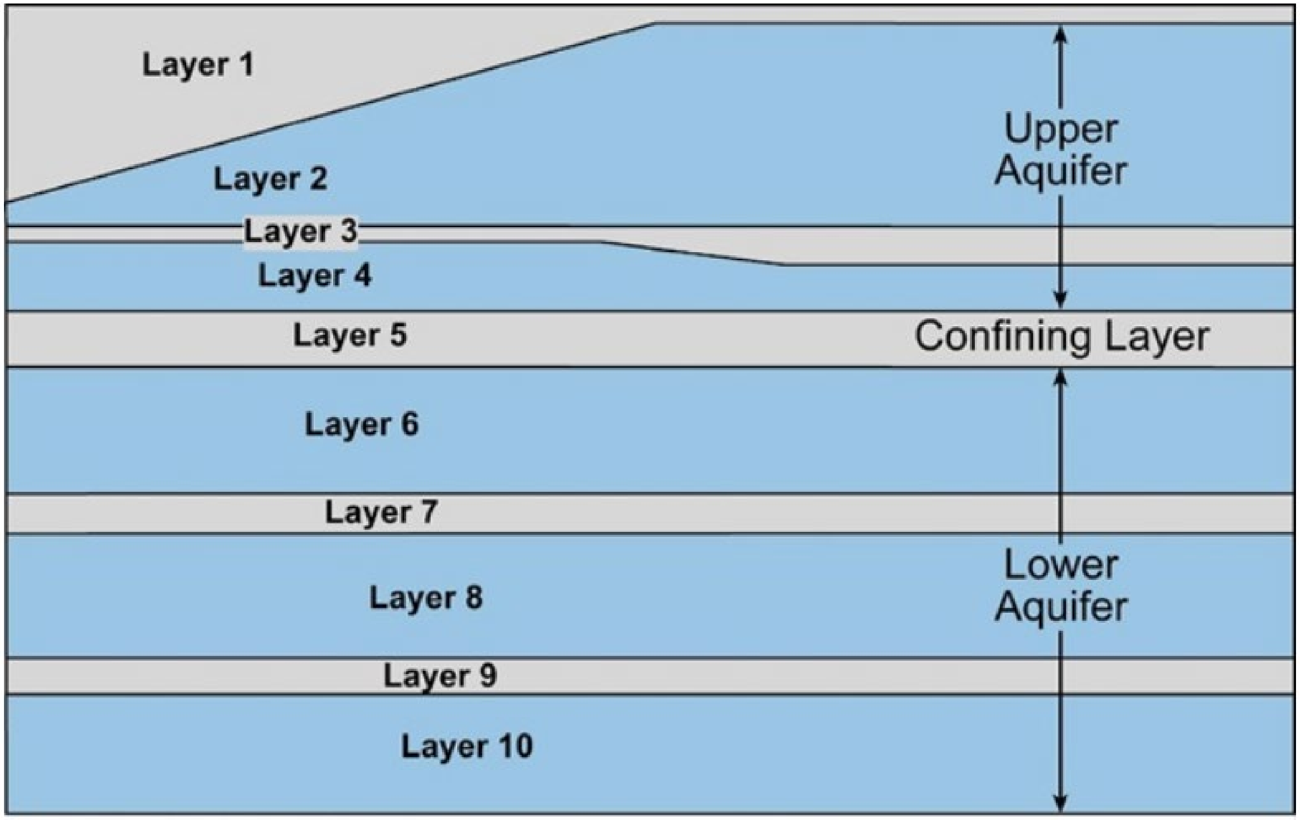

Source: Modified from Hydro Metrics, 2016.

Figure D-3. Schematic of 10-layer groundwater model

Source: Zone 7, 2021

D.2.5 Recharge and Pumping

Natural recharge rates and non-City pumping were unchanged from the Kennedy Jenks model. Natural recharge occurs from streams and rainfall and is decreased during drought conditions in the simulations. Pumping rates of municipal wells vary by Scenario as described in Table D-1. Modifications were made to existing City well pumping rates for all City model scenarios. Specifically, pumping rates in all scenarios for existing City wells was set to zero. Figure D-4 illustrates the pumping rates in the existing municipal wells throughout the LVGB for the City baseline (Scenario 1), and Years 4 through 20 in model Scenario 5.

Figure D-5 shows higher pumping rate conditions simulated for existing wells for the duration of Scenario 4, as well as injection at Zone 7 municipal well Mocho 4. Pumping rates for Years 1 through 3 for Scenario 5 are similar to the higher-rate pumping conditions shown in Figure D-5, with the exception of no injection at Mocho 4.

D.2.6 Hydraulic Parameters

Hydraulic parameterization was maintained from the Kennedy Jenks model. Horizontal hydraulic conductivity ranges from approximately 0.1 feet per day (ft/day) in the fine-grained aquitard units to 1,820 ft/day in the coarse-grained aquifer units. Vertical hydraulic conductivity is one tenth of horizontal hydraulic conductivity.

D.2.7 Solutes Simulated

The solute transport model includes simulation of PFAS. Initial PFAS concentrations remained unchanged from the Kennedy Jenks model. It is assumed in the transport model that PFAS behaves as a conservative solute. It is, therefore, not affected by adsorption or desorption to or from the soil, or degradation. It is also assumed the PFAS source is no longer active. In the state of California, the notification limit for PFAS is 3 parts per trillion (ppt) (California State Water Resources Control Board [SWRCB], 2023). To align with this notification limit, the presentations of simulation results use 3 ppt as the lower limit for the predicted PFAS plume extent.

Model-projected PFAS groundwater concentrations are intended to be used as a tool to evaluate relative changes in the extent of PFAS contamination between modeled scenarios. Due to the model's inability to simulate the complex fate and transport mechanisms of PFAS, model-projected PFAS concentrations should not be used to evaluate absolute PFAS concentrations.

D.2.8 Transport Parameters

Transport parameters were unchanged from the Kennedy Jenks model and are summarized in Table D-2.

Table D-2. Groundwater Model Transport Parameters

Parameter	Value
Effective porosity	0.25
Longitudinal dispersivity	1,000 ft
Transverse dispersivity	100 ft
Vertical dispersivity	10 ft

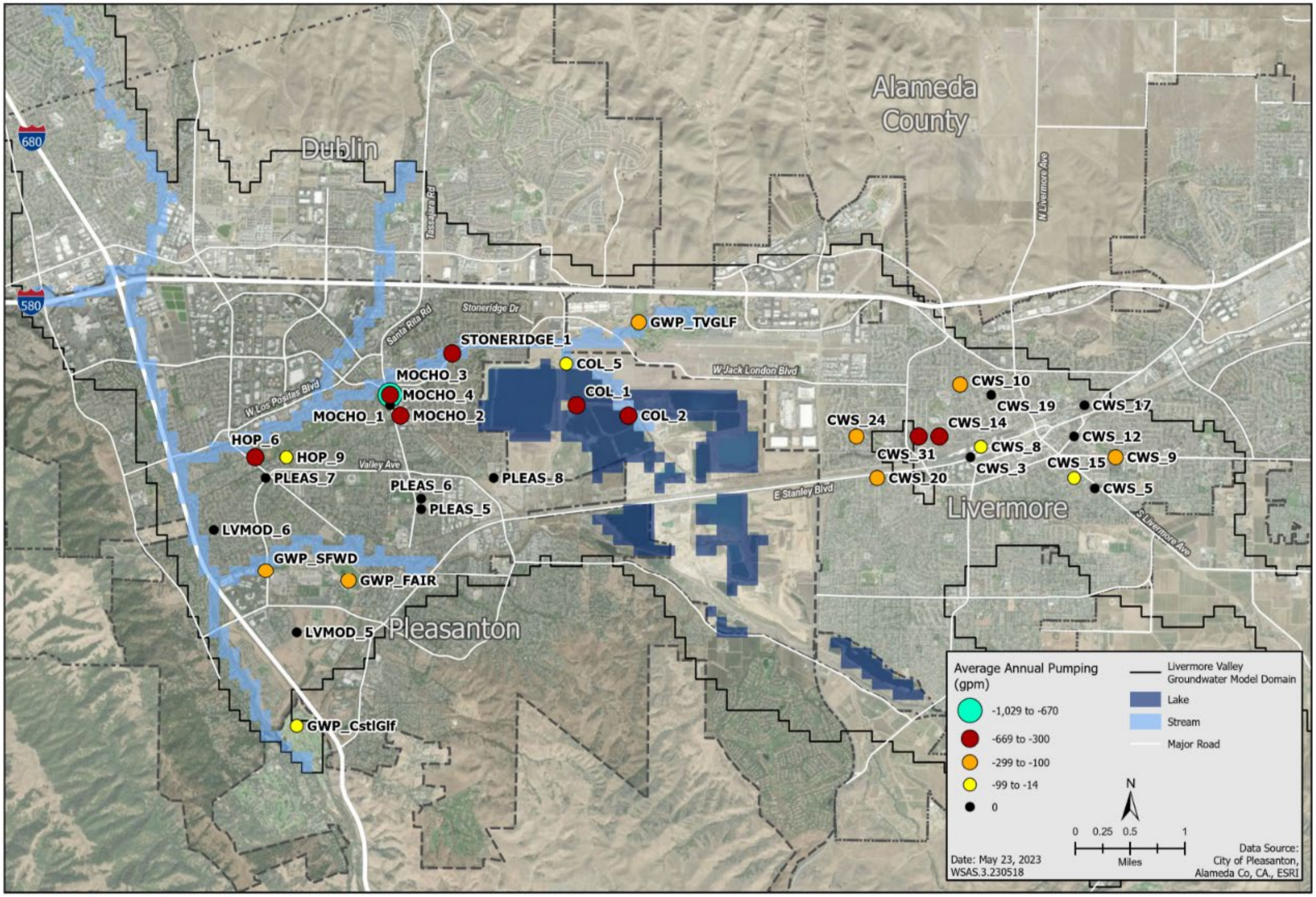

Figure D-4. Livermore Valley groundwater model pumping and recharge, Kennedy Jenks (2022) Scenario 1

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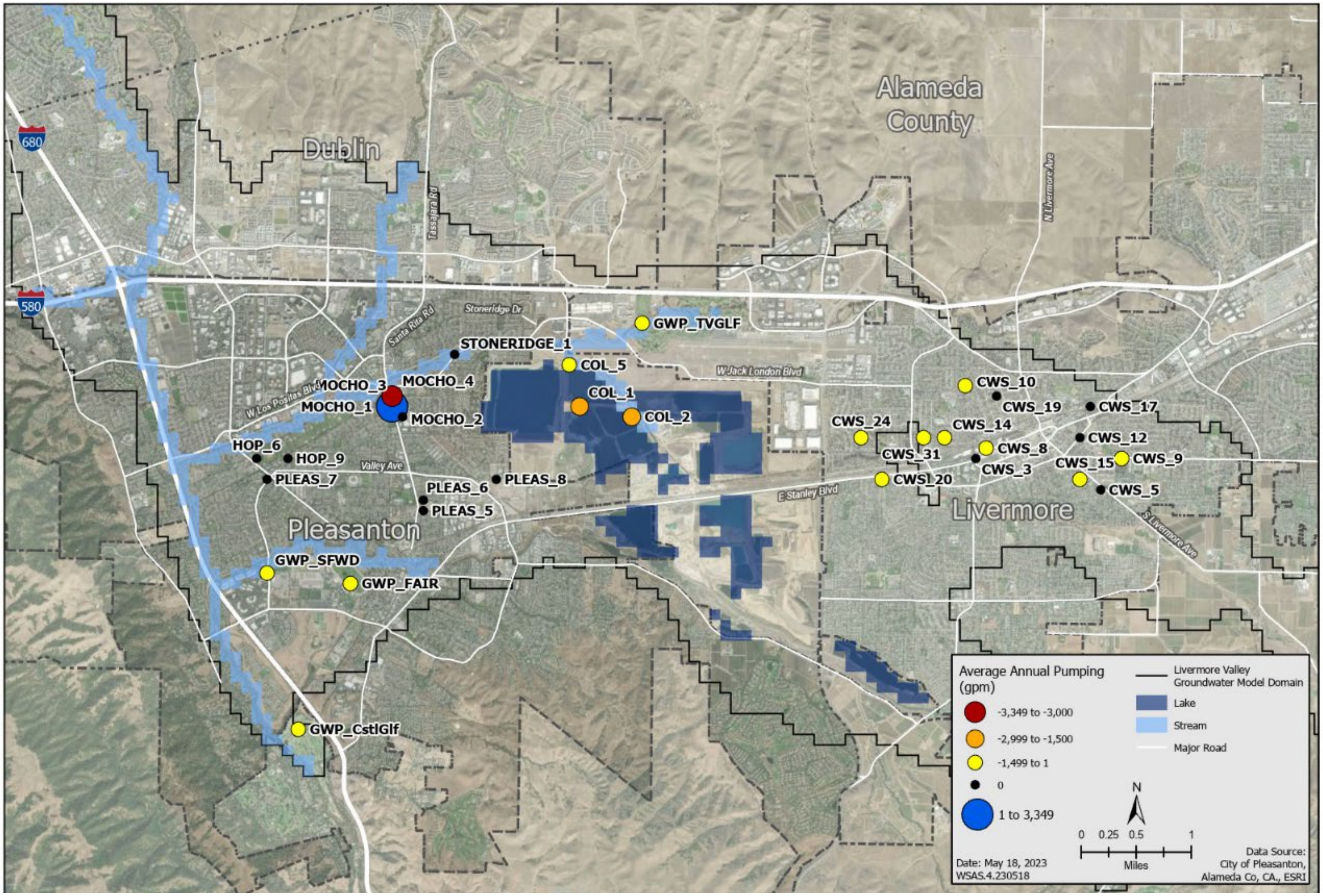

Figure D-5. Livermore Valley groundwater model pumping and recharge, Kennedy Jenks (2022) Scenario 4

D.2.9 2023 City Model Scenario Options

Multiple alternative options for Scenarios 4 and 5 were considered to assess the best locations and seasonal pumping schedules for two new additional City wells in the western portion of the basin. After initial consideration, Option one locations were not deemed accessible and are eliminated from further discussion in this document. Option 2 locations were selected for further consideration and applied to City modeling and are identified on Figure D-1 as LVMOD_5 and LVMOD_6.

The two new City wells identified under Option 2 were further evaluated under two conditions related to seasonal variations in pumping, as described in Table D-3 as Options 2a and 2b. Both options were simulated using the original Kennedy Jenks model Scenarios 4 and 5 with both the new potential supply wells and modifications to existing City wells described in Section D.2.5 added. The new wells were not added to the baseline (Scenario 1). Assumptions related to new well construction are based on existing City municipal wells, which are screened in the lower aquifer.

The total simulated annual yield for each additional well was assumed to be 1,750 acre-feet per year (AFY) each, to produce a total additional yield of 3,500 AFY based on City-desired additional yield. In Option 2a, pumping from the additional wells is spread throughout the year with varying rates for each month based on existing seasonal supply well operation schedules, with total combined extraction per year totaling 3,500 acre-feet (AF). In Option 2b pumping from the additional wells is limited to the dry season months, with total combined extraction per year totaling 3,500 acre-feet (Table D-3). For Scenario 5 Options 2a and 2b, the new well pumping rates were higher during drought years 1 to 3, consistent with the existing wells in Scenario 5. All other parameters remained consistent with the Kennedy Jenks model scenarios.

Table D-3. 2023 City Model Scenario Options

Option	Description	Total Months Pumped per Year	Individual Additional Well Pumping Rates (gpm) [a]			
			Scenario 4		Scenario 5	
			Wet Season (6 months)	Dry Season (6 months)	Wet Season (6 months)	Dry Season (6 months)
2a	Wet and Dry Season Pumping	12	330	1,870	330	1,870
2b	Dry Season Pumping Only	6	0	2,200	0	2,200

a. *From Kennedy Jenks (2022)*

D.3 Simulation Results

The following section discusses the flow model simulation results produced from the City modelling effort. Model projected results are intended to only be used for comparative purposes between model scenario options. This discussion is focused on results of Scenarios 4 and 5 to allow comparison of the new well options. The baseline (Scenario 1) is not discussed.

D.3.1 Projected Groundwater Elevation Results

Model-projected groundwater elevations for the 2023 Scenarios 4 and 5 with Options 2a and 2b added are summarized in the following sections.

D.3.1.1 Upper Aquifer

The simulated groundwater elevation contours at the end of the 10-year period for the upper aquifer in the LVGB for Scenario 4 Options 2a and 2b, and Scenario 5 Options 2a and 2b, are shown in Figure D-6. For both scenarios, the difference in head between Options 2a and 2b throughout the LVGB is minimal. This suggests pumping only during the dry season in Option 2b in wells LVMOD-5 and LVMOD-6 does not influence the basin groundwater elevations significantly from pumping year-round at the two wells. Due to the reinjection at Mocho 1 during Scenario 4, there is an approximate 10-ft-higher groundwater elevation in the central portion of the LVGB than simulated in Scenario 5 without reinjection occurring (Figure D-6).

D.3.1.2 Lower Aquifer

The simulated groundwater elevation contours at the end of the 10-year period for the lower aquifer in the LVGB for Scenario 4 Options 2a and 2b, and Scenario 5 Options 2a and 2b, are shown in Figure D-7. A groundwater divide can be seen in the central portion of the LVGB, with a no-flow zone dividing the northern and southern subbasins. Similar to the upper aquifer, the difference in head between Options 2a and 2b throughout the LVGB is minimal for both scenarios.

