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REGIONAL GROUNDWATER FACILITIES PROJECT FEASIBILITY STUDY

PREPARED FOR

ZONE 7 WATER AGENCY

THE CITY OF PLEASANTON

PREPARED BY



Luhdorff & Scalmanini Consulting Engineers

LSCE PROJECT #24-077

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
$/AF	dollars per acre-foot
AACE	Association for the Advancement of Cost Engineering
AFY	acre-feet per year
AF	acre-feet
Alt GSP	Livermore Valley Alternative Groundwater Sustainability Plan
Basin	Livermore Valley Groundwater Basin
bgs	below ground surface
bhp	Brake horsepower
BODR	Basis of Design Report
CEQA	California Environmental Quality Act
City	City of Pleasanton
CRF	capital recovery factor
DB	design-build
DBB	design-bid-build
EUAC	equivalent uniform annual cost
gpm	gallons per minute
GPQ	groundwater pumping quota
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCF	Hopyard Chloramine Facility
hp	horsepower
LF	lineal feet
LSCE	Luhdorff and Scalmanini Consulting Engineers
MGD	million gallons per day
mg/L	milligrams per liter
MCL	maximum contaminant level
ng/L	nanograms per liter
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
PFOS	perfluorooctane sulfonate
ppt	parts per trillion
psi	pounds per square inch
Q/s	specific capacity in gallons per minute per foot
RFP	Request for Proposals
Study	Regional Groundwater Facilities Project Feasibility Study
TDS	total dissolved solids
Zone 7	Zone 7 Water Agency
yr	Year

EXECUTIVE SUMMARY

Luhdorff & Scalmanini Consulting Engineers (LSCE) has prepared this Regional Groundwater Facilities Project Feasibility Study (Study) on behalf of Zone 7 Water Agency (Zone 7), and in coordination with the City of Pleasanton (City), to evaluate the potential for new groundwater production facilities to provide groundwater supplies to the City and provide drought reliability for Zone 7. The Study addresses the City's and Zone 7's combination of overlapping and separate project objectives including providing customers with safe water, addressing long-term water supply reliability challenges, capturing cost savings through economies of scale, continuing management of per- and polyfluoroalkyl substances (PFAS) and total dissolved solids (TDS), and protection of the Livermore Valley Groundwater Basin (Basin) given proximity to known PFAS footprints, and enhancing local drought resilience through additional regional groundwater production capacity.

The City originally advanced its own Water Supply Alternatives Study (Brown and Caldwell, 2023) and was preparing to design and construct a two-well groundwater project identified through that process. From the City's perspective, a primary objective of pursuing local groundwater development was a means of improving long-term water supply reliability, reducing reliance on purchased wholesale water and achieving long-term cost savings relative to Zone 7 wholesale supply rates.

In parallel, Zone 7 and the City identified broader complementary regional and local objectives, including improving long-term water supply reliability, enhancing drought resilience, managing basin-wide PFAS and TDS risks, and maximizing the value of new groundwater infrastructure through coordinated planning. Based on these shared interests, the City and Zone 7 jointly evaluated whether a coordinated regional groundwater project could better advance both agencies' objectives compared to planning and implementation of separate water supply projects.

This joint evaluation led to the issuance of Request for Proposals (RFP) #2025-12, selection of LSCE as the lead consultant with technical support from Carollo Engineers, and development of this Feasibility Study. Since project initiation, Zone 7, the City, and the consultant team have conducted multiple workshops and technical meetings with the Zone 7 Board of Directors and City leadership to review hydrogeologic findings, define evaluation criteria, and advance alternatives to a feasibility-level assessment.

A central technical driver of the Study remains the presence of PFAS within the Basin, requiring careful siting and design of new production capacity to expand local supplies while avoiding PFAS-impacted zones and protecting long-term basin sustainability.

The Study applied a structured evaluation and ranking process that began with an initial screening of potential alternatives and advanced four representative project configurations for detailed evaluation as follows:

- Project Alternative #1 – Tennis Park
- Project Alternative #2 – Tennis and Hansen Park
- Project Alternative #3 – Tennis and Del Prado Park
- Project Alternative #4 – Tennis, Hansen, and Del Prado Park

Through comparative assessment of the project alternatives against project alternative evaluation criteria (yield, groundwater sustainability, water quality, operational flexibility, cost, and other criteria) the Study concludes that Project Alternative #2 (Tennis and Hansen Park) offers the most balanced and implementable solution. This configuration, involving construction of two new production wells, raw water transmission pipeline to the Hopyard Chloramine Facility (HCF), and HCF upgrades, can meet both agencies' objectives under drought-year conditions with realistic operating schedules, while minimizing exposure to PFAS risks and avoiding excessive infrastructure and operations and maintenance (O&M) costs and operational complexity. It is important to note that the estimated well production capacities and resulting annual project yield estimates associated with the selected alternative in this Study are preliminary and based on test well performance data. These estimates will be refined and confirmed through installation and testing of the full-scale production wells as the project advances into final design and implementation.

Carollo Engineers has prepared a Basis of Design Report (BODR), 10 percent design drawings and engineer's opinion of probable construction capital costs and O&M for the preferred project alternative identified in this Study (**see Appendix J**). Together, this Study, the attached BODR and probable construction capital and O&M costs are intended to provide Zone 7 and the City governing bodies with the required information needed to confirm whether the joint project is agreeable to proceed over individual water supply projects.

1. INTRODUCTION

Zone 7 and the City commissioned this Study to evaluate the development of new groundwater production wells in the Bernal Subbasin of the Livermore Valley Groundwater Basin. Zone 7 is the regional water wholesaler and designated Groundwater Sustainability Agency (GSA) for the Basin, responsible for long-term supply reliability, groundwater management, and regulatory compliance.

Zone 7 supplies treated and untreated water to multiple retail agencies in the Tri-Valley, which include the Cities of Pleasanton and Livermore, Dublin San Ramon Services District, and California Water Service Company. Zone 7 serves more than 280,000 residents and businesses across a service area of approximately 425 square miles in Alameda and Contra Costa Counties through surface water treatment plants, groundwater wells, and over 40 miles of transmission pipelines. Pleasanton's potable water demand has historically been met by a combination of Zone 7 treated water purchases and a City groundwater production quota (GPQ) of 3,500 acre-feet per year (AFY).

1.1. Background

Zone 7 supplies treated drinking water to multiple agencies in the Tri-Valley, including the City. The City's potable water demands have historically been met by a mix of Zone 7 treated water purchases and City owned groundwater wells (Wells 5, 6, and 8). In 2020, PFAS was detected in these wells and near after were removed from service, increasing the City's reliance to 100% Zone 7 supplies at the more expensive wholesale rate. To address this immediate loss, the City advanced the PFAS Treatment and Wells Rehabilitation Project (2020–2022), which reached the 50-percent design stage and included well rehabilitation, construction of new wells, and a centralized PFAS treatment facility. In late 2022, the City put the project on hold pending completion of a broader Water Supply Alternatives Study before committing to long-term treatment (Brown and Caldwell, 2024).

That study, completed in 2023, identified a project involving construction of two new City wells west of the PFAS footprint as the preferred alternative. While the City was prepared to pursue this independently, Zone 7 and the City recognized that a coordinated regional project could provide broader benefits, including drought resilience, reduced reliance on imported supplies, and cost efficiencies.

Zone 7 and the City initiated this Feasibility Study (Study) for the Regional Groundwater Facilities Project as part of Phase I, which includes the exploratory test well program and evaluation of up to three new municipal supply wells in the Bernal Subbasin. The purpose of Phase I is to identify a preferred project alternative capable of providing a minimum of 7,000 AFY of groundwater under drought conditions, of which 3,500 AFY will be allocated to meet the City's GPQ. LSCE was retained as lead consultant, with Carollo Engineers supporting conceptual project design and cost estimating and associated Phase I design tasks. If Zone 7 and the City decide to proceed with the identified project alternative, the project will then be advanced into Phase II which consists of detailed design of production wells, pipelines, and required HCF upgrades, followed by construction and implementation.

Because PFAS, TDS, and other regulated constituents occur in the Bernal Subbasin, the Study included test well drilling, aquifer testing, and water quality sampling to characterize production capacity and assess long-term water quality risks. Any new groundwater supplies developed as part of this project will be integrated into Zone 7's HCF, which uses chloramines for disinfection prior to being combined with separate treated surface water sources in the distribution system. Delivery of the City's GPQ would be via the Zone 7 water supply system (as opposed to the City current configuration of direct delivery from dedicated City wells). Separate from this Study, the City is evaluating needed improvements to their distribution system to receive the water in this fashion. An overall project site map is shown in **Figure 1**.



Luhdorff & Scalmanini Consulting Engineers

Overview Project Site Map

Zone 7 Regional Groundwater Facilities Project
Pleasanton, CA

Figure 1

1.2. Purpose

The purpose of this Study is to:

- Identify and evaluate feasible groundwater development project alternatives capable of producing a minimum of 7,000 AFY (including the City's GPQ) under drought conditions as desired by Zone 7.
- Assess the scope, costs, and pros/cons of wellfield configurations in terms of yield, water quality, operational resilience, project capital and O&M costs, and community impacts across dry, average, and wet years.
- Provide Zone 7 and the City with a technically and financially sound basis for selecting a preferred alternative for consideration to advance to design, permitting, and construction (Phase II).

1.3. Approach to Study

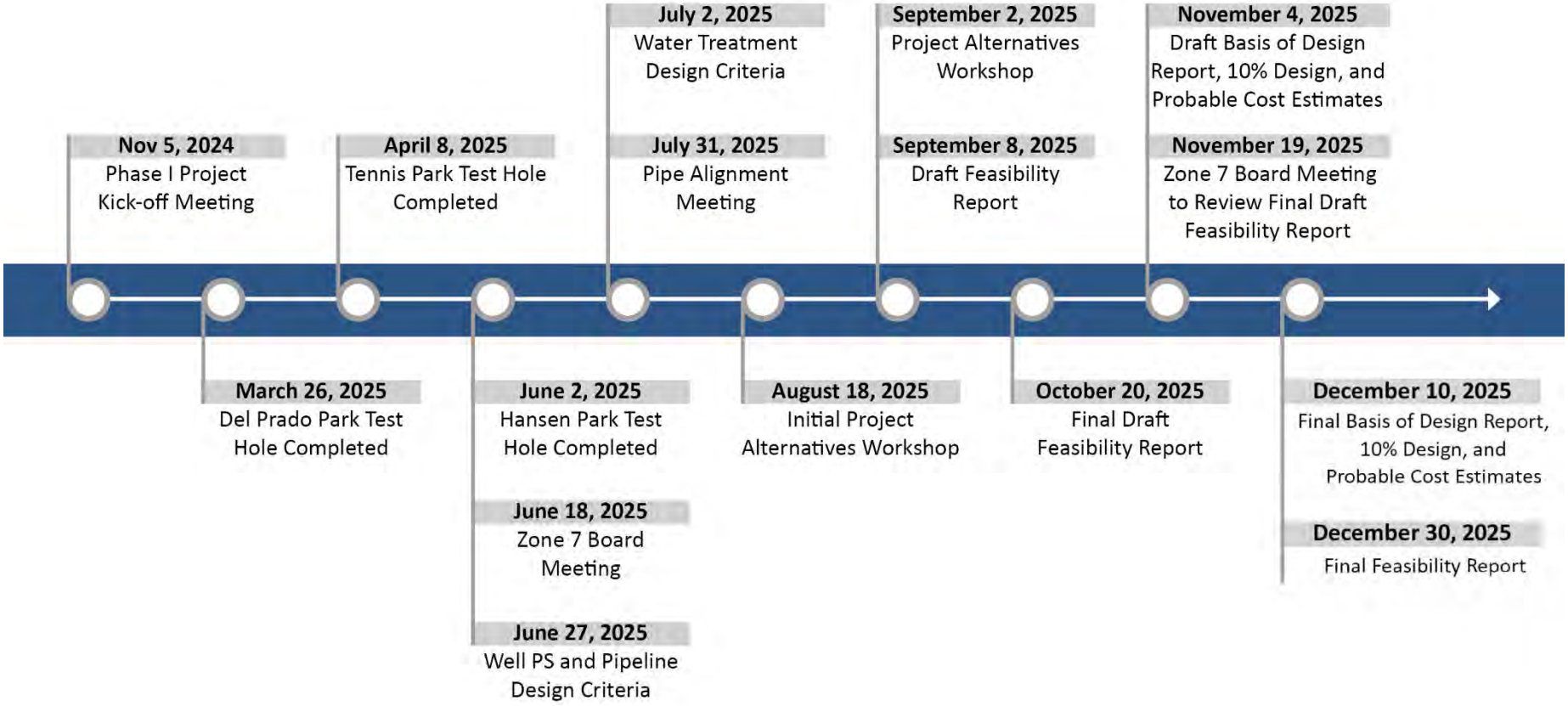
The Study was structured to follow the framework outlined in Zone 7's Regional Groundwater Facilities Project RFP. Work began with exploratory drilling and aquifer testing at three candidate sites: Tennis Park, Hansen Park, and Del Prado Park, to principally establish baseline production capacity and water quality characterization. These results were supplemented by LSCE's review of existing production and water quality records from existing production wells in the basin, as well as groundwater modeling efforts performed by Zone 7. Together, these efforts informed the development of a common set of project evaluation criteria shared by Zone 7 and City leadership, and LSCE to guide comparison of project alternatives.

Two project evaluation criteria, groundwater production capacity and groundwater basin sustainability, were treated as pass/fail requirements given target project production values and to ensure compliance with Zone 7's Alternative Groundwater Sustainability Plan (Alt GSP). Six additional criteria, including capital cost, O&M costs, community and environmental impacts, water quality and treatment impacts, implementation schedule, and operational flexibility, were weighted and scored to provide a transparent framework for evaluation of the project alternatives. Using this framework, four alternatives were advanced for detailed analysis, each representing different combinations of wells across the three candidate sites. Feasibility-level capital and O&M cost estimates were developed by LSCE with support from Carollo Engineers, providing the basis for comparative evaluation of alternatives and identification of a preferred configuration.

1.4. Zone 7 / City of Pleasanton Coordination

Development of this Study has relied on the active support and direction of both Zone 7 and the City. Coordination was carried out through online workshops, technical meetings, and project communications in which Zone 7 staff, City staff, and the consultant team reviewed Phase I project data/findings, and established the framework for evaluating project alternatives. Following completion of the three project test wells, Zone 7 and LSCE presented the initial water-quality and production-rate results at the June 18, 2025 Zone 7 Board meeting. If an agreement to proceed with the regional groundwater project is reached, between the Zone 7 Board and City Council, subsequent Phase II design and construction activities will be initiated. Refer to **Figure 2,** which depicts the project communication milestones to date.

Figure 2. Project Meeting and Coordination Milestones



2. GROUNDWATER SUPPLY

This section provides the hydrogeologic and water quality context for the Bernal Subbasin of the Livermore Valley Groundwater Basin, including aquifer conditions, PFAS occurrence, and TDS trends relevant to the siting of new production wells. The information presented is based on Zone 7's Alt GSP, subsequent annual reports, and the results of recent test well drilling and aquifer testing performed as part of this Study.

As the GSA, Zone 7 prepared the Alt GSP for the Livermore Valley Basin in 2016, submitted a five-year update to the Alt GSP in 2021, and has prepared Annual Reports for the Basin since implementation of the Alt GSP. These planning and reporting efforts provide the technical and regulatory foundation for this Study and for Zone 7's ongoing role in managing basin sustainability.

2.1. Hydrogeologic Setting

The Main Basin of the Livermore Valley Groundwater Basin, a portion of which underlies the City, is comprised of the Upper Aquifer, Lower Aquifer, and the Livermore Gravels. The base of the Upper Aquifer occurs at depths ranging from approximately 70 to 190 feet below ground surface (bgs) across the Main Basin, with greater thicknesses observed in the southeastern portion. Beneath the Upper Aquifer is a relatively continuous regional aquitard up to 50 feet thick. Cross-sections indicate that the Lower Aquifer extends to depths of about 550 feet bgs in the Pleasanton area. Below this, the upper 200 to 300 feet of the older Livermore Formation also exhibits relatively permeable intervals that may contribute to groundwater production (EKI, 2021).

Groundwater quality in the Bernal Subbasin reflects both natural conditions and anthropogenic influences. Maps from the most recent Alt GSP Annual Report show PFOS concentrations in the Lower Aquifer exceeding 4 nanograms per liter (ng/L) across a continuous area extending from near the intersection of Black Avenue and Hopyard Road in Pleasanton eastward to the quarry pits, and from just south of I-580 to Stanley Boulevard. This area encompasses the City's existing Wells 5, 6, and 8, which have been taken offline due to PFAS detections. The western edge of this continuous PFAS-impacted zone lies between the existing City wells and the proposed test well sites (Zone 7, WY 2024 AR).

2.1.1. Water Quality

As part of this Study, exploratory test well drilling, step-drawdown testing, and water quality sampling were conducted at Tennis Park, Hansen Park, and Del Prado Park to characterize source water quality at the three potential production well sites. Separate Test Well Investigation Summary and Well Design Recommendations for each of the three well sites can be found in **Appendix A, B, and C** which provide detailed analytical water quality results, including concentrations of regulated and unregulated constituents, variability by aquifer depth, and explanations for why certain constituents detected in test well samples above state regulatory or Zone 7 water quality target thresholds are not expected to persist at similar levels in production wells. These differences reflect the inherent limitations of test well sampling, which can produce conservative or non-representative results for these certain constituents,

and the broader regional dataset from existing Zone 7 and City wells, which more accurately represents long-term basin conditions.

Zone 7 voluntarily sets water quality targets that in some instances are more stringent than state and federal requirements. For example, under Zone 7's Water Quality policies, PFAS concentrations in delivered treated water is generally required to remain below 80 percent of primary and secondary federal/state Maximum Contaminant Level (MCL) standards and/or 80 percent below proposed and enforced notification levels. Zone 7's target water quality goals also include more stringent levels for boron, salinity and hardness, taste and odor, hexavalent chromium and other specific contaminants as compared to state/federal MCL standards. A full list of Zone 7 potable water quality target goals can be found in **Appendix D**.

While treatment for hardness and TDS is not required at this time for state and federal regulatory compliance, as part of this Study's efforts, a Basis of Design Report and 10 percent design with probable construction and operational costs will be developed to allow Zone 7 (separate from the City) to evaluate the feasibility and cost of treatment of these constituents should Zone 7 choose to pursue it for regional salt management purposes.

PFAS Assessment

PFAS conditions and potential future risks were evaluated using Zone 7's basin-wide PFAS fate and transport model (EKI, 2025). For modeling purposes, perfluorooctane sulfonate (PFOS) was used as a representative compound for the PFAS class. The 20-year predictive model simulations indicate that PFOS concentrations at all three proposed well sites remain below Zone 7's operational water quality goals (80 percent of applicable proposed or enforced notification levels or MCLs) under both the Baseline (No-Project) and Project Alternative scenarios.

Simulated PFOS concentrations at the Tennis Park site are the highest of the three, primarily due to its relative proximity to the existing PFAS footprint and high production rate, but still remain below Zone 7's target levels in all model scenarios, with final predicted concentrations ranging from approximately 0.9 to 1.5 parts per trillion (ppt). Modeling results and assumptions are summarized in **Appendix G.**

The conclusion of the PFAS modeling analysis is that treatment for PFAS is not required for the proposed production wells to meet current regulatory or Zone 7 water quality targets. However, recognizing the evolving nature of PFAS regulations and ongoing regional investigations, Zone 7 is further assessing potential feasible PFAS treatment approaches from a conceptual cost and site-space perspective as part of this Study with development of a Basis of Design Report and 10 percent design with probable construction and operational costs. Implementation of PFAS treatment is not planned at this time and would be pursued separately by Zone 7 if future regulatory or operational conditions warrant.

2.1.2. Groundwater Production Rates

Test well drilling and aquifer testing conducted at Tennis Park, Hansen Park, and Del Prado Park confirmed that the Bernal Subbasin has favorable hydrogeologic conditions capable of supporting high-capacity municipal supply wells. Constant-rate pumping tests were performed at each site to evaluate sustainable yield, aquifer response, and long-term production potential. Zone 7's groundwater modeling was also applied to assess the potential for mutual well interference between the proposed project wells and

existing regional third party wells. A detailed discussion of test results, derivation of production rates, and methodology for estimating the performance of each well site under dry, average, and wet year conditions is provided in **Appendix A, B, and C**.

Testing at Tennis Park indicated some of the highest potential yields among the three sites. Step-drawdown and constant-rate testing suggested an estimated production capacity ranging from 3,400 to 5,100 gallons per minute (gpm), depending on hydrologic conditions during dry, average, and wet year conditions. Hansen Park test well data showed similar favorable results, with sustainable yields in the range of 3,400 to 4,200 gpm. At Del Prado Park, pump testing demonstrated lower estimated yields of approximately 1,300 to 1,900 gpm. As discussed in **Appendix C**, the reduced performance at this site is believed to be largely attributable to different aquifer conditions near the edge of the groundwater basin and to a lesser extent, test well drilling construction issues (e.g. extended well development time). **Table 1** summarizes the estimated production well flow rates at each of the three candidate sites.

Table 1. Estimated Groundwater Production for Three Test Well Sites[a]

Test Well Site	Design Flow Rate (gpm)	Design Flow Rate (MGD)
Tennis Park		
Drought Year Conditions	3,400	4.90
Average Year Conditions	4,250	6.12
Wet Year Conditions	5,100	7.34
Hansen Park		
Drought Year Conditions	3,400	4.90
Average Year Conditions	3,800	5.47
Wet Year Conditions	4,200	6.05
Del Prado Park		
Drought Year Conditions	1,300	1.87
Average Year Conditions	1,600	2.30
Wet Year Conditions	1,900	2.74

[a] *Estimated production flow rates are based on exploratory test well drilling and aquifer testing conducted for this Study. Values represent preliminary planning-level estimates under drought-year, average-year, and wet-year hydrologic conditions, and are intended for feasibility-level evaluation only. Final design flowrates and overall project yield will likely vary from preliminary estimates and cannot be determined until final installation of full-scale production wells.*

These results confirm that multiple high-capacity wells can be developed to reliably meet Zone 7's project objective of 7,000 AFY which includes an allocation of 3,500 AFY to meet the City's GPQ. In combination, all three candidate sites are estimated to provide a design capacity of 8,100 to 11,200 gpm, which equates to an annual production range of roughly 9,800 to 13,550 AFY, assuming 18-hr daily runtimes. Several combinations of these wells as project alternatives are therefore capable of producing the minimum AFY targets required, and these configurations are carried forward as project alternatives for detailed evaluation in later sections of this Study.

The well capacity estimates provided in this study, and hence the overall project yield, should be considered best estimates at this time based on installation and testing of relatively small diameter test wells. The final full-scale production well yields and overall project yield may vary by several hundred gpm more or less than the test well based estimates provided in this feasibility study. Production well yields will be a function of multiple variables (e.g., specific capacity and well efficiency) that may vary between test well drilling and production well drilling. The amount of project yield above the baseline amount allocated to City of Pleasanton (and hence, available to Zone 7) cannot be confirmed until production wells are installed and tested.

2.1.3. Well Pump Sizing

Preliminary well pump motor sizing for each proposed well was developed using estimated design parameters (including but not limited to: production flowrate ranges, deepest anticipated pumping water levels, and maximum assumed discharge pressures) in order to estimate brake horsepower (bhp), nominal well pump motor size requirements, and electrical input power for each production well site. Calculations assumed pumping water levels at the top of the well screen, design flow rates during wet/average/dry years, an estimated discharge pressure of 100 psi at the wellhead, an assumed bowl efficiency of approximately 75 percent.

Preliminary estimates of brake horsepower requirements for each well pump are based on the preliminary assumptions described above and are therefore subject to refinement as additional production well test data, hydraulic modeling results, and other information affecting lift and flow become available. Using these assumptions, estimated brake horsepower requirements are on the order of approximately 250 hp for the Del Prado well and approximately 700 hp for the Tennis Park and Hansen Park wells. Actual brake horsepower requirements and corresponding nominal motor sizes will depend on factors including final dynamic range of discharge head conditions, production well specific capacity, well efficiency, and installed pump configuration. Accordingly, the brake horsepower and motor sizing values presented herein are preliminary and will be confirmed and refined through full-scale production well installation and performance testing.

2.2. Modeling of Future Groundwater Levels

Three model scenarios were developed by Zone 7 and LSCE for simulation of future groundwater level conditions with operations occurring at two or three new test well sites. The scenarios that were simulated included the following:

- Scenario 1 – Operation of new production wells at Del Prado Park, Tennis Park, and Hansen Park;
- Scenario 2 – Operation of new production wells at Tennis Park and Hansen Park;
- Scenario 3 – Operation of new production wells at Tennis Park and Del Prado Park.

Each of the three scenarios included development of separate monthly pumping amounts from each well for Average/Wet Years and Drought Years. It was assumed that Average/Wet Years had a target total production from the new wells of 6,500 AFY, whereas the Drought Year target total production was set at 9,000 AFY. Due to desired monthly pumping volumes and estimated pumping capacities, the target annual volumes were not always able to be achieved and actual simulated pumping volumes for each scenario

are summarized below in **Table 2**. A more detailed spreadsheet with monthly assigned pumping rates for each scenario and well is provided in **Appendix E**.

Table 2. Summary of Scenario Pumping Volumes at New Production Wells

Scenario	New Production Wells	Year Type	Target Pumping Volume (AFY)	Actual Pumping Volume	Annual Shortfall (AFY)
1	Del Prado; Tennis; Hansen	Drought	9,000	8,783	217
1	Del Prado; Tennis; Hansen	Average/Wet	6,500	6,500	0
2	Tennis; Hansen	Drought	9,000	8,018	982
2	Tennis; Hansen	Average/Wet	6,500	6,500	0
3	Tennis; Del Prado	Drought	9,000	6,591	2,409
3	Tennis; Del Prado	Average/Wet	6,500	6,344	156

The anticipated screen zones in each new production well were compared to model layering to assign well screen to appropriate model aquifer layers in the groundwater model. In addition, flow profiling data collected during aquifer testing at each test well site were reviewed. The combination of well screen assigned to each model layer and proportion of flow derived from each screen zone during field testing were used to assign the amount of flow coming from each model aquifer layer for each well. This information is summarized in **Appendix F** and was provided to the groundwater modelers to assist with assignment of the vertical distribution of pumping.

The model scenario results are briefly summarized below in **Table 3**. The groundwater model results were evaluated for overall conclusions regarding three main areas:

- Potential migration of PFOS footprint;
- Potential impacts to basin sustainability in terms of Alt GSP Sustainability Management Criteria (SMC);
- Potential well interference impacts to third party wells.

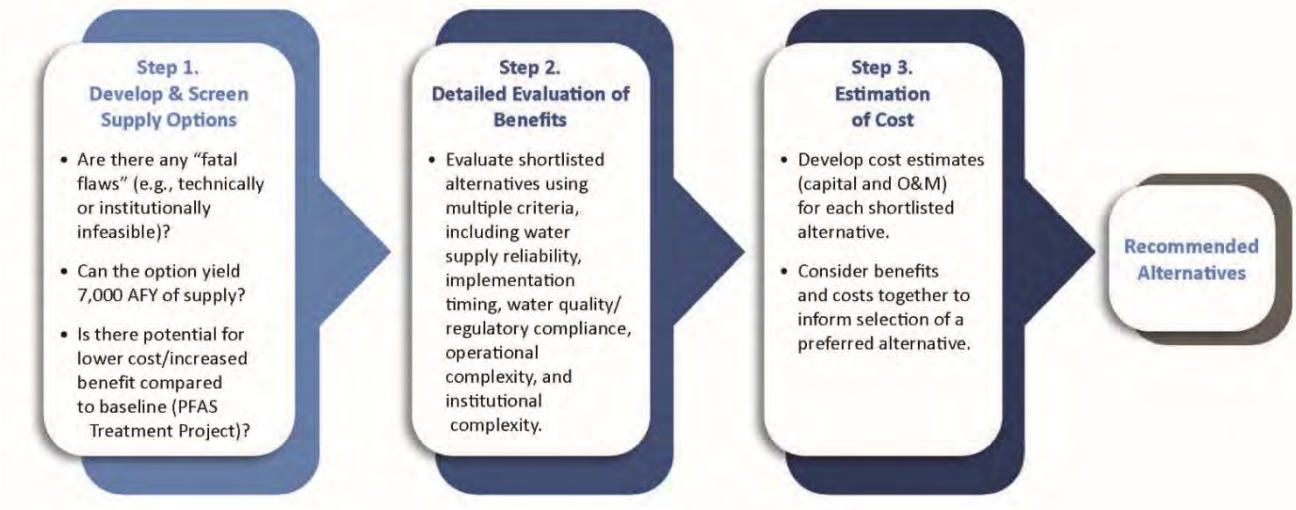
As indicated in **Table 3**, groundwater model results indicate that none of the scenarios were found to be problematic in terms of the three different areas outlined above. Overall, these model results indicate that all scenarios are acceptable in terms of hydrogeologic considerations and warrant further consideration in terms of cost and other engineering factors. A detailed summary of groundwater model scenario results are provided in **Appendix G**.

Table 3. Summary of Groundwater Model Scenario Results				
Scenario	**New Production Wells**	**PFOS Concentrations**	**Comparison to Alt GSP SMC**	**Third Party Well Interference**
1	Del Prado; Tennis; Hansen	<4	No Undesirable Results	Not limiting ability of SFPUC & Fairgrounds wells to pump annual volumes
2	Tennis; Hansen	<4	No Undesirable Results	Not limiting ability of SFPUC & Fairgrounds wells to pump annual volumes
3	Tennis; Del Prado	<4	No Undesirable Results	Not limiting ability of SFPUC & Fairgrounds wells to pump annual volumes

3. PROJECT ALTERNATIVES OVERVIEW

As documented in a Zone 7 memorandum to the Steering Committee, three City parks (Tennis Park, Hansen Park, and Del Prado Park) to the west of the known existing PFAS footprint were identified by Zone 7 and the City for the Study as proposed locations for the new production wells (Zone 7, 2024).

Figure 3. Water Supply Alternatives Identification Process



3.1. Initial Screening of Project Alternatives

LSCE, working with Zone 7, the City, and Carollo Engineers, conducted a series of workshops, meetings, and project communications to screen potential project alternatives against the study's goals and objectives. Primary screening considerations included:

- Minimum production capacity target of 7,000 AFY (Zone 7 drought-year goal), which includes 3,500 AFY for the City's GPQ.

- Preferred pipeline alignments and potential integration with new/replacement/existing facilities.
- Test well water quality and treatment considerations for each well location.
- Site-specific constraints and potential community impacts for each park setting.

Alternatives that could not meet the production objectives were eliminated (e.g., a Del Prado-only project). A Hansen-only project was also dismissed, as it offered no clear production advantage compared with a Tennis-only project and carries greater community impact potential due to proximity to residential areas. Following similar screening measures, four representative alternatives were advanced for detailed evaluation, ranging from a single-well project to a three-well configuration:

- Alternative 1 – Tennis Park
- Alternative 2 – Tennis and Hansen Park
- Alternative 3 – Tennis and Del Prado Park
- Alternative 4 – Tennis, Hansen, and Del Prado Park

3.2. Project Alternatives

Each of the four project alternatives involves construction of either one, two, or three new production wells at the City-owned park sites evaluated in this Study. The sites were selected for their proximity to the HCF, sufficient land area for facility development, and locations outside the known PFAS footprint. Site visits with Zone 7 and City staff were used to identify potential permanent well locations and assess park impacts, and define other collective project goals.

At the feasibility level, the final production well and pump station locations within Tennis Park and Hansen Park have not yet been finalized. Final site selection will occur during the initial design phase and will be developed in coordination with City Planning, Parks, and Recreation staff, with public outreach conducted as appropriate. Site selection will consider factors including routine and special operations and maintenance access such as access for portable generators, equipment removal, and crane operations, availability and routing of PG&E electrical service, storm drain capacity for blowoff and testing discharges, and compliance with applicable noise ordinances. The proposed siting concepts for the Tennis Park and Hansen Park locations are illustrated in the BODR (see **Appendix J**). Figures included in this section are provided for conceptual planning purposes only and are intended to illustrate the general relationship of well facilities to each park and the HCF, not to depict final or precise facility locations within the parks.

Under all project alternatives evaluated in this Study, integration of new groundwater production capacity will require substantial modification and expansion of the existing HCF as the existing HCF configuration does not have sufficient operational capabilities to accommodate the proposed raw water conveyance, flow ranges, and operational requirements associated with the new production wells. As a result, implementation of any project alternative would involve reconfiguration of the HCF to support updated chloramination, hydraulics, controls, and operational flexibility consistent with project objectives.

3.2.1. Alternative 1 – Tennis Park Well

Tennis Park is located at the corner of Valley Avenue and Hopyard Road and is the closest of the candidate

sites to the HCF. The park is large, with tennis and basketball courts providing well pump station siting flexibility. Two potential well and pump station siting concepts within the park were identified, including locations near Valley Avenue and Hopyard Road and alternative locations accessed from existing parking areas, each offering different tradeoffs related to visual impacts, proximity to residences, and pipeline connection locations. Tennis Park also demonstrated the highest estimated yields from aquifer testing. Alternative 1 consists of one well at Tennis Park, with raw water conveyed to the HCF for chloramination via approximately 1,400 lineal feet (LF) of 18-inch diameter pipeline. While it is the lowest-cost alternative, it cannot meet Zone 7's 7,000 AFY drought-year production target on its own. The proposed well pump station location (with an estimated well pump motor size requirement of 700 hp) and associated pipeline alignment are shown in **Figure 4**.

3.2.2. Alternative 2 – Tennis and Hansen Park Wells

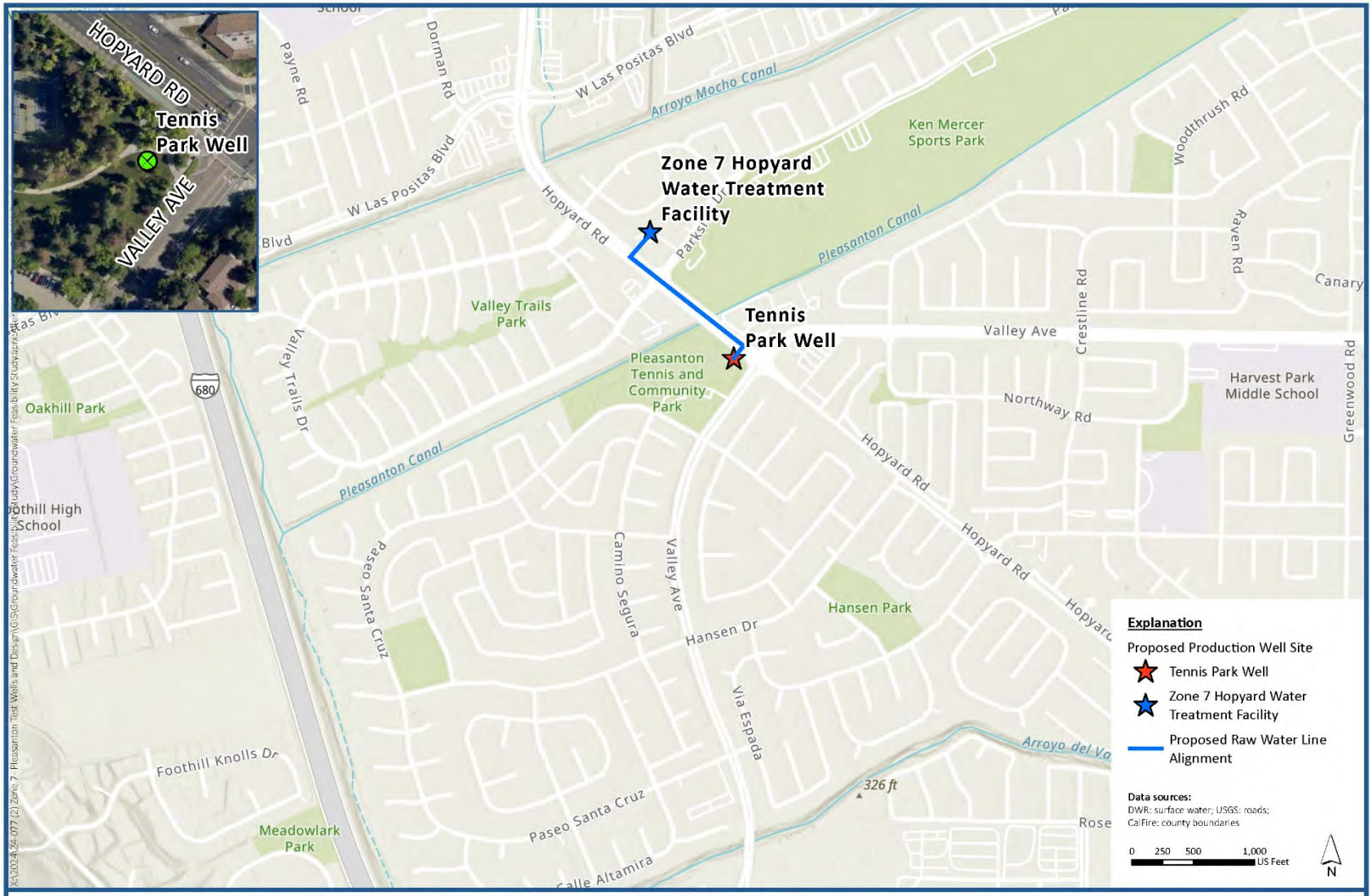
Hansen Park is located along Hansen Drive. Two potential well and pump station siting concepts were identified within the park. These siting concepts were evaluated to minimize impacts on park use while maintaining efficient pipeline routing to the HCF. Paired with the Tennis Park well, this alternative provides the two highest-yielding wells and maximizes production potential from the evaluated sites. Alternative 2 consists of one well at Tennis Park and one well at Hansen Park, each with an estimated well pump motor size requirement of approximately 700 horsepower. Raw water from the Hansen Park well would be conveyed via approximately 2,500 lineal feet of 16-inch diameter pipeline along Hansen Drive and Hopyard Road to the Tennis Park site, where flows would be combined. From there, approximately 1,500 lineal feet of 24-inch-diameter pipeline along Hopyard Road would convey combined flows from both well sites to the HCF for chloramination. The conceptual well pump station locations and associated pipeline alignments are shown in **Figure 5**.

3.2.3. Alternative 3 – Tennis and Del Prado Park Wells

Alternative 3 consists of one well at Tennis Park and one at Del Prado Park (also located along Hansen Drive). The Hansen Drive frontage is the preferred location for production well placement, as it offers straightforward pipeline routing to the HCF and flexibility in siting the permanent well. When paired with Tennis Park, Del Prado Park represents the two wells furthest west of the known PFAS footprint, thereby minimizing potential for future PFAS treatment needs, although Del Prado (with an estimated 250 hp well pump motor size requirement) has lower yields than Hansen. The proposed well pump station locations and associated pipeline alignment (approximately 6,100 LF of up to 24-inch diameter pipe) are shown in **Figure 6**.

3.2.4. Alternative 4 – Tennis, Hansen, and Del Prado Park Wells

This configuration includes wells at all three candidate sites: Tennis Park, Hansen Park, and Del Prado Park. It provides the maximum total pumping capacity along with enhanced operational flexibility, redundancy, and long-term resilience. Alternative 4 has the highest capital cost and the largest community footprint but offers the broadest set of benefits from a supply and operations standpoint. The proposed well pump station locations and associated pipeline alignments (approximately 7,500 LF up to 30-inch diameter pipe) are shown in **Figure 7**.

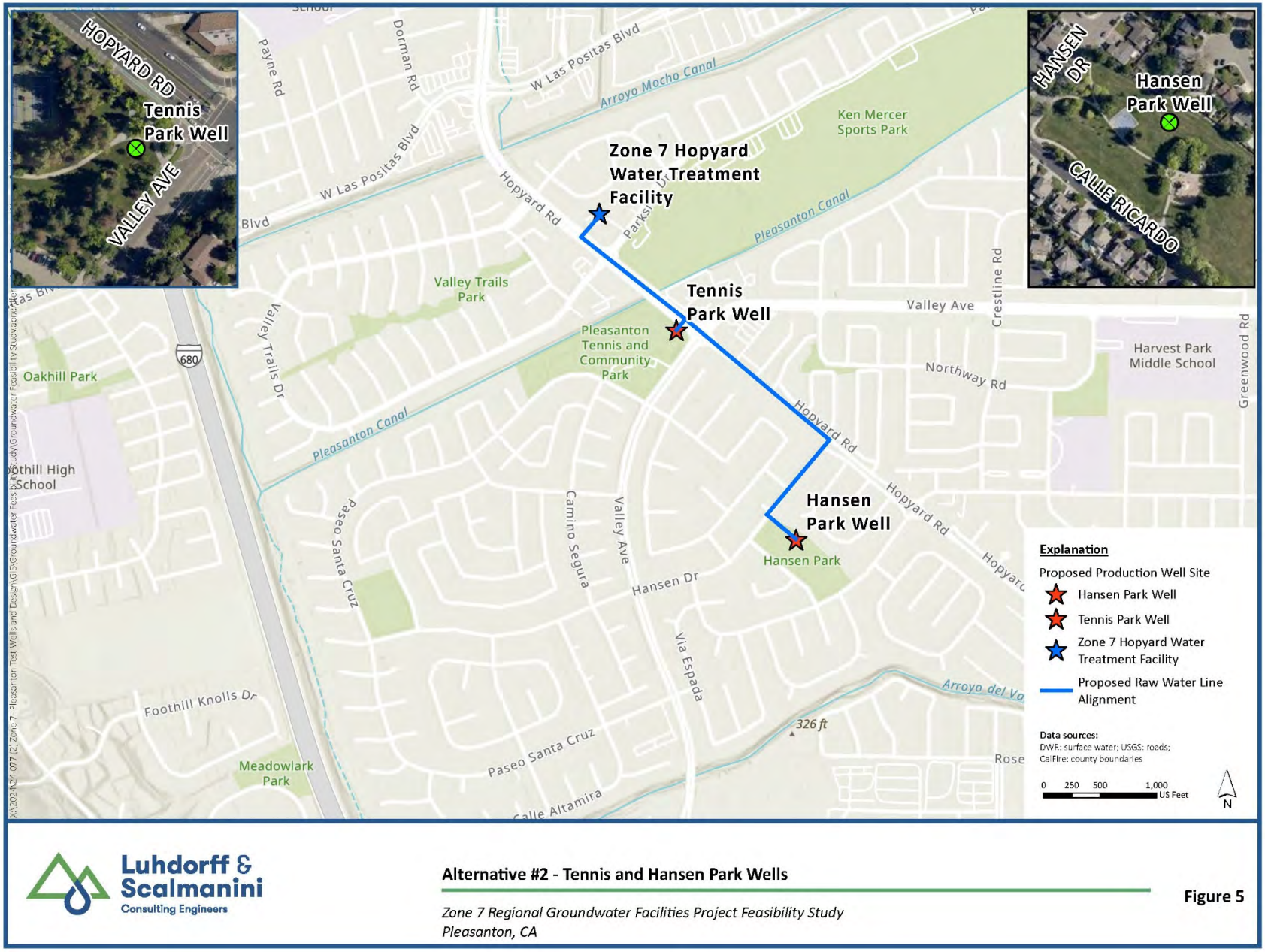


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Alternative #1 - Tennis Park Well

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Figure 4

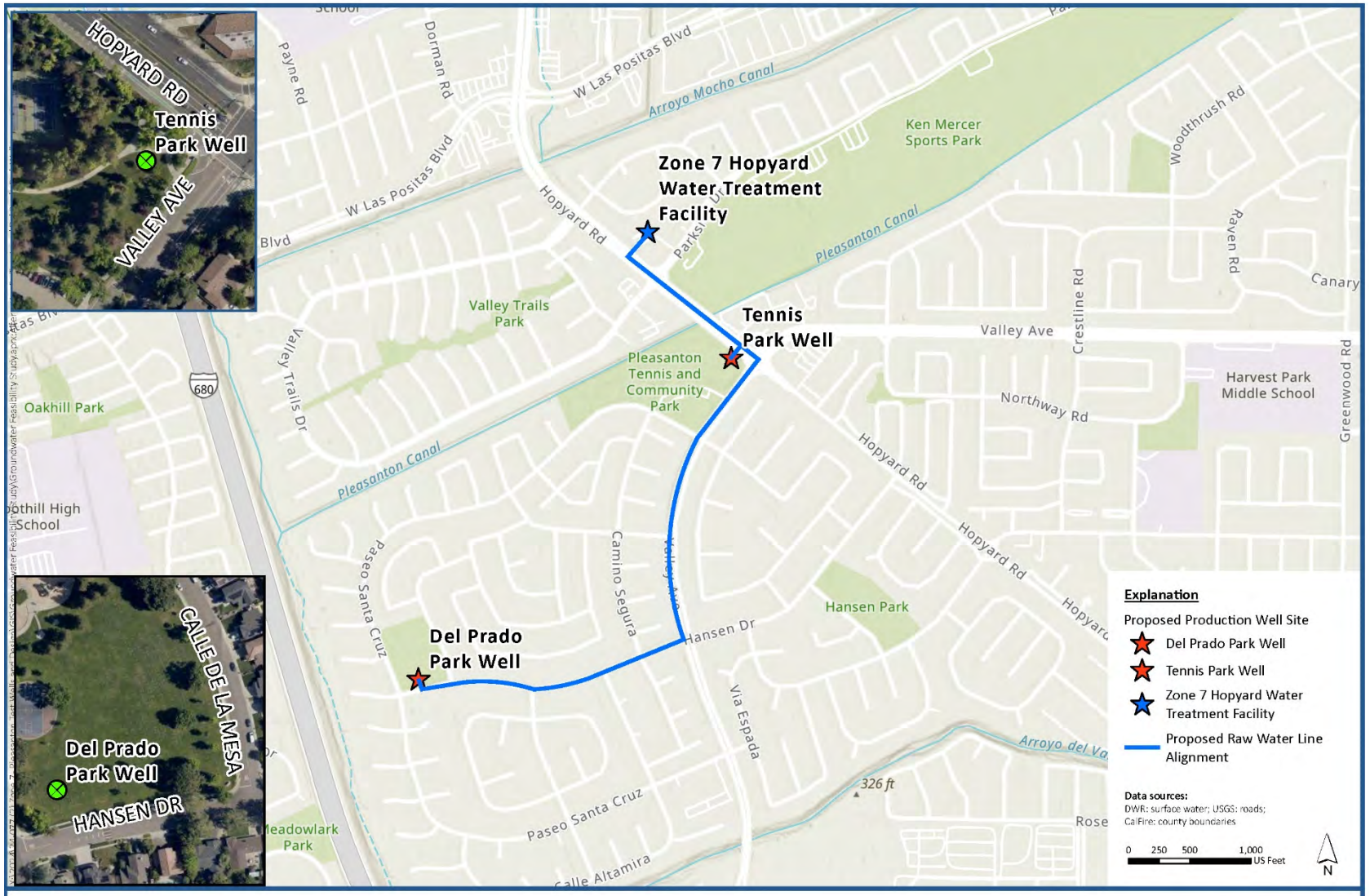


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Alternative #2 - Tennis and Hansen Park Wells

Zone 7 Regional Groundwater Facilities Project Feasibility Study
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Figure 5

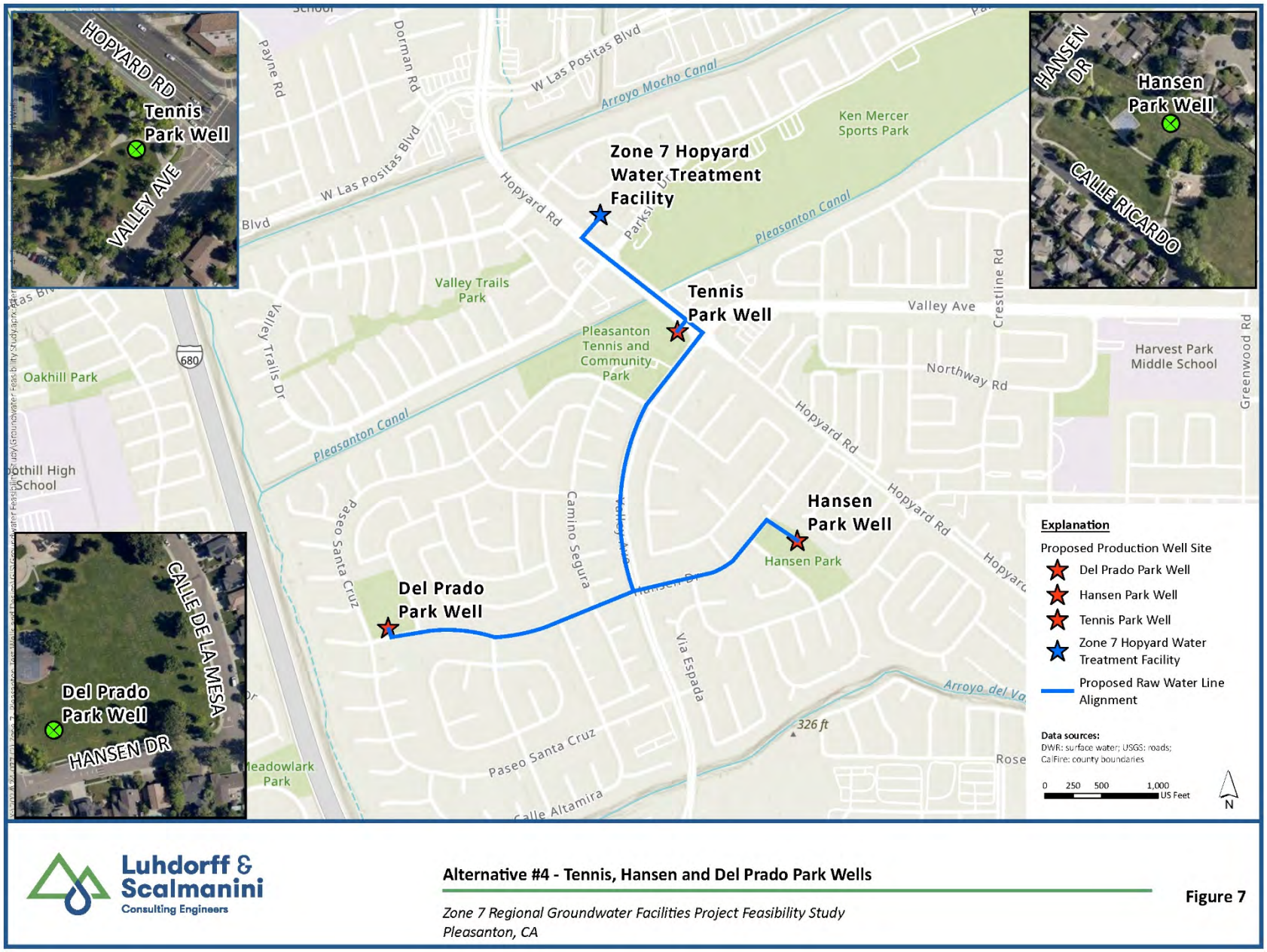


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Alternative #3 - Tennis and Del Prado Park Wells

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Figure 6



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Alternative #4 - Tennis, Hansen and Del Prado Park Wells

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 7

3.3. Project Alternative Production Rates

Each of the four project alternatives is capable of producing a range of instantaneous and annual volumes, with actual groundwater production influenced by both hydrogeologic setting/conditions and engineered well materials and pump equipment design features.

Hydrogeologic setting/conditions include the thickness and continuity of water-bearing sands and gravels relative to less permeable materials, which determine aquifer transmissivity, defined as the aquifer's ability to yield water when pumping induces drawdown. Seasonal water level fluctuations and long-term basin trends further affect available drawdown and, therefore, sustainable production. Siting of a production well site a significant distance from the test well site may result in different hydrogeologic conditions (e.g. yield and/or water quality).

Well construction characteristics also play a critical role. Production capacity depends on drilling contractor performance/efficiency, selection and placement of well screens, screen length, and gravel pack design. The position of the uppermost screen interval is particularly important for accessing available drawdown in the well (defined as the difference between the static water level and the top of the well screen). Collectively, these factors establish the specific capacity (Q/s) and ultimately the production rate of the well, defined as the pumping rate achieved per unit of drawdown (expressed in gpm/ft).

Pump equipment design must then be optimized in consideration of site-specific hydrogeologic and well construction conditions. Properly sized bowls, column, shaft, and motors allow the pump to utilize the full drawdown range from static water levels down to the top of the screen.

If any one of these system components (hydrogeologic setting/conditions, well design/construction, or pumping equipment) is suboptimal, the overall capacity of the well is constrained. Conversely, when all three are optimized together, wells can reliably achieve their design production rates and sustain long-term groundwater development.

Table 4 summarizes the estimated production capacities for each project alternative under drought-year, average-year, and wet-year conditions. Annual production estimates assume an 18-hour daily runtime (6,570 hours per year), consistent with Zone 7's 75-percent reliability factor for facility operation and provide a common basis for comparison against Zone 7's 7,000 AFY drought-year production objective. Results indicate that Alternatives 1 and 3 cannot meet the 7,000 AFY target while operating within the 18-hour limit and therefore are not considered viable for Zone 7's production goals, though they are carried forward for informational and comparative purposes.

At the upper end, Alternative 4 is capable of producing approximately 9,800 AFY under drought conditions; however, Zone 7 does not intend to produce more than 9,000 AFY during drought years, as groundwater sustainability impacts have not been modeled beyond this annual production total for drought years. As a result, the additional production capacity represented by Alternative 4 would not be utilized under normal operating conditions, effectively increasing capital cost without a proportional supply benefit leaving Alternative 4's only primary advantage of enhanced operational flexibility and reliability beyond Zone 7's standard policy requirements.

For average and wet years, Zone 7 similarly plans to cap groundwater production at approximately 6,500 AFY, since other water sources are generally available to meet system demands and similarly, groundwater sustainability impacts have not been modeled beyond this annual production total for average and wet years. Therefore, although select project alternatives are technically capable of exceeding the groundwater modeled annual production totals, any selected project alternative would be operated within the 6,500 AFY and 9,000 AFY caps to maintain consistency with Zone 7's groundwater management and sustainability objectives.

Table 4. Project Alternative Estimated Production Rates[d]

Basin Condition Scenario	Production Metric	Project Alternative #1 (Tennis Park)	Project Alternative #2 (Tennis and Hansen Parks)	Project Alternative #3 (Tennis and Del Prado Parks)	Project Alternative #4 (Tennis, Hansen and Del Prado Parks)
Drought Year Basin Condition	**Design Flow Rate (gpm)**	*3,400*	6,800	*4,700*	8,100
	Design Flow Rate (MGD)	*4.9*	9.8	*6.8*	11.7
	Production Estimate (AFY)[c]	*4,113[e]*	8,227	*5,686[e]*	9,800[a]
Average Year Basin Condition	**Design Flow Rate (gpm)**	*4,250*	8,050	*5,850*	9,650
	Design Flow Rate (MGD)	*6.1*	11.6	*8.4*	13.9
	Production Estimate (AFY)[c]	*5,142[e]*	9,739[b]	*7,078[b]*	11,675[b]
Wet Year Basin Condition	**Design Flow Rate (gpm)**	*5,100*	9,300	*7,000*	11,200
	Design Flow Rate (MGD)	*7.3*	13.4	*10.1*	16.1
	Production Estimate (AFY)[c]	*6,170[e]*	11,251[b]	*8,469[b]*	13,550[b]

[a] Note that impacts to groundwater basin sustainability were not modeled at annual production rates beyond 9,000 AFY in drought year conditions.

[b] Note that impacts to groundwater basin sustainability were not modeled at annual production rates beyond 6,500 AFY in average and wet year conditions.

[c] Production Estimates are based on continuous operation of 18 hours per day, 365 days per year (6,570 hours annually) consistent with Zone 7's reliability factor operational goal of 75 percent. One AFY = 325,851 gallons.

[d] Production figures are planning-level estimates subject to change as part of Phase II design and construction project development. Actual production may vary due to aquifer conditions, production well drilling contractor performance, long-term groundwater level fluctuations, equipment performance, and gradual well efficiency decline.

[e] Production estimates for Alternatives 1 and 3 do not meet Zone 7's annual production criteria of 7,000 AFY

3.4. Cost Estimates

Each of the four project alternatives involves construction of either one, two, or three new production wells along with associated pipelines, pump stations, and the HCF upgrades. Capital and operating costs were estimated at a feasibility-level to allow comparison of the relative cost-effectiveness of each alternative. The following subsections summarize capital costs, annual O&M costs, and combined annualized costs, with detailed breakdowns provided in **Appendices H and I**.

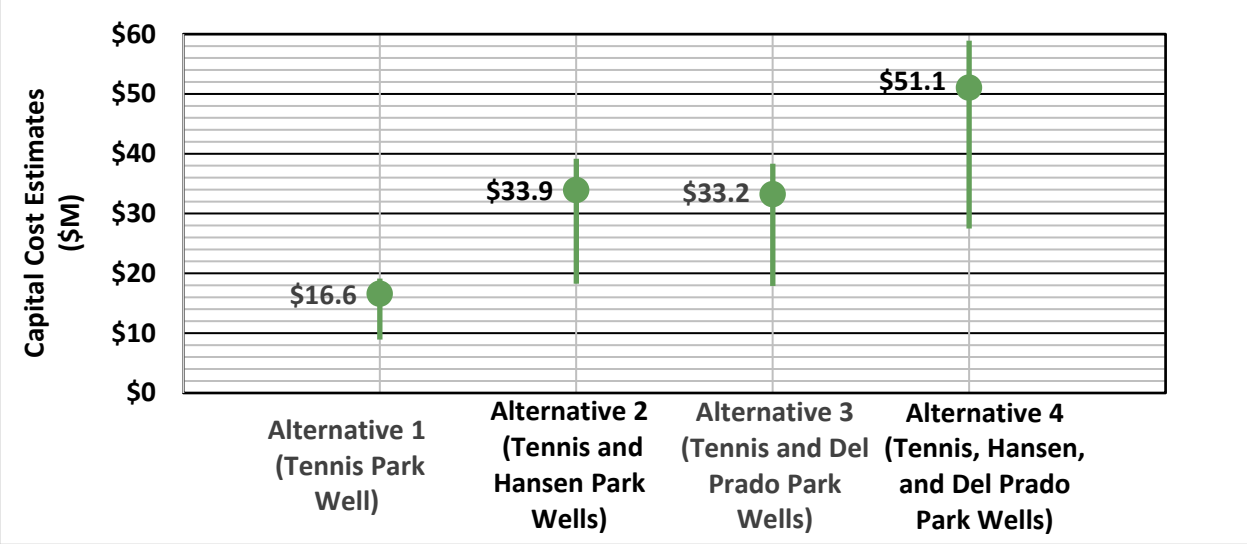
As Project Alternative #2 (Tennis and Hansen) is recommended as the most feasible option in this Study, specific refined capital cost estimates and operational costs are provided with the BODR and 10% design prepared by Carollo Engineers in **Appendix J**. Should agreement be reached between Zone 7 and the City to proceed with Project Alternative #2, the capital operational cost estimates will be further refined and accuracy improved as the project advances to Phase II design.

3.4.1. Capital Costs

Carollo Engineers prepared feasibility-level capital cost estimates for each alternative in accordance with the Association for the Advancement of Cost Engineering (AACE) Class 5 standards. Class 5 estimates are appropriate for early-stage planning and carry an expected accuracy range of −30 percent to +50 percent. The Class 5 defined project costs shown in **Figure 8** (single data points) include both direct construction costs and a 30 percent allowance for project soft costs (e.g., engineering, permitting, administration, and contingencies). The error bars represent the Class 5 uncertainty range applied to the underlying construction cost component only. Detailed assumptions and breakdowns are provided in **Appendix H.**

The total capital cost estimates include well drilling and construction, pump equipment and pipelines, electrical and instrumentation, sitework, HCF facility upgrades, transmission pipelines between the new well facilities and the HCF, mobilization, contingency, and project soft costs. Off-site distribution system improvements downstream of the HCF that may be triggered by the increased capacity resulting from this Project were not included in this Study but are being evaluated separately by the City.

Figure 8. Project Alternative Capital Cost Estimates and Ranges (Class 5)



[a] Point estimates (dots) represent construction costs plus 30% soft costs, which include engineering, permitting, administration, and contingency.
[b] Error bars represent the AACE Class 5 accuracy range (−30% to +50%) applied to construction costs only.
[c] Costs are presented in 2025 dollars.
*[d] Refined capital cost estimates for Project Alternative 2 are provided with the BODR in **Appendix J** and will be further refined as the project advances to Phase II design if agreement is reached between Zone 7 and the City.*
[d] Costs for Alternatives 1 and 3 are presented for informational purposes only, as these alternatives cannot meet Zone 7's drought year production target under the agency's maximum allowable 75% runtime and have accordingly been eliminated from consideration.

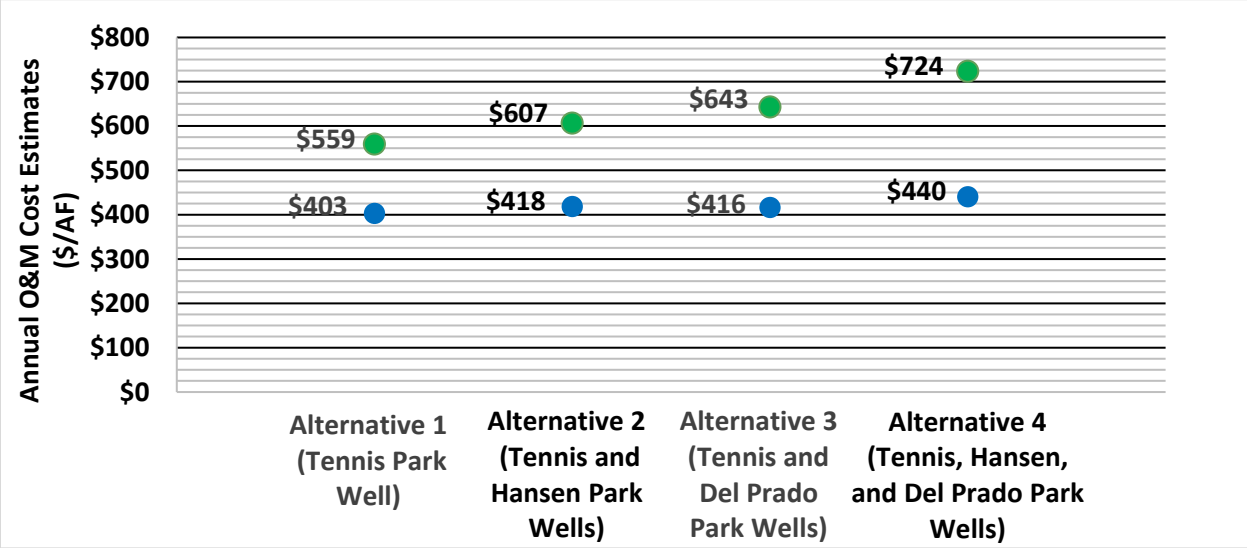
As shown in **Figure 8**, capital costs generally scale with the number of wells, ranging from approximately $16.5 million for Alternative 1 (one well) to about $51.0 million for Alternative 4 (three wells). Alternatives 2 and 3, each involving two wells, fall in the $33 million range. The error bars reflect the Class 5 cost uncertainty.

3.4.2. Annual Costs

Annual O&M costs were estimated for each alternative based on a target production of 7,000 AFY, or the maximum annual production that the alternative is able to produce during drought years as shown in **Table 4**. Major categories include staffing, power, chemicals, well rehabilitation, pump repair and/or replacement, and electrical/instrumentation maintenance. Detailed assumptions are presented in **Appendix I**. As previously discussed in this Study, although Alternatives 1 and 3 are not capable of producing 7,000 AFY during drought years, the evaluation for these alternatives have been carried forward for informational and comparison purposes.

In addition to direct O&M costs, capital costs were annualized using an Equivalent Uniform Annual Cost (EUAC) approach in which one-time project capital cost are converted into an equivalent stream of constant annual payments over the assumed facility life, enabling direct comparison with annual O&M costs. The calculation applies a Capital Recovery Factor (CRF), which is based on a 50-year project life and a 3 percent discount rate. The resulting annualized capital recovery values are then combined with O&M to develop total annual project costs on a $/AF basis.

Figure 9. Project Alternative $/AF Annual Cost Estimates



[a] Blue points represent annual O&M costs ($/AF) at each alternative's maximum feasible production (≤7,000 AFY during drought conditions) under Zone 7's 75% reliability limit (18 hr/day); capital (annualized) costs are excluded.
[b] Green points represent total annualized costs ($/AF), including both O&M and capital (annualized) costs, at each alternative's maximum feasible production (≤7,000 AFY during drought conditions) under Zone 7's 75% reliability limit (18 hr/day).
[c] Capital recovery factor was calculated assuming a 50-year facility life and 3% discount rate.
*[d] O&M cost categories include staffing, chemicals, power, well rehabilitation, pump repair/replacement, and electrical/instrumentation maintenance. See **Appendix I** for details and unit cost / quantity assumptions.*
*[e] Costs are presented in 2025 dollars. Refined cost for Alternative 2 is provided with the BODR in **Appendix J** and will be further refined as the project advances to Phase II design if agreement is reached between Zone 7 and the City*
[f] Costs for Alternatives 1 and 3 are presented for informational purposes only, as these alternatives cannot meet Zone 7's drought year production target under the agency's maximum allowable 75% runtime and have accordingly been eliminated from consideration.

As shown in **Figure 9**, O&M-only costs (blue) range from approximately $403/AF to $440/AF, while annualized costs that incorporate capital recovery (green) range from $559/AF to $724/AF, depending on the project alternative.

3.4.3. Cost Summary

A summary of estimated capital costs, annual O&M costs, and total annualized costs for each project alternative is provided in **Table 5**.

Table 5. Project Alternative Cost Estimates (Class 5)

Cost Category	Project Alternative #1 (Tennis Park)[d]	Project Alternative #2 (Tennis and Hansen Parks)	Project Alternative #3 (Tennis and Del Prado Parks)[d]	Project Alternative #4 (Tennis, Hansen and Del Prado Parks)
Capital Costs[a]	*$16.6M ($8.9M - $19.1M)*	$33.9M *($18.3M - $39.2M)*	*$33.2M ($17.9M - $38.3M)*	$51.1M *($27.5M - $58.9M)*
Annual O&M Costs ($/AF)[b]	*$403*	$418	*$416*	$440
Annualized Capital Costs ($/AF)[c]	*$157*	$188	*$227*	$283
Total Annual Costs ($/AF)	*$559*	$607	*$643*	$724
Total Annual Costs ($/yr)	*$2,300,583*	$4,246,178	*$3,656,449*	$5,065,094

[a] Discrete capital cost totals for each project alternative are AACE Class 5 order-of-magnitude estimates with an accuracy range of −30% to +50% on construction costs and includes estimated 30% soft costs.
[b] Annual O&M costs ($/AF) at each alternative's maximum feasible production (≤7,000 AFY during drought conditions) under Zone 7's 75% reliability limit (18 hr/day).
[c] EUAC of estimated project capital costs assuming a 50-year facility life and 3% discount rate.
[d] Costs for Alternatives 1 and 3 are presented for informational purposes only, as these alternatives cannot meet Zone 7's drought year production target under the agency's maximum allowable 75% runtime and have accordingly been eliminated from consideration.

4. PROJECT ALTERNATIVES EVALUATION

The purpose of this section of the Study is to present a structured and rational evaluation of the identified alternatives. The evaluation provides a consistent basis for comparing options against both Zone 7 and City objectives, recognizing that Zone 7 requires at least 7,000 AFY of reliable production during drought years, while the City's GPQ is 3,500 AFY. The evaluation framework combines pass/fail screening for minimum production and groundwater sustainability with weighted scoring across six total qualitative criteria. This evaluation approach enables Zone 7 and the City to compare the relative ranking of each alternative in a transparent and repeatable manner, supporting the eventual selection of a preferred project that can be considered by the Zone 7 Board and City Council for advancement into Phase II design and construction. The evaluation criteria and their weightings overall were confirmed by the City and Zone 7 following the Initial Project Alternatives Workshop held on August 18, 2025.

4.1. Evaluation Overview

The project alternatives evaluation process involved three main steps:

A. Applying pass/fail screening for production capacity and groundwater sustainability,
B. Scoring project alternatives against weighted evaluation criteria, and
C. Combining results into a computed project score and overall ranking that reflects the perspectives of both Zone 7 and the City.

Eight evaluation criteria were initially proposed by LSCE during the August 18, 2025, workshop. Following internal deliberation, Zone 7 and the City agreed that two criteria - Production Capacity and Groundwater Basin Sustainability - should be treated as pass/fail requirements rather than weighted into a project score. The remaining six criteria form the scoring framework which ensure that the specific needs and shared priorities of all parties are reflected in the final project score ranking. Specific weightings for each project criteria were also deliberated between the City and Zone 7, representing the varying importance/priority of each evaluation criteria to each agency.

4.1.1. Evaluation Criteria

All of the considerations and factors associated with each of the specific project evaluation criteria are defined in detail below, including explanations of the scoring criteria associated with each category.

1. Water Production Capacity – (*Pass/Fail)*

This criterion assesses whether an alternative can reliably produce the volumes needed to meet Zone 7's drought-year target of 7,000 AFY, which includes the City's GPQ of 3,500 AFY. Zone 7's operating policy applies a 75 percent reliability factor, meaning facilities are expected to run no more than 18 hours per day on average, with 24-hour operation permissible during summer months coinciding with maximum water demands. Alternatives meeting these thresholds are considered to pass; those that do not are screened out.

2. Groundwater Basin Sustainability – (*Pass/Fail)*

Groundwater basin sustainability is evaluated with respect to the Alt GSP. Project alternatives must demonstrate that they will not cause undesirable results such as chronic lowering of groundwater levels or long-term degradation of water quality. Alternatives that cannot meet these requirements are

screened out and do not advance in the evaluation. Zone 7's groundwater modeling indicates that all four project alternatives are consistent with the Alt GSP, remaining compliant with sustainability criteria for both groundwater levels and water quality. In addition, LSCE and Zone 7 staff reviewed modeling results conducted by EKI (**Appendix G**) for this Feasibility Study and concluded that the proposed well development aligns with Zone 7's basin sustainability objectives.

3. Community & Environmental Impacts

This criterion considers how new well facilities located within residential parks may affect nearby residents and the environment. Construction activities are expected to cause short-term impacts such as noise, dust, traffic, and temporary loss of recreational space, while long-term impacts may include visual changes, operational noise, and access restrictions to parks. Alternatives that minimize these impacts and reduce intrusion into community spaces are considered more favorable than those with greater visibility or community disruption.

4. Capital Cost

Capital cost reflects the relative initial investment needed to bring each alternative online, including well construction, equipping, pipelines, electrical facilities, and site development. Costs have been estimated in Section 3, and this criterion scores alternatives qualitatively against one another rather than repeating detailed numbers. Lower-cost alternatives are generally more favorable, although higher-cost options may offer added benefits such as improved reliability or other benefits that balance their expense.

5. Water Quality/Treatment Impacts

This criterion evaluates the potential for water quality concerns at proposed well sites that may require current or future treatment. Zone 7's PFAS transport model, which accounted for long-term effects of the large PFAS footprint to the east, indicates that projected concentrations remain below detection limits over a 20-year period. While this modeling provides confidence that PFAS migration and concentrations at all project alternative well sites will not constrain the alternatives, wells located closer to the existing footprint carry greater long-term uncertainty and possible treatment requirements. Alternatives farther from the footprint are considered less vulnerable and therefore score higher.

6. Implementation Schedule

The implementation schedule reflects the anticipated time from project approval to initial water production. For all alternatives, the principal driver is reaching an agreement between Zone 7 and the City on project scope and cost sharing. Once a decision is made, design and construction are expected to take 18 to 30 months, depending on the complexity of the alternative and whether contract structures allow multiple construction crews to work concurrently. Simpler, shorter-duration alternatives score higher, while those with longer or more complex delivery paths score lower.

7. Operational Flexibility & Resilience

This criterion measures the ability of each project alternative to perform reliably under varying conditions such as drought, planned and unplanned equipment downtime, or future changes in groundwater quality. Alternatives with multiple wells allow for lead/lag operational flexibility, provide redundancy, and maintain production during maintenance or outages, resulting in higher scores. Single-well alternatives, while simpler, have limited redundancy and are more vulnerable to interruptions.

8. Operations & Maintenance Cost

O&M cost compares the relative effort and expense required to operate and maintain the facilities, referencing estimates presented in Section 3. Costs include power, staffing, treatment requirements, routine maintenance, and eventual well rehabilitation. Alternatives with limited treatment needs, fewer facilities, and reduced community interface generally score higher, while those with multiple wells, greater treatment potential, or higher community-facing obligations (e.g., landscaping, noise control) score lower.

4.1.2. Weighting Criteria

The six weighted evaluation criteria were assigned percentage values agreed upon by Zone 7 and the City to reflect their relative importance in selecting a preferred project. The final weighting framework is summarized in **Table 6** below along with a concise description of the evaluation criteria.

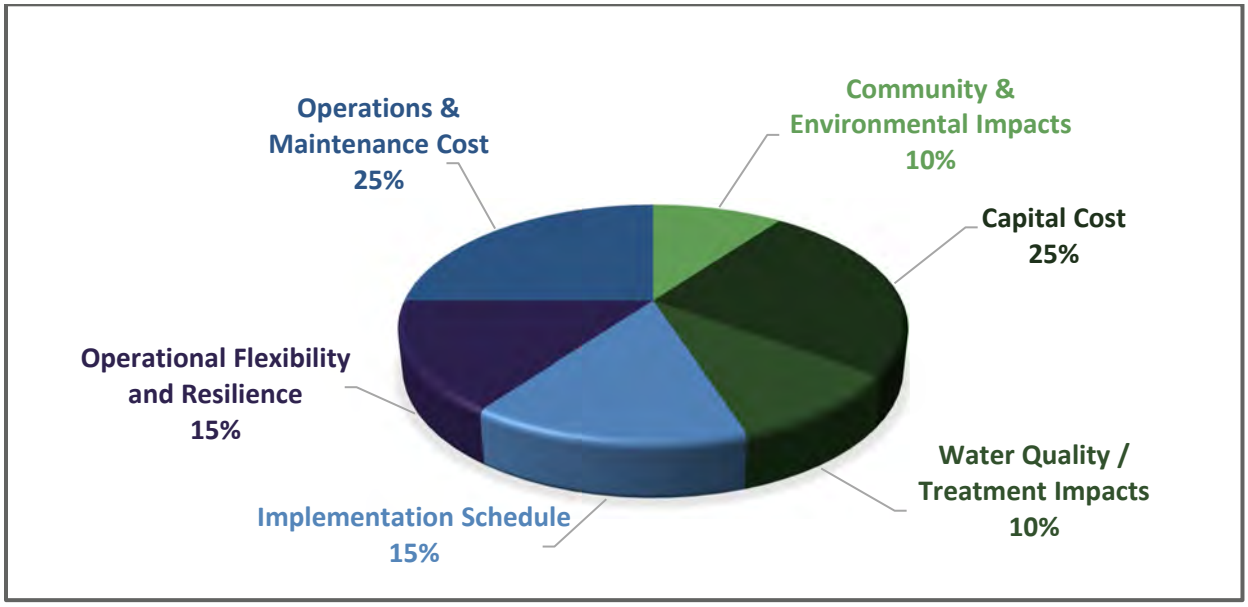
Table 6. Project Alternative Weighting Criteria

Project Alternative Evaluation Criteria (Scoring Weight)	Evaluation Criteria Summary	Weighting
Water Production Capacity	Ability to satisfy Zone 7's drought-year target of 7,000 AFY, which includes the City's GPQ of 3,500 AFY. Zone 7 applies a 75% reliability factor (limiting average annual runtime to 18 hr/day; up to 24 hr/day during summer months).	Pass/Fail
Groundwater Basin Sustainability	Conformance to Zone 7's Livermore Valley Alternative Groundwater Sustainability Plan. Alternatives must not cause undesirable results such as chronic lowering of groundwater levels or degradation of water quality.	Pass/Fail
Community & Environmental Impacts	Proximity to residential areas and sensitive receptors, and the anticipated level of public concern or required outreach. Alternatives with fewer short-term and long-term community/environmental effects are more favorable.	10%
Capital Cost	Relative initial investment required, including wells, pipelines, treatment, electrical, and sitework. Alternatives are compared qualitatively; lower-cost options are more favorable.	25%
Water Quality / Treatment Impacts	Alternatives located nearer to the PFAS footprint carry higher long-term treatment risk; those farther away are more favorable.	10%
Implementation Schedule	Expected timeframe from project approval to water delivery, including planning, permitting, construction, and startup. Shorter-duration or more easily phased alternatives are more favorable.	15%

Operational Flexibility and Resilience	Ability to maintain reliable operation under varying conditions such as drought, equipment downtime, or groundwater quality changes. Alternatives with multiple wells and redundant capacity are more favorable.	15%
Operations & Maintenance Cost	Relative effort and cost of long-term operation and maintenance, including power, staffing, treatment, routine maintenance, and rehabilitation. Alternatives with lower O&M burdens are more favorable.	25%

The distribution of project criteria weighting is illustrated in **Figure 10**. Financial factors such as Capital Cost and O&M Cost make up half of the total score reflecting the emphasis on both initial investment and long-term operating financial commitments. Operational Flexibility & Resilience and Implementation Schedule together account for 30 percent, recognizing the importance of reliable performance and timely delivery. The remaining 20 percent is allocated to Community & Environmental Impacts and Water Quality/Treatment Impacts, ensuring that social and groundwater quality considerations are included in the overall evaluation.

Figure 10. Project Alternative Weightings



4.1.3. Scoring Criteria

Each weighted project evaluation criterion was scored on a scale of 1 to 10, grouped into three scoring bands to provide consistency and avoid over-interpretation. Scores of 1 to 3 represent low performance with significant limitations relative to project objectives. Scores of 4 to 7 represent moderate performance that meets minimum expectations but carry risks or tradeoffs. Scores of 8 to 10 represent high performance, demonstrating a clear margin of benefit over other project alternatives.

Notably, the first two criteria, Water Production Capacity and Groundwater Basin Sustainability, are not included in the scoring framework because they function as pass/fail requirements. While only Project Alternatives 2 and 4 satisfy Zone 7's 7,000 AFY production threshold, all four project alternatives are carried forward into the scoring process for informational and comparison purposes. Scoring definitions were tailored to each of the six weighted categories to ensure transparency and repeatability. **Table 7** summarizes the scoring framework for these six categories.