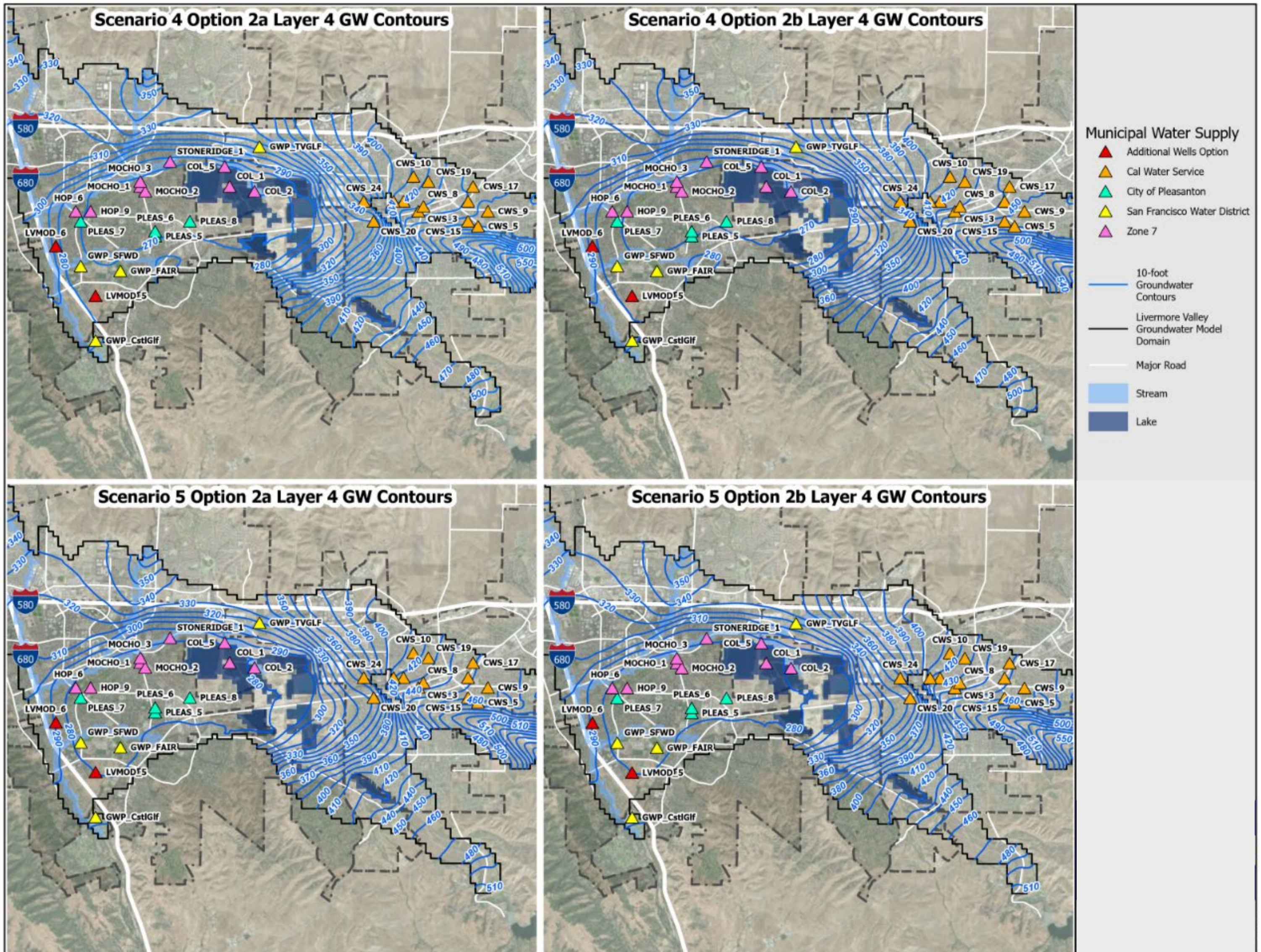

Figure D-6. Upper Aquifer, Layer 4, simulated groundwater elevation contours (feet)

Brown AND Caldwell

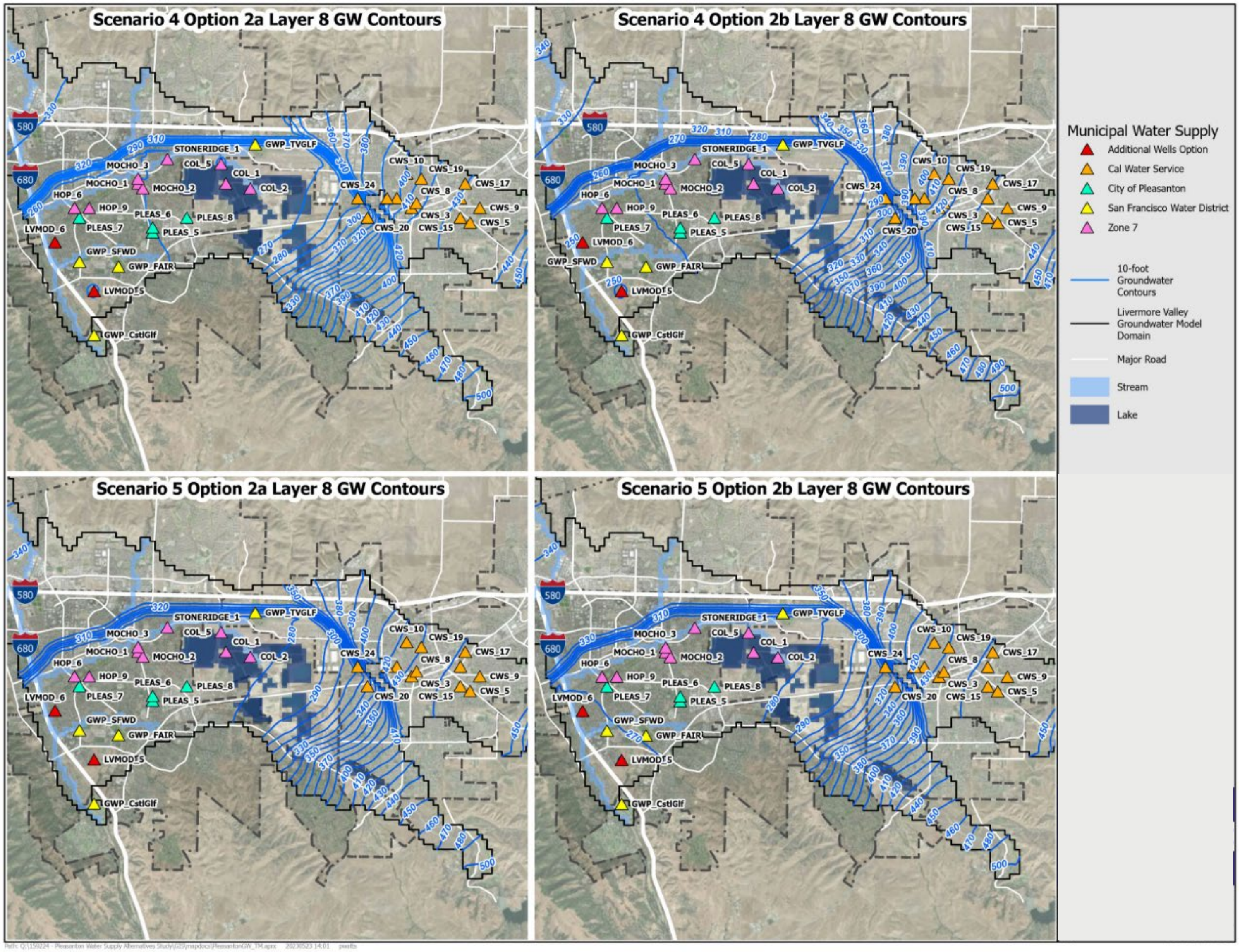

Figure D-7. Lower Aquifer, Layer 8, simulated groundwater elevation contours (feet)

D.3.2 Projected Solute Transport Results

In the 2019 water year, in the 2019 WY Zone 7 began sampling for PFAS, an Environmental Protection Agency (EPA) “contaminant of emerging concern”. Zone 7’s 2021 Alternative GSP update includes a summary of a PFAS levels in both the Upper and Lower Aquifers and planned programs to further monitor and characterize PFAS in the Basin (Zone 7, 2021).

The following section discusses the transport model simulation results produced from the City modelling effort. Model-projected results are intended to only be used for comparative purposes between model scenario options.

D.3.2.1 Upper Aquifer

Figure D-8 shows the projected PFAS concentrations for City Scenarios 4 and 5 Options 2a and 2b at the end of the 10-year simulation period for the upper aquifer in the LVGB. As discussed in Section D.2.7, the lower concentration limit shown for the PFAS plume throughout the simulations is 3 ppt to align with notification limits of the SWRCB (2023).

Similar to the groundwater elevations, the difference in the simulated PFAS plume between Scenario 4 Options 2a and 2b, in the upper aquifer unit throughout the LVGB is minimal. However, a comparison of the simulated PFAS concentrations in Scenarios 4 and 5 show differences in the central portion of the LVGB as well as an increase in the simulated extent of the plume in Scenario 5 in the western portion of the LVGB for both Options 2a and 2b (Figure D-8). The projected PFAS plume extent after a 10-year simulation suggests the additional City well locations, LVMOD-5 and LVMOD-6, may not be affected above the 3 ppt PFAS notification limit.

D.3.2.2 Lower Aquifer Solute Transport Results

The projected PFAS contamination plume for Kennedy Jenks Scenarios 4 and 5 Options 2a and 2b at the end of the 10-year simulation period for the lower aquifer in the LVGB is shown in Figure D-9. As with the upper aquifer results, the lower concentration limit shown for the PFAS plume throughout the simulations is 3 ppt to align with notification limits of the SWRCB (2023).

The difference in the simulated PFAS plume between Scenario 5 Options 2a and 2b throughout the LVGB is minimal. Similar to the upper aquifer, the simulated PFAS plume in Scenarios 4 and 5 show differences in the lower aquifer unit in the central portion of the LVGB as well as an increase in the simulated extent of the plume in Scenario 5 to the west (Figure D-9). The projected PFAS plume extent after a 10-year simulation suggests the additional City well locations (LVMOD-5 and LVMOD-6) may not be affected above the 3 ppt PFAS notification limit. As mentioned, most municipal wells in the basin are screened in the lower aquifer, including the two new LVMOD wells. The wider plume extent seen in the lower aquifer in Figure D-9 in comparison to the plume extent in the upper aquifer in Figure D-8 may be influenced by enhanced groundwater velocities due to the higher pumping withdrawal seen in the lower aquifer from the municipal wells.

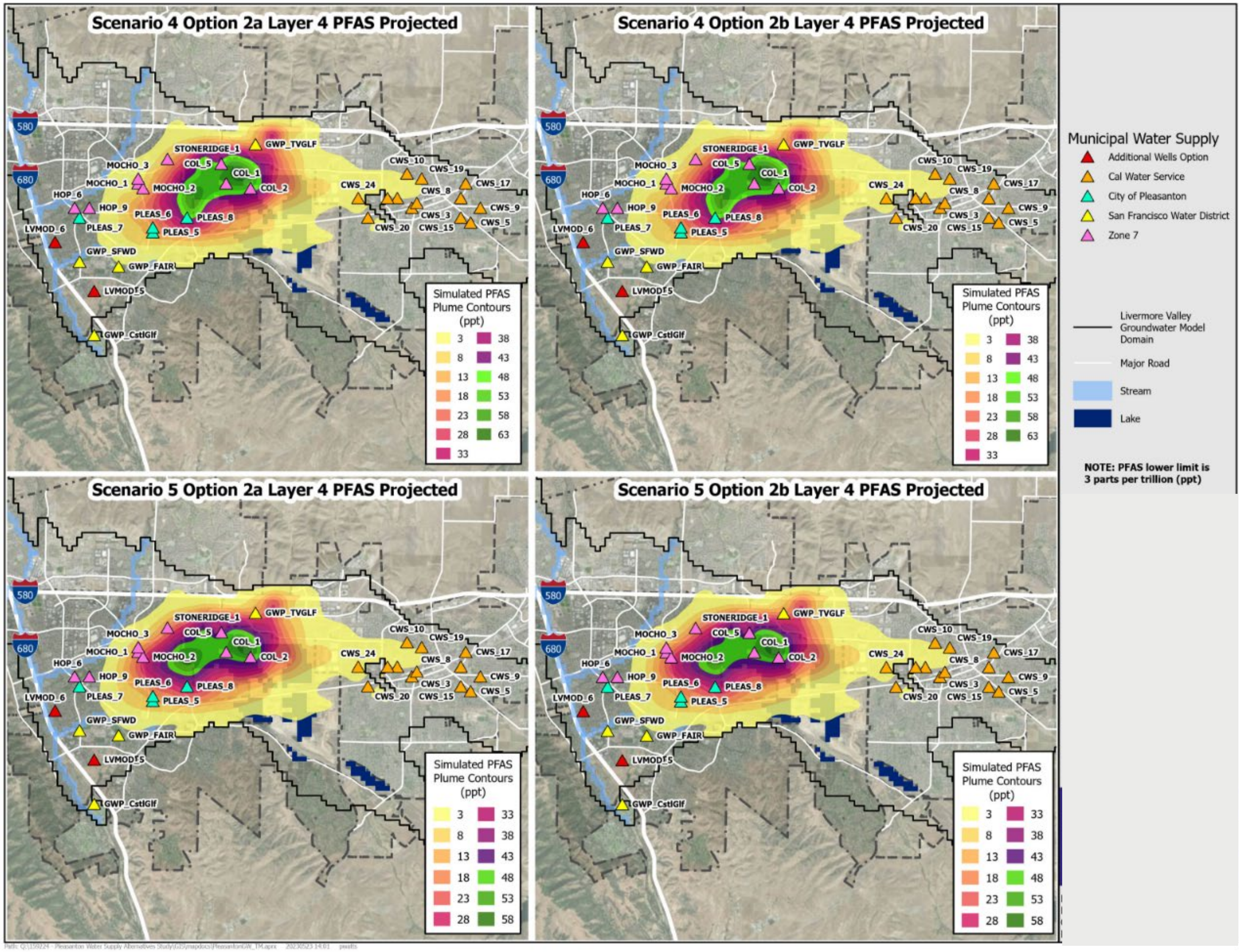

Figure D-8. Upper Aquifer, Layer 4, simulated PFAS concentrations

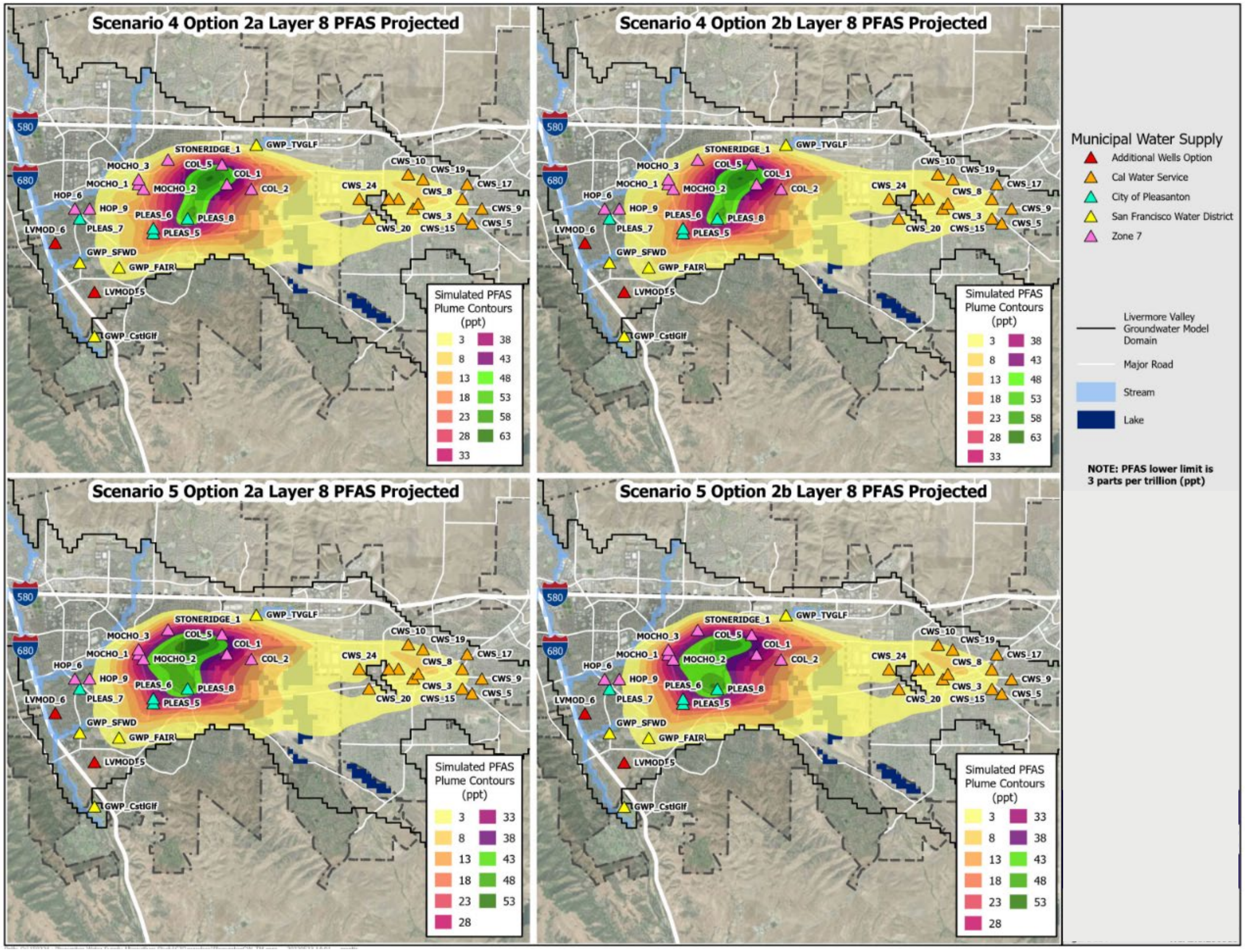

Figure D-9. Lower Aquifer, Layer 8, simulated PFAS concentrations

D.4 Summary and Conclusions

BC conducted groundwater flow and solute transport modeling to assess potential groundwater quality changes from potential additional City municipal supply wells. A groundwater flow and solute transport model was developed by Kennedy Jenks as a previous effort by Zone 7 to characterize the PFAS plume in the water supply alternatives study area. Since the model development, the City altered the pumping at several of its municipal wells and is looking at potential additional new well construction. The modeling evaluation involved altering the multi-network well package in the model and reassessing projected plume extent.