Table 7. Evaluation Category Scoring Criteria

Project Alternative Evaluation Category	1 – 3	4 – 7	8 – 10
Community & Environmental Impacts	Excessive community or environmental impacts (e.g., high visibility, long-term disruption to parks)	Moderate impacts with manageable mitigation	Low impacts; minimal disruption to community spaces
Capital Cost	Highest capital cost relative to other alternatives	Moderate capital cost	Lowest capital cost relative to other alternatives
Water Quality/Treatment Impacts	High risk of treatment requirements or long-term water quality concerns	Moderate treatment requirements or risk	Minimal treatment needs; strong long-term water quality outlook
Implementation Schedule	Long duration to implement; significant permitting or construction delays expected	Moderate timeline; some delays but manageable	Shorter timeline; few constraints
Operational Flexibility & Resilience	Poor to marginal flexibility; limited redundancy; major operational constraints	Adequate flexibility; at least one redundant source with some constraints	High flexibility; multiple redundant sources with minimal constraints
Operations & Maintenance Cost	High O&M cost relative to other alternatives	Moderate O&M cost	Low O&M cost relative to other alternatives

4.1.4. Ranking Methodology

Each project alternative was first screened against the two pass/fail requirements: water production capacity and groundwater basin sustainability. While only Alternatives 2 and 4 satisfy Zone 7's 7,000 AFY production target, all four alternatives were considered in this Study.

Alternatives passing the initial screen were then scored against the six weighted criteria described in Section 4.1.1. Scores were assigned on a 1–10 scale in accordance with the definitions in Section 4.1.3 and

Table 7. Pass/fail criteria (Water Production Capacity and Groundwater Basin Sustainability) do not contribute numerically to the total score.

For each alternative *i,* and weighted criterion *k*, a raw score (1 to 10) is converted to Weighted Points using the criterion's weight expressed in point values (e.g., 15, 25). The Weighted Points were calculated as follows:

$$Weighted\ Points_{i,k} = \left(\frac{RawScore_{i,k}}{10}\right) \times Weight\%_k$$

The Total Project Score for alternative *i* is the sum of the Weighted Points across the six weighted criteria:

$$Total\ Project\ Score_i = \sum_{k=1}^{6} \left(\frac{RawScore_{i,k}}{10}\right) \times Weight\%_k$$

Where:

- *i* = project alternative,
- *k* = evaluation criterion,
- Raw Score = value from 1 to 10 assigned to the alternative for that criterion,
- Weight% = weighting (point value) agreed upon by Zone 7 and the City for that criterion

The maximum possible total score is 100 points, equal to the sum of the six weighted criteria, which corresponds to a theoretical perfect score of 10 for each category.

4.2. Evaluation Results

The Total Project Score provides a transparent basis for comparing the relative performance of the alternatives. **Table 8** presents the scoring results for each project alternative across the six weighted criteria.

Table 8. Project Evaluation Scoring Summary

	Alternative 1 (Tennis Park Only)		Alternative 2 (Tennis/Hansen Parks)		Alternative 3 (Tennis/Del Prado Parks)		Alternative 4 (Tennis/Hansen/Del Prado Parks)	
Criteria Descriptions	*Raw Score*	*Weighted Points*	**Raw Score**	**Weighted Points**	*Raw Score*	*Weighted Points*	**Raw Score**	**Weighted Points**
Operational Flexibility & Resilience	*3*	*4.5*	6	9.0	*5*	*7.5*	9	13.5
Capital Cost	*8*	*20.0*	6	15.0	*7*	*17.5*	4	10.0
Water Quality/Treatment Impacts	*8*	*8.0*	7	7.0	*8*	*8.0*	7	7.0

Table 8. Project Evaluation Scoring Summary

Criteria Descriptions	Alternative 1 (Tennis Park Only)		Alternative 2 (Tennis/Hansen Parks)		Alternative 3 (Tennis/Del Prado Parks)		Alternative 4 (Tennis/Hansen/Del Prado Parks)	
	Raw Score	*Weighted Points*	**Raw Score**	**Weighted Points**	*Raw Score*	*Weighted Points*	**Raw Score**	**Weighted Points**
Community & Environmental Impacts	*8*	*8.0*	5	5.0	*5*	*5.0*	4	4.0
Implementation Schedule	*9*	*13.5*	8	12.0	*8*	*12.0*	7	10.5
Operations & Maintenance Cost	*8*	*20.0*	7	17.5	*7*	*17.5*	6	15.0
TOTAL PROJECT SCORE		***74.0***		**65.5**		***67.5***		**60.0**

Alternative 1 (Tennis Park Only) received the highest overall score (74.0), largely due to low capital cost, straightforward implementation, and minimal community impacts. However, as a single-well configuration, it cannot meet Zone 7's minimum 7,000 AFY drought-year production target on its own and therefore is not a viable stand-alone solution.

Alternative 2 (Tennis + Hansen) scored 65.5, ranking third overall but representing the highest-scoring feasible alternative capable of meeting both agencies' annual water production objectives.

Alternative 3 (Tennis + Del Prado) scored 67.5, benefiting from reduced PFAS risk but limited by lower yield and higher cost and unable to meet Zone 7's minimum 7,000 AFY drought-year production target and therefore is not a viable project alternative.

Alternative 4 (Tennis + Hansen + Del Prado) scored lowest at 60.0 points, reflecting its significantly higher capital and O&M costs and greater community impacts, principally only offering greater production and operational flexibility/resilience.

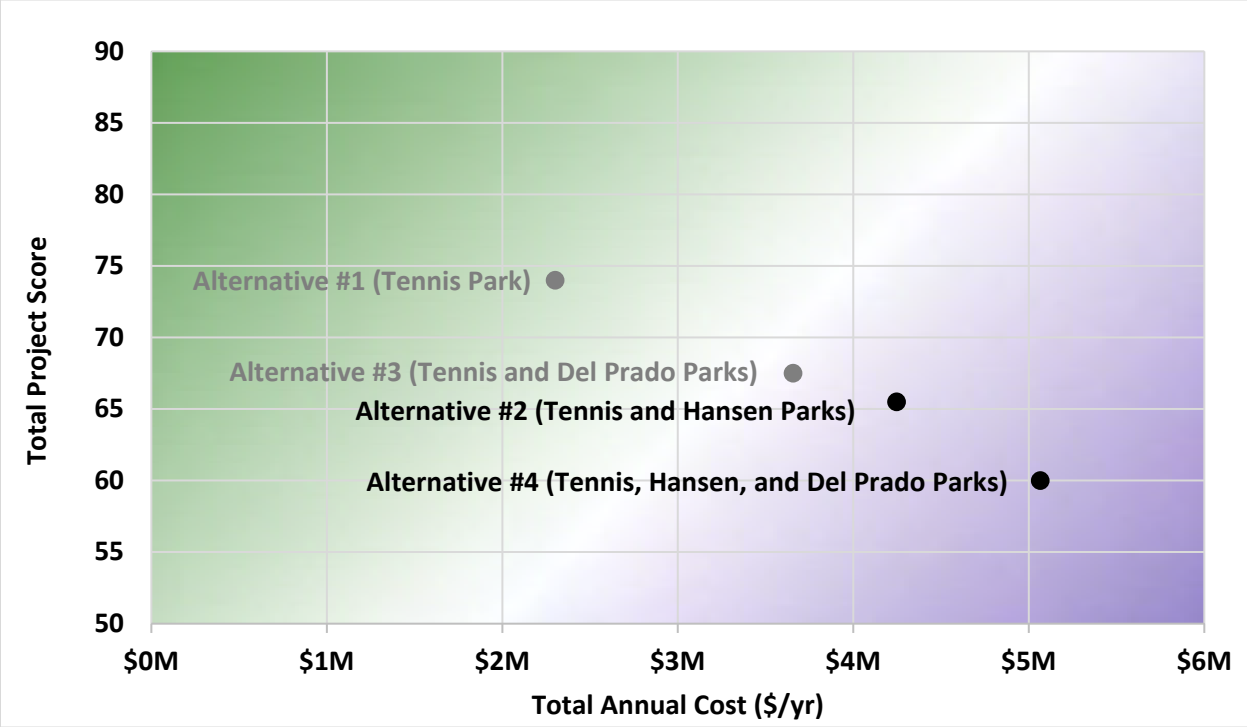
While Alternatives 1 and 3 achieve relatively high total project scores, both alternatives are unable to satisfy Zone 7's minimum drought-year production target of 7,000 AFY and therefore do not meet a fundamental project requirement. As a result, these alternatives are considered screening-level options only and were not carried forward as implementable solutions, despite their favorable performance in certain evaluation categories.

Among the alternatives that meet the minimum drought-year production requirement, Alternatives 2 and 4 represent feasible multi-well configurations. As illustrated in **Figure 11**, Alternative 2 provides a comparatively high overall project score while maintaining a substantially lower estimated annual cost than Alternative 4. Although Alternative 4 offers the greatest total production capacity and operational redundancy, these incremental benefits are accompanied by significantly higher capital and annualized

costs, increased infrastructure footprint, and greater operational and community impacts.

Based on this comparative evaluation, Alternative 2 (Tennis and Hansen Parks) is identified as the preferred alternative for advancement into Phase II. It represents the most balanced and implementable solution when considering capacity, reliability, cost effectiveness, and community considerations, while satisfying the core project objectives established by the City and Zone 7.

Figure 11. Benefit Score and Estimated Annual Cost for Each Alternative



5. RECOMMENDED PROJECT AND NEXT STEPS

Based on the evaluation of project alternatives, Alternative 2 (Tennis and Hansen Wells) is identified as the recommended project. Of the alternatives that passed the pass/fail criteria for minimum drought year water production capacity, this alternative ranked highest following the scoring process.

LSCE understands that this regional groundwater project is being considered as a joint effort between the City and Zone 7, reflecting the regional nature of groundwater planning and operations. It is important to note that well production capacity and annual project yield presented herein are preliminary estimates based on test well data and will need to be refined and confirmed upon installation and testing of the full-scale production wells.

Design-bid-build (DBB) is assumed to be the primary project delivery method given both agencies' familiarity and experience with this approach. However, design-build (DB) may also be considered if the agencies determine that early cost certainty or schedule acceleration is desirable. LSCE assumes the City and Zone 7 will coordinate the preferred delivery method prior to initiation of the detailed design effort.

Implementation of Alternative 2 is anticipated to require approximately three to four years from completion of the 10 percent design phase through construction and startup. **Figure 12** illustrates the anticipated project schedule, assuming a DBB delivery approach with drilling and civil improvement work implemented as separate, phased efforts. Key components of Phase II include:

- Advancing the conceptual design from the 10% design level by further gathering additional City and Zone 7 input to define specific well station layouts, pipeline alignments, and integration with existing Zone 7 facilities.
- Progressing through phased design (e.g., 30%, 60%, 90%, Final) for the production wells, pipelines, well station facilities, and related HCF upgrades.
- Securing necessary permits and approvals, including but not limited to California Environmental Quality Act (CEQA) compliance, well drilling permits, utility service applications, and stormwater and air quality permits. To prevent schedule delays, particularly those affecting the start of well drilling, it is assumed that Zone 7 will lead CEQA compliance efforts and initiate related work early, potentially prior to formal selection of the design consultant, as this activity is on the project's critical path.
- Procuring drilling and general civil contractors through a competitive bid process under the selected project delivery method (e.g., design-build or design-bid-build). Construction of the wells is expected to proceed separately and in advance of DWSRF funding approval, which would be secured for the well pump station, pipeline, and HCF improvements.
- Constructing, equipping, and commissioning the Tennis and Hansen production wells, associated station facilities, HCF upgrades, and transmission pipelines connecting the new wells with the HCF.
- Off-site distribution system improvements downstream of the HCF that may be triggered by the increased capacity resulting from this Project are not included with Phase II but are being

evaluated separately by the City. Such improvements would be constructed separate from this Project.

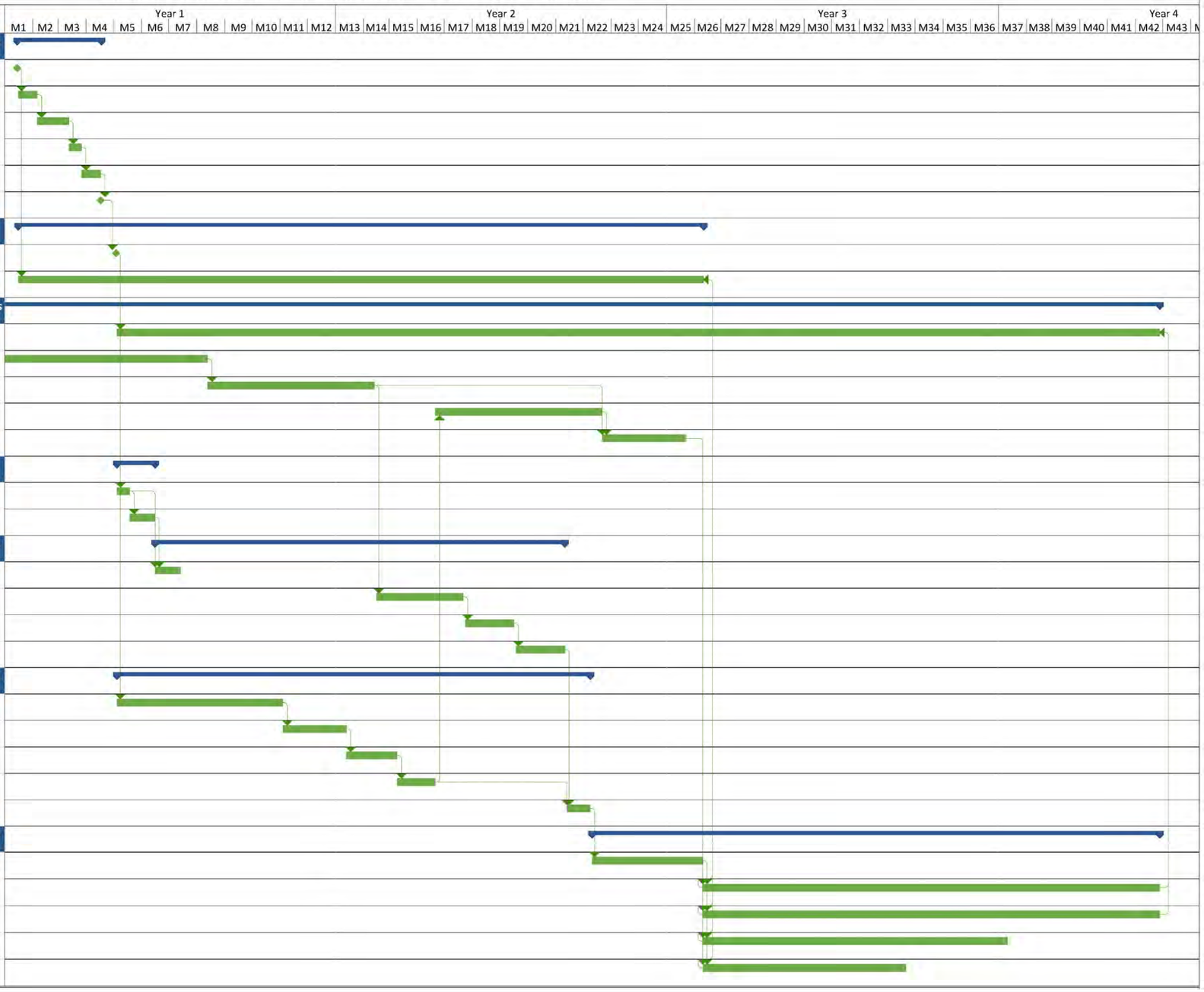
- Consideration of an early Phase II groundwater resampling event at the Hansen test well, including laboratory analysis for PFHxS and the broader PFAS analyte suite previously tested, to confirm the presence of PFHxS and evaluate whether observed concentrations are consistent with, higher than, or lower than previously measured values.

LSCE assumes funding for the project will be determined jointly by the City and Zone 7, with options ranging from existing rate base revenues and/or pursuing federal or state grant and loan programs. The cost-sharing approach for anticipated project capital and O&M costs will need to be established between the City and Zone 7. Additionally, project cash flow requirements and financing strategy will need to be defined by both agencies as the project advances through design and construction.

Figure 12. Phase II Estimated Project Schedule

Phase II Alternative 2 - Tennis and Hansen Wells Project Schedule

ID	Task Name	Duration
1	**PROPOSAL PHASE II**	**3.35 mons**
2	Zone 7 Board Meeting (Phase II Project Approval)	1 day
3	RFP Development	3 wks
4	Advertise RFP	5 wks
5	Evaluate Consultant Proposal	2 wks
6	Consultant Selection/Execution of Agreement	3 wks
7	Board Meeting (Phase II Consultant Approval)	1 day
8	**TASK 1 - PRELIMINARY ENGINEERING**	**27 mons**
9	Task 1.1 - Kickoff & Information Request	1 day
10	Task 1.2 - Project Permitting (PG&E, SWRCB-DDW, City/County Bldg Dept.)	27 mons
11	**TASK 2 - SUPPORT SERVICES**	**48.25 mons**
12	Task 2.1 - Project Coordination, Meetings and Administration	41.1 mons
13	Task 2.2 - CEQA - Assume Prepare IS/MND	215 days
14	Task 2.3 - DWSRF - State Review of Environmental Package (CEQA + Fed Cross Cutters)	132 days
15	Task 2.4 - DWSRF - State Review of Technical & Financial Packages	132 days
16	Task 2.5 - DWSRF - Eligibility Approval	66 days
17	**TASK 3 - SITE EVALUATION AND DDW CONCURRENCE**	**1.5 mons**
18	Task 3.1 - Site Evaluation	2 wks
19	Task 3.2 - Site Concurrence	4 wks
20	**TASK 4 - PRODUCTION WELL CONSTRUCTION AND TESTING**	**16.2 mons**
21	Task 4.1 - Production Well Design/Specifications (Including Bid Set)	4 wks
22	Task 4.2 - Bidding Assistance	70 days
23	Task 4.3 - Tennis Park Well Construction	8 wks
24	Task 4.4 - Hansen Park Well Construction	8 wks
25	**TASK 5 - PHASE II FACILITY IMPROVEMENTS PROJECT DESIGN**	**18.7 mons**
26	Task 5.1 - Field Surveys, Geotechnical Study, Utility Coordination and Potholing	6.55 mons
27	Task 5.2 - 30% Design and Construction Specifications (includes 2 week Zone 7 review time)	10 wks
28	Task 5.3 - 60% Design and Construction Specifications (includes 2 week Zone 7 review time)	8 wks
29	Task 5.4 - 90% Design and Construction Specifications (includes 2 week Zone 7 review time)	6 wks
30	Task 5.5 - 100% Design and Construction Specifications (Including Bid Set)	4 wks
31	**TASK 6 - PHASE II FACILITY IMPROVEMENTS PROJECT CONSTRUCTION**	**22.4 mons**
32	Task 6.1 - Project Bidding Assistance	88 days
33	Task 6.2 - Tennis Park Well Pump Station	18 mons
34	Task 6.3 - Hansen Park Well Pump Station	18 mons
35	Task 6.4 - Pipeline	12 mons
36	Task 6.5 - Hopyard Chloramine Facility Improvements	8 mons



6. BASIS OF DESIGN AND FUTURE TREATMENT CONSIDERATIONS

As part of this Feasibility Study, a Basis of Design Report (BODR) and associated 10 percent design drawings were prepared by Carollo Engineers for the recommended project alternative. The Final BODR (December 2025), included as **Appendix J**, establishes the technical basis, planning-level layouts, and implementation approach required to advance the Regional Groundwater Facilities Project into Phase II design and construction.

The BODR confirms the overall project configuration evaluated in this Study, including development of new municipal supply wells at the Tennis Park and Hansen Park sites, associated well pump stations, raw water transmission pipelines, and key modifications required at the existing HCF to integrate the new groundwater supply. The BODR provides planning-level design criteria and preliminary layouts sufficient to support refinement of project costs and implementation strategy. Key findings and outcomes include:

- Conceptual siting options and facility layouts for the Tennis Park and Hansen Park well pump stations, with recognition that final siting will be determined during subsequent design phases in coordination with City Planning, Parks, and Recreation staff and subject to City Council approval;
- Preliminary production well design parameters, anticipated production capacities, and pump sizing based on test well data and planning-level assumptions, with acknowledgment that final production well performance and equipment sizing will be confirmed following full-scale well installation and testing;
- Raw water transmission pipeline routing and sizing concepts that integrate new well production with the HCF, including provisions for phased implementation;
- Conceptual reconfiguration of the HCF to accommodate expanded flow ranges, improve operational flexibility and redundancy, and integrate new process, electrical, and control systems;
- Electrical, instrumentation, and control concepts adequate to support phased construction and future expansion; and
- Planning-level opinions of probable capital and operation and maintenance costs for Project Alternative #2, refined from the Feasibility Study evaluation and suitable for use in Phase II budgeting and funding planning.

The Class 4 cost information presented in the BODR reflects feasibility-level estimates intended to support alternative selection, funding evaluation, and project sequencing. These estimates will be further refined during Phase II design as final facility siting, production well performance, and detailed equipment selections are confirmed.

Decisions Deferred to Phase II

Consistent with a feasibility-level analysis, several key decisions are intentionally deferred and will be addressed during Phase II design and permitting, including:

- Final siting of well pump stations within Tennis Park and Hansen Park;

- Final production well design, pump selection, and motor sizing based on full-scale performance testing;
- Final configuration and layout of the Tennis Park and Hansen Park well pump station facilities;
- Final configuration and layout of the reconfigured HCF; and
- Detailed construction sequencing and phasing combined with schedule considerations

Deferring these decisions allows for coordination with City departments, public outreach, and refinement of technical assumptions while maintaining flexibility as the project advances.

Treatment Considerations and Future Planning

In addition to defining the facilities required for initial project implementation, the BODR includes a planning-level evaluation of potential future treatment pathways to address longer-term water quality considerations and Zone 7 water quality target goals. These considerations focus on treatment of total dissolved solids (TDS), per- and polyfluoroalkyl substances (PFAS), or a combined treatment approach, recognizing both current groundwater quality conditions and the potential for future regulatory or basin-wide water quality changes.

The BODR treatment evaluation is intentionally framed as a future planning effort and documents the regulatory context, treatment drivers, and conceptual treatment strategies that could be required under different water quality scenarios, including blending of treatment technologies, development of centralized treatment facilities, and phased implementation approaches. The BODR also identifies the relative scale, operational complexity, footprint implications, and order-of-magnitude cost considerations associated with these treatment pathways, without selecting or recommending a specific treatment configuration at this time subject to Zone 7 future decision making. Key findings from the BODR treatment evaluation include:

- Treatment for PFAS and/or TDS is not required for initial implementation of the groundwater production facilities associated with Alternative 2, based on current water quality data from the test wells;
- Future treatment needs, if any, would be driven by changes in regulatory requirements, long-term groundwater quality trends, or Zone 7 policy direction related to water quality targets and basin management objectives;
- Treatment strategies may differ depending on whether future needs are limited to PFAS, limited to TDS, or require a combined treatment approach, with materially different capital, operational, and siting implications; and
- Any future treatment facilities would require additional planning, environmental review, stakeholder coordination, and funding considerations separate from the Phase II scope.

Final selection of any treatment approach, whether TDS only, PFAS only, or combined treatment, will be guided by Zone 7 policy direction, evolving regulatory requirements, and confirmation of long-term water quality objectives. Such decisions would occur independently of, and subsequent to, implementation of the initial groundwater production facilities under Alternative 2.

7. REFERENCES

Zone 7, 2024. Memo: Test Well Siting for the Regional Groundwater Facilities Project. Included with Request for Proposal. June 12, 2024.

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

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

Kennedy Jenks, 2022. Analysis of PFAS Mobilization Under Various Pumping Scenarios. Prepared for Zone 7 Water Agency. September 2022.

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Appendix A

Test Well Investigation Summary and Well Design Recommendations (Tennis Park)

LSCE

DECEMBER 2025

REGIONAL GROUNDWATER FACILITIES PROJECT FEASIBILITY STUDY

Tennis Park
Test Well Investigation Summary and Well Design Recommendations

PREPARED FOR

THE CITY OF PLEASANTON

ZONE 7 WATER AGENCY

PREPARED BY

Luhdorff & Scalmanini
Consulting Engineers

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
bgs	below ground surface
City	City of Pleasanton
DDW	State Water Resources Control Board, Division of Drinking Water
gpm	gallons per minute
LSCE	Luhdorff and Scalmanini, Consulting Engineers
MCL	maximum contaminant level
Nor Cal	Nor Cal Pump and Well Drilling
North State	North State Electric and Pump
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
O.D.	outside diameter
PFOS/PFAS	Perfluorooctanesulfonic acid/Per- and polyfluoroalkyl substances
QA/QC	Quality Assurance/Quality Control

1. INTRODUCTION

Luhdorff and Scalmanini, Consulting Engineers (LSCE) have prepared this summary report documenting the hydrogeologic site investigation of the Pleasanton Tennis and Community Park (Tennis Park) and the construction and testing of the Tennis Park test well. The Tennis Park investigation was one of three site investigations conducted as part of the Regional Groundwater Facilities Project Feasibility Study, a joint project between Zone 7 Water Agency and the City of Pleasanton. Investigations and test well construction were also conducted at Del Prado Park and Hansen Park in the City of Pleasanton. The investigation of the Tennis Park site included drilling of an exploratory borehole to a depth of 820 feet below ground surface (bgs), construction of an eight-inch diameter test well completed to 770 feet bgs with eight screen sections between 195 feet and 760 feet bgs, pump testing, flow profiling, and water quality sampling and analysis. This report also includes production well design recommendations and flow rate estimates.

2. SITE SPECIFIC INVESTIGATION

The primary purposes of the investigation of the Tennis Park site were to characterize subsurface lithology, characterize zonal water quality and flow characteristics, and collect the information necessary to design a sand-free and efficient well that could yield water in sufficient quantity and quality to meet project objectives.

The Tennis Park test well site is located in the east area of the park along Valley Avenue in Pleasanton, CA (**Figures 1 and 2**).

The Tennis Park test well was drilled and constructed by Nor Cal Pump and Well Drilling (Nor Cal) of Yuba City, California (CA C-57 License #908591). A copy of the permit for the drilling of the test hole and test well construction obtained from Zone 7 Water Agency is attached in **Appendix A.** A copy of the encroachment permit issued by the City of Pleasanton to work in the park is also included in **Appendix A**. Pump test development and pump testing was performed by North State Electric and Pump (North State) of Chico, California (CA C57 License #812678). A copy of the encroachment permit issued to North State by the City of Pleasanton is attached in **Appendix A**.

Drilling commenced on February 5, 2025, and final well testing was completed on April 9, 2025. All work was conducted per project specifications and permitting requirements including traffic control, sound attenuation, and working hours unless variances were specifically granted by the City of Pleasanton.

2.1. Test Hole Drilling and Well Construction

Nor-Cal drilled the test hole from ground surface to 820 feet bgs at a diameter of 8.75 inches using the direct rotary drilling method. Drill cuttings from the boring were collected at 10-foot intervals and described by LSCE. Representative samples were collected in one-gallon resealable plastic bags and “chip trays”. On February 7, 2025, after reaching the target depth, a suite of geophysical surveys were conducted in the borehole (**Appendix A**) by Pacific Surveys of Claremont, California. Using the descriptions of the drill cuttings and the geophysical surveys, LSCE developed a lithologic log of the materials

encountered in the test hole. The lithology encountered in the test hole and the geophysical logs are detailed on the attached test well as-built profile (**Figure 3**). Multiple coarse-grained intervals were identified in the borehole that could be targeted in a future production well between 195 feet and 760 feet bgs. Coarse-grained intervals above 195 feet bgs were not considered potential target zones in a new well due to anticipated poor water quality.

LSCE submitted a preliminary test well profile (**Figure 3)** to Zone 7 for approval. The test well design included multiple intermediate bentonite seals to isolate each coarse-grained zone and a cement annular seal to a depth of 185 feet bgs. Test well design features are included in **Table 1**.

Table 1. Tennis Park Test Well Construction Information

Depth of Borehole	(ft bgs)	820
Borehole Diameter	Diameter (in.)	14.75-Inch (0-780 ft bgs) 8.75-Inch (780-820 ft bgs)
Depth of Well	(ft bgs)	770
Blank Casing	Depth (ft bgs)	0-195, 215-220, 240-300, 320-380, 420-470, 520-560, 600-700, 730-740, 760-770
	Diameter (in)	8.625 O.D.*
	Wall Thickness (in)	0.250
	Material Type	Mild Steel
Screened Interval	Depth (ft bgs)	195-215, 220-240, 300-320, 380-420, 470-520, 560-600, 700-730, 740-760
	Screen Type	Louvered (Ful-Flo)
	Slot Size (inches)	0.060
	Screen Material Type	Mild Steel
Gravel Envelope	Depth (ft bgs)	187-255, 295-340, 375-525, 555-610, 680-780
	(type/size)	SRI #8
Transition Seal	Depth (ft bgs)	185-187
	Seal Material Type	Fine Sand
Intermediate Seal	Depth (ft bgs)	255-295, 340-375, 525-555, 610-680, 780-820
	Seal Material Type	Bentonite Chips
Annular Seal	Depth (ft bgs)	0-185
	Seal Material Type	10.3 Sack Sand/Cement Grout
*Outside Diameter		

After receiving approval of the test well design by Zone 7, the test hole was then reamed from ground surface to a depth of 780 feet at a diameter of 14.75 inches. Borehole reaming operations began on

February 10, 2025. Test well construction was completed on February 21, 2025. A copy of the Well Completion Report is attached (**Appendix A**).

2.2. Well Development and Testing

Initial development of the well was performed by open-ended airlifting from the bottom of the casing assembly, followed by swab/airlift development by Nor-Cal. Final developmental pumping was performed with a submersible pump by North State.

Starting on February 25, 2025, the drill string was installed to the bottom of the casing, and the well was airlifted open-ended. Between February 25 and March 7, 2025, a swab isolation tool was used to swab/airlift each well screen. The screened sections were swabbed/airlifted from the top screen section to the bottom screen section, and then from the bottom screen section to the top screen section over multiple passes. All fluids generated during airlift operations were contained and disposed of offsite by Nor-Cal.

After airlift operations were completed, LSCE collected water samples from the well for analysis of volatile organic compounds (VOCs), fuel additives, semi-volatile organic compounds (VOC's), polycyclic aromatic hydrocarbons (PAH's), and metals listed in NPDES Permit No. CAG912002. A summary table of analytes and analysis results is included **Appendix A**. Only after the results of the water testing and discharge plan (**Appendix A**) were accepted by the City of Pleasanton, was water discharged to the City's storm water system. Storm drain discharge monitoring field notes are included in **Appendix A**.

North State installed a temporary submersible pump in the well to perform pump and surge development of the well and to conduct well testing. Between April 2, 2025, and April 4, 2025, the well was developed at rates between 200 and 650 gallons per minute (gpm).

Step Test

Step testing was performed on April 8, 2025, and consisted of three (3) steps. The static water level in the well measured prior to testing was 16.55 feet bgs. The discharge rate, pumping duration, projected pumping water drawdown, and projected specific capacity of the test are included below in **Table 2.** The step test hydrograph is depicted in **Figure 4**.

Table 2. Step Testing Results

Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
120	329	21.1	72.3
120	493	23.6	66.2
240	613	27.8	53.5

Long-Term Constant Rate Test

An 8-hour constant rate pumping test was performed on April 9, 2025, to determine well and aquifer characteristics. The static water level measured prior to testing was 16.70 feet bgs. The discharge rate,

pumping duration, projected pumping drawdown, and projected specific capacity of the test are included below in **Table 3.** The long-term constant rate test hydrograph is depicted in **Figure 5**.

Table 3. Long-Term Constant Rate Test Results			
Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
480	549	26.5	56

2.3. Water Quality

Water quality samples were collected by LSCE personnel from a dedicated sample tap on the well discharge assembly on April 8, 2025, for drinking water constituent analysis and for other constituents of interest. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* (**Appendix A**) prepared for the project and standard industry practice. All collected samples were submitted for analysis at the same time. Due to a laboratory error, analysis for twenty-seven constituents was not performed. The results of the water quality analysis show that all constituents analyzed were below their respective maximum contaminant levels (MCL). **Appendix B** summarizes the results of analysis results. The constituents that were not analyzed were either below their respective MCL's or were not detected.

While meeting drinking water quality standards, hardness, nitrite, and total dissolved solids values exceed Zone 7/City of Pleasanton's water quality targets. The exceedances are summarized in **Table 4**.

Table 4. Water Quality Targets and Exceedances		
Parameter	Target	Result
Hardness	150 mg/l	440
Nitrite	0.02 mg/l	0.87
Total Dissolved Solids	500 mg/l	820

2.4. Zone Sampling

Depth-discrete water samples were collected from above each screened interval within the well to characterize zonal water quality. Groundwater samples were collected on April 9, 2025, under pumping conditions. Starting with Zone #1, Pacific Surveys installed a sampling tool into the well to the specified zone to collect a sample for analysis. Samples were analyzed for general mineral, general physical, inorganic, and PFOS/PFAS constituents. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* prepared for the project. A summary table of zonal water quality analysis results are in in **Appendix B.** Samples were collected at the depths shown in **Table 5**.

Table 5. Zone Sampling Information	
Sample Zone	**Sample Depth**
Zone #1	217 feet bgs
Zone #2	290 feet bgs
Zone #3	370 feet bgs
Zone #4	460 feet bgs
Zone #5	550 feet bgs
Zone #6	690 feet bgs
Zone #7	735 feet bgs

The maximum contaminate level for manganese is 0.050 mg/l. The zonal concentration of manganese ranged from a low of 0.036 mg/l in Zone #2 (290 feet bgs) to high of 0.17 mg/l in Zone #5 (550 feet bgs). Based on a review of water quality from other wells in the area, manganese is not a constituent of concern. The elevated and variable manganese concentrations seen in the well are likely a result of incomplete removal of drilling fluids during the well development process. It is not uncommon to have elevated manganese levels in monitoring wells and small diameter test wells in areas/depths where manganese is not a constituent of concern due to the limitations of development with these types of wells. The composite (all zones contributing) concentration manganese was 0.032 mg/l.

2.5. Flow Survey

On April 9, 2025, a spinner survey was performed in the well by Pacific Surveys to quantify the groundwater flow contribution from individual screen intervals under pumping (dynamic) conditions. **Table 6** summarizes the flow contribution for each screen section in the well. The dynamic spinner survey log is included in **Appendix A.**

Table 6. Zonal Flow Contribution Pumping Conditions		
Screen Interval (feet bgs)	**Production (gpm)**	**% of Flow**
195-240	164	27.6
300-320	161	27.2
380-420	97	16.4
470-520	106	17.9
560-600	19	3.2
700-730	31	5.2
740-760	15	2.6

The results of the spinner survey show that 89% of the total well yield is derived from screened intervals above 520 feet bgs. The low contribution from the lower three screen sections is not surprising, considering the thickness and the resistivity response on the geophysical log of those zones.

A spinner survey was also conducted in the well to measure flow under non-pumping (static) conditions (**Appendix A**). The results of the static spinner survey show that water flows within the well from the upper three screened interval into the lower three screened intervals under non-pumping conditions. **Table 7** summarizes the flow contribution for each screen section in the well under static conditions. Positive values for production and % of flow indicate water is moving into the well structure through screen sections, negative values indicate where water is moving out of the well structure those screened sections.

Table 7. Zonal Flow Contribution Static Conditions

Screen Interval (feet bgs)	Production (gpm)	% of Flow
195-215	11	35
220-240	10.5	34
300-320	9.7	31
380-420	0.0	0
470-520	0.0	0
560-600	(-2.2)	(-7)
700-730	(-13.7)	(-44)
740-760	(-15.3)	(-49)

2.6. Well Yield Estimation

LSCE used the data derived from the constant rate pumping test, combined with data regarding the range of expected regional groundwater levels, to develop well pumping capacity estimates for the wells constructed at Tennis Park, Del Prado Park, and Hansen Park. The methodology, data, and analysis used to develop pumping capacities for the three sites are detailed in **Appendix C**. **Table 8** summarizes the estimated pumping capacity of well constructed per the design recommendation presented in Section 3 at Tennis Park.

Table 8. Summary of Well Pumping Capacity Estimates

Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Tennis Park	195	57.2	178	120	50	5,100	3,400

The well capacity estimates provided in **Appendix C**, and hence the overall project yield, should be considered best estimates at this time based on installation and testing of relatively small diameter test wells. The final full-scale production well yields and overall project yield may vary by several hundred gpm more or less than the test well based estimates provided in this feasibility study. Production well yields will be a function of multiple variables (e.g., specific capacity and well efficiency) that may vary between

test well drilling and production well drilling. The amount of project yield above the baseline amount allocated to City of Pleasanton (and hence, available to Zone 7) cannot be confirmed until production wells are installed and tested.

3. PRODUCTION WELL DESIGN RECOMMENDATIONS

Based on our investigation of the Tennis Park site, the testing of the Tennis Park Test Well, and our well yield and drawdown analysis, LSCE believes that a well constructed at the Tennis Park site could yield between 3,400 and 5,100 gpm of water that would meet all current Title 22 Drinking Water Standards without treatment. Utilizing the information gathered as part of the site investigation, well testing, and analysis, LSCE has prepared the following design recommendations for a community supply well to be constructed at Tennis Park.

Our proposed well design meets the requirements of the Department of Water Resources Water Well Standards, Bulletin 74-81, 74-90; State Water Resources Control Board, Division of Drinking Water (DDW), and accepted water well design standards. **Figure 6** depicts the proposed well design. The well is designed to accommodate submersible pumping equipment that could pump up to 5,100 gpm. Collapse pressures for each casing type and thickness were calculated to ensure each can resist the hydrostatic pressures developed during sanitary and annular seal placement. Each of the well design elements is discussed below.

Conductor Casing / Sanitary Seal – The conductor casing will stabilize the upper portions of the borehole during drilling and well construction, while ensuring that requirements for sanitary seal are met. The conductor casing shall be installed in a 60-inch diameter borehole and cemented in place to a depth of 70 feet bgs. At a depth of 70 feet, the conductor will terminate in a clay layer. The conductor casing shall be fabricated of a 40-inch O.D. by 1/2-inch wall ASTM A-139 grade B steel.

Production Borehole – The production borehole shall be drilled using the reverse circulation drilling method. The final borehole diameter shall be 36 inches to a depth of 780 feet bgs.

Blank Well Casing – Stainless steel was selected for the blank casing. Stainless steel will provide superior corrosion resistance and well longevity while meeting DDW standards for NSF 60 certification. The blank well casing shall be 22-inch I.D. by 3/8-inch wall ASTM A-778 Type 304L stainless steel.

Well Screen – Stainless steel, louvered well screen was selected to maximize screen open area and efficiency, and for compatibility with the blank well casing. The 22-inch I.D. well screen will be constructed ASTM A-778, Type 304L stainless steel with a slot size of 0.080-inch. At a design capacity of 5,100 gpm, the screen will have a theoretical inlet velocity of 0.0377 feet/second.

Accessory Pipes - A 2-foot-long, stainless steel sounding port shall be installed on the well casing from 197 to 199 feet bgs. A 2-inch, Schedule 40, Type 304L stainless steel sounding tube shall be connected to the sounding port and installed to a depth of 197 feet bgs. A 3-inch, Schedule 40, BSP gravel fill tube shall be installed to a depth of 185 feet bgs.

Gravel Envelope – Based on the sieve analysis of selected formation samples (**Figure 7**), a 6 x 9 graded gravel envelope material was selected for use in this well. The gravel chosen is 4.9 times larger than the finest formation sample (555-560 feet bgs) at the d_{70} (cumulative percent retained) value. The 0.080-inch screen slot size will retain over 90 percent of the gravel material. The gravel envelope will be placed from 172 to 780 feet bgs. A two-foot, fine sand transition seal will be placed from 170 to 172 feet bgs.

Annular Seal – The deep annular seal will ensure that only groundwater from the targeted intervals will enter the well structure. The annular seal shall consist of "10.3-sack" sand/cement grout and shall be placed from a depth of 170 feet bgs to the ground surface.

Based on recent projects of similar size and scope, LSCE's preliminary Engineer's Estimate for the well construction, development, and testing is approximately $2,000,000. Items such as water supply for drilling, fluid and cutting disposal, development water disposal, material and equipment storage, sound attenuation, working hours, and site security and safety that may affect the cost of well installation and testing will need to be addressed in the final specifications before bidding.

Alternate Well Design Considerations

Well design recommendations were based on direction to maximize well yield. The recommended well design includes screens placed opposite each zone identified in the test well borehole below a depth of 195 feet. Development of well capacity estimates assumed that each zone screened in the test well would be targeted for completion in a production well.

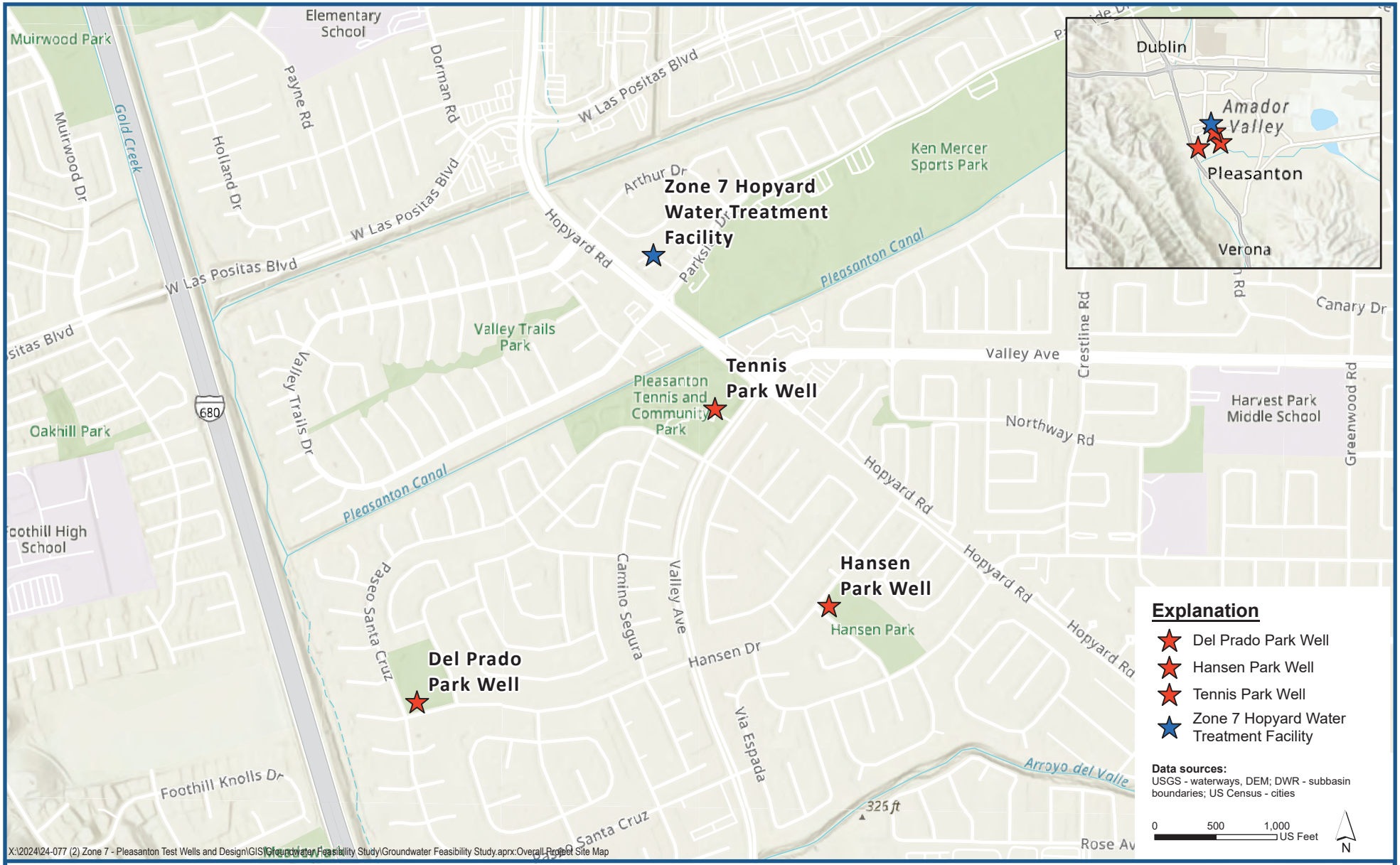
The projected yield of the proposed Tennis Park Well constructed as recommended above is between 5,100 and 3,400 gpm, depending on long term and seasonal water level variations and a conservative well efficiency value as discussed in the Pumping Capacity TM (Appendix C). Based on dynamic flow testing conducted in the test well, the bottom three zones (560 - 760 feet) in the recommended well design will contribute 11% of the total well yield or between 561 and 374 gpm of the projected yield of the production well. In contrast, the upper four zones in the production well would contribute 89% of the well yield, or 4,539 to 3,026 gpm.

The estimated cost to drill, construct, and test the production well as recommended above is $2,000,000, which equates to $2,545 per foot for the 780 foot well. The estimated cost to construct a 540 foot well that does not screen the zones between 560 and 760 feet is $1,384,560, or 31% less than a 780 foot well. Put another way, an 11% reduction in yield will result in a 31% cost savings for the construction of the production well.

FIGURES

Figure 1 - Well Location Map
Figure 2 - Tennis Park Site Map
Figure 3 - Test Well As-Built Profile
Figure 4 - Step Test Hydrograph
Figure 5 - Constant Rate Test Hydrograph
Figure 6 - Proposed Production Well Design
Figure 7 - Sieve Analysis

LSCE



Luhdorff & Scalmanini
Consulting Engineers

Project Well Location Map

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 1



Luhdorff & Scalmanini
Consulting Engineers

Tennis Park Site Map

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 2

Client: Zone 7 / City of Pleasanton	**Lat/Long:** 37.6754/-121.8984	Luhdorff & Scalmanini Consulting Engineers
Well Name: Tennis Park Test Well	**GSE (ft-msl)** +322	
LSCE #: 24-2-077	**Drill Date:** 2/5/2025 - 2/7/2025	
Location: Tennis Park, Pleasanton	**Drilling Method:** Direct Mud Rotary	
Geologist: B. Kearney	**Driller:** Nor-Cal Pump & Well Drilling	

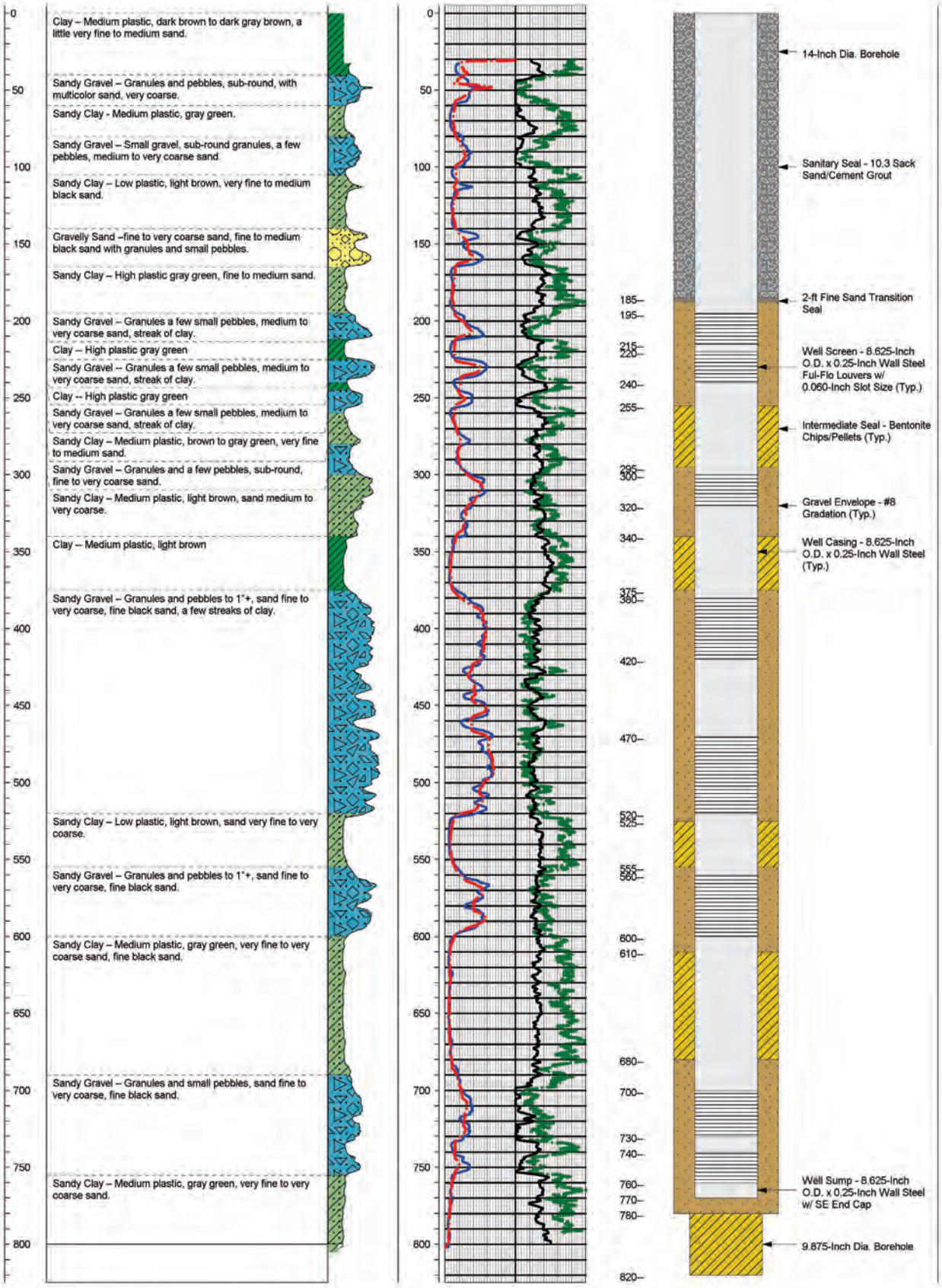
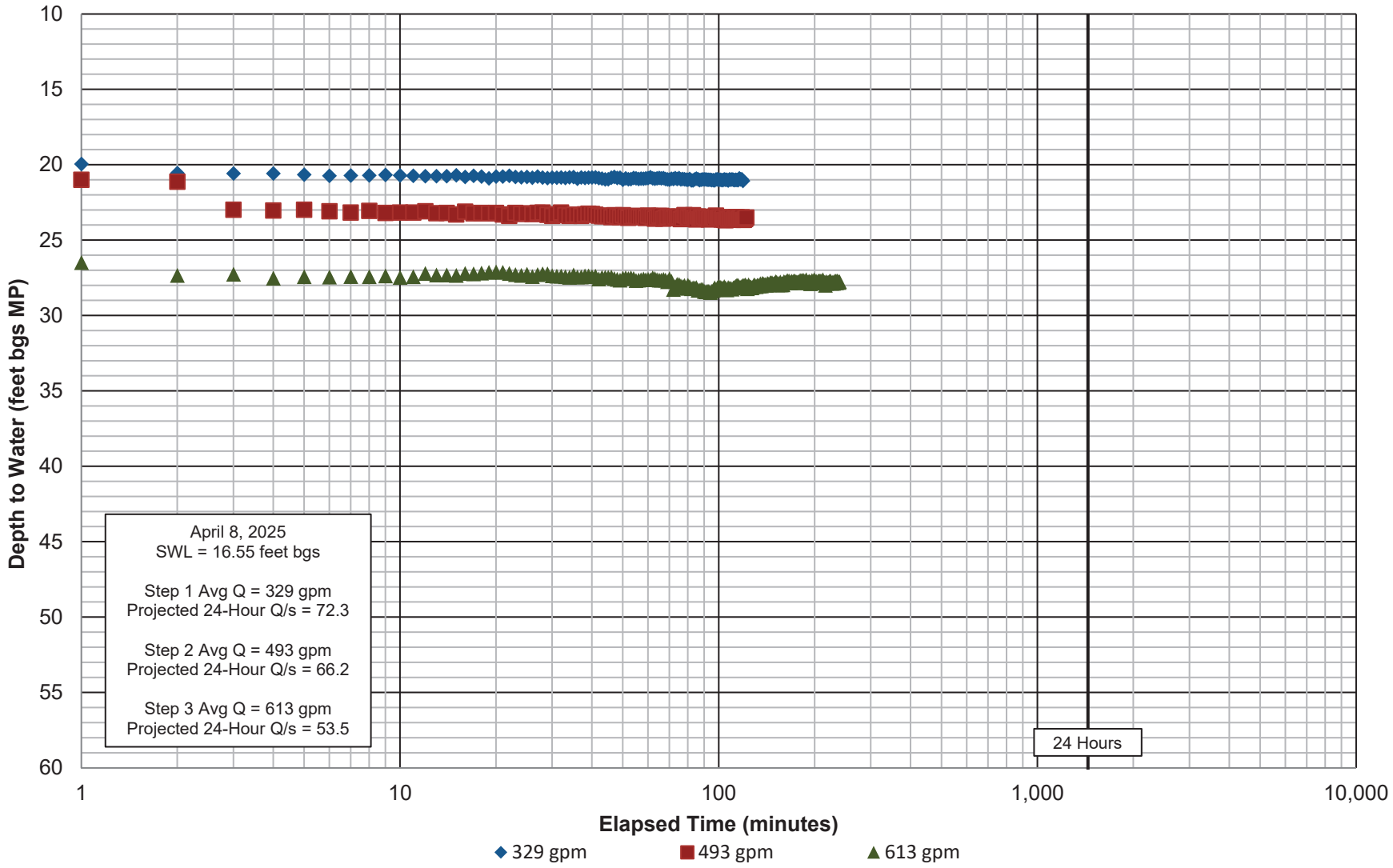


Figure 3

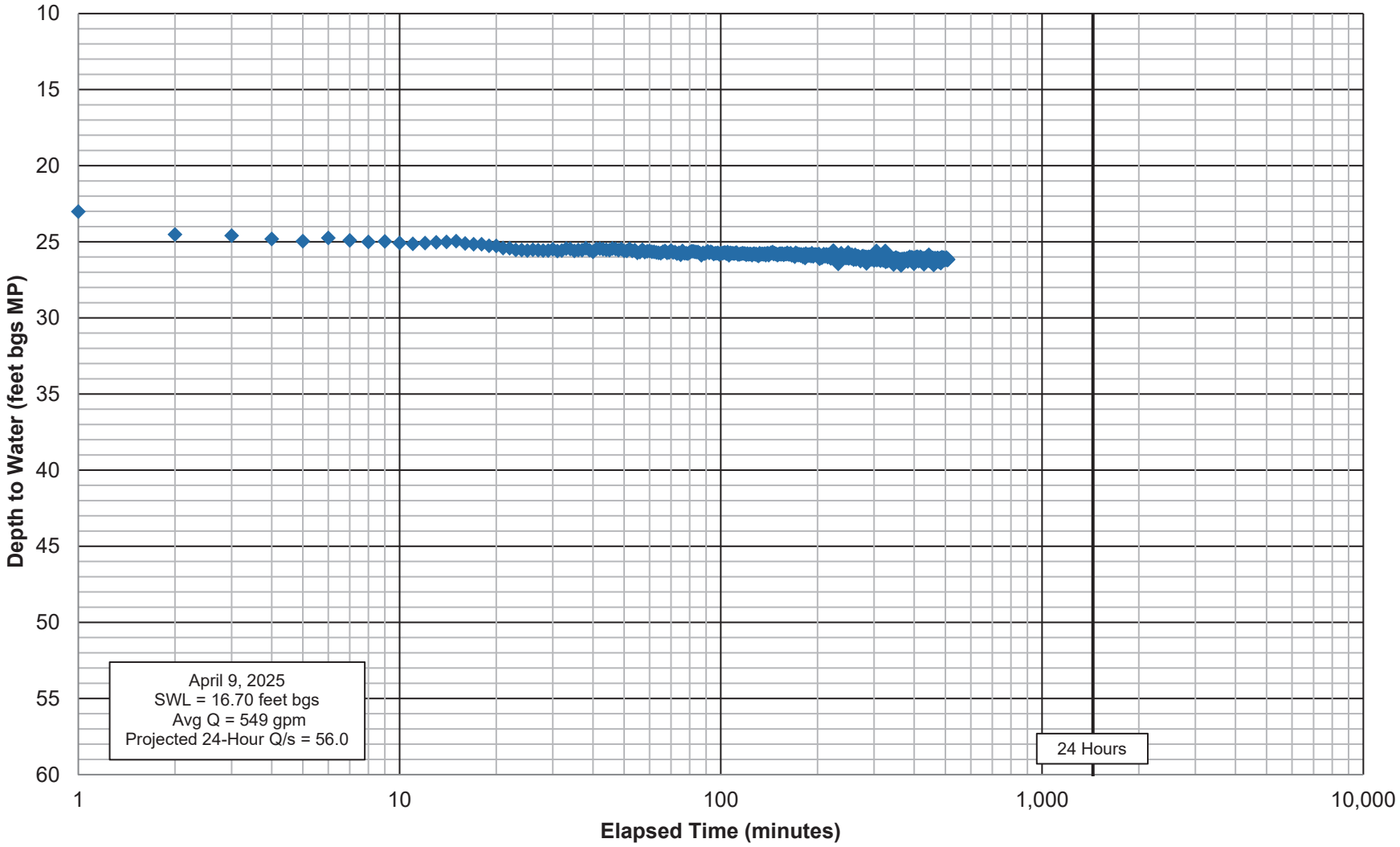


Luhdorff & Scalmanini Consulting Engineers

Step Test - Tennis Park Test Well

Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 4



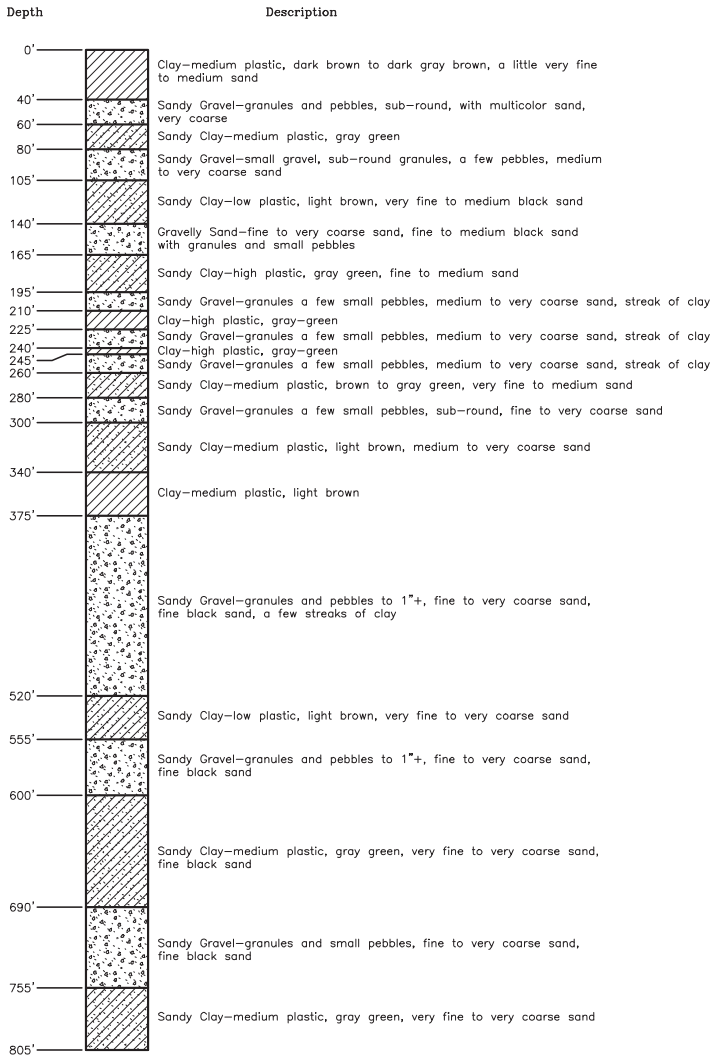
Luhdorff & Scalmanini Consulting Engineers

Constant Rate Test - Tennis Park Test Well

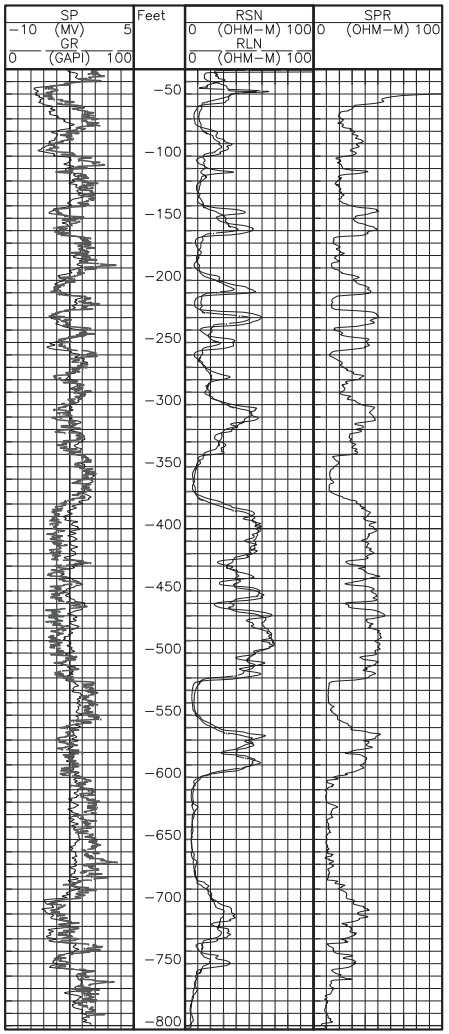
Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 5

TENNIS PARK WELL
TEST HOLE LITHOLOGY



TENNIS PARK WELL
TEST HOLE ELECTRICAL LOG



TENNIS PARK WELL
WELL PROFILE

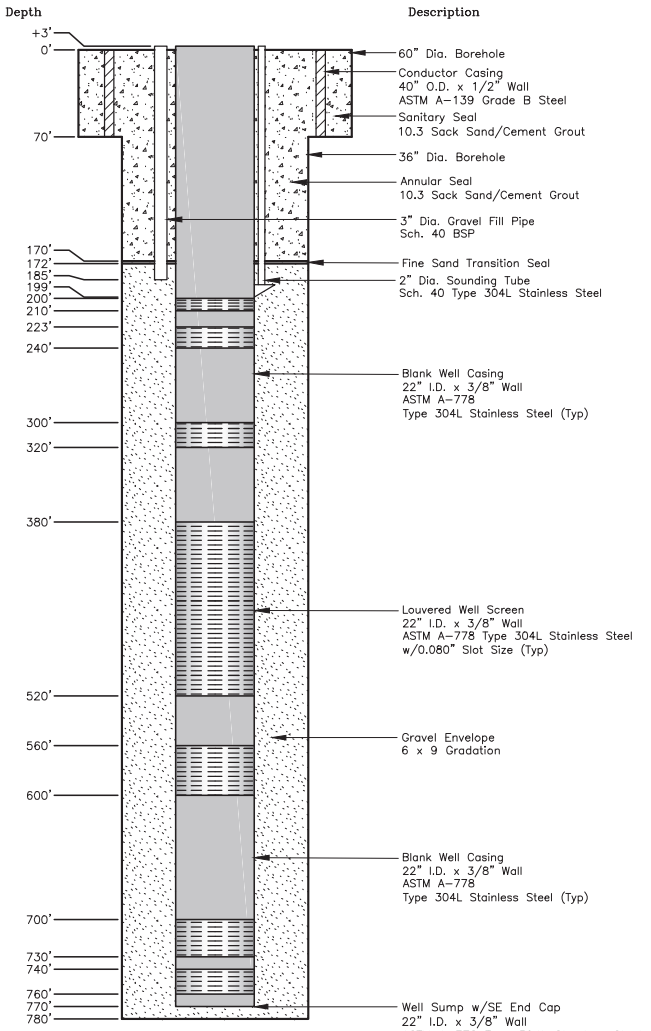


Figure 6

TENNIS PARK WELL PROFILE
Zone 7 Water Agency
Regional Groundwater Facilities
Project
Alameda County, California

Luhdorff & Scalmanini
Consulting Engineers

REVISIONS		
NO.	DATE	REVISION

DATE: SEPTEMBER 2025
JOB NO.: 24-2-077
DESIGN BY: SL
DRAWN BY: RM
CHECKED BY:
Tennis Park Well.dwg

SHEET: 1

CAD FILE: Z:\LS ACAD Dropbox\Projects\City of Pleasanton\24-2-077\Tennis Park Well.dwg DATE: 09/18/2025 3:41 PM

Tennis Park Test Hole

Luhdorff & Scalmanini
Consulting Engineers

U.S. Standard Sieve Numbers

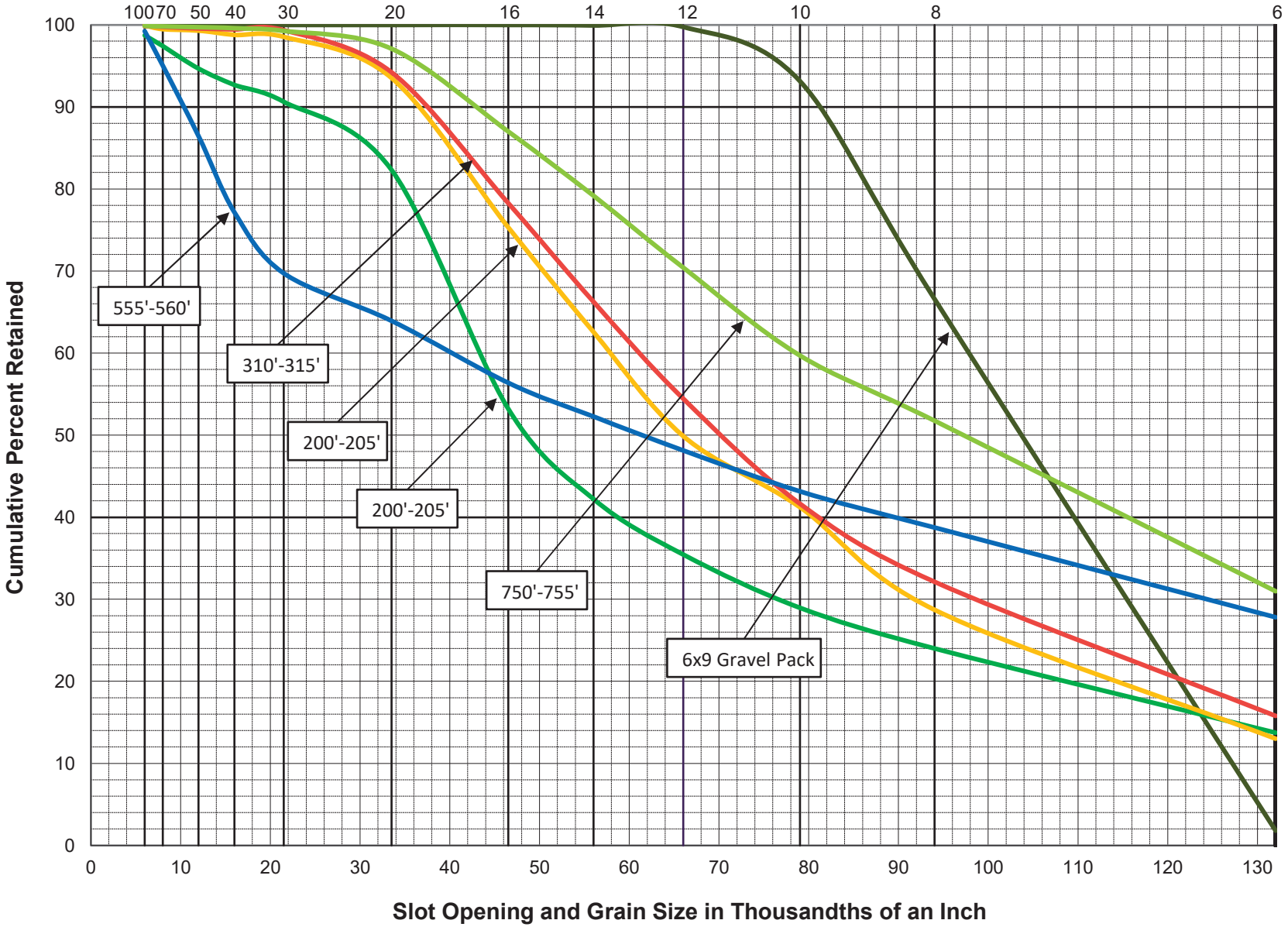


Figure 7

APPENDIX A

Well Drilling & Construction Permit

Zone 7 Water Agency
100 North Canyons Parkway
Livermore, CA 94551
wellpermits@zone7water.com

DRILLING PERMIT APPLICATION

For Office Use Only

Permit ID	Permit Date	Receipt ID	Well ID
2024106		N/A - Fee Waived	

For Applicant to Complete

Applicant: Nor-Cal Pump & Well Drilling, Inc.	Contact: Carn S. Heer	Email: carn@norcalpump.com
Address: 1325 Barry Road	City: Yuba City, California	Phone: (530) 740-2534
Client: Zone 7 Water Agency		Email: admin@zone7water.com
Address: 100 North Canyons Parkway	City: Livermore, California	Phone: (925) 454-5000
Owner: City of Pleasanton	■ Same as client	Email: tyamello@cityofpleasantonca.gov
Address: PO Box 520	City: Pleasanton	Phone: 925-931-5519

Site

Project Location/Address	Parcel	
5801 Valley Avenue, Pleasanton CA 94566	946-3400-18-6 / 946-3400-18-7	
GeoTracker ID:	**Latitude:** 37.675278	**Longitude:** -121.898385

Project Type

■ **Construction** ☐ **Modification** ☐ **Destruction**
($660/well)

Type of Well

☐ Domestic	■ Municipal	■ Monitoring
☐ Irrigation	☐ Industrial	☐ Dewatering
☐ Livestock	☐ Geothermal	☐ Other: _____
☐ Cathodic	☐ Inclinometer	

Borings and Remediation
($445/site up to 4 borings plus $85 for each additional boring)

Type of Work

☐ Geotechnical Boring	☐ Groundwater Extraction*
☐ Environmental Boring	☐ In Situ Treatment*
☐ Soil Vapor Sampling*	☐ Other
☐ Soil Vapor Extraction*	* *Submit design with seal intervals*

Drilling

Drilling Method

■ Mud Rotary	☐ Hollow Stem Auger
☐ Air Rotary	☐ Direct Push
☐ Sonic	☐ Other: _____

Drilling Company Nor-Cal Pump & Well Drilling, Inc.

C57 License # 908591

Well Construction Projects

Owner Well ID	Borehole Diameter	Casing Material	Casing Diameter	Surface Seal Depth	Total Well Depth
Tennis Park	14"	ASTM A39 Grade B Mild Steel	8.625" OD x .25" wall	125'	650' Casing ; 800' TD

Exploratory Boring Projects

Number of Borings:	Borehole Diameter:	Maximum Depth:	Estimated Depth-to-Water:

All Projects

Estimated Starting Date: 11/25/2024	Estimated Completion Date: 5/10/2025

*** Please attach a Site Plan with all proposed drilling locations, existing wells, significant site features, and adjacent streets.**

Applicant/Client/Owner assume all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner. I hereby agree to comply with all requirements of this permit (see Page 2) and Alameda County Ordinance No. O-2015-20.

Applicant's Signature: _____ Date: 11/11/2024

For Office Use Only

Approved: _____ Date: _____

REV 11/27/23

EMAIL INSPECTION REQUESTS TO WELLPERMITS@ZONE7WATER.COM

PERMIT CONDITIONS

(Selected Permit Requirements Apply)

FOR OFFICE USE ONLY

☐ General

1. Request an inspection by email (wellpermits@zone7water.com) at least 24 hours before the start of work.
2. Permit is void if project has not begun within 90 days of approval date. Applicant/Client/Owner assumes all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner.
3. Clear utilities prior to work commencement. Call 811 for more information.
4. Submit all analytical results including soil, vapor, and groundwater samples to Zone 7 within 60 days of collection.
5. California Well Standards and Alameda County Water Wells Ordinance apply unless otherwise required below.

Borings

Must be sealed within 24 hours of drilling

☐ GEOTECHNICAL

1. If groundwater is encountered, tremie cement grout from total depth to ground surface displacing water from hole. Hydrated bentonite granules/chips may be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.
2. If groundwater is not encountered, fill borehole from total depth to ground surface with compacted cuttings, cement grout placed by tremie pipe, or hydrated bentonite granules/chips (minimum 4 inch diameter borehole) using augers as tremie.

☐ CONTAMINATION INVESTIGATION

1. Fill open hole with neat cement placed by tremie pipe to ground surface. Hydrated bentonite granules/chips may also be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.

Wells

☐ GENERAL – Submit within 60 days of work completion:

1. DWR Well Completion Report containing owner and Zone 7 well ID from drilling permit to both DWR and Zone 7 Water Agency.
2. Top-of-casing elevation and pump test results

☐ SUPPLY WELLS

1. Borehole diameter shall be at least 4 inches greater than the well casing diameter.
2. Minimum seal depth must be 50 feet.
3. Cement grout shall be pumped though tremie pipe.
4. Plumbing
   - An access port at least 0.5 inches in diameter is required on the wellhead for water level measurements.
   - A water spigot for sampling is required on the discharge pipe near the wellhead.
   - A metering device is required on the discharge pipe near the wellhead.

☐ MONITORING WELLS

1. Borehole diameter shall be at least 4 inches greater than the well or piezometer casing diameter.
2. Minimum seal depth of monitoring well is the maximum depth practicable or 20 feet.
3. Cement grout shall be pumped through tremie unless freefall exception is met.

☐ Destructions and Other Special Conditions

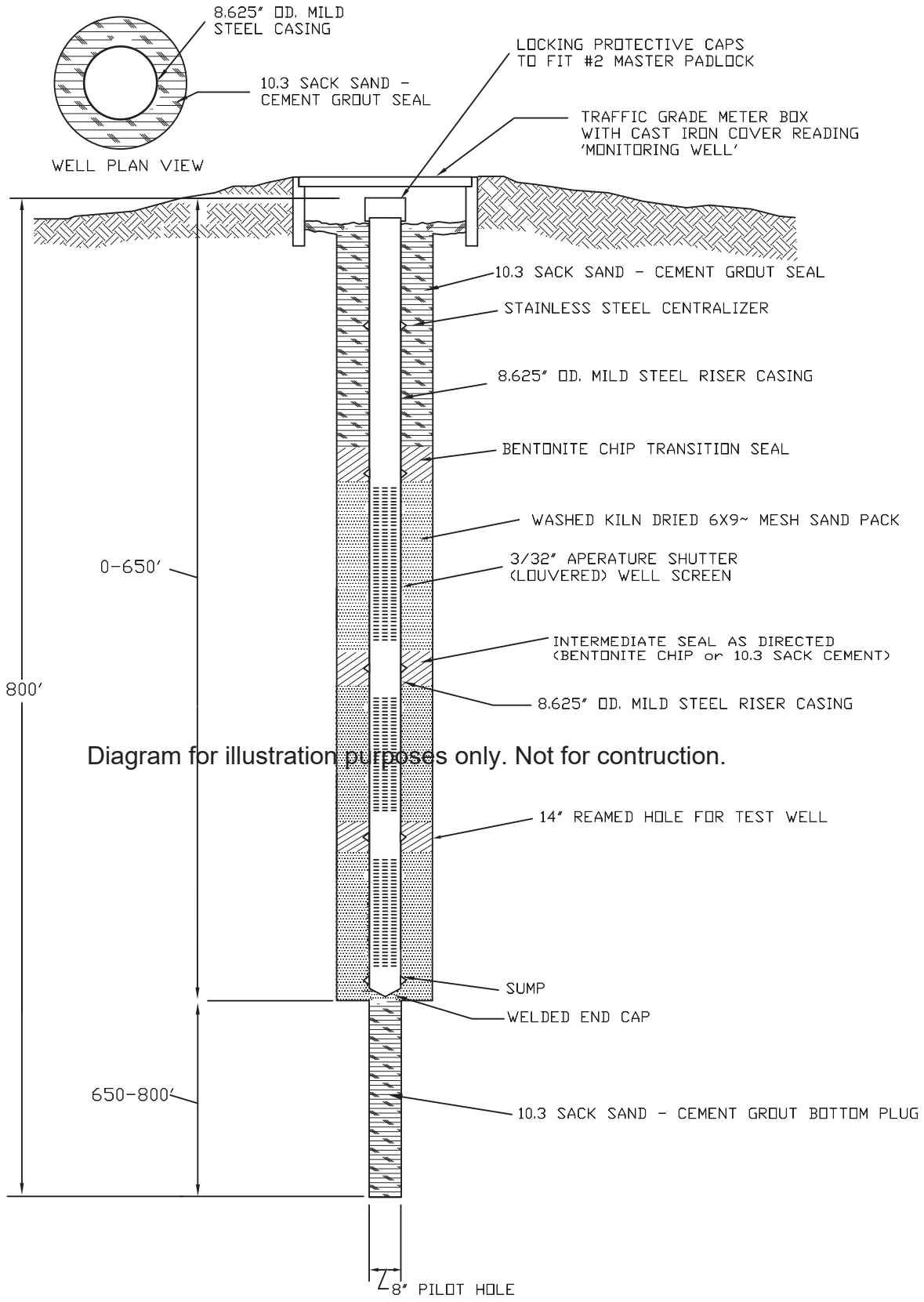
☐ Seal Requirements

Cement grout

- Neat Cement - 47lb Portland Type I /II or II/V cement to 3 gallons of water. Up to 5% bentonite powder by weight of cement.
- Sand Cement – 10.3 sack mix. 94lb Portland Type I/II or II/V cement to maximum 188lbs sand, and maximum 7 gallons of water.

Tremie: Grout shall be placed by tremie pipe. Bottom of tremie must remain submerged in grout until hole is filled. Upper 2 feet may also be restored with compacted material.

Freefall: 30 feet or less below ground surface in unsaturated zone only.

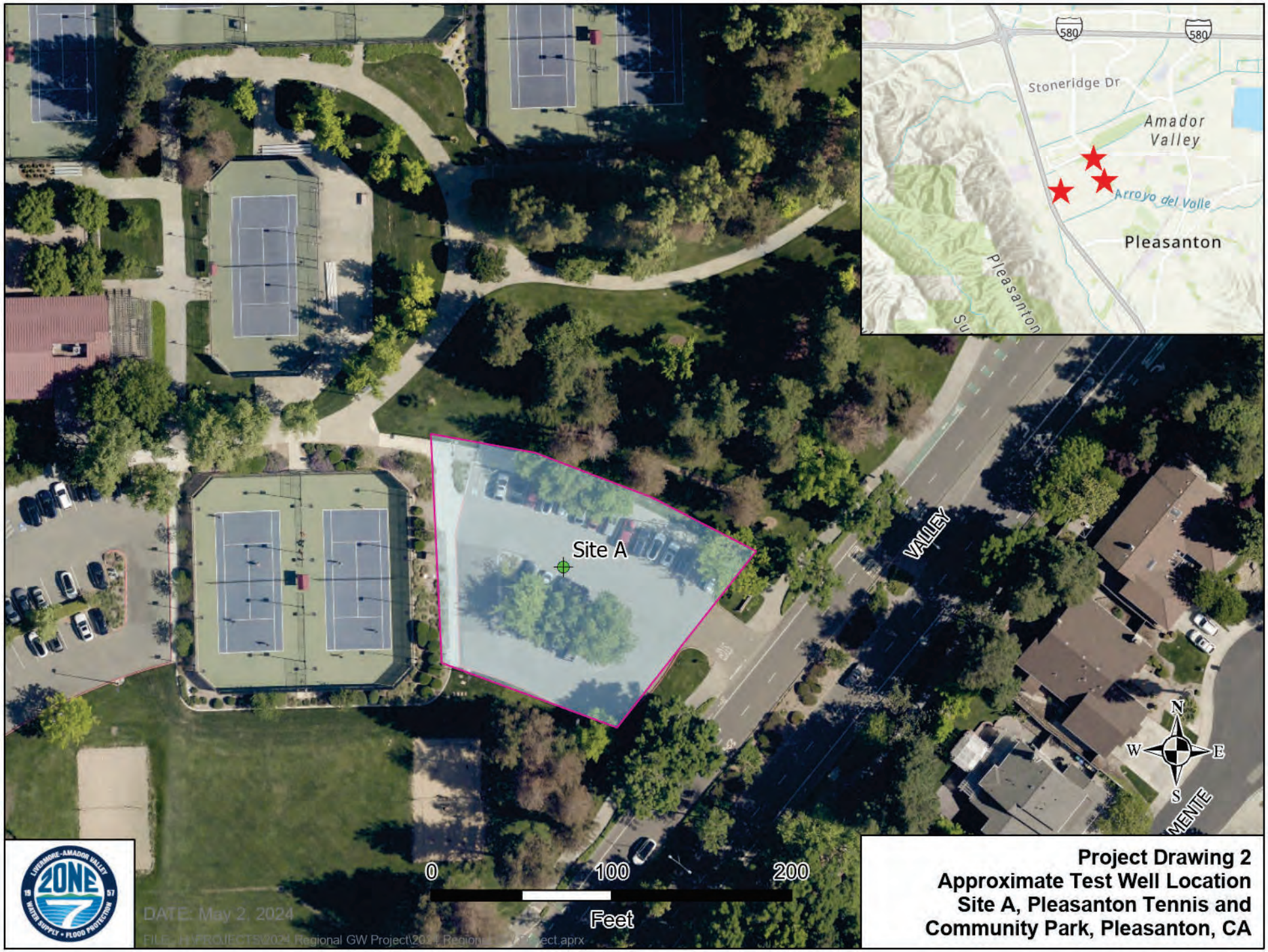


REVISIONS		
6		
5		
4		
3		
2		
1		

ZONE 7 WATER AGENCY

PROJECT DRAWING 5
GENERAL CONSTRUCTION DESIGN
TEST WELL

DRAWN: J. DANIELSEN
DESIGNED:
CHECKED:
APPROVED:
DATE: 05/28/2024
SCALE: NOT TO SCALE
FILE NAME: E:\PROJECTS\2024 Regional GW Development\Bid Packages\Test Wells
1 OF 1



Project Drawing 2
Approximate Test Well Location
Site A, Pleasanton Tennis and Community Park, Pleasanton, CA

APPENDIX A

Well Completion Report

State of California

Well Completion Report

Form DWR 188 Submitted

WCR2025-011219

Owner's Well Number: Test Well 1 - Tennis Park **Date Work Began:** 02/03/2025 **Date Work Ended:** 02/26/2025

Local Permit Agency: Zone 7 Water Agency - Alameda County Flood Control and Water Conservation District **County:** Alameda

Secondary Permit Agency: **Permit Number:** 2024106 **Permit Date:** 11/20/2024

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: ---

Business Name: City of Pleasanton

Address: P.O. Box 520

City: Pleasanton **State:** California **Zip:** 94566

Planned Use and Activity

Activity: New Production or Monitoring Well

Planned Use: Test Well

Well Location

Address: 5801 VALLEY AVE

City: PLEASANTON **Zip:** 94566

APN: 946-3400-18-6

Township: 03S **Range:** 01E

Section: 18 **BM:** Mount Diablo

Latitude: 37 Deg. 40 Min. 32.5596 Sec. N

Dec. Lat. : 37.675711

Vertical Datum:

Location Accuracy:

Longitude: -121 Deg. 53 Min. 52.8864 Sec. W

Dec. Long. : -121.898024

Horizontal Datum:

Location Determination Method:

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical **# of casings (Specify):** 1

Drilling Method: Direct Rotary **Drilling Fluid:** Bentonite

Total Depth of Boring: 820 Feet

Total Depth of Completed Well: 770 Feet

Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet)

Date Measured:

Estimated Yield*: (GPM) **Test Type:**

Test Length*: (Hours) **Total Drawdown:** (Feet)

***May not be representative of a well's long term yield.**

Geologic Log - Free Form

Depth from Surface (Feet to Feet)		Description
0	40	Clay - Medium plastic, dark brown to dark gray brown, a little very fine to medium sand
40	60	Sandy Gravel - Granules and pebbles, sub-round, with multicolor sand, very coarse
60	80	Sandy Clay - Medium plastic, gray green
80	105	Sandy Gravel - Small gravel, sub-round granules, a few pebbles, medium to very coarse sand
105	140	Sandy Clay - Low plastic, light brown, very fine to medium black sand

Depth from Surface (Feet to Feet)		Description
140	165	Gravelly Sand - fine to very coarse sand, fine to medium black sand with granules and small pebbles
165	195	Sandy Clay - High plastic gray green, fine to medium sand
195	210	Sandy Gravel - Granules a few small pebbles, medium to very coarse sand, streak of clay
210	225	Clay - High plastic grey green
225	235	Sandy Gravel - Granules a few small pebbles, medium to very coarse sand, streak of clay
235	245	Clay - High plastic gray green
245	260	Sandy Gravel - Granules a few small pebbles, medium to very coarse sand, streak of clay
260	280	Sandy Clay - Medium plastic, brown to gray green, very fine to medium sand
280	300	Sandy Gravel - Granules and a few pebbles, sub-round fine to very coarse sand
300	340	Sandy Clay - Medium plastic, light brown, sand medium to very coarse
340	375	Clay - Medium plastic, light brown
375	520	Sandy Gravel - Granules and pebbles to 1"+, sand fine to very coarse, fine black sand, a few streaks of clay
520	555	Sandy Clay - Low plastic, light brown, sand very fine to very coarse
555	600	Sandy Gravel - Granules and pebbles to 1"+, sand fine to very coarse, fine black sand
600	690	Sandy Clay - Medium plastic, gray green, very fine to very coarse sand, fine black sand
690	755	Sandy Gravel - Granules and small pebbles, sand fine to very coarse, fine black sand
690	755	Sandy Gravel - Granules and small pebbles, sand fine to very coarse, fine black sand
755	820	Sandy Clay - Medium plastic, gray green, very fine to very coarse sand

Casings

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	195	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	195	215	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	215	220	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	220	240	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	240	300	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	300	320	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	320	380	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	380	420	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	420	470	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	470	520	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	520	560	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	560	600	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	600	700	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	700	730	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	730	740	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	740	760	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	760	770	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139

Annular Material					
Depth from Surface (Feet to Feet)		Fill	Fill Type Details	Filter Pack Size	Description
0	185	Cement	10.3 Sack Mix		Sanitary Seal
185	187	Other Fill	See description		2-ft Fine Sand Transition Seal
187	255	Filter Pack	Other Gravel Pack		Gravel Envelop - #8 Gradation (Typ.)
255	295	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips/Pellets (Typ.)
295	340	Filter Pack	Other Gravel Pack		Gravel Envelop - #8 Gradation (Typ.)
340	375	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips/Pellets (Typ.)
375	525	Filter Pack	Other Gravel Pack		Gravel Envelop - #8 Gradation (Typ.)

Depth from Surface (Feet to Feet)		Fill	Fill Type Details	Filter Pack Size	Description
525	555	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips/Pellets (Typ.)
555	610	Filter Pack	Other Gravel Pack		Gravel Envelop - #8 Gradation (Typ.)
610	680	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips/Pellets (Typ.)
680	780	Filter Pack	Other Gravel Pack		Gravel Envelop - #8 Gradation (Typ.)
780	800	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips/Pellets (Typ.)

Other Observations:

Borehole Specifications

Depth from Surface (Feet to Feet)		Borehole Diameter (inches)
0	780	14
780	820	9.875

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

Name: NOR - CAL PUMP & WELL DRILLING INC
Person, Firm or Corporation

1325 BARRY ROAD	YUBA CITY	California	95993
Address	City	State	Zip

Signed: electronic signature received — C-57 Licensed Water Well Contractor

11/14/2025 — Date Signed

908591 — License Number

DWR Use Only

CSG #	State Well Number			Site Code	Local Well Number		
----	----	----	N	----	----	----	W

Latitude Deg/Min/Sec — Longitude Deg/Min/Sec

APN: ----

Township: ---- **Range:** ----

Section: ---- **Tract:** ----

SEQ: ---- **BM:** ----

Attachments

No Attachments

APPENDIX A

Geophysical Surveys

PACIFIC SURVEYS

ELECTRIC LOG
GAMMA-RAY

Job No. 33352

File No.

Company NOR-CAL PUMP & WELL DRILLING, INC.

Well 24-5008 - SITE 1 - TENNIS COURTS PARK

Field PLEASANTON

County ALAMEDA State CA

Location:

PLEASANTON TENNIS PARK - 5801 VALLEY AVE.
GPS: 37.6754 -121.8984

Sec. Twp. Rge.

Other Services:

NONE

Permanent Datum	G.L.	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Log Measured From	G.L. 0'		
Drilling Measured From	G.L.		

Date	02-07-2025		
Run Number	ONE		
Depth Driller	800'		
Depth Logger	803'		
Bottom Logged Interval	803'		
Top Log Interval	30'		
Casing Driller	16" @ 6'		
Casing Logger	N/A		
Bit Size	9.875"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	60 I 9.2		
pH / Fluid Loss	N/A		
Source of Sample	TANK		
Rm @ Meas. Temp	9.2 @ 77F		
Rmf @ Meas. Temp	9.1 @ 77F		
Rmc @ Meas. Temp	N/A		
Source of Rmf / Rmc	MEASURE		
Rm @ BHT	N/A		
Time Circulation Stopped	1720		
Time Logger on Bottom	1650		
Max. Recorded Temperature	N/A		
Equipment Number	PS-12		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	B. KEARNEY		

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

RSN & RLN CORR.

Calibration Report

Database File 33352.db
Dataset Pathname elog
Dataset Creation Fri Feb 07 18:50:35 2025

ELOG Calibration Report

Serial:	PS-5
Model:	DTQ
Shop Calibration Performed:	Wed Jun 5 20:52:35 2024
Before Survey Verification Performed:	Mon Jun 17 14:29:32 2024
After Survey Verification Performed:	Mon Jun 17 14:38:13 2024

Shop Calibration

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.949	51.704		0.500	50.000	Ohm-m	0.975	-0.426
Long	3.050	206.798		2.000	200.000	Ohm-m	0.972	-0.964
IEE	37.120	6472.600	counts	0.041	7.084	A		
VSN	157.220	7384.180	counts	2.999	140.844	V		
VLN	104.080	1887.160	counts	1.985	35.995	V		

Before Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.553		376.985	101.542	Ohm-m	-2.712	376.985
Long	0.000	101.634		998.259	103.804	Ohm-m	-8.801	998.259
IEE	0.000	6633.100	counts	0.000	7.259	A		
VSN	108.320	7568.100	counts	2.066	144.352	V		
VLN	48.040	1893.520	counts	0.916	36.117	V		

After Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.589		0.000	101.553	Ohm-m	1.000	0.000
Long	0.000	101.822		0.000	101.634	Ohm-m	0.998	0.000
IEE	0.000	6564.580	counts	0.000	7.184	A		
VSN	112.140	7492.520	counts	2.139	142.911	V		
VLN	53.260	1877.440	counts	1.016	35.810	V		

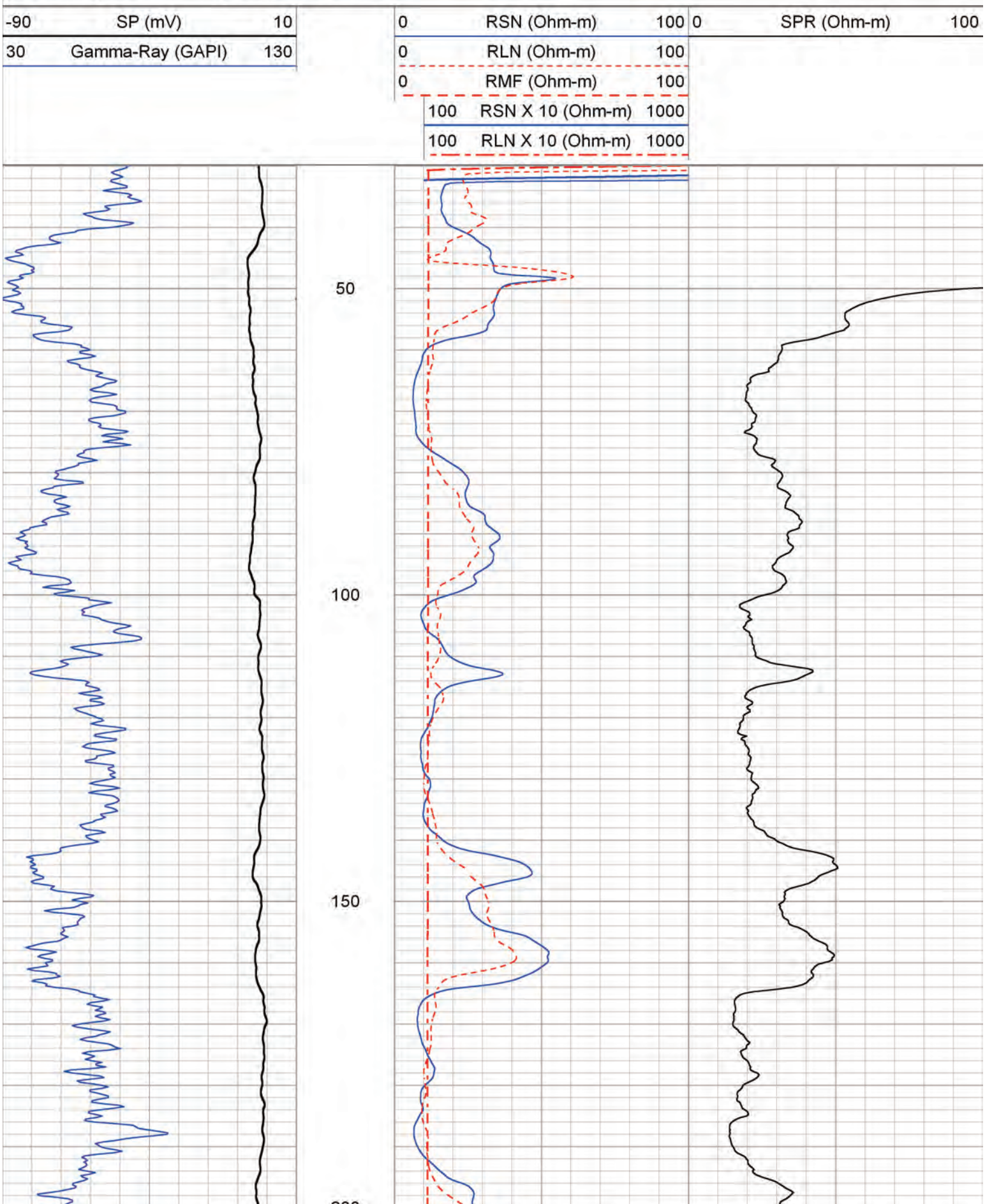
After Survey Verification compared to Before Survey Calibration

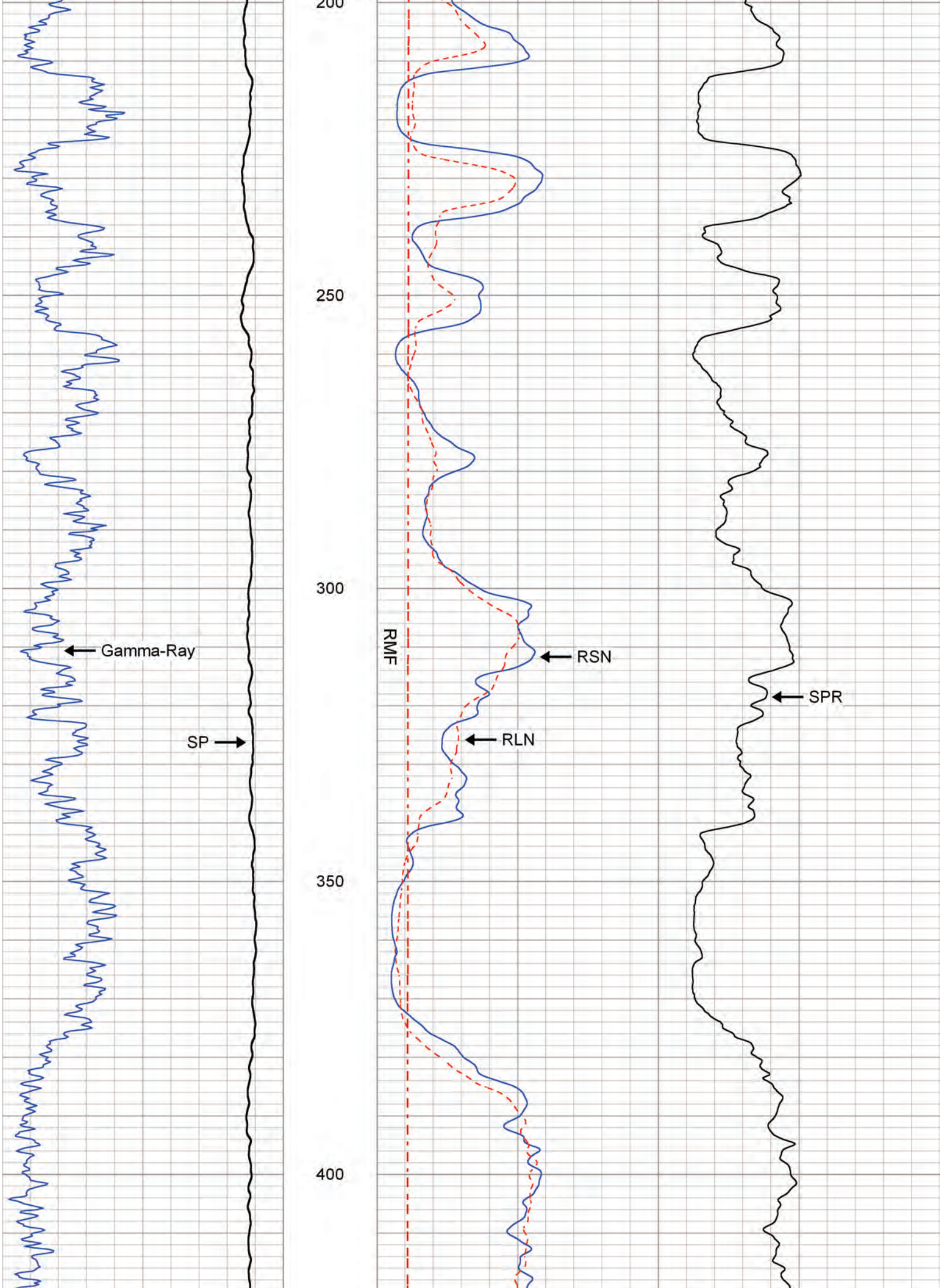
	Zero			Cal		
	Before	After		Before	After	
Short	376.985	0.000	Ohm-m	101.542	101.553	Ohm-m
Long	998.259	0.000	Ohm-m	103.804	101.634	Ohm-m

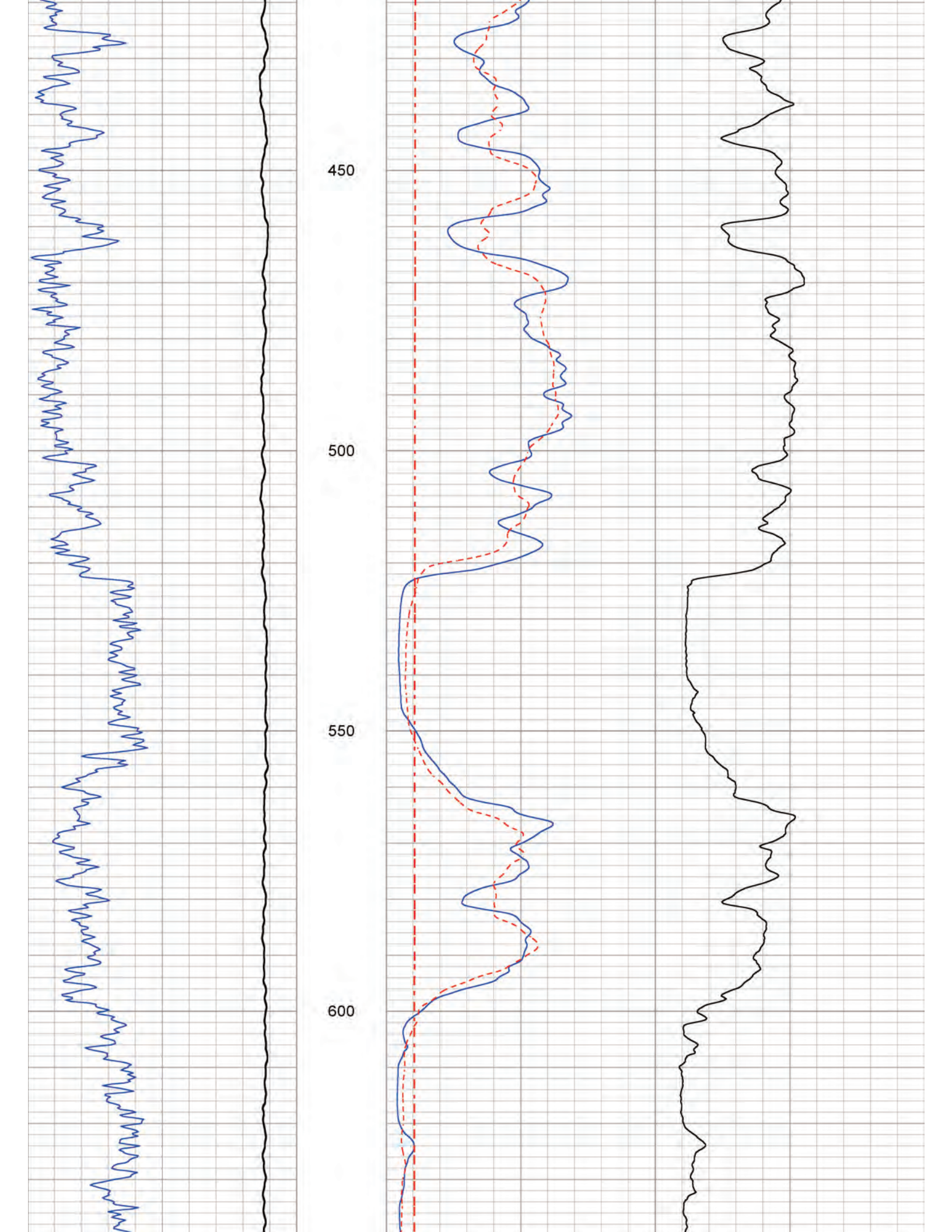
Gamma Ray Calibration Report

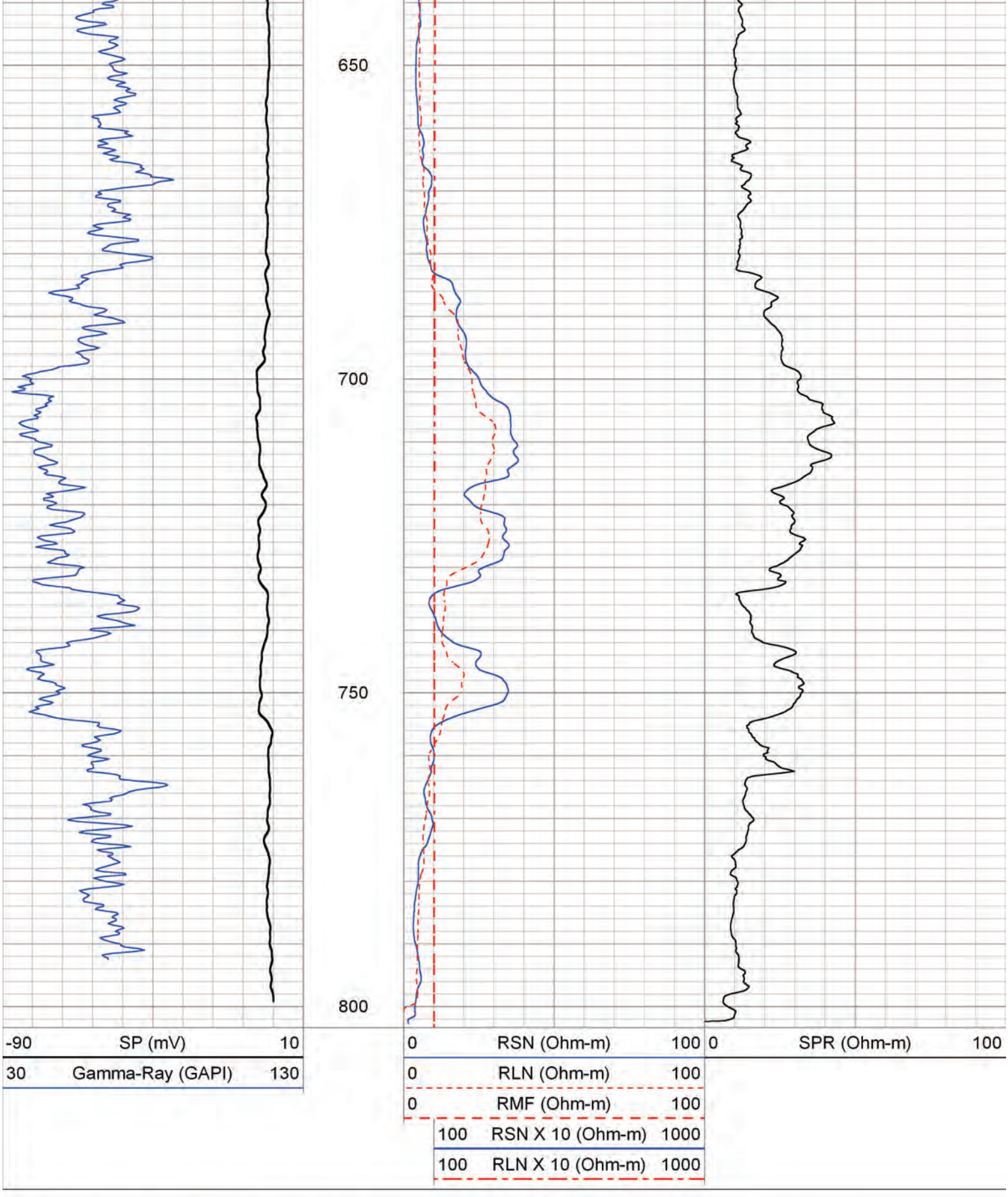
Serial Number:	D4	
Tool Model:	ELOG	
Performed:	Tue Apr 11 11:55:04 2023	
Calibrator Value:	162.0	GAPI
Background Reading:	124.7	cps
Calibrator Reading:	352.0	cps
Sensitivity:	0.5129	GAPI/cps

Database File	33352.db
Dataset Pathname	elog
Presentation Format	elog_cwa
Dataset Creation	Fri Feb 07 18:50:35 2025
Charted by	Depth in Feet scaled 1:240




200
250
300
350
400
Gamma-Ray
SP
RMF
RSN
RLN
SPR


450
500
550
600



Log Variables

DatabaseC:\ProgramData\Warrior\Data\33352.db
Dataset field/well/run1/elog/_vars_

Top - Bottom

BOREID in	BOTTEMP degF	CASEOD in	CASETHCK in	PERFS	RM_MEAS_R Ohm-m	RM_MEAS_T degF
9.875	69	0	0	No	9.2	77

RMF Ohm-m	RSH Ohm-m	SPSHIFT mV	SRFTEMP degF	TDEPTH ft	TempGrad degF/ft
9.1	20	0	59	0	0.01235

Variable Description

BOREID : Borehole I.D.
BOTTEMP : Bottom Hole Temperature
CASEOD : Casing O.D.
CASETHCK : Casing Thickness
PERFS : Perforation Flag
RM_MEAS_R : Mud Resistivity Measured
RM_MEAS_T : Mud Temperature Measured
RMF : Resistivity of Mud Filtrate
RSH : Resistivity of Shale
SPSHIFT : S.P. Baseline Offset
SRFTEMP : Surface Temperature
TDEPTH : Total Depth
TempGrad : Temperature Gradient

Filter Report

Database File 33352.db
Dataset Pathname elog
Dataset Creation Fri Feb 07 18:50:35 2025

Filter Name	Filter Type	Filter Length (ft)
LSPD	Gaussian	6.00
LTEN	None	
LSPDRT	None	
IEE	None	
VSN	None	
VLN	None	
SP	Gaussian	4.00
RSN	Gaussian	2.00
RLN	Gaussian	3.00
SPR	Gaussian	1.00
GR	Gaussian	2.00
HVOLT	Gaussian	1.00
INCL	None	
AZI	None	
ROLL	None	
MAG ROLL	None	
ACC TOTAL	None	
MTEMP	None	

APPENDIX A

Spinner Survey - Pumping Conditions

PACIFIC SURVEYS

1-INCH SPINNER FLUID VELOCITY SPINNER ANALYSIS PUMPING CONDITION

Job No. 33376

File No.

Company LUHDORFF & SCALMANINI

Well ZONE 7 - TENNIS COURTS TEST WELL

Field PLEASANTON

County ALAMEDA State CA

Location:

PLEASANTON TENNIS & COMMUNITY PARK
GPS: 37.675389 -122.898389

Sec. Twp. Rge.

Other Services:

DOWN RUNS
STOP COUNTS
FLUID SAMPLES

Permanent Datum	T.O.C.	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Log Measured From	T.O.C.		
Drilling Measured From	T.O.C.		

Date	04-09-2025	
Run Number	ONE	
Depth Driller	770'	
Depth Logger	N/A	
Bottom Logged Interval	760'	
Top Log Interval	115'	
Pump Set @	115'	
Time Pumping Prior to Survey	1 HR	
Pumping Water Level	26'	
Max. Recorded Temp.	N/A	
Pump Rate (GPM)	550	
Time Well Ready	0830	
Time Logger on Bottom	0845	
Equipment Number	PS-12	
Location	SAC	
Recorded By	SCHUMACHER	ABREAU
Witnessed By	B. KEARNY	

Perforation Record				Perforation Record			
Type	Slot Size	From	To	Type	Slot Size	From	To
FUL-FLO	0.060"	195'	215'	FUL-FLO	0.060"	470'	520'
FUL-FLO	0.060"	220'	240'	FUL-FLO	0.060"	560'	600'
FUL-FLO	0.060"	300'	320'	FUL-FLO	0.060"	700'	730'
FUL-FLO	0.060"	380'	420'	FUL-FLO	0.060"	740'	760'

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String				
Camera Tube				
Production String	8" ID	0.25" WALL	0'	770'
Liner				

<<< Fold Here >>>

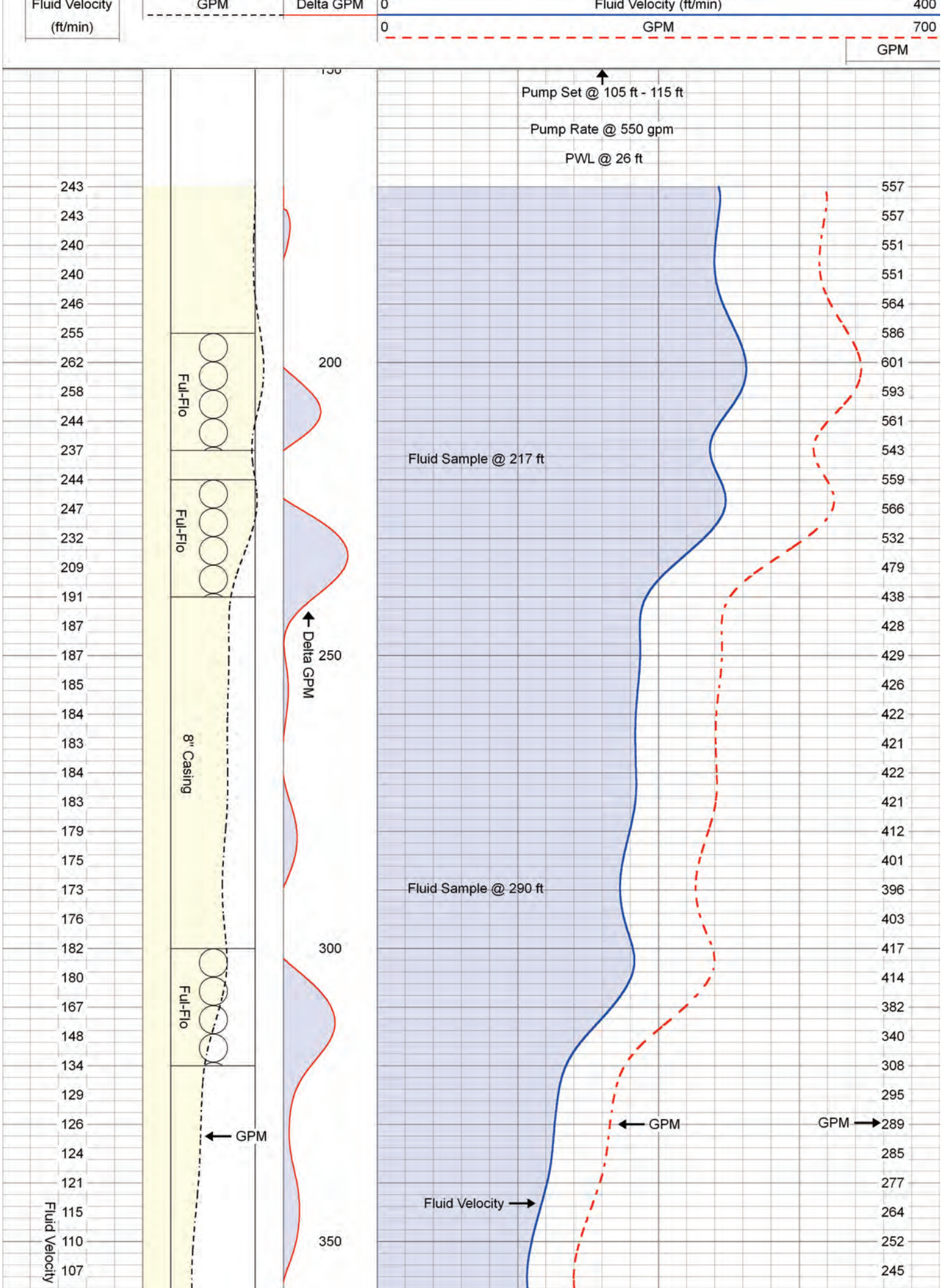
All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

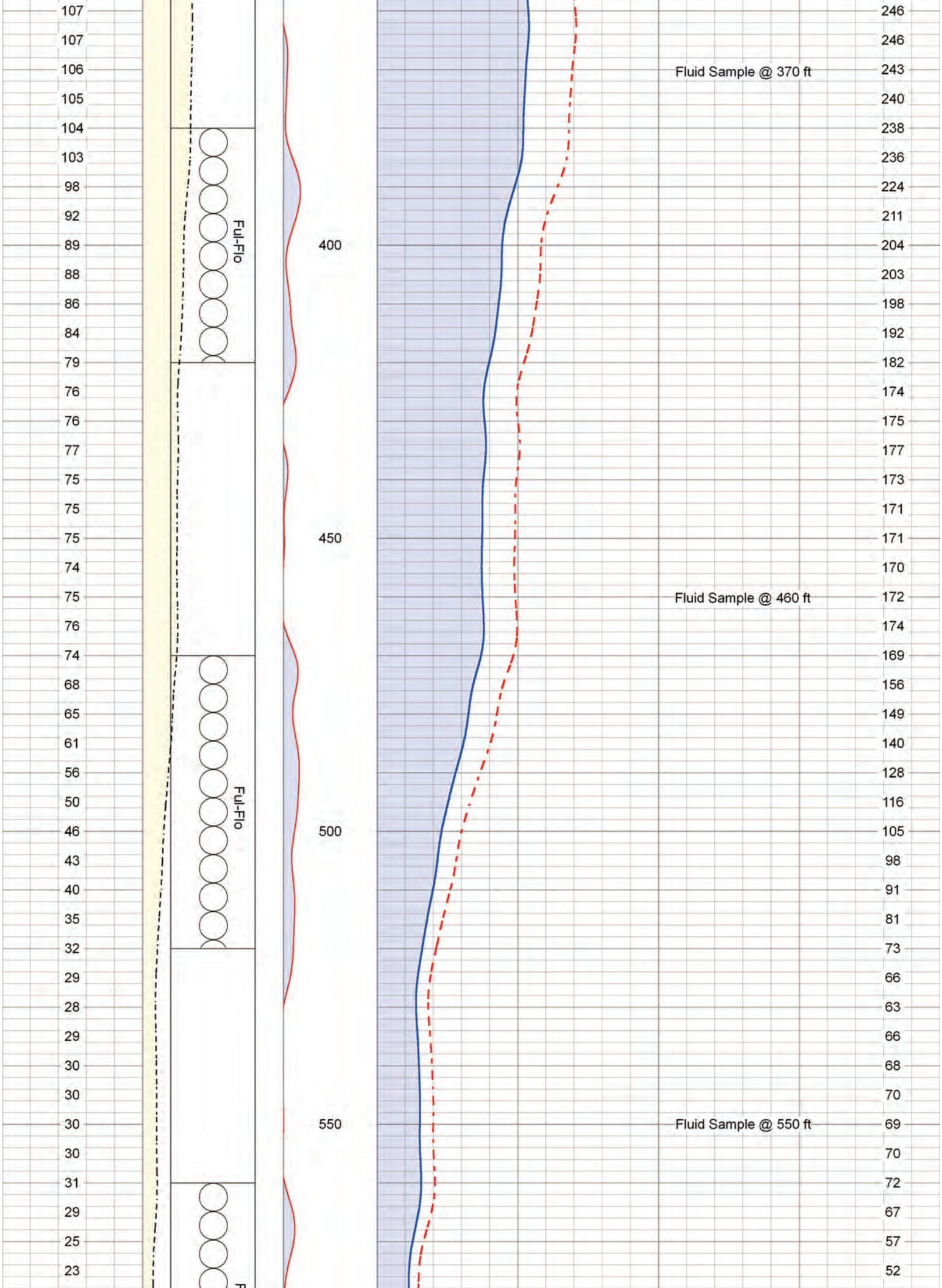
Comments

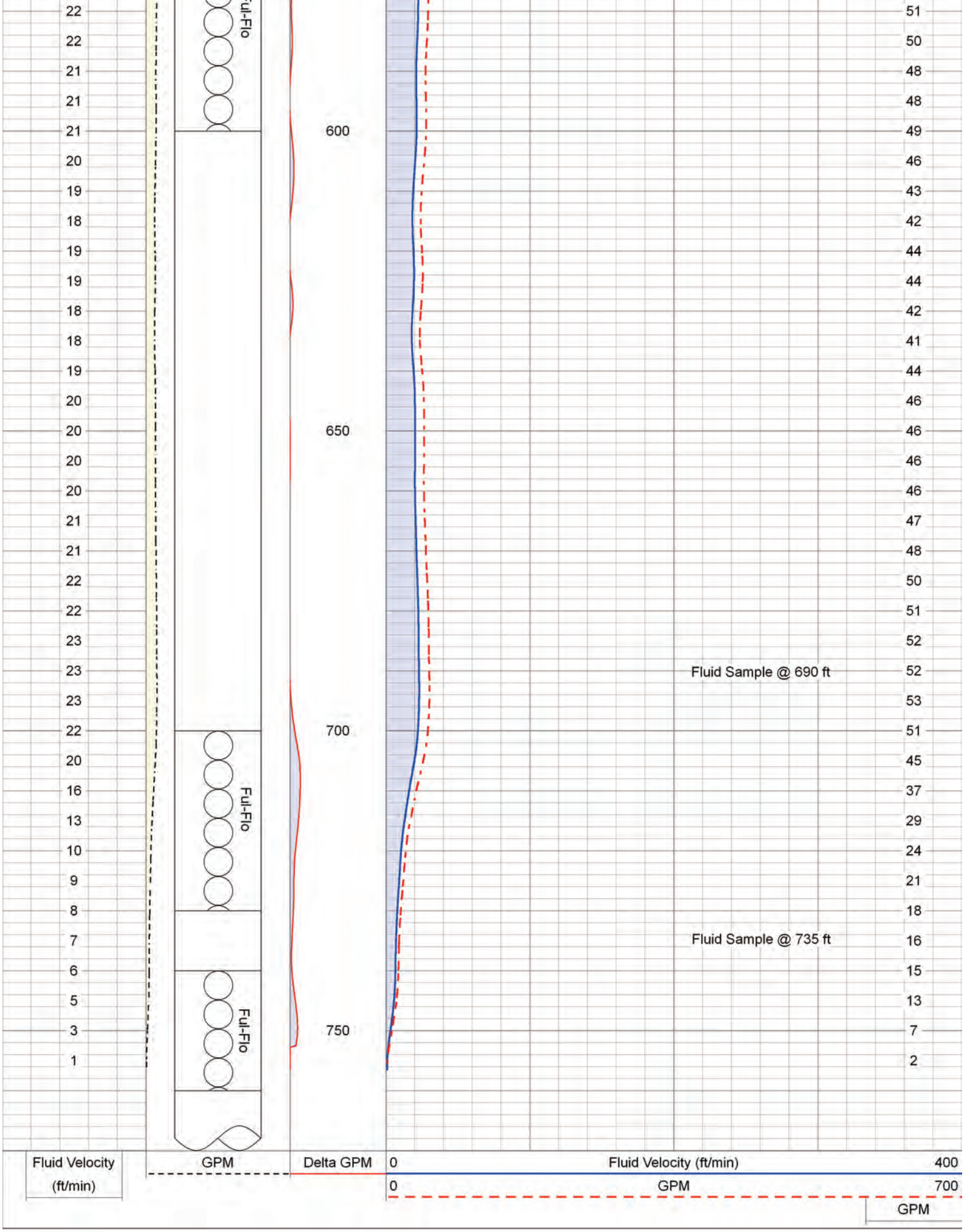
FLUID SAMPLE COLLECTED AT:
217 FT
290 FT
370 FT
460 FT
550 FT
690 FT
735 FT

NOTE: THE FLOWRATES FOR THE TWO UPPERMOST PERFORATED INTERVALS (195 FT - 215 FT & 220 FT - 240 FT) WERE COMBINED IN THE PROCESSING OF THIS ANALYSIS. THE CONCENTRATION DATA FROM THE 220 FT - 240 FT ZONE WERE ELIMINATED AND THE CONCENTRATIONS FROM THE SURFACE SAMPLE WERE USED TO REPRESENT THIS COMBINED ZONE FOR THE PURPOSES OF COMPLETING THE SPINNER ANALYSIS AND MASS BALANCE. THE SHORT BLANK SECTION BETWEEN THE TWO INTERVALS (215 FT - 220 FT) CREATED A FLUID DYNAMIC THAT MADE IT DIFFICULT TO ACCURATELY CHARACTERIZE THE FLOW AND CALCULATE THE CONCENTRATIONS BETWEEN THESE TWO ZONES.

Database File	33376.db
Dataset Pathname	33376_fldgpm2
Presentation Format	spinmerg
Dataset Creation	Fri Jun 06 11:47:04 2025 Imported depthlog
Charted by	Depth in Feet scaled 1:240


Fluid Velocity (ft/min)
GPM
Delta GPM
0
Fluid Velocity (ft/min)
400
0
GPM
700
GPM
Pump Set @ 105 ft - 115 ft
Pump Rate @ 550 gpm
PWL @ 26 ft
Ful-Flo
Ful-Flo
Ful-Flo
8" Casing
Fluid Sample @ 217 ft
Fluid Sample @ 290 ft
Delta GPM
GPM
GPM
GPM
Fluid Velocity
Fluid Velocity
243
243
240
240
246
255
262
258
244
237
244
247
232
209
191
187
187
185
184
183
184
183
179
175
173
176
182
180
167
148
134
129
126
124
121
115
110
107
150
200
250
300
350
557
557
551
551
564
586
601
593
561
543
559
566
532
479
438
428
429
426
422
421
422
421
412
401
396
403
417
414
382
340
308
295
289
285
277
264
252
245


Ful-Flo
Ful-Flo
400
450
500
550
Fluid Sample @ 370 ft
Fluid Sample @ 460 ft
Fluid Sample @ 550 ft


Ful-Flo
Ful-Flo
Ful-Flo
600
650
700
750
Fluid Sample @ 690 ft
Fluid Sample @ 735 ft
Fluid Velocity (ft/min)
GPM
Delta GPM
0
400
0
700
GPM

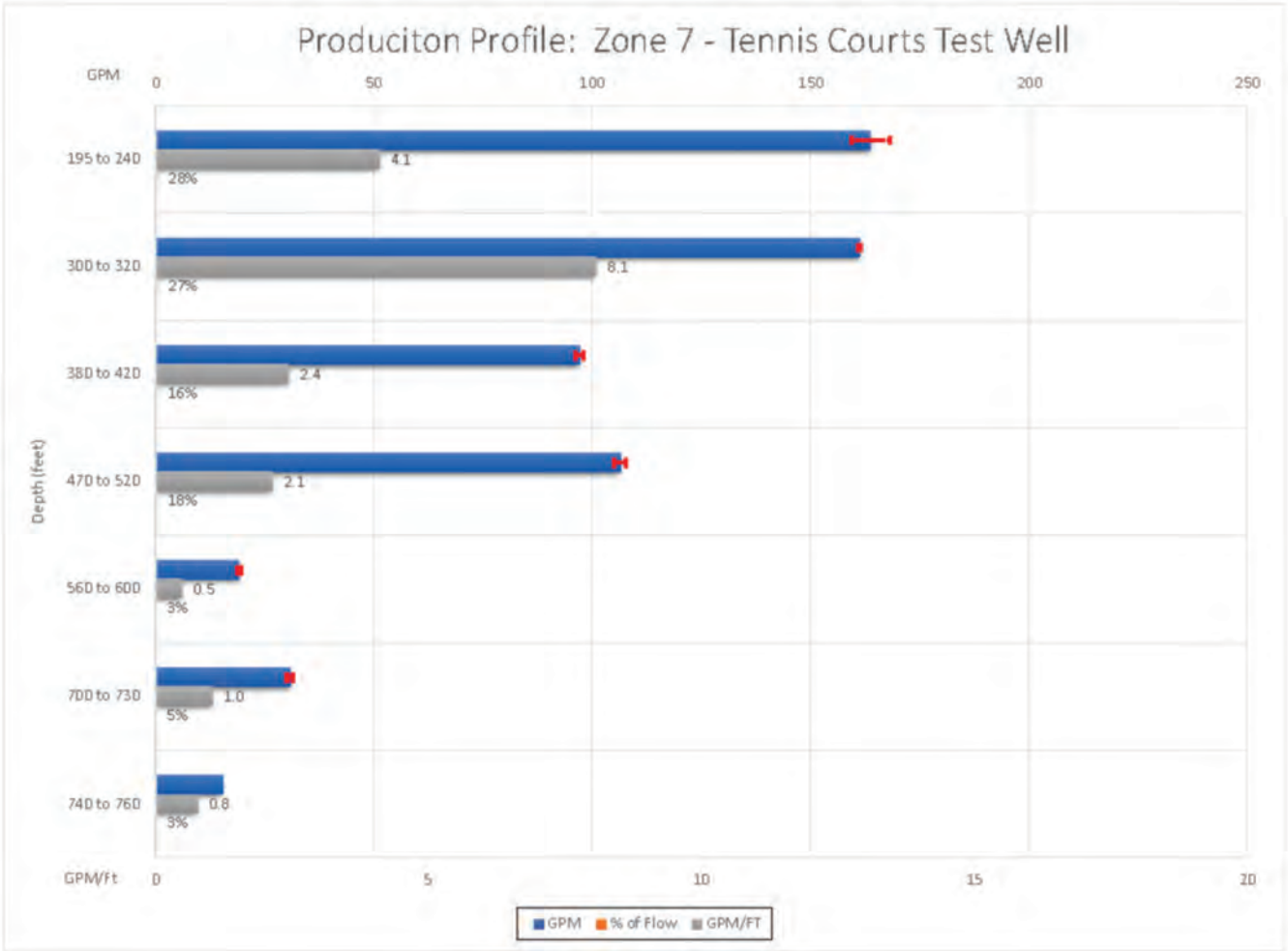
SPINNER LOG ANALYSIS

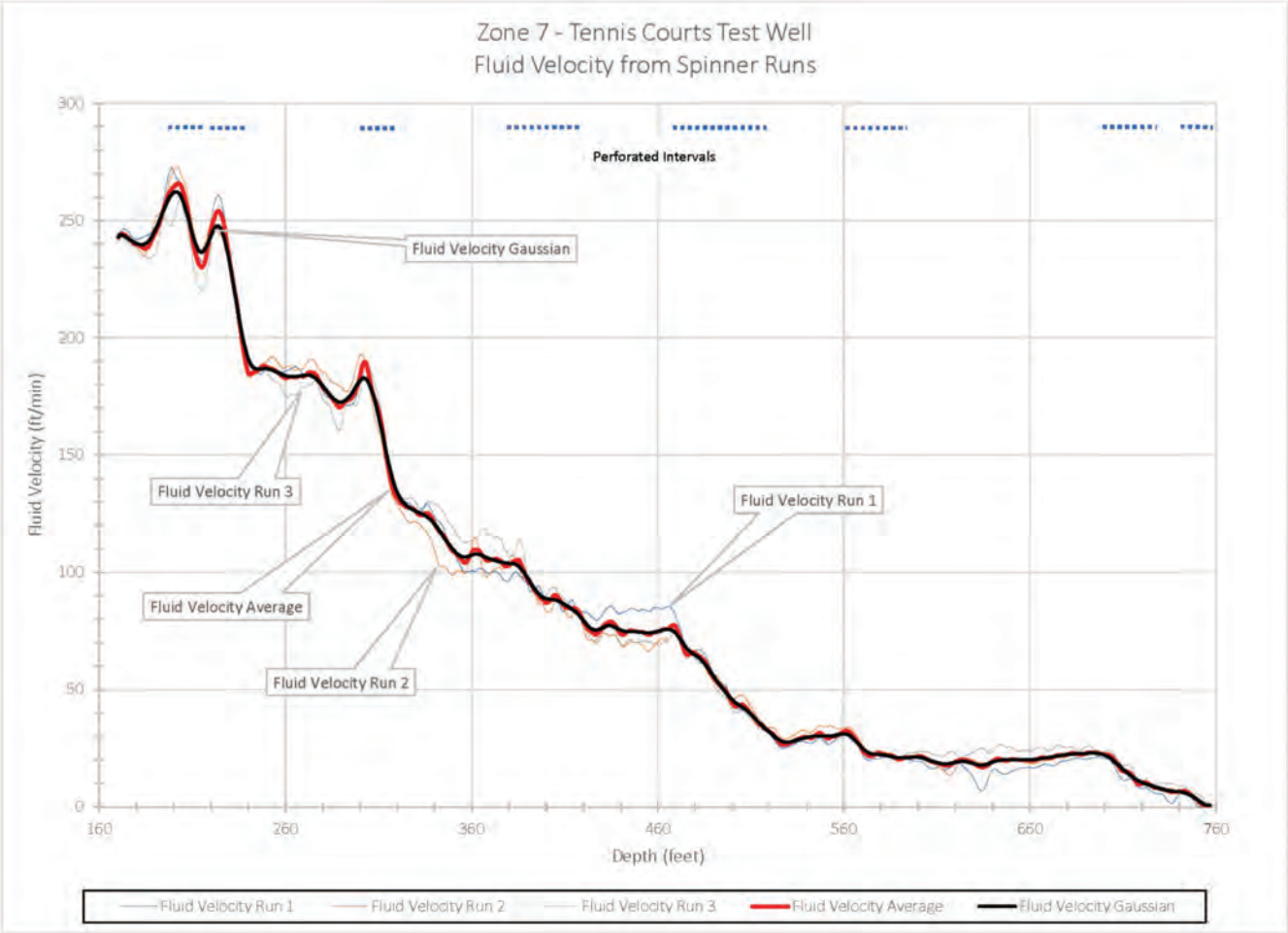
Pacific Surveys
geophysical well logging

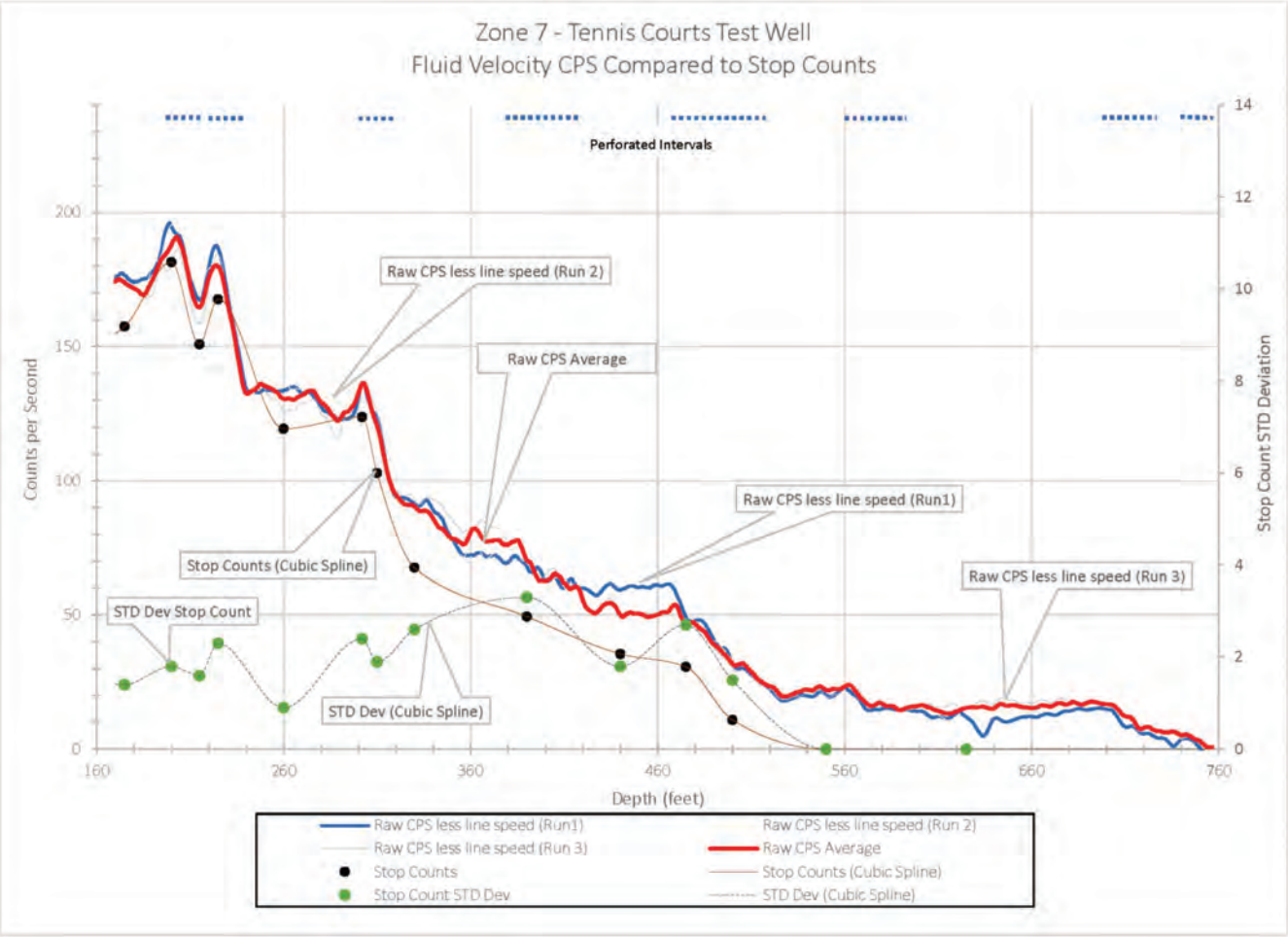
Company: Luhdorff & Scalmanini
Well: Zone 7- Tennis Courts Test Well
County: Alameda

9-Apr-2025
Job No. 33376

SURFACE FLOW RATE	594	GPM			
FLUID SAMPLE ZONES	PRODUCTION (GPM)	% OF FLOW (ZONES)	GPM/FT	STD DEV (GPM)	STD ERROR (+/- GPM)
195 to 240	164	27.6%	4.1	17	4.5
300 to 320	161	27.2%	8.1	4	0.4
380 to 420	97	16.4%	2.4	9	0.9
470 to 520	106	17.9%	2.1	15	1.4
560 to 600	19	3.2%	0.5	5	0.4
700 to 730	31	5.2%	1	8	0.7
740 to 760	15	2.6%	1	9	2.2


Produciton Profile: Zone 7 - Tennis Courts Test Well
GPM
0
50
100
150
200
250
195 to 240
4.1
28%
300 to 320
8.1
27%
380 to 420
2.4
16%
470 to 520
2.1
18%
560 to 600
0.5
3%
700 to 730
1.0
5%
740 to 760
0.8
3%
Depth (feet)
GPM/Ft
0
5
10
15
20
GPM
% of Flow
GPM/FT


Zone 7 - Tennis Courts Test Well
Fluid Velocity from Spinner Runs
Perforated Intervals
Fluid Velocity Gaussian
Fluid Velocity Run 3
Fluid Velocity Run 1
Fluid Velocity Average
Fluid Velocity Run 2
Fluid Velocity (ft/min)
300
250
200
150
100
50
0
160
260
360
460
560
660
760
Depth (feet)
Fluid Velocity Run 1
Fluid Velocity Run 2
Fluid Velocity Run 3
Fluid Velocity Average
Fluid Velocity Gaussian

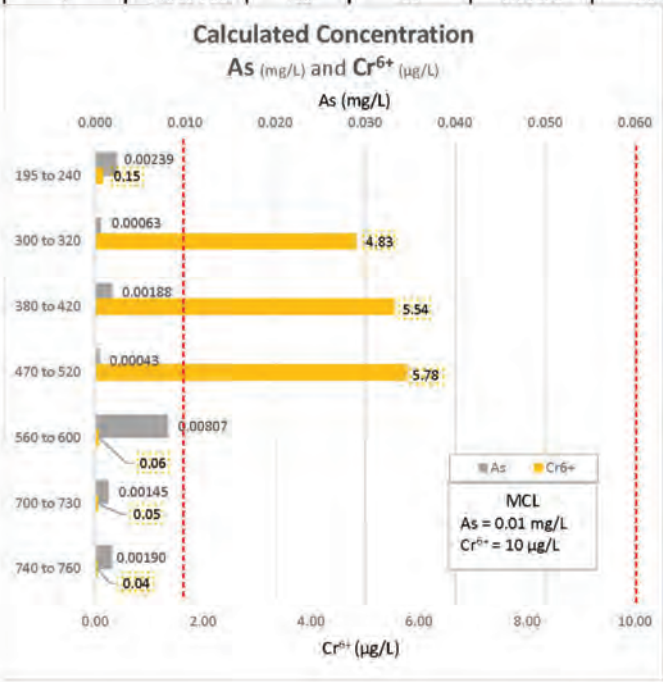

Zone 7 - Tennis Courts Test Well
Fluid Velocity CPS Compared to Stop Counts
Perforated Intervals
Raw CPS less line speed (Run 2)
Raw CPS Average
Raw CPS less line speed (Run1)
Stop Counts (Cubic Spline)
Raw CPS less line speed (Run 3)
STD Dev Stop Count
STD Dev (Cubic Spline)
Counts per Second
Stop Count STD Deviation
Depth (feet)
0
50
100
150
200
0
2
4
6
8
10
12
14
160
260
360
460
560
660
760
Raw CPS less line speed (Run1)
Raw CPS less line speed (Run 2)
Raw CPS less line speed (Run 3)
Raw CPS Average
Stop Counts
Stop Counts (Cubic Spline)
Stop Count STD Dev
STD Dev (Cubic Spline)

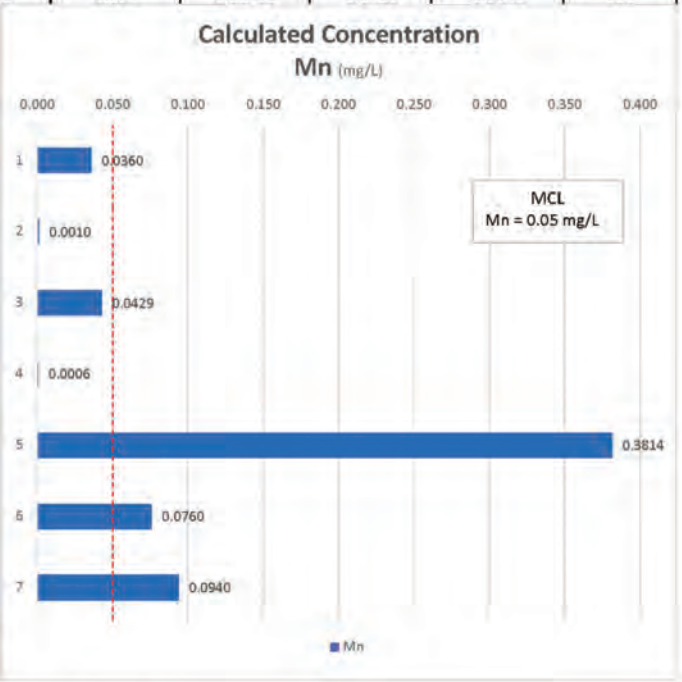
Zone 7 - Tennis Courts Test Well

Mass Balance Analysis

April 09, 2025

Sample Zone	Sample Zone Depth (feet)	Sample Depth (feet)	Flowrate (GPM)	Measured Concentration			Calculated Concentration			Measured
				As mg/L	Cr^{6+} µg/L	Mn mg/L	As mg/L	Cr^{6+} µg/L	Mn mg/L	Spec. Cond. µmhos/cm
1	195 to 240	Surface	164	0.00160	3.300	0.036	0.00239	0.1483	0.0360	912
2	300 to 320	290	161	0.00130	4.500	0.036	0.00063	4.8334	0.0010	920
3	380 to 420	370	97	0.00170	4.300	0.057	0.00188	5.5372	0.0429	864
4	470 to 520	460	106	0.00160	3.600	0.065	0.00043	5.7763	0.0006	790
5	560 to 600	550	19	0.00350	0.052	0.17	0.00807	0.0616	0.3814	962
6	700 to 730	690	31	0.00160	0.048	0.082	0.00145	0.0510	0.0760	939
7	740 to 760	735	15	0.00190	0.042	0.094	0.00190	0.0420	0.0940	936





800.919.7555
909.625.6262

1785 w. arrow rte., bldg. d, ste 3,4
upland, ca 91786
www.pacificsurveys.com

fax: 909.399.3180

APPENDIX A

Spinner Survey - Static Conditions

PACIFIC SURVEYS

3-INCH SPINNER
UP & DOWN RUNS
SPINNER ANALYSIS
NON-PUMPING CONDITION

Job No. 33378

File No.

Company LUHDORFF & SCALMANINI

Well ZONE 7 - TENNIS COURTS TEST WELL

Field PLEASANTON

County ALAMEDA State CA

Location:

PLEASANTON TENNIS & COMMUNITY PARK
GPS: 37.675389 -122.898389

Sec. Twp. Rge.

Other Services:

SPINNER UP & DOWN RUNS
STOP COUNTS

Permanent Datum	T.O.C.	Elevation above perm. datum	Elevation K.B.
Log Measured From	T.O.C.		D.F.
Drilling Measured From	T.O.C.		G.L.

Date	04-10-2025
Run Number	ONE
Depth Driller	770'
Depth Logger	N/A
Bottom Logged Interval	765'
Top Log Interval	5'
Pump Set @	N/A
Time Pumping Prior to Survey	N/A
Pumping Water Level	12' SWL
Max. Recorded Temp.	N/A
Pump Rate (GPM)	N/A
Time Well Ready	1015
Time Logger on Bottom	1030
Equipment Number	PS-12
Location	SAC
Recorded By	SCHUMACHER
Witnessed By	B. KEARNY

Perforation Record				Perforation Record			
Type	Slot Size	From	To	Type	Slot Size	From	To
FUL-FLO	0.060"	195'	215'	FUL-FLO	0.060"	470'	520'
FUL-FLO	0.060"	220'	240'	FUL-FLO	0.060"	560'	600'
FUL-FLO	0.060"	300'	320'	FUL-FLO	0.060"	700'	730'
FUL-FLO	0.060"	380'	420'	FUL-FLO	0.060"	740'	760'

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String				
Camera Tube				
Production String	8" ID	0.25" WALL	0'	770'
Liner				

<<< Fold Here >>>

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Comments

FLUID SAMPLE COLLECTED AT:
217 FT
290 FT
370 FT
460 FT
550 FT
690 FT
735 FT

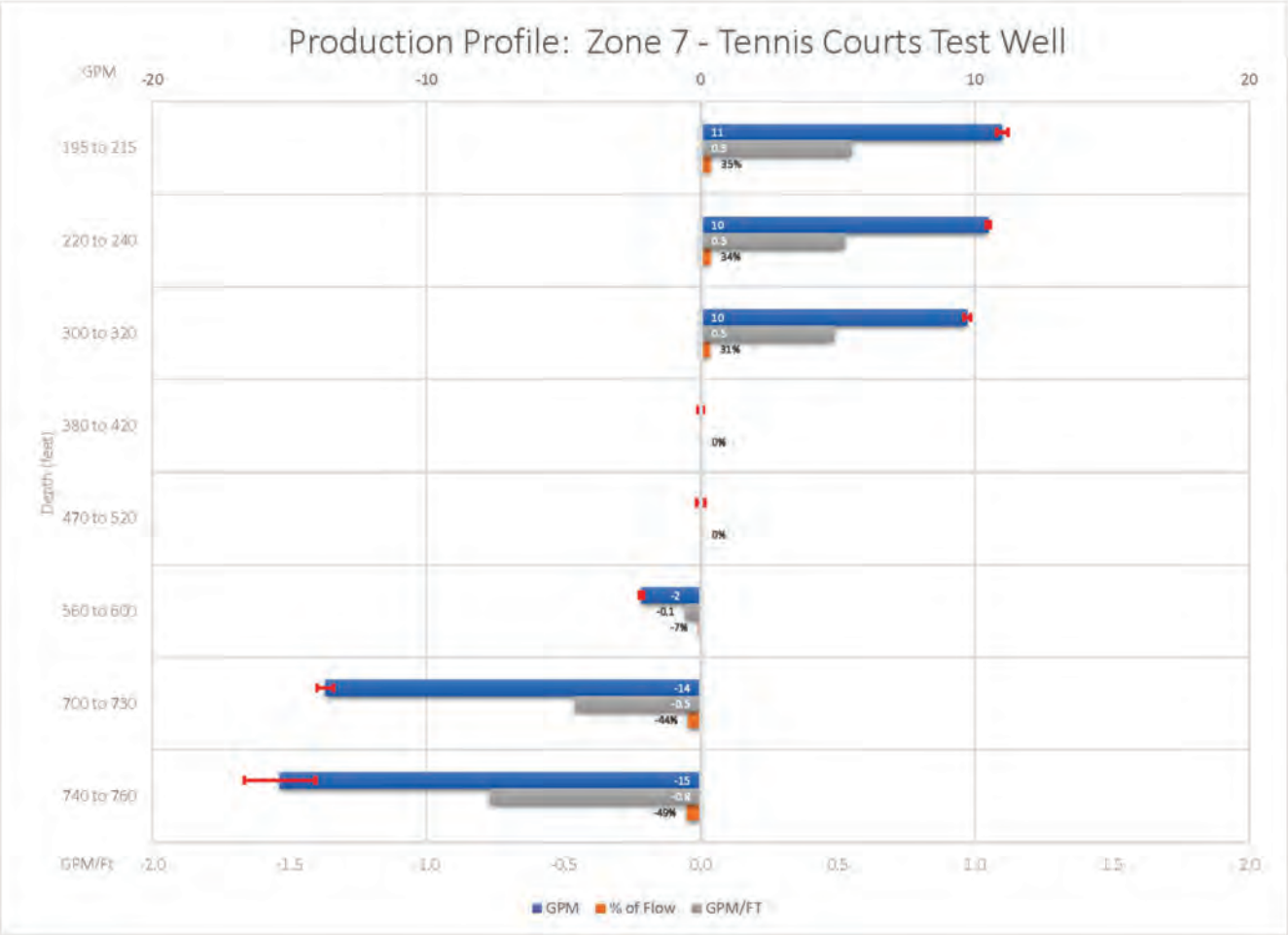
3"

Company: Luhdorf & Scalmanini
Well: Zone 7 - Tennis Courts Test Well
County: Alameda

10-Apr-2025
Job No. 33378

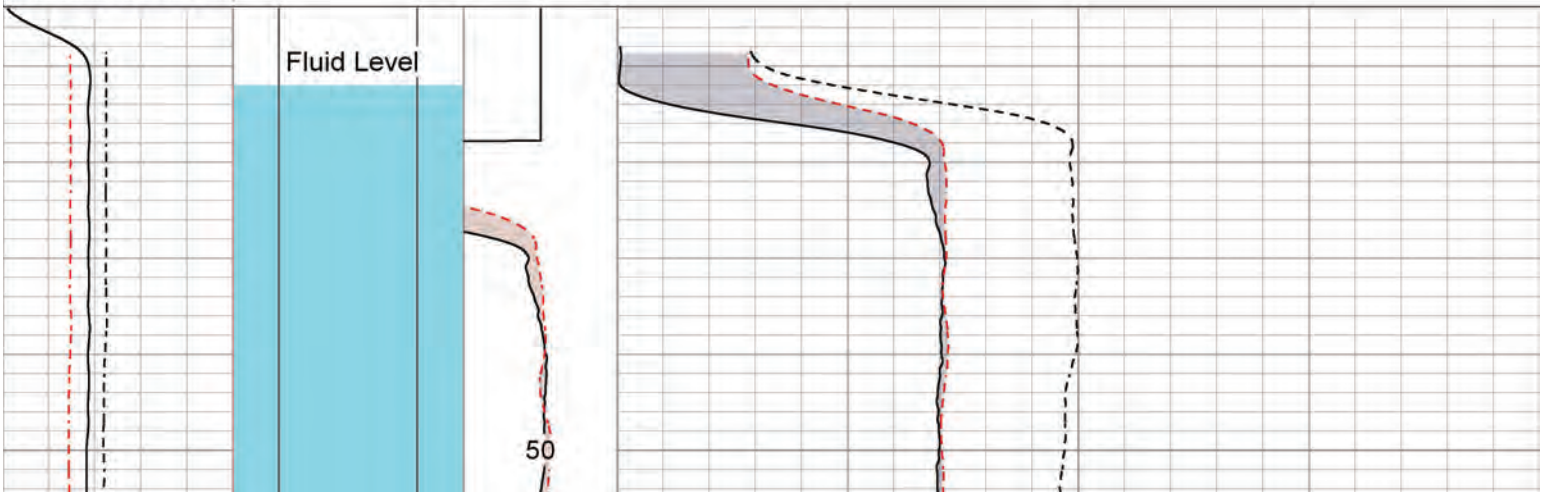
(DOWN) VERTICAL FLOW 31.2 GPM

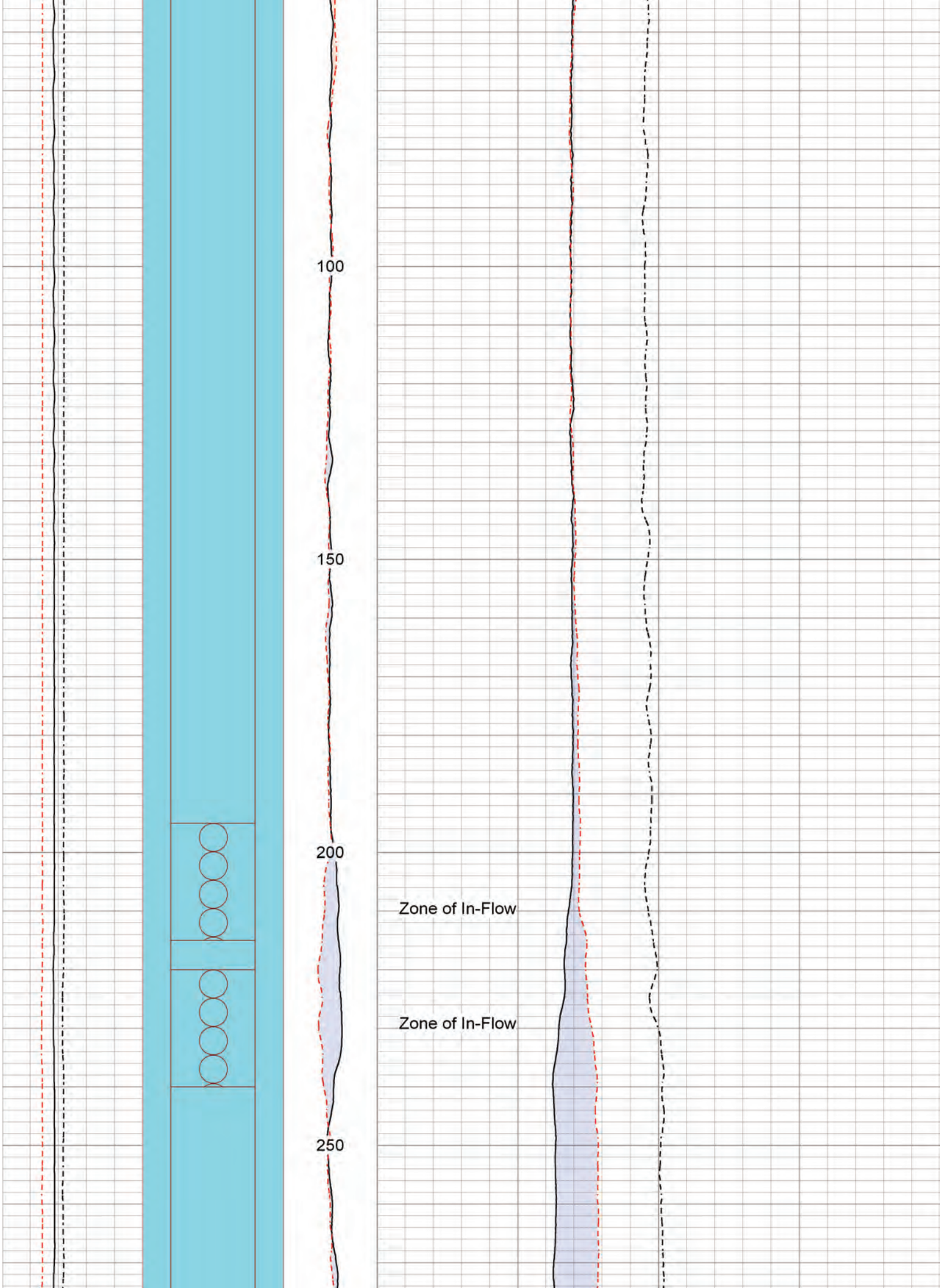
SCREEN DEPTHS	PRODUCTION (GPM)	% OF FLOW (ZONES)	GPM/FT	STD DEV (GPM)	STD ERROR (+/- GPM)
195 to 215	11.0	35%	0.5	1.7	0.2
220 to 240	10.5	34%	0.5	1.6	0.1
300 to 320	9.7	31%	0.5	1.9	0.1
380 to 420	0.0	0%	0.0	1.1	0.1
470 to 520	0.0	0%	0.0	1.6	0.1
560 to 600	-2.2	-7%	-0.1	1.8	0.1
700 to 730	-13.7	-44%	-0.5	2.2	0.3
740 to 760	-15.3	-49%	-0.8	3.2	1.3

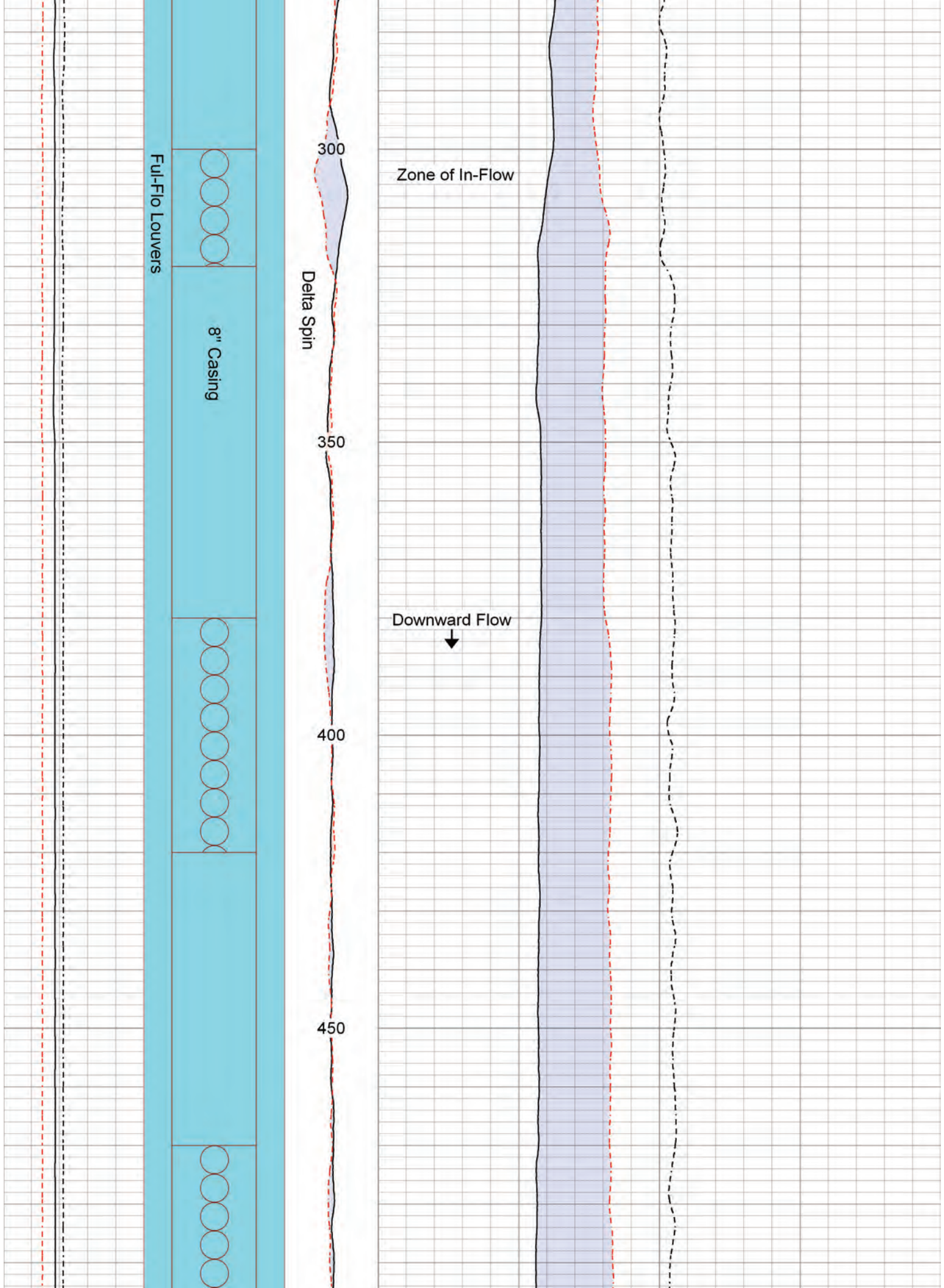


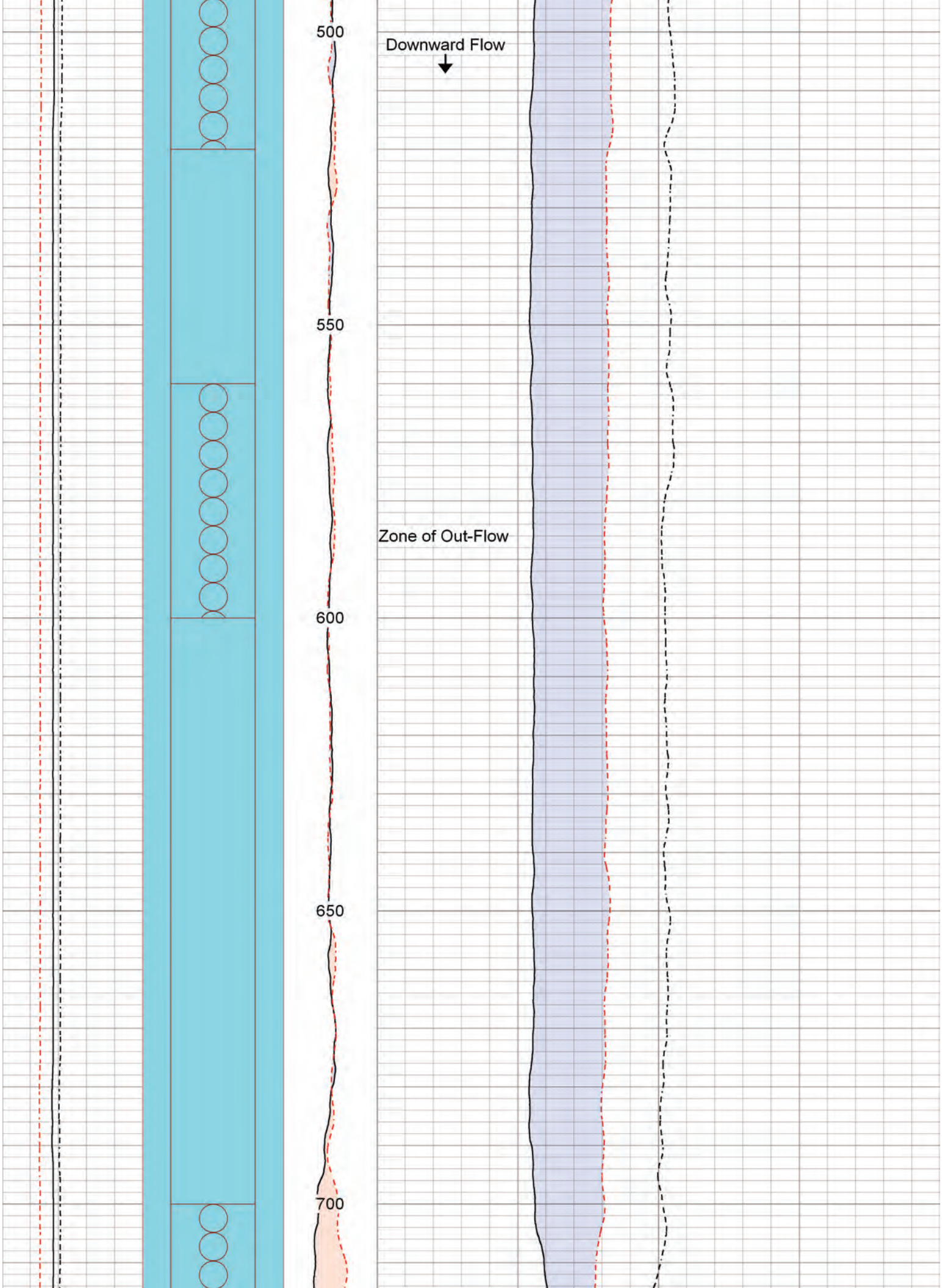
Database File	33378.db
Dataset Pathname	spnD1
Presentation Format	spinmerg
Dataset Creation	Thu Apr 10 10:22:12 2025
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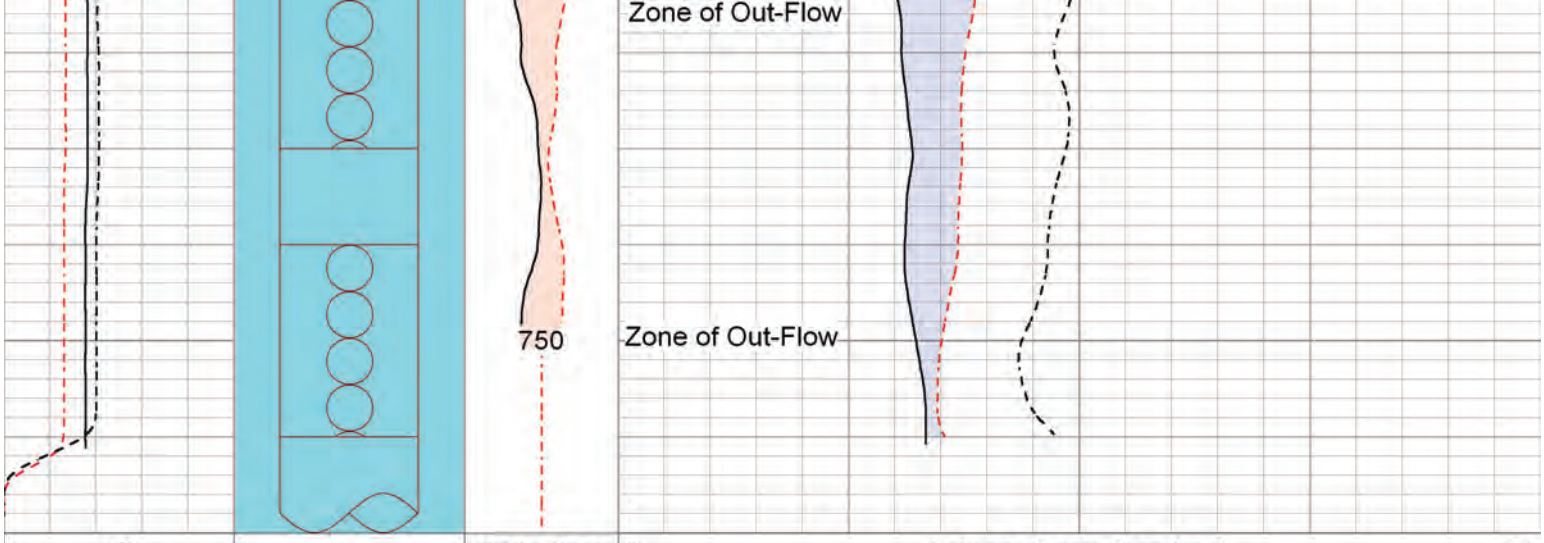
LS				
0	(ft/min) -150	Delta Spin	0	Spinner Down Run (cps) 60
0	LS (ft/min)150	Delta Spin	-8.5	Spinner Up Run (cps) 51.5
0	LS (ft/min)150		-8.5	Spinner Up Run (cps) 51.5




100
150
200
Zone of In-Flow
Zone of In-Flow
250


Ful-Flo Louvers
8" Casing
Delta Spin
300
350
400
450
Zone of In-Flow
Downward Flow


500
Downward Flow
550
Zone of Out-Flow
600
650
700



LS				
0	(ft/min)	-150		
0	LS (ft/min)	150		
0	LS (ft/min)	150		

Delta Spin	0	Spinner Down Run (cps)	60
Delta Spin	-8.5	Spinner Up Run (cps)	51.5
	-8.5	Spinner Up Run (cps)	51.5

APPENDIX A

Testing, Sampling, and Analysis Plan

JANUARY 2025

TESTING, SAMPLING, AND ANALYSIS PLAN

PREPARED FOR

ZONE 7 WATER AGENCY AND
CITY OF PLEASANTON

PREPARED BY



Luhdorff & Scalmanini
Consulting Engineers

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ATTACHMENTS

Attachment 1 Zonal Analyte Table

Attachment 2 Title 22 Analyte Table

Appendix A Field Forms

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
°C	degree Celsius
°F	degree Fahrenheit
CCR	California Code of Regulations
City	City of Pleasanton
Cm	Centimeter
COC	Chain of custody
DO	dissolved oxygen
EPA	Environmental Protection Agency
Kg	Kilogram
Lbs	Pounds
ml	milliliter
Mpa	Megapascal
OD	Outside Diameter
ORP	oxygen reduction potential
Plan	Testing, Sampling, and Analysis Plan
PSI	Pounds per Square Inch
QA	quality assurance
QC	quality control
Scope	Regional Groundwater Facilities Project Feasibility Study
SP	specific conductance
spinner	spinner flowmeter
SVOC	semi volatile organic compound
T	temperature
T	Time
Zone 7	Zone 7 Water Agency
µm	micrometer

1. INTRODUCTION AND PURPOSE

This Testing, Sampling, and Analysis Plan (plan) was prepared to satisfy Task 2 of the scope of work described in the Regional Groundwater Facilities Project Feasibility Study (Scope) for the Zone 7 Water Agency (Zone 7) and the City of Pleasanton (City), dated September 17, 2024. This Plan details the procedures, methods, timelines, analytes, test methods, sample control, chain of custody forms and documentation, and turnaround times for the sampling that will be completed on the newly constructed test wells that will be constructed under Task 1 of the Scope. Each well will be pump tested to assess well performance, subject to spinner analysis to characterize zonal flow within the well, and collection of zonal and composite water samples for analysis.