The solute plume figures depict the projected results of the flow and transport model at the end of a 10-year period. As with the Kennedy Jenks model, PFAS is treated as a conservative solute, it is considered persistent in the environment, and sources are not active. The predictions developed using the updated flow and transport assumptions are conservative in that these predictions reflect more rapid movement and spreading of PFAS than would be expected, and the resulting concentrations from these simulations are most likely biased high. Due to the inability of the model to simulate the complex PFAS fate and transport processes, model-projected concentrations are intended to only be used for comparative purposes between City scenario options.

The model results discussed represent a preliminary screening level assessment for the purpose of comparison between new City well location options. To improve model predictions, it is recommended to review PFAS compounds sorption or reaction characteristics with site-specific data for the LVGB and potentially include those parameters in future transport simulations. Incorporating more robust and updated site-specific data, including updating initial PFAS concentrations in the model to current concentrations, would also allow for improved model calibration and predictions.

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Appendix E: Infrastructure Improvements

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CITY OF PLESANTON

TECHNICAL MEMORANDUM

HYDRAULIC ANALYSIS FOR THE WATER SUPPLY ALTERNATIVES

Draft

August 2023

AKEL ENGINEERING GROUP, INC.

AKEL
ENGINEERING GROUP, INC.

August 18, 2023

City of Pleasanton, Engineering Department
P.O Box 520, 200 Old Bernal Avenue
Pleasanton, CA, 94566

Attention: Adam Nelkie, P.E.
City Engineer/Assistant Director of Public Works

Subject: Technical Memorandum – Hydraulic Analysis for the Water Supply Alternatives

We are pleased to submit this technical memorandum documenting the hydraulic modeling and analysis for the Water Supply Alternatives (WSA). This analysis included determining the required infrastructure for the four future water supply alternatives.

1.0 BACKGROUND

As part of the Water Supply Alternatives (WSA) Evaluation, being performed by Brown & Caldwell (B&C), an understanding of the water capacity improvements that will be required for the projected future demands as compared to the improvements required for the water supply alternatives from the WSA Evaluation is needed. This hydraulic analysis will determine if there are other additional/incremental improvements needed for each of the proposed alternatives.

2.0 WATER SUPPLY ALTERNATIVES

The Water Supply Alternatives Evaluation being prepared by B&C included four supply alternatives for the projected demands that are to be included in this hydraulic analysis to determine the required infrastructure improvements. These alternatives are described as follows:

- **Alternative 1 – OSC at Well 8**: This is the baseline alternative and includes recommendations for improvements assuming the existing wells remain active per the PFAS Treatment and Well Rehab Project.
- **Alternative 2 – Well 8**: This alternative assumes Well 8 will operate at 3,500 gpm and no other wells are active.
- **Alternative 3 - Two New Wells**: This alternative includes two new wells at 3,000 gpm each (6,000 gpm total) at the flowing locations:
    - One well in the southwest portion of Bernal Park
    - One well in Del Prado Park

Apart from these two new wells, no other wells would be active.

- **Alternative 4 – No Wells**: Pleasanton would fully rely on Zone 7 to meet all future demands through the turnouts (all wells inactive).

3.0 PROJECTED WATER DEMANDS

The projected demands for the City of Pleasanton (Pleasanton) were extracted from the 2023 Water Distribution System Capacity Master Plan. The projections extend to the year 2045 and include City identified additional growth sites, Approved/Entitled projects, additional dwelling units, the 2023 Housing Element Update, and the East Pleasanton specific plan. The projected annual demand for 2045 is 17.3 mgd and the maximum day demand used for this analysis is 32.9 mgd as documented on **Table 1**.

4.0 EVALUATION CRITERIA

The hydraulic analysis will utilize Pleasanton's water system performance and design criteria to identify system capacity deficiencies for sizing water mains and determining impacts to storage reservoirs and pump stations. **Table 2** documents the performance and design criteria and it includes the maximum allowable pipeline velocities and headlosses along with the minimum and maximum pressure criteria. Additionally, this analysis will assess how the Lower Pressure Zone Tanks (Foothill and Sycamore) operate as there are current operational issues with keeping the tank levels similar during the fill and drain cycles.

5.0 HYDRAULIC MODELING ANALYSIS AND RECOMMENDATIONS

The hydraulic analysis utilized the calibrated hydraulic model to evaluate the system with the projected water demands for each alternative. The current 7-day fill/drain operations will be used and the supply assumptions for each alternative are documented in **Table 3**. This table documents the flow from each turnout and well (if active), the system pressures at each turnout, and the historical Zone 7 pressures assumed for the analysis.

5.1 Alternative 1 – OSC at Well 8

This alternative will require three major transmission mains plus a booster station at Turnout 4 as identified on **Figure 1** to maintain pressures under 90 psi and mitigate the operational challenges with the Foothill and Sycamore tank levels. The recommended improvements are summarized as follows:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road (Replacing the existing 12-inch main)
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road (Replacing the existing 12-inch main)
- 5,200 gpm booster station at Turnout 4

5.2 Alternative 2 – Well 8

This alternative will require the same three major transmission mains as Alternative 1 plus a larger booster station at Turnout 4 as identified on **Figure 2** to maintain pressures under 90 psi and mitigate operational challenges with the Foothill and Sycamore tank levels. The recommended improvements are summarized as follows:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road (Replacing the existing 12-inch main)
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road (Replacing the existing 12-inch main)
- 5,500 gpm booster station at Turnout 4

5.3 Alternative 3 – Two New Wells

This alternative will require 5 major transmission mains plus a booster station at Turnout 4 as identified on **Figure 3** to maintain pressures under 90 psi and mitigate operational challenges with the Foothill and Sycamore tank levels. The recommended improvements are summarized as follows:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road (Replacing the existing 12-inch main)
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road (Replacing the existing 12-inch main)
- 12-inch main in Valley Avenue from Pleasanton to Sunol Boulevard
- 12-inch main in Oak Vista Way from Cotton Mill Way to Valley Avenue
- 16-inch discharge main for the Del Prado well in Hansen Way from the Del Prado well to Valley Avenue
- 5,000 gpm booster station at Turnout 4

5.4 Alternative 4 – No Wells

This alternative will require the same three major transmission mains as Alternative 1, a larger booster station at Turnout 4, and an additional Zone 7 turnout as identified on **Figure 4** to maintain pressures under 90 psi and mitigate operational challenges with the Foothill and Sycamore tank levels. The recommended improvements are summarized as follows:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road (Replacing the existing 12-inch main)
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road (Replacing the existing 12-inch main)
- 16-inch main in Vineyard Ave from Bernal Avenue to First Street
- 16-inch main in First Street from Vineyard Avenue to Bernal Avenue

- 7,000 gpm booster station at Turnout 4
- A new turnout from Zone 7 near Vineyard Avenue and Bernal

6.0 CAPITAL IMPROVEMENT COSTS

Cost estimates presented for the alternatives were prepared for general planning purposes and, where relevant, for further project evaluations. The final costs of a project will depend on several factors including the specific project scope of work, costs of labor and material, and market conditions during construction. Costs developed in this study should be considered “Class 5” and have an expected accuracy range of **-30 percent** and **+50 percent**.

AACE International Recommended Practice No. 56R-08, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Building and General Construction Industries (Rev. August 2020)

Estimate Class	Description	Data Availability and Percent Accuracy
Class 5	This classification is also known as an order of magnitude estimate and is generally intended for long-range capital planning and master plans. This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indices	The data is 0% to 2% complete and includes the location and proposed project. It is generally expected that this estimate would be accurate within -30 percent to +50 percent.

The unit cost estimates used for developing the project costs are summarized in **Table 4** and were calculated using a 20-City national average ENR CCI of 13,229, reflecting a date of April of 2023.

The costs for the infrastructure projects identified for each alternative are documented on **Table 5**. The improvements list the type of improvement, location, and cost. The costs included in this analysis account for construction (30%) and project-related (30%) contingencies. The costs for each alternative are summarized as follows:

- **Alternative 1 – OSC at Well 8: $14,010,000**
- **Alternative 2 – Well 8 Active: $14,200,000**
- **Alternative 3 – Two New Wells: $15,960,000**
- **Alternative 4 – No Wells: $19,900,000**

The costs do not include the well treatment facilities, raw water pipelines (from Wells 9 and 10 to the Well 8 OSC), or costs for developing new wells.

7.0 ANALYSIS AND ALTERNATIVES IMPROVEMENT SUMMARY

The hydraulic analysis for the water supply alternatives identified the major infrastureutre improvements required to maintain system pressures, pipeline velocities, and system operations within criteria. The recommended improvements and costs for each alternative are documented on **Table 5** and summarized as follows:

Alternative 1 – OSC at Well 8 (Figure 1): The following improvements are required:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road
- 5,200 gpm booster station at Turnout 4

Total Cost: $14,010,000

Alternative 2 - Well 8 (Figure 2): The following improvements are required:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road
- 5,500 gpm booster station at Turnout 4

Total Cost: $14,200,000

Alternative 3 – Two New Wells (Figure 3): The following improvements are required:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road
- 12-inch main in Valley Avenue from Pleasanton to Sunol Boulevard
- 12-inch main in Oak Vista Way from Cotton Mill Way to Valley Avenue
- 16-inch discharge main for the Del Prado well in Hansen Way from the Del Prado well to Valley Avenue
- 5,000 gpm booster station at Turnout 4

Total Cost: $15,960,000

Alternative 4 – No Wells (Figure 4): The following improvements are required:

- 24-inch main in Stoneridge Drive from Hopyard Road to Foothill Road
- 18-inch main in Bernal Avenue from Nevada Court to Vinyard Ave
- 20-inch main in Sunol Boulevard from Bernal Avenue to Sycamore Road
- 16-inch main in Vineyard Ave from Bernal Avenue to First Street
- 16-inch main in First Street from Vineyard Avenue to Bernal Avenue
- 7,000 gpm booster station at Turnout 4
- A new turnout from Zone 7 near Vineyard Avenue and Bernal

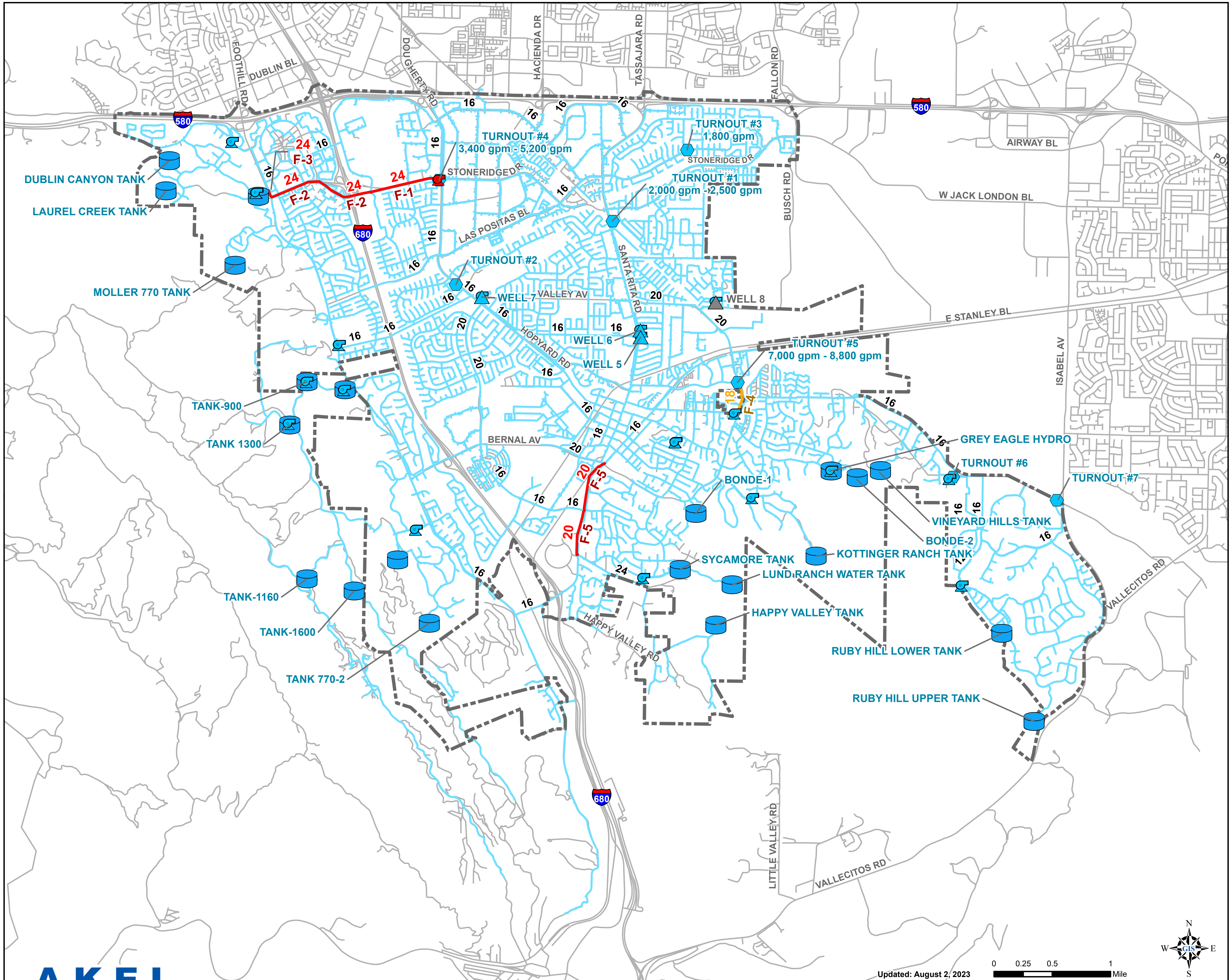
Total Cost: $19,900,000

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

FIGURES



Legend

Existing CIP Improvements

- Pump Stations
- Parallel Improvement
- Replacement Improvement

Existing System

- Tanks
- Pump Stations
- Turnouts
- Active Wells
- Inactive Wells
- Pipes
- Streets
- City Limits

Notes:

1. Projected Maximum Day Demands: 32.9 mgd
2. Shifting supply from TO 3 to TO 1 helps Sycamore float more closely to Foothill

PRELIMINARY

Figure 1
Alternative 1
OSC at Well 8

Water Supply Alternatives
City of Pleasanton

THE CITY OF PLEASANTON.

AKEL ENGINEERING GROUP, INC.

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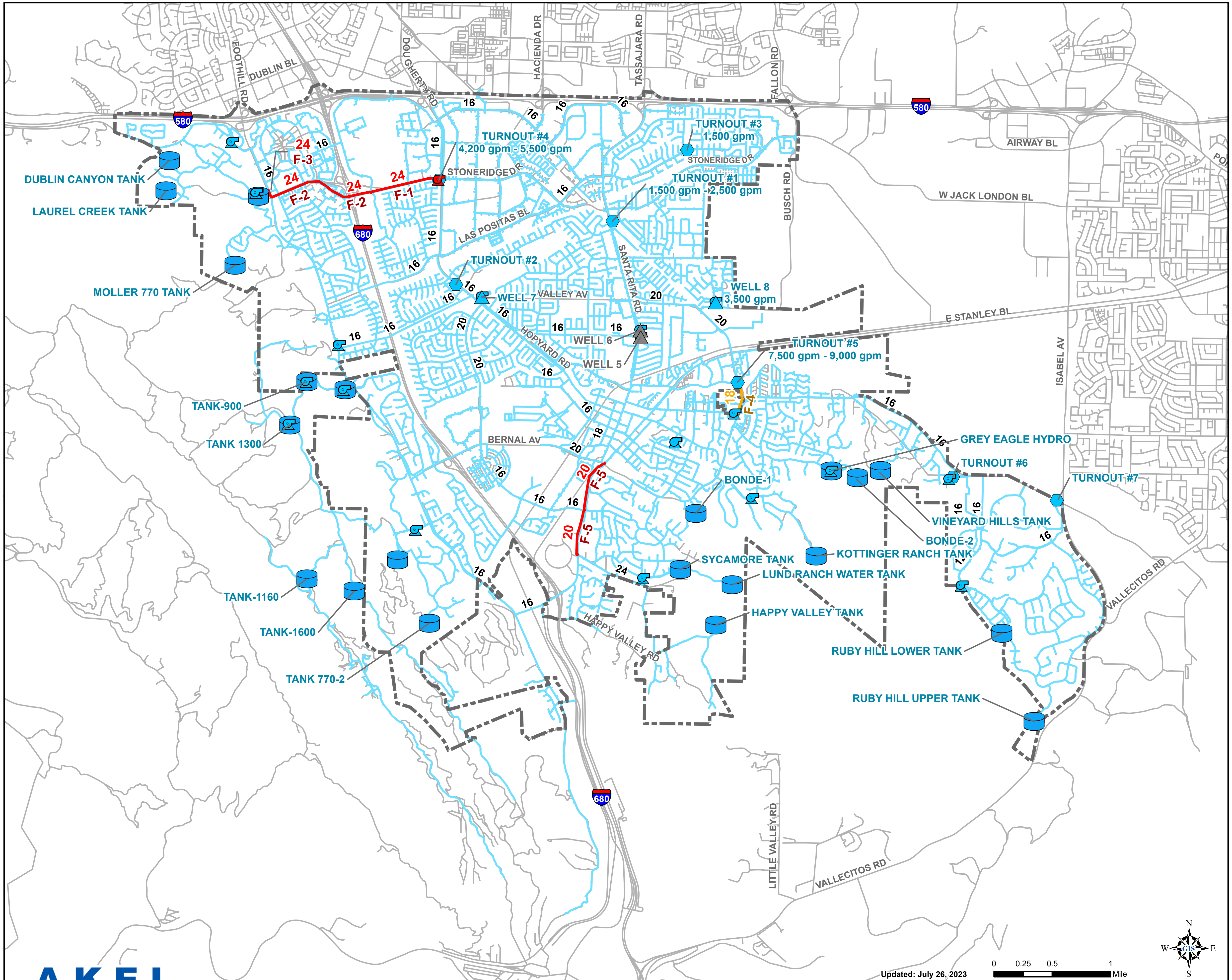

Legend

Alternative 2 Improvements
- Pump Stations
- Parallel Improvement
- Replacement Improvement

Existing System
- Tanks
- Pump Stations
- Turnouts
- Active Wells
- Inactive Wells
- Pipes
- Streets
- City Limits

Notes:
1. Projected Maximum Day Demands: 32.9 mgd

PRELIMINARY

Figure 2
Alternative 2
Projected Demands, Well 8 Act.
Water Supply Alternatives
City of Pleasanton

THE CITY OF PLEASANTON

AKEL ENGINEERING GROUP, INC.