Groundwater sampling activities will include Title 22 drinking water analysis as described in the California Code of Regulations (CCRs). Constituents, laboratory analytical methods, and practical quantitation limits are summarized in **Attachments 1 and 2**.

The purpose of this Plan is to provide guidance to qualified professional personnel engaging in the collection of well performance data and analysis of groundwater quality data. Use of this Plan intends to promote the collection of high-quality data, thereby supporting data usability. Testing and sampling procedures and protocols outlined herein are in accordance with pertinent current Environmental Protection Agency (EPA) Standard Methods, California Code of Regulations Title 22, and current industry standards and practices.

2. WELL AND AQUIFER TESTING

After final development and when the well meets the specified performance requirements, tests will be performed. The first test will be an 8-hour step pumping test to determine the target design capacity of the well. The second test will be an 8-hour constant rate pumping test at the final design capacity as determined by the Engineer based upon evaluation of well performance during the step test. The test capacities will be determined by the Engineer before or during the testing based upon the results of development and test pumping. Well and aquifer testing shall not exceed 20 hours without written direction from the Engineer/Owner.

2.1. Well and Aquifer Testing Procedures

A. Static Water Level
    a. At the start of each day of pumping, the Contractor shall record the static water level in the well (see Section 5.1). At all other times, the static water level shall be considered to be attained when three successive water level measurements spaced ten minutes apart show no appreciable change.

B. Flow Metering
    a. During each test or step, the discharge of the pump shall be measured with an accurate, calibrated totalizing and instantaneous flow meter, or other type as approved by the Engineer. The pump discharge rate shall be maintained at all times during the test within

plus or minus 5 percent of the pump test rate by means of an approved gate valve in concert with engine speed.

b. Throughout the test, the Contractor shall frequently record flow rate and totalizer readings to ensure that the pumping rate remains constant.

C. Measurements

a. The Contractor shall measure the depth to water to the nearest 0.01 feet, flow rate, and sand content at the time intervals specified herein.

b. Each well test shall be monitored by the Contractor with data recorded according to the following applicable time schedules:

i. Turn the pump on to the approved test pumping capacity at time (t) = 0.

ii. The contractor shall measure and record the depth to water as follows:

1. each minute, from t = 1 to t = 10.
2. each 2 minutes, from t = 10 to t = 20.
3. each 5 minutes from t = 20 to t = 50.
4. each 10 minutes from t = 50 to t = 100.
5. at t = 120, t = 150, t = 180, t = 240, and t = 300.
6. each 100 minutes after t = 300.

c. Each recovery test shall be recorded according to the following applicable schedule:

i. The contractor shall measure the depth to water and record as follows (t' refers to time since pump shut off):

1. each minute, t' = 1 to t' = 10
2. each 2 minutes, t' = 10 to t' = 20
3. each 5 minutes, t' = 20 to t' = 50
4. each 10 minutes, t' = 50 to t' = 100
5. at t' = 120, t' = 150, t' = 180, t' = 240, t' = 300

D. Pump Failure

a. In the case of failure or interruption of the pump operation for a period greater than one (1) percent of the elapsed pumping time from t = 0, the test shall be suspended until the static water level has been attained. Should the test be aborted as a result of a deficiency on the part of the Contractor's equipment or personnel, all time consumed in waiting for complete water level recovery and in resuming the pump test to the point where it was aborted shall be at no cost to the Owner.

E. Completion

a. After the well testing has been completed, the record of water level measurements shall be delivered to the Engineer on the forms provided as part of these documents. The test pump shall not be removed from the well until the Engineer has evaluated the data and authorized its removal.

3. SPINNER/FLOWMETER, AND DISCRETE DEPTH SAMPLING STANDARD OPERATING PROCEDURE, PACIFIC SURVEYS

3.1. Applicability

The main application of Spinner/Flowmeter logging is subsurface characterization of the vertical fluid movement within the well-bore. The impeller or spinner flowmeter (spinner) uses an impeller that revolves in response to fluid flow. As fluid moves through the impeller blades, they rotate at a known speed based on the pitch of the impeller blades. The number of impeller revolutions per second is automatically recorded and used to calculate the velocity of the fluid. Spinner measurements can be made while ascending or descending in the opposite direction of the fluid movement to generate a continuous flow profile. Additionally, spinner stop count measurements can be recorded at a particular depth while the tool is held stationary to measure flow at a specific location in the well-bore. Once the flow profile of the well-bore has been identified, depth-specific samples can be collected at the identified flow zones.

3.2. Scope

The geophysical logging contractor's responsibility is to provide a qualified logging Engineer (a qualified person familiar with logging equipment, operations & procedures) and the following:

- Properly calibrated logging tools.
- Sufficient backup tools to ensure that all requested services will be successfully performed.
- Ensure that all measurements have a common depth basis (i.e., depth-matched data).
- Borehole corrected data.
- Paper copy field prints of all logs at the proper depth and horizontal scales.
- Paper and reproducible copy final prints of all logs at the proper depth and horizontal scales.
- Log ASCII standard containing all digitally measured and processed log data.
- Log PDF files of all logs at the proper depth and horizontal scales.

3.3. Data Collection

Measurements are made as the tool is ascended or descended in the well-bore at a constant rate on a multi-conductor or coaxial armored cable (or wireline) using a power supply at the surface. Measurement depth is controlled by passing the cable over a calibrated sheave wheel. Downhole data is transmitted via the cable to a data acquisition system (i.e., processing system) and transmitted to a computer at the surface where the data is stored and processed. Geophysical logs are paper copy records of borehole measurements plotted with amplitude on the horizontal axis and depth on the vertical axis. Other information presented in the geophysical logs include:

A. Borehole identification number
B. Client name
C. Borehole location (city, county, state GPS coordinates if available)
D. Date

E. Casing/borehole size
F. Surface elevation (if available)
G. Services requested (logs run)
H. Perforated intervals
I. Pump depth
J. Pump rate
K. Drill depth or completed depth
L. Logging depth

3.4. Logging Order

The spinner/flowmeter is normally run prior to the depth-specific sampling program. The spinner log will help determine where the samples will be collected based on the well-bore flow profile.

3.5. Calibration

The spinner log will be run at multiple tool velocities to develop a slope and ensure repeatability of the fluid velocities within the well-bore.

Basically, there are three types of tool calibration standards:

1. Primary calibration standards involve permanent test pits, which are primarily used to calibrate logging tool prototypes and shop standards.
2. Secondary or shop calibration standards are transportable calibration standards that are referenced to the primary standards. Shop standards are often too bulky to be easily transported to field sites. Logging sondes should be checked against these standards on a monthly basis.
3. Tertiary or field standards are compact enough that they can easily be taken to the field to verify that the sondes calibration has not drifted from the shop calibration at each logging job.

3.6. Standard Procedure for Logging Operation

Pacific Surveys logging equipment is fixed and mounted within a vehicle. It consists of a winch that spools the wireline, a data processing system that powers up and processes the data, and a computer that collects and plots the data.

3.6.1. Pacific Surveys Logging Procedures consist of the following steps:

1. Parking and securing the logging vehicle at the well/borehole.
2. Rigging up, consisting of hanging a sheave wheel or using a boom to support the wireline during logging operations.
3. Rigging up the sondes and centering them within the well/borehole.
4. Powering up the sonde and checking the acquisition system's outputs for correct voltage, tool current and applicable tool measurements.
5. Zeroing the tool to the log datum (i.e., ground surface, top of casing).

6. Lowering the sonde into the well/borehole to the desired depth.
7. Initiating the recording process once at the desired depth (i.e., record up or Down).
8. Retrieving the sonde from the well/borehole and decontaminating.
9. Rigging down of sheave wheel and spooling wire-line into the vehicle.

3.7. Theory of Operation

Pacific surveys offers many different sondes which can characterize various different geologic, hydrologic and physical properties of the well/wellbore.

3.7.1. Spinner (Flowmeter)

Spinner/Flowmeter measures vertical fluid velocity in a pumping or non-pumping well. A sensor counts the revolutions of a mechanical impeller as the tool descends or ascends in the well. A production profile of the pumping well can be determined over the entire perforated interval. With a continuous record, Q values from any interval can be measured without interpolation. Hydraulic conductivity can be derived, aiding in well design and ascertaining production problems. Combined with a depth-specific fluid sampling system, the spinner can be used to determine the concentration of specific constituents when chemical analysis is available. In non-pumping wells, the spinner can locate confining zones and calculate fluid velocity between zones.

Spinner diameters are either 1-inch or 1-11/16-inch. Depending on the configuration, the length can range from 24 inches to 5 feet. The 1-inch spinner is primarily used in small tubing or when tight clearances, such as pump bowls, need to be passed.

A. Spinner/Flowmeter

SPECIFICATIONS AT A GLANCE

Diameter: 1.6875-inches

Length: 24-inch

Weight: 8 Lbs (3.6 Kg)

Temperature Rating: 350° F (176.7° C) Make Up Length (as shown): 24-inch (60.96 centimeter [Cm]) Pulses: 12 per revolution

Pressure: 15,000 Pounds per square inch (PSI) (103 Mpa)

3.7.2. Depth-Specific Fluid Sampling

Retrieve down-hole sealed fluid samples under pumping or non-pumping conditions from any depth in well. Procedure for collecting and decontaminating sampler complies with EPA guidelines.

Procedure: The sample chamber is evacuated using a vacuum pump, sealed and sent down-hole to a specific depth. The upper intake valve is opened electronically from the surface and the fluid sample is taken. The upper intake valve is closed before returning to the surface. Once at the surface the sampler is removed from the wire line and the sample is dispensed to collection bottles (see section 5). The in-situ

sample is under pressure and temperature similar to where it was collected, ensuring integrity. All sampler chambers and parts are constructed of stainless steel. Samplers are fully decontaminated between each trip into the well, further ensuring sample integrity.

- 2-1/8-inch OD sampler capable of collecting up to 6 liters per trip in well
- 1.70-inch OD sampler capable of collecting 2 liters per trip in well
- 1 3/8-inch OD sampler capable of collecting 1 liter per trip in well

The 1-3/8-inch sampler is often used with the 1-inch spinner to pass by tight restrictions, such as pump bowls, column pipe that is adjacent to camera entry ports, and thru-chlorine tubing that runs below the pump intake.

Samplers complement spinner surveys where Mass Balance calculation of analyzed constituents can be used to determine the concentration at depth. We can also provide onsite analysis of particular constituents.

A. 2.135-inch Dia. 2 Liter Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 2.135-inch

Length: 82-inch

Housing: Stainless Steel Weight: 32 Lbs

Temperature Rating: 250 °F Pressure Rating: 5000 PSI

B. 1.75-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.75-inch

Length: 48.75-inch Housing: Stainless Steel Weight: 22 Lbs.

Temperature Rating: 250 °F

Pressure Rating: 5000 PSI

C. 1.38-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.38-inch

Length: 64-inch

Housing: Stainless Steel Weight: Lbs

Temperature Rating: 250 °F

Pressure Rating: 5,000 PSI

4. EQUIPMENT, CALIBRATION, AND DECONTAMINATION

4.1. Equipment

Field personnel shall be adequately equipped to perform field activities described herein. The following list is not a comprehensive list of all instrumentation, equipment, gear, and consumables that may be needed to complete the field activities. The list merely states key items that are specific to this project

1. Electrical sounder with 0.01-foot graduation to support direct readings with a resolution of 0.01 foot.
2. Multi-parameter water quality meter or individual sensors for measurement of specific conductance (SP), temperature, (T), pH, oxygen reduction potential (ORP), and dissolved oxygen (DO).
3. Turbidity meter
4. Consumables such as powder-free nitrile gloves and single-use in-line filters (0.45 µm).
5. Decontamination supplies including Alconox® (or other phosphate-free detergent) and deionized water.

All instrumentation is to have manufacturers' specifications for accuracy and precision reflective of standards commonly used in environmental groundwater monitoring applications comparable to the Zone 7 sites. Instrumentation is to be kept clean and to be stored and handled appropriately.

4.2. Calibration

Shop and field calibration of instrumentation shall be conducted following the manufacturer's instructions and guidelines using appropriate standard solutions (primary and secondary, as appropriate) and procedures and at manufacturer-recommended intervals. Documentation of calibration activities shall recorded on specified forms (Section 6). The electrical sounder and thermometer are factory-calibrated and do not require calibration by the user. The ORP sensor shall be cleaned and conditioned according to the manufacturer's instructions.

4.3. Decontamination

Prior to the first use at the Zone 7 sites, the portion of the electrical sounder that will be entering the wells shall be washed with an Alconox® (or a comparable phosphate-free detergent) solution and thoroughly rinsed with deionized water. The portion of the electrical sounder that enters the well is not to contact the ground or otherwise be subjected to potential contamination. Between wells, the portion of the electrical sounder that entered the well is to be thoroughly rinsed with deionized water.

The portions of water quality meters and individual sensors that come into contact with purged water shall be thoroughly rinsed with deionized water between wells.

5. PROCEDURES AND SAMPLE COLLECTION

Upon arrival at each test well site, the well identification shall be checked against project information (e.g., location map, description, or photographs). The well structure shall inspected for evidence of damage, tampering, and vandalism.

5.1. Depth-to-Water Measurements

1. A static depth-to-water reading shall be obtained prior to turning on the well pump.
2. An electric water level sounder shall be used in accordance with the manufacturer's instructions to obtain a depth-to-water measurement from a specified reference point (i.e., top of sounding tube, top of well casing, etc.). The sounder shall have a 0.01-foot graduation to support direct readings with a resolution of 0.01 feet. The reading shall be taken in duplicate or more to ensure that an accurate measurement is obtained and recorded.
3. The static water level, in conjunction with well construction information, well used to calculate the volume of water in the test well. This information will used to determine the minimum volume of water to be purged prior to sample collection (i.e., a minimum of three wet casing volumes).

5.2. Purging Protocol

1. Wells are to be purged and sampled using the dedicated sampling port on the temporary well pump.
2. Wells are to be purged of a minimum of three wet casing values and,
3. Wells are purged until indicator parameters stabilize. Stabilization is defined as consecutive readings at approximately 5-minute intervals, where parameters do not vary more than 5 percent between readings.
4. The following indicator parameters are monitored during the well purging:
    b. temperature (°C)
    c. pH (standard pH-units)
    d. electrical conductivity (µS/cm)
    e. dissolved oxygen (percent saturation or mg/L)
    f. oxygen reduction potential (mV)
    g. turbidity (NTU)
    2. Visual (color, occurrence of solids), olfactory (odor) and other observations (e.g., wellhead conditions, well access, ground conditions, weather) are noted as appropriate.
    3. Purge water shall be disposed of according to project specifications.

5.3. Sample Collection

1. Upon completion of purging activities, sample containers shall be filled such that the designated sample tap or container does not come into contact with the sample container.
2. The sampler shall not touch the inside of the lip or the inside of the sample container.
2. The cap of the sample container shall never be laid down and shall be held facing down to minimize particles settling inside the cap.
3. The sample container shall remain closed until the sample is ready to be retrieved.
4. The sample container shall not be allowed to overflow.
5. The sample shall not come into contact with any other surface prior to entering the sample container.
6. The cap is closed without delay to minimize exposure to potential contaminants.

7. Filled sample containers shall be immediately placed on ice in an ice chest and kept at a temperature not exceeding 6°C until received by the laboratory.
8. Samples shall be shipped to the laboratory within the specified sample hold time.
9. Sample containers shall be marked with laboratory-supplied labels and recorded on associated chain-of-custody documentation.
10. Order of Sample Collection: Sample containers shall be filled based on decreasing volatility of the constituents to be quantified (e.g., Semi-volatile organic compounds [SVOCs], metals, and general minerals).

6. LOGISTICS AND DOCUMENTATION

1. The calibration of instrumentation shall be documented by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Calibration Record Sheet is provided in **Attachment 3**.
2. Depth-to-water readings shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Field Data Sheet is provided in **Attachment 3.**
3. During purging, activities shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Purge Record Sheet is provided in **Attachment 3**.
4. The analytical laboratory shall be provided with chain of custody (COC) forms, sample containers, container labels, duplicates, and blanks.
5. The COC forms shall specify each test well, identify associated containers, preservatives, and other pertinent information.
6. The COC shall be filled out completely at the time that the samples are collected. All samples are to be accompanied at all times by the COC. Field personnel are responsible for the care and custody of the samples until they are relinquished. The individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time on the COC. The individual receiving the samples shall verify that the information on the labels matches the information on the COC and that all samples are accounted for.
7. Samples shall only be collected in containers provided by the analytical laboratory. Field personnel shall completely fill out and affix the appropriate labels on individual sample containers. Each container shall be uniquely identified and cross-referenced on the COC by field personnel.

7. METHODS AND TIMELINES

7.1. Methods

Depth specific water samples from individual screen intervals will be analyzed for selected analytes summarized in **Attachment 1**, which also includes units, laboratory analytical methods, and method detection and reporting limits.

Composite water samples from the well discharge assembly will be analyzed for Title 22 Drinking Water Analysis. Title 22 constituents, units, laboratory analytical methods, and method detection and reporting limits are summarized in **Attachment 2**.

7.2. Timeline

After completion of purging activities, grab groundwater quality samples are collected in laboratory-supplied bottles with or without preservatives (depending on analyses to be conducted). Bottles are labeled with laboratory-supplied labels, immediately placed on ice, and kept in an ice chest (at 6 °C) until delivered to the laboratory.

Samples shall be delivered with the proper chain-of-custody documentation within the required holding time. A chain-of-custody (COC) form shall be used to record sample identification numbers, type of samples (matrix), date and time of collection, and analytical tests requested. In addition, times, dates, and individuals who had possession of the samples are documented to record sample custody.

Unless otherwise specified, the standard laboratory turn-around time will be requested. The standard laboratory turn-around time is approximately 15 business days.

8. QUALITY ASSURANCE PROCEDURES

Quality assurance (QA) is an overall management plan used to guarantee the integrity of data collected. This includes the above guidelines for groundwater level measurements, purging protocol, and sampling handling and recording. Quality control (QC) is a component of QA that includes analytical measurements used to evaluate the quality of the data. This includes blanks and spiked samples.

The source of contamination introduced in the field or laboratory can be deduced by comparing blank results. An equipment blank could potentially be contaminated in the field, during transport to the laboratory, or in the laboratory. A method blank could only be contaminated in the laboratory. A field duplicate sample provides a measure of natural variability

8.1. Field Quality Control

8.1.1. Equipment Blank

The equipment blank only applies when decontaminated equipment is used.

Purpose: Assess the adequacy of the decontamination process. Assess contamination from the total sampling, sample preparation, and measurement process when decontaminated sampling equipment is used to collect samples.

Procedure: A sample of analyte-free water is poured through decontaminated field sampling equipment prior to the collection of test well samples.

Frequency: 1 blank per 20 samples.

8.1.2. Field Blank

Purpose: Assess contamination from field conditions during sampling. Assess contamination from the total sampling, sample preparation, and measurement process, minus the decontamination process.

Procedure: A sample of analyte-free water is poured into the container in the field, preserved and shipped to the laboratory with the test well samples.

Frequency: 1 blank per 20 samples.

8.1.3. Field Duplicate

Purpose: Assess the precision (i.e., repeatability) of sampling results as influenced by the natural variability of concentrations during sampling.

Procedure: A duplicate sample is retrieved immediately following retrieval of the test well sample.

Frequency: 1 duplicate per 20 samples.

8.2. Laboratory Quality Control

8.2.1. Method Blank

Purpose: Assess contamination introduced during sample preparation activities in the laboratory.

Procedure: The laboratory is currently certified by ELAP to conduct the requested analyses. A blank is prepared to represent the matrix as closely as possible. The method blank is prepared/extracted/digested and analyzed exactly like the test well samples.

Frequency: 1 blank per batch.

8.2.2. Other Quality Control Measures

The laboratory is to employ laboratory blanks, fortified blanks, and duplicate analyses and document percent recovery and relative percent differences to assess laboratory contamination sources, accuracy, and precision.

8.2.3. Laboratory Analytical Methods

Analysis shall be performed using the appropriate USEPA methods as defined in **Attachments 1 and 2**, equal or superior methods. All instruments and equipment shall be properly calibrated and maintained for accuracy.

8.3. Laboratory Reports

Laboratory reports shall identify the analyst, analytical methods, reporting limits, method detection limits, results of test well samples and associated blanks and duplicate samples, units, dilution factors, applicable qualifiers, and flags, date of analysis, and all applicable QA/QC information. The laboratory supervisor shall supervise all analytical work performed in the laboratory and sign the laboratory reports.

APPENDIX A

Post Airlift Water Quality Summary

Zone 7 Water Agency
Tennis Park Test Well
Water Quality Summary - Post Airlift

ANALYTE	UNITS	REPORTING LIMIT	METHOD	3/11/2025
INORGANICS				
Antimony	µg/L	2.0	200.8	ND
Arsenic	µg/L	2.0	200.8	ND
Barium	µg/L	5.0	200.8	ND
Beryllium	µg/L	1.0	200.8	ND
Cadmium	µg/L	1.0	200.8	ND
Chromium (Total)	µg/L	5.0	200.8	ND
Hexavalent Chromium	µg/L	1.0	218.6	ND
Copper	µg/L	3.0	200.8	5.8
Lead	µg/L	5.0	200.8	ND
Manganese	µg/L	10	245.1	420
Mercury	µg/L	0.4	245.1	ND
Nickel	µg/L	5.0	200.8	ND
Selenium	µg/L	2.0	200.8	ND
Silver	µg/L	5.0	200.8	ND
Thallium	µg/L	1.0	200.8	ND
Vanadium	µg/L	1.0	200.8	ND
Zinc	µg/L	10.0	200.8	16
OTHER ANALYSES				
Turbidity	NTU		SM2130B	94
pH	SU		SM 4500-H B	7.73
Chlorine (Total Residual)	mg/L	0.10	SM 4500-CL-G	ND
Cyanide	mg/L	0.0050	SM 4500-CN-E	ND
Sulfate	mg/L	0.50	300.0	61
Purgeable Organic Compounds (VOC's)	µg/L	5.0	624.1	ND
Chloroform	µg/L	5.0	624.1	1
SVOC's	µg/L	*	625.1	ND
TPH as Gasoline	µg/L	50	8015B	ND
TPH as Diesel	mg/L	0.11	8015B	0.2
TPH (C13-C28)	mg/L	0.1	8015B	0.17
TPH (C29-C44)	mg/L	0.33	8015B	ND
PFAS	ng/L	2.00	537.1	ND

ND = Non-Detect

Luhdorff & Scalmanini
Consulting Engineers

APPENDIX B

Summary of Title 22 Sampling

Zone 7
Tennis Park Test Well
Water Quality Summary Table

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	Title 22 4/8/2025
CATIONS					
Calcium	mg/L	0.100	200.7		85
Magnesium	mg/L	0.050	200.7		54
Potassium	mg/L	1.00	200.7		1.9
Sodium	mg/L	0.50	200.7		43
Hardness as $CaCO_3$	mg/L	0.50	Calculation		440
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	75
Fluoride	mg/L	0.050	300.0	2[1]	0.084
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	12
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.87
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	2.9
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	56
Total Alkalinity	mg/L	4.1	SM 2320B		330
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	7.84[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Elelctrical Conductivity @ 25˚C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	864
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	820[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	0.19
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.027 J
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00012 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0011 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0012 J
Barium	mg/L	0.010	200.7	1[1]	0.25
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.34
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0064 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0051 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	4.8[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0025 J
Iron	mg/L	0.050	200.7	0.3[2]	0.066 J
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	ND
Manganese	mg/L	0.010	200.7	0.050[2]	0.032
Manganese (Dissolved)	mg/L	0.010	200.7		0.032
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0028
Silicon as Si	mg/L	0.10	200.7		11
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0031 J
Zinc	mg/L	0.050	200.7	5[2]	0.015 J
OTHER ANALYSES					
Benzo-a-pyrene	µg/L	0.10	525.2	0.2[1]	ND
1,2-Dibromo-3-Chloropropane DBCP	µg/L	0.010	504.1	0.2[1]	ND
Di(2-ethylhexyl)adipate	µg/L	3.0	525.2	400[1]	ND
Di(2-ethylhexyl)phthalate	µg/L	3.6	525.2	4[1]	ND
Nitrogen/Phosphorus Pesticides	µg/L	*	525.2		ND
Total Trihalomethanes (TTHM)	µg/L	2.0	524.2	80[1]	ND
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

* - Various reporting and detection limits
1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
6 - EPA Method 533 analysis includes 25 Perflourinated Alkyl Acids
ND = Non-Detect
J = Estimated value above the method detection limit and below reporting limit

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APPENDIX B

Summary of Discrete Zone Sampling

Zone 7
Tennis Park Test Well
Water Quality Summary Table - 217 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	217' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		81
Magnesium	mg/L	0.050	200.7		52
Potassium	mg/L	1.00	200.7		1.9
Sodium	mg/L	0.50	200.7		44
Hardness as $CaCO_3$	mg/L	0.50	Calculation		410
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	75
Fluoride	mg/L	0.050	300.0	2[1]	0.098
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	11
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.68
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	2.9
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	55
Total Alkalinity	mg/L	4.1	SM 2320B		320
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	8.12[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.25
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	923
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	570[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	0.17[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.038 J
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00013 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0015 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0015 J
Barium	mg/L	0.010	200.7	1[1]	0.26
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.35
Cadmium	mg/L	0.001	200.8	0.005[1]	0.00037 J
Chromium	mg/L	.010	200.7	0.050[1]	0.0081 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0057 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	4.8[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0029 J
Iron	mg/L	0.050	200.7	0.3[2]	0.097
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00031 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.041
Manganese (Dissolved)	mg/L	0.010	200.7		0.038
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0045 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0024
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0035 J
Zinc	mg/L	0.050	200.7	5[2]	0.025 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	2.00	533		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
ND = Non-Detect

Luhdorff & Scalmanini
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Zone 7
Tennis Park Test Well
Water Quality Summary Table - 290 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	290' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		70
Magnesium	mg/L	0.050	200.7		45
Potassium	mg/L	1.00	200.7		1.7
Sodium	mg/L	0.50	200.7		39
Hardness as $CaCO_3$	mg/L	0.50	Calculation		360
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	73
Fluoride	mg/L	0.050	300.0	2[1]	0.096
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	10
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.57
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	2.7
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	53
Total Alkalinity	mg/L	4.1	SM 2320B		320
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	7.73[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.025 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	920
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	770[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	1.1[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	ND
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00014 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0013 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0013 J
Barium	mg/L	0.010	200.7	1[1]	0.24
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.31
Cadmium	mg/L	0.001	200.8	0.005[1]	0.00014 J
Chromium	mg/L	0.010	200.7	0.050[1]	0.0045 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0055 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	4.5[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0012 J
Iron	mg/L	0.050	200.7	0.3[2]	0.040 J
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	ND
Manganese	mg/L	0.010	200.7	0.050[2]	0.036
Manganese (Dissolved)	mg/L	0.010	200.7		0.041
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0024 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0020
Silicon as Si	mg/L	0.10	200.7		9.5
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0030 J
Zinc	mg/L	0.050	200.7	5[2]	0.010 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.91	533		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
ND = Non-Detect

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Zone 7
Tennis Park Test Well
Water Quality Summary Table - 370 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	370' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		71
Magnesium	mg/L	0.050	200.7		45
Potassium	mg/L	1.00	200.7		1.8
Sodium	mg/L	0.50	200.7		45
Hardness as $CaCO_3$	mg/L	0.50	Calculation		360
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	71
Fluoride	mg/L	0.050	300.0	2[1]	0.091
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	8.9
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.61
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	2.4
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	49
Total Alkalinity	mg/L	4.1	SM 2320B		300
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	7.86[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.033 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	864
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	510[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	0.18[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	ND
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00015 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0017 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0017 J
Barium	mg/L	0.010	200.7	1[1]	0.28
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.36
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0052 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0053 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	4.3[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0012 J
Iron	mg/L	0.050	200.7	0.3[2]	0.055
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00011 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.057
Manganese (Dissolved)	mg/L	0.010	200.7		0.056
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0026 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0019 J
Silicon as Si	mg/L	0.10	200.7		10
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0029 J
Zinc	mg/L	0.050	200.7	5[2]	ND
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.96	533		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
ND = Non-Detect

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Zone 7
Tennis Park Test Well
Water Quality Summary Table - 450 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	450' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		55
Magnesium	mg/L	0.050	200.7		33
Potassium	mg/L	1.00	200.7		1.6
Sodium	mg/L	0.50	200.7		42
Hardness as $CaCO_3$	mg/L	0.50	Calculation		270
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	63
Fluoride	mg/L	0.050	300.0	2[1]	0.091
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	6.1
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.51
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	1.8
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	45
Total Alkalinity	mg/L	4.1	SM 2320B		270
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	7.91[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	790
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	480[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	2.0
Turbidity	NTU	0.10	180.1	5[2]	0.75[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.040 J
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00022 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0019 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0019 J
Barium	mg/L	0.010	200.7	1[1]	0.24
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.34
Cadmium	mg/L	0.001	200.8	0.005[1]	0.00012 J
Chromium	mg/L	0.010	200.7	0.050[1]	0.0066 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0048 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	3.6[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0015 J
Iron	mg/L	0.050	200.7	0.3[2]	0.14
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00017 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.065
Manganese (Dissolved)	mg/L	0.010	200.7		0.074
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0042 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0011 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.027 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	2.01	533		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
ND = Non-Detect

Luhdorff & Scalmanini
Consulting Engineers

Zone 7
Tennis Park Test Well
Water Quality Summary Table - 550 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	550' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		67
Magnesium	mg/L	0.050	200.7		42
Potassium	mg/L	1.00	200.7		1.7
Sodium	mg/L	0.50	200.7		71
Hardness as $CaCO_3$	mg/L	0.50	Calculation		340
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	91
Fluoride	mg/L	0.050	300.0	2[1]	0.072
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.65
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.14
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	50
Total Alkalinity	mg/L	4.1	SM 2320B		330
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	7.90[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	962
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	830[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	1.4[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	ND
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00041 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0035
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0035
Barium	mg/L	0.010	200.7	1[1]	0.41
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.53
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0019 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.052[5] J
Copper	mg/L	0.010	200.7	1.0[2]	0.0014 J
Iron	mg/L	0.050	200.7	0.3[2]	1.3
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00012 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.17
Manganese (Dissolved)	mg/L	0.010	200.7		0.18
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0032 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00094 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0033 J
Zinc	mg/L	0.050	200.7	5[2]	0.014 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	2.07	533		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
ND = Non-Detect

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Zone 7
Tennis Park Test Well
Water Quality Summary Table - 690 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	690' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		78
Magnesium	mg/L	0.050	200.7		52
Potassium	mg/L	1.00	200.7		1.9
Sodium	mg/L	0.50	200.7		53
Hardness as $CaCO_3$	mg/L	0.50	Calculation		410
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	85
Fluoride	mg/L	0.050	300.0	2[1]	0.095
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND[5]
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.32[5]
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.12
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	65
Total Alkalinity	mg/L	4.1	SM 2320B		340
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.28[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	939
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	620[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	0.97
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	ND
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00055 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0016 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0016 J
Barium	mg/L	0.010	200.7	1[1]	0.33
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.38
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0021 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.048[5] J
Copper	mg/L	0.010	200.7	1.0[2]	0.0018 J
Iron	mg/L	0.050	200.7	0.3[2]	1.1
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	ND
Manganese	mg/L	0.010	200.7	0.050[2]	0.082
Manganese (Dissolved)	mg/L	0.010	200.7		0.084
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0042 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00097 J
Silicon as Si	mg/L	0.10	200.7		8.9
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0035 J
Zinc	mg/L	0.050	200.7	5[2]	0.018 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.99	533		ND

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Zone 7
Tennis Park Test Well
Water Quality Summary Table - 735 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	735' (4/9/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		80
Magnesium	mg/L	0.050	200.7		53
Potassium	mg/L	1.00	200.7		1.9
Sodium	mg/L	0.50	200.7		51
Hardness as $CaCO_3$	mg/L	0.50	Calculation		420
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	83
Fluoride	mg/L	0.050	300.0	2[1]	0.095
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND[5]
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.40[5]
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.047 J
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	68
Total Alkalinity	mg/L	4.1	SM 2320B		340
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.18[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	936
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	650[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	2.0
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.092
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00057 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0019 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0019 J
Barium	mg/L	0.010	200.7	1[1]	0.29
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.36
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0081 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.042[5] J
Copper	mg/L	0.010	200.7	1.0[2]	0.0020 J
Iron	mg/L	0.050	200.7	0.3[2]	4.3
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00020 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.094
Manganese (Dissolved)	mg/L	0.010	200.7		0.083
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0074 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00071 J
Silicon as Si	mg/L	0.10	200.7		9.5
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0037 J
Zinc	mg/L	0.050	200.7	5[2]	0.024 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.91	533		ND

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APPENDIX C

Well Capacity Estimates TM

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Well Capacity Estimates for Zone 7/Pleasanton Test Well Sites

An 8-inch diameter test well was constructed at Del Prado Park, Tennis Park, and Hansen Park. Each well was developed, had step-drawdown pumping tests conducted, and had constant rate pumping tests conducted for 8 hours. The data derived from the constant rate pumping tests, combined with data regarding the range of expected regional groundwater levels, were reviewed for the development of full-scale production well pumping capacity estimates at each location.

It should be noted that while well capacity estimates described below are based on some very specific input values (e.g., for specific capacity, assumed static groundwater levels), the final production capacity for each well cannot be precisely known until the large-diameter production wells are drilled and tested. This is due in large part to considerable uncertainty in the well efficiency input parameter, which is as much a function of the well efficiency and quality of work done by the drilling subcontractor as it is a function of the engineering oversight and design specifications (e.g., filter pack gradation, screen slot size). Thus, while the well capacity estimates described below may represent a best estimate at this time, they could vary by several hundred gpm more or less than the values described below.

Background and Considerations in Low-End Well Capacity Estimates

The basis for the low-end production rate well capacity analysis is the occurrence of worst-case (critical years with maximum municipal groundwater pumping) groundwater basin conditions. Groundwater elevation contour maps were reviewed for recent critical drought years, including Fall 2015, Fall 2021, and Fall 2022. In addition, total municipal well pumping and City of Pleasanton groundwater pumping were reviewed for these three critical dry years, along with the last ten years overall (**Table 1**). Overall, the lowest groundwater elevations occurred in the Fall of 2021 and Fall 2022, consistent with the highest rates of total municipal groundwater pumping (over the past 10 years), ranging from 21,500 to 23,600 AFY, and relatively high City of Pleasanton groundwater pumping between about 2,600 and 3,800 AFY.

Table 1. Summary of Municipal Well Pumping and Groundwater Elevations at Test Well Sites Over Past Ten Years				
Year	Water Year Type	City of Pleasanton Annual Pumping (AF)	Total Municipal Pumping (AF)	Test Well Spring/Fall GWE (ft msl)
2015	Critical	2,775	8,874	265-270/270
2016	Dry	3,752	9,860	
2017	Wet	4,222	11,369	
2018	Below Normal	3,913	12,657	
2019	Wet	3,785	15,309	
2020	Dry	2,701	17,069	
2021	Critical	3,802	23,597	260-275/250-255
2022	Critical	2,587	21,497	265-270/245-255
2023	Wet	270	9,987	
2024	Above Normal	0	7,104	

A summary of the proposed top of well screen, high and low depths to (static) water, and calculated available drawdown at each test well site are summarized in **Table 2**.

Table 2. Summary of Test Well Sites Critical Year Depth to Water					
Well	Depth to Top of Screen	High DTW (ft bgs)	Low DTW (ft bgs)	Maximum Available Drawdown (ft)	Minimum Available Drawdown (ft)
Tennis	195	16.7	75	178	120
Hansen	298	24.5	75	273.5	223
Del Prado	170	16.7	65	153	105
Notes: DTW = Depth to Water					

Based on the analysis summarized above, the regional groundwater level conditions assumed for the well capacity analysis are based on a time of maximum overall municipal groundwater pumping (since at least 1974) and relatively high City of Pleasanton groundwater pumping (2,600 to 3,800 AFY vs. long-term average of 3,100 AFY). Thus, the well capacity analysis assumes that groundwater pumping at the test well sites is occurring in addition to maximum historical municipal pumping (since at least 1974), which is likely a very conservative assumption for this assessment (i.e., the new test well sites are expected to supplement and be used in conjunction with existing municipal well sites, and not constitute additional pumping at a time of maximum pumping of existing municipal production wells).

Methodology

The well capacity calculation methodology requires input values for specific capacity, available drawdown, and assumed production well efficiency. Specific capacity varies (declines) with time, although the rate of decline decreases dramatically after about 24 hours for most high-capacity wells. Given the planned long-term continuous operation of the new wells, 30-day and 90-day specific capacity values were evaluated

along with the typical 24-hour specific capacity value used in most well yield calculations. Available drawdown relates to regional groundwater elevations and varies seasonally and year to year, depending on how wet or dry the recent and preceding years have been. Well capacities were estimated for relatively high and low available drawdown estimates. Well efficiency can be highly variable and is heavily dependent on well engineering design considerations (e.g., screen slot size, filter pack quality and gradation, well drilling/development specifications) and drilling contractor performance (e.g., driller efficiency, driller adherence to drilling specifications). Each of these three key inputs is described in more detail below.

Data from the constant rate aquifer tests were reviewed to calculate the 24-hour specific capacity by extending the trend of water level declines (on a semi-log time-drawdown plot) from the 8-hour test out for a 24-hour period. The 24-hour specific capacity was calculated by dividing the average pumping rate during the 8-hour constant rate test by the total estimated drawdown over a 24-hour period. In addition, specific capacity values were determined in a similar manner (extending the semi-log plot time-drawdown line from 8 hours to 30 days and 90 days) for 30-day and 90-day continuous pumping scenarios to evaluate the difference in assumptions regarding specific capacity values. The specific capacity values for different time periods are summarized in **Table 3**.

Table 3. Summary of Test Well Specific Capacity Values

Well ID	Pumping Rate (gpm)	24-hr DD (ft)	24-hr Q/s (gpm/ft)	30-Day DD (ft)	30-Day Q/s (gpm/ft)	90-Day DD (ft)	90-Day Q/s (gpm/ft)
Tennis Park	549	9.6	57.2	10.3	53.3	10.6	51.8
Hansen Park	594	19.5	30.5	21.5	27.6	22.5	26.4
Del Prado Park	252	15.6	16.2	16.2	15.3	17.2	14.7

As summarized above Tennis Park specific capacity ranges from 57 to 52 gpm/ft, Hansen Park specific capacity ranges from 30.5 to about 26.5 gpm/ft, and Del Prado Park ranges from 16.2 to 14.7 gpm/ft for 24 hours to 90 days of pumping.

Given the relatively high groundwater elevations at the time of the pumping tests, the measured groundwater level at the start of testing was used as the basis for the high-end well capacity estimate. The difference between the measured groundwater level and the top of the uppermost screen was used as the available drawdown for the well capacity estimate. As described above, historical groundwater elevation contour maps (for critical dry years) and municipal pumping were reviewed to determine an appropriate regional groundwater elevation to use at the test well sites as the basis for low-end well capacity estimates. The water years considered for the low-end estimate were 2021 and 2022. The difference between groundwater elevations in these dry years and the top of the well screen were used as available drawdown for low-end estimates.

Well efficiency relates to the difference between the pumping water level inside a production well casing and the groundwater level in the aquifer formation just outside the well filter pack. In theory, a well would be 100% efficient if these water levels are the same; in practice, this rarely occurs for high-capacity

production wells. The difference between water levels inside a well casing and in the adjacent aquifer formation refers to the well efficiency needed for well capacity estimates. For example, if the water level in the wells declines by 100 feet during pumping but the aquifer groundwater level just outside the well filter pack declines by 50 feet, the well efficiency is considered to be 50%. A reasonable well efficiency target to strive for in most high-capacity production well drilling operations is 70 to 80%. For the purposes of the well capacity estimates (based on 24-hour specific capacity) described below, it was assumed that a production well at the Del Prado Park site could achieve a 75% well efficiency, while the production wells at the Tennis Court and Hansen Park sites were conservatively estimated to have 50% well efficiency. Lower well efficiencies were assumed at the higher specific capacity sites (Tennis and Hansen) primarily because in highly permeable sediments, the flow of water at higher pumping rates has a greater tendency to become turbulent, which increases friction losses and reduces well efficiencies.

Del Prado Park Well Capacity Estimate

The upper end well capacity estimate for the Del Prado Park test well is summarized in **Table 4**. The average pumping rate of 252 gpm combined with a projected 24-hour drawdown of 15.6 feet yields a specific capacity of 16.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 170 feet bgs, yields an available drawdown of 153 feet. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 153 feet yields an interim well capacity calculation of about 2,500 gpm. Applying a well efficiency factor of 75% yields a final upper-end well yield estimate of approximately 1,900 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 17 feet bgs was substituted with a drought year assumed depth to water of 65 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 105 feet compared to 153 feet for the upper end well capacity calculation. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 105 feet yields an interim well capacity calculation of 1,700 gpm. Applying a well efficiency factor of 75% yields a final lower-end well yield estimate of approximately 1,300 gpm (**Table 4**).

Tennis Park Well Capacity Estimate

The upper end well capacity estimate for the Tennis Park test well is summarized in **Table 4**. The average pumping rate of 549 gpm combined with a projected 24-hour drawdown of 9.6 feet yields a specific capacity of 57.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 195 feet bgs, yields an available drawdown of 178 feet. Multiplying the specific capacity of 57.2 gpm/ft times the available drawdown of 178 feet yields an interim well capacity calculation of 10,200 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 5,100 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 17 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 120 feet compared to 178 feet for the upper end well capacity calculation. Multiplying the specific capacity of

57.2 gpm/ft times the available drawdown of 120 feet yields an interim well capacity calculation of 6,900 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Hansen Park Well Capacity Estimate

The upper end well capacity estimate for the Hansen Park test well is summarized in **Table 4**. The average pumping rate of 594 gpm combined with a projected 24-hour drawdown of 19.5 feet yields a specific capacity of 30.5 gpm/ft. The April 2025 static water level of 24.5 feet below ground surface (bgs), combined with depth to top of first screen of 298 feet bgs, yields an available drawdown of 273.5 feet. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 273.5 feet yields an interim well capacity calculation of 8,300 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 4,200 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 24.5 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 223 feet compared to 273.5 feet for the upper end well capacity calculation. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 223 feet yields an interim well capacity calculation of 6,800 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Table 4. Summary of Test Well Pumping Capacity Estimates

Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Tennis Park	195	57.2	178	120	50	5,100	3,400
Hansen Park	298	30.5	273.5	223	50	4,200	3,400
Del Prado Park	170	16.2	153	105	75	1,900	1,300

Comparison to Existing Production Well Capacities

A summary of pumping test data available from DWR WCR for other production wells in the general project area is provided in **Table 5**. The range of specific capacities for these existing wells ranges from 10 to 123 gpm/ft, compared to a range of specific capacities from 16 to 57 gpm/ft for the new test well sites. Thus, the new test well sites are consistent with existing sites in terms of specific capacity.

Table 5. Summary of Existing Production Well Specific Capacities							
Well ID	Pumping Rate (gpm)	Well Diameter/ Slot Size (Inches)	Pumping Duration (hr)	DD (ft)	Q/s (gpm/ft)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)
Hopyard 6	4,550	18/0.075	0.5	61	75	215	490
Hopyard 7	1,200	22/0.085	8	101	12	150	415
Hopyard 9	1,000	18/0.080	24	102	10	NA	NA
Pleasanton 5	2,820	18/ 2 1/2 x 1/8	100	23	123	149	650
Pleasanton 6	3,052	18/ 2 1/2 x 1/8	NA	28	109	165	647
Pleasanton 7	4,000	18/	68	115	35	120	440
Pleasanton 8		20/0.085				200	490
SFPUC A	1,200	18/0.070	12	88	14	196	320
SFPUC B	2,100	18/0.070	10	93	23	189	326

Evaluation of 30-Day and 90-Day Specific Capacities

Due to the potential continuous operation of the new test well sites on a continuous basis for weeks to months and associated slightly lower specific capacity values, an evaluation was conducted in terms of the required difference in assumed well efficiency that is needed to maintain the same pumping capacities. This evaluation provides both the pumping capacity using the longer-term specific capacity combined with the original well efficiency assumptions, along with the estimated new well efficiency required to maintain the original pumping capacity (**Table 6**).

The longer-term specific capacity was estimated based on straight-line projection of drawdown vs. time (on semi-log paper) for constant rate pumping of the test well. It should be noted that unknown boundary conditions (recharge or discharge) may occur at later time and not be reflected in projection of time-drawdown data from an 8-hour test, which may result in higher or lower long-term specific capacities.

Table 6. Evaluation of Long-Term Specific Capacity and Low-End Well Yield Analysis						
Well ID	24-Hr Well Yield (gpm)	24-Hr Well Efficiency Assumption (%)	30-Day Well Yield [1] (gpm)	30-Day Well Efficiency Assumption[2] (%)	90-Day Well Yield [1] (gpm)	90-Day Well Efficiency Assumption[2] (%)
Tennis Park	3,400	50	3,200	54	3,100	55
Hansen Park	3,400	50	3,100	55	2,950	58
Del Prado Park	1,300	75	1,200	80	1,150	83
[1]Well yield estimate at the original assumed well efficiency. [2]Required well efficiency assumption to maintain the original 24-hour baseline pumping capacity.						

As indicated in **Table 6**, use of longer-term specific capacities results in either slightly lower pumping capacities (generally, a reduction of 10% or less) or the need to assume slightly higher well efficiencies (from 50% to as much as 58%, and from 75% to as much as 83%). Overall, the impact of accounting for longer-term specific capacities (in and of itself) does not appear to require adjustments to the original well capacity estimates (because the increased well efficiencies are still reasonably attainable). Additional discussion of the combination of longer-term specific capacities and mutual well interference is provided below.

Mutual Well Interference Considerations

Methodology

Calculations of mutual well interference using the Theis equation requires input values for transmissivity, storativity, time of continuous pumping, and pumping rate. Calculations were made for continuous pumping durations of 30 and 90 days. Assigned pumping rates were 3,400 gpm for Tennis and Hansen Park well sites, and 1,300 gpm for the Del Prado Park well site. Transmissivity and storativity were initially estimated based on calibrated model parameters with subsequent slight adjustments based on reviewed of observation well drawdowns measured for each constant rate pumping test. The final assigned values of transmissivity and storativity associated with pumping from each well are summarized below in **Table 7.**

Table 7. Summary of Assigned Transmissivity and Storativity Values		
Well ID	Transmissivity (gpd/ft)	Storativity
Tennis Park	190,000	0.0008
Hansen Park	200,000	0.0015
Del Prado Park	200,000	0.0015
Note: Distances between wells are as follows – Tennis to Hansen = 1,900 ft.; Tennis to Del Prado = 3,550 ft.; and Hansen to Del Prado = 3,450 ft.		

Scenarios

Four different scenarios of pumping well combinations were evaluated:

- Tennis, Hansen, and Del Prado
- Tennis and Hansen
- Tennis and Del Prado
- Hansen and Del Prado

The mutual well interference drawdown at each of the three new test well sites from pumping at each of the other new test well sites is summarized below in **Table 8**. For each combination of pumping wells, the cumulative or total well interference drawdown from pumping of the other one or two wells is provided in **Table 8**.

Table 8. Summary of Test Well Site Production Well Interference Estimates

Pumping Well	30 Days Continuous Pumping			90 Days Continuous Pumping		
	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)
Tennis	NA	13	11	NA	15	13
Hansen	11	NA	9	13	NA	11
Del Prado	3	3	NA	4	4	NA
Cumulative	14	16	20	17	19	24
Tennis	NA	13	-	NA	15	-
Hansen	11	NA	-	13	NA	-
Cumulative	11	13	-	13	15	-
Tennis	NA	-	11	NA	-	13
Del Prado	3	-	NA	4	-	NA
Cumulative	3	-	11	4	-	13
Hansen	-	NA	9	-	NA	11
Del Prado	-	3	NA	-	4	NA
Cumulative	-	3	9	-	4	11

The cumulative well interference drawdowns ranged from 14 to 20 feet when all three test wells are pumping for 30 days and 17 to 24 feet when all three test wells are pumping for 90 days. The cumulative well interference drawdowns ranged from 3 to 13 feet, with two wells pumping over 30 days and 4 and 15 feet with two wells pumping over 90 days.

Assessment of Test Well Site Production Well Capacity with Consideration of Mutual Well Interference and Longer-Term Specific Capacities

An extreme (and unlikely) scenario is that the mutual well interference drawdown calculations summarized above would be additive to the groundwater elevations observed during the Fall of 2021/2022. It is not anticipated that all the existing wells would be operating at the same time as the new test well sites. Assuming that the groundwater elevations observed in Fall 2021 and Fall 2022 reflect operation of all the existing wells (as is generally indicated by review of historical annual municipal groundwater pumping since 1974), the mutual well interference drawdowns calculated above would not apply to the relatively low groundwater elevations observed in Fall 2021/2022.

However, in the case that Fall 2021 and Fall 2022 groundwater elevations are representative of the future conditions without any new production wells at the test well sites operating, and that three new production wells at the test well sites are operating as additional pumping capacity, the following analysis may warrant consideration. **Table 9** summarizes the assessment of how the original baseline minimum well capacities may be impacted by the mutual well interference with all three test well sites pumping simultaneously for 30 and 90 days continuously. The results are characterized both by reduced well capacities that would result, and also by what the change would have to be in the well efficiency assumptions to obtain the same original well pumping capacity estimates. The results for Tennis Park and Hansen generally indicate a reduction in well capacities by approximately 10 percent or the need to assume well efficiencies on the order of 55 to 60 percent instead of 50 percent. In the case of Del Prado Park, either well capacities are reduced from 1,300 gpm to between 1,000 and 1,050 gpm, or well efficiencies of 93 to 99 percent would need to be assumed.

Table 9 also shows the combination of long-term specific capacity assumptions (for 30 and 90 days) and mutual well interference drawdowns (for three test well sites pumping). This maximum worst-case scenario indicates Tennis Park and Hansen Park have well capacities reduced from 3,400 gpm to between 2,600 and 2,900 gpm, or the need to assume well efficiencies ranging from 59 to 66 percent. For Del Prado Park, well capacities for this worst case drop from 1,300 gpm to between 880 and 975 gpm, or assumed well efficiencies of 100 percent or greater (not possible).

Overall, this maximum worst-case scenario indicates that it is still reasonable to assume the original low-end well capacities at Tennis Park and Hansen Park can be maintained, because achieving well efficiencies up to 66 percent is reasonable. However, well efficiencies of 100 percent or greater are not reasonable to assume for Del Prado Park, and it is likely that a reduced well capacity would occur under these worst-case conditions. However, on additional consideration, it is noted that these low-end well capacity estimates are based on Fall groundwater level conditions, whereas drought-year pumping will occur throughout the year when water levels may be slightly higher. Therefore, even in the worst-case scenario, the decline in well capacity may be limited to the Fall season.

Table 9. Evaluation of Mutual Well Interference Impact and 30/90-Day Specific Capacity on Minimum Production Well Capacity					
Well ID	**Case**	**Pumping Rate[1]**	**Assumed Efficiency[2]**	**Pumping Rate[3]**	**Assumed Efficiency[4]**
Tennis Park	Baseline	3,400	50	-	-
Tennis Park	Including MWI (3 Wells Pumping 30 days)	3,400	-	3,000	57
Tennis Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	2,850	60
Tennis Park	Including MWI and 30-Day Q/s	-	-	2,800	61
Tennis Park	Including MWI and 90-Day Q/s	-	-	2,600	66
Hansen Park	Baseline	3,400	50	-	-
Hansen Park	Including MWI (3 Wells Pumping for 30 days)	3,400	-	3,200	54
Hansen Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	3,100	55
Hansen Park	Including MWI and 30-Day Q/s	-	-	2,900	59
Hansen Park	Including MWI and 90-Day Q/s	-	-	2,700	64
Del Prado Park	Baseline	1,300	75	-	-
Del Prado Park	Including MWI (3 Wells Pumping for 30 days)	1,300	-	1,050	93
Del Prado Park	Including MWI (3 Wells Pumping 90 days)	1,300	-	1,000	99
Del Prado Park	Including MWI and 30-Day Q/s	-	-	975	100
Del Prado Park	Including MWI and 90-Day Q/s	-	-	880	110[5]

[1] Baseline minimum pumping capacity based on 24-hour Q/s and no mutual well interference

[2] Baseline assumed well efficiency

[3] Minimum pumping capacity accounting for mutual well interference or mutual well interference plus longer term
specific capacity

[4] Assumed well efficiency to maintain the original baseline pumping capacity

[5] Well efficiency cannot exceed 100%

Appendix B

Test Well Investigation Summary and Well Design Recommendations (Hansen Park)

LSCE

DECEMBER 2025

REGIONAL GROUNDWATER FACILITIES PROJECT FEASIBILITY STUDY

Hansen Park
Test Well Investigation Summary and Well Design Recommendations

PREPARED FOR

THE CITY OF PLEASANTON

ZONE 7 WATER AGENCY

PREPARED BY

Luhdorff & Scalmanini
Consulting Engineers

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
bgs	below ground surface
City	City of Pleasanton
DDW	State Water Resources Control Board, Division of Drinking Water
gpm	gallons per minute
LSCE	Luhdorff and Scalmanini, Consulting Engineers
MCL	maximum contaminant level
Nor Cal	Nor Cal Pump and Well Drilling
North State	North State Electric and Pump
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
O.D.	outside diameter
PFOS/PFAS	Perfluorooctanesulfonic acid/Per- and polyfluoroalkyl substances
PFHxS	Perfluorohexanesulfonic acid
PAHs	Polycyclic aromatic hydrocarbons
QA/QC	Quality Assurance/Quality Control
NPDES	National Pollutant Discharge Elimination System
SFPUC	San Francisco Public Utilities Commission
µg/L	Micrograms per liter
ng/l	Nanograms per liter

1. INTRODUCTION

Luhdorff and Scalmanini, Consulting Engineers (LSCE) have prepared this summary report documenting the hydrogeologic site investigation of Hansen Park in the City of Pleasanton and the construction and testing of the Hansen Park test well. The Hansen Park investigation was one of three site investigations conducted as part of the Regional Groundwater Facilities Project Feasibility Study, a joint project between Zone 7 Water Agency and the City of Pleasanton. Investigations and test well construction were also conducted at Del Prado Park and Tennis Park in the City of Pleasanton. The investigation of the Hansen Park site included drilling of an exploratory borehole to a depth of 770 feet below ground surface (bgs), construction of an eight-inch diameter test well completed to 766 feet bgs with five screen sections between 298 feet and 756 feet bgs, pump testing, flow profiling, and water quality sampling and analysis. This report also includes well production design and flow rate recommendations.

2. SITE SPECIFIC INVESTIGATION

The primary purposes of the investigation of the Hansen Park site were to characterize subsurface lithology, characterize zonal water quality and flow characteristics, and collect the information necessary to design a sand-free and efficient well that could yield water in sufficient quantity and quality to meet project objectives.

The Hansen Park site is located in the northwest corner of the park near the corner of Calle Ricardo and Hasen Drive in Pleasanton, CA (**Figures 1 and 2**).

The Hansen Park test well was drilled and constructed by Nor Cal Pump and Well Drilling (Nor Cal) of Yuba City, California (CA C-57 License #908591). A copy of the permit for the drilling of the test hole and test well construction obtained from Zone 7 Water Agency is attached in **Appendix A.** A copy of the encroachment permit issued by the City of Pleasanton to work in the park is also included in **Appendix A**. Pump test development and pump testing was performed by North State Electric and Pump (North State) of Chico, California (CA C57 License #812678). A copy of the encroachment permit issued to North State by the City of Pleasanton is attached in **Appendix A**.

Drilling commenced on March 18, 2025, and final well testing was completed on June 4, 2025. All work was conducted per project specifications and permitting requirements including traffic control, sound attenuation, and working hours unless variances were specifically granted by the City of Pleasanton.

2.1. Test Hole Drilling and Well Construction

Nor-Cal drilled the test hole from ground surface to 770 feet bgs at a diameter of 8.75 inches using the direct rotary drilling method. Drill cuttings from the boring were collected at 10-foot intervals and described by LSCE Staff. Representative samples were collected in one-gallon resealable plastic bags and “chip trays”. A suite of geophysical surveys were conducted in the borehole (**Appendix A**) by Pacific Surveys of Claremont, California on March 21, 2025. Using the descriptions of the drill cuttings and the geophysical surveys, LSCE developed a lithologic log of the materials encountered in the test hole. The lithology encountered in the test hole and the geophysical logs are detailed on the attached test well as-

built figure (**Figure 3**). Multiple coarse-grained intervals were identified in the borehole that could be targeted in a future production well between 298 feet and 756 feet bgs. Coarse-grained intervals above 298 feet bgs were not considered potential target zones in a new well due to potential for poor water quality.

LSCE submitted a test well profile (**Figure 3)** to Zone 7 for approval. The test well design included multiple intermediate bentonite seals to isolate each coarse-grained zone and a cement annular seal to a depth of 265 feet bgs. Test well design features are included in **Table 1**.

Table 1. Hansen Park Test Well Construction Information

Depth of Borehole	(ft bgs)	770
Borehole Diameter	Diameter (in.)	30-Inch (0-100 ft bgs) 14.75-Inch (100-770 ft bgs)
Depth of Well	(ft bgs)	766
Conductor Casing	Depth (ft bgs)	0-100
	Diameter (in)	18 I.D.*
	Wall Thickness (in)	0.3125
	Material Type	Mild Steel
Blank Casing	Depth (ft bgs)	0-298, 318-458, 578-608, 628-656, 676-736, 756-766
	Diameter (in)	8.625 O.D.**
	Wall Thickness (in)	0.250
	Material Type	Mild Steel
Screened Interval	Depth (ft bgs)	298-318, 458-578, 608-628, 656-676, 736-756
	Screen Type	Louvered (Ful-Flo)
	Slot Size (inches)	0.060
	Screen Material Type	Mild Steel
Gravel Envelope	Depth (ft bgs)	267-325, 440-585, 600-640, 650-690, 720-770
	(type/size)	SRI #8
Transition Seal	Depth (ft bgs)	265-267
	Seal Material Type	Fine Sand
Intermediate Seal	Depth (ft bgs)	325-440, 585-600, 640-650, 690-720
	Seal Material Type	Bentonite Chips
Annular Seal	Depth (ft bgs)	0-265
	Seal Material Type	10.3 Sack Sand/Cement Grout

*Inside Diameter
**Outside Diameter

After receiving approval of the test well design by Zone 7, reaming of the test hole to a diameter of 14.75 inches to a depth of 770 feet bgs began. During reaming operations, upper borehole stability and caving of formation materials were encountered. Drilling tools were removed from the borehole to prevent the drill stem and bit from being struck in the borehole. A caliper log was performed in the borehole which indicated the borehole was filled with formation materials and that the likely source of that materials were washouts above 100 feet bgs. In order to proceed with well construction, LSCE recommended to Zone 7 that a conductor casing be installed to a depth of 100 feet bgs and cemented into place to stabilize the upper formations. After receiving approval from Zone 7 for the installation of the conductor casing, Hogg Drilling (CA C-57 License #829276), working as a subcontractor to Nor-Cal, advanced a 30-inch diameter borehole to 100 feet bgs using the bucket auger drilling method. An 18-inch diameter conductor casing was installed to 100 feet and cemented into place with cement grout. After letting the seal material cure, Nor-Cal reamed the remaining pilot hole from 100 feet bgs to 770 feet bgs to a diameter of 14.75-inches with no further issues. A copy of the Well Completion Report is attached in **Appendix A**.

2.2. Well Development and Testing

Initial development of the well was performed by open-ended airlifting from the bottom of the casing assembly, followed by swab/airlift development by Nor-Cal. Final developmental pumping was performed with a submersible test pump by North State.

Starting on April 28, 2025, the drill string was installed to the bottom of the casing, and the well was airlifted open-ended. Between April 29 and May 5, 2025, a swab isolation tool was used to swab/airlift each well screen. The screened sections were swabbed/airlifted from the top screen section to the bottom screen section, and then from the bottom screen section to the top screen section over multiple passes. All fluids generated during airlift operations were contained and disposed of offsite by Nor-Cal.

After airlift operations were completed, LSCE collected water samples from the well for analysis of volatile organic compounds (VOCs), fuel additives, semi-volatile organic compounds (SVOC's), polycyclic aromatic hydrocarbons (PAHs), and metals listed in NPDES Permit No. CAG912002. A summary table of analytes and analysis results is included **Appendix A**. Only after the results of the water testing and discharge plan (**Appendix A**) were accepted by the City of Pleasanton, was water discharged to the City's storm water system.

North State installed a temporary submersible pump in the well on May 28, 2025, to perform pump and surge development of the well and to conduct well testing. Between May 28, 2025, and May 30, 2025, the well was developed at rates between 200 and 650 gallons per minute (gpm)

Step Test

Step testing was performed on June 2, 2025, and consisted of three (3) steps. The static water level in the well measured prior to testing was 25.50 feet bgs. The discharge rate, pumping duration, projected pumping water drawdown, and projected specific capacity of the test are included below in **Table 2.** The step test hydrograph is depicted in **Figure 4**.

Table 2. Step Testing Results			
Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
120	356	7.5	47.5
120	466	11.5	40.5
120	622	18.5	33.6

Long-Term Constant Rate Test

An 8-hour constant rate pumping test was performed on June 3, 2025, to determine well and aquifer characteristics. The static water level measured prior to testing was 24.50 feet bgs. The discharge rate, pumping duration, projected pumping drawdown, and projected specific capacity of the test are included below in **Table 3.** The long-term constant rate test hydrograph is depicted in **Figure 5**.

Table 3. Long-Term Constant Rate Test Results			
Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
480	594	19.5	30.5

2.3. Water Quality

Water quality samples were collected by LSCE personnel from a dedicated sample tap on the well discharge assembly on June 2, 2025, for Title 22 drinking water constituent analysis and for other constituents of interest. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* (**Appendix A**) prepared for the project and standard industry practice. The results of the water quality analysis show that for the constituents analyzed, only benzo-a-pyrene and iron exceeded the respective maximum contaminant levels (MCL) (**Table 4**). All other constituents were below their respective MCLs. Perfluorohexanesulfonic acid (PFHxS), which has a MCL of 10 ng/l, was detected at a concentration of 2.73 ng/l. **Appendix B** summarizes the results of the Title 22 sampling.

Table 4. Exceedances of Drinking Water Maximum Contaminate Levels			
Analyte	Units	MCL	Result
Benzo-a-pyrene	µg/L	0.2	0.5
Iron	mg/l	0.3	0.54

According to the US Environmental Protection Agency, benzo-a-pyrene is a polycyclic aromatic hydrocarbon that is formed as a result of incomplete combustion of organic materials from sources such as combustion engines, incinerators, cooking, and smoke. LSCE reviewed water quality records for all of Zone 7's, City of Pleasanton's, and SFPUC's (Pleasanton) drinking water wells and found no detections of benzo-a-pyrene in any well. Before water from the well could be directed to the City's stormwater system, it was tested for a number of contaminants, including benzo-a-pyrene, to determine if the water met the

requirements of the City's Waste Discharge Permit. Benzo-a-pyrene was not detected in that testing. Based on the fact there have been no detections of benzo-a-pyrene in other wells in Pleasanton area and the non-detect in the initial sample from the well, LSCE believes that sample was contaminated and is not representative of groundwater.

Based on a review of water quality data for the City of Pleasanton and Zone 7 wells, iron, aluminum, and manganese concentrations are typically non-detect or below their respective MCLs. Iron and aluminum concentrations can be elevated in a turbid sample. Aluminum has typically been non-detect in the City of Pleasanton and Zone 7 wells. The concentration of aluminum in the Hansen Park well was 0.44 mg/l. The concentration of iron in the well was 0.54 mg/l. LSCE believes that, based on the water quality of other wells in the area and the elevated turbidity of samples, the levels of aluminum and iron are not representative of groundwater.

The concentration of manganese was 0.045 mg/l, below its MCL of 0.050 mg/l. It has been our experience that manganese concentrations in monitoring wells and test wells can be higher than observed in production wells. That is, water produced from monitoring wells or test wells will have elevated manganese concentrations, whereas production wells completed in the same formations have lower concentrations or are non-detect for manganese. LSCE has recognized this phenomenon in monitoring and test wells across the state, in different geologic environments, using different drillers and drilling techniques, and different laboratories. In our experience, this only occurs with manganese.

The most probable cause for elevated concentrations of manganese in the test well is related to well development techniques and limitations. Due to the size of the well casing, limited screen section lengths, water levels during pump and surge development, pump size limitations, and well yield, the development of a small-diameter well can be less effective than can be achieved in a large-diameter well. The development of a full-size production well can be more vigorous and effective than is possible in a small-diameter well with isolated zones. LSCE believes that the large discharge volumes and development techniques utilized in production wells results in more effective well development and removal of residual drilling fluids and formation material than is possible in small diameter wells. Based on our experience and the water quality of other wells in the vicinity of the Del Prado test well, and the limitations of development of a small-diameter well, we believe that the elevated concentration of manganese is not representative of groundwater.

While meeting Title 22 water quality standards, hardness and total dissolved solids values exceed Zone 7/City of Pleasanton's water quality targets. The exceedances are summarized in **Table 5**.

Table 5. Water Quality Targets and Exceedances

Parameter	Target	Result
Hardness	150 mg/l	410
Total Dissolved Solids	500 mg/l	542

2.4. Zone Sampling

Depth-discrete water samples were collected from above each screened interval within the well to characterize zonal water quality. Groundwater samples were collected on June 3, 2025, under pumping conditions. Starting with Zone #1, Pacific Surveys installed a sampling tool into the well to the specified zone to collect samples for analysis. Samples were collected at the depths shown in **Table 6**. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* prepared for the project and analyzed for general mineral, general physical, inorganic, and PFOS/PFAS constituents. A summary table of zonal water quality analysis results are in **Appendix B.** Zonal PFHxS detections are shown in **Table 7**.

Table 6. Zone Sampling Information

Sample Zone	Sample Depth
Zone #1	448 feet bgs
Zone #2	518 feet bgs
Zone #3	598 feet bgs
Zone #4	646 feet bgs
Zone #5	726 feet bgs

Table 7. Zonal PFHxS Concentrations

Sample Zone	Concentration (ng/l)
Zone #1	2.70
Zone #2	ND
Zone #3	ND
Zone #4	ND
Zone #5	2.53

The maximum contaminant level for manganese is 0.050 mg/l. The zonal concentration of manganese ranged from a low of 0.046 mg/l in Zone #1 (448 feet bgs) to high of 0.24 mg/l in Zone #5 (726 feet bgs). Based on a review of water quality from other wells in the area, manganese is not a constituent of concern. The elevated and variable manganese concentrations seen in the well are likely a result of incomplete removal of drilling fluids during the well development process. It is not uncommon to have elevated manganese levels in monitoring wells and small diameter test wells in areas/depths where manganese is not a constituent of concern due to the limitations of development with these types of wells. The composite (all zones contributing) concentration manganese was 0.045 mg/l.

2.5. Flow Survey

On June 3, 2025, a spinner survey was performed in the well by Pacific Surveys to quantify the groundwater flow contribution from individual screen intervals under pumping (dynamic) conditions.

Table 8 summarizes the flow contribution for each screen section in the well. The dynamic spinner survey log is included in **Appendix A.**

Table 8. Zonal Flow Contribution Pumping Conditions		
Screen Interval (feet bgs)	**Production (gpm)**	**% of Flow**
298-318	92	15.4
458-518	293	49.0
518-578	121	20.2
608-628	25	4.2
656-676	31	5.2
736-756	36	6.0

The results of the spinner survey show that 85% of the total well yield is derived from screened intervals above 578 feet bgs. The low contribution from the lower three screen sections is not surprising, considering the thickness and the resistivity response on the geophysical log of those zones.

A spinner survey was also conducted in the well to measure flow under non-pumping (static) conditions (**Appendix A**). The results of the static spinner survey show that water flows within the well from the upper screened interval into the lower three screened intervals under non-pumping conditions. **Table 9** summarizes the flow contribution for each screen section in the well under static conditions. Positive values for production and % of flow indicate water is moving into the well structure through screen sections, negative values indicate where water is moving out of the well structure those screened sections.

Table 9. Zonal Flow Contribution Static Conditions		
Screen Interval (feet bgs)	**Flow (gpm)**	**% of Flow**
298-318	12.2	100
458-578	0.0	0
608-628	(-0.5)	(-4)
656-676	(-3.5)	(-29)
736-756	(-8.2)	(-67)

2.6. Well Yield Estimation

LSCE used the data derived from the constant rate pumping test, combined with data regarding the range of expected regional groundwater levels, to develop well pumping capacity estimates for the wells constructed at Hansen Park, Del Prado Park, and Tennis Park. The methodology, data, and analysis used to develop pumping capacities for the three sites are detailed in **Appendix C**. **Table 10** summarizes the estimated pumping capacity of a well constructed per the design recommendation presented in Section 3 at Hansen Park.

Table 10. Summary of Well Pumping Capacity Estimates							
Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Hansen Park	298	30.5	273.5	223	50	4,200	3,400

The well capacity estimates provided in **Appendix C**, and hence the overall project yield, should be considered best estimates at this time based on installation and testing of relatively small diameter test wells. The final full-scale production well yields and overall project yield may vary by several hundred gpm more or less than the test well based estimates provided in this feasibility study. Production well yields will be a function of multiple variables (e.g., specific capacity and well efficiency) that may vary between test well drilling and production well drilling. The amount of project yield above the baseline amount allocated to City of Pleasanton (and hence, available to Zone 7) cannot be confirmed until production wells are installed and tested.

3. PRODUCTION WELL DESIGN RECOMMENDATIONS

Based on our investigation of the Hansen Park site, the testing of the Hansen Test Well, and our well yield and drawdown analysis, LSCE believes that a well constructed at the Hansen Park site could yield between 3,400 to 4,200 gpm of water that would meet all current Title 22 Drinking Water Standards without treatment. Utilizing the information gathered as part of the site investigation, well testing, and analysis, LSCE has prepared the following design recommendations for a community supply well to be constructed at Hansen Park.

Our proposed well design meets the requirements of the Department of Water Resources Water Well Standards, Bulletin 74-81, 74-90; State Water Resources Control Board, Division of Drinking Water (DDW), and accepted water well design standards. **Figure 6** depicts the proposed well design. The well is designed to accommodate submersible pumping equipment that could pump up to 4,200 gpm. Collapse pressures for each casing type and thickness were calculated to ensure each can resist the hydrostatic pressures developed during sanitary and annular seal placement. Each of the well design elements is discussed below.

Conductor Casing / Sanitary Seal – The conductor casing will stabilize the upper portions of the borehole during drilling and well construction, while ensuring that requirements for sanitary seal are met. The conductor casing shall be installed in a 60-inch diameter borehole and cemented in place to a depth of 95 feet bgs. At a depth of 95 feet, the conductor will terminate in a clay layer. The conductor casing shall be fabricated of a 48-inch O.D. by 1/2-inch wall ASTM A-139 Grade B steel.

Production Borehole – The production borehole shall be drilled using the reverse circulation drilling method. The final borehole diameter shall be 40 inches to a depth of 775 feet bgs.

Blank Well Casing – Stainless steel was selected for the blank casing. Stainless steel will provide superior corrosion resistance and well longevity while meeting DDW standards for NSF 60 certification. The blank well casing shall be 24-inch I.D. by 3/8-inch wall ASTM A-778 Type 304L stainless steel.

Well Screen – Stainless steel, louvered well screen was selected to maximize well open area and efficiency, and for compatibility with the blank well casing. The 24-inch I.D. well screen will be constructed ASTM A-778, Type 304L stainless steel with a slot size of 0.080-inch. At a design capacity of 4,200 gpm, the screen will have a theoretical inlet velocity of 0.0346 feet/second.

Accessory Pipes - A 2-foot-long, stainless steel sounding port shall be installed on the well casing from 297 to 299 feet bgs. A 2-inch, Schedule 40, Type 304L stainless steel sounding tube shall be connected to the sounding port and installed to a depth of 297 feet bgs. A 3-inch, Schedule 40, BSP gravel fill tube shall be installed to a depth of 280 feet bgs.

Gravel Envelope – Based on the sieve analysis of selected formation samples (**Figure 7**), a 6 x 9 graded gravel envelope material was selected for use in this well. The gravel chosen is 5.1 times larger than the finest formation sample (515-520 feet bgs) at the d_{70} (cumulative percent retained) value. The 0.080-inch screen slot size will retain over 90 percent of the gravel material. The gravel envelope will be placed from 262 to 775 feet bgs. A two-foot, fine sand transition seal will be placed from 260 to 262 feet bgs.

Annular Seal – The deep annular seal will ensure that only groundwater from the targeted intervals will enter the well structure. The annular seal shall consist of "10.3-sack" sand/cement grout and shall be placed from a depth of 260 feet bgs to the ground surface.

Based on recent projects of similar size and scope, LSCE's preliminary Engineer's Estimate for the well construction, development, and testing is approximately $2,000,000. Items such as water supply for drilling, fluid and cutting disposal, development water disposal, material and equipment storage, sound attenuation, working hours and site security and safety that may affect the cost of well installation and testing will need to be addressed in the final specifications before bidding.

Alternate Well Design Considerations

Well design recommendations were based on direction to maximize well yield. The recommended well design includes screens placed opposite each zone identified in the test well borehole below a depth of 300 feet. Development of well capacity estimates assumed that each zone screened in the test well would be targeted for completion in a production well.

The projected yield of the proposed Hansen Park Well constructed as recommended above is between 4,200 and 3,400 gpm, depending on long term and seasonal water level variations and a conservative well efficiency value as discussed in the TM (attached). Based on dynamic flow testing conducted in the test well, the bottom three zones (605 - 755 feet) in the well contribute 15% of the total well yield or between 647 and 524 gpm of the projected yield of the production well. In contrast, the upper two zones in the production well would contribute 85% of the well yield, or 3,553 to 2,876 gpm.

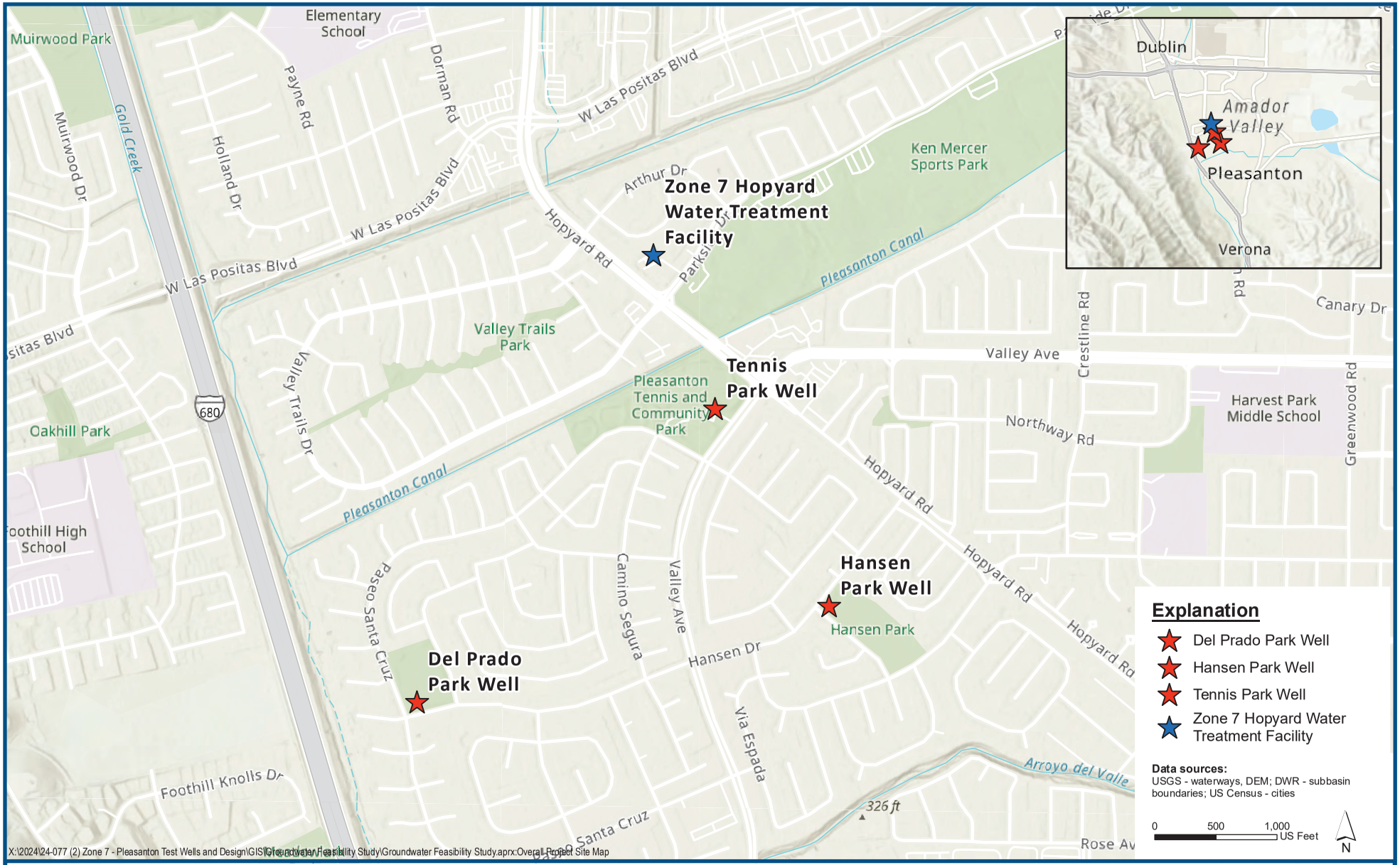
The estimated cost to drill, construct, and test the production well as recommended above is $2,000,000, which equates to $2,545 per foot for a 775 foot well. The estimated cost to construct a well that targets

the zones above 590 feet is $1,522,200, or 24% less than a 775 foot well. Put another way, a 15% reduction in yield will result in a 24% cost savings for the construction of the production well.

FIGURES

Figure 1 - Well Location Map
Figure 2 - Hansen Park Site Map
Figure 3 - Test Well As-Built Profile
Figure 4 - Step Test Hydrograph
Figure 5 - Constant Rate Test Hydrograph
Figure 6 - Proposed Production Well Design
Figure 7 - Sieve Analysis

LSCE



X:\2024\24-077 (2) Zone 7 - Pleasanton Test Wells and Design\GIS\Groundwater Feasibility Study\Groundwater Feasibility Study.aprx:Overall Project Site Map

Luhdorff & Scalmanini
Consulting Engineers

Project Well Location Map

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 1



Luhdorff & Scalmanini
Consulting Engineers

Hansen Park Site Map

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 2

Client: Zone 7	**Lat/Long:** 37.6710/-121.8951
Project Name: Test Wells and Design	**Well Name:** Hansen Park Test Well
LSCE #: 24-2-077	**Drill Date:** 3/18/2025 - 3/21/2025
Location: Pleasanton, CA	**Drilling Method:** Direct Mud Rotary
Geologist: B. Kearney	**Driller:** Nor-Cal Pump & Well Drilling

Luhdorff & Scalmanini Consulting Engineers

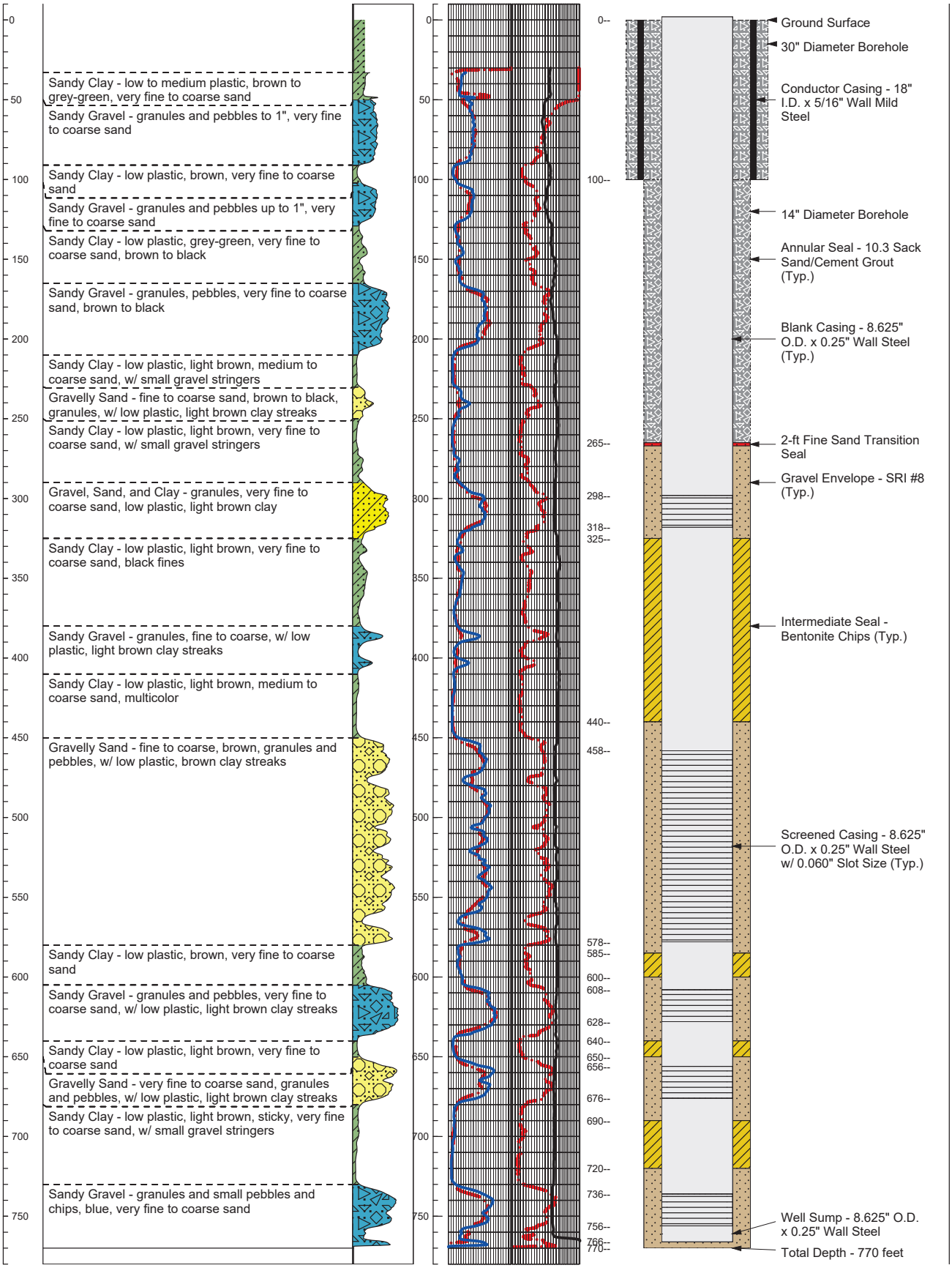
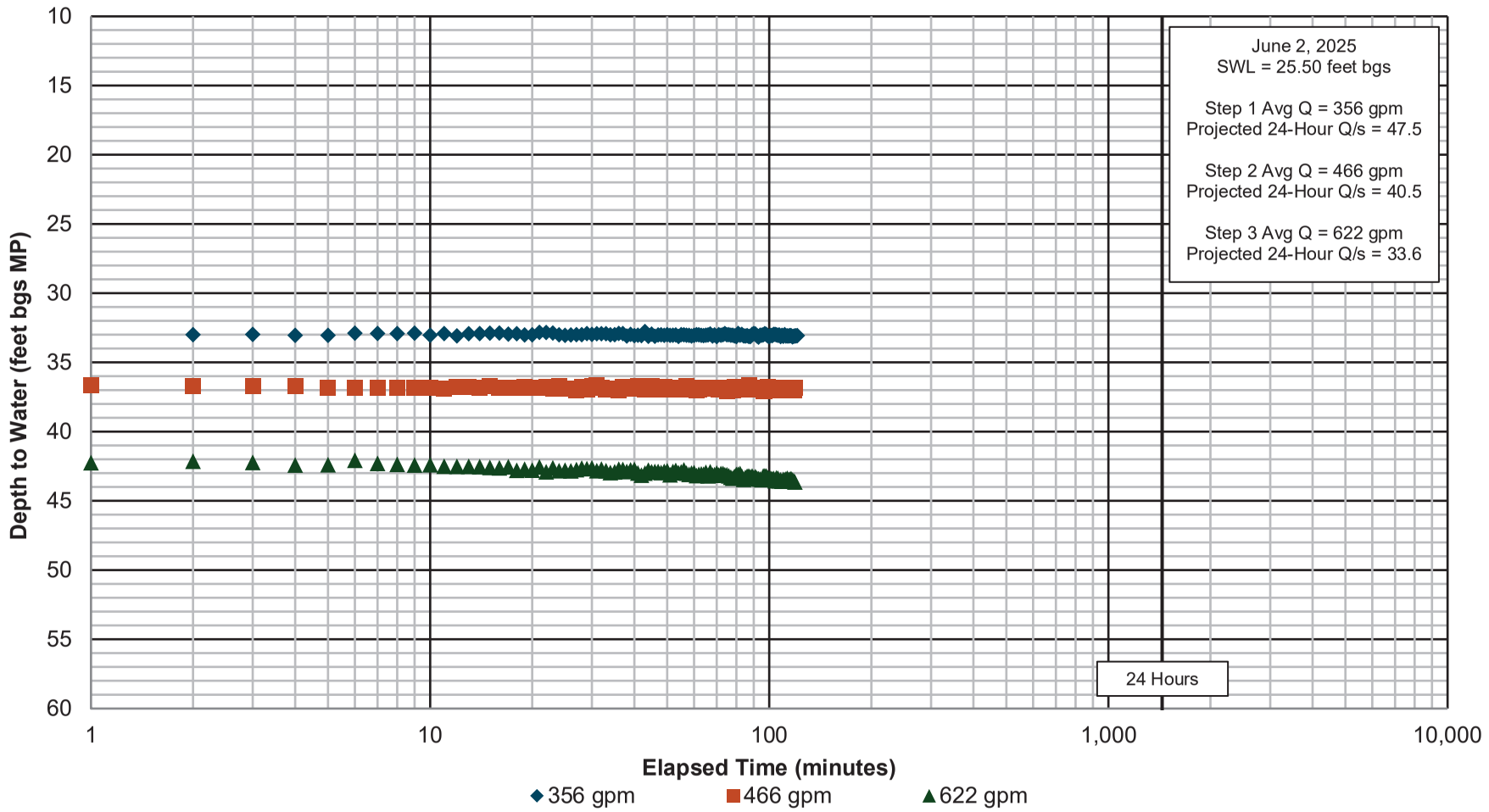


Figure 3

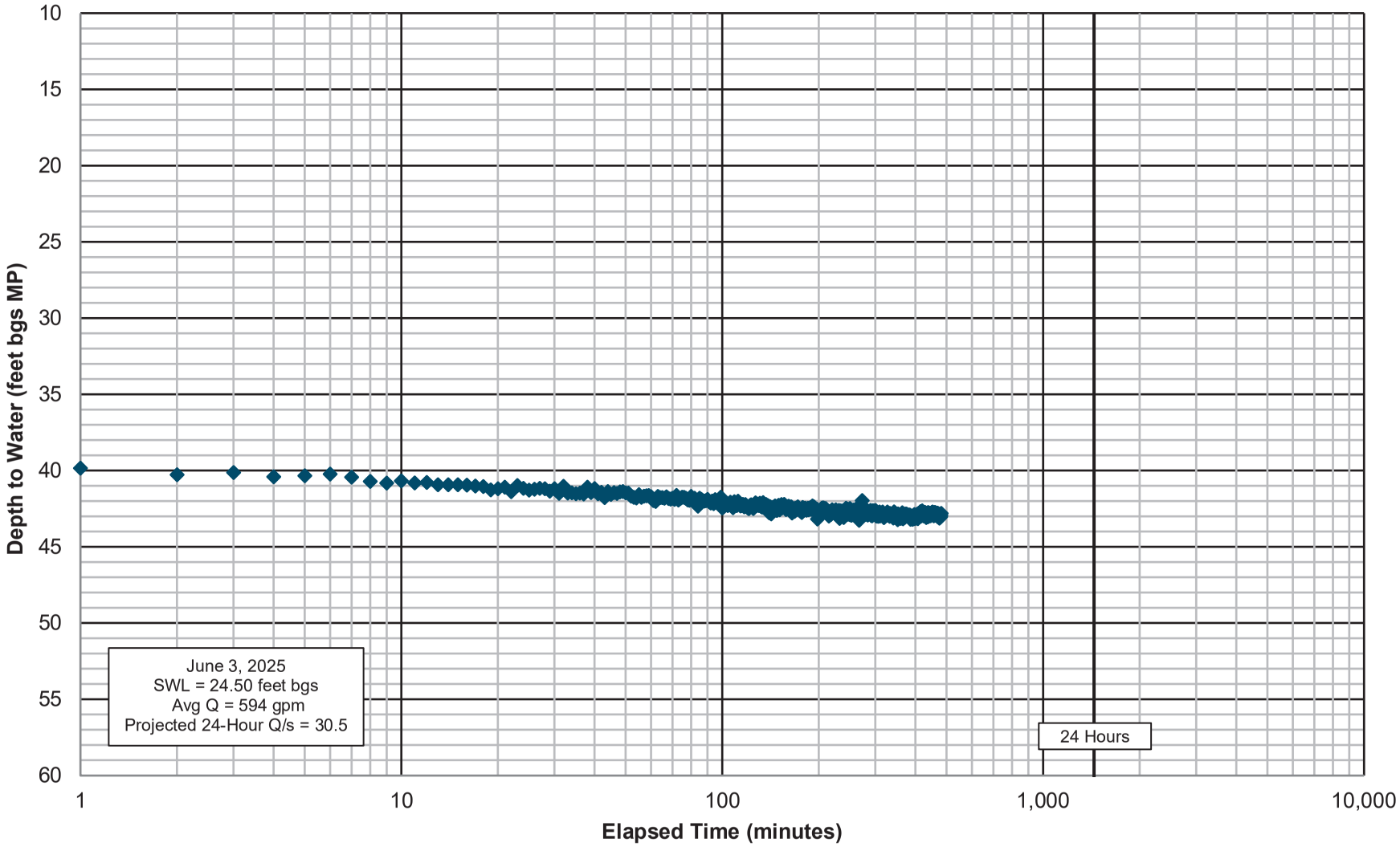


Luhdorff & Scalmanini Consulting Engineers

Step Test - Hansen Park Test Well

Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 4



Luhdorff & Scalmanini
Consulting Engineers

Constant Rate Test - Hansen Park Test Well

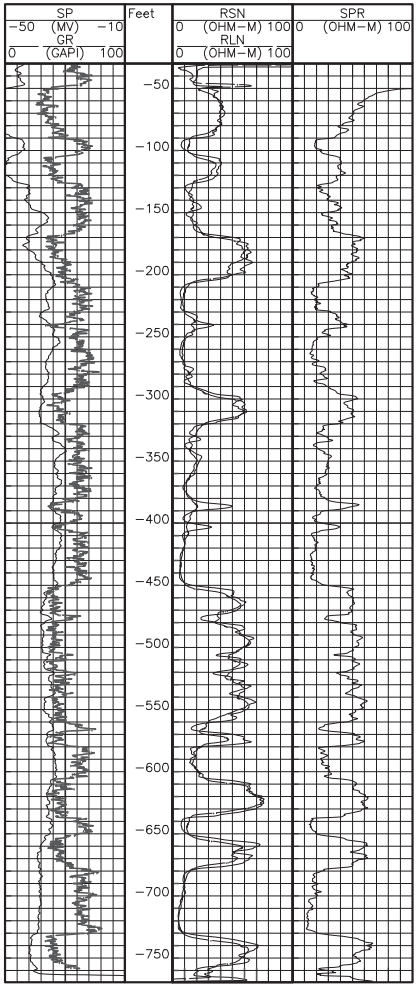
Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 5

HANSEN PARK WELL
TEST HOLE LITHOLOGY

Depth	Description
0'	Sandy Clay–low to medium plastic, brown to grey–green, very fine to coarse sand
50'	Sandy Gravel–granules and pebbles to 1", very fine to coarse sand
90'	Sandy Clay–low plastic, brown, very fine to coarse sand
100'	Sandy Gravel–granules and pebbles up to 1", very fine to coarse sand
130'	Sandy Clay–low plastic, grey–green, very fine to coarse sand, brown to black
165'	Sandy Gravel–granules, pebbles, very fine to coarse sand, brown to black
210'	Sandy Clay–low plastic, light brown, medium to coarse sand, w/ small gravel stringers
230'	Gravelly Sand–fine to coarse sand, brown to black, granules, w/ low plastic, light brown clay streaks
250'	Sandy Clay–low plastic, light brown, very fine to coarse sand, w/ small gravel stringers
290'	Gravel, Sand, and Clay–granules, very fine to coarse sand, low plastic, light brown clay
325'	Sandy Clay–low plastic, light brown, very fine to very coarse sand, black fines
380'	Sandy Gravel–granules, fine to coarse, w/ low plastic, light brown clay streaks
410'	Sandy Clay–low plastic, light brown, medium to coarse sand, multicolor
450'	Sandy Gravel–granules and pebbles, very fine to coarse sand, w/ low plastic, light brown clay streaks
580'	Sandy Clay–low plastic, brown, very fine to coarse sand
605'	Sandy Gravel–granules and pebbles, very fine to coarse sand, w/ low plastic, light brown clay streaks
640'	Sandy Clay–low plastic, light brown, very fine to coarse sand
650'	Gravelly Sand–very fine to coarse sand, granules and pebbles, w/ low plastic, light brown clay streaks
680'	Sandy Clay–low plastic, light brown, sticky, very fine to coarse sand, w/ small gravel stringers
730'	Sandy Gravel–granules and small pebbles and chips, blue, very fine to coarse sand
770'	

HANSEN PARK WELL
TEST HOLE ELECTRICAL LOG



HANSEN PARK WELL
WELL PROFILE

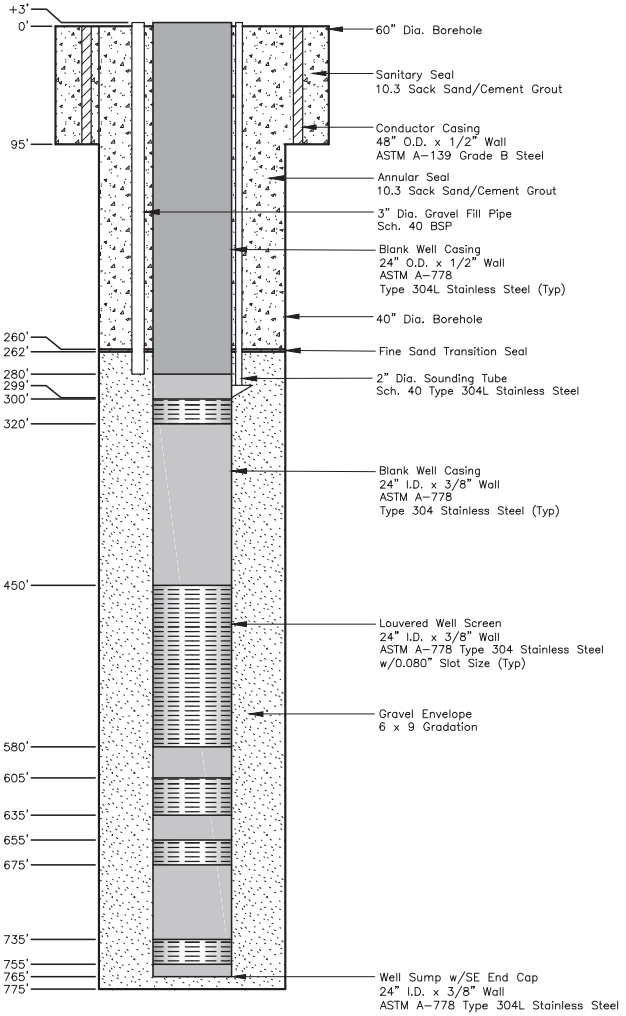


Figure 6

HANSEN PARK WELL PROFILE
Zone 7 Water Agency
Regional Groundwater Facilities
Project
Alameda County, California

Luhdorff & Scalmanini
Consulting Engineers

REVISIONS		
NO.	DATE	REVISION

DATE: SEPTEMBER 2025
JOB NO.: 24-2-077
DESIGN BY: SL
DRAWN BY: RM
CHECKED BY:
Hansen Park Well.dwg

SHEET: 1

CAD FILE: Z:\LS ACAD Dropbox\Projects\City of Pleasanton\24-2-077\Hansen Park Well.dwg DATE: 09/18/2025 3:42 PM

Hansen Park Test Hole

Luhdorff & Scalmanini
Consulting Engineers

U.S. Standard Sieve Numbers

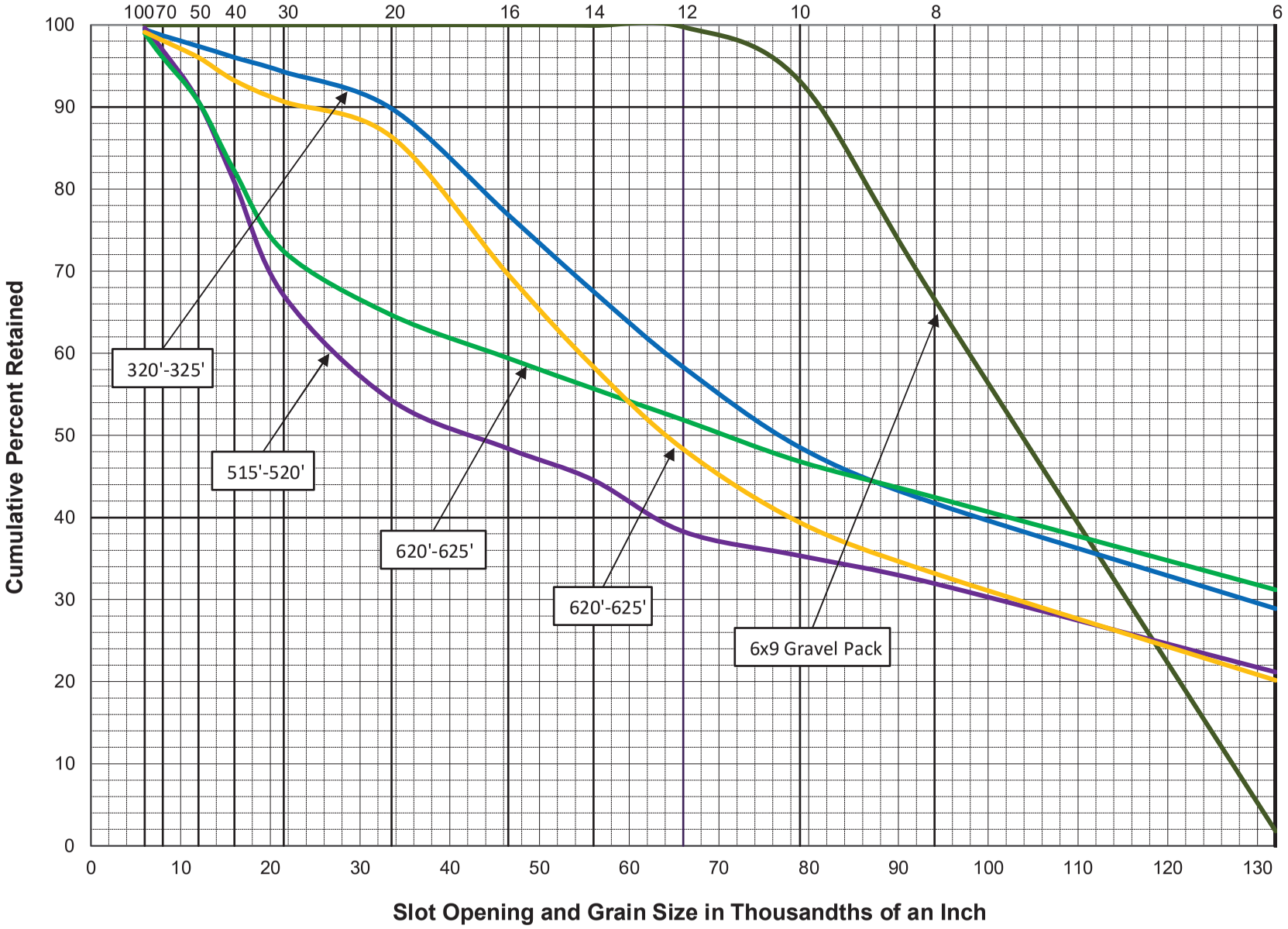


Figure 7

APPENDIX A

A-1 Well Drilling & Construction Permit

Zone 7 Water Agency
100 North Canyons Parkway
Livermore, CA 94551
wellpermits@zone7water.com

DRILLING PERMIT APPLICATION

For Office Use Only

Permit ID 2024108	Permit Date	Receipt ID N/A - Fee Waived	Well ID

For Applicant to Complete

Applicant: Nor-Cal Pump & Well Drilling, Inc.	Contact: Carn S. Heer	Email: carn@norcalpump.com
Address: 1325 Barry Road	City: Yuba City, California	Phone: (530) 740-2534
Client: Zone 7 Water Agency		Email: admin@zone7water.com
Address: 100 North Canyons Parkway	City: Livermore, California	Phone: (925) 454-5000
Owner: City of Pleasanton	☒ Same as client	Email: tyamello@cityofpleasantonca.gov
Address: PO Box 520	City: Pleasanton	Phone: 925-931-5519

Site

Project Location/Address	Parcel	
5697 Black Ave, Pleasanton, CA 94566		
GeoTracker ID:	**Latitude:**	**Longitude:**

Project Type

☒ **Construction** ☐ **Modification** ☐ **Destruction**
($660/well)

Type of Well

☐ Domestic	☒ Municipal	☒ Monitoring
☐ Irrigation	☐ Industrial	☐ Dewatering
☐ Livestock	☐ Geothermal	☐ Other: _____
☐ Cathodic	☐ Inclinometer	

Borings and Remediation
($445/site up to 4 borings plus $85 for each additional boring)

Type of Work

☐ Geotechnical Boring	☐ Groundwater Extraction*
☐ Environmental Boring	☐ In Situ Treatment*
☐ Soil Vapor Sampling*	☐ Other
☐ Soil Vapor Extraction*	** Submit design with seal intervals*

Drilling

Drilling Method

☒ Mud Rotary	☐ Hollow Stem Auger
☐ Air Rotary	☐ Direct Push
☐ Sonic	☐ Other: _____

Drilling Company Nor-Cal Pump & Well Drilling, Inc.

C57 License # 908591

Well Construction Projects

Owner Well ID	Borehole Diameter	Casing Material	Casing Diameter	Surface Seal Depth	Total Well Depth
Tennis Park	14"	ASTM A39 Grade B Mild Steel	8.625" OD x .25" wall	125'	650' Casing ; 800' TD

Exploratory Boring Projects

Number of Borings:	Borehole Diameter:	Maximum Depth:	Estimated Depth-to-Water:

All Projects

Estimated Starting Date: 11/25/2024	Estimated Completion Date: 5/10/2025

*** Please attach a Site Plan with all proposed drilling locations, existing wells, significant site features, and adjacent streets.**

Applicant/Client/Owner assume all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner. I hereby agree to comply with all requirements of this permit (see Page 2) and Alameda County Ordinance No. O-2015-20.

Applicant's Signature: _____ Date: 11/11/2024

For Office Use Only

Approved: _____ Date: _____

REV 11/27/23

EMAIL INSPECTION REQUESTS TO WELLPERMITS@ZONE7WATER.COM

PERMIT CONDITIONS

(Selected Permit Requirements Apply)

FOR OFFICE USE ONLY

☐ General

1. Request an inspection by email (wellpermits@zone7water.com) at least 24 hours before the start of work.
2. Permit is void if project has not begun within 90 days of approval date. Applicant/Client/Owner assumes all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner.
3. Clear utilities prior to work commencement. Call 811 for more information.
4. Submit all analytical results including soil, vapor, and groundwater samples to Zone 7 within 60 days of collection.
5. California Well Standards and Alameda County Water Wells Ordinance apply unless otherwise required below.

Borings

Must be sealed within 24 hours of drilling

☐ GEOTECHNICAL

1. If groundwater is encountered, tremie cement grout from total depth to ground surface displacing water from hole. Hydrated bentonite granules/chips may be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.
2. If groundwater is not encountered, fill borehole from total depth to ground surface with compacted cuttings, cement grout placed by tremie pipe, or hydrated bentonite granules/chips (minimum 4 inch diameter borehole) using augers as tremie.

☐ CONTAMINATION INVESTIGATION

1. Fill open hole with neat cement placed by tremie pipe to ground surface. Hydrated bentonite granules/chips may also be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.

Wells

☐ GENERAL – Submit within 60 days of work completion:

1. DWR Well Completion Report containing owner and Zone 7 well ID from drilling permit to both DWR and Zone 7 Water Agency.
2. Top-of-casing elevation and pump test results

☐ SUPPLY WELLS

1. Borehole diameter shall be at least 4 inches greater than the well casing diameter.
2. Minimum seal depth must be 50 feet.
3. Cement grout shall be pumped though tremie pipe.
4. Plumbing
   - An access port at least 0.5 inches in diameter is required on the wellhead for water level measurements.
   - A water spigot for sampling is required on the discharge pipe near the wellhead.
   - A metering device is required on the discharge pipe near the wellhead.

☐ MONITORING WELLS

1. Borehole diameter shall be at least 4 inches greater than the well or piezometer casing diameter.
2. Minimum seal depth of monitoring well is the maximum depth practicable or 20 feet.
3. Cement grout shall be pumped through tremie unless freefall exception is met.

☐ Destructions and Other Special Conditions

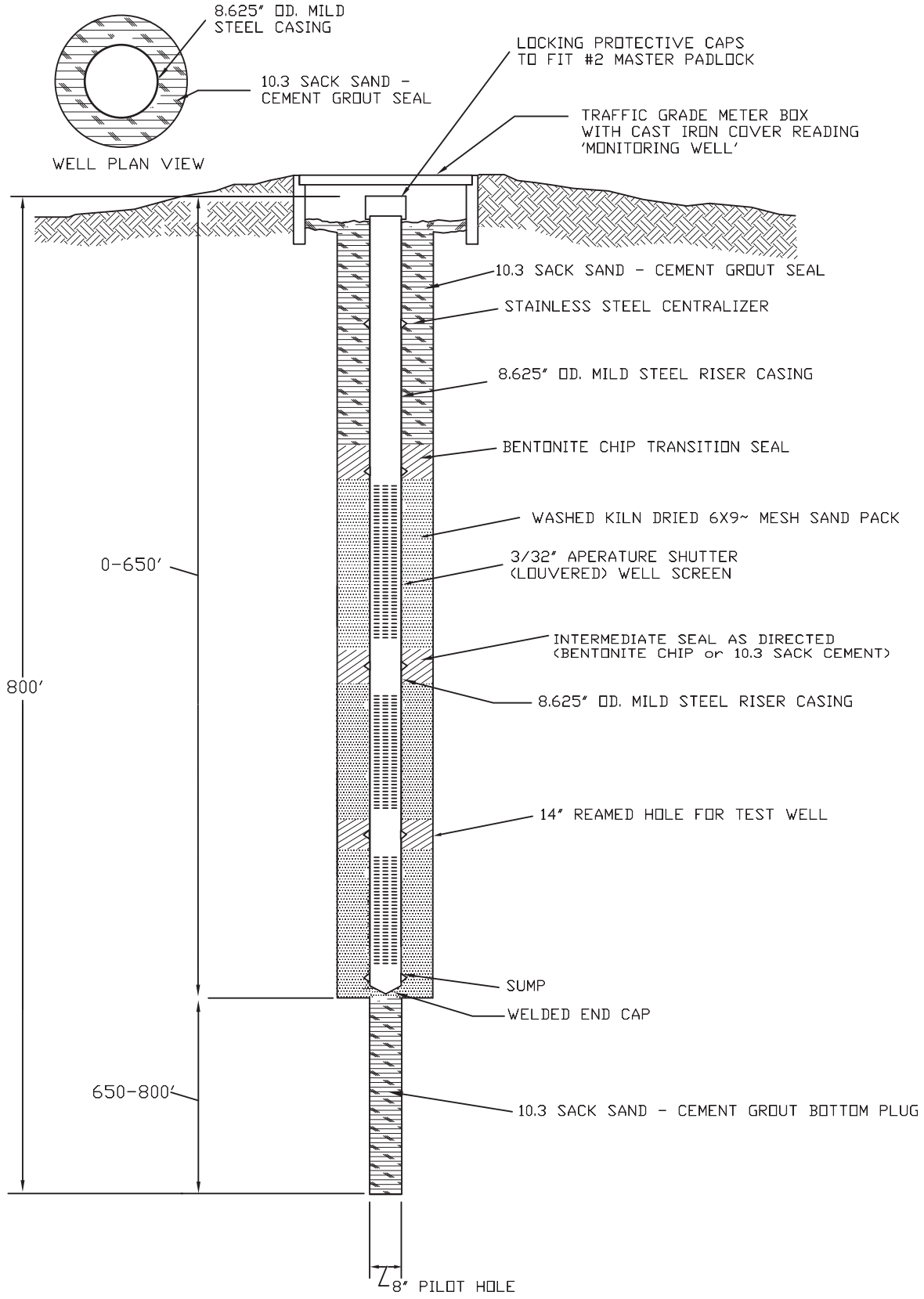
☐ Seal Requirements

Cement grout

- Neat Cement - 47lb Portland Type I /II or II/V cement to 3 gallons of water. Up to 5% bentonite powder by weight of cement.
- Sand Cement – 10.3 sack mix. 94lb Portland Type I/II or II/V cement to maximum 188lbs sand, and maximum 7 gallons of water.

Tremie: Grout shall be placed by tremie pipe. Bottom of tremie must remain submerged in grout until hole is filled. Upper 2 feet may also be restored with compacted material.

Freefall: 30 feet or less below ground surface in unsaturated zone only.



REVISIONS		
6		
5		
4		
3		
2		
1		

ZONE 7 WATER AGENCY

PROJECT DRAWING 5
GENERAL CONSTRUCTION DESIGN
TEST WELL

DRAWN: J. DANIELSEN
DESIGNED:
CHECKED:
APPROVED:
DATE: 05/28/2024
SCALE: NOT TO SCALE
FILE NAME: E:\PROJECTS\2024 Regional GW Development\Bid Packages\Test Wells
1 OF 1



Project Drawing 4
Approximate Test Well Location
Site C, Hansen Park, Pleasanton, CA

APPENDIX A

A-2 Encroachment Permits

THE CITY OF
PLEASANTON
PO Box 520, Pleasanton, CA 94566-0802

Application for Encroachment Permit

ENGINEERING DEPARTMENT
Phone 925 931-5650 Email eod@cityofpleasantonca.gov

Date of Application 11/11/2024
Date Work to Begin 11/25/2024
Date of Completion 5/10/2025

Work Location 5801 Valley Avenue, Pleasanton, CA 94566; 6701 Hansen Drive, Pleasanton, CA 94566; 5697 Black Avenue, Pleasanton, CA 94566 APN# 946-3400-18-6; 946-4563-125; 946-3405-25-5

Owner/Developer City of Pleasanton | Zone 7 Water Agency Phone (925) 931-5686 | (925) 454-4000

Address: 157 Main Street PO Box 520, Pleasanton CA 94566-0802 | 100 North Canyons Parkway, Livermore, CA 94551

Contractor: Nor-Cal Pump & Well Drilling, Inc. Phone (530) 674-5861

Address: 1325 Barry Road, Yuba City, CA 95993

California Contractor's License # 908591 Type C57 Exp. Date January 31, 2026

Workers' Comp. Carrier Redwood Fire and Casualty Policy # _____ Exp. Date _____

City of Pleasanton Business License # 1023779 Exp. Date 11/21/2025

Valuation of Work in the Right of Way $1,400,000.00

Description of proposed work Construction and drilling of three (3) test wells for water quality purposes

REQUIRED: 3 copies of the Plans for proposed work (Google overview map with sketch showing work at minimum), traffic control plan (**allow 48 hrs for approval**), copy of liability insurance with endorsements for: 1) naming City of Pleasanton as an additional insured, and 2) waiver of subrogation.

The undersigned hereby certifies that all work proposed herein will be completed in a timely manner to the satisfaction of the City Engineer in accordance with the provisions of Chapter 13.04 of City of Pleasanton's Muni Code and City Standards.

Sign Nar Heer Date 11/11/2024 Title President

Print Nar Singh Heer

Application reviewed by _____ Date _____ Permit Number _____

Observations/Special Conditions _____

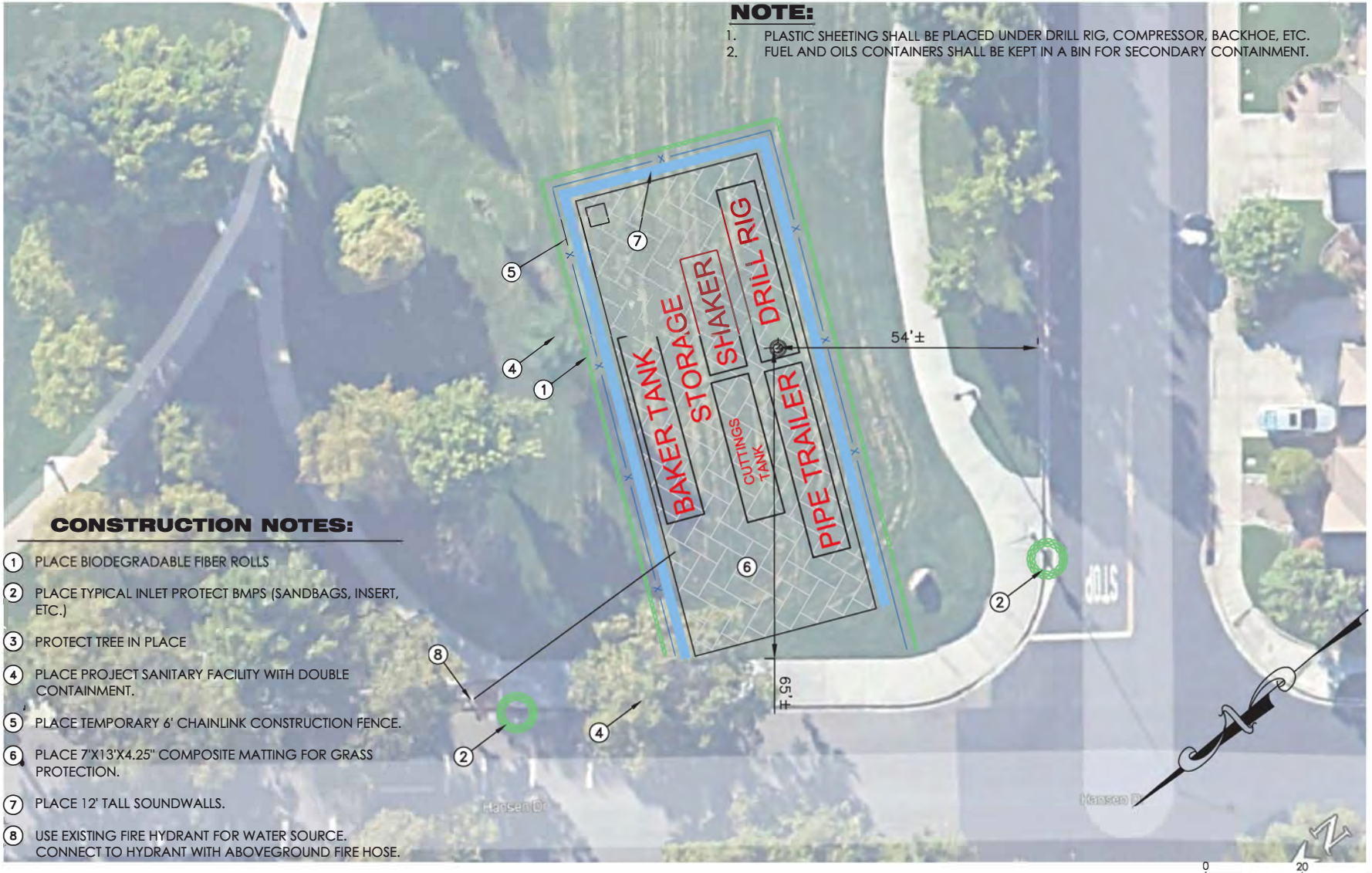
Bond amount required _____ Cash _____ Surety _____

Permit approved for issuance as noted above:

By _____ Date _____

NOTE:

1. PLASTIC SHEETING SHALL BE PLACED UNDER DRILL RIG, COMPRESSOR, BACKHOE, ETC.
2. FUEL AND OILS CONTAINERS SHALL BE KEPT IN A BIN FOR SECONDARY CONTAINMENT.



CONSTRUCTION NOTES:

1. PLACE BIODEGRADABLE FIBER ROLLS
2. PLACE TYPICAL INLET PROTECT BMPS (SANDBAGS, INSERT, ETC.)
3. PROTECT TREE IN PLACE
4. PLACE PROJECT SANITARY FACILITY WITH DOUBLE CONTAINMENT.
5. PLACE TEMPORARY 6' CHAINLINK CONSTRUCTION FENCE.
6. PLACE 7'X13'X4.25" COMPOSITE MATTING FOR GRASS PROTECTION.
7. PLACE 12' TALL SOUNDWALLS.
8. USE EXISTING FIRE HYDRANT FOR WATER SOURCE. CONNECT TO HYDRANT WITH ABOVEGROUND FIRE HOSE.

0 20 40

SCALE: 1" = 20'

NO.	DATE	DESCRIPTION

DATE: 2/2025
SCALE: 1"=20'
DRAWN BY: AV
DESIGNED BY: AV
CHECKED BY: AV

NOR-CAL PUMP & WELL DRILLING, INC.
1325 BARRY ROAD
YUBA CITY, CA 95993
PHONE: 530-674-5861
WWW.NORCALPUMP.COM

ZONE 7 WATER AGENCY

HANSEN SITE PLAN

PLEASANTON, STATE OF CALIFORNIA

PROJECT NUMBER
24-5008

SHEET
1 OF 1

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NOTE:

1. ALL DELIVERIES AND PICKUPS SHALL OCCUR ONSITE MONDAY-FRIDAY BETWEEN 9:00 AM AND 3:00 PM.
2. FLAGGERS SHALL BE USED TO CONTROL TRAFFIC WHILE EQUIPMENT IS GUIDED ONSITE AT ALL TIMES. STAFF SHALL HAVE PROPER TRAINING FOR USE OF TRAFFIC DEVICES.
3. ALL SIGNS SHALL BE SET ON TYPE II BARRICADES.

NO.	DATE	DESCRIPTION

DATE: 2/2025
SCALE: 1"=40'
DRAWN BY: AV
DESIGNED BY: A V
CHECKED BY: A V

NOR-CAL PUMP & WELL DRILLING, INC.
1325 BARRY ROAD
YUBA CITY, CA 95993
PHONE: 530-674-5861
WWW.NORCALPUMP.COM

ZONE 7 WATER AGENCY

HANSEN PARK TRAFFIC CONTROL PLAN

PLEASANTON, STATE OF CALIFORNIA

PROJECT NUMBER
24-5008

SHEET
1 OF 1

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THE CITY OF PLEASANTON
PO Box 520, Pleasanton, CA 94566-0802

Application for Encroachment Permit

ENGINEERING DEPARTMENT
Phone 925 931-5650 Email eod@cityofpleasantonca.gov

Date of Application 4/21/2025
Date Work to Begin 5/19/2025
Date of Completion 6/13/2025

Work Location 6701 Hansen Drive, Pleasanton, CA 94566 APN# 946-3405-025-05

Owner/Developer City of Pleasanton Phone (925) 931-5519

Address: PO Box 520, Pleasanton, Ca

Contractor: Well Industries Inc. Phone (530) 228 - 1928

Address: 3282 Hwy 32, Chico, Ca 95973

California Contractor's License # 812678 Type C-57 Exp. Date 7-31-2025

Workers' Comp. Carrier The Liberty Company Insurance Brokers Policy # 7600019873251 Exp. Date 1/1/26

City of Pleasanton Business License # 1023975 Exp. Date 1/28/2026

Valuation of Work in the Right of Way $50k

Description of proposed work Test well development and testing

REQUIRED: 3 copies of the Plans for proposed work (Google overview map with sketch showing work at minimum), traffic control plan (**allow 48 hrs for approval**), copy of liability insurance with endorsements for: 1) naming City of Pleasanton as an additional insured, and 2) waiver of subrogation.

The undersigned hereby certifies that all work proposed herein will be completed in a timely manner to the satisfaction of the City Engineer in accordance with the provisions of Chapter 13.04 of City of Pleasanton's Muni Code and City Standards.

Sign Justin Brandon Date 4/21/2025 Title Project Manager

Print Justin Brandon

Application reviewed by _____ Date _____ Permit Number _____

Observations/Special Conditions _____

Bond amount required _____ Cash _____ Surety _____

Permit approved for issuance as noted above:

By _____ Date _____



Luhdorff & Scalmanini
Consulting Engineers

Hansen Park - Site Map

Zone 7/City of Pleasanton
Test Well & Design

Figure 1



NOTE:

1. ALL DELIVERIES AND PICKUPS SHALL OCCUR ONSITE MONDAY-FRIDAY BETWEEN 9:00 AM AND 3:00 PM.
2. FLAGGERS SHALL BE USED TO CONTROL TRAFFIC WHILE EQUIPMENT IS GUIDED ONSITE AT ALL TIMES. STAFF SHALL HAVE PROPER TRAINING FOR USE OF TRAFFIC DEVICES.
3. ALL SIGNS SHALL BE SET ON TYPE II BARRICADES.

NO.	DATE	DESCRIPTION

DATE: 2/2025
SCALE: 1"=40'
DRAWN BY: AV
DESIGNED BY: AV
CHECKED BY: AV

NOR-CAL PUMP & WELL DRILLING, INC.
1325 BARRY ROAD
YUBA CITY, CA 95993
PHONE: 530-674-5861
WWW.NORCALPUMP.COM

ZONE 7 WATER AGENCY

HANSEN PARK TRAFFIC CONTROL PLAN

PLEASANTON, STATE OF CALIFORNIA

PROJECT NUMBER
24-5008

SHEET
1 OF 1

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APPENDIX A

A-3 Well Completion Report

State of California

Well Completion Report

Form DWR 188 Submitted

WCR2025-011217

Owner's Well Number: Test Well 3 - Hansen Park **Date Work Began:** 02/27/2025 **Date Work Ended:** 04/18/2025

Local Permit Agency: Zone 7 Water Agency - Alameda County Flood Control and Water Conservation District **County:** Alameda

Secondary Permit Agency: **Permit Number:** 2024108 **Permit Date:** 11/20/2024

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: ---

Business Name: City of Pleasanton

Address: P.O. Box 520

City: Pleasanton **State:** California **Zip:** 94566

Planned Use and Activity

Activity: New Production or Monitoring Well

Planned Use: Test Well

Well Location

Address: 5697 BLACK AVE

City: PLEASANTON **Zip:** 94566

APN: 946-3405-25-5

Township: 03S **Range:** 01E

Section: 17 **BM:** Mount Diablo

Latitude: 37 Deg. 40 Min. 14.7612 Sec. N

Dec. Lat. : 37.670767

Vertical Datum:

Location Accuracy:

Longitude: -121 Deg. 53 Min. 41.2764 Sec. W

Dec. Long. : -121.894799

Horizontal Datum:

Location Determination Method:

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical **# of casings (Specify):** 2

Drilling Method: Direct Rotary **Drilling Fluid:** Bentonite

Total Depth of Boring: 770 Feet

Total Depth of Completed Well: 766 Feet

Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet)

Date Measured:

Estimated Yield*: (GPM) **Test Type:**

Test Length*: (Hours) **Total Drawdown:** (Feet)

***May not be representative of a well's long term yield.**

Geologic Log - Free Form

Depth from Surface (Feet to Feet)		Description
0	50	Sandy Clay - low to medium plastic, brown to grey-green, very fine to coarse sand
50	90	Sandy Gravel - granules and pebbles to 1", very fine to coarse sand
90	110	Sandy Clay - low plastic, brown, very fine to coarse sand
110	130	Sandy Gravel - granules and pebbles up to 1", very fine to coarse sand
130	165	Sandy Clay - low plastic, grey-green, very fine to coarse sand, brown to black

Depth from Surface (Feet to Feet)		Description
165	210	Sandy Gravel - granules, pebbles, very fine to coarse sand, brown to black
210	230	Sandy Clay - low plastic, light brown, medium to coarse sand, w/ small gravel stringers
230	250	Gravelly Sand - fine to coarse sand, brown to black, granules, w/ low plastic, light brown clay streaks
250	290	Sandy Clay - low plastic, light brown, very fine to coarse sand, w/ small gravel stringers
250	290	Sandy Clay - low plastic, light brown, very fine to coarse sand, w/ small gravel stringers
250	290	Sandy Clay - low plastic, light brown, very fine to coarse sand, w/ small gravel stringers
290	325	Gravel, Sand, and Clay - granules, very fine to coarse sand, low plastic, light brown clay
325	380	Sandy Clay - low plastic, light brown, very fine to coarse sand, black fines
380	410	Sandy Gravel - granules, fine to coarse, w/ low plastic, light brown clay streaks
410	450	Sandy Clay - low plastic, light brown, medium to coarse sand, multicolor
450	580	Gravelly Sand - fine to coarse, brown, granules and pebbles, w/ low plastic, brown clay streaks
580	605	Sandy Clay - low plastic, brown, very fine to coarse sand
605	640	Sandy Gravel - granules and pebbles, very fine to coarse sand, w/ low plastic, light brown clay streaks
640	650	Sandy Clay - low plastic, light brown, very fine to coarse sand
650	680	Gravelly Sand - very fine to coarse sand, granules and pebbles, w/ low plastic, light brown clay streaks
680	730	Sandy Clay - low plastic, light brown, sticky, very fine to coarse sand, w/ small gravel stringers
730	770	Sandy Gravel - granules and small pebbles and chips, blue, very fine to coarse sand

Casings

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	298	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	298	318	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	318	458	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	458	578	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	578	608	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	608	628	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	628	656	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	656	676	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	676	736	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	736	756	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139
1	756	766	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
2	0	100	Conductor or Fill Pipe	Low Carbon Steel	Other	0.312	18			Conductor

Annular Material

Depth from Surface (Feet to Feet)		Fill	Fill Type Details	Filter Pack Size	Description
0	100	Cement	10.3 Sack Mix		Conductor Seal
100	265	Cement	10.3 Sack Mix		Sanitary Seal
265	267	Other Fill	See description		2-ft Fine Sand Transition Seal
267	325	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 (Typ.)
325	440	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips (Typ.)
440	585	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 (Typ.)
585	600	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips (Typ.)
600	640	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 (Typ.)
640	650	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips (Typ.)
650	690	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 (Typ.)
690	720	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chips (Typ.)
720	770	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 (Typ.)

Other Observations:

Borehole Specifications

Depth from Surface (Feet to Feet)		Borehole Diameter (inches)
0	100	30
100	770	14

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

Name: NOR - CAL PUMP & WELL DRILLING INC

Person, Firm or Corporation

1325 BARRY ROAD YUBA CITY California 95993

	Address	City	State	Zip
Signed:	electronic signature received		11/14/2025	908591
	C-57 Licensed Water Well Contractor		Date Signed	License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

----	----	----	**N**	----	----	----	**W**
Latitude Deg/Min/Sec				**Longitude Deg/Min/Sec**			

APN: ----

Township: ---- **Range:** ----

Section: ---- **Tract:** ----

SEQ: ---- **BM:** ----

Attachments

No Attachments

APPENDIX A

A-4 Geophysical Surveys

PACIFIC SURVEYS

ELECTRIC LOG
GAMMA-RAY

Job No.
33366

File No.

Company NOR-CAL PUMP & WELL DRILLING, INC.
Well 24-5008 - SITE 3 - HANSEN PARK
Field PLEASANTON
County ALAMEDA State CA

Location:

HANSEN PARK
GPS: 37.6710 -121.8951

Sec. Twp. Rge.

Other Services:

NONE

Permanent Datum	G.L.	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Log Measured From	G.L. 0'		
Drilling Measured From	G.L.		

Date	03-21-2025		
Run Number	ONE		
Depth Driller	770'		
Depth Logger	770'		
Bottom Logged Interval	770'		
Top Log Interval	30'		
Casing Driller	16" @ 6'		
Casing Logger	N/A		
Bit Size	9.875"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	-- I 56		
pH / Fluid Loss	N/A		
Source of Sample	TANK		
Rm @ Meas. Temp	9.3 @ 77F		
Rmf @ Meas. Temp	9.3 @ 77F		
Rmc @ Meas. Temp	N/A		
Source of Rmf / Rmc	MEASURE		
Rm @ BHT	N/A		
Time Circulation Stopped	1235		
Time Logger on Bottom	1530		
Max. Recorded Temperature	N/A		
Equipment Number	PS-12		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	B. KEARNEY		

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Comments

RSN & RLN CORR.

Calibration Report

Database File 33366.db
Dataset Pathname elog
Dataset Creation Fri Mar 21 15:20:08 2025

ELOG Calibration Report

Serial:	PS-5
Model:	DTQ
Shop Calibration Performed:	Wed Jun 5 20:52:35 2024
Before Survey Verification Performed:	Mon Jun 17 14:29:32 2024
After Survey Verification Performed:	Mon Jun 17 14:38:13 2024

Shop Calibration

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.949	51.704		0.500	50.000	Ohm-m	0.975	-0.426
Long	3.050	206.798		2.000	200.000	Ohm-m	0.972	-0.964
IEE	37.120	6472.600	counts	0.041	7.084	A		
VSN	157.220	7384.180	counts	2.999	140.844	V		
VLN	104.080	1887.160	counts	1.985	35.995	V		

Before Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.553		376.985	101.542	Ohm-m	-2.712	376.985
Long	0.000	101.634		998.259	103.804	Ohm-m	-8.801	998.259
IEE	0.000	6633.100	counts	0.000	7.259	A		
VSN	108.320	7568.100	counts	2.066	144.352	V		
VLN	48.040	1893.520	counts	0.916	36.117	V		

After Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.589		0.000	101.553	Ohm-m	1.000	0.000
Long	0.000	101.822		0.000	101.634	Ohm-m	0.998	0.000
IEE	0.000	6564.580	counts	0.000	7.184	A		
VSN	112.140	7492.520	counts	2.139	142.911	V		
VLN	53.260	1877.440	counts	1.016	35.810	V		

After Survey Verification compared to Before Survey Calibration

	Zero			Cal		
	Before	After		Before	After	
Short	376.985	0.000	Ohm-m	101.542	101.553	Ohm-m
Long	998.259	0.000	Ohm-m	103.804	101.634	Ohm-m

Gamma Ray Calibration Report

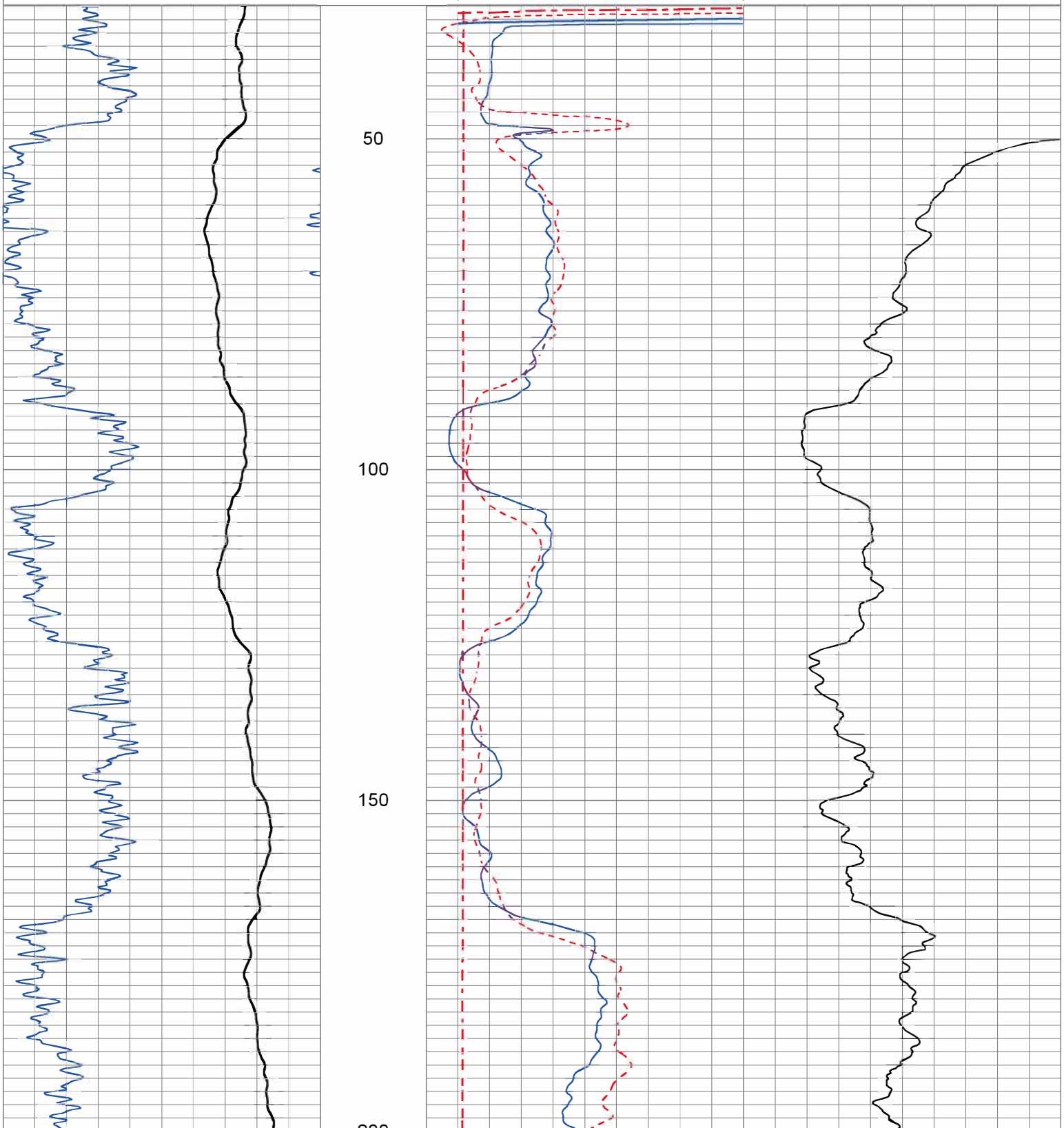
Serial Number:	D4	
Tool Model:	ELOG	
Performed:	Tue Apr 11 11:55:04 2023	
Calibrator Value:	162.0	GAPI
Background Reading:	124.7	cps
Calibrator Reading:	352.0	cps
Sensitivity:	0.5129	GAPI/cps

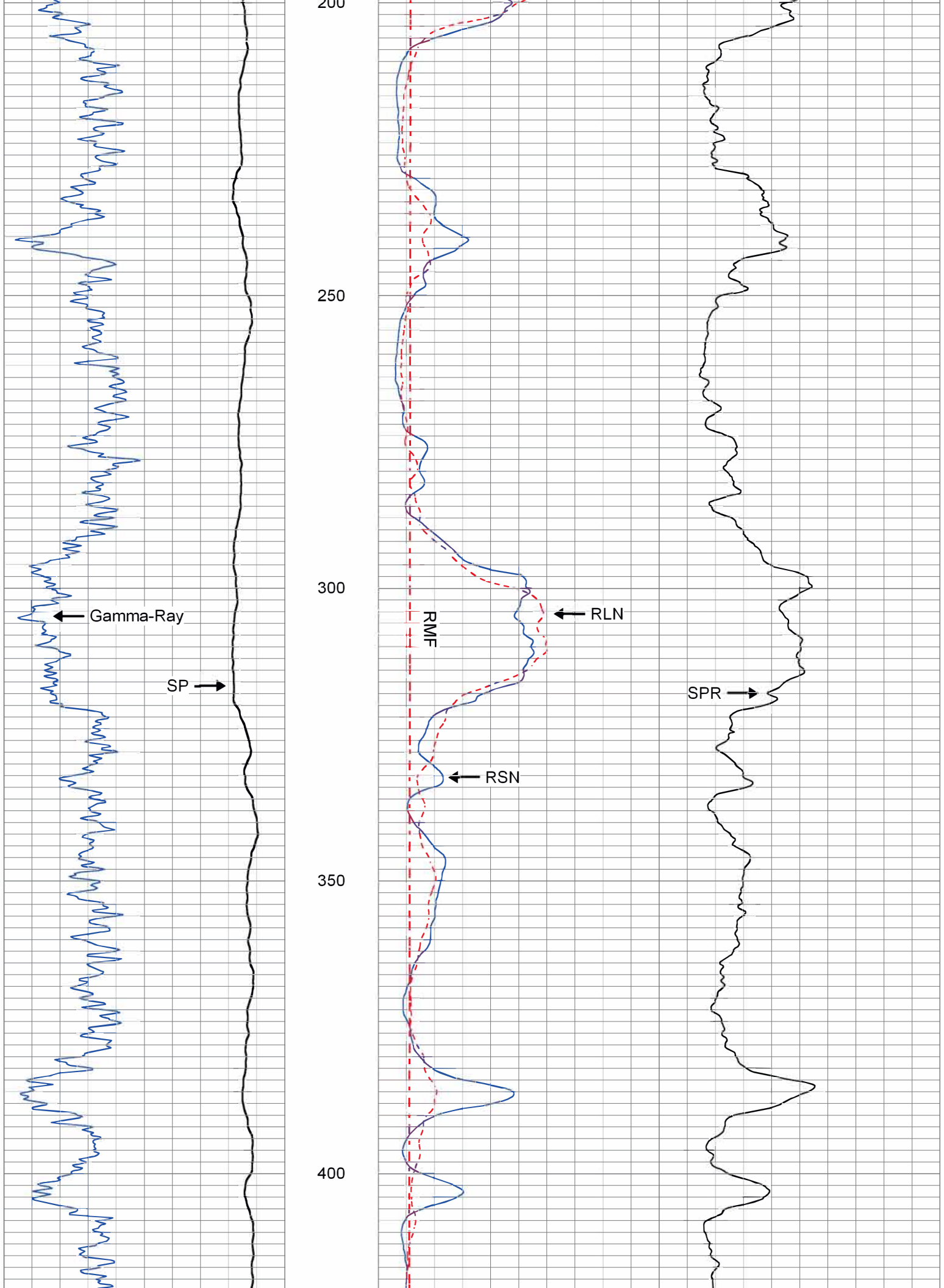
Database File	33366.db
Dataset Pathname	elog
Presentation Format	elog_cwa
Dataset Creation	Fri Mar 21 15:20:08 2025
Charted by	Depth in Feet scaled 1:240

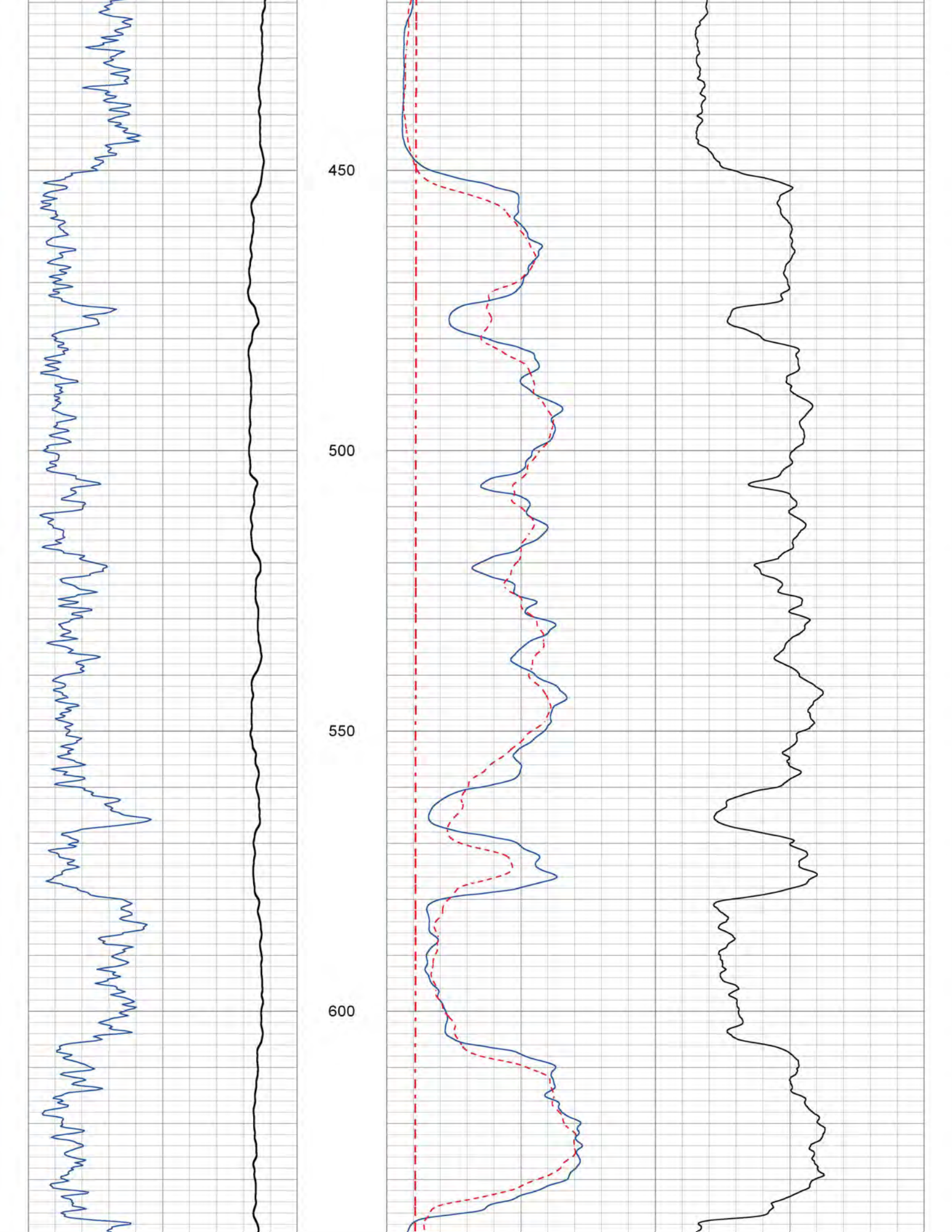
-120	SP (mV)	-20
30	Gamma-Ray (GAPI)	130

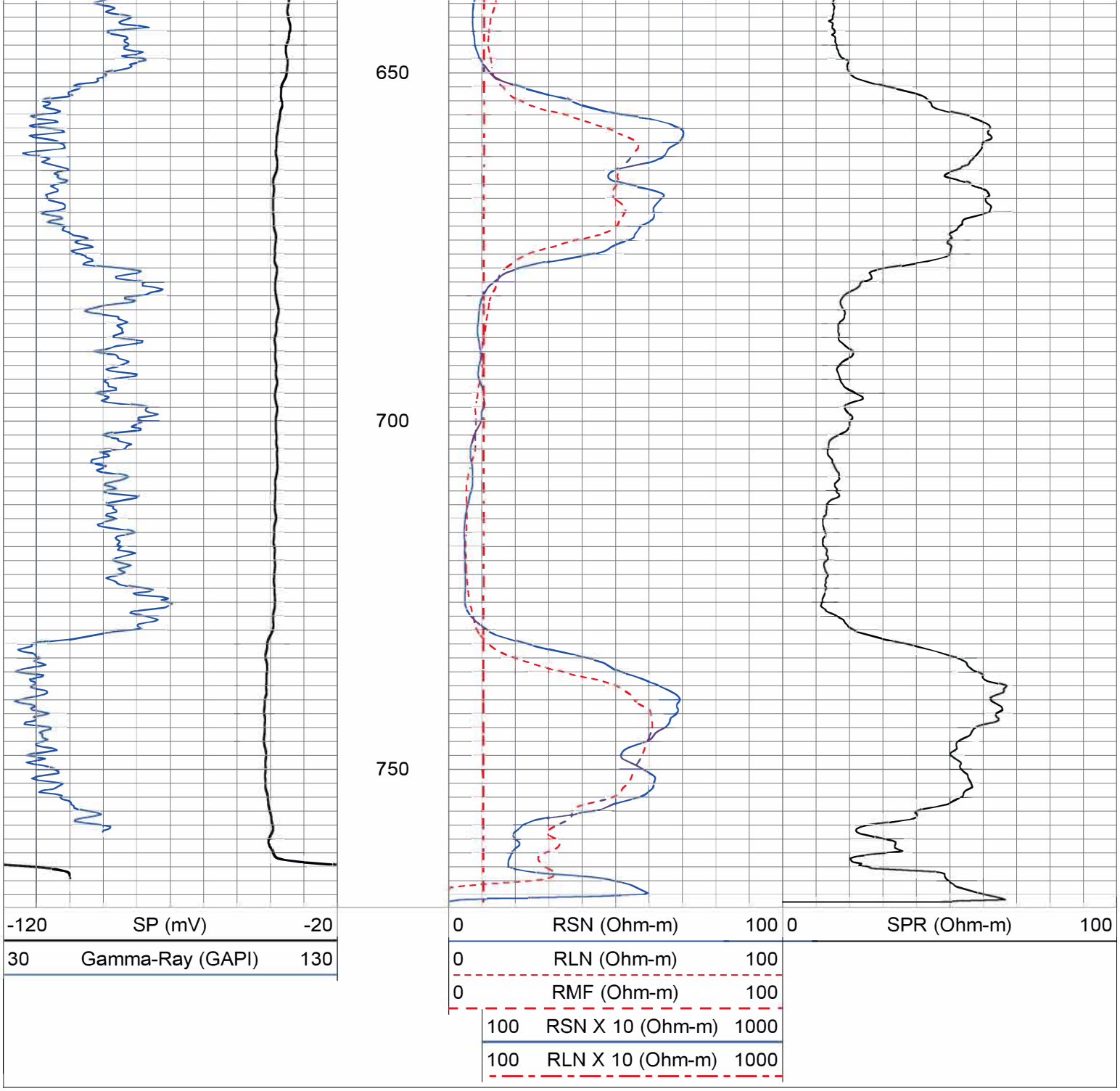
0	RSN (Ohm-m)	100
0	RLN (Ohm-m)	100
0	RMF (Ohm-m)	100
100	RSN X 10 (Ohm-m)	1000
100	RLN X 10 (Ohm-m)	1000

0	SPR (Ohm-m)	100




200
250
300
350
400
Gamma-Ray
SP
RMF
RLN
RSN
SPR


450
500
550
600



Log Variables

DatabaseC:\ProgramData\Warrior\Data\33366.db
Dataset field/well/run1/elog/_vars_

Top - Bottom

BOREID in	BOTTEMP degF	CASEOD in	CASETHCK in	PERFS	RM_MEAS_R Ohm-m	RM_MEAS_T degF
7.875	69	0	0	No	9.3	77

RMF Ohm-m	RSH Ohm-m	SPSHIFT mV	SRFTEMP degF	TDEPTH ft	TempGrad degF/ft
9.3	20	0	59	770	0.01235

Variable Description

BOREID : Borehole I.D.
BOTTEMP : Bottom Hole Temperature
RMF : Resistivity of Mud Filtrate
RSH : Resistivity of Shale

CASEOD : Casing O.D.
CASETHCK : Casing Thickness
PERFS : Perforation Flag
RM_MEAS_R : Mud Resistivity Measured
RM_MEAS_T : Mud Temperature Measured
SPSHIFT : S.P. Baseline Offset
SRFTEMP : Surface Temperature
TDEPTH : Total Depth
TempGrad : Temperature Gradient

Filter Report

Database File	33366.db
Dataset Pathname	elog
Dataset Creation	Fri Mar 21 15:20:08 2025

Filter Name	Filter Type	Filter Length
		(ft)
LSPD	Gaussian	6.00
LTEN	None	
LSPDRT	None	
IEE	None	
VSN	None	
VLN	None	
SP	Gaussian	4.00
RSN	Gaussian	2.00
RLN	Gaussian	3.00
SPR	Gaussian	1.00
GR	Gaussian	2.00
HVOLT	Gaussian	1.00
INCL	None	
AZI	None	
ROLL	None	
MAG ROLL	None	
ACC TOTAL	None	
MTEMP	None	

APPENDIX A

A-5 Caliper Survey

PACIFIC SURVEYS

ELECTRIC LOG
GAMMA-RAY

Job No. 33368

Company NOR-CAL PUMP & WELL DRILLING, INC.

Well 24-5008 - SITE 3 - HANSEN PARK

Field PLEASANTON

File No.