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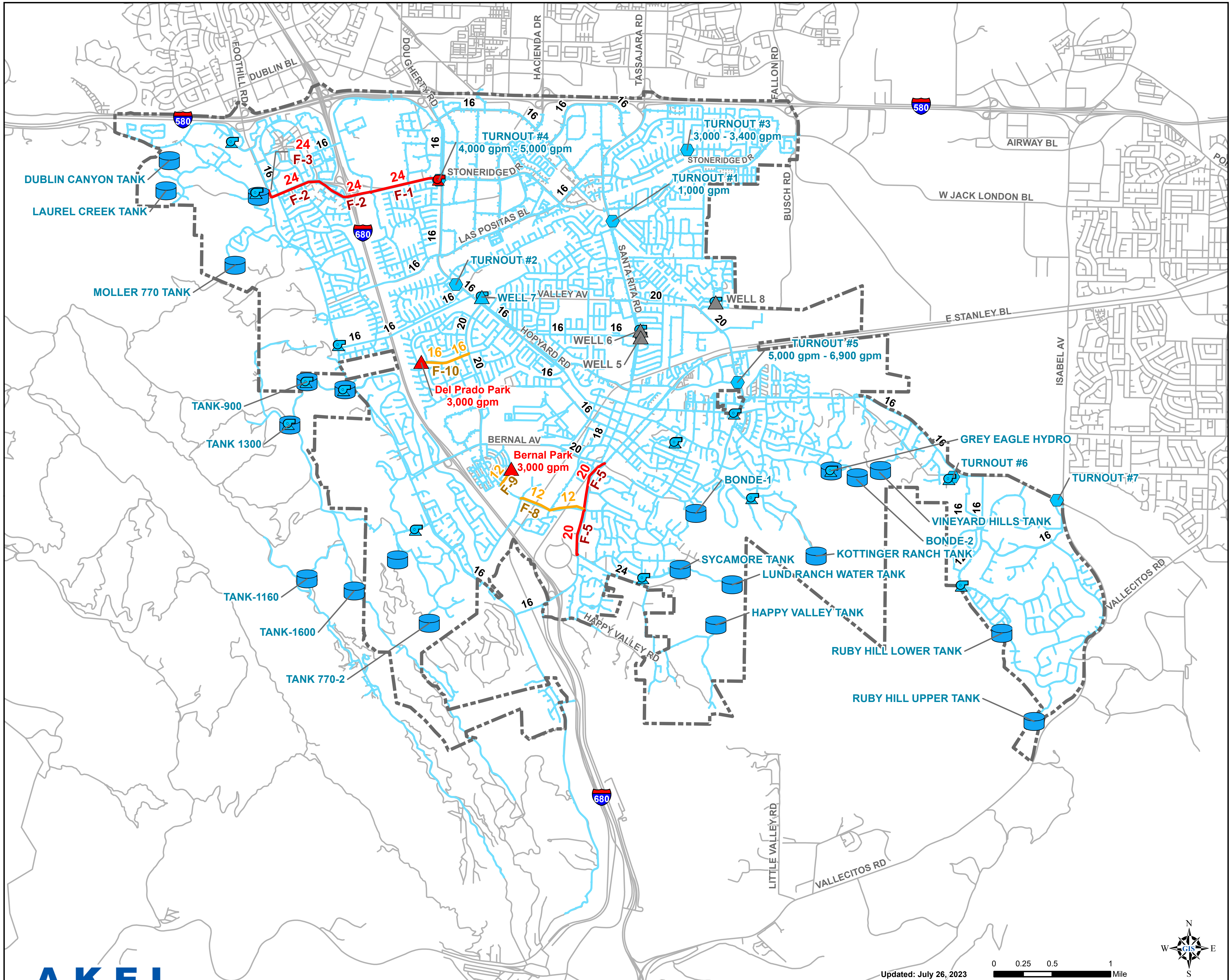

Legend

Alternative 3 Improvements

- Pump Stations
- Wells
- Parallel Improvement
- Replacement Improvement

Existing System

- Tanks
- Pump Stations
- Turnouts
- Active Wells
- Inactive Wells
- Pipes
- Streets
- City Limits

Notes:
1. Projected Maximum Day Demands: 32.9 mgd

PRELIMINARY

Figure 3
Alternative 3
Projected Demands,2 New Wells
Water Supply Alternatives
City of Pleasanton

THE CITY OF PLEASANTON

AKEL ENGINEERING GROUP, INC.

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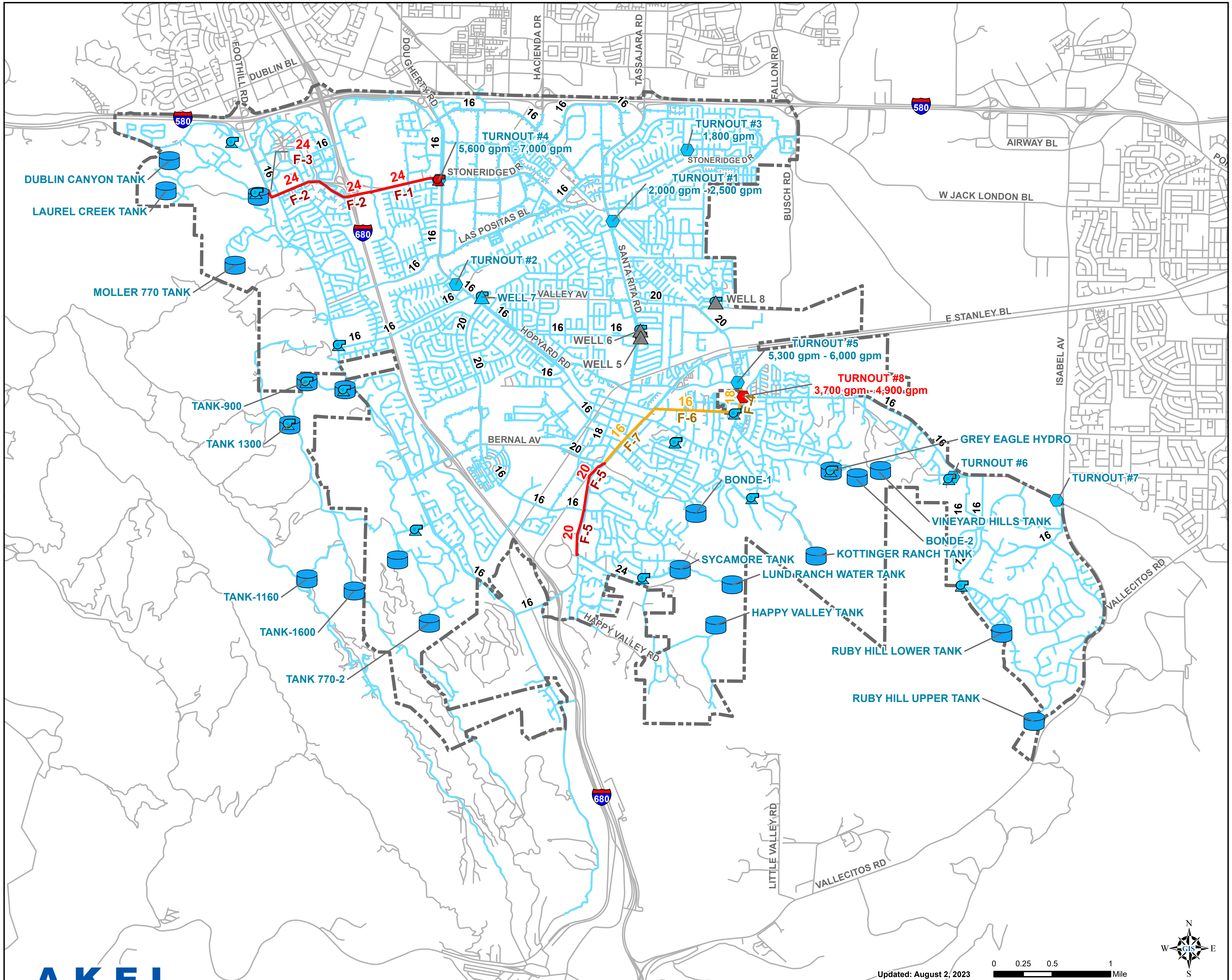

Legend

Alternative 4 Improvements

- Pump Stations
- Turnout
- Parallel Improvement
- Replacement Improvement

Existing System

- Tanks
- Pump Stations
- Turnouts
- Active Wells
- Inactive Wells
- Pipes
- Streets
- City Limits

Notes:
1. Projected Maximum Day Demands: 32.9 mgd

PRELIMINARY

Figure 4
Alternative 4
Projected Demands, No Wells

Water Supply Alternatives
City of Pleasanton

THE CITY OF PLEASANTON

AKEL ENGINEERING GROUP, INC.

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TABLES

Table 1 Water Demand Summary

Water Supply Alternatives
City of Pleasanton

PRELIMINARY

Demand	Existing (gpm)	Existing (mgd)	Peaking Factor
Existing Demands (2022)			
Average Day Demand	9,792	14.1	-
Maximum Day Demand	18,604	**26.8**	1.9
Projected Demands (2045)			
Average Day Demand	12,014	17.3	-
Maximum Day Demand	22,826	**32.9**	1.9

5/25/2023

Table 2 Planning and Design Criteria Summary

Water Supply Alternatives

City of Pleasanton

PRELIMINARY

Design Parameter	Capacity Master Plan Criteria	
Supply	Supply to meet Maximum Day Demand with largest unit out or service	
Storage	Total Required Storage = Operational + Fire + Emergency	
	Operational Storage	25% of Maximum Day Demand
	Emergency Storage	50% of Maximum Day Demand
	Fire Storage (Use most critical land use within pressure zone, see fire flow requirement table)	
Distribution Mains	Distribution mains should be designed to satisfy the following criteria (except under fire flow conditions):	
	Maximum Pipeline Velocity:	10 ft/s
	Maximum Pipeline Headloss:	10 ft/1,000 ft
	Pipeline "C" Factor of 130 should be used for new pipelines	
	Minimum Pipe Size: 8-inches	
Pump Stations	Meet 150 Percent of Maximum Day Demand	
	Hydropneumatic systems to meet Peak Hour or Maximum Day Demand plus fire flow, whichever is larger.	
PRVs	PRVs should be designed to meet:	
	Peak Hour Demand + Fire Flow	
Service Pressures	Minimum Pressures:	
	Peak Hour Demand	40 psi
	MDD + Fire Flows	20 psi
	Maximum Pressures in the Lower Zone	90 psi
Demand Peaking Factors	Maximum Month Demand	1.6 x Average Day Demand
	Maximum Day Demand	1.9 x Average Day Demand
	Peak Hour Demand (system wide)	3.2 x Average Day Demand
	Pressure Zone Peak Hour factors vary (see Appendix)	
	Minimum Month Demand	0.5 x Average Day Demand
	Peak Production Factor	2.1 x Average Day Demand
Fire Flows	Rural Residential	1,500 gpm for 2 hours (0.18 MG)
	Single-family Residential	2,000-2,500 gpm for 2 hours (0.24 - 0.30 MG)
	Multi-family Residential	2,500 gpm for 2 hours (0.30 MG)
	Social/Recreation	2,500 gpm for 2 hours (0.30 MG)
	Schools/Commercial/Public/Institution	3,500 gpm for 2 hours (0.42 MG)
	Industrial	5,000 gpm for 4 hours (1.2 MG)
	Fairgrounds	5,000 gpm for 4 hours (1.2 MG)

Table 3 Turnout Operations for Modeling Scenarios

Water Supply Alternatives

City of Pleasanton

PRELIMINARY

Supply ID	Pleasanton Pressures (psi)	Zone 7 Historical Pressures (psi)	Turnout Flow Fill (gpm)	Turnout Flow Drain (gpm)	Comments
Alternative 1 - OSC at Well 8 (32.9 mgd)					
TO 1	54-88 psi	93	2,500	2,000	
TO 2	61-88 psi	Avg. 58 psi 46-68 psi	0	0	
TO 3	53-86 psi	Avg. 123 psi 88-149 psi	1,800	1,800	
TO 4	61-88 psi	Avg. 97 psi 75-145 psi	5,200	3,400	Booster Station recommended due to Zone 7 supply pressure concerns
TO 5	49-85 psi	Avg. 117 psi 50-160 psi	8,800	7,000	
Well 9 & 10	51-85 psi	-	3,300 - 4,450		Pressure at OSC discharge (Well 8)
Alternative 2 - Well 8 (32.9 mgd)					
TO 1	54-87 psi	93	2,500	1,500	
TO 2	61-87 psi	Avg. 58 psi 46-68 psi	0	0	
TO 3	53-84 psi	Avg. 123 psi 88-149 psi	1,500	1,500	
TO 4	62-87 psi	Avg. 97 psi 75-145 psi	5,500	4,200	Booster Station recommended due to Zone 7 supply pressure concerns
TO 5	50-85 psi	Avg. 117 psi 50-160 psi	9,000	7,500	
Well 8	51-85 psi	-	3,500	3,500	

Supply ID	Pleasanton Pressures (psi)	Zone 7 Historical Pressures (psi)	Turnout Flow Fill (gpm)	Turnout Flow Drain (gpm)	Comments
Alternative 3 - Two New Wells (32.9 mgd)					
TO 1	54-82 psi	93	1,000	1,000	
TO 2	62-88 psi	Avg. 58 psi 46-68 psi	0	0	
TO 3	56-87 psi	Avg. 123 psi 88-149 psi	3,400	3,000	
TO 4	63-87 psi	Avg. 97 psi 75-145 psi	5,000	4,000	Booster Station recommended due to Zone 7 supply pressure concerns
TO 5	48-78 psi	Avg. 117 psi 50-160 psi	6,900	5,000	
Well Bernal Park	65-90 psi	-	3,000	3,000	
Well Del Prado Park	63-90 psi	-	3,000	3,000	Pressure at recommended discharge point (Valley Ave and Hansen Dr)
Alternative 4 - No Wells (32.9 mgd)					
TO 1	53-85 psi	93	2,500	2,000	
TO 2	61-88 psi	Avg. 58 psi 46-68 psi	0	0	
TO 3	53-84 psi	Avg. 123 psi 88-149 psi	1,800	1,800	
TO 4	65-89 psi	Avg. 97 psi 75-145 psi	7,000	5,600	Booster Station recommended due to Zone 7 supply pressure concerns
TO 5	49-82 psi	Avg. 117 50-160 psi	6,000	5,300	
TO8	46 -79 psi	-	4,900	3,700	New Turnout on Vineyard and Bernel

Table 4 Unit Costs

Water Supply Alternatives
City of Pleasanton

Pipelines	
Pipe Size (in)	**Cost** ($/lineal foot)
8	$188
10	$212
12	$255
14	$284
16	$305
18	$314
20	$337
24	$402
30	$502
36	$563

Pump Stations

Estimated Pumping Station Project Cost =
$2.605*10^{(0.7583*\log(Q)+3.1951)}$ where Q is in gpm

AKEL ENGINEERING GROUP, INC.