County ALAMEDA State CA

Location:

HANSEN PARK
GPS: 37.6710 -121.8951

Sec. Twp. Rge.

Other Services:

NONE

Permanent Datum	G.L.		Elevation	K.B.
Log Measured From	G.L.	0'	above perm. datum	D.F.
Drilling Measured From	G.L.			G.L.

Date	03-26-2025
Run Number	ONE
Depth Driller	196'
Depth Logger	196'
Bottom Logged Interval	195.5'
Top Log Interval	0'
Type Caliper	3-ARM
Type Fluid in Hole	BENTONITE
Density / Viscosity	N/A
Max. Recorded Temp.	N/A
pH/Fluid Loss	N/A
Time Well Ready	1700
Time Logger on Bottom	1730
Equipment Number	PS-12
Location	SAC
Recorded By	SCHUMACHER
Witnessed By	--

Borehole Record

Run Number	Bit	From	To

Gravel Feed/Tubing Schedule

Size	Type	From	To

Casing Schedule	Size	Wgt/Ft	Top	Bottom
Surface String	18" TEMPORARY		0'	7'
Production String				
Production String				
Production String				
Production String				

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Comments

Calibration Report

Database File	33368.db
Dataset Pathname	cal.1
Dataset Creation	Wed Mar 26 17:51:11 2025

XY Caliper Calibration Report

Serial Number/Model:	PS-8_Short-ALLEN
Performed:	Wed Mar 26 17:32:00 2025

	Ring		X Caliper		Y Caliper	
1:	20.00	in	3478.35	cps	3478.35	cps
2:	14.00	in	4100.12	cps	4100.12	cps
3:	9.63	in	4421.33	cps	4421.33	cps
4:	8.00	in	4554.38	cps	4554.38	cps
5:	5.25	in	4742.54	cps	4742.54	cps
6:	4.00	in	4830.11	cps	4830.11	cps
7:		in		cps		cps
8:		in		cps		cps
9:		in		cps		cps
10:		in		cps		cps

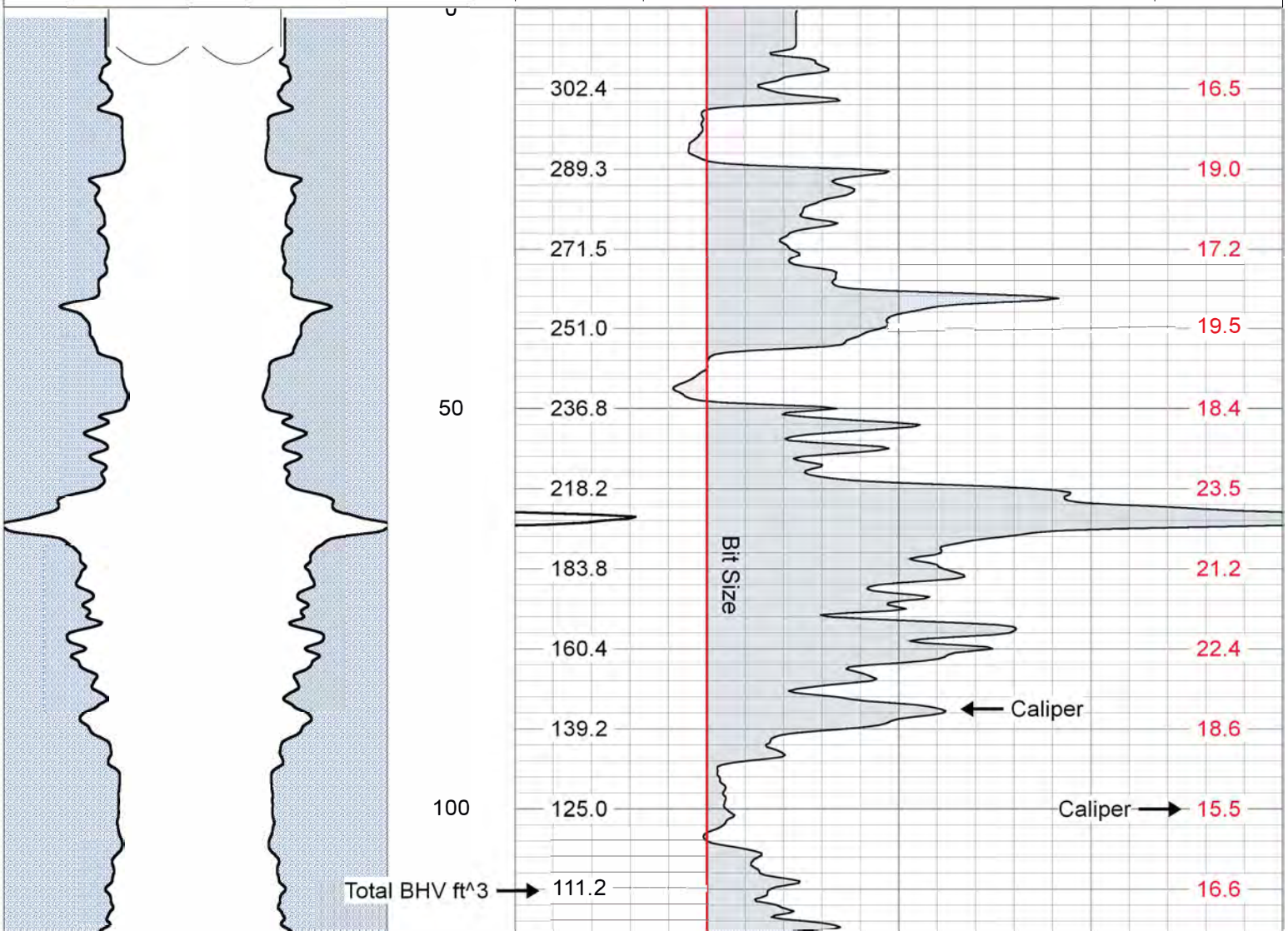
Database File	33368.db
Dataset Pathname	cal.1
Presentation Format	xyc_gph_final
Dataset Creation	Wed Mar 26 17:51:11 2025
Charted by	Depth in Feet scaled 1:240

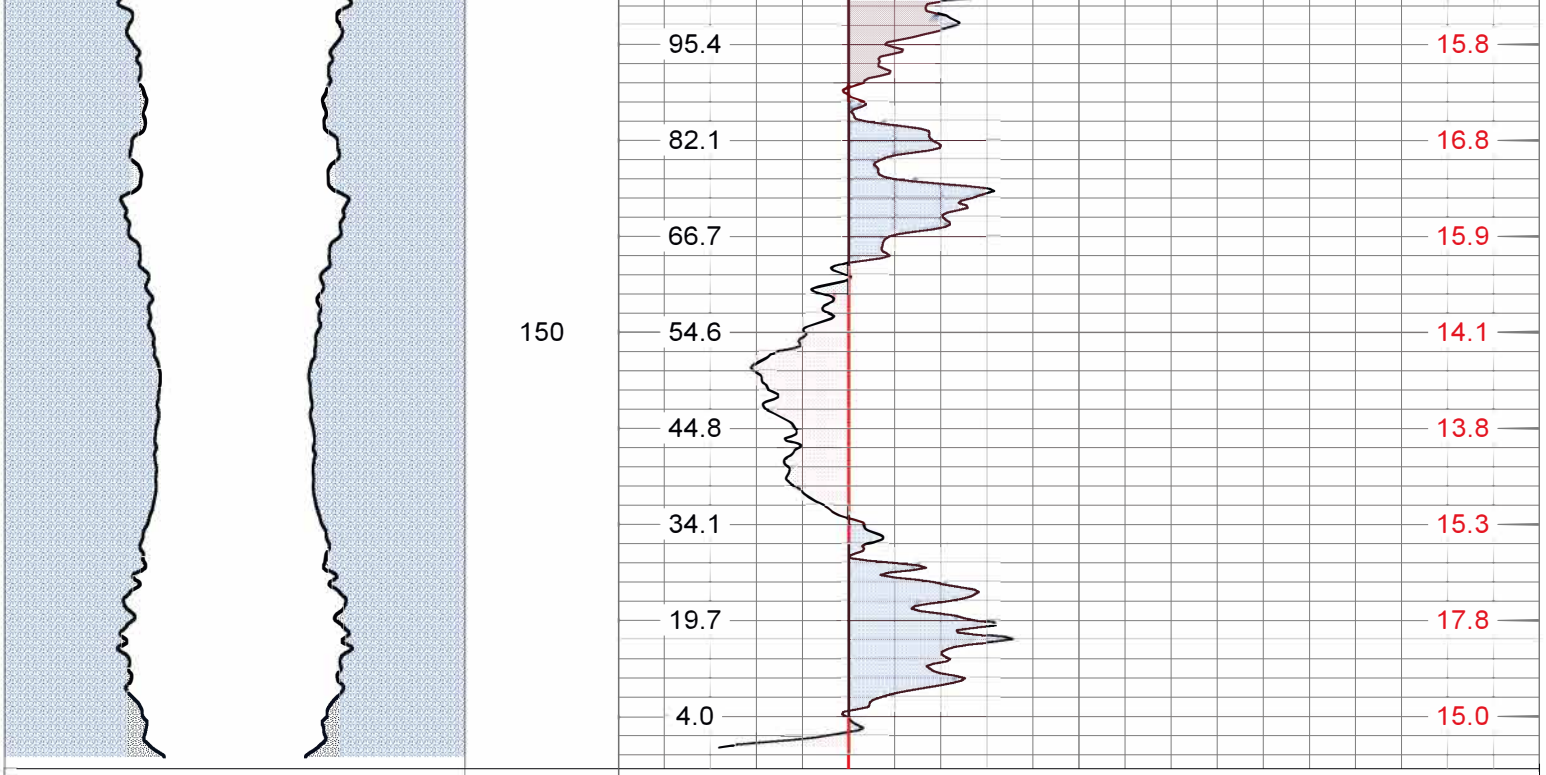
CSG SCHEDULE

Pipe(s) proportional to Hole Size

10	Caliper (in)	30
10	Bit Size (in)	30
30	Caliper back-up (in)	50

Total BHV ft^3 (ft3) | Caliper (in)





CSG SCHEDULE			
Pipe(s) proportional to Hole Size	10	Caliper (in)	30
	10	Bit Size (in)	30
	30	Caliper back-up (in)	50
	Total BHV ft^1 (ft3)		Caliper (in)

Log Variables

DatabaseC:\ProgramData\Warrior\Data\33368.db
Dataset field/well/run1/cal.1/_vars_

Top - Bottom

BOREID	BOTTEMP	CASEOD	CASETHCK	PERFS	SRFTEMP	TDEPTH
in	degF	in	in		degF	ft
15	100	0	0	No	0	0

Variable Description

BOREID : Borehole I.D.
BOTTEMP : Bottom Hole Temperature
CASEOD : Casing O.D.
CASETHCK : Casing Thickness
PERFS : Perforation Flag
SRFTEMP : Surface Temperature
TDEPTH : Total Depth

APPENDIX A

A-6 Dynamic Spinner Survey

PACIFIC SURVEYS

1-INCH SPINNER FLUID VELOCITY SPINNER ANALYSIS PUMPING CONDITION

Job No. 33555

File No.

Company LUHDORF & SCALMANINI

Well ZONE 7 - HANSEN PARK TEST WELL

Field PLEASANTON

County ALAMEDA State CA

Location:

HANSEN PARK
GPS: 37.6710 -121.8951

Sec. Twp. Rge.

Other Services:

DOWN RUNS
STOP COUNTS
FLUID SAMPLES

			Elevation
Permanent Datum	G.L.	Elevation above perm. datum	K.B.
Log Measured From	G.L. 0'		D.F.
Drilling Measured From	G.L.		G.L.

Date	06-03-2025		
Run Number	ONE		
Depth Driller	766'		
Depth Logger	N/A		
Bottom Logged Interval	760'		
Top Log Interval	180'		
Pump Set @	105'		
Time Pumping Prior to Survey	5 HRS		
Pumping Water Level	42'		
Max. Recorded Temp.	N/A		
Pump Rate (GPM)	550		
Time Well Ready	1100		
Time Logger on Bottom	1615		
Equipment Number	PS-12		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	--		

Perforation Record				Perforation Record			
Type	Slot Size	From	To	Type	Slot Size	From	To
FUL-FLO	0.060"	298'	318'	FUL-FLO	0.060"	736'	756'
FUL-FLO	0.060"	458'	578'				
FUL-FLO	0.060"	608'	628'				
FUL-FLO	0.060"	656'	676'				

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String	18" ID	0.3125"	0'	100'
Camera Tube				
Production String	8" ID	0.3125"	0'	766'
Liner				

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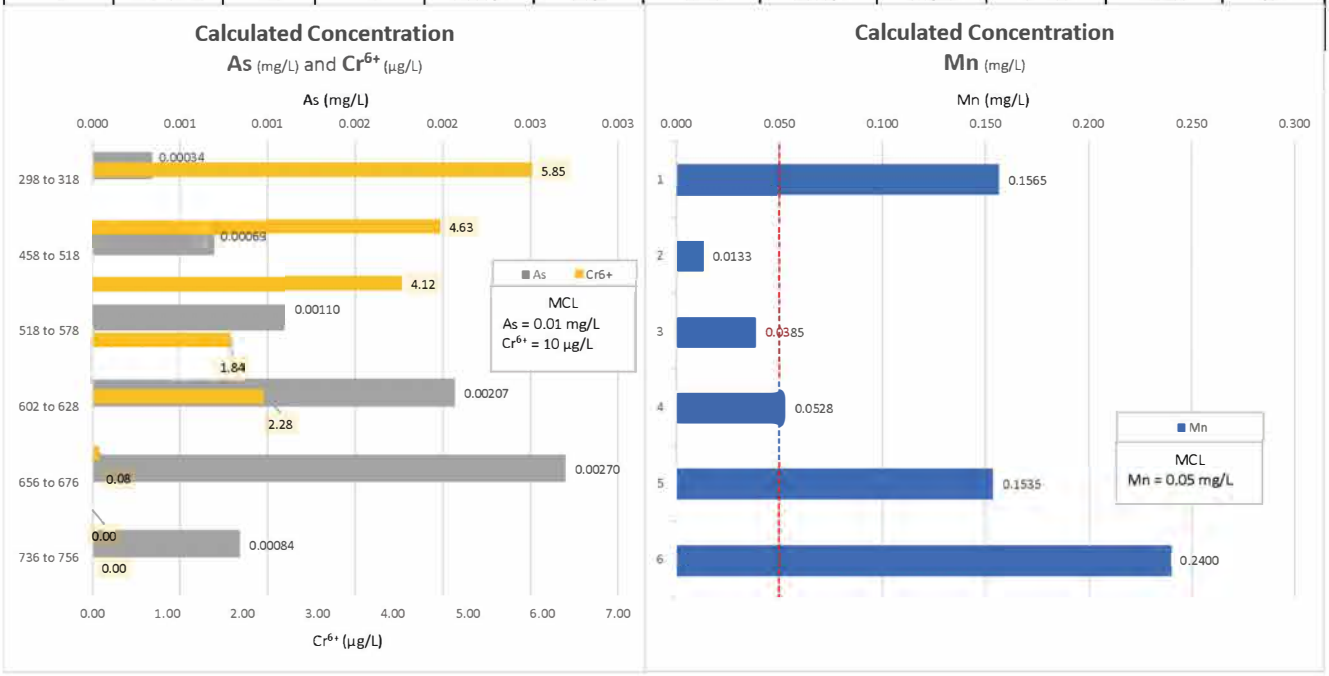
Comments

1.5-INCH ID PVC ACCESS TUBE INSTALLED TO APPROX. 106 FT.

Zone 7 - Hansen Park Test Well

Mass Balance Analysis
June 3, 2025

Sample Zone	Sample Zone Depth (feet)	Sample Depth (feet)	Flowrate (GPM)	Measured Concentration			Calculated Concentration			Measured	
				As mg/L	Cr^{6+} µg/L	Mn mg/L	As mg/L	Cr^{6+} µg/L	Mn mg/L	PFHxS µg/L	Spec. Cond. µmhos/cm
1	298 to 318	Surface	92	0.00089	4.200	0.063	0.00034	5.8500	0.1565	2.7300	930
2	458 to 518	448	293	0.00099	3.900	0.046	0.00069	4.6270	0.0133	2.7000	933
3	518 to 578	518	121	0.00140	2.900	0.091	0.00110	4.1165	0.0385	0.0000	773
4	602 to 628	598	25	0.00180	1.300	0.160	0.00207	1.8360	0.0528	0.0000	665
5	656 to 676	646	31	0.00170	1.100	0.200	0.00270	2.2822	0.1535	0.0000	693
6	736 to 756	726	36	0.00084	0.082	0.240	0.00084	0.0820	0.2400	2.5300	894

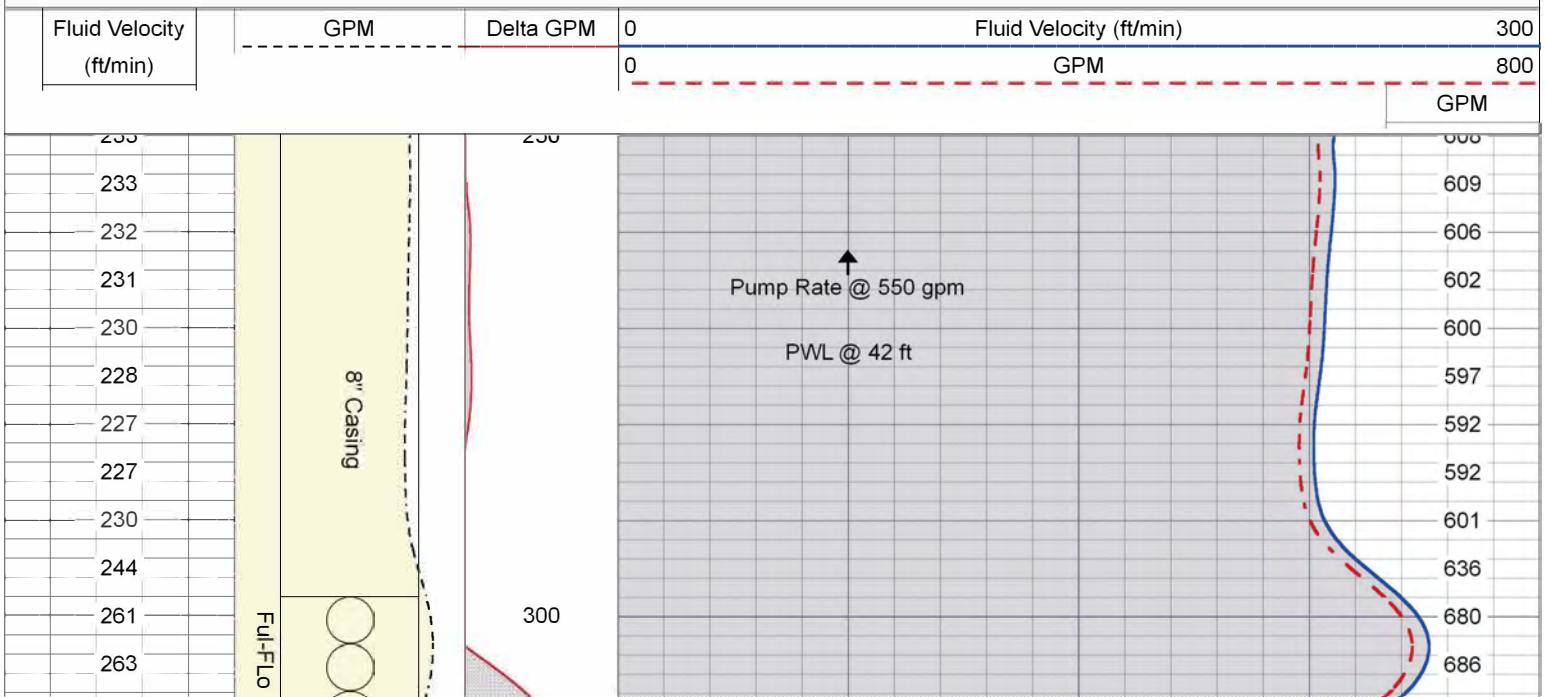


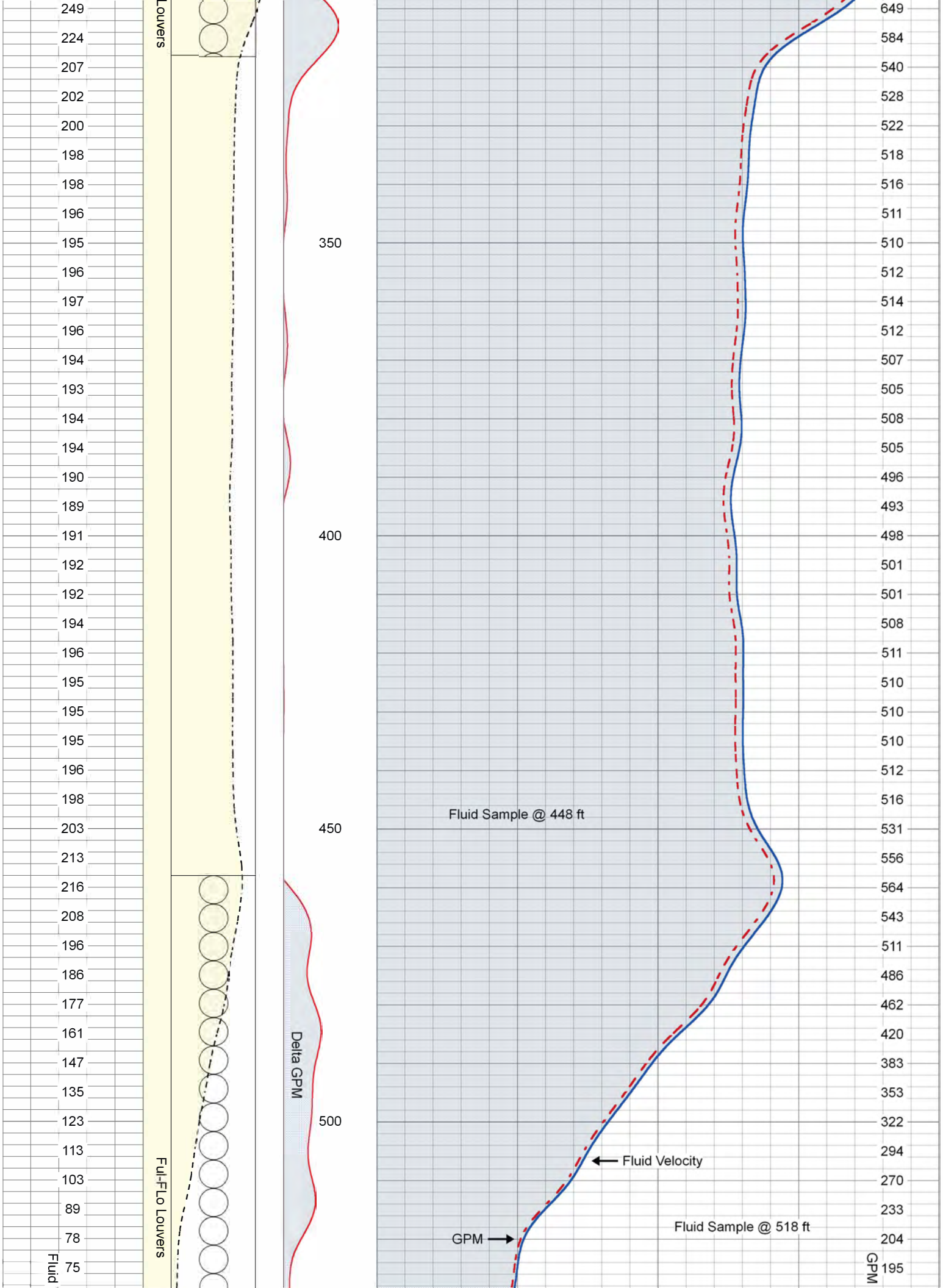
800.919.7555
909.625.6262

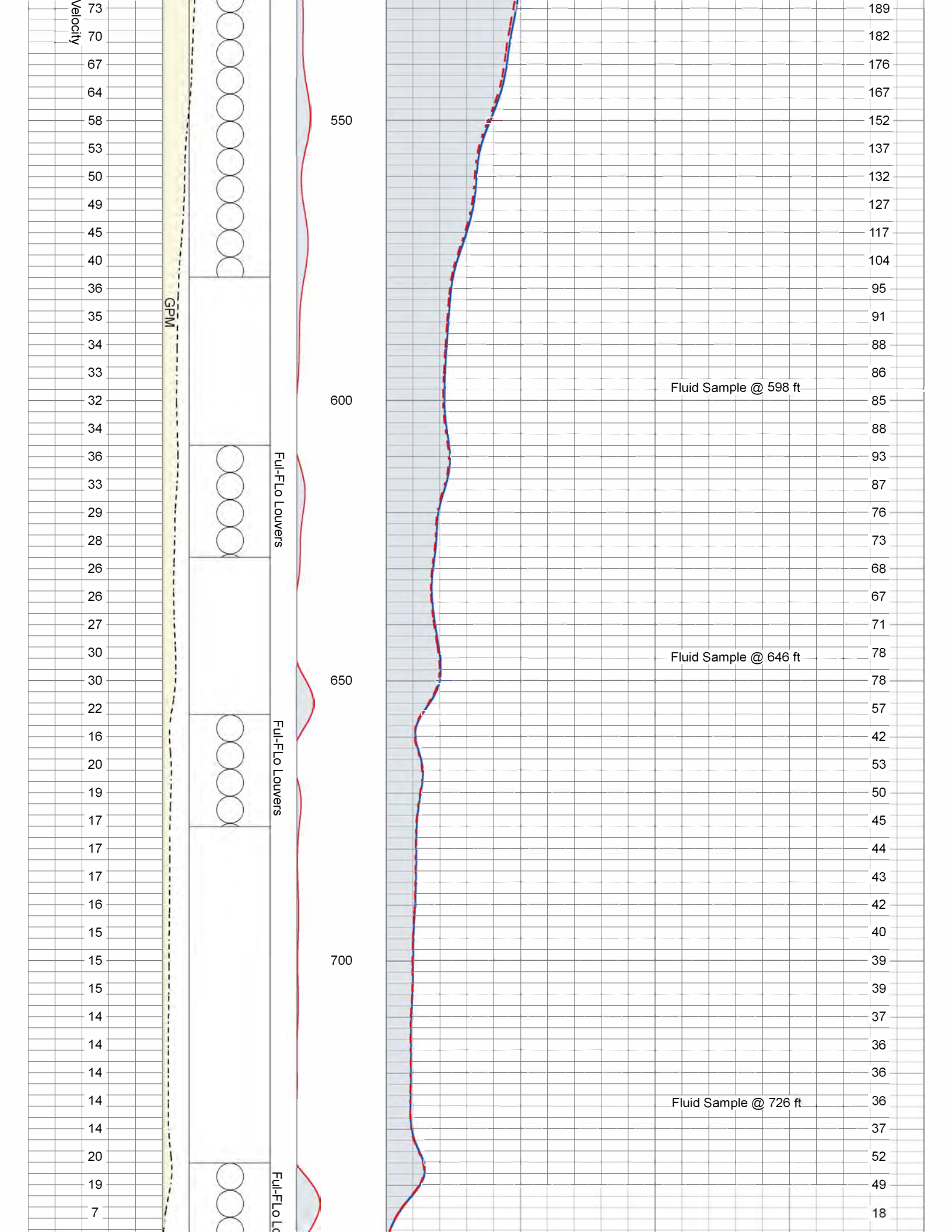
1785 w. arrow rte., bldg. d, ste 3,4
upland, ca 91786
www.pacificsurveys.com

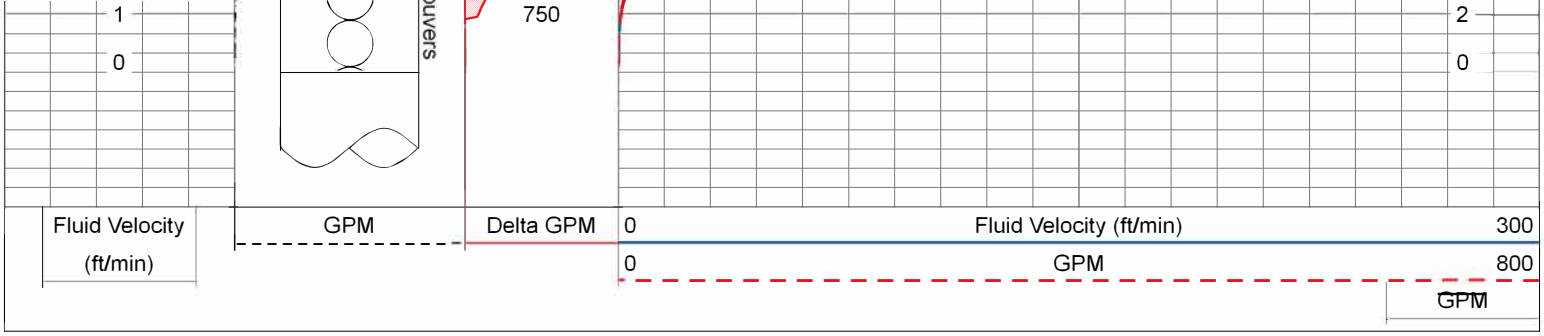
fax: 909.399.3180

Database File	33555.db
Dataset Pathname	33555_fldgpm
Presentation Format	spinmerg
Dataset Creation	Wed Jul 02 11:47:39 2025 Imported depthlog
Charted by	Depth in Feet scaled 1:240




Louvers
Ful-FLo Louvers
Fluid
Delta GPM
350
400
450
500
Fluid Sample @ 448 ft
Fluid Velocity
GPM
Fluid Sample @ 518 ft
GPM
249
224
207
202
200
198
198
196
195
196
197
196
194
193
194
194
190
189
191
192
192
194
196
195
195
195
196
198
203
213
216
208
196
186
177
161
147
135
123
113
103
89
78
75
649
584
540
528
522
518
516
511
510
512
514
512
507
505
508
505
496
493
498
501
501
508
511
510
510
510
512
516
531
556
564
543
511
486
462
420
383
353
322
294
270
233
204
195


Velocity
GPM
Ful-FLo Louvers
Ful-FLo Louvers
Ful-FLo Louvers
550
600
650
700
Fluid Sample @ 598 ft
Fluid Sample @ 646 ft
Fluid Sample @ 726 ft


1
0
750
2
0
Fluid Velocity
(ft/min)
GPM
Delta GPM
0
Fluid Velocity (ft/min)
300
0
GPM
800
GPM

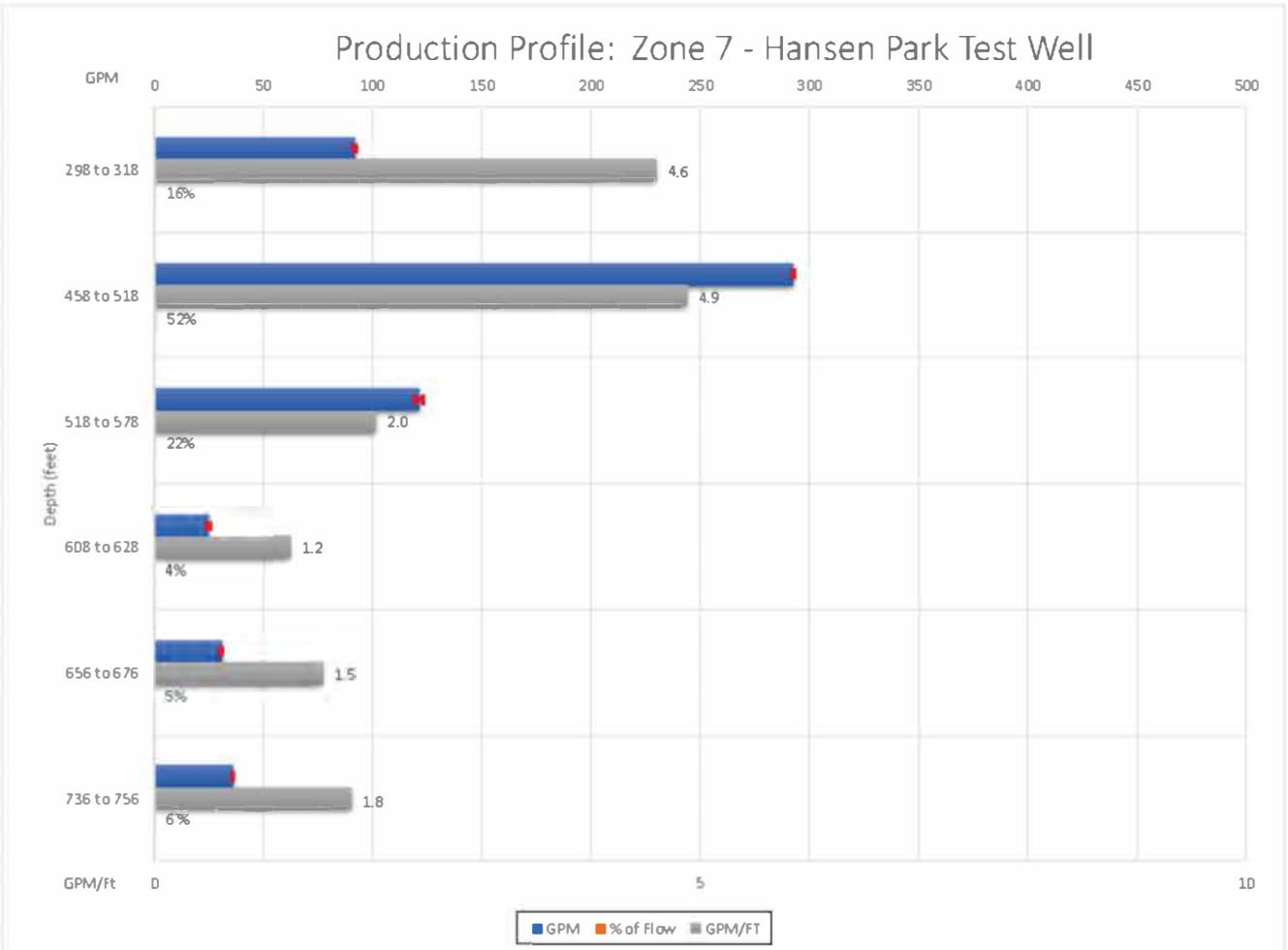
SPINNER LOG ANALYSIS

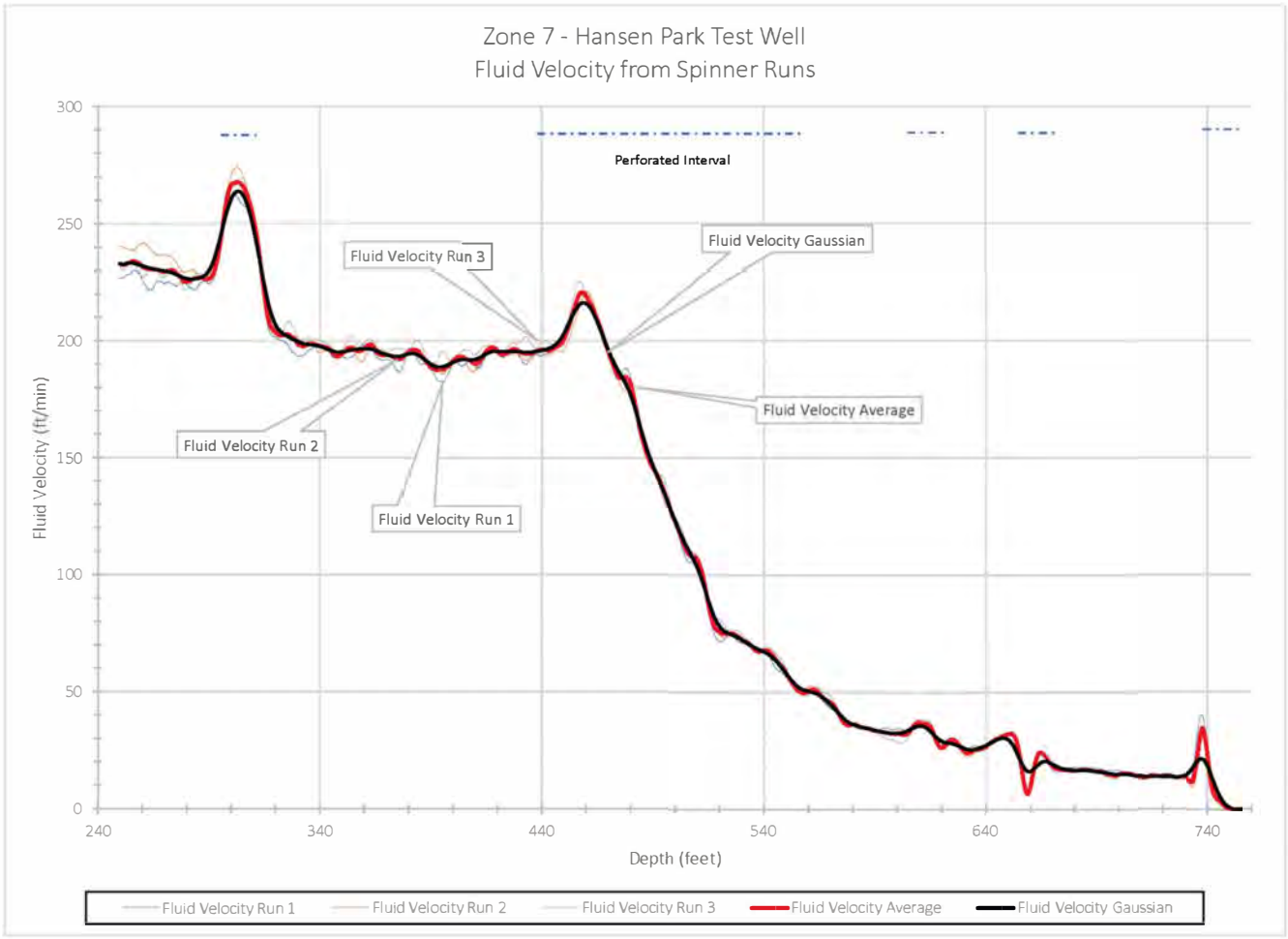
Pacific Surveys
geophysical well logging

Company: Luhdorf & Scalmanini
Well: Zone 7 - Hansen Park Test Well
County: Alameda

3-Jun-2025
Job No. 33555

SURFACE FLOW RATE	598	GPM			
FLUID SAMPLE ZONES	PRODUCTION (GPM)	% OF FLOW (ZONES)	GPM/FT	STD DEV (GPM)	STD ERROR (+/- GPM)
298 to 318	92	15.4%	4.6	13	0.7
458 to 518	293	49.0%	4.9	11	0.4
518 to 578	121	20.2%	2.0	10	1.8
608 to 628	25	4.2%	1.2	1	0.3
656 to 676	31	5.2%	1.5	4	0.5
736 to 756	36	6.0%	1.8	2	0.1


Production Profile: Zone 7 - Hansen Park Test Well
GPM
0
50
100
150
200
250
300
350
400
450
500
298 to 318
4.6
16%
458 to 518
4.9
52%
518 to 578
2.0
22%
608 to 628
1.2
4%
656 to 676
1.5
5%
736 to 756
1.8
6%
Depth (feet)
GPM/ft
0
5
10
GPM
% of Flow
GPM/FT


Zone 7 - Hansen Park Test Well
Fluid Velocity from Spinner Runs
Perforated Interval
Fluid Velocity Run 3
Fluid Velocity Gaussian
Fluid Velocity Average
Fluid Velocity Run 2
Fluid Velocity Run 1
Fluid Velocity (ft/min)
300
250
200
150
100
50
0
240
340
440
540
640
740
Depth (feet)
Fluid Velocity Run 1
Fluid Velocity Run 2
Fluid Velocity Run 3
Fluid Velocity Average
Fluid Velocity Gaussian

APPENDIX A

A-7 Static Spinner Survey

PACIFIC SURVEYS

3-INCH SPINNER
UP & DOWN RUNS
SPINNER ANALYSIS
NON-PUMPING CONDITION

Job No. 33556

File No.

Company LUHDORF & SCALMANINI

Well ZONE 7 - HANSEN PARK TEST WELL

Field PLEASANTON

County ALAMEDA State CA

Location:

HANSEN PARK
GPS: 37.6710 -121.8951

Sec. Twp. Rge.

Other Services:

STATIC SPN

			Elevation
Permanent Datum	G.L.	Elevation above perm. datum	K.B.
Log Measured From	G.L. 0'		D.F.
Drilling Measured From	G.L.		G.L.

Date	06-04-2012		
Run Number	ONE		
Depth Driller	766'		
Depth Logger	N/A		
Bottom Logged Interval	762'		
Top Log Interval	10'		
Pump Set @	N/A		
Time Pumping Prior to Survey	N/A		
Pumping Water Level	26' SWL		
Max. Recorded Temp.	N/A		
Pump Rate (GPM)	N/A		
Time Well Ready	0900		
Time Logger on Bottom	0930		
Equipment Number	PS-12		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	B. KEARNEY		

Perforation Record				Perforation Record			
Type	Slot Size	From	To	Type	Slot Size	From	To
FUL-FLO	0.060"	298'	318'	FUL-FLO	0.060"	736'	756'
FUL-FLO	0.060"	458'	578'				
FUL-FLO	0.060"	608'	628'				
FUL-FLO	0.060"	656'	676'				

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String	18" ID	0.3125"	0'	100'
Camera Tube				
Production String	8" ID	0.3125"	0'	766'
Liner				

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

Comments

NOT ENOUGH STATIC FLUID VELOCITY TO COLLECT STOP COUNTS.

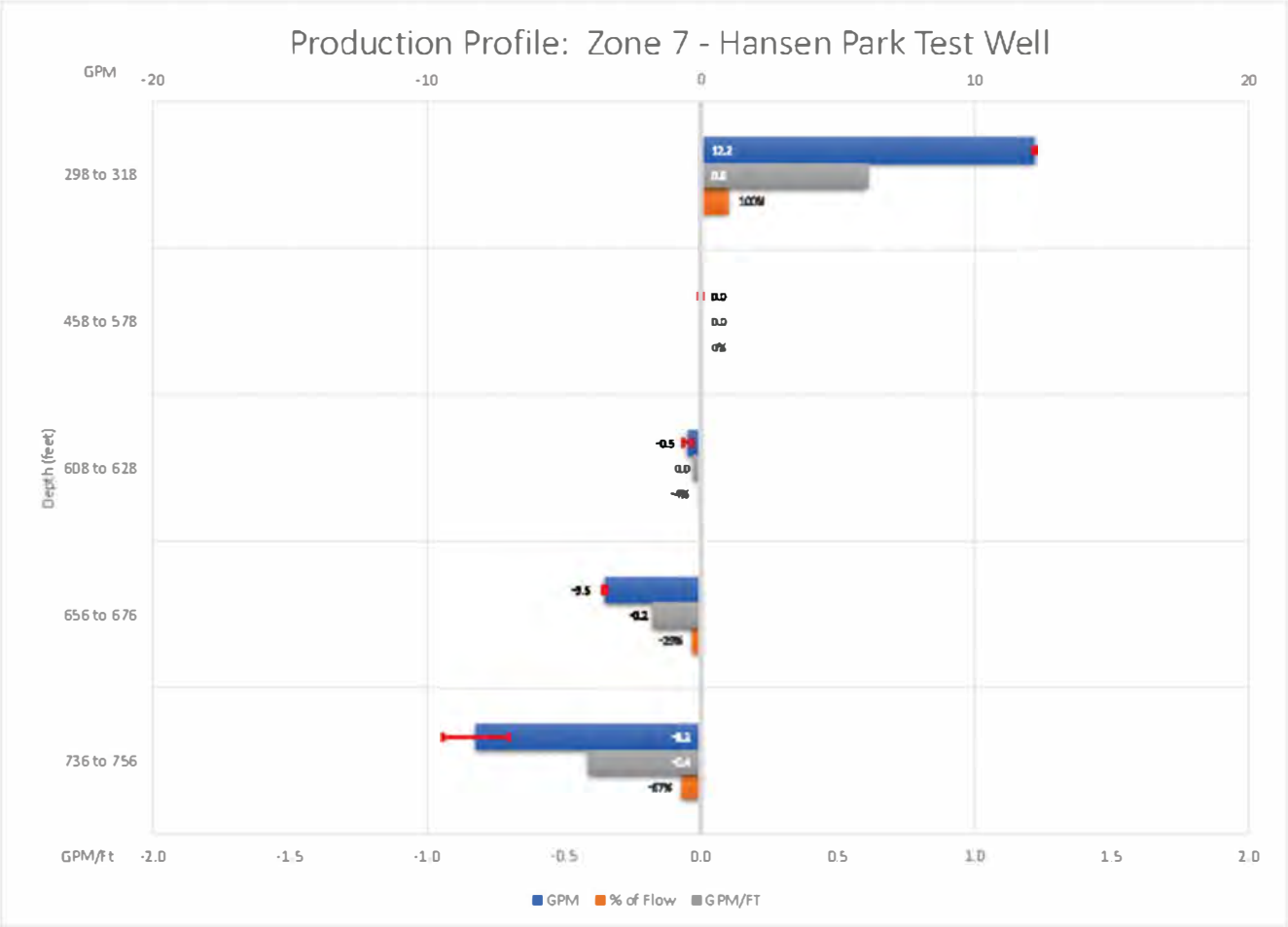
3"

Company: Luhdorf & Scalmanini
Well: Zone 7 - Hansen Park Test Well
County: Alameda

4-Jun-2025
Job No. 33556

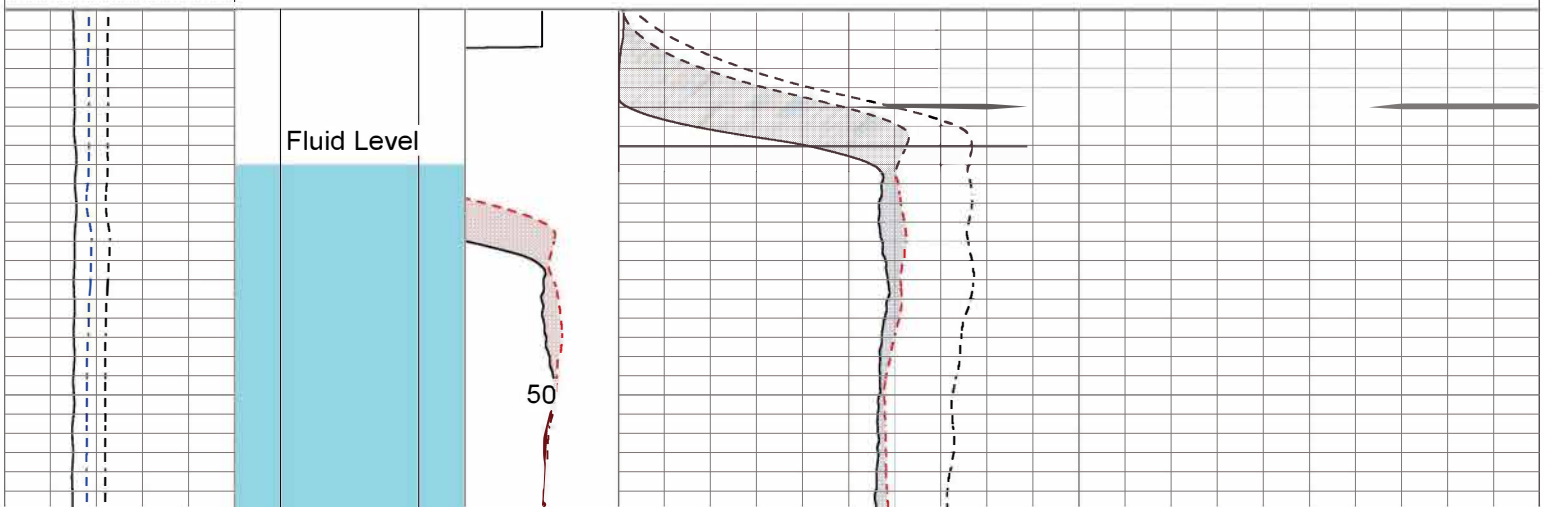
(DOWN) VERTICAL FLOW 12.2 GPM

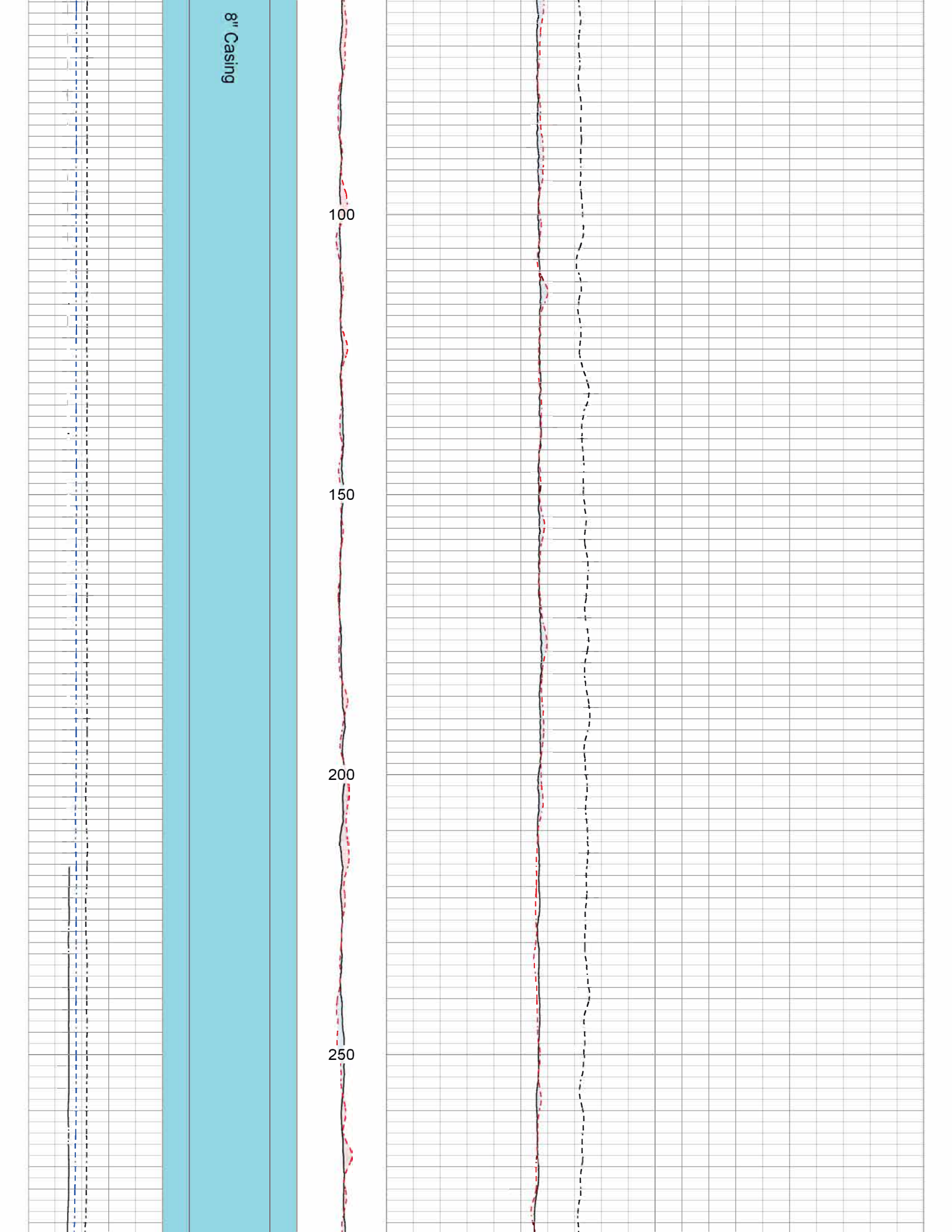
SCREEN DEPTHS	PRODUCTION (GPM)	% OF FLOW (ZONES)	GPM/FT	STD DEV (GPM)	STD ERROR (+/- GPM)
298 to 318	12.2	100%	0.6	1.6	0.0
458 to 578	0.0	0%	0.0	1.1	0.1
608 to 628	-0.5	-4%	0.0	1.8	0.2
656 to 676	-3.5	-29%	-0.2	1.6	0.1
736 to 756	-8.2	-67%	-0.4	3.0	1.2

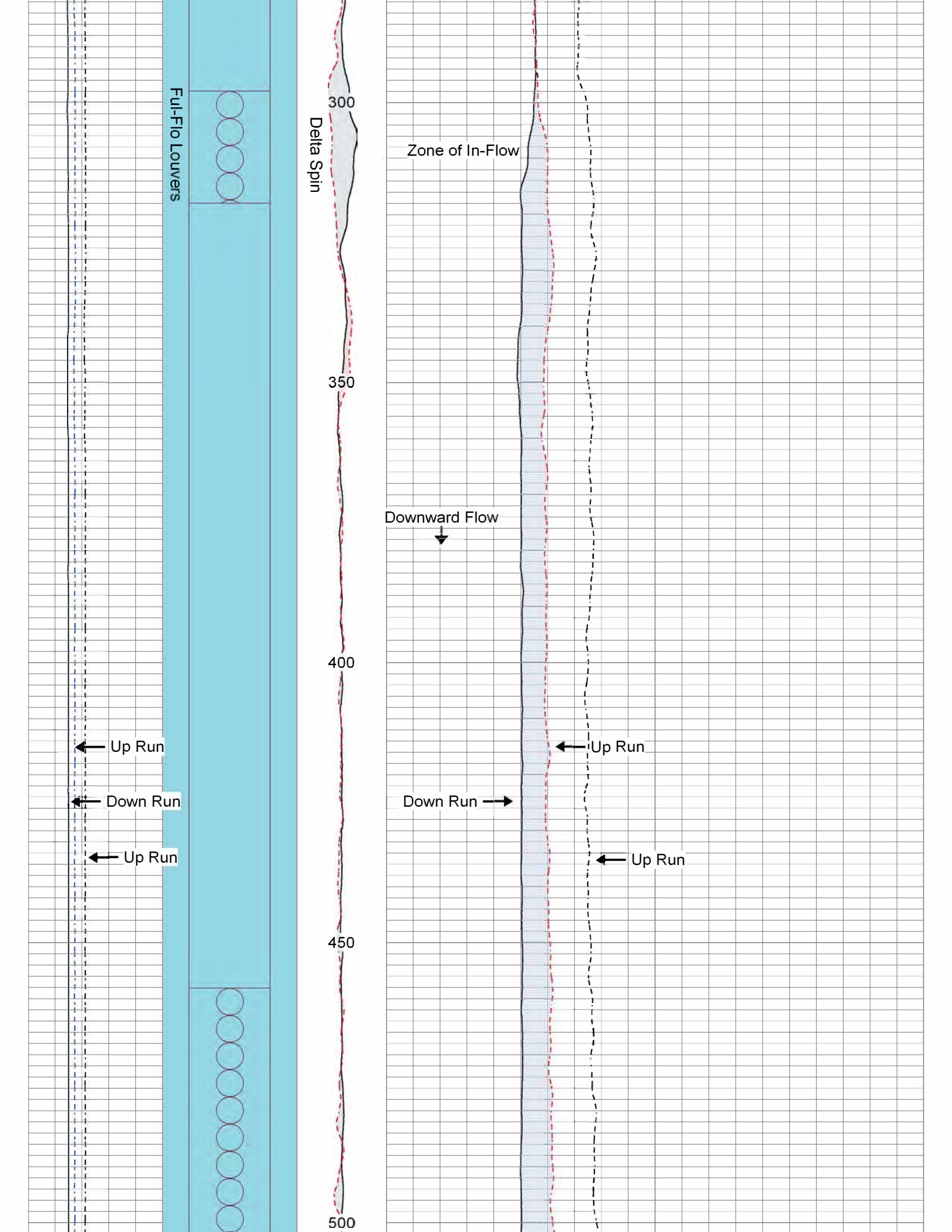


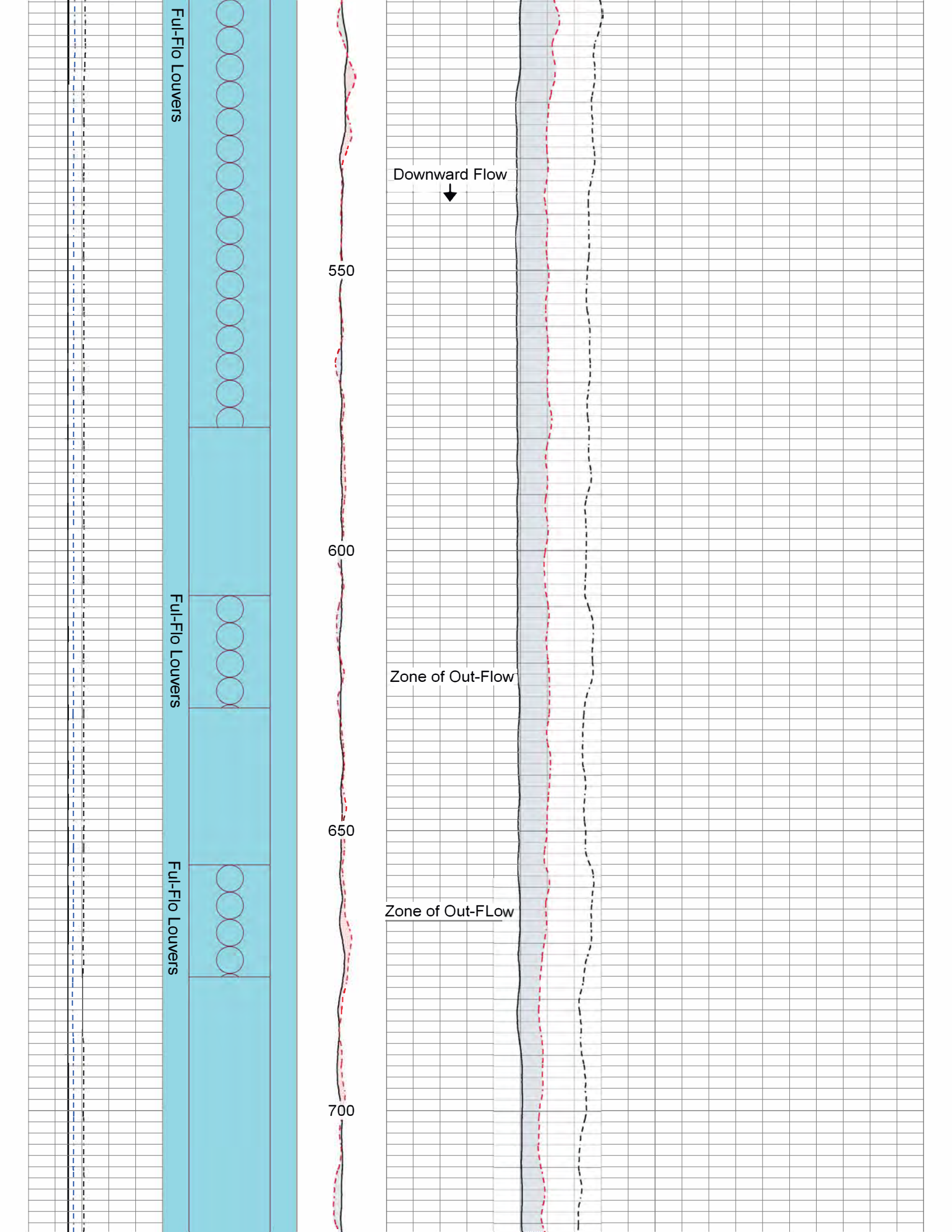
Database File	33556.db
Dataset Pathname	spnD1
Presentation Format	spinmerg
Dataset Creation	Wed Jun 04 09:10:22 2025
Charted by	Depth in Feet scaled 1:240

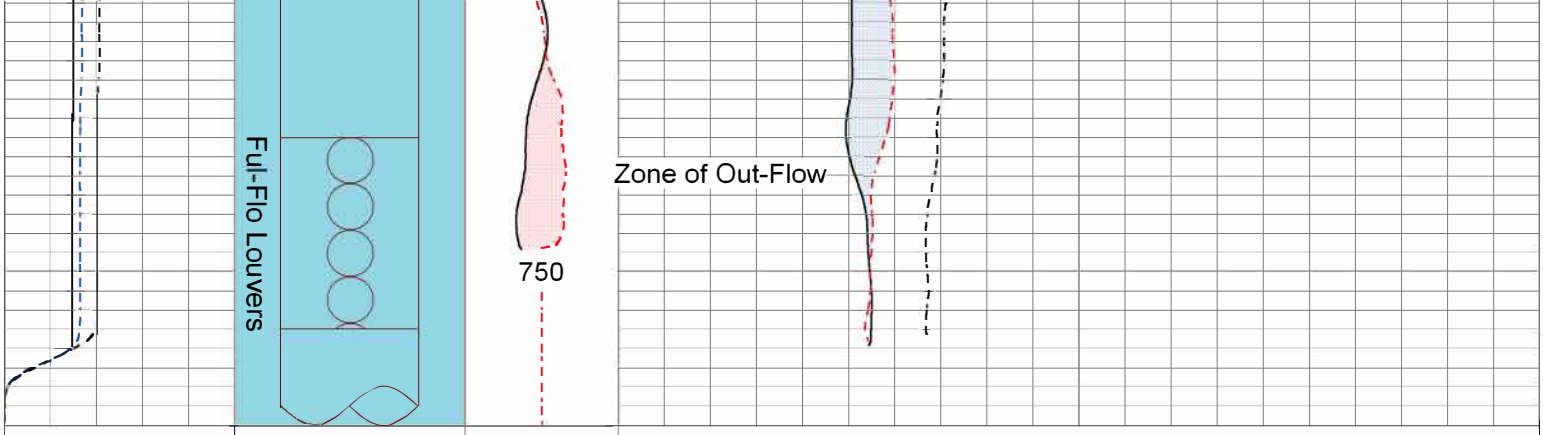
LS		Delta Spin	0	Spinner Down Run (cps)	60
0 (ft/min) -150		Delta Spin	0	Spinner Up Run (cps)	60
0 LS (ft/min)150			0	Spinner Up Run (cps)	60
0 LS (ft/min)150					




8" Casing
100
150
200
250


Ful-Flo Louvers
Delta Spin
300
350
400
450
500
Zone of In-Flow
Downward Flow
Up Run
Down Run
Up Run
Up Run
Down Run
Up Run


Ful-Flo Louvers
Ful-Flo Louvers
Ful-Flo Louvers
Downward Flow
550
600
650
700
Zone of Out-Flow
Zone of Out-FLow



LS		Delta Spin	0 Spinner Down Run (cps)	60
0 (ft/min) -150		Delta Spin	0 Spinner Up Run (cps)	60
0 LS (ft/min) 150			0 Spinner Up Run (cps)	60
0 LS (ft/min) 150				

APPENDIX A

A-8 Testing, Sampling, and Analysis Plan

JANUARY 2025

TESTING, SAMPLING, AND ANALYSIS PLAN

PREPARED FOR

ZONE 7 WATER AGENCY AND
CITY OF PLEASANTON

PREPARED BY



Luhdorff & Scalmanini
Consulting Engineers

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ATTACHMENTS

Attachment 1 Zonal Analyte Table

Attachment 2 Title 22 Analyte Table

Appendix A Field Forms

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
°C	degree Celsius
°F	degree Fahrenheit
CCR	California Code of Regulations
City	City of Pleasanton
Cm	Centimeter
COC	Chain of custody
DO	dissolved oxygen
EPA	Environmental Protection Agency
Kg	Kilogram
Lbs	Pounds
ml	milliliter
Mpa	Megapascal
OD	Outside Diameter
ORP	oxygen reduction potential
Plan	Testing, Sampling, and Analysis Plan
PSI	Pounds per Square Inch
QA	quality assurance
QC	quality control
Scope	Regional Groundwater Facilities Project Feasibility Study
SP	specific conductance
spinner	spinner flowmeter
SVOC	semi volatile organic compound
T	temperature
T	Time
Zone 7	Zone 7 Water Agency
µm	micrometer

1. INTRODUCTION AND PURPOSE

This Testing, Sampling, and Analysis Plan (plan) was prepared to satisfy Task 2 of the scope of work described in the Regional Groundwater Facilities Project Feasibility Study (Scope) for the Zone 7 Water Agency (Zone 7) and the City of Pleasanton (City), dated September 17, 2024. This Plan details the procedures, methods, timelines, analytes, test methods, sample control, chain of custody forms and documentation, and turnaround times for the sampling that will be completed on the newly constructed test wells that will be constructed under Task 1 of the Scope. Each well will be pump tested to assess well performance, subject to spinner analysis to characterize zonal flow within the well, and collection of zonal and composite water samples for analysis.

Groundwater sampling activities will include Title 22 drinking water analysis as described in the California Code of Regulations (CCRs). Constituents, laboratory analytical methods, and practical quantitation limits are summarized in **Attachments 1 and 2**.

The purpose of this Plan is to provide guidance to qualified professional personnel engaging in the collection of well performance data and analysis of groundwater quality data. Use of this Plan intends to promote the collection of high-quality data, thereby supporting data usability. Testing and sampling procedures and protocols outlined herein are in accordance with pertinent current Environmental Protection Agency (EPA) Standard Methods, California Code of Regulations Title 22, and current industry standards and practices.

2. WELL AND AQUIFER TESTING

After final development and when the well meets the specified performance requirements, tests will be performed. The first test will be an 8-hour step pumping test to determine the target design capacity of the well. The second test will be an 8-hour constant rate pumping test at the final design capacity as determined by the Engineer based upon evaluation of well performance during the step test. The test capacities will be determined by the Engineer before or during the testing based upon the results of development and test pumping. Well and aquifer testing shall not exceed 20 hours without written direction from the Engineer/Owner.

2.1. Well and Aquifer Testing Procedures

A. Static Water Level
    a. At the start of each day of pumping, the Contractor shall record the static water level in the well (see Section 5.1). At all other times, the static water level shall be considered to be attained when three successive water level measurements spaced ten minutes apart show no appreciable change.

B. Flow Metering
    a. During each test or step, the discharge of the pump shall be measured with an accurate, calibrated totalizing and instantaneous flow meter, or other type as approved by the Engineer. The pump discharge rate shall be maintained at all times during the test within

plus or minus 5 percent of the pump test rate by means of an approved gate valve in concert with engine speed.

b. Throughout the test, the Contractor shall frequently record flow rate and totalizer readings to ensure that the pumping rate remains constant.

C. Measurements

a. The Contractor shall measure the depth to water to the nearest 0.01 feet, flow rate, and sand content at the time intervals specified herein.

b. Each well test shall be monitored by the Contractor with data recorded according to the following applicable time schedules:

i. Turn the pump on to the approved test pumping capacity at time (t) = 0.

ii. The contractor shall measure and record the depth to water as follows:

1. each minute, from t = 1 to t = 10.
2. each 2 minutes, from t = 10 to t = 20.
3. each 5 minutes from t = 20 to t = 50.
4. each 10 minutes from t = 50 to t = 100.
5. at t = 120, t = 150, t = 180, t = 240, and t = 300.
6. each 100 minutes after t = 300.

c. Each recovery test shall be recorded according to the following applicable schedule:

i. The contractor shall measure the depth to water and record as follows (t' refers to time since pump shut off):

1. each minute, t' = 1 to t' = 10
2. each 2 minutes, t' = 10 to t' = 20
3. each 5 minutes, t' = 20 to t' = 50
4. each 10 minutes, t' = 50 to t' = 100
5. at t' = 120, t' = 150, t' = 180, t' = 240, t' = 300

D. Pump Failure

a. In the case of failure or interruption of the pump operation for a period greater than one (1) percent of the elapsed pumping time from t = 0, the test shall be suspended until the static water level has been attained. Should the test be aborted as a result of a deficiency on the part of the Contractor's equipment or personnel, all time consumed in waiting for complete water level recovery and in resuming the pump test to the point where it was aborted shall be at no cost to the Owner.

E. Completion

a. After the well testing has been completed, the record of water level measurements shall be delivered to the Engineer on the forms provided as part of these documents. The test pump shall not be removed from the well until the Engineer has evaluated the data and authorized its removal.

3. SPINNER/FLOWMETER, AND DISCRETE DEPTH SAMPLING STANDARD OPERATING PROCEDURE, PACIFIC SURVEYS

3.1. Applicability

The main application of Spinner/Flowmeter logging is subsurface characterization of the vertical fluid movement within the well-bore. The impeller or spinner flowmeter (spinner) uses an impeller that revolves in response to fluid flow. As fluid moves through the impeller blades, they rotate at a known speed based on the pitch of the impeller blades. The number of impeller revolutions per second is automatically recorded and used to calculate the velocity of the fluid. Spinner measurements can be made while ascending or descending in the opposite direction of the fluid movement to generate a continuous flow profile. Additionally, spinner stop count measurements can be recorded at a particular depth while the tool is held stationary to measure flow at a specific location in the well-bore. Once the flow profile of the well-bore has been identified, depth-specific samples can be collected at the identified flow zones.

3.2. Scope

The geophysical logging contractor's responsibility is to provide a qualified logging Engineer (a qualified person familiar with logging equipment, operations & procedures) and the following:

- Properly calibrated logging tools.
- Sufficient backup tools to ensure that all requested services will be successfully performed.
- Ensure that all measurements have a common depth basis (i.e., depth-matched data).
- Borehole corrected data.
- Paper copy field prints of all logs at the proper depth and horizontal scales.
- Paper and reproducible copy final prints of all logs at the proper depth and horizontal scales.
- Log ASCII standard containing all digitally measured and processed log data.
- Log PDF files of all logs at the proper depth and horizontal scales.

3.3. Data Collection

Measurements are made as the tool is ascended or descended in the well-bore at a constant rate on a multi-conductor or coaxial armored cable (or wireline) using a power supply at the surface. Measurement depth is controlled by passing the cable over a calibrated sheave wheel. Downhole data is transmitted via the cable to a data acquisition system (i.e., processing system) and transmitted to a computer at the surface where the data is stored and processed. Geophysical logs are paper copy records of borehole measurements plotted with amplitude on the horizontal axis and depth on the vertical axis. Other information presented in the geophysical logs include:

A. Borehole identification number
B. Client name
C. Borehole location (city, county, state GPS coordinates if available)
D. Date

E. Casing/borehole size
F. Surface elevation (if available)
G. Services requested (logs run)
H. Perforated intervals
I. Pump depth
J. Pump rate
K. Drill depth or completed depth
L. Logging depth

3.4. Logging Order

The spinner/flowmeter is normally run prior to the depth-specific sampling program. The spinner log will help determine where the samples will be collected based on the well-bore flow profile.

3.5. Calibration

The spinner log will be run at multiple tool velocities to develop a slope and ensure repeatability of the fluid velocities within the well-bore.

Basically, there are three types of tool calibration standards:

1. Primary calibration standards involve permanent test pits, which are primarily used to calibrate logging tool prototypes and shop standards.
2. Secondary or shop calibration standards are transportable calibration standards that are referenced to the primary standards. Shop standards are often too bulky to be easily transported to field sites. Logging sondes should be checked against these standards on a monthly basis.
3. Tertiary or field standards are compact enough that they can easily be taken to the field to verify that the sondes calibration has not drifted from the shop calibration at each logging job.

3.6. Standard Procedure for Logging Operation

Pacific Surveys logging equipment is fixed and mounted within a vehicle. It consists of a winch that spools the wireline, a data processing system that powers up and processes the data, and a computer that collects and plots the data.

3.6.1. Pacific Surveys Logging Procedures consist of the following steps:

1. Parking and securing the logging vehicle at the well/borehole.
2. Rigging up, consisting of hanging a sheave wheel or using a boom to support the wireline during logging operations.
3. Rigging up the sondes and centering them within the well/borehole.
4. Powering up the sonde and checking the acquisition system's outputs for correct voltage, tool current and applicable tool measurements.
5. Zeroing the tool to the log datum (i.e., ground surface, top of casing).

6. Lowering the sonde into the well/borehole to the desired depth.
7. Initiating the recording process once at the desired depth (i.e., record up or Down).
8. Retrieving the sonde from the well/borehole and decontaminating.
9. Rigging down of sheave wheel and spooling wire-line into the vehicle.

3.7. Theory of Operation

Pacific surveys offers many different sondes which can characterize various different geologic, hydrologic and physical properties of the well/wellbore.

3.7.1. Spinner (Flowmeter)

Spinner/Flowmeter measures vertical fluid velocity in a pumping or non-pumping well. A sensor counts the revolutions of a mechanical impeller as the tool descends or ascends in the well. A production profile of the pumping well can be determined over the entire perforated interval. With a continuous record, Q values from any interval can be measured without interpolation. Hydraulic conductivity can be derived, aiding in well design and ascertaining production problems. Combined with a depth-specific fluid sampling system, the spinner can be used to determine the concentration of specific constituents when chemical analysis is available. In non-pumping wells, the spinner can locate confining zones and calculate fluid velocity between zones.

Spinner diameters are either 1-inch or 1-11/16-inch. Depending on the configuration, the length can range from 24 inches to 5 feet. The 1-inch spinner is primarily used in small tubing or when tight clearances, such as pump bowls, need to be passed.

A. Spinner/Flowmeter

SPECIFICATIONS AT A GLANCE

Diameter: 1.6875-inches

Length: 24-inch

Weight: 8 Lbs (3.6 Kg)

Temperature Rating: 350° F (176.7° C) Make Up Length (as shown): 24-inch (60.96 centimeter [Cm]) Pulses: 12 per revolution

Pressure: 15,000 Pounds per square inch (PSI) (103 Mpa)

3.7.2. Depth-Specific Fluid Sampling

Retrieve down-hole sealed fluid samples under pumping or non-pumping conditions from any depth in well. Procedure for collecting and decontaminating sampler complies with EPA guidelines.

Procedure: The sample chamber is evacuated using a vacuum pump, sealed and sent down-hole to a specific depth. The upper intake valve is opened electronically from the surface and the fluid sample is taken. The upper intake valve is closed before returning to the surface. Once at the surface the sampler is removed from the wire line and the sample is dispensed to collection bottles (see section 5). The in-situ

sample is under pressure and temperature similar to where it was collected, ensuring integrity. All sampler chambers and parts are constructed of stainless steel. Samplers are fully decontaminated between each trip into the well, further ensuring sample integrity.

- 2-1/8-inch OD sampler capable of collecting up to 6 liters per trip in well
- 1.70-inch OD sampler capable of collecting 2 liters per trip in well
- 1 3/8-inch OD sampler capable of collecting 1 liter per trip in well

The 1-3/8-inch sampler is often used with the 1-inch spinner to pass by tight restrictions, such as pump bowls, column pipe that is adjacent to camera entry ports, and thru-chlorine tubing that runs below the pump intake.

Samplers complement spinner surveys where Mass Balance calculation of analyzed constituents can be used to determine the concentration at depth. We can also provide onsite analysis of particular constituents.

A. 2.135-inch Dia. 2 Liter Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 2.135-inch

Length: 82-inch

Housing: Stainless Steel Weight: 32 Lbs

Temperature Rating: 250 °F Pressure Rating: 5000 PSI

B. 1.75-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.75-inch

Length: 48.75-inch Housing: Stainless Steel Weight: 22 Lbs.

Temperature Rating: 250 °F

Pressure Rating: 5000 PSI

C. 1.38-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.38-inch

Length: 64-inch

Housing: Stainless Steel Weight: Lbs

Temperature Rating: 250 °F

Pressure Rating: 5,000 PSI

4. EQUIPMENT, CALIBRATION, AND DECONTAMINATION

4.1. Equipment

Field personnel shall be adequately equipped to perform field activities described herein. The following list is not a comprehensive list of all instrumentation, equipment, gear, and consumables that may be needed to complete the field activities. The list merely states key items that are specific to this project

1. Electrical sounder with 0.01-foot graduation to support direct readings with a resolution of 0.01 foot.
2. Multi-parameter water quality meter or individual sensors for measurement of specific conductance (SP), temperature, (T), pH, oxygen reduction potential (ORP), and dissolved oxygen (DO).
3. Turbidity meter
4. Consumables such as powder-free nitrile gloves and single-use in-line filters (0.45 µm).
5. Decontamination supplies including Alconox® (or other phosphate-free detergent) and deionized water.

All instrumentation is to have manufacturers' specifications for accuracy and precision reflective of standards commonly used in environmental groundwater monitoring applications comparable to the Zone 7 sites. Instrumentation is to be kept clean and to be stored and handled appropriately.

4.2. Calibration

Shop and field calibration of instrumentation shall be conducted following the manufacturer's instructions and guidelines using appropriate standard solutions (primary and secondary, as appropriate) and procedures and at manufacturer-recommended intervals. Documentation of calibration activities shall recorded on specified forms (Section 6). The electrical sounder and thermometer are factory-calibrated and do not require calibration by the user. The ORP sensor shall be cleaned and conditioned according to the manufacturer's instructions.

4.3. Decontamination

Prior to the first use at the Zone 7 sites, the portion of the electrical sounder that will be entering the wells shall be washed with an Alconox® (or a comparable phosphate-free detergent) solution and thoroughly rinsed with deionized water. The portion of the electrical sounder that enters the well is not to contact the ground or otherwise be subjected to potential contamination. Between wells, the portion of the electrical sounder that entered the well is to be thoroughly rinsed with deionized water.

The portions of water quality meters and individual sensors that come into contact with purged water shall be thoroughly rinsed with deionized water between wells.

5. PROCEDURES AND SAMPLE COLLECTION

Upon arrival at each test well site, the well identification shall be checked against project information (e.g., location map, description, or photographs). The well structure shall inspected for evidence of damage, tampering, and vandalism.

5.1. Depth-to-Water Measurements

1. A static depth-to-water reading shall be obtained prior to turning on the well pump.
2. An electric water level sounder shall be used in accordance with the manufacturer's instructions to obtain a depth-to-water measurement from a specified reference point (i.e., top of sounding tube, top of well casing, etc.). The sounder shall have a 0.01-foot graduation to support direct readings with a resolution of 0.01 feet. The reading shall be taken in duplicate or more to ensure that an accurate measurement is obtained and recorded.
3. The static water level, in conjunction with well construction information, well used to calculate the volume of water in the test well. This information will used to determine the minimum volume of water to be purged prior to sample collection (i.e., a minimum of three wet casing volumes).

5.2. Purging Protocol

1. Wells are to be purged and sampled using the dedicated sampling port on the temporary well pump.
2. Wells are to be purged of a minimum of three wet casing values and,
3. Wells are purged until indicator parameters stabilize. Stabilization is defined as consecutive readings at approximately 5-minute intervals, where parameters do not vary more than 5 percent between readings.
4. The following indicator parameters are monitored during the well purging:
    b. temperature (°C)
    c. pH (standard pH-units)
    d. electrical conductivity (µS/cm)
    e. dissolved oxygen (percent saturation or mg/L)
    f. oxygen reduction potential (mV)
    g. turbidity (NTU)
    2. Visual (color, occurrence of solids), olfactory (odor) and other observations (e.g., wellhead conditions, well access, ground conditions, weather) are noted as appropriate.
    3. Purge water shall be disposed of according to project specifications.

5.3. Sample Collection

1. Upon completion of purging activities, sample containers shall be filled such that the designated sample tap or container does not come into contact with the sample container.
2. The sampler shall not touch the inside of the lip or the inside of the sample container.
2. The cap of the sample container shall never be laid down and shall be held facing down to minimize particles settling inside the cap.
3. The sample container shall remain closed until the sample is ready to be retrieved.
4. The sample container shall not be allowed to overflow.
5. The sample shall not come into contact with any other surface prior to entering the sample container.
6. The cap is closed without delay to minimize exposure to potential contaminants.