7/20/2023

Notes:

1. Construction costs estimated using April 2023 ENR CCI of 13229

Table 5 Water Supply Alternative Improvements

Water Supply Alternatives

City of Pleasanton

PRELIMINARY

Itemized Cost Estimate											
Improvement Number	Pressure Zone	Type of Improv.	Alignment	Limits	Pipeline and Appurtenances Costs				Baseline Constr. Cost	Estimated Constr. Cost[3]	Capital Improv. Cost
					Diam.	Length	Unit Cost	Pipe Cost			
					(in)	(ft)	($)	($)	($)	($)	($)
Alternative 1 - OSC at Well 8											
F-1	Lower	Pipe (R)	Stoneridge Dr	Hopyard Rd to Johnson Dr (Replacement pipe for 12-inch)	24	3,250	402	1,306,321	1,306,321	1,698,217	2,210,000
F-2	Lower	Pipe (R)	Stoneridge Dr	Johnson Dr to Foothill Dr (Replacement pipe for 12-inch)	24	5,250	402	2,110,211	2,110,211	2,743,274	3,570,000
F-3	Lower	Pipe (R)	Foothill Rd	Stoneridge Dr to 310 feet n/o Stoneridge Dr	24	310	402	124,603	124,603	161,984	210,000
F-4	Lower	Pipe	Bernal Ave	Nevada Ct to Vineyard Ave	18	1,600	314	501,627	501,627	652,115	850,000
F-5	Lower	Pipe (R)	Sunol Blvd	Bernal Ave to Sycamore Rd (Replacement pipe for 12-inch)	20	4,650	337	1,567,920	1,567,920	2,038,296	2,650,000
BS-1	Lower	Booster Station	Turnout 4 Hopyard Rd and Stoneridge Dr	5,200 gpm firm capacity booster station at Turnout 4		5,200	gpm	2,672,485	2,672,485	3,474,231	4,520,000
										Existing CIP Total	**14,010,000**
Alternative 2 - Well 8 Active [4]											
F-1	Lower	Pipe (R)	Stoneridge Dr	Hopyard Rd to Johnson Dr (replacement pipe for 12-inch)	24	3,250	402	1,306,321	1,306,321	1,698,217	2,210,000
F-2	Lower	Pipe (R)	Stoneridge Dr	Johnson Dr to Foothill Dr (replacement pipe for 12-inch)	24	5,250	402	2,110,211	2,110,211	2,743,274	3,570,000
F-3	Lower	Pipe (R)	Foothill Rd	Stoneridge Dr to 310 feet n/o Stoneridge Dr	24	310	402	124,603	124,603	161,984	210,000
F-4	Lower	Pipe	Bernal Ave	Nevada Ct to Vineyard Ave	18	1,600	314	501,627	501,627	652,115	850,000
F-5	Lower	Pipe (R)	Sunol Blvd	Bernal Ave to Sycamore Rd (replacement pipe for 12-inch)	20	4,650	337	1,567,920	1,567,920	2,038,296	2,650,000
BS-1	Lower	Booster Station	Turnout 4 Hopyard Rd and Stoneridge Dr	5,500 gpm firm capacity booster station at Turnout 4		5,500	gpm	2,788,605	2,788,605	3,625,186	4,710,000
										Alternative 2 Total	**14,200,000**
Alternative 3 - Two New Wells [4]											
F-1	Lower	Pipe (R)	Stoneridge Dr	Hopyard Rd to Johnson Dr (replacement pipe for 12-inch)	24	3,250	402	1,306,321	1,306,321	1,698,217	2,210,000
F-2	Lower	Pipe (R)	Stoneridge Dr	Johnson Dr to Foothill Dr (replacement pipe for 12-inch)	24	5,250	402	2,110,211	2,110,211	2,743,274	3,570,000
F-3	Lower	Pipe (R)	Foothill Rd	Stoneridge Dr to 310 feet n/o Stoneridge Dr	24	310	402	124,603	124,603	161,984	210,000
F-5	Lower	Pipe (R)	Sunol Blvd	Bernal Ave to Sycamore Rd (replacement pipe for 12-inch)	20	4,650	337	1,567,920	1,567,920	2,038,296	2,650,000
BS-1	Lower	Booster Station	Turnout 4 Hopyard Rd and Stoneridge Dr	5,000 gpm firm capacity booster station at Turnout 4		5,000	gpm	2,594,173	2,594,173	3,372,425	4,380,000
F-8	Lower	Pipe	Valley Ave	Pleasanton Ave to Sunol Blvd	12	3,100	255	789,152	789,152	1,025,897	1,330,000

Table 5 Water Supply Alternative Improvements

Water Supply Alternatives

City of Pleasanton

PRELIMINARY

Itemized Cost Estimate											
Improvement Number	Pressure Zone	Type of Improv.	Alignment	Limits	Pipeline and Appurtenances Costs				Baseline Constr. Cost	Estimated Constr. Cost[3]	Capital Improv. Cost
					Diam. (in)	Length (ft)	Unit Cost ($)	Pipe Cost ($)	($)	($)	($)
F-9	Lower	Pipe	Oak Vista Wy	Cotton Mill Wy to Valley Ave	12	975	255	248,201	248,201	322,661	420,000
F-10	Lower	Pipe	Hansen Dr	Del Prado Well to Valley Ave (Dedicated main from well to Valley Ave)	16	2,300	305	702,600	702,600	913,380	1,190,000
										Alternative 3 Total	15,960,000
Alternative 4 - No Wells											
F-1	Lower	Pipe (R)	Stoneridge Dr	Hopyard Rd to Johnson Dr (replacement pipe for 12-inch)	24	3,250	402	1,306,321	1,306,321	1,698,217	2,210,000
F-2	Lower	Pipe (R)	Stoneridge Dr	Johnson Dr to Foothill Dr (replacement pipe for 12-inch)	24	5,250	402	2,110,211	2,110,211	2,743,274	3,570,000
F-3	Lower	Pipe (R)	Foothill Rd	Stoneridge Dr to 310 feet n/o Stoneridge Dr	24	310	402	124,603	124,603	161,984	210,000
F-4	Lower	Pipe	Bernal Ave	Nevada Ct to Vineyard Ave	18	1,600	314	501,627	501,627	652,115	850,000
F-5	Lower	Pipe (R)	Sunol Blvd	Bernal Ave to Sycamore Rd (replacement pipe for 12-inch)	20	4,650	337	1,567,920	1,567,920	2,038,296	2,650,000
F-6	Lower	Pipe	Vineyard Ave	Bernal Ave to First St	16	3,800	305	1,160,817	1,160,817	1,509,062	1,960,000
F-7	Lower	Pipe	First St	Vineyard Ave to Bernal Ave	16	3,450	305	1,053,900	1,053,900	1,370,069	1,780,000
BS-1	Lower	Booster Station	Turnout 4 Hopyard Rd and Stoneridge Dr	7,000 gpm firm capacity booster station at Turnout 4		7,000	gpm	3,348,172	3,348,172	4,352,624	5,660,000
TO-8	Lower	Turnout	Vineyard Ave	New Turnout from Zone 7 at Vineyard Ave and Bernal Ave				600,000	600,000	780,000	1,010,000
										Alternative 1 Total	19,900,000
Recommended Improvements Summary											
										Alternative 1 - OSC at Well 8	14,010,000
										Alternative 2 - Well 8 Active[4]	14,200,000
										Alternative 3 - Two New Wells[4]	15,960,000
										Alternative 4 - No Wells	19,900,000

AKEL ENGINEERING GROUP, INC.

8/2/2023

1. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
2. Estimated construction cost plus 30% to cover other costs including: engineering design, project administration (developer and City staff), construction management and inspection, and legal costs.
3. Cost estimates are based on the Engineering News Record (ENR) construction cost index (CCI) of 13229 for the 20 cities for April 2023.
4. Costs do not include well treatment or cost for the new wells, only major transmission main, booster station, and turnout costs included
5. Pipeline improvements are parallel unless otherwise specified

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Appendix F: City Council Presentations

February 21, 2023

May 16, 2023

September 19, 2023

October 17, 2023

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Water Supply Alternatives Study Update

Pleasanton City Council Meeting

February 21, 2023

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Contents

- Study objective
- Project status
- Evaluation criteria
- Water supply alternatives

Recap: Study Objective

- Identify, evaluate, and recommend a preferred alternative for the portion of water supply historically sourced via the City's groundwater pumping quota (3,500 AFY).

  - *Note: For the purpose of this study, the PFAS Treatment and Well Rehab Project is considered the baseline alternative that other options will be evaluated against.*

Project Status

- **Task 1. Project management *(ongoing)***
- **Task 2. Information collection and review *(complete)*** – Gathered and reviewed data and information from City and Zone 7, including Zone 7's groundwater model.
- **Task 3. Alternatives development *(complete)*** – Developed a list of water supply alternatives, which has been confirmed by the Water Ad Hoc Subcommittee and reviewed by Zone 7.
- **Task 4. Alternatives evaluation *(in progress)*** – Developed a list of evaluation criteria, which has been confirmed by the Water Ad Hoc Subcommittee.
  - *Next: assign weights to criteria, further analyze alternatives, develop cost estimates, evaluate against criteria.*

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Evaluation Criteria - Considerations

- Criteria are used to score various water supply alternatives and analyze trade-offs (helps with prioritization and alternatives selection).
- Evaluation criteria should be:
  - Measurable (quantitative or qualitative)
  - Independent
  - Established without considering the alternatives ("why" before "how")
- Criteria are framed around **benefits**, with cost considered separately (as a constraint).

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Evaluation Criteria – Definitions (confirmed by subcommittee)

- **Water Supply Reliability.** The ability to predictably, consistently meet water demands, including during dry years. Considers redundancy of system and ability to meet demands during peak periods and/or emergency conditions.
- **Water Quality / Regulatory Compliance.** Degree of ability to deliver water below all current and anticipated future state and federal drinking water standards.
- **Operational Complexity.** Ease of operating and maintaining the system from a technical standpoint, considering organizational readiness, necessary staff qualifications/certifications (e.g., ability to operate the project with existing staff resources), and the ability to enhance system in the event of additional and/or more stringent drinking water regulations.
- **Institutional Complexity.** Ease of implementation and management from an institutional standpoint (e.g., willingness of external partners, complexity of agreements and administration).
- **Timing of Implementation.** How quickly the alternative can be online, considering timeframe for design, permitting, and construction (if applicable).

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Evaluation Criteria – Next Steps

- Assign weights to each criteria (to reflect relative importance)
  - Survey being completed by Subcommittee members

- Once alternatives are further developed, apply weighted criteria to evaluate and prioritize alternatives *(LATER STEP)*

Water Supply Alternatives – Evaluation Process (in progress)

Step 1

Develop & screen alternatives

- Are there any “fatal flaws” (e.g., technical or institutional feasibility)?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment & Rehab Project)?

We Are Here

Step 2

Combine into alternatives that yield 3,500 AFY

- Alternatives may include a combination of supply options (want to make sure all alternatives can yield 3,500 AFY), for apples-to-apples comparison

Step 3

Detailed evaluation (apply multiple criteria)

- Alternatives that can achieve 3,500 AFY and have no fatal flaws will be evaluated based on multiple criteria
- e.g., cost, reliability, operational complexity…

Recommended alternative

Water Supply Alternatives - Overview

Four categories of water supply options:

Baseline (PFAS Treatment & Well Rehab Project)	Groundwater Supply Options (projects that maintain City’s groundwater pumping quota)
Other Supply Sources (e.g., purchases from another agency)	Demand Management (reduce or offset potable water demand)

Water Supply Alternatives

Baseline - **PFAS Treatment & Well Rehabilitation Project.** Rehabilitate City's existing wells and add PFAS treatment. (Project currently on hold.)

Groundwater Supply Options (maintain groundwater pumping quota)

a. **Modified PFAS Treatment (Well 8).** Similar to the Baseline, but would involve adding PFAS treatment to one well (vs. all three).
b. **New City well(s) outside PFAS plume (west part of the City).** City-owned well, with or without treatment for other constituents (non-PFAS). Could also consider use of existing SFPUC wells.
c. **Zone 7 pump on City's behalf.** Zone 7 to pump from existing wells (if there is capacity) or new well(s) outside PFAS plume (with or without treatment).
d. **Regional PFAS treatment facility.** New facility constructed by Pleasanton (or jointly constructed by Pleasanton/Zone 7) and operated and maintained by Zone 7 to produce regional water supply, including Pleasanton's groundwater pumping quota.
e. **Blending/dilution.** Blend existing well supply with water from Zone 7 to reduce PFAS concentration below future MCLs or lower, if possible.

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Water Supply Alternatives, continued

Other Supply Sources

a. **100% purchases from Zone 7.** Agnostic of source (could include State Water Project, groundwater, and future additions to Zone 7's supply portfolio).
b. **Purchases from another agency.** Either wheeled through Zone 7's system or direct connection to wholesaler (SFPUC or EBMUD).
c. **Local alternative supplies.** E.g., desalination, stormwater capture, satellite wastewater treatment.

Demand Management

a. **Expansion of non-potable system.** Expand non-potable supply beyond what's projected in UWMP (~500 AFY), using recycled water and/or non-potable groundwater.
b. **Long-term water use efficiency (WUE).** Invest in permanent demand reduction measures (e.g., turf replacement), beyond existing/planned WUE.
   - Note: does not include short-term conservation (i.e., behavioral changes).

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Alternatives – Next Steps

- Perform initial screening *(underway)*
  - Technical feasibility – review existing data, model groundwater scenarios, etc.
  - Institutional feasibility – meet with Zone 7 to discuss options that would require an explicit agreement/partnership.
- Combine into alternatives yielding 3,500 AFY
- Develop cost estimates (capital and annual)
- Apply multiple criteria to perform detailed evaluation (benefits & cost)

Questions?

Water Supply Alternatives Study Update

Pleasanton Water City Council Meeting

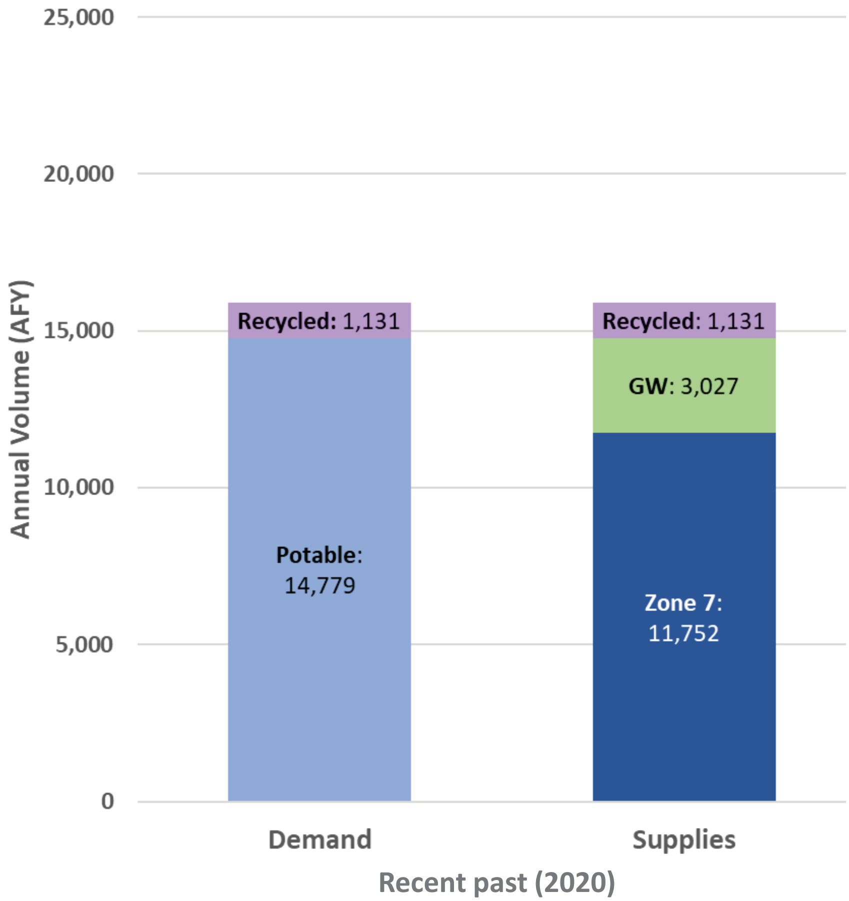
May 16, 2023

Objective of Water Supply Alternatives Study

- **Identify and evaluate alternatives** relative to the PFAS Treatment and Wells Rehabilitation Project for the portion of water supply that has been sourced using the City's groundwater pumping quota (3,500 Acre Feet/Year)

- **Inform path forward** including whether the City should proceed with the PFAS Treatment and Wells Rehabilitation Project or pursue an alternative to produce 3,500 AFY of potable (drinking) water supply

Background Context



Source: Pleasanton's 2020 UWMP

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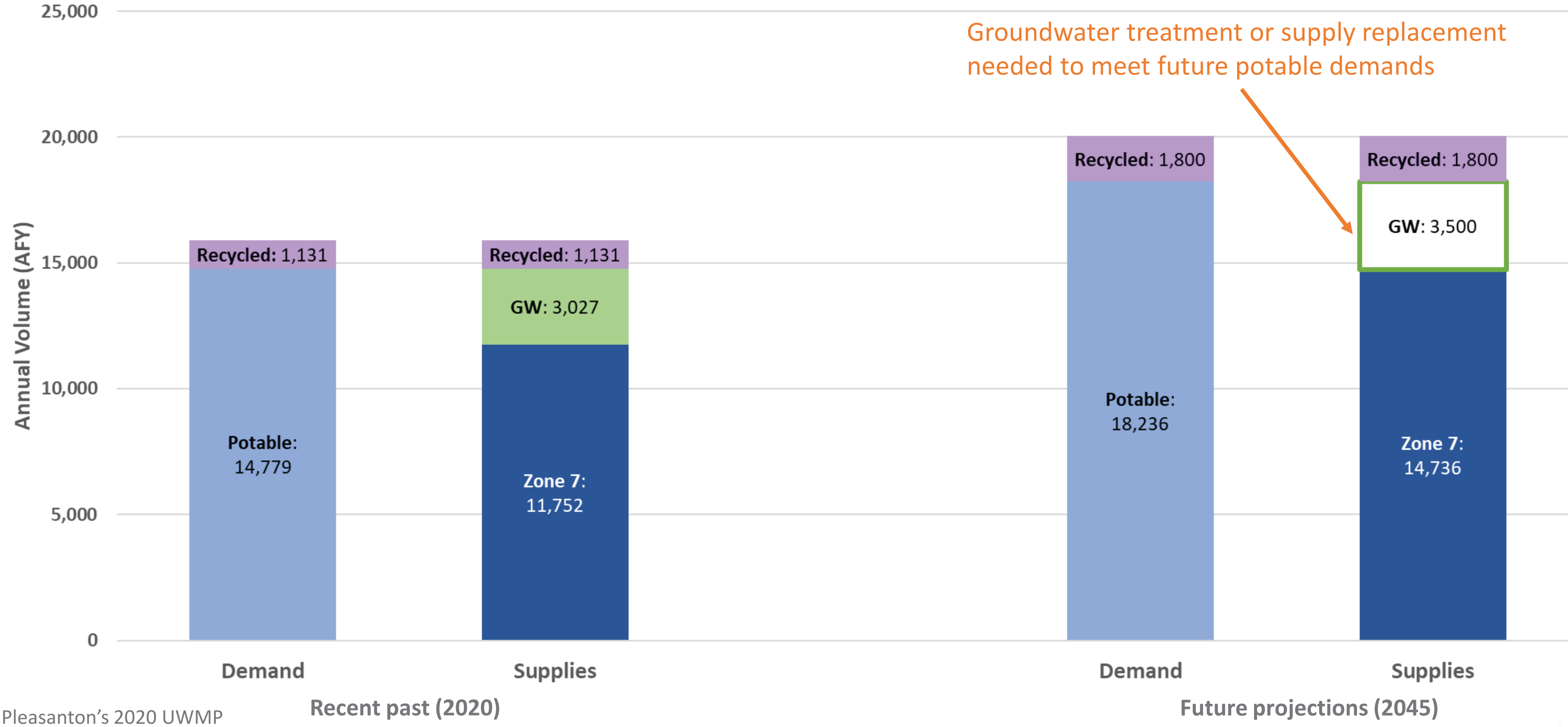
Background Context



Source: Pleasanton's 2020 UWMP

Evaluation Process – Recap

Step 1

Develop & screen supply options

- Are there any "fatal flaws" (e.g., technical or institutional feasibility)?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment & Rehab Project)?

Complete

Step 2

Combine options into alternatives that yield 3,500 AFY

- Alternatives may include a combination of supply options (want to make sure all alternatives can yield 3,500 AFY), for apples-to-apples comparison

Step 3

Detailed evaluation (apply multiple criteria)

- Alternatives that can achieve 3,500 AFY and have no fatal flaws will be evaluated based on multiple criteria
- e.g., cost, reliability, operational complexity…

Recommended alternative

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Step 1 Screening Results

Screened out:

- **Blending/dilution**
  - Not feasible based on current contaminant levels.
- **Local alternative supplies**
  - Screened out due to high cost of desal or satellite treatment relative to baseline and seasonality/unpredictability of stormwater availability.
- **Purchases from another agency**
  - Connection to SFPUC or EBMUD not feasible.
  - Wheeling through Zone 7's system screened out due to institutional limitations.
- **Expansion of non-potable system (beyond 2020 UWMP expansion assumptions)**
  - Recycled water expansion not feasible in near-term due to DERWA capacity limitations.
  - Long term opportunities will be evaluated in Recycled Water Master Plan Update (not anticipated to be able to fully offset 3,500 AF/year of potable supply)

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Evaluation Process – Update

Step 1

Develop & screen supply options

- Are there any "fatal flaws" (e.g., technical or institutional feasibility)?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment & Rehab Project)?

Step 2

Combine options into alternatives that yield 3,500 AFY

- Alternatives may include a combination of supply options (want to make sure all alternatives can yield 3,500 AFY) for apples-to-apples comparison

Complete

Step 3

Detailed evaluation (apply multiple criteria)

- Alternatives that can achieve 3,500 AFY and have no fatal flaws will be evaluated based on multiple criteria
- e.g., cost, reliability, operational complexity…

Recommended alternative

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Step 2 – Combining to yield 3,500 AFY

- All remaining groundwater supply options and other supply sources could yield 3,500 AFY
- Long-term water use efficiency can partially offset demands, but not achieve 3,500 AFY alone
  - Therefore, this option was screened out as a standalone solution, though potentially could be used in combination with other alternatives
  - City is conducting a separate turf reduction study to inform potential water savings and associated costs

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Evaluation Process – Current Status

Step 1

Develop & screen supply options

- Are there any “fatal flaws” (e.g., technical or institutional feasibility)?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment & Rehab Project)?

Step 2

Combine options into alternatives that yield 3,500 AFY

- Alternatives may include a combination of supply options (want to make sure all alternatives can yield 3,500 AFY) for apples-to-apples comparison

Step 3

Detailed evaluation (apply multiple criteria)

- Alternatives that can achieve 3,500 AFY and have no fatal flaws will be evaluated based on multiple criteria
- e.g., cost, reliability, operational complexity…

We Are Here

Recommended alternative

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Step 3 – Detailed Evaluation

Benefit Criteria

- Water Supply Reliability (35%)
- Water Quality / Regulatory Compliance (15%)
- Operational Complexity (15%)
- Institutional Complexity (10%)
- Timing of Implementation (25%)

Note: Sensitivity will be performed with alternative weighting schemes.

Costs

- Capital and O&M

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Shortlisted Alternatives

Pros and cons relative to baseline

*Note: Any alternatives involving Zone 7 would require Zone 7 Board approval

Groundwater Supply Options (maintain groundwater pumping quota)

Alternative	Pros	Cons
a) Modified PFAS Treatment (Well 8)	• **Cost:** Less expensive than baseline	• **Reliability:** Lack of redundancy and peaking ability
b) New City well(s) outside PFAS plume (west part of the City)	• **Cost:** Less expensive than baseline • **Operations:** No near-term treatment needed	• **Water Quality:** Potential contaminant mobilization (long-term) • **Timing of Implementation:** Requires more complex new well permitting
c) Zone 7 pump on City's behalf (using ~~existing or~~ new infrastructure) *Zone 7 does not have capacity to pump on the City's behalf with existing infrastructure.*	• **Cost:** Less expensive than baseline and potential cost sharing opportunity (if new supply provides regional benefit) • **Operations:** Ease of operations & maintenance	• **Institutional Complexity & Timing of Implementation:** Dependent on Zone 7's groundwater model update, well master plan, and Board approval*
d) Regional PFAS treatment facility (located at ~~COL, Stoneridge, or~~ Pleasanton OSC) *No space to expand capacity at COL or Stoneridge site.*	• **Cost:** Potential cost sharing opportunity (dependent on Zone 7) • **Operations:** Ease of operations & maintenance	• **Institutional Complexity:** Dependent on Zone 7's groundwater model update, well master plan, and Board approval*
e) Blending/dilution (screened out)		

Shortlisted Alternatives, cont'd

Pros and cons relative to baseline

<u>Other Supply Sources</u>

Alternative	Pros	Cons
a) 100% purchases from Zone 7	• **Operations** • **Timing of Implementation**	• **Institutional Complexity:** Zone 7 unable to commit to providing additional supply for long-term • **Reliability:** Dry year uncertainty; limited redundancy and peaking ability; inability to meet future demands • **Cost (potential):** Unknown escalation of wholesale supply rate; requires new infrastructure and water reliability projects
b) Purchases from another agency (screened out)		
c) Local alternative supplies (screened out)		

<u>Demand Management</u>

Alternative	Pros	Cons
a) Expansion of non-potable system (screened out)		
b) Long-term water use efficiency (screened out as standalone alternative)	• **Institutional Complexity** • **Operations** • **Timing of Implementation**	• **Reliability:** Cannot achieve 3,500 AFY alone, but could complement any other alternative

Other Considerations

Regional benefit—Zone 7 more willing to cost share or operate if capacity exceeds Pleasanton's pumping quota

- No guarantee at this time while Zone 7 conducts its studies and constructs treatment facilities
  - **Timing**—Zone 7's groundwater studies won't be completed until mid 2024

Potential phased approach—for example:

  - Start with treatment at Well 8 with potential to expand capacity in the future

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Next Steps on Water Supply Alternatives Study

- Complete technical analysis of alternatives (June 2023)
- Score alternatives against evaluation criteria (July 2023)
- Perform sensitivity analysis (July 2023)
- Finalize cost estimates (July 2023)
- Identify preferred alternative and implementation strategy (August 2023)
- Prepare draft and final report (September 2023)

Questions?

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Water Supply Alternatives Study Update

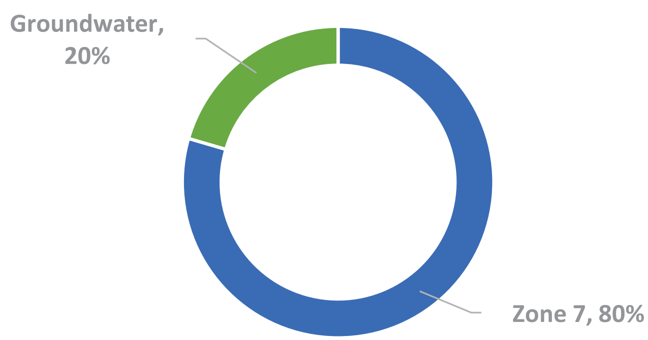
Pleasanton Water City Council Meeting

September 19, 2023

Objective of Water Supply Alternatives Study

- **Identify and evaluate alternatives** relative to the PFAS Treatment and Wells Rehabilitation Project for the portion of water supply that has been sourced using the City's groundwater pumping quota (3,500 acre-feet/year [AFY])

- **Inform path forward** including whether the City should proceed with the PFAS Treatment and Wells Rehabilitation Project or pursue an alternative to produce 3,500 AFY of potable (drinking) water supply



2020 water supplies
(from Pleasanton's 2020 UWMP)

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Evaluation Process – Current Status

Step 1

Develop & screen supply options

- Are there any "fatal flaws" (e.g., technical or institutional feasibility)?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment & Rehab Project)?

Step 2

Combine options into alternatives that yield 3,500 AFY

- Alternatives may include a combination of supply options (want to make sure all alternatives can yield 3,500 AFY) for apples-to-apples comparison

Step 3

Detailed evaluation (apply multiple criteria)

- Alternatives that can achieve 3,500 AFY and have no fatal flaws will be evaluated based on multiple criteria
- e.g., cost, reliability, operational complexity…

Recommended alternative

We Are Here

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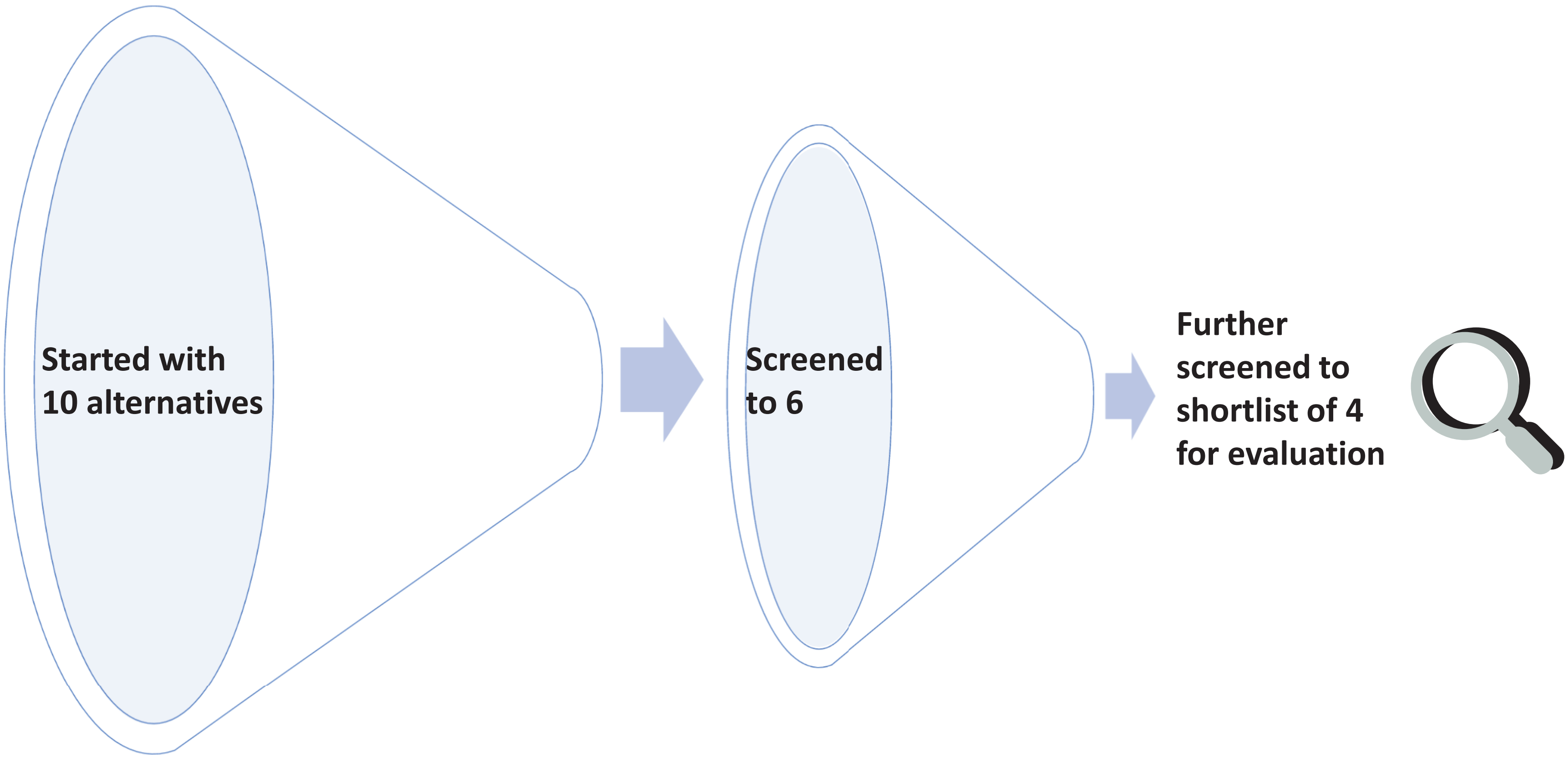
Background



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Shortlist of Water Supply Alternatives

Water Supply Alternatives

Four alternatives for evaluation:

1. Baseline (PFAS Treatment and Wells 5, 6, & 8 Rehabilitation)
2. Reduced Baseline (PFAS Treatment for Well 8 only)
3. Two New City Wells (West of PFAS plume)
4. 100% purchases from Zone 7*

City pumps its groundwater quota (1–3)

City does not utilize groundwater quota (4)

Potential <u>future</u> regional alternative with Zone 7*

- New regional groundwater wells outside PFAS plume

Zone 7 pumps City's groundwater quota as part of regional project

*Any alternatives involving Zone 7 would require Zone 7 Board approval.

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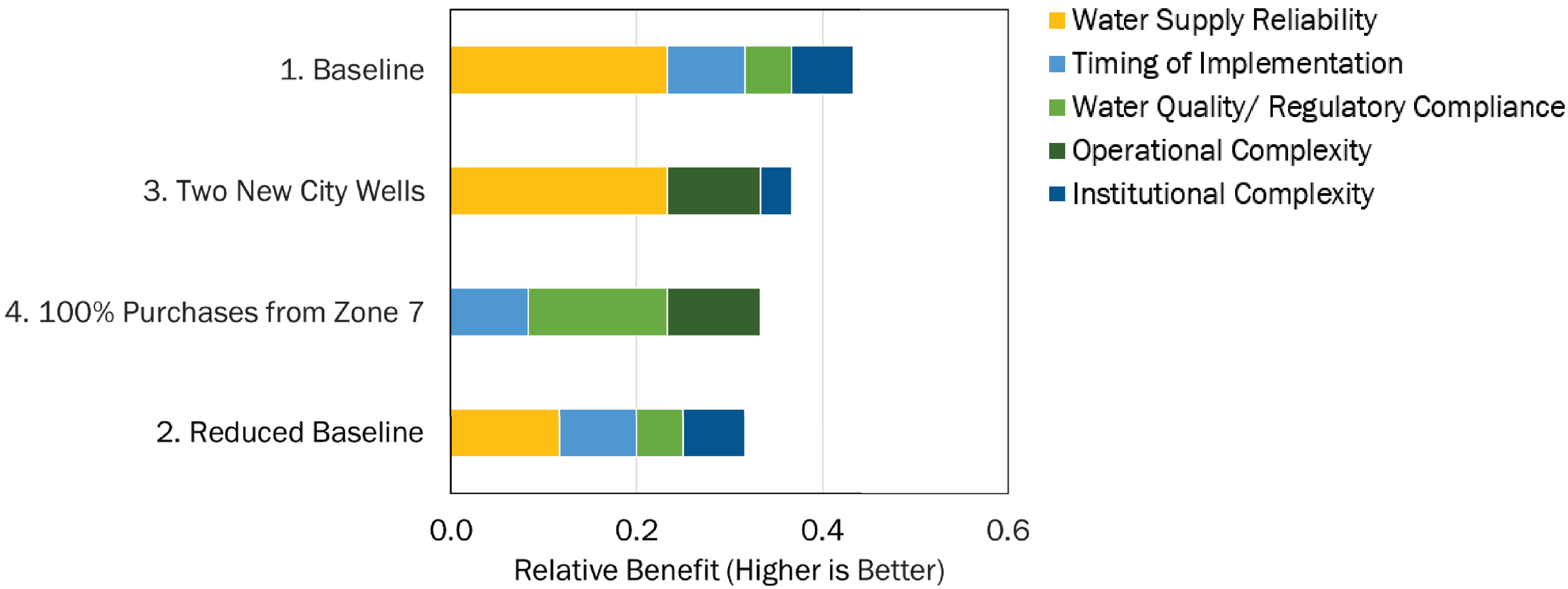
Evaluation Results and Costs

Relative Benefit of Alternatives



Estimated Capital and Annual O&M Costs

	Alt. 1 (Baseline, PFAS Treatment, 50% design)	**Alt. 2** (Reduced Baseline, PFAS treatment)	**Alt. 3** (Two New City Wells)	**Alt. 4** (100% Purchases from Zone 7)
Capital [a, b] – including infrastructure improvements (Range)	**$65M** ($57M-$77M)	**$29M** ($26M-$34M)	**$23M** ($13M-$42M)	**$11M** ($6M-$21M)
Annual O&M [c, d] (Range)	**$1.2M/year** ($1M-$1.5M/year)	**$0.6M/year** ($0.5M-$0.7M/year)	**$0.5M/year**	**$6.1M/year** ($6M-$6.3M/year)

Costs shown in estimated 2024 $ (assuming 5% escalation from 2023 $).