7. Filled sample containers shall be immediately placed on ice in an ice chest and kept at a temperature not exceeding 6°C until received by the laboratory.
8. Samples shall be shipped to the laboratory within the specified sample hold time.
9. Sample containers shall be marked with laboratory-supplied labels and recorded on associated chain-of-custody documentation.
10. Order of Sample Collection: Sample containers shall be filled based on decreasing volatility of the constituents to be quantified (e.g., Semi-volatile organic compounds [SVOCs], metals, and general minerals).

6. LOGISTICS AND DOCUMENTATION

1. The calibration of instrumentation shall be documented by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Calibration Record Sheet is provided in **Attachment 3**.
2. Depth-to-water readings shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Field Data Sheet is provided in **Attachment 3.**
3. During purging, activities shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Purge Record Sheet is provided in **Attachment 3**.
4. The analytical laboratory shall be provided with chain of custody (COC) forms, sample containers, container labels, duplicates, and blanks.
5. The COC forms shall specify each test well, identify associated containers, preservatives, and other pertinent information.
6. The COC shall be filled out completely at the time that the samples are collected. All samples are to be accompanied at all times by the COC. Field personnel are responsible for the care and custody of the samples until they are relinquished. The individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time on the COC. The individual receiving the samples shall verify that the information on the labels matches the information on the COC and that all samples are accounted for.
7. Samples shall only be collected in containers provided by the analytical laboratory. Field personnel shall completely fill out and affix the appropriate labels on individual sample containers. Each container shall be uniquely identified and cross-referenced on the COC by field personnel.

7. METHODS AND TIMELINES

7.1. Methods

Depth specific water samples from individual screen intervals will be analyzed for selected analytes summarized in **Attachment 1**, which also includes units, laboratory analytical methods, and method detection and reporting limits.

Composite water samples from the well discharge assembly will be analyzed for Title 22 Drinking Water Analysis. Title 22 constituents, units, laboratory analytical methods, and method detection and reporting limits are summarized in **Attachment 2**.

7.2. Timeline

After completion of purging activities, grab groundwater quality samples are collected in laboratory-supplied bottles with or without preservatives (depending on analyses to be conducted). Bottles are labeled with laboratory-supplied labels, immediately placed on ice, and kept in an ice chest (at 6 °C) until delivered to the laboratory.

Samples shall be delivered with the proper chain-of-custody documentation within the required holding time. A chain-of-custody (COC) form shall be used to record sample identification numbers, type of samples (matrix), date and time of collection, and analytical tests requested. In addition, times, dates, and individuals who had possession of the samples are documented to record sample custody.

Unless otherwise specified, the standard laboratory turn-around time will be requested. The standard laboratory turn-around time is approximately 15 business days.

8. QUALITY ASSURANCE PROCEDURES

Quality assurance (QA) is an overall management plan used to guarantee the integrity of data collected. This includes the above guidelines for groundwater level measurements, purging protocol, and sampling handling and recording. Quality control (QC) is a component of QA that includes analytical measurements used to evaluate the quality of the data. This includes blanks and spiked samples.

The source of contamination introduced in the field or laboratory can be deduced by comparing blank results. An equipment blank could potentially be contaminated in the field, during transport to the laboratory, or in the laboratory. A method blank could only be contaminated in the laboratory. A field duplicate sample provides a measure of natural variability

8.1. Field Quality Control

8.1.1. Equipment Blank

The equipment blank only applies when decontaminated equipment is used.

Purpose: Assess the adequacy of the decontamination process. Assess contamination from the total sampling, sample preparation, and measurement process when decontaminated sampling equipment is used to collect samples.

Procedure: A sample of analyte-free water is poured through decontaminated field sampling equipment prior to the collection of test well samples.

Frequency: 1 blank per 20 samples.

8.1.2. Field Blank

Purpose: Assess contamination from field conditions during sampling. Assess contamination from the total sampling, sample preparation, and measurement process, minus the decontamination process.

Procedure: A sample of analyte-free water is poured into the container in the field, preserved and shipped to the laboratory with the test well samples.

Frequency: 1 blank per 20 samples.

8.1.3. Field Duplicate

Purpose: Assess the precision (i.e., repeatability) of sampling results as influenced by the natural variability of concentrations during sampling.

Procedure: A duplicate sample is retrieved immediately following retrieval of the test well sample.

Frequency: 1 duplicate per 20 samples.

8.2. Laboratory Quality Control

8.2.1. Method Blank

Purpose: Assess contamination introduced during sample preparation activities in the laboratory.

Procedure: The laboratory is currently certified by ELAP to conduct the requested analyses. A blank is prepared to represent the matrix as closely as possible. The method blank is prepared/extracted/digested and analyzed exactly like the test well samples.

Frequency: 1 blank per batch.

8.2.2. Other Quality Control Measures

The laboratory is to employ laboratory blanks, fortified blanks, and duplicate analyses and document percent recovery and relative percent differences to assess laboratory contamination sources, accuracy, and precision.

8.2.3. Laboratory Analytical Methods

Analysis shall be performed using the appropriate USEPA methods as defined in **Attachments 1 and 2**, equal or superior methods. All instruments and equipment shall be properly calibrated and maintained for accuracy.

8.3. Laboratory Reports

Laboratory reports shall identify the analyst, analytical methods, reporting limits, method detection limits, results of test well samples and associated blanks and duplicate samples, units, dilution factors, applicable qualifiers, and flags, date of analysis, and all applicable QA/QC information. The laboratory supervisor shall supervise all analytical work performed in the laboratory and sign the laboratory reports.

APPENDIX A

A-9 Post Airlift Water Quality Summary

Zone 7 Water Agency
Hansen Park Test Well
Water Quality Summary - Post Airlift

ANALYTE	UNITS	REPORTING LIMIT	METHOD	5/6/2025
INORGANICS				
Antimony	µg/L	2.0	200.8	ND
Arsenic	µg/L	2.0	200.8	ND
Barium	µg/L	5.0	200.8	82
Beryllium	µg/L	1.0	200.8	ND
Cadmium	µg/L	1.0	200.8	ND
Chromium (Total)	µg/L	5.0	200.8	ND
Hexavalent Chromium	µg/L	1.0	218.6	ND
Copper	µg/L	3.0	200.8	5.1
Lead	µg/L	5.0	200.8	ND
Manganese	µg/L	10	245.1	360
Mercury	µg/L	0.4	245.1	ND
Nickel	µg/L	5.0	200.8	ND
Selenium	µg/L	2.0	200.8	ND
Silver	µg/L	5.0	200.8	ND
Thallium	µg/L	1.0	200.8	ND
Vanadium	µg/L	1.0	200.8	ND
Zinc	µg/L	10.0	200.8	30
OTHER ANALYSES				
Turbidity	NTU		Field	45
pH	SU		SM 4500-H B	8.06
Chlorine (Total Residual)	mg/L	0.10	SM 4500-CL-G	ND
Cyanide	mg/L	0.0050	SM 4500-CN-E	ND
Sulfate	mg/L	0.50	300.0	51
Purgeable Organic Compounds (VOC's)	µg/L	5.0	624.1	ND
Chloroform	µg/L	5.0	624.1	11
SVOC's	µg/L	*	625.1	ND
TPH as Gasoline	µg/L	50	8015B	ND
Diesel (C10-C28)	mg/L	0.11	8015B	ND
GRO (C6-C10)	mg/L	0.1	8015B	ND
ORO (C28-C44)	mg/L	0.33	8015B	ND
PFAS	ng/L	2.00	537.1	ND

ND = Non-Detect

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APPENDIX A

A-10 Storm Drain Discharge Monitoring Sheets

Luhdorff & Scalmanini
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STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells 9 Design Date: 5-28-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Hansen Park, Hansen Dr. & Calle Ricardo

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 13:20 / 18:35
Flow Rate: 200-400 gpm
Discharge Volume: 109 600
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☐ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☐ other, specify:

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
5-28-25	13:30	7.57	38.2	
"	13:45	7.40	29.5	
"	18:30	7.40	44.2	

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STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design Date: 5-29-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Hansen Park, Hansen Dr. & Calle Ricardo

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
- ☐ Well Development
- ☐ Well Pump Test
- ☐ Water Sampling
- ☐ Other:

Time Start/Stop: 8:00/19:30
Flow Rate: 400-500 gpm
Discharge Volume: 191,000
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☐ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☐ other, specify:

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
5-29-25	8:15	7.51	57.1	
"	8:45	7.41	40.5	
"	19:30	7.37	20.0	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 5-30-25
Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Hansen Park, Hansen Dr. & Calle Ricardo

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☐ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:00 / 12:00
Flow Rate: 600 gpm
Discharge Volume: 147,800
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☐ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☐ other, specify:

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
5-30-25	8:15	7.48	15.4	
"	8:30	7.41	9.21	
"	12:00	7.37	7.91	

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STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 6-2-25
Contractor: North State

Discharge Description: step test to storm drain
Location (cross roads): Hansen Park, Hansen Dr. & Calle Ricardo

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☐ Well Development
☒ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:00 - 14:00
Flow Rate: 350 - 600 gpm
Discharge Volume: 72,500
If Any Reused, Volume: ∅

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☐ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☐ other, specify:

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
6-2-25	8:30	7.57	37.6	
"	8:56	7.78	8.11	
	13:40	8.60	16.29	

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STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design Date: 6-3-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: CQ test to storm drain
Location (cross roads): Hansen Pk., Hansen Dr. & Calle Ricardo

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
- ☐ Well Development
- ☒ Well Pump Test
- ☐ Water Sampling
- ☐ Other:

Time Start/Stop: 10:47 / 18:47
Flow Rate: 600 gpm
Discharge Volume: 284,900
If Any Reused, Volume: 0

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☐ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☐ other, specify:

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
6-3-25	10:57	7.46	14.8	
"	11:32	7.85	10.37	
"	18:47	8.45	5.23	

APPENDIX B

B-1 Summary of Title 22 Sampling

Zone 7
Hansen Park Test Well
Water Quality Summary Table

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	Title 22 6/2/2025
CATIONS					
Calcium	mg/L	0.10	200.7		83
Magnesium	mg/L	0.050	200.7		49
Potassium	mg/L	1.0	200.7		2.1
Sodium	mg/L	0.50	200.7		46
Hardness as $CaCO_3$	mg/L	0.50	Calc		410
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	79
Fluoride	mg/L	0.050	300.0	2[1]	0.12
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	12
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	3
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	55
Total Alkalinity	mg/L	4.1	SM 2320B		320
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1
pH	pH units	0.05	150.1	6.5/8.5[4]	7.72[5]
Methylene Blue Active Substance	mg/L	0.20	SM 5540C	0.5[2]	ND
Electrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	906
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	542[5]
Turbidity	NTU	0.10	180.1	5[2]	2.1
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.44
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	ND
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0011 J
Arsenic (Dissolved)	mg/L	0.010	200.8		0.00092 J
Barium	mg/L	0.010	200.7	1[1]	0.26
Beryllium	mg/L	0.01	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.37
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium (Total)	mg/L	.010	200.7	0.050[1]	0.0054 J
Chromium (Dissolved)	mg/L	0.01	200.7		0.0026 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	4.0[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0018 J
Iron	mg/L	0.05	200.7	0.3[2]	0.54
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00045 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.045
Manganese (Dissolved)	mg/L	0.010	200.7		0.035
Mercury	mg/L	0.0002	245.1	0.002[1]	0.00041
Nickel	mg/L	0.010	200.7	0.1[1]	0.0038 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0021
Silicon as Si	mg/L	0.10	200.7		11
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.0028	200.7	0.05[3]	0.0029 J
Zinc	mg/L	0.050	200.7	5[2]	ND

Zone 7
Hansen Park Test Well
Water Quality Summary Table

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	Title 22 6/2/2025
RADIOCHEMISTRY					
Gross Alpha	pCi/L		900.0		7.44 ± 2.20
Gross Beta	pCi/L		9000.0		3.10 ± 2.10
Ra 226	pCi/L		903.0/9315		ND
Ra 228	pCi/L		904/9320		1.80 ± 1.10
Strontium-90	pCi/L		905.0	8[1]	ND
Tritium	pCi/L		906.0	20,000[1]	ND
Uranium-234	pCi/L		D3972 U-02	20[1]	1.61 ± 0.757
Uranium-235	pCi/L		D3972 U-02	20[1]	ND
Uranium-238	pCi/L		D3972 U-02	20[1]	1.32 ± 0.641
OTHER ANALYSES					
Ammonia as N	mg/L	0.20	350.1		ND
Asbestos	MFL	5.10	600/R-94/134	7[1]	ND
Benzo-a-pyrene	µg/L	0.10	525.2	0.2[1]	0.50
Bromate	µg/L	1.0	317	10	ND
Chlorinated Herbicides	µg/L	*	515.1		ND
Chlorite (ClO2)	mg/L	0.0050	300.1	1.0[1]	ND
Cyanide (Total)	mg/L	0.0050	335.4		ND
1,2-Dibromo-3-Chloropropane DBCP	µg/L	0.010	504.1	0.2	ND
Di(2-ethylhexyl)adipate	µg/L	1.0	525.2		ND
Di(2-ethylhexyl)phthalate	µg/L	3.0	525.2		ND
Diquat and/or Paraquat	µg/L	4.0	549.2	20	ND
Endothall	µg/L	45	548.1	100[1]	ND
Ethylene Dibromide EDB	µg/L	0.010	504.1	0.05	ND
Glyphosate	µg/L	25	547	700[1]	ND
Hydrogen Sulfide (H2S)	mg/L	0.10	SM-4500SH		ND
Methane	µg/L	0.001	RSK175M		0.0030
Nitrogen/Phosphorus Pesticides	µg/L	*	525.2		ND
Organchlorin Pesticides and PCB's	µg/L	*	508		ND
PCB's	µg/L	0.20	8082		ND
Perchlorate	mg/L	0.00400	314.0		ND
Phosphorus (Total)	mg/L	0.050	365.4		ND
Purgeable Organic Compounds (VOCs)	µg/L	*	524.2		ND
Sulfide (Total)	mg/L	0.10	SM-4500SD		ND
Sulfide (Dissolved)	mg/L	0.10	SM-4500SD		ND
2,3,7,8-TCDD (Dioxin)	pg/L	10	1613B	0.00003[1]	ND
1,2,3-Trichloropropane	µg/L	0.0050	SRL 524M-TCP	0.005[1]	ND
Total Haloacetic acids (five) HAA5	µg/L	1	552.3	60[1]	ND
Total Organic Carbon	mg/L	1.0	SM5310C		0.32 J
Total Trihalomethanes (TTHM)	µg/L	2	524.2	80	ND
PFAS					
Perfluorohexane Solfonic Acid (PFHxS)	ng/l	1.80	533[7]	10	2.73[6]

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
6 - Sampled on 6/3/25
7 - EPA Method 533 analysis includes 25 Perfluorinated Alkyl Acids
ND = Non-Detect
J Flag = Estimated value above the method detection limit and below the reporting limit

Luhdorff & Scalmanini
Consulting Engineers

APPENDIX B

B-2 Summary of Discrete Zone Sampling

Zone 7
Hansen Park Test Well
Water Quality Summary Table - 448 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	448' (6/3/2025)
CATIONS					
Calcium	mg/L	0.10	200.7		84
Magnesium	mg/L	0.050	200.7		51
Potassium	mg/L	1.0	200.7		2.1
Sodium	mg/L	0.50	200.7		41
Hardness as $CaCO_3$	mg/L	0.50	Calculation		420
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	79
Fluoride	mg/L	0.050	300.0	2[1]	0.13
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	14
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	3.5
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	56
Total Alkalinity	mg/L	4.1	SM 2320B		320
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.03[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.11
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	933
Total Dissolved Solids (TDS)	mg/L	25	SM 2540C	500/1,000[2]	569[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	6.8
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.57
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.0060[1]	0.00011 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0011 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.00099 J
Barium	mg/L	0.010	200.7	1.0[1]	0.28
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1.0[3]	0.32
Cadmium	mg/L	0.0010	200.8	0.0050[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0071 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0037 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	3.9
Copper	mg/L	0.010	200.7	1.0[2]	0.021
Iron	mg/L	0.050	200.7	0.30[2]	0.70
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00029 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.046
Manganese (Dissolved)	mg/L	0.010	200.7		0.042
Mercury	mg/L	0.00020	245.1	0.0020[1]	0.00017 J
Nickel	mg/L	0.010	200.7	0.100[1]	0.0070 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0019 J
Silver	mg/L	0.010	200.7	0.10[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0036 J
Zinc	mg/L	0.050	200.7	5.0[2]	0.17
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.98	533[6]		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
6 - EPA Method 533 analysis includes 25 Perfluorinated Alkyl Acids
ND = Non-Detect

Luhdorff & Scalmanini
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Zone 7
Hansen Park Test Well
Water Quality Summary Table - 518 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	518' (6/3/2025)
CATIONS					
Calcium	mg/L	0.10	200.7		61
Magnesium	mg/L	0.050	200.7		36
Potassium	mg/L	1.0	200.7		1.7
Sodium	mg/L	0.50	200.7		44
Hardness as $CaCO_3$	mg/L	0.50	Calculation		300
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	60
Fluoride	mg/L	0.050	300.0	2[1]	0.15
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	7.0
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.25
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	1.8
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	49
Total Alkalinity	mg/L	4.1	SM 2320B		270
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0
pH	pH units	0.05	150.1	6.5/8.5[4]	7.97[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.066 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	773
Total Dissolved Solids (TDS)	mg/L	25	SM 2540C	500/1,000[2]	426[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	
Turbidity	NTU	0.10	180.1	5[2]	9.9
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.64
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.0060[1]	0.00011 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0015 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0014 J
Barium	mg/L	0.010	200.7	1.0[1]	0.22
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1.0[3]	0.38
Cadmium	mg/L	0.0010	200.8	0.0050[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.013
Chromium (Dissolved)	mg/L	0.010	200.7		0.0027 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	2.9
Copper	mg/L	0.010	200.7	1.0[2]	0.0028 J
Iron	mg/L	0.050	200.7	0.30[2]	0.77
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00036 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.091
Manganese (Dissolved)	mg/L	0.010	200.7		0.084
Mercury	mg/L	0.00020	245.1	0.0020[1]	0.00030
Nickel	mg/L	0.010	200.7	0.100[1]	0.0052 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0013 J
Silver	mg/L	0.010	200.7	0.10[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5.0[2]	0.060
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.85	533[6]		ND

1 - Primary MCL
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3 - Notification Level
4 - Suggested lower/upper acceptable range
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ND = Non-Detect

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Zone 7
Hansen Park Test Well
Water Quality Summary Table - 598 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	598' (6/3/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		51
Magnesium	mg/L	0.050	200.7		28
Potassium	mg/L	1.00	200.7		1.7
Sodium	mg/L	0.50	200.7		59
Hardness as $CaCO_3$	mg/L	0.50	Calculation		240
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	48
Fluoride	mg/L	0.050	300.0	2[1]	0.14
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	1.4
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.21
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.47
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	42
Total Alkalinity	mg/L	4.1	SM 2320B		240
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2
pH	pH units	0.05	150.1	6.5/8.5[4]	7.98[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.048 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	665
Total Dissolved Solids (TDS)	mg/L	25	SM 2540C	500/1,000[2]	367[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	5.3
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.28
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.0060[1]	ND
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0020
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0018 J
Barium	mg/L	0.010	200.7	1.0[1]	0.22
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1.0[3]	0.50
Cadmium	mg/L	0.001	200.8	0.0050[1]	ND
Chromium	mg/L	.010	200.7	0.050[1]	0.0055 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0011 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	1.3
Copper	mg/L	0.010	200.7	1.0[2]	0.0020 J
Iron	mg/L	0.050	200.7	0.30[2]	0.50
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00017 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.16
Manganese (Dissolved)	mg/L	0.010	200.7		0.15
Mercury	mg/L	0.0002	245.1	0.0020[1]	0.00016 J
Nickel	mg/L	0.010	200.7	0.100[1]	0.0030 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00075 J
Silver	mg/L	0.010	200.7	0.10[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5.0[2]	0.051
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.98	533[6]		ND

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ND = Non-Detect

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Zone 7
Hansen Park Test Well
Water Quality Summary Table - 646 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	646' (6/3/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		59
Magnesium	mg/L	0.050	200.7		32
Potassium	mg/L	1.00	200.7		1.8
Sodium	mg/L	0.50	200.7		61
Hardness as $CaCO_3$	mg/L	0.50	Calculation		280
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	51
Fluoride	mg/L	0.050	300.0	2[1]	0.14
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	1.0
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.70
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.55
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	46
Total Alkalinity	mg/L	4.1	SM 2320B		260
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.04[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.099 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	693
Total Dissolved Solids (TDS)	mg/L	25	SM 2540C	500/1,000[2]	396[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	6.0
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.31
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.0060[1]	0.00013 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0021
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0017 J
Barium	mg/L	0.010	200.7	1.0[1]	0.25
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1.0[3]	0.49
Cadmium	mg/L	0.001	200.8	0.0050[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0074 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	1.1
Copper	mg/L	0.010	200.7	1.0[2]	0.0022 J
Iron	mg/L	0.050	200.7	0.30[2]	0.47
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00022 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.20
Manganese (Dissolved)	mg/L	0.010	200.7		0.19
Mercury	mg/L	0.0002	245.1	0.0020[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0039 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0012 J
Silver	mg/L	0.010	200.7	0.10[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5.0[2]	0.071
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.96	533[6]		ND

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ND = Non-Detect
J Flag = Estimated value above the method detection limit and below the reporting limit

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Zone 7
Hansen Park Test Well
Water Quality Summary Table - 726 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	726' (6/3/25)
CATIONS					
Calcium	mg/L	0.100	200.7		75
Magnesium	mg/L	0.050	200.7		39
Potassium	mg/L	1.00	200.7		2.0
Sodium	mg/L	0.50	200.7		72
Hardness as $CaCO_3$	mg/L	0.50	Calculation		350
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	86
Fluoride	mg/L	0.050	300.0	2[1]	0.12
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	1.7[5]
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	2.5[5]
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	1.9
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	53
Total Alkalinity	mg/L	4.1	SM 2320B		310
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	8.14[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.083 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	894
Total Dissolved Solids (TDS)	mg/L	25	SM 2540C	500/1,000[2]	505[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	14[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.68
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.0060[1]	0.00015 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0011 J
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.00084 J
Barium	mg/L	0.010	200.7	1.0[1]	0.32
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1.0[3]	0.55
Cadmium	mg/L	0.001	200.8	0.0050[1]	0.00017 J
Chromium	mg/L	.010	200.7	0.050[1]	0.0076 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.082[5] J
Copper	mg/L	0.010	200.7	1.0[2]	0.0034 J
Iron	mg/L	0.050	200.7	0.30[2]	1.2
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00042 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.24
Manganese (Dissolved)	mg/L	0.010	200.7		0.23
Mercury	mg/L	0.0002	245.1	0.0020[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0072 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0023
Silver	mg/L	0.010	200.7	0.10[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5.0[2]	0.063
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.98	533[6]		2.53

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ND = Non-Detect

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APPENDIX C

Well Capacity Estimates TM

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Well Capacity Estimates for Zone 7/Pleasanton Test Well Sites

An 8-inch diameter test well was constructed at Del Prado Park, Tennis Park, and Hansen Park. Each well was developed, had step-drawdown pumping tests conducted, and had constant rate pumping tests conducted for 8 hours. The data derived from the constant rate pumping tests, combined with data regarding the range of expected regional groundwater levels, were reviewed for the development of full-scale production well pumping capacity estimates at each location.

It should be noted that while well capacity estimates described below are based on some very specific input values (e.g., for specific capacity, assumed static groundwater levels), the final production capacity for each well cannot be precisely known until the large-diameter production wells are drilled and tested. This is due in large part to considerable uncertainty in the well efficiency input parameter, which is as much a function of the well efficiency and quality of work done by the drilling subcontractor as it is a function of the engineering oversight and design specifications (e.g., filter pack gradation, screen slot size). Thus, while the well capacity estimates described below may represent a best estimate at this time, they could vary by several hundred gpm more or less than the values described below.

Background and Considerations in Low-End Well Capacity Estimates

The basis for the low-end production rate well capacity analysis is the occurrence of worst-case (critical years with maximum municipal/agricultural groundwater pumping) groundwater basin conditions. Groundwater elevation contour maps were reviewed for recent critical drought years, including Fall 2015, Fall 2021, and Fall 2022. In addition, total municipal/agricultural well pumping and City of Pleasanton (a subcomponent of total municipal/agricultural pumping) groundwater pumping were reviewed for these three critical dry years, along with the last ten years overall (**Table 1**). Overall, the lowest groundwater elevations occurred in the Fall of 2021 and Fall 2022, consistent with the highest rates of total municipal and agricultural groundwater pumping (over the past 10 years), ranging from 21,500 to 23,600 AFY, and relatively high City of Pleasanton groundwater pumping between about 2,600 and 3,800 AFY.

Table 1. Summary of Municipal Well Pumping and Groundwater Elevations at Test Well Sites Over Past Ten Years[1]				
Year	Water Year Type	City of Pleasanton Annual Pumping (AF)	Total Municipal and Agricultural Pumping (AF)[2]	Test Well Spring/Fall GWE (ft msl)
2015	Critical	2,775	8,874	265-270/270
2016	Dry	3,752	9,860	
2017	Wet	4,222	11,369	
2018	Below Normal	3,913	12,657	
2019	Wet	3,785	15,309	
2020	Dry	2,701	17,069	
2021	Critical	3,802	23,597	260-275/250-255
2022	Critical	2,587	21,497	265-270/245-255
2023	Wet	270	9,987	
2024	Above Normal	0	7,104	

1. Annual pumping derived from Table D-3 in 2024 Water Year Annual Report (Zone 7, March 2025).
2. Total Municipal and Agricultural Pumping includes City of Pleasanton pumping.

A summary of the proposed top of well screen, high and low depths to (static) water, and calculated available drawdown at each test well site are summarized in **Table 2**.

Table 2. Summary of Test Well Sites Critical Year Depth to Water					
Well	Depth to Top of Screen	High DTW (ft bgs)	Low DTW (ft bgs)	Maximum Available Drawdown (ft)	Minimum Available Drawdown (ft)
Tennis	195	16.7	75	178	120
Hansen	298	24.5	75	273.5	223
Del Prado	170	16.7	65	153	105
Notes: DTW = Depth to Water					

Based on the analysis summarized above, the regional groundwater level conditions assumed for the well capacity analysis are based on a time of maximum overall municipal/agricultural groundwater pumping (since at least 1974) and relatively high City of Pleasanton groundwater pumping (2,600 to 3,800 AFY vs. long-term average of 3,100 AFY). Thus, the well capacity analysis assumes that groundwater pumping at the test well sites is occurring in addition to maximum historical municipal pumping (since at least 1974), which is likely a very conservative assumption for this assessment (i.e., the new test well sites are expected to supplement and be used in conjunction with existing Zone 7 municipal well sites, and not constitute additional pumping at a time of maximum pumping of existing municipal production wells).

Methodology

The well capacity calculation methodology requires input values for specific capacity, available drawdown, and assumed production well efficiency. Specific capacity varies (declines) with time, although the rate of

decline decreases dramatically after about 24 hours for most high-capacity wells. Given the planned long-term continuous operation of the new wells, 30-day and 90-day specific capacity values were evaluated along with the typical 24-hour specific capacity value used in most well yield calculations. Available drawdown relates to regional groundwater elevations and varies seasonally and year to year, depending on how wet or dry the recent and preceding years have been. Well capacities were estimated for relatively high and low available drawdown estimates. Well efficiency can be highly variable and is heavily dependent on well engineering design considerations (e.g., screen slot size, filter pack quality and gradation, well drilling/development specifications) and drilling contractor performance (e.g., driller efficiency, driller adherence to drilling specifications). Each of these three key inputs is described in more detail below.

Data from the constant rate aquifer tests were reviewed to calculate the 24-hour specific capacity by extending the trend of water level declines (on a semi-log time-drawdown plot) from the 8-hour test out for a 24-hour period. The 24-hour specific capacity was calculated by dividing the average pumping rate during the 8-hour constant rate test by the total estimated drawdown over a 24-hour period. In addition, specific capacity values were determined in a similar manner (extending the semi-log plot time-drawdown line from 8 hours to 30 days and 90 days) for 30-day and 90-day continuous pumping scenarios to evaluate the difference in assumptions regarding specific capacity values. The specific capacity values for different time periods are summarized in **Table 3**.

Table 3. Summary of Test Well Specific Capacity Values

Well ID	Pumping Rate (gpm)	24-hr DD (ft)	24-hr Q/s (gpm/ft)	30-Day DD (ft)	30-Day Q/s (gpm/ft)	90-Day DD (ft)	90-Day Q/s (gpm/ft)
Tennis Park	549	9.6	57.2	10.3	53.3	10.6	51.8
Hansen Park	594	19.5	30.5	21.5	27.6	22.5	26.4
Del Prado Park	252	15.6	16.2	16.2	15.3	17.2	14.7

As summarized above Tennis Park specific capacity ranges from 57 to 52 gpm/ft, Hansen Park specific capacity ranges from 30.5 to about 26.5 gpm/ft, and Del Prado Park ranges from 16.2 to 14.7 gpm/ft for 24 hours to 90 days of pumping.

Given the relatively high groundwater elevations at the time of the pumping tests, the measured groundwater level at the start of testing was used as the basis for the high-end well capacity estimate. The difference between the measured groundwater level and the top of the uppermost screen was used as the available drawdown for the well capacity estimate. As described above, historical groundwater elevation contour maps (for critical dry years) and municipal pumping were reviewed to determine an appropriate regional groundwater elevation to use at the test well sites as the basis for low-end well capacity estimates. The water years considered for the low-end estimate were 2021 and 2022. The difference between groundwater elevations in these dry years and the top of the well screen were used as available drawdown for low-end estimates.

Well efficiency relates to the difference between the pumping water level inside a production well casing and the groundwater level in the aquifer formation just outside the well filter pack. In theory, a well would be 100% efficient if these water levels are the same; in practice, this rarely occurs for high-capacity production wells. The difference between water levels inside a well casing and in the adjacent aquifer formation refers to the well efficiency needed for well capacity estimates. For example, if the water level in the wells declines by 100 feet during pumping but the aquifer groundwater level just outside the well filter pack declines by 50 feet, the well efficiency is considered to be 50%. A reasonable well efficiency target to strive for in most high-capacity production well drilling operations is 70 to 80%. For the purposes of the well capacity estimates (based on 24-hour specific capacity) described below, it was assumed that a production well at the Del Prado Park site could achieve a 75% well efficiency, while the production wells at the Tennis Court and Hansen Park sites were conservatively estimated to have 50% well efficiency. Lower well efficiencies were assumed at the higher specific capacity sites (Tennis and Hansen) primarily because in highly permeable sediments, the flow of water at higher pumping rates has a greater tendency to become turbulent, which increases friction losses and reduces well efficiencies.

Del Prado Park Well Capacity Estimate

The upper end well capacity estimate for the Del Prado Park test well is summarized in **Table 4**. The average pumping rate of 252 gpm combined with a projected 24-hour drawdown of 15.6 feet yields a specific capacity of 16.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 170 feet bgs, yields an available drawdown of 153 feet. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 153 feet yields an interim well capacity calculation of about 2,500 gpm. Applying a well efficiency factor of 75% yields a final upper-end well yield estimate of approximately 1,900 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 17 feet bgs was substituted with a drought year assumed depth to water of 65 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 105 feet compared to 153 feet for the upper end well capacity calculation. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 105 feet yields an interim well capacity calculation of 1,700 gpm. Applying a well efficiency factor of 75% yields a final lower-end well yield estimate of approximately 1,300 gpm (**Table 4**).

Tennis Park Well Capacity Estimate

The upper end well capacity estimate for the Tennis Park test well is summarized in **Table 4**. The average pumping rate of 549 gpm combined with a projected 24-hour drawdown of 9.6 feet yields a specific capacity of 57.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 195 feet bgs, yields an available drawdown of 178 feet. Multiplying the specific capacity of 57.2 gpm/ft times the available drawdown of 178 feet yields an interim well capacity calculation of 10,200 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 5,100 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level

of 17 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 120 feet compared to 178 feet for the upper end well capacity calculation. Multiplying the specific capacity of 57.2 gpm/ft times the available drawdown of 120 feet yields an interim well capacity calculation of 6,900 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Hansen Park Well Capacity Estimate

The upper end well capacity estimate for the Hansen Park test well is summarized in **Table 4**. The average pumping rate of 594 gpm combined with a projected 24-hour drawdown of 19.5 feet yields a specific capacity of 30.5 gpm/ft. The April 2025 static water level of 24.5 feet below ground surface (bgs), combined with depth to top of first screen of 298 feet bgs, yields an available drawdown of 273.5 feet. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 273.5 feet yields an interim well capacity calculation of 8,300 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 4,200 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 24.5 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 223 feet compared to 273.5 feet for the upper end well capacity calculation. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 223 feet yields an interim well capacity calculation of 6,800 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Table 4. Summary of Test Well Pumping Capacity Estimates

Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Tennis Park	195	57.2	178	120	50	5,100	3,400
Hansen Park	298	30.5	273.5	223	50	4,200	3,400
Del Prado Park	170	16.2	153	105	75	1,900	1,300

Comparison to Existing Production Well Capacities

A summary of pumping test data available from DWR WCR for other production wells in the general project area is provided in **Table 5**. The range of specific capacities for these existing wells ranges from 10 to 123 gpm/ft, compared to a range of specific capacities from 16 to 57 gpm/ft for the new test well sites. Thus, the new test well sites are consistent with existing sites in terms of specific capacity.

Table 5. Summary of Existing Production Well Specific Capacities							
Well ID	Pumping Rate (gpm)	Well Diameter/ Slot Size (Inches)	Pumping Duration (hr)	DD (ft)	Q/s (gpm/ft)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)
Hopyard 6	4,550	18/0.075	0.5	61	75	215	490
Hopyard 7	1,200	22/0.085	8	101	12	150	415
Hopyard 9	1,000	18/0.080	24	102	10	NA	NA
Pleasanton 5	2,820	18/ 2 1/2 x 1/8	100	23	123	149	650
Pleasanton 6	3,052	18/ 2 1/2 x 1/8	NA	28	109	165	647
Pleasanton 7	4,000	18/	68	115	35	120	440
Pleasanton 8		20/0.085				200	490
SFPUC A	1,200	18/0.070	12	88	14	196	320
SFPUC B	2,100	18/0.070	10	93	23	189	326

Evaluation of 30-Day and 90-Day Specific Capacities

Due to the potential continuous operation of the new test well sites on a continuous basis for weeks to months and associated slightly lower specific capacity values, an evaluation was conducted in terms of the required difference in assumed well efficiency that is needed to maintain the same pumping capacities. This evaluation provides both the pumping capacity using the longer-term specific capacity combined with the original well efficiency assumptions, along with the estimated new well efficiency required to maintain the original pumping capacity (**Table 6**).

The longer-term specific capacity was estimated based on straight-line projection of drawdown vs. time (on semi-log paper) for constant rate pumping of the test well. It should be noted that unknown boundary conditions (recharge or discharge) may occur at later time and not be reflected in projection of time-drawdown data from an 8-hour test, which may result in higher or lower long-term specific capacities.

Table 6. Evaluation of Long-Term Specific Capacity and Low-End Well Yield Analysis						
Well ID	24-Hr Well Yield (gpm)	24-Hr Well Efficiency Assumption (%)	30-Day Well Yield [1] (gpm)	30-Day Well Efficiency Assumption[2] (%)	90-Day Well Yield [1] (gpm)	90-Day Well Efficiency Assumption[2] (%)
Tennis Park	3,400	50	3,200	54	3,100	55
Hansen Park	3,400	50	3,100	55	2,950	58
Del Prado Park	1,300	75	1,200	80	1,150	83
[1]Well yield estimate at the original assumed well efficiency. [2]Required well efficiency assumption to maintain the original 24-hour baseline pumping capacity.						

As indicated in **Table 6**, use of longer-term specific capacities results in either slightly lower pumping capacities (generally, a reduction of 10% or less) or the need to assume slightly higher well efficiencies (from 50% to as much as 58%, and from 75% to as much as 83%). Overall, the impact of accounting for longer-term specific capacities (in and of itself) does not appear to require adjustments to the original well capacity estimates (because the increased well efficiencies are still reasonably attainable). Additional discussion of the combination of longer-term specific capacities and mutual well interference is provided below.

Mutual Well Interference Considerations

Methodology

Calculations of mutual well interference using the Theis equation requires input values for transmissivity, storativity, time of continuous pumping, and pumping rate. Calculations were made for continuous pumping durations of 30 and 90 days. Assigned pumping rates were 3,400 gpm for Tennis and Hansen Park well sites, and 1,300 gpm for the Del Prado Park well site. Transmissivity and storativity were initially estimated based on calibrated model parameters with subsequent slight adjustments based on reviewed of observation well drawdowns measured for each constant rate pumping test. The final assigned values of transmissivity and storativity associated with pumping from each well are summarized below in **Table 7.**

Table 7. Summary of Assigned Transmissivity and Storativity Values		
Well ID	Transmissivity (gpd/ft)	Storativity
Tennis Park	190,000	0.0008
Hansen Park	200,000	0.0015
Del Prado Park	200,000	0.0015
Note: Distances between wells are as follows – Tennis to Hansen = 1,900 ft.; Tennis to Del Prado = 3,550 ft.; and Hansen to Del Prado = 3,450 ft.		

Scenarios

Four different scenarios of pumping well combinations were evaluated:

- Tennis, Hansen, and Del Prado
- Tennis and Hansen
- Tennis and Del Prado
- Hansen and Del Prado

The mutual well interference drawdown at each of the three new test well sites from pumping at each of the other new test well sites is summarized below in **Table 8**. For each combination of pumping wells, the cumulative or total well interference drawdown from pumping of the other one or two wells is provided in **Table 8**.

Table 8. Summary of Test Well Site Production Well Interference Estimates

Pumping Well	30 Days Continuous Pumping			90 Days Continuous Pumping		
	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)
Tennis	NA	13	11	NA	15	13
Hansen	11	NA	9	13	NA	11
Del Prado	3	3	NA	4	4	NA
Cumulative	14	16	20	17	19	24
Tennis	NA	13	-	NA	15	-
Hansen	11	NA	-	13	NA	-
Cumulative	11	13	-	13	15	-
Tennis	NA	-	11	NA	-	13
Del Prado	3	-	NA	4	-	NA
Cumulative	3	-	11	4	-	13
Hansen	-	NA	9	-	NA	11
Del Prado	-	3	NA	-	4	NA
Cumulative	-	3	9	-	4	11

The cumulative well interference drawdowns ranged from 14 to 20 feet when all three test wells are pumping for 30 days and 17 to 24 feet when all three test wells are pumping for 90 days. The cumulative well interference drawdowns ranged from 3 to 13 feet, with two wells pumping over 30 days and 4 and 15 feet with two wells pumping over 90 days.

Assessment of Test Well Site Production Well Capacity with Consideration of Mutual Well Interference and Longer-Term Specific Capacities

An extreme (and unlikely) scenario is that the mutual well interference drawdown calculations summarized above would be additive to the groundwater elevations observed during the Fall of 2021/2022. It is not anticipated that all the existing wells would be operating at the same time as the new test well sites. Assuming that the groundwater elevations observed in Fall 2021 and Fall 2022 reflect operation of all the existing wells (as is generally indicated by review of historical annual municipal groundwater pumping since 1974), the mutual well interference drawdowns calculated above would not apply to the relatively low groundwater elevations observed in Fall 2021/2022.

However, in the case that Fall 2021 and Fall 2022 groundwater elevations are representative of the future conditions without any new production wells at the test well sites operating, and that three new production wells at the test well sites are operating as additional pumping capacity, the following analysis may warrant consideration. **Table 9** summarizes the assessment of how the original baseline minimum well capacities may be impacted by the mutual well interference with all three test well sites pumping simultaneously for 30 and 90 days continuously. The results are characterized both by reduced well capacities that would result, and also by what the change would have to be in the well efficiency assumptions to obtain the same original well pumping capacity estimates. The results for Tennis Park and Hansen generally indicate a reduction in well capacities by approximately 10 percent or the need to assume well efficiencies on the order of 55 to 60 percent instead of 50 percent. In the case of Del Prado Park, either well capacities are reduced from 1,300 gpm to between 1,000 and 1,050 gpm, or well efficiencies of 93 to 99 percent would need to be assumed.

Table 9 also shows the combination of long-term specific capacity assumptions (for 30 and 90 days) and mutual well interference drawdowns (for three test well sites pumping). This maximum worst-case scenario indicates Tennis Park and Hansen Park have well capacities reduced from 3,400 gpm to between 2,600 and 2,900 gpm, or the need to assume well efficiencies ranging from 59 to 66 percent. For Del Prado Park, well capacities for this worst case drop from 1,300 gpm to between 880 and 975 gpm, or assumed well efficiencies of 100 percent or greater (not possible).

Overall, this maximum worst-case scenario indicates that it is still reasonable to assume the original low-end well capacities at Tennis Park and Hansen Park can be maintained, because achieving well efficiencies up to 66 percent is reasonable. However, well efficiencies of 100 percent or greater are not reasonable to assume for Del Prado Park, and it is likely that a reduced well capacity would occur under these worst-case conditions. However, on additional consideration, it is noted that these low-end well capacity estimates are based on Fall groundwater level conditions, whereas drought-year pumping will occur throughout the year when water levels may be slightly higher. Therefore, even in the worst-case scenario, the decline in well capacity may be limited to the Fall season.

Table 9. Evaluation of Mutual Well Interference Impact and 30/90-Day Specific Capacity on Minimum Production Well Capacity					
Well ID	**Case**	**Pumping Rate[1]**	**Assumed Efficiency[2]**	**Pumping Rate[3]**	**Assumed Efficiency[4]**
Tennis Park	Baseline	3,400	50	-	-
Tennis Park	Including MWI (3 Wells Pumping 30 days)	3,400	-	3,000	57
Tennis Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	2,850	60
Tennis Park	Including MWI and 30-Day Q/s	-	-	2,800	61
Tennis Park	Including MWI and 90-Day Q/s	-	-	2,600	66
Hansen Park	Baseline	3,400	50	-	-
Hansen Park	Including MWI (3 Wells Pumping for 30 days)	3,400	-	3,200	54
Hansen Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	3,100	55
Hansen Park	Including MWI and 30-Day Q/s	-	-	2,900	59
Hansen Park	Including MWI and 90-Day Q/s	-	-	2,700	64
Del Prado Park	Baseline	1,300	75	-	-
Del Prado Park	Including MWI (3 Wells Pumping for 30 days)	1,300	-	1,050	93
Del Prado Park	Including MWI (3 Wells Pumping 90 days)	1,300	-	1,000	99
Del Prado Park	Including MWI and 30-Day Q/s	-	-	975	100
Del Prado Park	Including MWI and 90-Day Q/s	-	-	880	110[5]

[1] Baseline minimum pumping capacity based on 24-hour Q/s and no mutual well interference

[2] Baseline assumed well efficiency

[3] Minimum pumping capacity accounting for mutual well interference or mutual well interference plus longer term
specific capacity

[4] Assumed well efficiency to maintain the original baseline pumping capacity

[5] Well efficiency cannot exceed 100%

Appendix C

Test Well Investigation Summary and Well Design Recommendations (Del Prado Park)

LSCE

DECEMBER 2025

REGIONAL GROUNDWATER FACILITIES PROJECT FEASIBILITY STUDY

Del Prado Park
Test Well Investigation Summary and Well Design Recommendations

PREPARED FOR

THE CITY OF PLEASANTON

ZONE 7 WATER AGENCY

PREPARED BY

Luhdorff & Scalmanini
Consulting Engineers

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
bgs	below ground surface
City	City of Pleasanton
DDW	State Water Resources Control Board, Division of Drinking Water
gpm	gallons per minute
LSCE	Luhdorff and Scalmanini, Consulting Engineers
MCL	maximum contaminant level
Nor Cal	Nor Cal Pump and Well Drilling
North State	North State Electric and Pump
NDPES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
O.D.	outside diameter
PFOS/PFAS	Perfluorooctanesulfonic acid/Per- and polyfluoroalkyl substances
QA/QC	Quality Assurance/Quality Control
TM	Technical Memorandum

1. INTRODUCTION

Luhdorff and Scalmanini, Consulting Engineers (LSCE) have prepared this summary report documenting the hydrogeologic site investigation of Del Prado Park in the City of Pleasanton and the construction and testing of the Del Prado Park test well. The Del Prado Park investigation was one of three site investigations conducted as part of the Regional Groundwater Facilities Project Feasibility Study, a joint project between Zone 7 Water Agency and the City of Pleasanton. Investigations and test well construction were also conducted at Tennis Park and Hansen Park in the City of Pleasanton. The investigation of the Del Prado Park site included drilling of an exploratory borehole to a depth of 800 feet below ground surface (bgs), construction of an eight-inch diameter test well completed to 590 feet bgs with eight screen sections between 170 feet and 580 feet bgs, pump testing, flow profiling, and water quality sampling and analysis. This report also includes well production design and flow rate recommendations.

2. SITE SPECIFIC INVESTIGATION

The primary purposes of the investigation of the Del Prado Park site were to characterize subsurface lithology, characterize zonal water quality and flow characteristics, and collect the information necessary to design a sand-free and efficient well that could yield water in sufficient quantity and quality to meet project objectives.

The Del Prado Park test well site is located in the southwest corner of the park near the intersection of Paseo Santa Cruz and Hasen Drive in Pleasanton, CA (**Figures 1 and 2).**

The Del Prado Park test west well was drilled and constructed by Nor Cal Pump and Well Drilling (Nor Cal) of Yuba City, California (CA License #908591). A copy of the permit for the drilling of the test hole and test well construction obtained from Zone 7 Water Agency is attached in **Appendix A.** A copy of the encroachment permit issued by the City of Pleasanton to work in the park is also included in **Appendix A**. Pump test development and pump testing was performed by North State Electric and Pump (North State) of Chico, California (CA C57 License #812678). A copy of the encroachment permit issued to North State by the City of Pleasanton is attached in **Appendix A**.

Drilling commenced on December 11, 2024, and final well testing was completed on April 18, 2025. All work was conducted per project specifications and permitting requirements including traffic control, sound attenuation, and working hours unless variances were specifically granted by the City of Pleasanton.

2.1. Test Hole Drilling and Well Construction

Nor-Cal drilled the test hole from ground surface to 800 feet bgs at a diameter of 9 inches using the direct rotary drilling method. Drill cuttings from the boring were collected at 10-foot intervals and described by LSCE. Representative samples were collected in one-gallon resealable plastic bags and “chip trays”. On December 17, 2024, after reaching the target depth, a suite of geophysical surveys were conducted in the

borehole (**Appendix A**) by Pacific Surveys of Claremont, California. Using the descriptions of the drill cuttings and the geophysical surveys, LSCE developed a lithologic log of the materials encountered in the test hole. The lithology encountered in the test hole and the geophysical logs are detailed on the attached test well as-built figure (**Figure 3**). Multiple coarse-grained intervals were identified in the borehole that could be targeted in a future production well between 170 feet and 580 feet bgs. Coarse-grained intervals above 170 feet bgs were not considered potential target zones in a new well due to anticipated poor water quality.

LSCE submitted a test well profile (**Figure 3**) to Zone 7 for approval. The test well design included multiple intermediate bentonite seals to isolate each coarse-grained zone and a cement annular seal to a depth of 154 feet bgs. Test well design features are included in **Table 1**.

Table 1. Del Prado Park Test Well Construction Information

Depth of Borehole	(ft bgs)	800
Borehole Diameter	Diameter (in.)	14.75-Inch (0-605 ft bgs) 9-Inch (605-800 ft bgs)
Depth of Well	(ft bgs)	590
Blank Casing	Depth (ft bgs)	0-170, 190-240, 260-300, 320-370, 380-440, 460-490, 500-510, 520-570, 580-590
	Diameter (in)	8.625 O.D.*
	Wall Thickness (in)	0.250
	Material Type	Mild Steel
Screened Interval	Depth (ft bgs)	170-190, 240-260, 300-320, 370-380, 440-460, 490-500, 510-520, 570-580
	Screen Type	Louvered (Ful-Flo)
	Slot Size (inches)	0.060
	Screen Material Type	Mild Steel
Gravel Envelope	Depth (ft bgs)	156-195, 235-270, 290-330, 360-470, 480-530, 560-605
	(type/size)	SRI #8
Transition Seal	Depth (ft bgs)	154-156
	Seal Material Type	Fine Sand
Intermediate Seal	Depth (ft bgs)	195-235, 270-290, 330-360, 470-480, 530-560, 605-800
	Seal Material Type	Bentonite Chips
Annular Seal	Depth (ft bgs)	0-154
	Seal Material Type	10.3 Sack Sand/Cement Grout

*Outside Diameter

After receiving approval of the test well design by Zone 7, the test hole was then reamed from ground surface to a depth of 605 feet at a diameter of 14.75 inches. Borehole reaming operations began on January 6, 2025. Test well construction was completed on January 11, 2025. A copy of the Well Completion Report is attached in **Appendix A**.

2.2. Well Development and Testing

Initial development of the well was performed by open-ended airlifting from the bottom of the casing assembly, followed by swab/airlift development by Nor-Cal. Final developmental pumping was performed with a submersible pump by North State.

Starting on January 13, 2025, the drill string was installed to the bottom of the casing, and the well was airlifted open-ended. Between January 14 and 17, 2025, a swab isolation tool was used to swab/airlift each well screen. The screened sections were swabbed/airlifted from top to bottom during the first pass. A second pass started from the bottom screen section to the top screen section. All fluids generated during airlift operations were contained and disposed of offsite by Nor-Cal.

After airlift operations were completed, LSCE collected water samples from the well for analysis of volatile organic compounds (VOCs), fuel additives, semi-volatile organic compounds (VOC's), polycyclic aromatic hydrocarbons (PAH's), and metals listed in NPDES Permit No. CAG912002. A summary table of analytes and analysis results is included **Appendix A**. Only after the results of the water testing and discharge plan (**Appendix A**) were accepted by the City of Pleasanton, was water discharged to the City's storm water system. Storm drain discharge monitoring field notes are included in **Appendix A**.

North State installed a temporary submersible pump in the well on March 10, 2025, to perform pump and surge development of the well and to conduct well testing. Between March 10, 2025, and March 21, 2025, the well was developed at rates between 50 and 450 gallons per minute (gpm). Additional time and effort was required to develop the well using pump and surge operations than what is typical, primarily due to incomplete swab/airlift development.

Step Test

Step testing was performed on March 26, 2025, and consisted of three (3) steps. The static water level in the well measured prior to testing was 16.45 feet bgs. The discharge rate, pumping duration, projected pumping water drawdown, and projected specific capacity of the test are included below in **Table 2.** The step test hydrograph is depicted in **Figure 4**.

Table 2. Step Testing Results

Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
120	172	7.5	22.9
120	243	13.4	18.2
180	370	24.8	14.9

Long-Term Constant Rate Test

An 8-hour constant rate pumping test was performed on March 27, 2025, to determine well and aquifer characteristics. The static water level measured prior to testing was 16.65 feet bgs. The discharge rate, pumping duration, projected pumping drawdown, and projected specific capacity of the test are included below in **Table 3.** The long-term constant rate test hydrograph is depicted in **Figure 5**.

Table 3. Long-Term Constant Rate Test Results

Duration (min)	Average Discharge Rate (gpm)	Projected 24-Hour Drawdown (ft)	Projected 24-Hour Specific Capacity (gpm/ft)
480	252	15.6	16.2

2.3. Water Quality

Water quality samples were collected by LSCE personnel from a dedicated sample tap on the well discharge assembly on March 26, 2025, for Title 22 drinking water constituent analysis and for other constituents of interest. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* (**Appendix A**) prepared for the project and standard industry practice. The results of the water quality analysis show that for the constituents analyzed, only turbidity, iron, and manganese exceeded their respective maximum contaminant levels (MCL) (**Table 4**). All other constituents were below their respective MCLs. **Appendix B** summarizes the results of the Title 22 sampling.

Table 4. Exceedances of Drinking Water Maximum Contaminate Levels

Analyte	Units	MCL	Result
Turbidity	NTU*	5	7.5
Iron	mg/l	0.3	0.66
Manganese	mg/l	0.050	0.060
*nephelometric turbidity units			

Based on a review of water quality data for the City of Pleasanton and Zone 7 wells, iron, aluminum, and manganese concentrations are typically non-detect or below their respective MCLs. Iron and aluminum concentrations can be elevated in a turbid sample. Aluminum has typically been non-detect in the City of Pleasanton and Zone 7 wells. The concentration of aluminum in the Del Prado well was 0.54 mg/l. Due to difficulties developing the test well, the turbidity of the collected samples were elevated. LSCE believes that, based on the water quality of other wells in the area and the elevated turbidity of samples, the level of iron is not representative of groundwater.

It has been our experience that manganese concentrations in monitoring wells and test wells can be higher than observed in production wells. That is, water produced from monitoring wells or test wells will have elevated manganese concentrations, whereas production wells completed in the same formations have lower concentrations or are non-detect for manganese. LSCE has recognized this phenomenon in

monitoring and test wells across the state, in different geologic environments, using different drillers and drilling techniques, and different laboratories. In our experience, this only occurs with manganese.

The most probable cause for elevated concentrations of manganese in the test well is related to well development techniques and limitations. Due to the size of the well casing, limited screen section lengths, water levels during pump and surge development, pump size limitations, and well yield, the development of a small-diameter well can be less effective than can be achieved in a large-diameter well. The development of a full-size production well can be more vigorous and effective than is possible in a small-diameter well with isolated zones. LSCE believes that the large discharge volumes and development techniques utilized in production wells results in more effective well development and removal of residual drilling fluids and formation material than is possible in small diameter wells. Based on our experience and the water quality of other wells in the vicinity of the Del Prado test well, and the limitations of development of a small-diameter well, we believe that the elevated concentration of manganese is not representative of groundwater.

While meeting Title 22 water quality standards, hardness, nitrite, ammonia and total dissolved solids values exceed Zone 7/City of Pleasanton's water quality targets. The exceedances are summarized in **Table 5**.

Table 5. Water Quality Targets and Exceedances

Parameter	Target	Result
Hardness	150 mg/l	400 mg/l
Nitrite	0.02 mg/l	0.43 mg/l
Ammonia	0.15 mg/l	0.19 mg/l
Total Dissolved Solids	500 mg/l	860 mg/l

2.4. Zone Sampling

Depth-discrete water samples were collected from above each screened interval within the well to characterize zonal water quality. Groundwater samples were collected on March 27, 2025, under pumping conditions. Starting with Zone #1, Pacific Surveys installed a sampling tool into the well to the specified zone to collect a sample for analysis. Samples were analyzed for general mineral, general physical, inorganic, and PFOS/PFAS constituents. Water samples were collected and handled according to the *Testing, Sampling, and Analysis Plan* prepared for the project. A summary table of zonal water quality analysis results are in **Appendix B.** Samples were collected at the depths shown in **Table 6**.

Table 6. Zone Sampling Information	
Sample Zone	**Sample Depth**
Zone #1	230 feet bgs
Zone #2	290 feet bgs
Zone #3	360 feet bgs
Zone #4	430 feet bgs
Zone #5	480 feet bgs
Zone #6	505 feet bgs
Zone #7	560 feet bgs

The zonal concentration of manganese ranged from a low of 0.037 mg/l in Zone #1 (230 feet bgs) to high of 0.11 mg/l in Zone #7 (560 feet bgs). For the reasons explained above in Section 2.3, LSCE believes that the elevated zonal manganese concentrations are not representative of native groundwater.

2.5. Flow Survey

On March 27, 2025, a spinner survey was performed in the well by Pacific Surveys to quantify the groundwater flow contribution from individual screen intervals under pumping (dynamic) conditions. **Table 7** summarizes the flow contribution for each screen section in the well. The dynamic spinner survey log is included in **Appendix A.**

Table 7. Zonal Flow Contribution Pumping Conditions		
Screen Interval (feet bgs)	**Production (gpm)**	**% of Flow**
170-190	99	36.5
240-260	71	26.1
300-320	45	16.7
370-380	14	5.2
440-460	26	9.6
490-500	9	3.2
510-520	5	1.9
570-580	2	0.7
Total	**271**	**99.9**

The results of the spinner survey show that 94% of the total well yield is derived from screened intervals above 460 feet bgs. The low contribution from the lower three screen sections is not surprising, considering the thickness and the resistivity response on the geophysical log of those zones.

A spinner survey was also conducted in the well to measure flow under non-pumping (static) conditions (**Appendix A**). The results of the static spinner survey show that water does not flow within the well from or into screened intervals under non-pumping conditions.

2.5 Well Yield Estimation

LSCE used the data derived from the constant rate pumping test, combined with data regarding the range of expected regional groundwater levels, to develop well pumping capacity estimates for the wells constructed at Del Prado Park, Tennis Park, and Hansen Park. The methodology, data, and analysis used to develop pumping capacities for the three sites were detailed in a Technical Memorandum (TM), which is attached (**Appendix C**). **Table 8** summarizes the estimated pumping capacity of well constructed per the design recommendation presented in Section 3 at Del Prado Park.

Table 8. Summary of Well Pumping Capacity Estimates

Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Del Prado Park	175	16.2	153	105	75	1,900	1,300

The well capacity estimates provided in **Appendix C**, and hence the overall project yield, should be considered best estimates at this time based on installation and testing of relatively small diameter test wells. The final full-scale production well yields and overall project yield may vary by several hundred gpm more or less than the test well based estimates provided in this feasibility study. Production well yields will be a function of multiple variables (e.g., specific capacity, aquifer transmissivity, well efficiency) that may vary between test well drilling and production well drilling. The amount of project yield above the baseline amount allocated to City of Pleasanton (and hence, available to Zone 7) cannot be confirmed until production wells are installed and tested.

The specific capacity, how many gallons of water that can be pumped for every foot of drawdown, and projected yield of a production well constructed at Del Prado Park is less than was projected for proposed wells at Hansen Park (4,200 – 3,400 gpm) and Tennis Park (5,100 – 3,400 gpm). Factors that can affect the specific capacity and performance of a well include the transmissivity and thickness of the aquifer zones, the length and placement of well screens, pumping rate, and the development of the well. Based on a review of geophysical logs from each of the test boreholes, the Del Prado site had the least amount (thickness) of potential aquifer material to screen in a production well. The Del Prado test well was constructed with 120-feet of screen whereas the Tennis Park and Hansen Part test wells constructed with 240 and 200 feet of screen, respectively. The transmissivity of the formations at the Del Prado site along with the thickness of aquifer material and length of screen in the test well are likely contributing factors to the low specific capacity of the well compared to that of the Tennis Park and Hansen Park test well.

Additional time and effort was required to develop the test well using pump and surge operations than what is typical, primarily due to incomplete swab/airlift development. Well development is typically considered compete when the well yield is free of sand, silt, and turbidity and the specific capacity of the well is stable (i.e., no longer increasing). Discharge from the well before testing began was sand free and clear and the specific capacity was stable. However, due to the length of time it took to develop the well, there is the possibility that some residual material from drilling operations was not removed during well development that may impact the performance of the test well.

3. PRODUCTION WELL DESIGN RECOMMENDATIONS

Based on our investigation of the Del Prado Park site, the testing of the Del Prado Test Well, and our well yield and drawdown analysis, LSCE believes that a well constructed at the Del Prado site could yield between 1,300 and 1,900 gpm of water that would meet all current Title 22 Drinking Water Standards without treatment. Utilizing the information gathered as part of the site investigation, well testing, and analysis, LSCE has prepared the following design recommendations for a community supply well to be constructed at Del Prado Park.

Our proposed well design meets the requirements of the Department of Water Resources Water Well Standards, Bulletin 74-81, 74-90; State Water Resources Control Board, Division of Drinking Water (DDW), and accepted water well design standards. **Figure 6** depicts the proposed well design. The well is designed to accommodate submersible pumping equipment that could pump up to 1,900 gpm. Collapse pressures for each casing type and thickness were calculated to ensure each can resist the hydrostatic pressures developed during sanitary and annular seal placement. Each of the well design elements is discussed below.

Conductor Casing / Sanitary Seal – The conductor casing will stabilize the upper portions of the borehole during drilling and well construction, while ensuring that requirements for sanitary seal are met. The conductor casing shall be installed in a 48-inch diameter borehole and cemented in place to a depth of 50 feet bgs. At a depth of 50 feet, the conductor will terminate in a clay layer. The conductor casing shall be fabricated of a 36-inch O.D. by 3/8-inch wall ASTM A-139 Grade B steel.

Production Borehole – The production borehole shall be drilled using the reverse circulation drilling method. The final borehole diameter shall be 32 inches to a depth of 605 feet bgs.

Blank Well Casing – Stainless steel was selected for the blank casing. Stainless steel will provide superior corrosion resistance and well longevity while meeting DDW standards for NSF 60 certification. The blank well casing shall be 18-inch I.D. by 5/16-inch wall ASTM A-778 Type 304L stainless steel.

Well Screen – Stainless steel, louvered well screen was selected to maximize well open area and efficiency, and for compatibility with the blank well casing. The 18-inch I.D. well screen will be constructed ASTM A-778, Type 304L stainless steel with a slot size of 0.050-inch. At a design capacity of 1,900 gpm, the screen will have a theoretical inlet velocity of 0.0359 feet/second.

Accessory Pipes - A 2-foot-long, stainless steel sounding port shall be installed on the well casing from 172 to 174 feet bgs. A 2-inch, Schedule 40, Type 304L stainless steel sounding tube shall be connected to the sounding port and installed to a depth of 174 feet bgs. A 3-inch, Schedule 40, BSP gravel fill tube shall be installed to a depth of 165 feet bgs.

Gravel Envelope – Based on the sieve analysis of selected formation samples (**Figure 7**), an 8 x 16 graded gravel envelope material was selected for use in this well. The gravel chosen is 5.3 times larger than the finest formation sample (300-305 feet bgs) at the d_{70} (cumulative percent retained) value. The 0.050-inch screen slot size will retain 90 percent of the gravel material. The gravel envelope will be placed from 605 to 157 feet bgs. A two-foot, fine sand transition seal will be placed from 157 to 155 feet bgs.

Annular Seal – The deep annular seal will ensure that only groundwater from the targeted intervals will enter the well structure. The annular seal shall consist of "10.3-sack" sand/cement grout and shall be placed from a depth of 155 feet bgs to the ground surface.

Based on recent projects of similar size and scope, LSCE's preliminary Engineer's Estimate for the well construction, development, and testing is approximately $950,000. Items such as water supply for drilling, fluid and cutting disposal, development water disposal, material and equipment storage, sound attenuation, and site security and safety that may affect the cost of well installation and testing will need to be addressed in the final specifications before bidding.

Alternate Well Design Considerations

Well design recommendations were based on direction to maximize well yield. The recommended well design includes screens placed opposite each zone identified in the test well borehole below a depth of 195 feet. Development of well capacity estimates assumed that each zone screened in the test well would be targeted for completion in a production well.

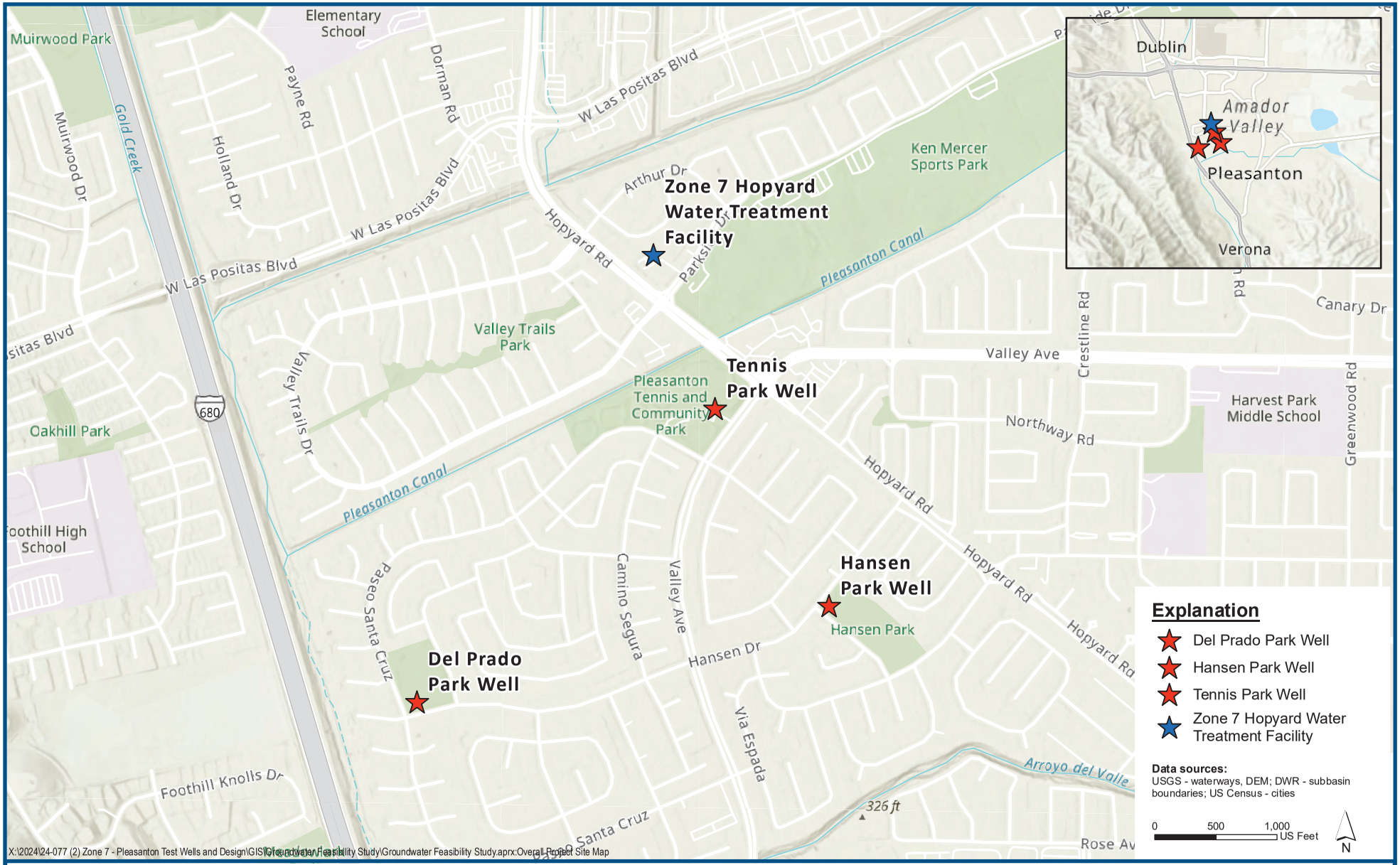
The projected yield of the proposed Del Pado Park Well constructed as recommended above is between 1,900 and 1,300 gpm, depending on long term and seasonal water level variations and a conservative well efficiency value as discussed in the attached Well Capacity TM. Based on dynamic flow testing conducted in the test well, the bottom three zones (480 - 605 feet) in the well contribute 6% of the total well yield or between 114 and 78 gpm of the projected yield of the production well. In contrast, the upper four zones in the production well would contribute 94% of the well yield, or 1,786 to 1,222 gpm.

The estimated cost to drill, construct, and test the production well as recommended above is $950,000, which equates to $1,570 per foot for the 605 foot well. The estimated cost to construct a well that targets zones above 480 feet is $753,600, or 21% less than a 605 foot well. Put another way, an 6% reduction in yield will result in a 21% cost savings for the construction of the production well.