[a] Including: design, construction, contingency, construction support services (construction management [CM] and engineering services during construction [ESDC]), and incremental cost of required infrastructure improvements beyond those identified in footnote (a).

[b] Assumes near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station BS-1 as identified in Akel's Water Supply Alternative Improvements summary dated 8/2/23), estimated at ~$10.2M, will be funded and addressed in advance of implementing water supply alternatives.

[c] Including: GAC media change-out, hazardous disposal of GAC spent media, chemical (additional costs), electricity (additional costs), and wholesale water supply (assuming 3,500 AFY)

[d] Not including additional operations staff for PFAS treatment (estimated at 2-3 FTEs for Alts. 1 and 2)

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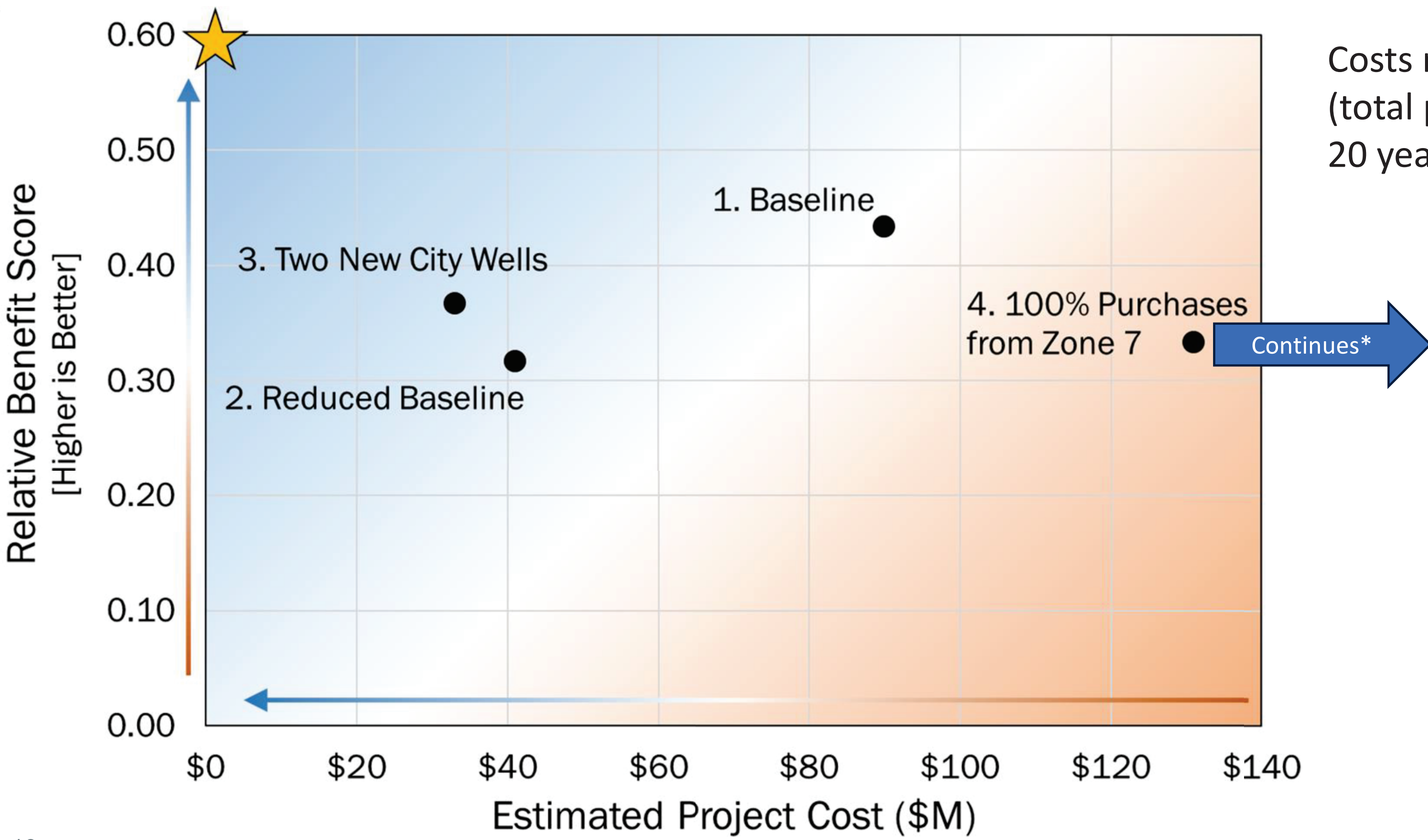
Benefits and Costs of Water Supply Alternatives



Costs reflect **"simplified life cycle"** (total project capital costs with 20 years of annual O&M).

*Cost of 100% purchases from Zone 7 would continue every year in perpetuity.

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Revenue Analysis

- Separate from existing rate study, staff assessed revenue need to implement water supply alternatives.
- City staff conducted a comparative analysis for the purpose of determining if any single alternative has more or less significant effect on future revenue requirements.
- Conclusions:
  - The Zone 7 purchases have the most significant effects on revenue requirements due to the annual cost to purchase 3,500 AFY of base supply from Zone 7.
  - The baseline alternative, which is the most expensive alternative by a factor of 2x, would have the highest revenue requirements.
  - The reduced baseline and two new wells alternatives would be the least impact and have similar revenue requirements.
- Regardless of alternative selected, City staff are working to secure grants and state/federal funds to reduce impact on ratepayers.

Recommended Path Forward

Move forward with Alt. 3
(Two New City Wells)

- Provides high reliability at lowest cost
- Operating complexity is low. Groundwater pumping is in the City's wheelhouse; treatment is not.
- High quality drinking water, drawn in a manner unaffected by and not disturbing the PFAS plume

Continue discussion with Zone 7

- Zone 7 exploring installation of new wells in similar area as Pleasanton's possible sites for two new wells.
- Staff will investigate possible opportunities for coordinated implementation, which may result in cost savings.
- If timing and shared interest align, City may explore discussions for a joint project.

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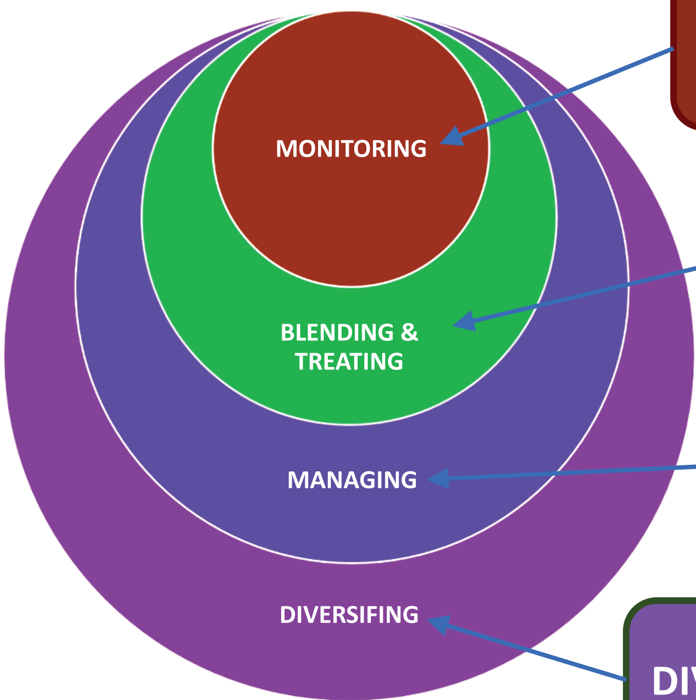
Components of Zone 7's Long-term Strategy (post-2023)



MONITORING to track and manage groundwater quality

BLENDING & TREATING to meet water quality standards

MANAGING GROUNDWATER QUALITY to prevent further degradation

DIVERSIFING GROUNDWATER SOURCES to become more resilient

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Next Steps on Water Supply Alternatives Study

Sept. 2023

- Prepare draft report and implementation plan

Oct. 2023

- Prepare final report and implementation plan
- Oct. 17th Council approval of staff recommendation

Assuming City Council approval:

- FY24 – Evaluate locations of City only and co-located facilities
    - Receive update on Zone 7's groundwater modeling (as the agency in charge of valley groundwater basin)
    - Explore collaboration with Zone 7
- FY25 – Perform test wells and well facilities design
- FY26 and FY27 – Construct and equip wells, then begin operation

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Questions?

Water Supply Alternatives Study Update

Pleasanton Water City Council Meeting

October 17, 2023

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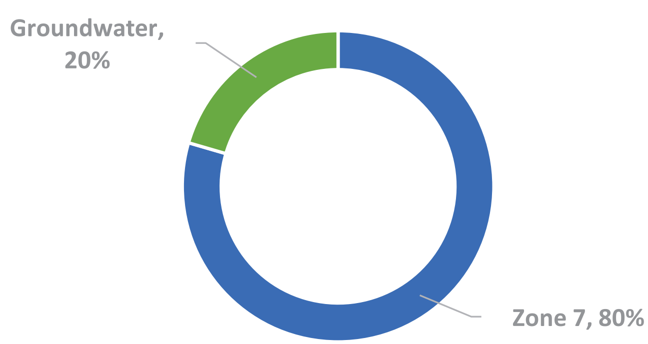
Objective of Water Supply Alternatives Study

- **Identify and evaluate alternatives** relative to the PFAS Treatment and Wells Rehabilitation Project for the portion of water supply that has been sourced using the City's groundwater pumping quota (3,500 acre-feet/year [AFY])

- **Inform path forward** including whether the City should proceed with the PFAS Treatment and Wells Rehabilitation Project or pursue an alternative to produce 3,500 AFY of potable (drinking) water supply



2020 water supplies
(from Pleasanton's 2020 UWMP)

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Evaluation Process – Current Status

Step 1

Develop & screen supply options

- Are there any "fatal flaws" (e.g., technically or institutionally infeasible)?
- Can the option yield 3,500 AFY of supply?
- Is there potential for lower cost / increased benefit compared to baseline (PFAS Treatment Project)?

Step 2

Detailed evaluation of benefits

- Evaluate shortlisted alternatives using multiple criteria, including water supply reliability, implementation timing, water quality/ regulatory compliance, operational complexity, and institutional complexity.

Step 3

Estimation of cost

- Develop cost estimates (capital and O&M) for each shortlisted alternative.
- Consider benefits and costs together to inform selection of a preferred alternative.

Recommended alternative

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Background

Water Supply Option		Result of Initial Screening
Baseline Project (PFAS Treatment and Wells 5, 6, & 8 Rehabilitation)	→	Passed screening, evaluated as **Alternative 1**
Reduced Baseline (PFAS Treatment for Well 8 Only)	→	Passed screening, evaluated as **Alternative 2**
New City well(s) outside PFAS plume (west part of the City)	→	Passed screening, evaluated as **Alternative 3**

Groundwater Options

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Background (continued)

Water Supply Option	Result of Initial Screening
Zone 7 to Pump Groundwater on City's Behalf	Screened out initially due to Zone 7's anticipated timing for updating its regional groundwater model and Well Siting Master Plan. Zone 7 subsequently decided to accelerate its planning, which makes a joint project potentially viable. The City and Zone 7 will continue to explore this option as Zone 7 progresses its planning.
Regional PFAS Treatment Facility (at Pleasanton's Operations Services Center)	Screened out, Zone 7 is not interested in advancing this concept.
Regional PFAS Treatment Facility (at Pleasanton's Operations Services Center)	Screened out, dilution would require substantially more supply from Zone 7 than is available or capable of being delivered to the City.

Groundwater Options (cont'd)

Background (continued)

Water Supply Option	Result of Initial Screening
100% Purchases from Zone 7	Passed screening, evaluated as **Alternative 4**
Other Supply Options: Purchases from Another Agency (e.g., SFPUC or EBMUD)	Screened out, Connections to SFPUC or EBMUD do not currently exist and are not institutionally feasible. Long-term transfers through Zone 7's system are considered under the option for 100% purchases from Zone 7.
Other Supply Options: Local Alternative Supplies	Screened out, High cost of desalination or satellite treatment relative to baseline and seasonality/unpredictability of stormwater availability.

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Background (continued)

Water Supply Option	Result of Initial Screening
Expansion of Non-potable (Recycled Water) System	Screened out, recycled water is supply-limited in the peak season, which is when the City typically relies on groundwater for meeting peak potable demands.
Long-term Water Use Efficiency (WUE)	Passed screening, while WUE alone cannot reduce the City's peak demand and annual need for 3,500 AFY within the timeframe desired by the City, WUE is considered an "add-on" that complements all other water supply options.

Demand Management Options

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Water Supply Alternatives

Four alternatives for evaluation:

1. Baseline (PFAS Treatment and Wells 5, 6, & 8 Rehabilitation)
2. Reduced Baseline (PFAS Treatment for Well 8 only)
3. Two New City Wells (West of PFAS plume)
4. 100% purchases from Zone 7*

City pumps its groundwater quota

City does not utilize groundwater quota

Potential <u>future</u> regional alternative with Zone 7*

- New regional groundwater wells outside PFAS plume

Zone 7 pumps City's groundwater quota as part of regional project

*Any alternatives involving Zone 7 would require Zone 7 Board approval.

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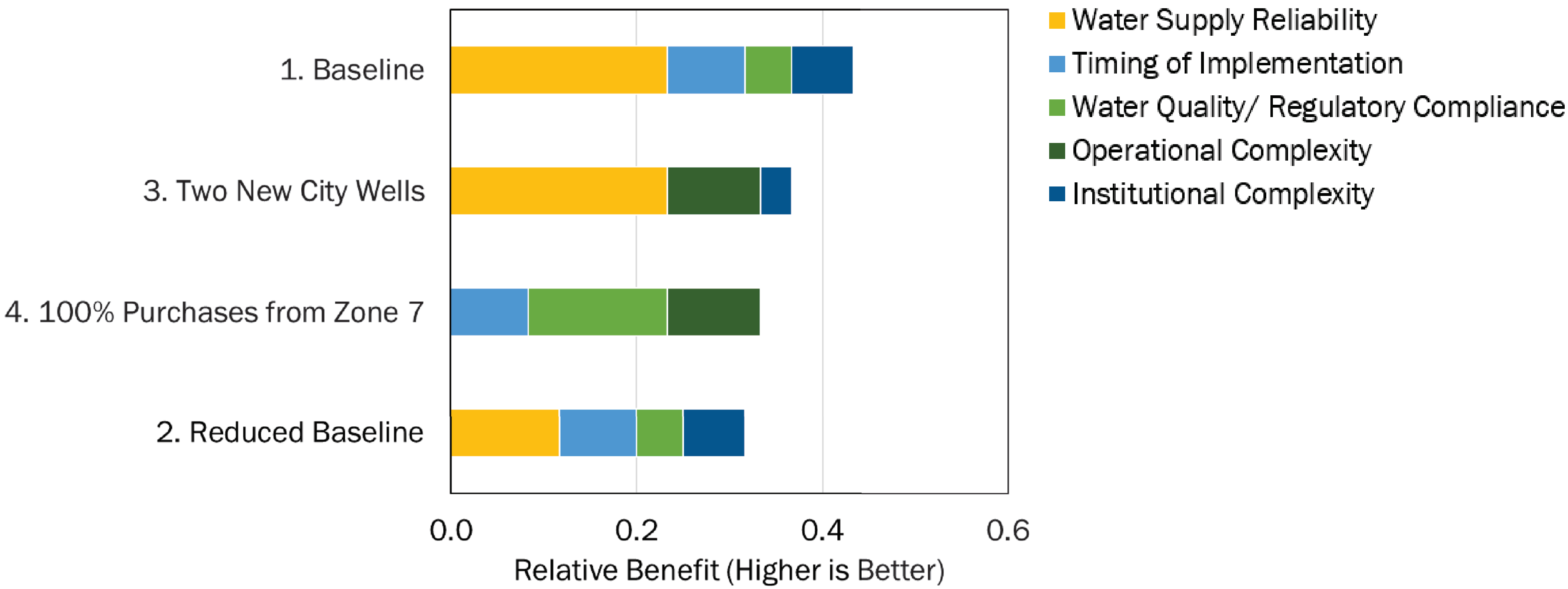
Relative Benefit of Alternatives



Estimated Capital and Annual O&M Costs

	Alt. 1 (Baseline, PFAS Treatment, 50% design)	Alt. 2 (Reduced Baseline, PFAS treatment)	Alt. 3 (Two New City Wells)	Alt. 4 (100% Purchases from Zone 7)
Capital [a, b] – including infrastructure improvements (Range)	**$65M** ($57M-$77M)	**$29M** ($26M-$34M)	**$23M** ($13M-$42M)	**$11M** ($6M-$21M)
Annual O&M [c, d] (Range)	**$1.2M/year** ($1M-$1.5M/year)	**$0.6M/year** ($0.5M-$0.7M/year)	**$0.5M/year**	**$6.1M/year** ($6M-$6.3M/year)
Total Annual Cost	**$5.5M/year**	**$2.5M/year**	**$2.0M/year**	**$7.2M/year**

Costs shown in estimated 2024 $ (assuming 5% escalation from 2023 $).

[a] Including: design, construction, contingency, construction support services (construction management [CM] and engineering services during construction [ESDC]), and incremental cost of required infrastructure improvements beyond those identified in footnote (a).

[b] Assumes near-term improvements (including pipelines F-1, F-4, and F-5 and baseline booster station BS-1 as identified in Akel's Water Supply Alternative Improvements summary dated 8/2/23), estimated at ~$10.2M, will be funded and addressed in advance of implementing water supply alternatives.

[c] Including: GAC media change-out, hazardous disposal of GAC spent media, chemical (additional costs), electricity (additional costs), and wholesale water supply (assuming 3,500 AFY)

[d] Not including additional operations staff for PFAS treatment (estimated at 2-3 FTEs for Alts. 1 and 2)

[e] Includes capital and O&M. Capital cost annualized using a 5% interest rate over a 30-year period.

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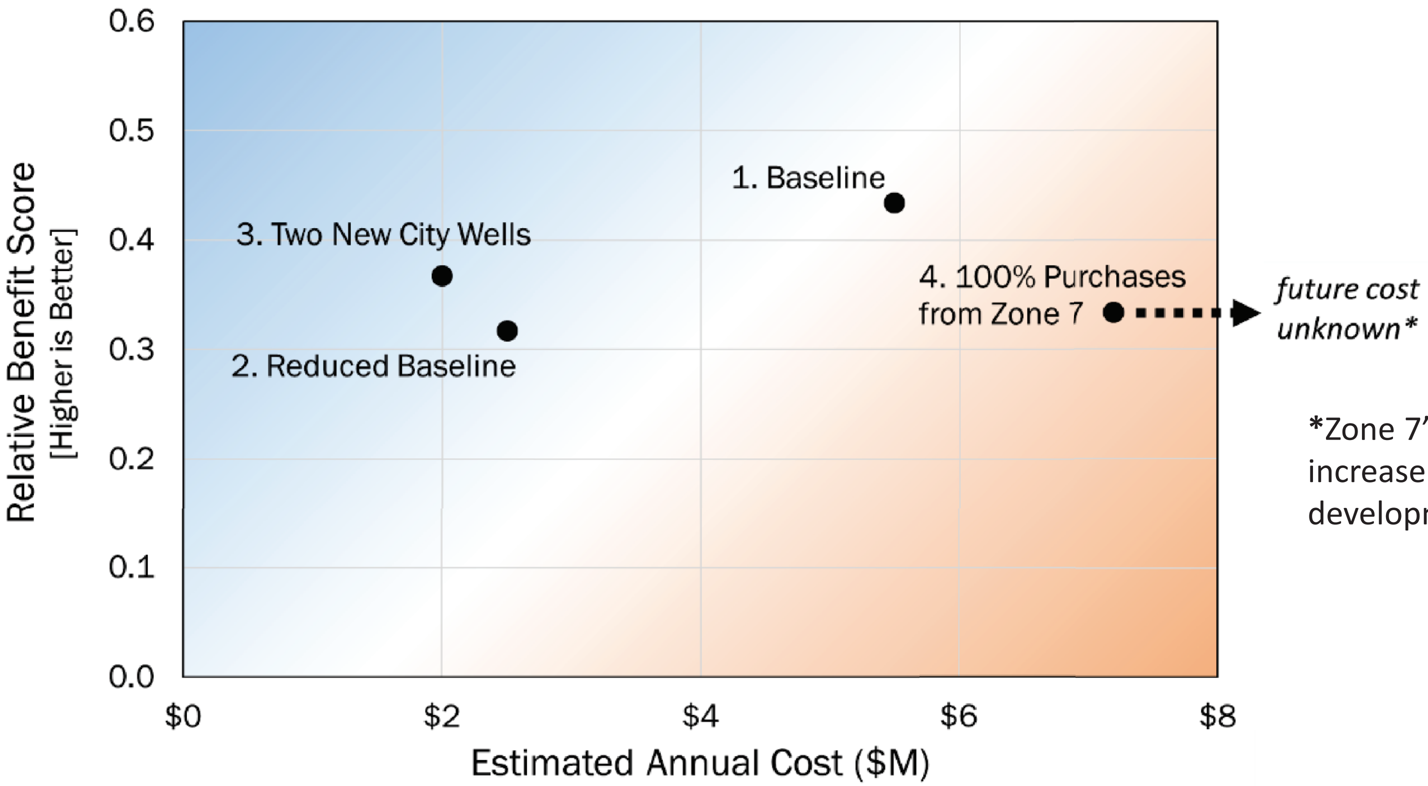
Benefits and Costs of Water Supply Alternatives



*Zone 7's wholesale rate will likely increase over time with development of new supplies.

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Revenue Analysis

- Separate from existing rate study, staff assessed revenue need to implement water supply alternatives.
- City staff conducted a comparative analysis for the purpose of determining if any single alternative has more or less significant effect on future revenue requirements.
- Conclusions:
  - The Zone 7 purchases have the most significant effects on revenue requirements due to the annual cost to purchase 3,500 AFY of base supply from Zone 7.
  - The baseline alternative, which is the most expensive alternative by a factor of 2x, would have the highest revenue requirements.
  - The reduced baseline and two new wells alternatives would be the least impact and have similar revenue requirements.
- Regardless of alternative selected, City staff are working to secure grants and state/federal funds to reduce impact on ratepayers.

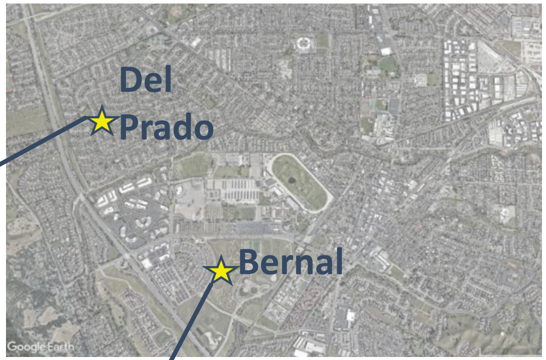
Recommended Path Forward

Move forward with Alt. 3
(Two New City Wells)

- Provides high reliability at lowest cost
- Operating complexity is low. Groundwater pumping is in the City's wheelhouse; treatment is not.
- High quality drinking water, drawn in a manner unaffected by and not disturbing the PFAS plume

Continue discussion with Zone 7

- Zone 7 exploring installation of new wells in similar area as Pleasanton's possible sites for two new wells.
- Staff will investigate possible opportunities for coordinated implementation, which may result in cost savings.
- If timing and shared interest align, City may explore discussions for a joint project.



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Other Considerations

- Pausing the PFAS Treatment project and conducting the Water Supply Alternatives Study resulted in significant cost savings for the City.
- Risks of implementing Alternative 3 (Two New City Wells) are manageable.
  - Schedule – “Dual path” approach not necessary.
  - Water quality and quantity – In advance of significant expenditures on new wells, City’s test wells and Zone 7’s modeling will confirm water quality and production capacity.
  - Cost – Estimates will be updated before proceeding to final design and construction.
- The backup plan can be a quick pivot to Alternative 2 (Reduced Baseline) without impacting schedule, though it is anticipated to be a higher cost than Alternative 3 (Two New City Wells).

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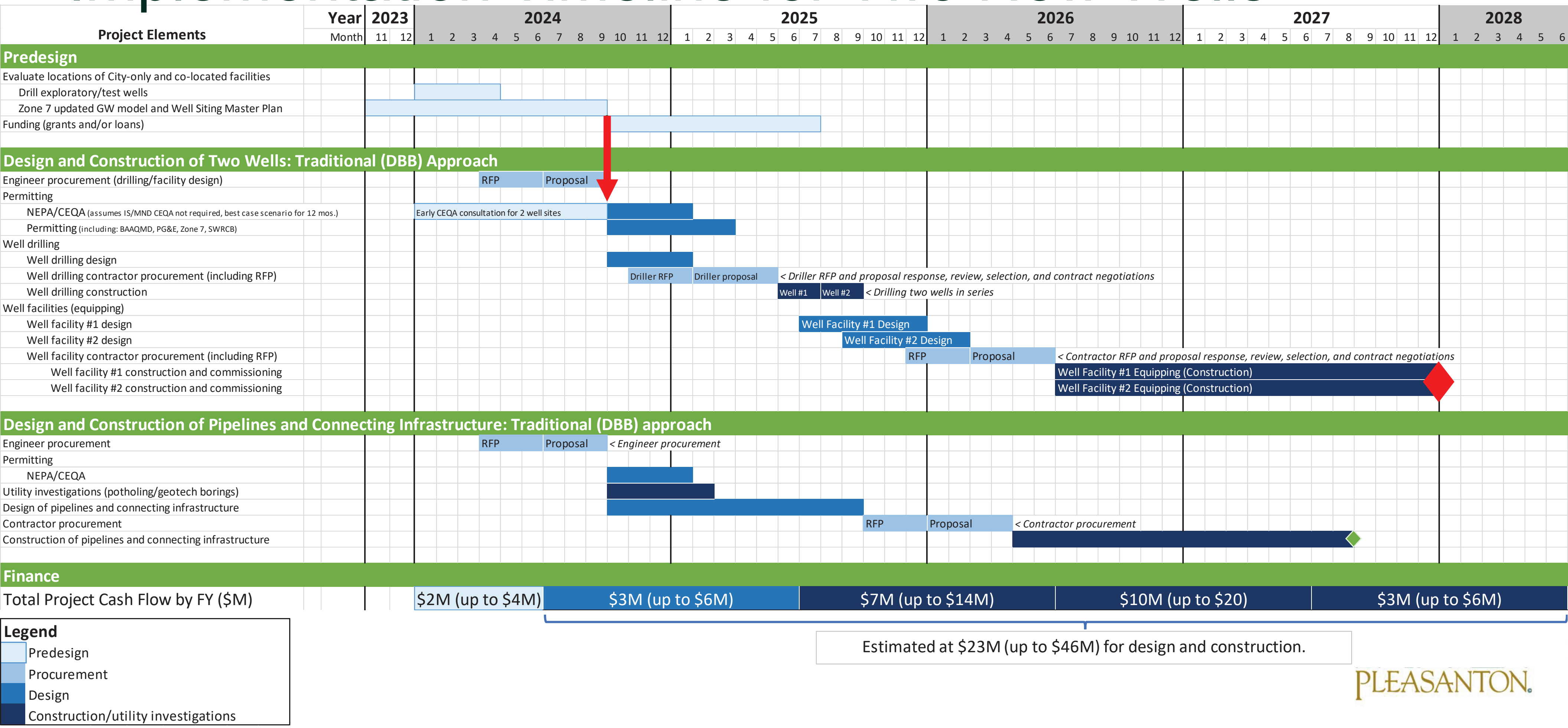
Implementation Timeline for Two New Wells



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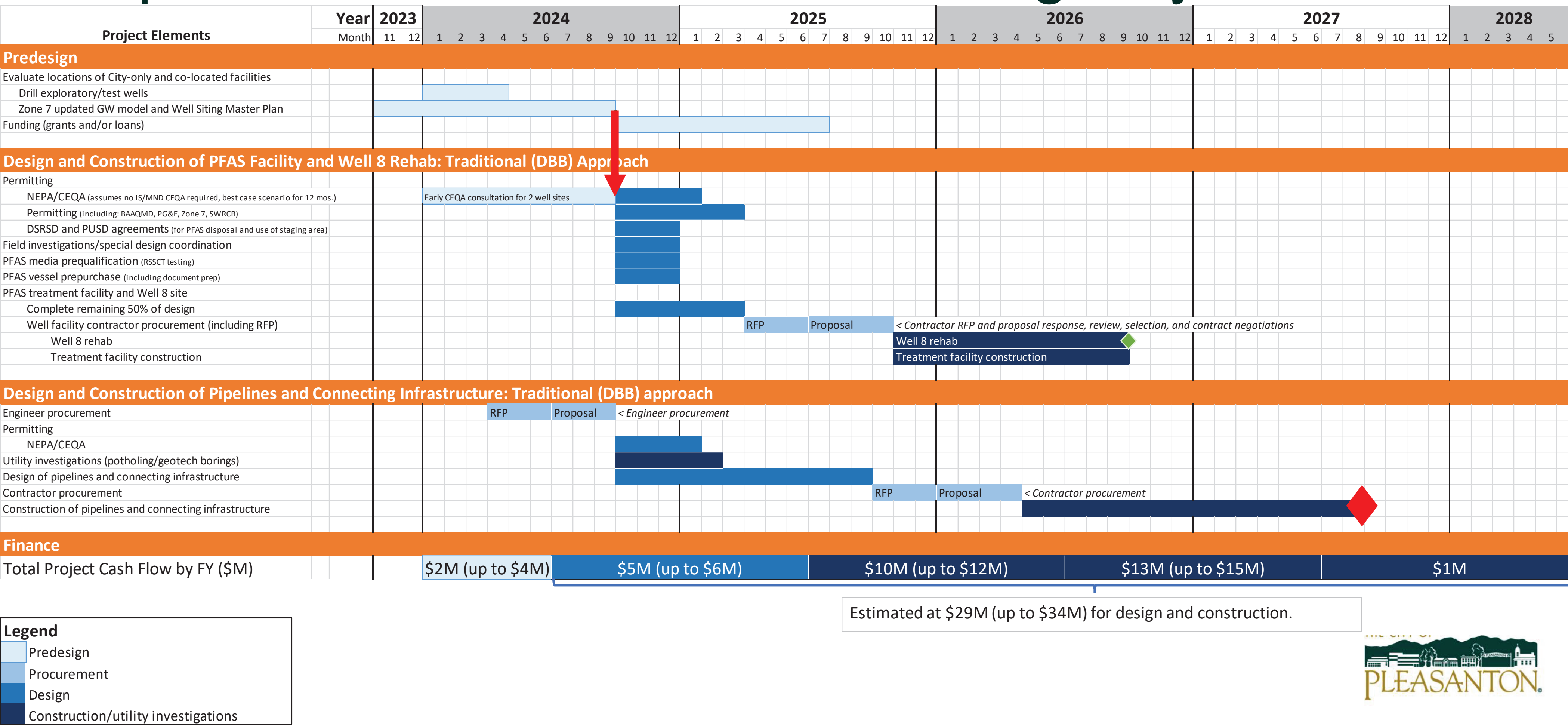
Implementation Timeline for Contingency Plan



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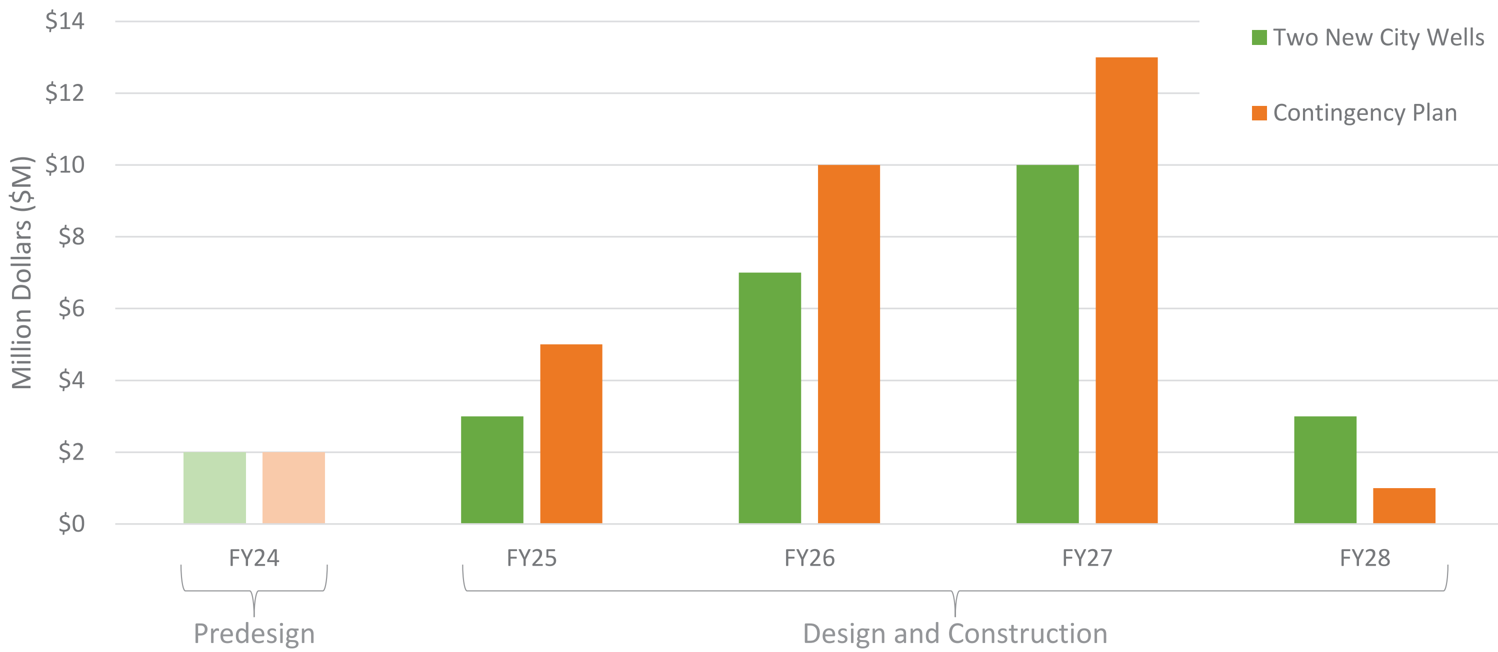
Estimated Fiscal Impact



Total Estimated Project Capital Costs for Design and Construction:

- Two New City Wells = $23M (up to $42M)
- Contingency Plan pivot to Reduced Baseline) = $29M (up to $34M)

Next Steps

Assuming City Council approval:

- FY24 – Conduct predesign to evaluate locations of City only and co-located facilities
  - Drill exploratory test wells
  - Collaborate with Zone 7 on updated groundwater model and Well Siting Master Plan
  - Initiate engineering design procurements and CEQA consultation for Two New Wells
  - Evaluate key terms of agreement with Zone 7 for a joint project
  - Evaluate alternative project delivery
- FY25
  - Zone 7 finalizes groundwater modeling well siting
  - Decide on city-only Two New Wells or joint new well project with Zone 7
  - Confirm continuing with Two New Wells or pivot to Reduced Baseline (PFAS Treatment and Rehab for Well 8 Only)
  - Procure designers, perform environmental reviews and designs, procure well driller
- FY26 to FY27 – Complete designs and begin construction
- FY28 – Complete construction and initiate operations

Questions?