FIGURES

Figure 1 - Well Location Map
Figure 2 - Del Prado Park Site Map
Figure 3 - Test Well As-Built Profile
Figure 4 - Step Test Hydrograph
Figure 5 - Constant Rate Test Hydrograph
Figure 6 - Proposed Production Well Design
Figure 7 - Sieve Analysis

LSCE



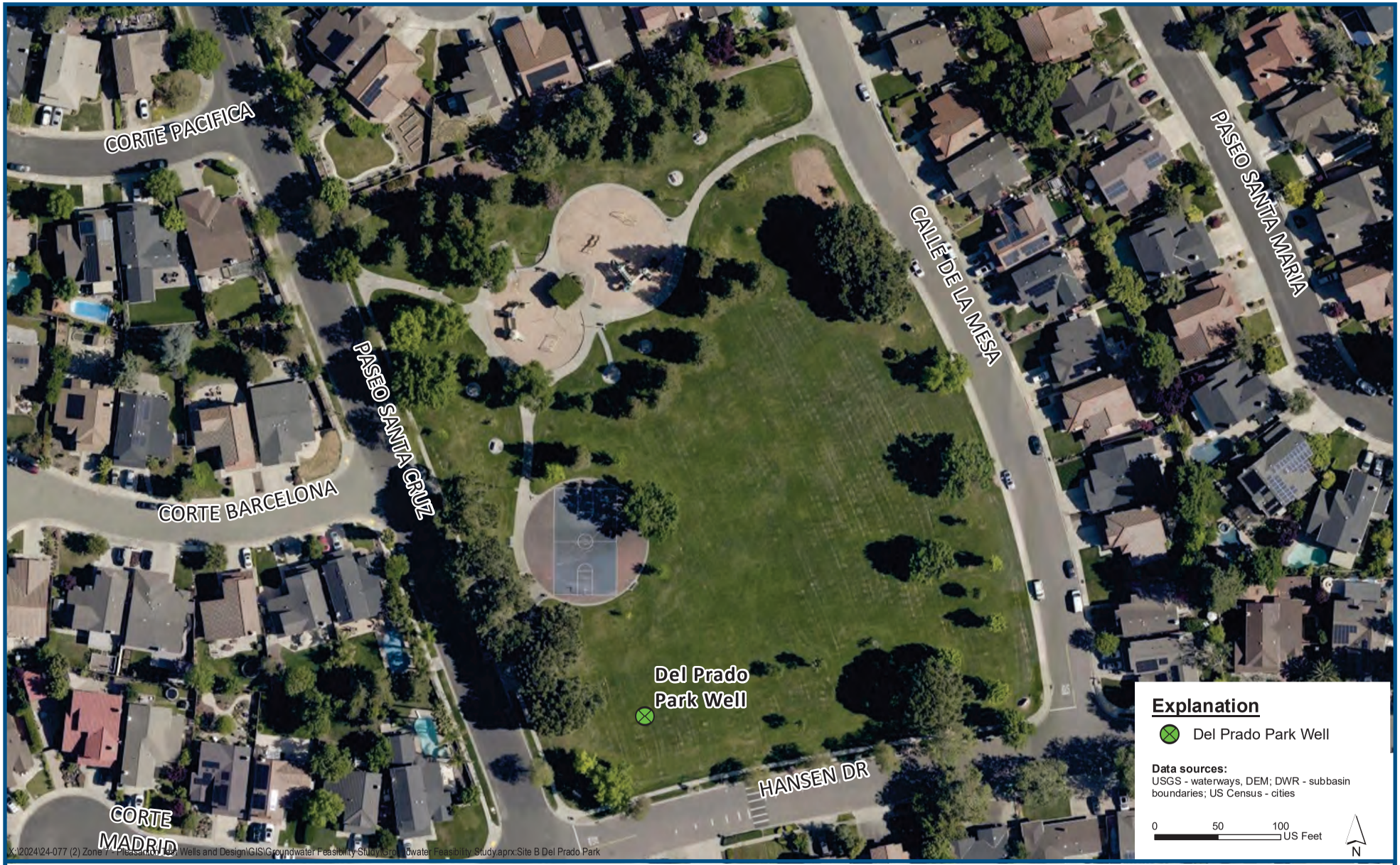
X:\2024\24-077 (2) Zone 7 - Pleasanton Test Wells and Design\GIS\Groundwater Feasibility Study\Groundwater Feasibility Study.aprx:Overall Project Site Map

Luhdorff & Scalmanini
Consulting Engineers

Project Well Location Map

Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

Figure 1



Luhdorff & Scalmanini
Consulting Engineers

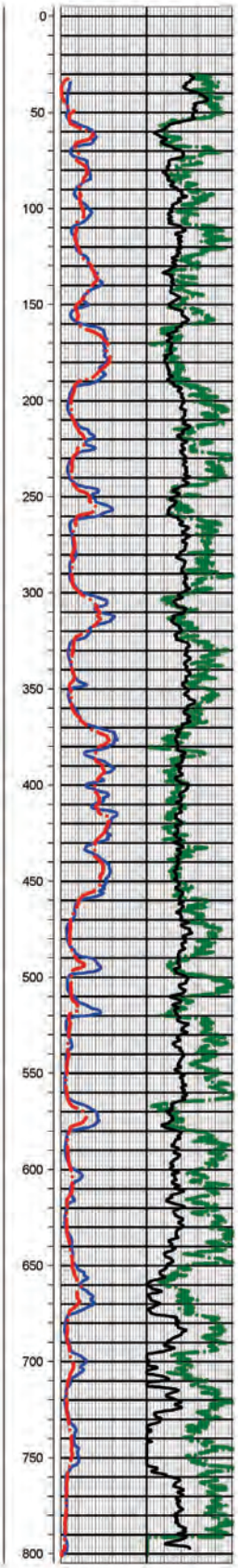
Del Prado Park Site Map

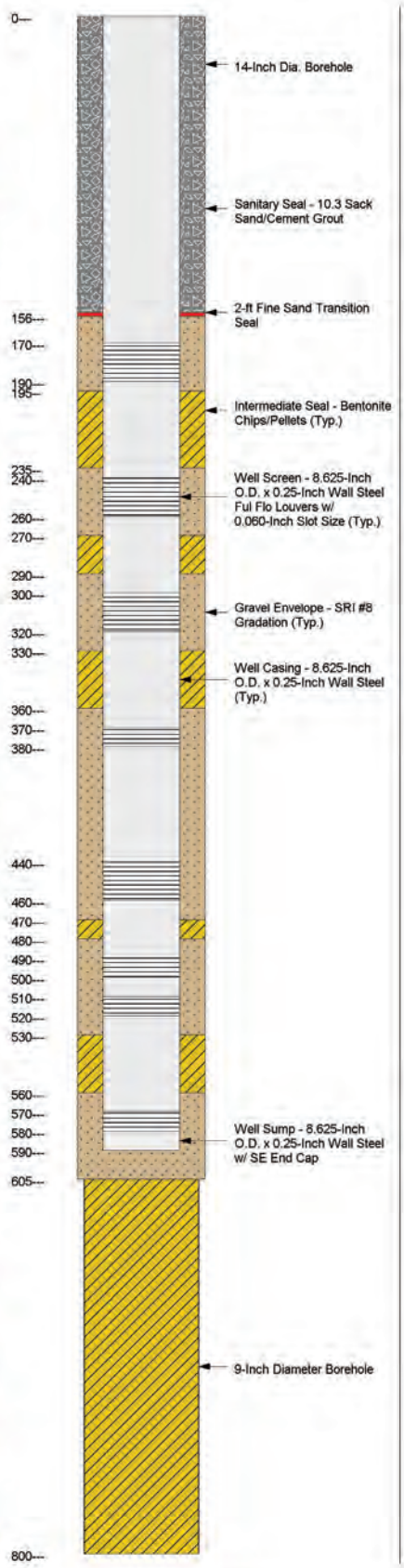
Zone 7 Regional Groundwater Facilities Project Feasibility Study
Pleasanton, CA

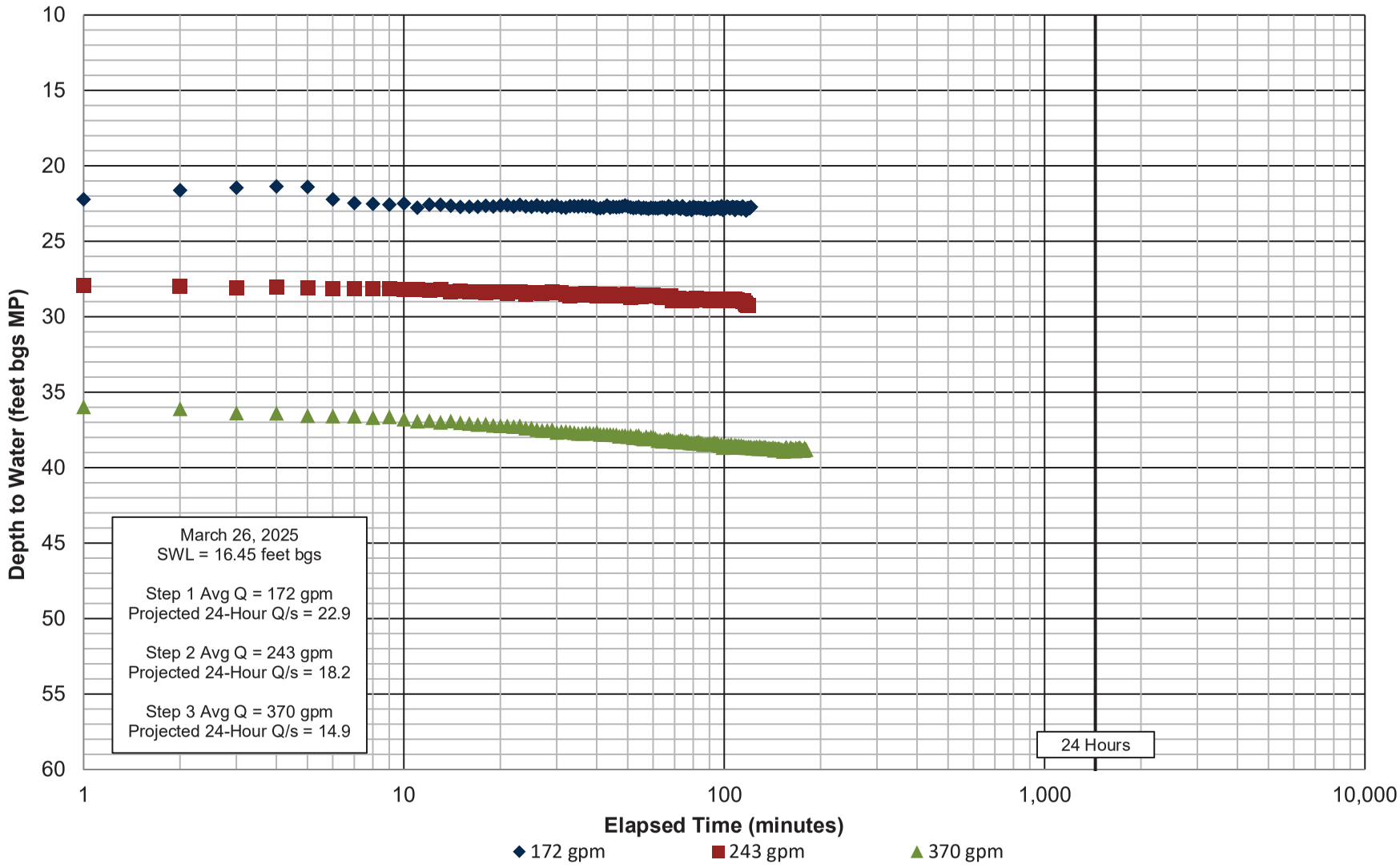
Figure 2

Client: Zone 7 / City of Pleasanton	**Lat/Long:** 37.6687/-121.9067	Luhdorff & Scalmanini Consulting Engineers
Well Name: Del Prado ParkTest Well	**GSE (ft-msl)** +322	
LSCE #: 24-2-077	**Drill Date:** 12/11/2024 - 12/17/2024	
Location: Del Prado Park, Pleasanton	**Drilling Method:** Direct Mud Rotary	
Geologist: B. Kearney	**Driller:** Nor-Cal Pump & Well Drilling	

Depth(ft bgs)	Lithologic Description	Strat-Column
0	Sandy Clay - low to medium plastic, dark brown to grey-brown, very fine to medium sand	
50	Sandy Gravel - Granules and pebbles, sub-round, very fine to very coarse multicolor sand, w/ low plastic brown clay streaks	
100	Clay - medium plastic, brown to grey, sticky	
	Sandy Gravel - small gravel, sub-round granules, a few pebbles, medium to very coarse sand	
150	Sandy Clay - low plastic, brown, very fine to medium sand, black	
	Sandy Gravel - granules and pebbles, fine to very coarse sand	
200	Sandy Clay - medium plastic, grey, fine to medium sand	
	Sandy Gravel - granules, very fine to very coarse sand	
	Sandy Clay - medium plastic, brown to grey-green, very fine to medium sand	
250	Sandy Gravel - granules and pebbles, sub-round, fine to very coarse sand	
	Sandy Clay - medium to high plastic, dark grey-green, orange-brown mottles, very fine to medium sand, quartz-rich, black	
300	Sandy Gravel - granules and pebbles > 1", very fine to very coarse sand	
	Sandy Clay - low plastic, brown to grey-green, very fine to very coarse sand	
350	Sandy Gravel - granules and pebbles > 1", fine to very coarse sand, quartz-rich, black	
400		
450	Sandy Clay w/ Gravel - medium plastic, grey to grey-green, very fine to medium sand, black, w/ small gravel stringers	
500		
550	Sandy Gravel - granules and pebbles, fine to very coarse sand, quartz-rich, black	
	Sandy Clay - medium plastic, grey-green, very fine to very coarse sand	
600		
650	Sandy Gravel - granules, fine to very coarse sand, quartz-rich, black	
	Sandy Clay - low plastic, grey-green, very fine to very coarse sand, w/ small gravel stringers	
700		
750		
800		





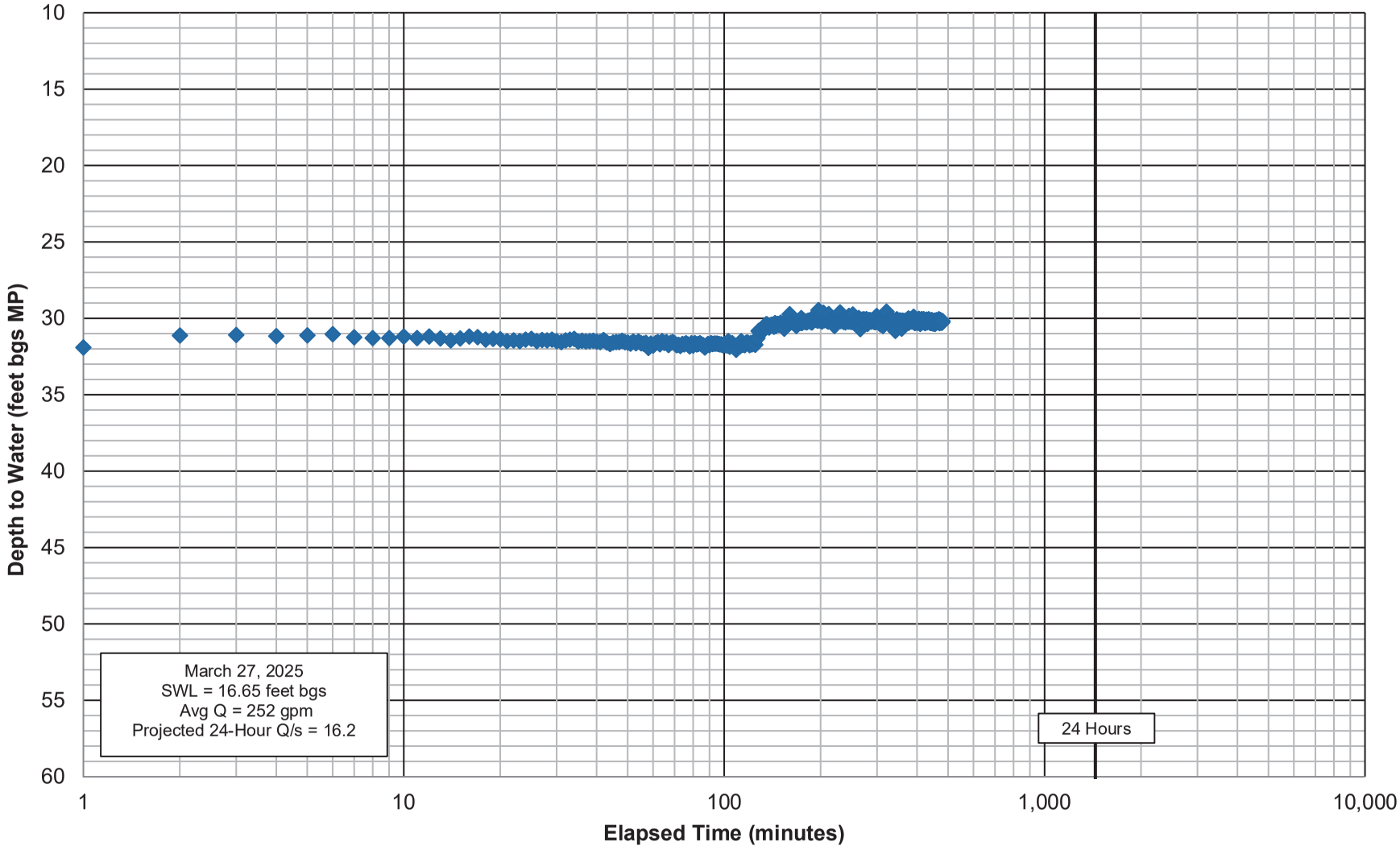


Luhdorff & Scalmanini Consulting Engineers

Step Test - Del Prado Park Test Well

Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 4



Luhdorff & Scalmanini
Consulting Engineers

Constant Rate Test - Del Prado Park Test Well

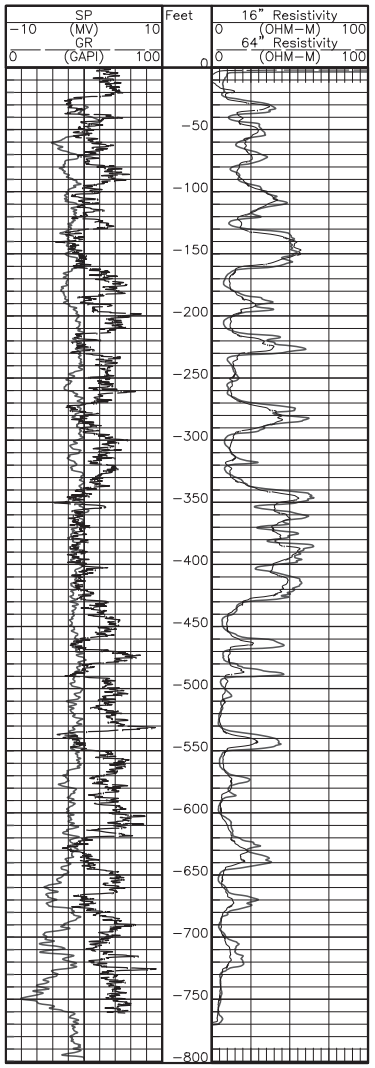
Test Wells and Design Construction Summary Report
Zone 7 Pleasanton, CA

Figure 5

DEL PRADO PARK WELL
TEST HOLE LITHOLOGY

Depth	Description
0'	Sandy Clay–low to medium plastic, dark brown to grey–brown, very fine to medium sand
55'	Sandy Gravel–granules and pebbles, sub–round, very fine to very coarse multicolor sand, w/ low plastic brown clay streaks
110'	Clay–medium plastic, brown to grey, sticky
120'	Sandy Gravel–small gravel, sub–round granules, a few pebbles, medium to very coarse sand
150'	Sandy Clay–low plastic, brown, very fine to medium sand, black
160'	Sandy Gravel–granules and pebbles, fine to very coarse sand
190'	Sandy Clay–medium plastic, grey, fine to medium sand
210'	Sandy Gravel–granules, very fine to very coarse sand
230'	Sandy Clay–medium plastic, brown to grey–green, very fine to medium sand
245'	Sandy Gravel–granules and pebbles, sub–round, fine to very coarse sand
260'	Sandy Clay–medium to high plastic, dark grey–green, orange–brown mottles, very fine to medium sand, quartz–rich, black
295'	Sandy Gravel–granules and pebbles > 1", very fine to very coarse sand
325'	Sandy Clay–low plastic, brown to grey–green, very fine to very coarse sand
365'	Sandy Gravel–granules and pebbles > 1", fine to very coarse sand, quartz–rich, black
460'	Sandy Clay w/ Gravel–medium plastic, grey to grey–green, very fine to medium sand, black, w/ small gravel stringers
560'	Sandy Gravel–granules and pebbles, fine to very coarse sand, quartz–rich, black
580'	Sandy Clay–medium plastic, grey–green, very fine to very coarse sand
650'	Sandy Gravel–granules, fine to very coarse sand, quartz–rich, black
675'	Sandy Clay–low plastic, grey–green, very fine to very coarse sand, w/ small gravel stringers
805'	

DEL PRADO PARK WELL
TEST HOLE ELECTRICAL LOG



DEL PRADO PARK WELL
WELL PROFILE

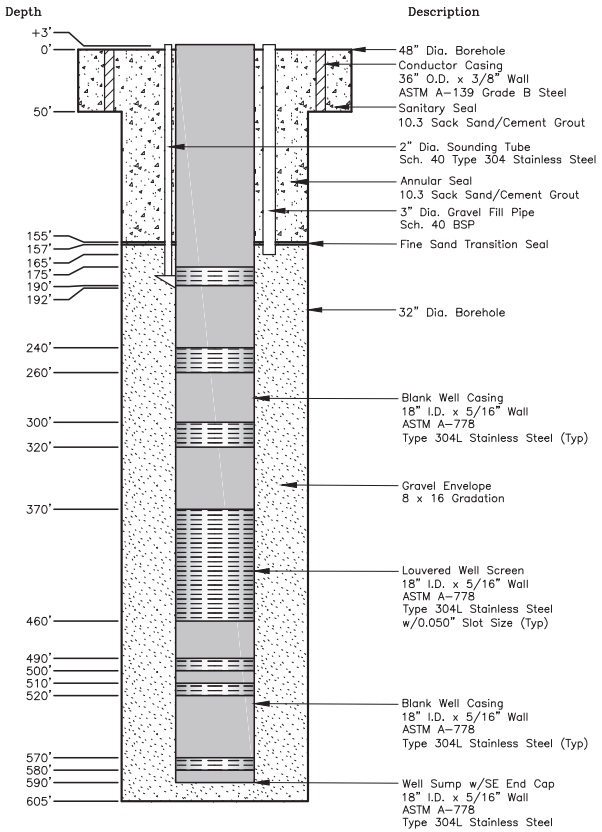


Figure 6

DEL PRADO PARK WELL PROFILE
Zone 7 Water Agency
Regional Groundwater Facilities
Project
Alameda County, California

Luhdorff & Scalmanini
Consulting Engineers

REVISIONS

NO.	DATE	REVISION

DATE: AUGUST 2025
JOB NO.: 24–2–077
DESIGN BY: SL
DRAWN BY: RM
CHECKED BY:
Del Prado Park Well.dwg

SHEET: 1

CAD FILE: Z:\LS ACAD Dropbox\Projects\City of Pleasanton\24–2–077\Del Prado Park Well.dwg DATE: 08/21/2025 1:34 PM

Del Prado Park Test Hole

Luhdorff & Scalmanini
Consulting Engineers

U.S. Standard Sieve Numbers

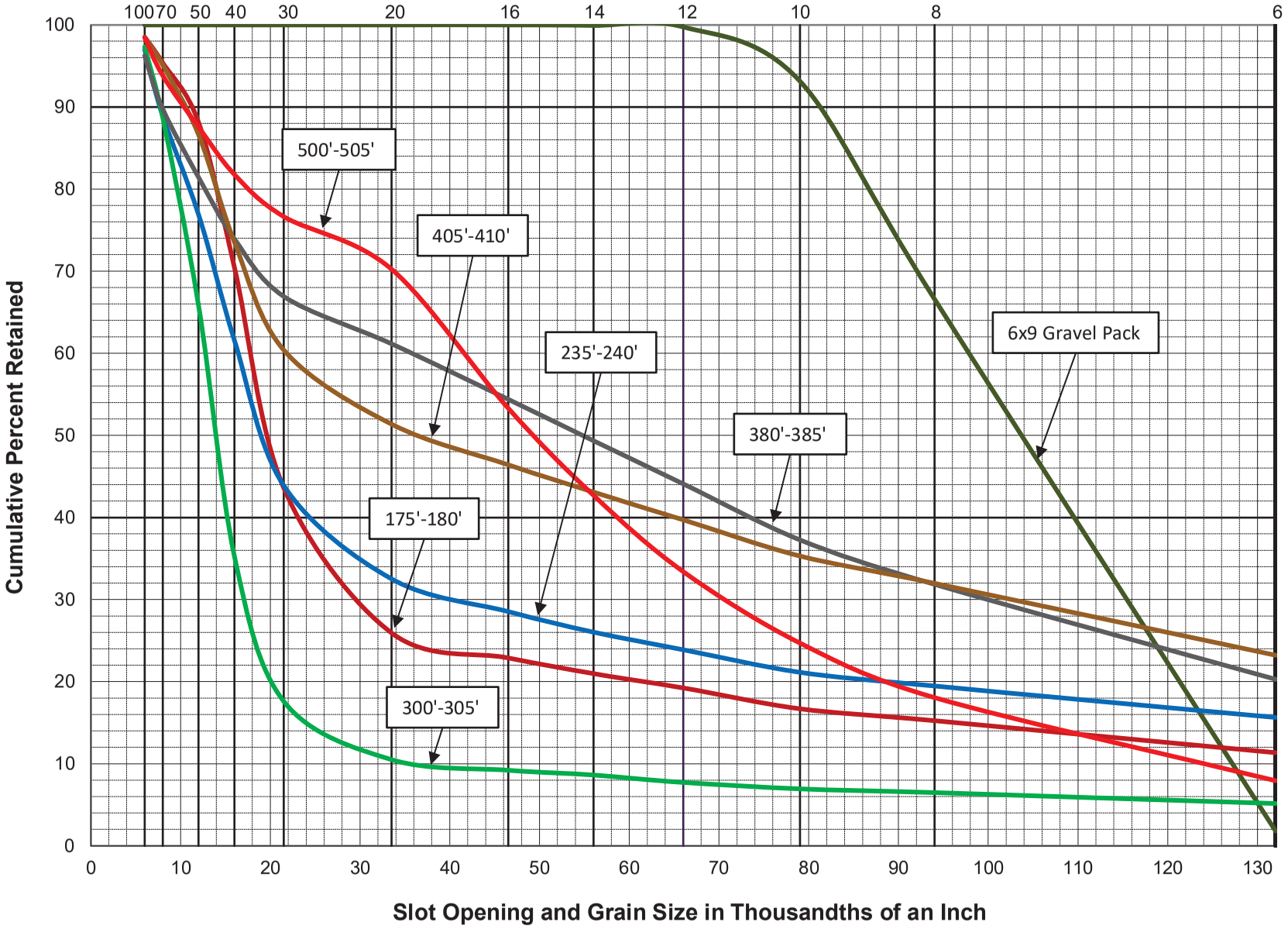


Figure 7

APPENDIX A

A-1 Well Drilling & Construction Permit

Zone 7 Water Agency
100 North Canyons Parkway
Livermore, CA 94551
wellpermits@zone7water.com

DRILLING PERMIT APPLICATION

For Office Use Only

Permit ID	Permit Date	Receipt ID	Well ID
2024107		N/A - Fee Waived	

For Applicant to Complete

Applicant: Nor-Cal Pump & Well Drilling, Inc.	Contact: Carn S. Heer	Email: carn@norcalpump.com
Address: 1325 Barry Road	City: Yuba City, California	Phone: (530) 740-2534
Client: Zone 7 Water Agency		Email: admin@zone7water.com
Address: 100 North Canyons Parkway	City: Livermore, California	Phone: (925) 454-5000
Owner: City of Pleasanton	☒ Same as client	Email: tyamello@cityofpleasantonca.gov
Address: PO Box 520	City: Pleasanton	Phone: 925-931-5519

Site

Project Location/Address 5801 Valley Ave, Pleasanton, CA 94566	**Parcel** 946-4563-125
GeoTracker ID:	**Latitude:** / **Longitude:**

Project Type

☒ **Construction** ☐ **Modification** ☐ **Destruction**
($660/well)

Type of Well

☐ Domestic	☒ Municipal	☒ Monitoring
☐ Irrigation	☐ Industrial	☐ Dewatering
☐ Livestock	☐ Geothermal	☐ Other: _____
☐ Cathodic	☐ Inclinometer	

Borings and Remediation
($445/site up to 4 borings plus $85 for each additional boring)

Type of Work

☐ Geotechnical Boring	☐ Groundwater Extraction*
☐ Environmental Boring	☐ In Situ Treatment*
☐ Soil Vapor Sampling*	☐ Other
☐ Soil Vapor Extraction*	* *Submit design with seal intervals*

Drilling

Drilling Method

☒ Mud Rotary	☐ Hollow Stem Auger
☐ Air Rotary	☐ Direct Push
☐ Sonic	☐ Other: _____

Drilling Company Nor-Cal Pump & Well Drilling, Inc.

C57 License # 908591

Well Construction Projects

Owner Well ID	Borehole Diameter	Casing Material	Casing Diameter	Surface Seal Depth	Total Well Depth
Tennis Park	14"	ASTM A39 Grade B Mild Steel	8.625" OD x .25" wall	125'	650' Casing ; 800' TD

Exploratory Boring Projects

Number of Borings:	Borehole Diameter:	Maximum Depth:	Estimated Depth-to-Water:

All Projects

Estimated Starting Date: 11/25/2024 | Estimated Completion Date: 5/10/2025

*** Please attach a Site Plan with all proposed drilling locations, existing wells, significant site features, and adjacent streets.**

Applicant/Client/Owner assume all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner. I hereby agree to comply with all requirements of this permit (see Page 2) and Alameda County Ordinance No. O-2015-20.

Applicant's Signature: _____ Date: 11/11/2024

For Office Use Only

Approved: _____ Date: _____

REV 11/27/23

EMAIL INSPECTION REQUESTS TO WELLPERMITS@ZONE7WATER.COM

PERMIT CONDITIONS

(Selected Permit Requirements Apply)

FOR OFFICE USE ONLY

☐ General

1. Request an inspection by email (wellpermits@zone7water.com) at least 24 hours before the start of work.
2. Permit is void if project has not begun within 90 days of approval date. Applicant/Client/Owner assumes all liability associated with the execution of this permit. Violation of Permit Conditions may result in an order by Zone 7 to cease work, correct the violation, re-permit the work, and/or address other actions taken against Applicant/Client/Owner.
3. Clear utilities prior to work commencement. Call 811 for more information.
4. Submit all analytical results including soil, vapor, and groundwater samples to Zone 7 within 60 days of collection.
5. California Well Standards and Alameda County Water Wells Ordinance apply unless otherwise required below.

Borings

Must be sealed within 24 hours of drilling

☐ GEOTECHNICAL

1. If groundwater is encountered, tremie cement grout from total depth to ground surface displacing water from hole. Hydrated bentonite granules/chips may be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.
2. If groundwater is not encountered, fill borehole from total depth to ground surface with compacted cuttings, cement grout placed by tremie pipe, or hydrated bentonite granules/chips (minimum 4 inch diameter borehole) using augers as tremie.

☐ CONTAMINATION INVESTIGATION

1. Fill open hole with neat cement placed by tremie pipe to ground surface. Hydrated bentonite granules/chips may also be used in unpaved areas for boreholes of diameter of 4 inches or greater, using augers as tremie.

Wells

☐ GENERAL – Submit within 60 days of work completion:

1. DWR Well Completion Report containing owner and Zone 7 well ID from drilling permit to both DWR and Zone 7 Water Agency.
2. Top-of-casing elevation and pump test results

☐ SUPPLY WELLS

1. Borehole diameter shall be at least 4 inches greater than the well casing diameter.
2. Minimum seal depth must be 50 feet.
3. Cement grout shall be pumped though tremie pipe.
4. Plumbing
   - An access port at least 0.5 inches in diameter is required on the wellhead for water level measurements.
   - A water spigot for sampling is required on the discharge pipe near the wellhead.
   - A metering device is required on the discharge pipe near the wellhead.

☐ MONITORING WELLS

1. Borehole diameter shall be at least 4 inches greater than the well or piezometer casing diameter.
2. Minimum seal depth of monitoring well is the maximum depth practicable or 20 feet.
3. Cement grout shall be pumped through tremie unless freefall exception is met.

☐ Destructions and Other Special Conditions

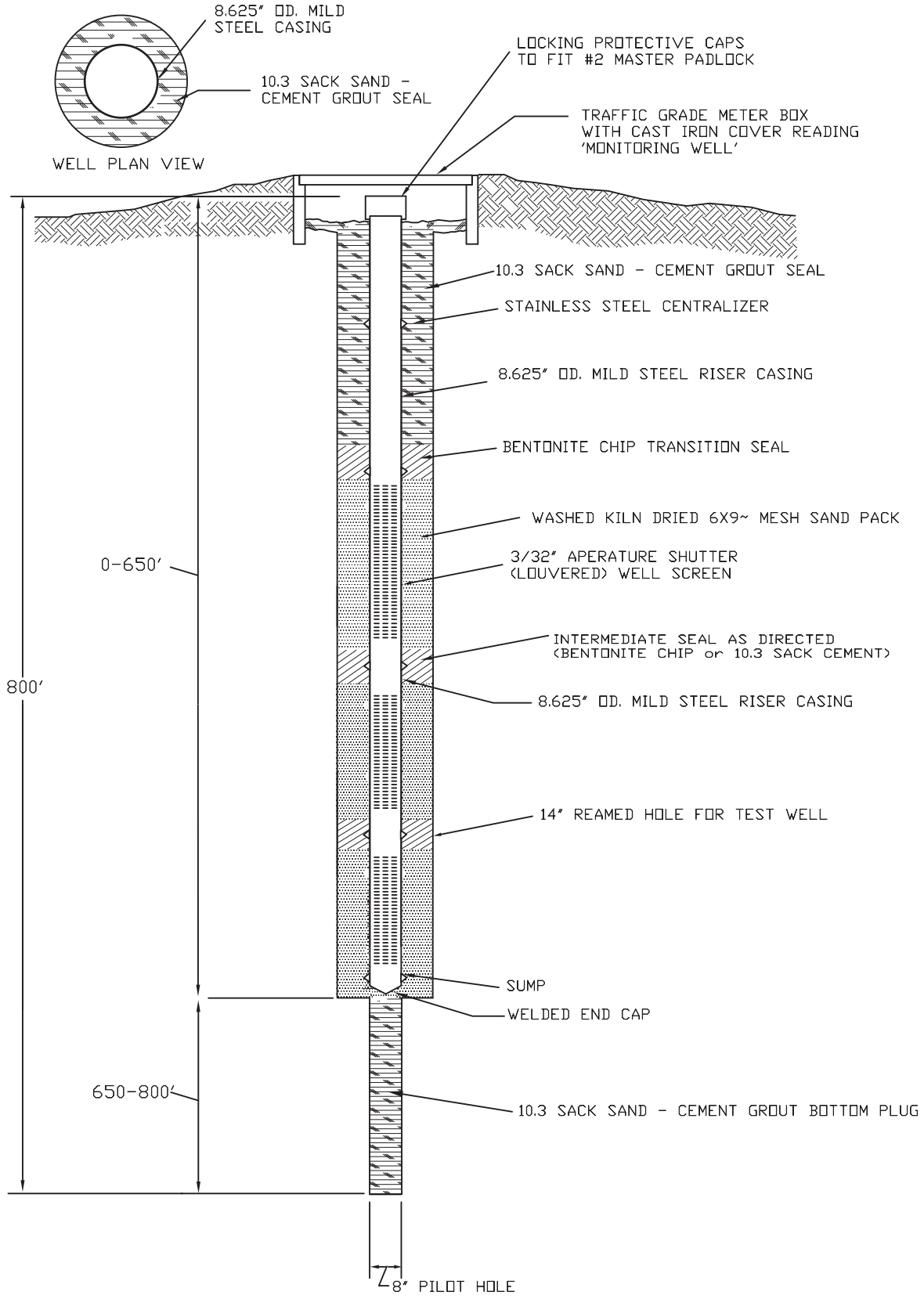
☐ Seal Requirements

Cement grout

- Neat Cement - 47lb Portland Type I /II or II/V cement to 3 gallons of water. Up to 5% bentonite powder by weight of cement.
- Sand Cement – 10.3 sack mix. 94lb Portland Type I/II or II/V cement to maximum 188lbs sand, and maximum 7 gallons of water.

Tremie: Grout shall be placed by tremie pipe. Bottom of tremie must remain submerged in grout until hole is filled. Upper 2 feet may also be restored with compacted material.

Freefall: 30 feet or less below ground surface in unsaturated zone only.



REVISIONS		
6		
5		
4		
3		
2		
1		

ZONE 7 WATER AGENCY

PROJECT DRAWING 5
GENERAL CONSTRUCTION DESIGN
TEST WELL

DRAWN: J. DANIELSEN
DESIGNED:
CHECKED:
APPROVED:
DATE: 05/28/2024
SCALE: NOT TO SCALE
FILE NAME: E:\PROJECTS\2024 Regional GW Development\Bid Packages\Test Wells
1 OF 1



Project Drawing 3
Approximate Test Well Location
Site B, Del Prado Park, Pleasanton, CA

APPENDIX A

A-2 Enchroachment Permit

ENCROACHMENT PERMIT

-Inspections must be requested 24 Hours prior to Starting Work-

Call (925) 931 - 5650

Project Address	Parcel #	Permit #	Applicant
6701 HANSEN DR PLEASANTON, CA 94566	946 456312500	**E24-0749**	NOR - CAL PUMP & WELL DRILLING INC

Project: Del Prado Park-Zone 7 Permit

Owner	Contractor
CITY OF PLEASANTON	NOR - CAL PUMP & WELL DRILLING INC
PO BOX 520, PLEASANTON CA 94566	1325 BARRY ROAD
	95993 530-674-5861
	License #: 908591 **Expires:**

Scope of Work

Construction and drilling of three (3) test wells for water quality purposes.

Contact: Zone 7-Colleen 925-360-8020
Contractor- Carn 530-740-2534

Issuance Comments

Del Prado Site Plan Conditions:
1. Prior to mobilization, the following activities shall occur:
   a. Submittal of baseline schedule to Zone 7 representatives for approval.
   b. Pre-construction photo documentation with Zone 7 representatives.
   c. Confirmation of final location of test well based on the following activities:
      i. Location of existing utilities based on calling in a USA ticket
      ii. Coordinating with City Parks Division on irrigation piping impacts
      iii. Approval by Zone 7 representative.
2. Contractor shall be responsible for securing site during non-working hours.
3. Contractor vehicle parking shall be limited to Hansen Drive as shown in the Zone 7 contract drawing. "No Parking" signs shall be furnished a minimum of 72 hours in advance of removing public parking in this area.
4. Any non-routine access or staging of site that may cause extended impacts to parking/traffic along Paseo Santa Cruz or Hansen Drive shall be coordinated with City 72 hours in advance and may require a traffic control plan.
5. If Contractor intends to use City fire hydrant for potable water connection a permit shall be required with Public Works Department at 3333 Busch Road. If contractor intends to route hosing from hydrant to site, a supplemental plan shall be submitted to this encroachment permit application showing location of piping, ramps at sidewalk crossings to maintain pedestrian access, and caution signage.

Total Fees:

Total Payments:

All work to be performed to City of Pleasanton Standard Details and Specifications. This permit is issued pursuant to all provisions of the City of Pleasanton Municipal Code, Chapter 13.04, Encroachment.

Issued By: Sidi Cruz sidi cruz-phillips **Date of Issue:** **12/3/2024**

Applicant/Agent: Nor-Cal Pump & Well Drilling, Inc. / Carn Heer

Building: (925) 931-5300 Planning: (925) 931-5600 Engineering: (925) 931-5650
Fire: (925) 454 -2307 Landscape: (925) 931-5672

THE CITY OF PLEASANTON

CONDITIONS FOR ENCROACHMENT PERMIT

1. ✓ Work area shall be clean at the end of each working day. No construction materials shall be stored in the public right of way (street or sidewalk) overnight. City of Pleasanton streets shall not be used for staging areas. If excessive debris accumulates to the dissatisfaction of the homeowners, business owners or the City due to construction activities, then the contractor shall be required to clean roadway and sidewalk areas during working hours. All cleaning methods used for construction shall conform to the Urban Runoff Program.

2. ✓ Work area shall be safe for vehicular, bicycle and pedestrian traffic. All driveways and other entrances to homes or businesses are to remain accessible at all times or other provisions for access shall be arranged.

3. ✓ Landscaping damaged during the project shall be repaired to the owner's satisfaction. In the case of City owned and maintained landscaping, contact the Parks Department at (925) 931-5565.

4. ✓ Traffic control shall conform to California Manual on Uniform Traffic Control Devices & Caltrans standards.

5. ____ Contractor to submit site specific traffic control plan. **(Traffic control plan must be received 48 hours prior to lane closure and approved before closure).**

6. ____ Concrete to be removed shall be removed to the closest score mark outside the work area. All replacement concrete shall be doweled to existing concrete per City Standard Detail.

7. ____ Removal of 12" of pavement is required where gutter is to be removed. 12" slot shall be re-paved with Asphalt Concrete deep lift after new gutter is in place.

8. ✓ Pipe or conduit that is installed in a trench over 5 feet in depth shall be shored in accordance with applicable Cal/OSHA regulations.

9. ____ When permission is granted for directional boring, existing utilities shall be "potholed" to establish bore profile.

10. ____ When permission is granted for directional boring in a landscaped area, the minimum bore depth shall be 42 inches, measured from the top of curb and not from the top of the landscape mound.

11. ✓ Structural trench backfill shall consist of:
    - A) Standard trenches: 3" min. AC on 10" of CTB (2 Sack mix) for minor streets.
    - B) Standard trenches: 3" min. AC on 15" of CTB (2-sack mix) for major streets.
    - C) Rock wheel trenching: 2" of AC on flowable concrete trench backfill. (City approved mix)
    - D) Backfill in sidewalk and landscape areas shall conform to City Specifications.

12. ____ Permits may be required from other agencies having jurisdiction in area.

13. ✓ Haul route per attached sheet.

14. ✓ Permittee to call utility locating service (USA) at 1-800-642-2444 48 hours prior to beginning of work.

15. ____ Work hours are from 8:00 a.m. to 5:00 p.m. Monday through Friday. Weekends, holidays and after-hours are only allowed on a case by case basis and upon written permission with 48-hours advance notification. (All overtime is subject to reimbursement).

16. ✓ The City Engineer or his authorized representative will be the sole judge of the quality of work, the interpretation of these conditions, and the interpretations of City specifications and/or City Details applicable to the project.

17. ✓ Contractor is responsible for removal of all USA marking.

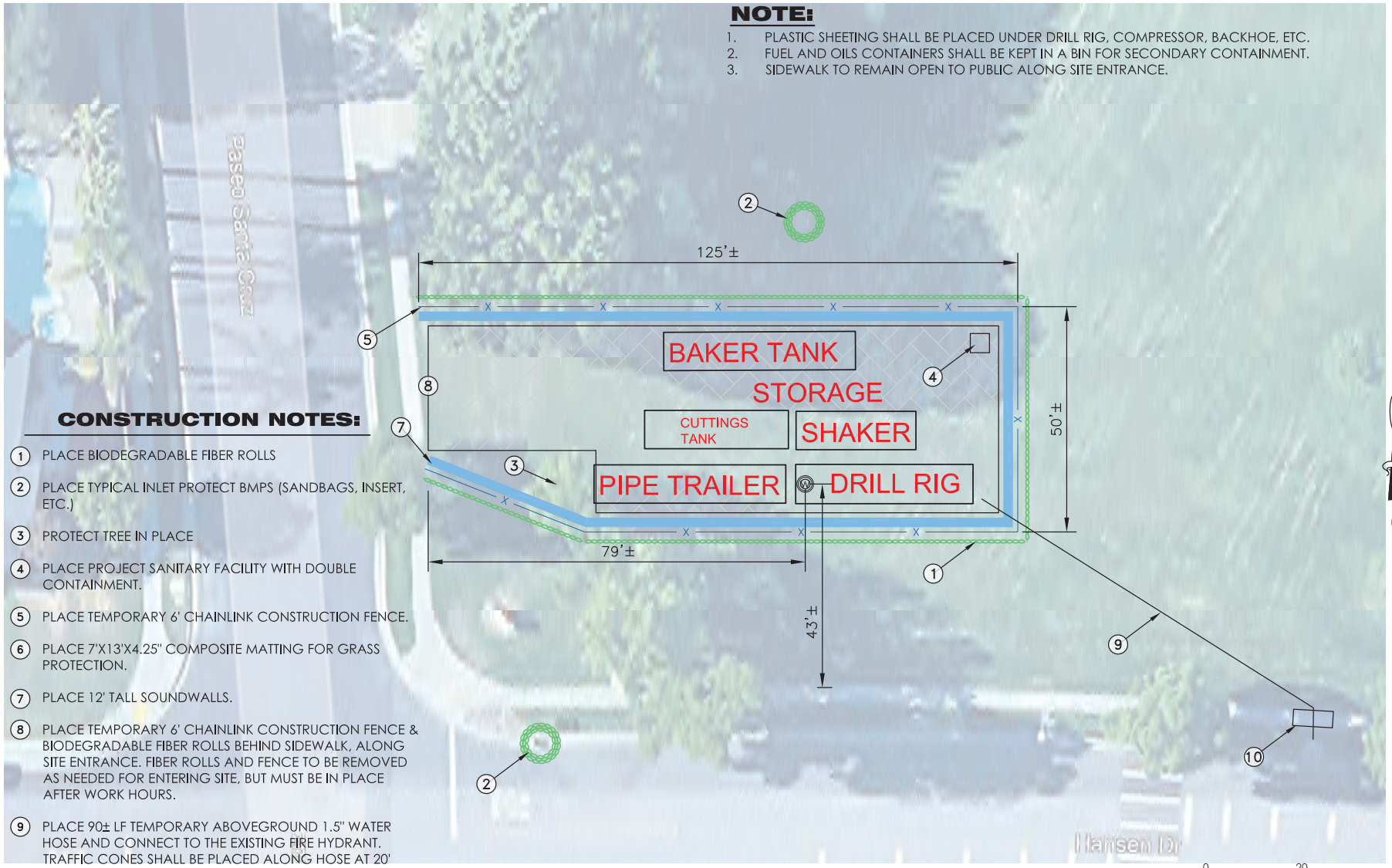
18. ____ Permittee shall begin work within 90 days from date of issuance of permit and shall complete work within 120 days from issuance of permit unless otherwise specified. If work has not begun accordingly or work is not completed within the time frame, the permit shall become void unless an extension has been granted by the City Engineer. The permittee shall reimburse the city for all expenses in restoring the right-of-way or watercourse.

PUBLIC WORKS P. O. Box 520, Pleasanton, CA 94566-0802

Administration	Engineering	Traffic	Inspection	Operation Service Center
200 Old Bernal Rd	200 Old Bernal Rd	200 Old Bernal Rd.	157 Main St.	3333 Busch Road
(925) 931-5650	(925) 931-5650	(925) 931-5650	(925) 931-5680	(925) 931-5500
(925) 931-5479	(925) 931-5479	(925) 931-5479	(925) 931-5484	(925) 931-5595

NOTE:

1. PLASTIC SHEETING SHALL BE PLACED UNDER DRILL RIG, COMPRESSOR, BACKHOE, ETC.
2. FUEL AND OILS CONTAINERS SHALL BE KEPT IN A BIN FOR SECONDARY CONTAINMENT.
3. SIDEWALK TO REMAIN OPEN TO PUBLIC ALONG SITE ENTRANCE.



CONSTRUCTION NOTES:

1. PLACE BIODEGRADABLE FIBER ROLLS
2. PLACE TYPICAL INLET PROTECT BMPS (SANDBAGS, INSERT, ETC.)
3. PROTECT TREE IN PLACE
4. PLACE PROJECT SANITARY FACILITY WITH DOUBLE CONTAINMENT.
5. PLACE TEMPORARY 6' CHAINLINK CONSTRUCTION FENCE.
6. PLACE 7'X13'X4.25" COMPOSITE MATTING FOR GRASS PROTECTION.
7. PLACE 12' TALL SOUNDWALLS.
8. PLACE TEMPORARY 6' CHAINLINK CONSTRUCTION FENCE & BIODEGRADABLE FIBER ROLLS BEHIND SIDEWALK, ALONG SITE ENTRANCE. FIBER ROLLS AND FENCE TO BE REMOVED AS NEEDED FOR ENTERING SITE, BUT MUST BE IN PLACE AFTER WORK HOURS.
9. PLACE 90± LF TEMPORARY ABOVEGROUND 1.5" WATER HOSE AND CONNECT TO THE EXISTING FIRE HYDRANT. TRAFFIC CONES SHALL BE PLACED ALONG HOSE AT 20' INTERVALS.
10. PLACE RAIN FOR RENT ADA SIDEWALK RAMP WITH RAIL. FOR PEDESTRIAN CROSSING.

NO.	DATE	DESCRIPTION

DATE: 11/2024
SCALE: 1"=20'
DRAWN BY: AV
DESIGNED BY: AV
CHECKED BY: AV

NOR-CAL PUMP & WELL DRILLING, INC.
1325 BARRY ROAD
YUBA CITY, CA 95993
PHONE: 530-674-5861
WWW.NORCALPUMP.COM

ZONE 7 WATER AGENCY

DEL PRADO PARK SITE PLAN & SQPP

PLEASANTON, STATE OF CALIFORNIA

PROJECT NUMBER
24-5008

SHEET
1 OF 1

C:\Users\AVasquez\Nor-Cal Pump\Estimates – Documents\General\Jobs\2024 Job Folder\24-5008 Zone 7\CAD\Site Plan.dwg Dec 03, 2024-04:02 pm AVasquez

NORCAL PUMP & WELL DRILLING, INC. IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF REPRODUCTIONS OF THIS DOCUMENT GENERATED BY OTHERS FROM ELECTRONIC MEDIA.

RampLox® Modular Pipe & Hose Ramp System

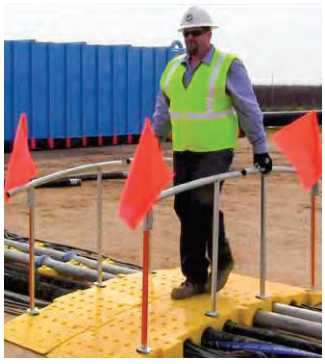
Part of the WORKSAFE™ family of products

Overview:

Rain for Rent's unique WORKSAFE™ RampLox® (U.S. Patent # D725,748) are modular and durable temporary pipe and hose ramps. By interlocking RampLox units to achieve your desired width, your hose, pipe, and conduit will be protected and vehicle or pedestrian traffic will continue unimpeded.



The lightweight design and hand cutouts make RampLox easy for one person to install and disassemble, eliminating the need for heavy machinery.



Optional handrails and flags for added safety.

Features:

- RampLox features tunnels for hose and pipe which, when assembled as one ramp, provide:
  - Four 5" tunnels for 4" and smaller IPS hose, cable and pipe
  - Two 4" tunnels for 3" and smaller IPS hose, cable and pipe
  - Two smaller tunnels for wire/cable.
  - Use three or more RampLox Extenders to reduce minimum required clearance to 5". (Each Extender adds two 5" tunnels)
  - RampLox Clearance Plates can be added to provide clearance for up to 7" pipe.
- Interlocking design allows them to tolerate minor to moderate ground surface variation.
- Vehicle crossings can be created using at least five pairs of RampLox to achieve a road width of 120 in (10 ft). Infinite width possibility.
- Each RampLox segment features two 0.5" anchor holes with room for fender washers for added security. It is recommended that anchors be at least 3" to 12" in length and ¼" to ½" in diameter.



The Clearance Plate creates a tunnel for pipe up to 7".



Low profile, making them easy to drive or walk over with a minimum vehicle clearance of 7.5". (5" clearance when used with 3 Extenders)

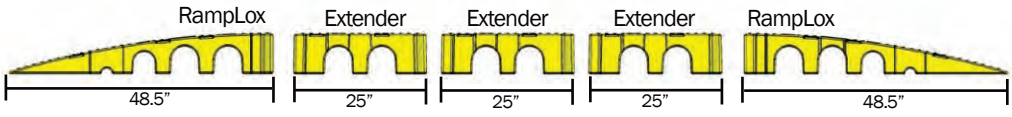
Specs:

- Load rating: 20,000 lbs. per axle
- Minimum vehicle ground clearance: 7.5" (5" with Extenders)
- For off-road (non-DOT) use only
- RampLox Dimensions: 48.5" long by 25" wide by 7" tall
- Weight per RampLox: 63 lbs.
- Molded UV-stabilized HDPE construction
- Manufactured in the USA

Accessories:

- PipeStax® pipe support blocks
- HoseTrax® hose organizing tracks
- Optional handrails for pedestrian crossings
- Optional short or tall flags create highly visible edge markings
- RampLox Extenders for low vehicle ground clearance (5") applications
- RampLox Clearance Plate for larger pipe (up to 7")

Product	Dimensions (L x W x H)	Weight
RampLox	48.5" x 25" x 7.5"	63 lbs.
RampLox Extender	25" x 25" x 7.5"	36 lbs.
RampLox Clearance Plate	18" x 23" x 5"	45 lbs.



PUMPS • TANKS • FILTRATION • PIPE • SPILLGUARDS

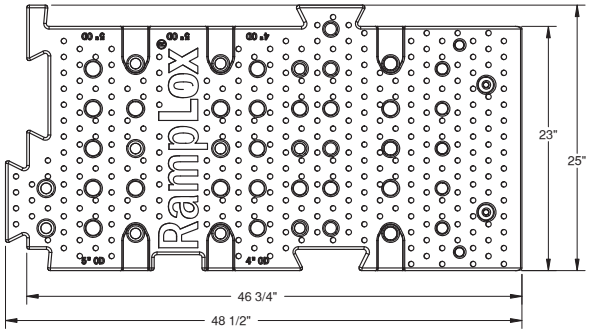
Rain for Rent is a registered trademark of Western Oilfields Supply Company. Features and specifications are subject to change without notice.

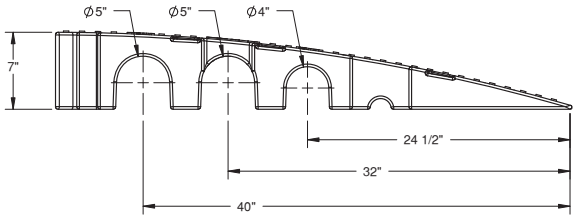
Liquid Ingenuity®

800-742-7246

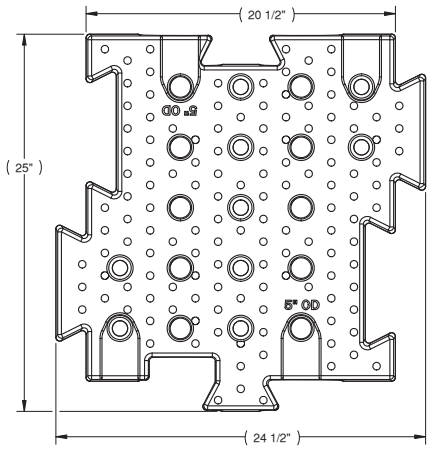
rainforrent.com

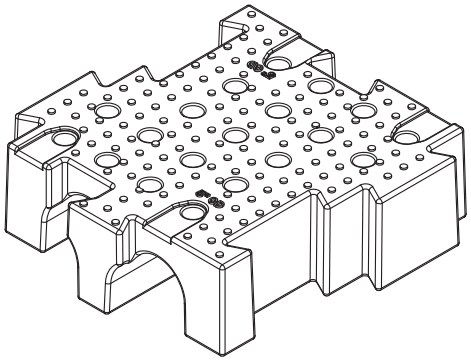
RampLox



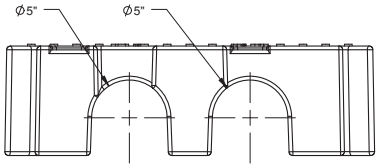


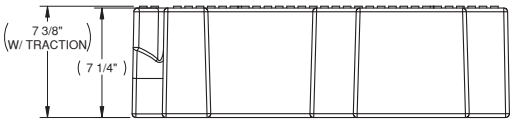
RampLox Extender



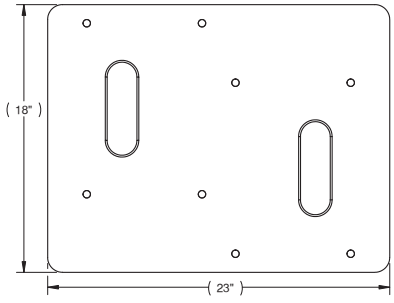


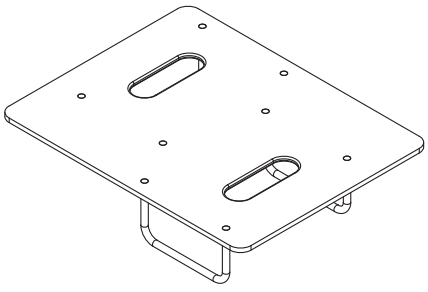
ISOMETRIC VIEW
NOT TO SCALE



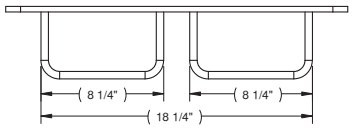


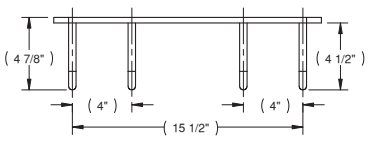
RampLox Clearance Plate





ISOMETRIC VIEW
NOT TO SCALE





APPENDIX A

A-3 Well Completion Report

State of California

Well Completion Report

Form DWR 188 Submitted

WCR2025-011215

Owner's Well Number: Test Well 2 - Del Prado **Date Work Began:** 12/04/2024 **Date Work Ended:** 01/24/2025

Local Permit Agency: Zone 7 Water Agency - Alameda County Flood Control and Water Conservation District **County:** Alameda

Secondary Permit Agency: **Permit Number:** 2024107 **Permit Date:** 11/20/2024

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: ---

Business Name: City of Pleasanton

Address: P.O. Box 520

City: Pleasanton **State:** California **Zip:** 94566

Planned Use and Activity

Activity: New Production or Monitoring Well

Planned Use: Test Well

Well Location

Address: 6701 HANSEN DR

City: PLEASANTON **Zip:** 94566

Latitude: 37 Deg. 40 Min. 9.4332 Sec. N

Dec. Lat. : 37.669287

Vertical Datum:

Location Accuracy:

Longitude: -121 Deg. 54 Min. 23.868 Sec. W

Dec. Long. : -121.90663

Horizontal Datum:

Location Determination Method:

APN: 946-4563-125

Township: 03S **Range:** 01E

Section: 18 **BM:** Mount Diablo

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical **# of casings (Specify):** 1

Drilling Method: Direct Rotary **Drilling Fluid:** Bentonite

Total Depth of Boring: 800 Feet

Total Depth of Completed Well: 590 Feet

Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet)

Date Measured:

Estimated Yield*: (GPM) **Test Type:**

Test Length*: (Hours) **Total Drawdown:** (Feet)

***May not be representative of a well's long term yield.**

Geologic Log - Free Form

Depth from Surface (Feet to Feet)		Description
0	55	Sandy Clay - low to medium plastic, dark brown to grey-brown, very fine to medium sand
55	110	Sandy Gravel - Granules and pebbles, sub-round, very fine to very coarse multicolor sand, w/low plastic brown clay streaks
110	120	Clay - medium plastic, brown to grey, sticky
120	150	Sandy Gravel - small gravel, sub-round granules, a few pebbles, medium to very coarse sand

Depth from Surface (Feet to Feet)		Description
150	160	Sandy Clay - low plastic, brown, very fine to medium sand, black
160	190	Sandy Gravel - granules and pebbles, fine to very coarse sand
190	210	Sandy Clay - medium, grey, fine to medium sand
210	230	Sandy Gravel - granules, very fine to very coarse sand
230	245	Sandy Clay - medium plastic, grey, fine to medium sand
245	260	Sandy Grave - granules and pebbles, sub-round, fine to very coarse sad
260	295	Sandy Clay - medium to high plastic, dark grey-green, orange-brown mottles, very fine to medium sand, quartz-rich black
295	325	Sandy Gravel - granules and pebbles greater than 1", very fine to very coarse sand
325	365	Sandy Clay - low plastic, brown to grey-green, very fine to very coarse sand
365	460	Sandy Gravel - granules and pebbles greater than 1", fine to very coarse sand, quartz-rich black
460	560	Sandy Clay w/ Gravel - medium plastic, grey to grey to grey-green, very fine to medium sand, black, w/ small gravel stringers
560	580	Sandy Gravel - granules and pebbles, fine to very coarse sand, quartz-rich, black
580	650	Sandy Gravel - granules, fine to very coarse sand, quartz-rich, black
650	675	Sandy Gravel - granules, fine to very coarse sand, quartz-rich, black
675	800	Sandy Clay - low plastic, grey-green, very fine to very coarse sand, w/ small gravel stringers

Casings

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	170	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	170	190	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	190	240	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	240	260	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	260	300	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	300	320	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	320	370	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139

Casing #	Depth from Surface (Feet to Feet)		Casing Type	Material	Casings Specifications	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	370	380	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	380	440	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	440	460	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	460	490	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	490	500	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	500	510	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	510	520	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	520	570	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139
1	570	580	Screen	Low Carbon Steel	Other	0.25	8	Louver	0.06	Mild Steel; ASTM A139; Ful Flo
1	580	590	Blank	Low Carbon Steel	Other	0.25	8			Mild Steel; ASTM A139

Annular Material

Depth from Surface (Feet to Feet)		Fill	Fill Type Details	Filter Pack Size	Description
0	154	Cement	10.3 Sack Mix		Sanitary Seal
154	156	Other Fill	See description		2-ft Fine Sand Transition Seal
156	195	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)
195	235	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)
235	270	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)
270	290	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)
290	330	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)
330	360	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)
360	470	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)

Depth from Surface (Feet to Feet)		Fill	Fill Type Details	Filter Pack Size	Description
470	480	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)
480	530	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)
530	560	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)
560	605	Filter Pack	Other Gravel Pack		Gravel Envelope - SRI #8 Gradation (Typ.)
605	800	Bentonite	Other Bentonite		Intermediate Seal - Bentonite Chip/Pellets (Typ.)

Other Observations:

Borehole Specifications

Depth from Surface (Feet to Feet)		Borehole Diameter (inches)
0	605	14
605	800	9

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

Name: NOR - CAL PUMP & WELL DRILLING INC
Person, Firm or Corporation

1325 BARRY ROAD	YUBA CITY	California	95993
Address	City	State	Zip

Signed: electronic signature received — C-57 Licensed Water Well Contractor

11/14/2025 — Date Signed

908591 — License Number

DWR Use Only

CSG #	State Well Number			Site Code	Local Well Number		
----	----	----	N	----	----	----	W
			Latitude Deg/Min/Sec				Longitude Deg/Min/Sec

APN: ----

Township: ---- **Range:** ----

Section: ---- **Tract:** ----

SEQ: ---- **BM:** ----

Attachments

No Attachments

APPENDIX A

A-4 Storm Drain Discharge Monitoring Sheets

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design Date: 3-17-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 10:25 / 16:55
Flow Rate: 250-300 gpm
Discharge Volume: 121,000 gal
If Any Reused, Volume: ∅

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☒ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-17-25	10:30	7.04	24.7	
"	10:55	7.82	27.9	
"	15:55	7.95	43.4	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 3-18-25
Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:00/17:00
Flow Rate: 250-300 gpm
Discharge Volume: 162,900 gal
If Any Reused, Volume: ∅

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☒ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-18-25	8:05	7.79	11.0	
"	8:45	7.86	35.0	
"	16:55	7.92	48.1	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 3-19-25
Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:00/17:00
Flow Rate: 100-350 gpm
Discharge Volume: 183,900
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☒ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-19-25	8:15	7.89	7.54	
"	8:45	7.92	3.98	
"	16:45	8.06	15.67	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design Date: 3-20-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Pasco Santa Cruz

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:00/17:00
Flow Rate: 200-400 gpm
Discharge Volume: 192,100 gal
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☒ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-20-25	8:15	7.84	32.6	
"	9:00	7.86	6.04	
"	16:45	7.92	19.3	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 3-21-25
Contractor: North State

Discharge Description: developmental pumping to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
☒ Well Development
☐ Well Pump Test
☐ Water Sampling
☐ Other:

Time Start/Stop: 8:05 / 13:15
Flow Rate: 300-400 gpm
Discharge Volume: 304,900 gal
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

☐ filter fabric ☒ gravel bag barrier ☐ sediment dam of gravel bags
☐ cleaning /debris removal (e.g. vac truck) ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-21-25	8:35	8.00	42.5	
"	9:05	8.03	16.91	
"	13:00	7.86	19.4	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design Date: 3-26-25
Project No.: 24-2-077 Contractor: North State

Discharge Description: step test to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no Beneficially Reused ?: ☐yes ☒no

Discharge Type:
- ☐ Well Development
- ☒ Well Pump Test
- ☐ Water Sampling
- ☐ Other:

Time Start/Stop: 8:00/15:00
Flow Rate: 150-350 gpm
Discharge Volume: 116,500
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

- ☐ filter fabric
- ☒ gravel bag barrier
- ☐ sediment dam of gravel bags
- ☐ cleaning /debris removal (e.g. vac truck)
- ☒ other, specify: straw wattle

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-26-25	8:06	7.79	18.12	
"	9:00	8.28	1.12	
"	15:00	8.42	5.01	

Luhdorff & Scalmanini
Consulting Engineers

STORM DRAIN DISCHARGE MONITORING

Project Name: Test Wells & Design
Project No.: 24-2-077
Date: 3-27-25
Contractor: North State

Discharge Description: CQ test to storm drain
Location (cross roads): Del Prado Park, Hansen Dr. & Paseo Santa Cruz

Within 300' of creek ?: ☐yes ☒no
Beneficially Reused ?: ☐yes ☒no

Discharge Type:
- ☐ Well Development
- ☒ Well Pump Test
- ☐ Water Sampling
- ☐ Other:

Time Start/Stop: 8:00/16:00
Flow Rate: 250 gpm
Discharge Volume: 121,000 gal
If Any Reused, Volume: Ø

Best Management Practices

Erosion & Sediment Control (Drain Inlet Protection) *check all that apply:*

- ☐ filter fabric
- ☒ gravel bag barrier
- ☐ sediment dam of gravel bags
- ☐ cleaning /debris removal (e.g. vac truck)
- ☒ other, specify: straw wattles

Discharge Event Duration	Timing
< 20 minutes	1 sample during first 10 min.
20-60 minutes	1st sample during first 10 min. 2nd sample during last 10 min.
>60 minutes	1st sample during first 10 min. 2nd sample during next 50 min. 3rd sample during last 10 min.

Date	Time	pH	Turbidity (NTU)	Comments
3-27-25	8:06	7.86	30.7	
"	8:10	7.76	4.97	
"	15:00	7.79	1.82	

APPENDIX A

A-5 Geophysical Surveys

PACIFIC SURVEYS

ELECTRIC LOG
GAMMA-RAY

Job No. 32934

File No.

Company NOR-CAL PUMP & WELL DRILLING, INC.

Well SITE 2 - DEL PRADO PARK

Field PLEASANTON

County ALAMEDA State CA

Location:

DEL PRADO PARK - 6701 HANSON DR.
GPS: 37.6687 -121.9067

Sec. Twp. Rge.

Other Services:

NONE

Permanent Datum	G.L.		Elevation	K.B.
Log Measured From	G.L.	0'	above perm. datum	D.F.
Drilling Measured From	G.L.			G.L.

Elevation

Date	12-17-2024		
Run Number	ONE		
Depth Driller	800'		
Depth Logger	802'		
Bottom Logged Interval	802'		
Top Log Interval	30'		
Casing Driller	16" @ 8'		
Casing Logger	N/A		
Bit Size	9" (8' - 625')	8.75" (625' - 800')	
Type Fluid in Hole	BENTONITE		
Density / Viscosity	50 I 9.1		
pH / Fluid Loss	N/A		
Source of Sample	TANK		
Rm @ Meas. Temp	9.6 @ 77F		
Rmf @ Meas. Temp	9.5 @ 77F		
Rmc @ Meas. Temp	N/A		
Source of Rmf / Rmc	MEASURE		
Rm @ BHT	N/A		
Time Circulation Stopped	1430		
Time Logger on Bottom	1600		
Max. Recorded Temperature	N/A		
Equipment Number	PS-12		
Location	SAC		
Recorded By	SCHUMACHER		
Witnessed By	B. KEARNEY		

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

RSN & RLN CORR.

Calibration Report

Database File	32934.db
Dataset Pathname	elog
Dataset Creation	Tue Dec 17 16:03:47 2024

ELOG Calibration Report

Serial:	PS-5
Model:	DTQ
Shop Calibration Performed:	Wed Jun 5 20:52:35 2024
Before Survey Verification Performed:	Mon Jun 17 14:29:32 2024
After Survey Verification Performed:	Mon Jun 17 14:38:13 2024

Shop Calibration

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.949	51.704		0.500	50.000	Ohm-m	0.975	-0.426
Long	3.050	206.798		2.000	200.000	Ohm-m	0.972	-0.964
IEE	37.120	6472.600	counts	0.041	7.084	A		
VSN	157.220	7384.180	counts	2.999	140.844	V		
VLN	104.080	1887.160	counts	1.985	35.995	V		

Before Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.553		376.985	101.542	Ohm-m	-2.712	376.985
Long	0.000	101.634		998.259	103.804	Ohm-m	-8.801	998.259
IEE	0.000	6633.100	counts	0.000	7.259	A		
VSN	108.320	7568.100	counts	2.066	144.352	V		
VLN	48.040	1893.520	counts	0.916	36.117	V		

After Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	0.000	101.589		0.000	101.553	Ohm-m	1.000	0.000
Long	0.000	101.822		0.000	101.634	Ohm-m	0.998	0.000
IEE	0.000	6564.580	counts	0.000	7.184	A		
VSN	112.140	7492.520	counts	2.139	142.911	V		
VLN	53.260	1877.440	counts	1.016	35.810	V		

After Survey Verification compared to Before Survey Calibration

	Zero			Cal		
	Before	After		Before	After	
Short	376.985	0.000	Ohm-m	101.542	101.553	Ohm-m
Long	998.259	0.000	Ohm-m	103.804	101.634	Ohm-m

Gamma Ray Calibration Report

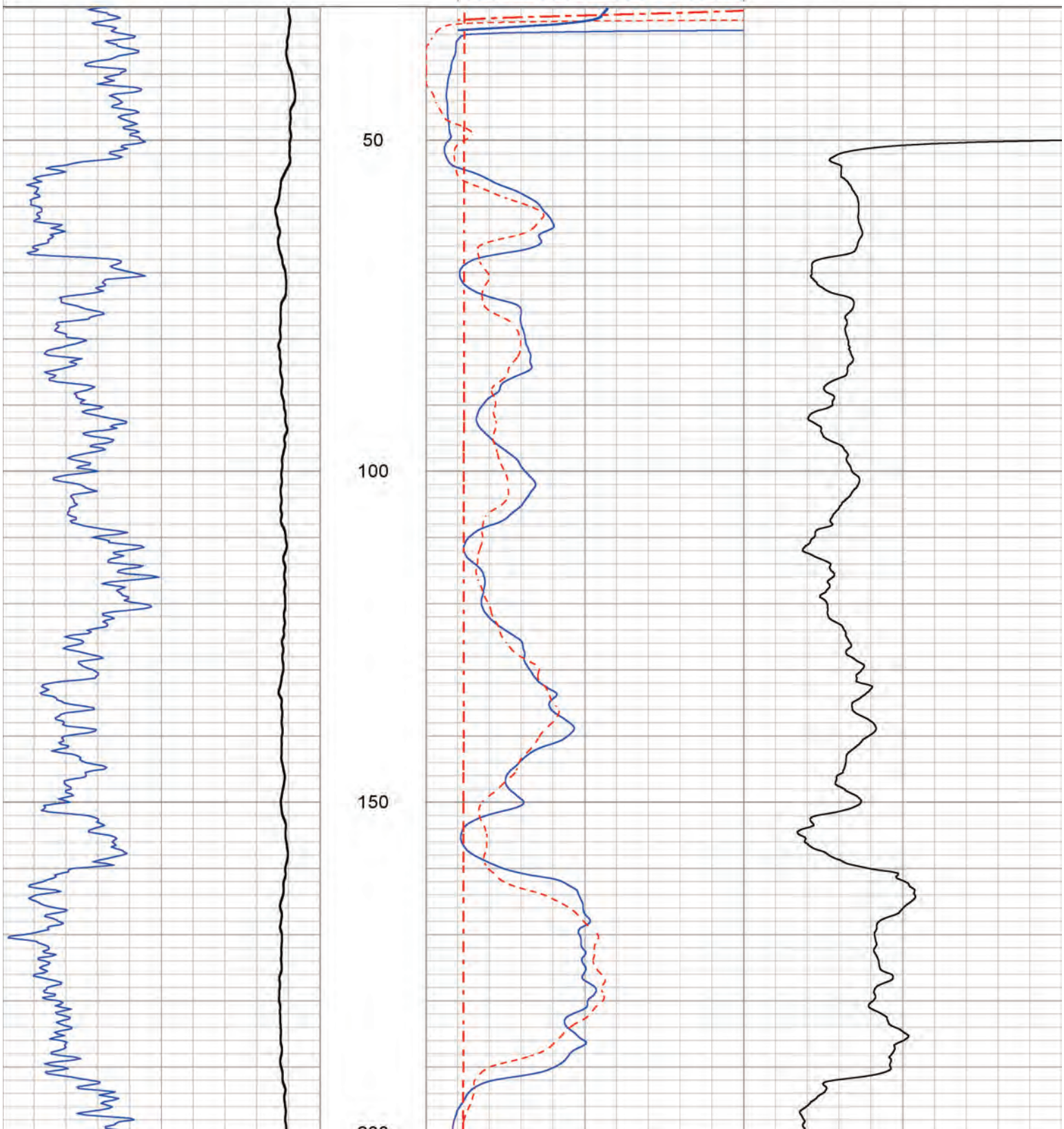
Serial Number:	D4	
Tool Model:	ELOG	
Performed:	Tue Apr 11 11:55:04 2023	
Calibrator Value:	162.0	GAPI
Background Reading:	124.7	cps
Calibrator Reading:	352.0	cps
Sensitivity:	0.5129	GAPI/cps

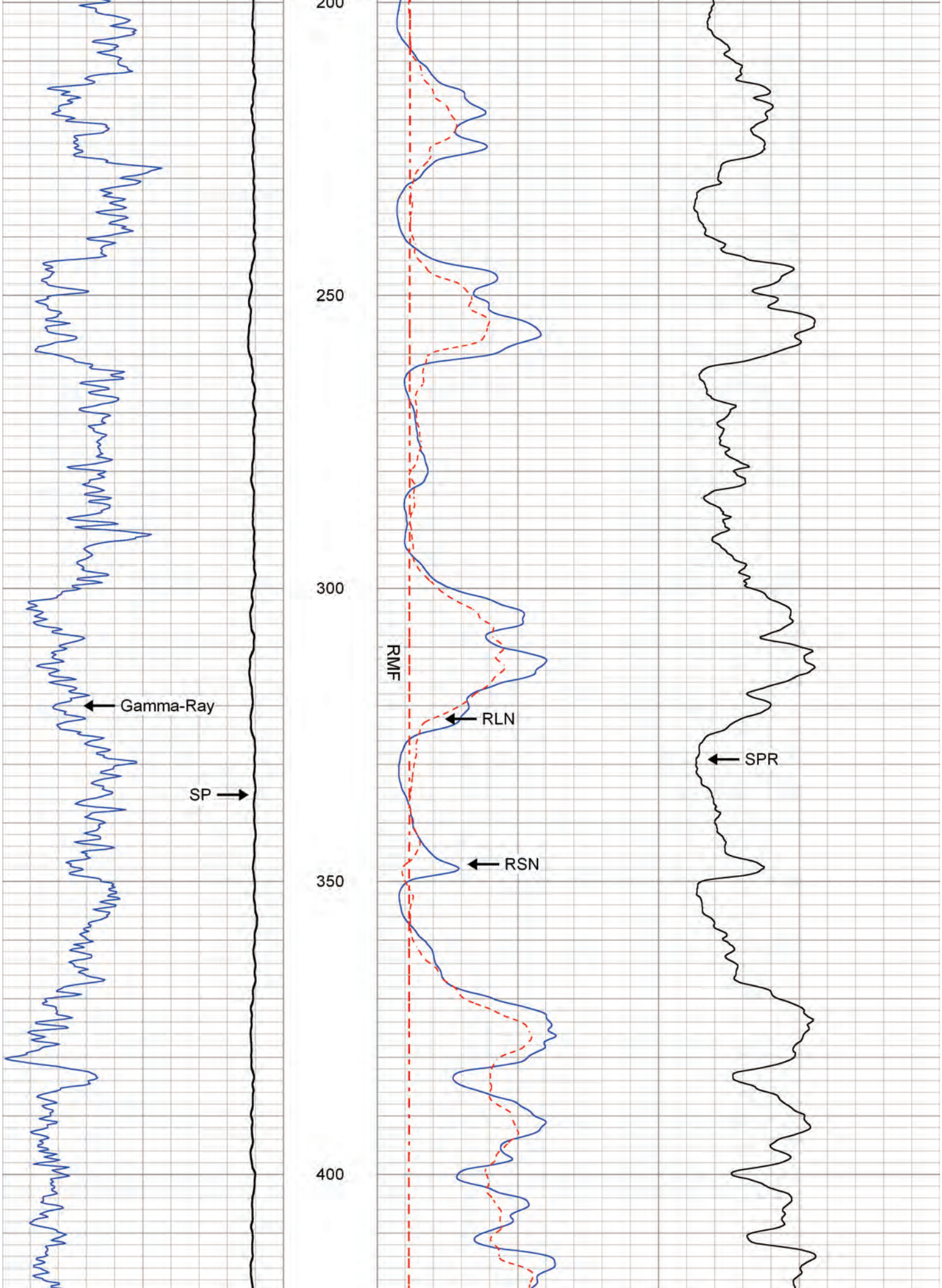
Database File	32934.db
Dataset Pathname	elog
Presentation Format	elog_cwa
Dataset Creation	Tue Dec 17 16:03:47 2024
Charted by	Depth in Feet scaled 1:240

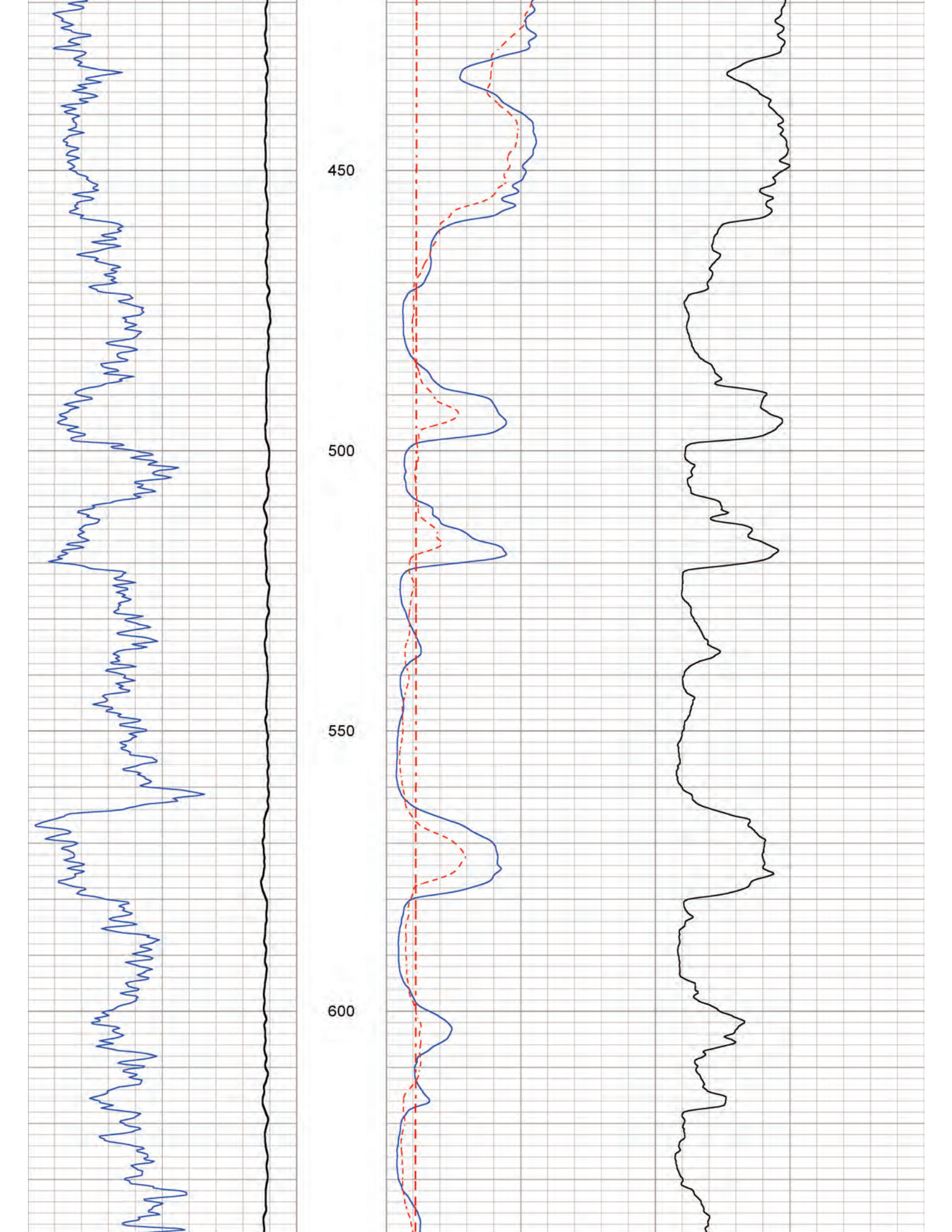
-90	SP (mV)	10
30	Gamma-Ray (GAPI)	130

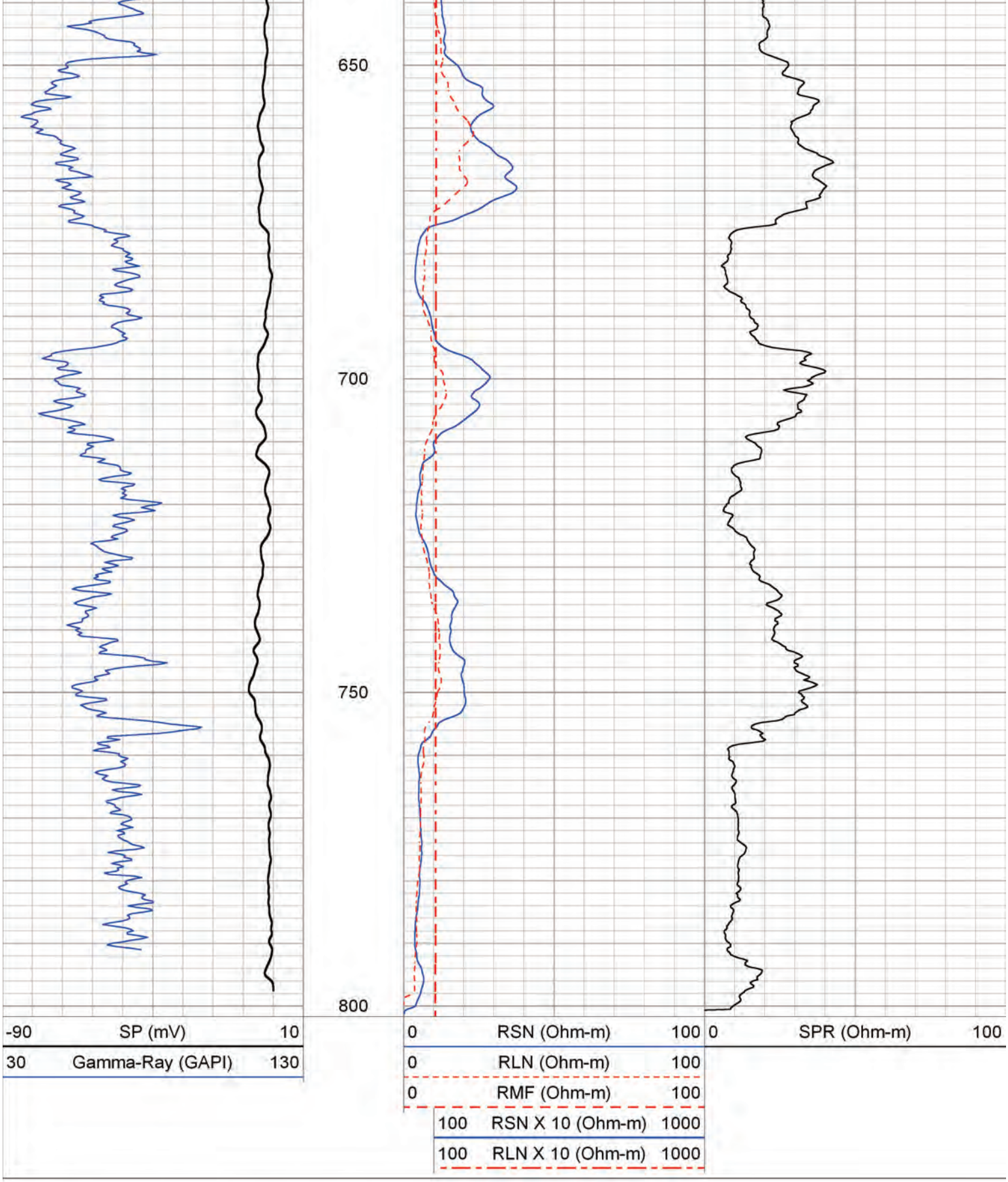
0	RSN (Ohm-m)	100
0	RLN (Ohm-m)	100
0	RMF (Ohm-m)	100
100	RSN X 10 (Ohm-m)	1000
100	RLN X 10 (Ohm-m)	1000

0	SPR (Ohm-m)	100




200
250
300
350
400
RMF
Gamma-Ray
SP
RLN
RSN
SPR


450
500
550
600



Log Variables

DatabaseC:\ProgramData\Warrior\Data\32934.db
Dataset field/well/run1/elog/_vars_

Top - 625.00 ft

BOREID in	BOTTEMP degF	CASEOD in	CASETHCK in	PERFS	RM_MEAS_R Ohm-m	RM_MEAS_T degF
9	68.9	0	0	No	9.6	77

RMF Ohm-m	RSH Ohm-m	SPSHIFT mV	SRFTEMP degF	TDEPTH ft	TempGrad degF/ft
9.5	20	0	59	800	0.01235

625.00 ft - Bottom

BOREID **in**	BOTTEMP degF	CASEOD in	CASETHCK in	PERFS	RM_MEAS_R Ohm-m	RM_MEAS_T degF
8.75	68.9	0	0	No	9.6	77

RMF Ohm-m	RSH Ohm-m	SPSHIFT mV	SRFTEMP degF	TDEPTH ft	TempGrad degF/ft
9.5	20	0	59	800	0.01235

Variable Description

BOREID : Borehole I.D.
BOTTEMP : Bottom Hole Temperature
CASEOD : Casing O.D.
CASETHCK : Casing Thickness
PERFS : Perforation Flag
RM_MEAS_R : Mud Resistivity Measured
RM_MEAS_T : Mud Temperature Measured
RMF : Resistivity of Mud Filtrate
RSH : Resistivity of Shale
SPSHIFT : S.P. Baseline Offset
SRFTEMP : Surface Temperature
TDEPTH : Total Depth
TempGrad : Temperature Gradient

Filter Report

Database File 32934.db
Dataset Pathname elog
Dataset Creation Tue Dec 17 16:03:47 2024

Filter Name	Filter Type	Filter Length (ft)
LSPD	Gaussian	6.00
LTEN	None	
LSPDRT	None	
IEE	None	
VSN	None	
VLN	None	
SP	Gaussian	4.00
RSN	Gaussian	2.00
RLN	Gaussian	3.00
SPR	Gaussian	1.00
GR	Gaussian	2.00
HVOLT	Gaussian	1.00
INCL	None	
AZI	None	
ROLL	None	
MAG ROLL	None	
ACC TOTAL	None	
MTEMP	None	

APPENDIX A

A-6 Spinner Survey - Pumping

PACIFIC SURVEYS

1-INCH SPINNER
FLUID VELOCITY
SPINNER ANALYSIS
PUMPING CONDITION

Job No. 33369

File No.

Company LUHDORFF & SCALMANINI

Well ZONE 7 - DEL PRADO PARK TEST WELL

Field PLEASANTON

County ALAMEDA State CA

Location:

DEL PRADO PARK
GPS: 37.6687 -122.9067

Sec. Twp. Rge.

Other Services:

DOWN RUNS
STOP COUNTS
FLUID SAMPLES

Permanent Datum	T.O.C.	Elevation	Elevation
Log Measured From	T.O.C.	above perm. datum	K.B.
Drilling Measured From	T.O.C.		D.F.
			G.L.

Date	03-27-2025
Run Number	TWO
Depth Driller	590'
Depth Logger	577'
Bottom Logged Interval	580'
Top Log Interval	115'
Pump Set @	115'
Time Pumping Prior to Survey	1 HR
Pumping Water Level	30'
Max. Recorded Temp.	N/A
Pump Rate (GPM)	250
Time Well Ready	0830
Time Logger on Bottom	0900
Equipment Number	PS-12
Location	SAC
Recorded By	SCHUMACHER
Witnessed By	B. KEARNY

Perforation Record												
Type	Slot Size	From	To	Type	Slot Size	From	To
FUL-FLO	0.060"	170'	190'	FUL-FLO	0.060"	440'	460'
FUL-FLO	0.060"	240'	260'	FUL-FLO	0.060"	490'	500'
FUL-FLO	0.060"	300'	320'	FUL-FLO	0.060"	510'	520'
FUL-FLO	0.060"	370'	380'	FUL-FLO	0.060"	570'	580'

	Size	Wgt/Ft	Top	Bottom
Casing Record				
Surface String				
Camera Tube				
Production String	8" ID	N/A	0'	590'
Liner				

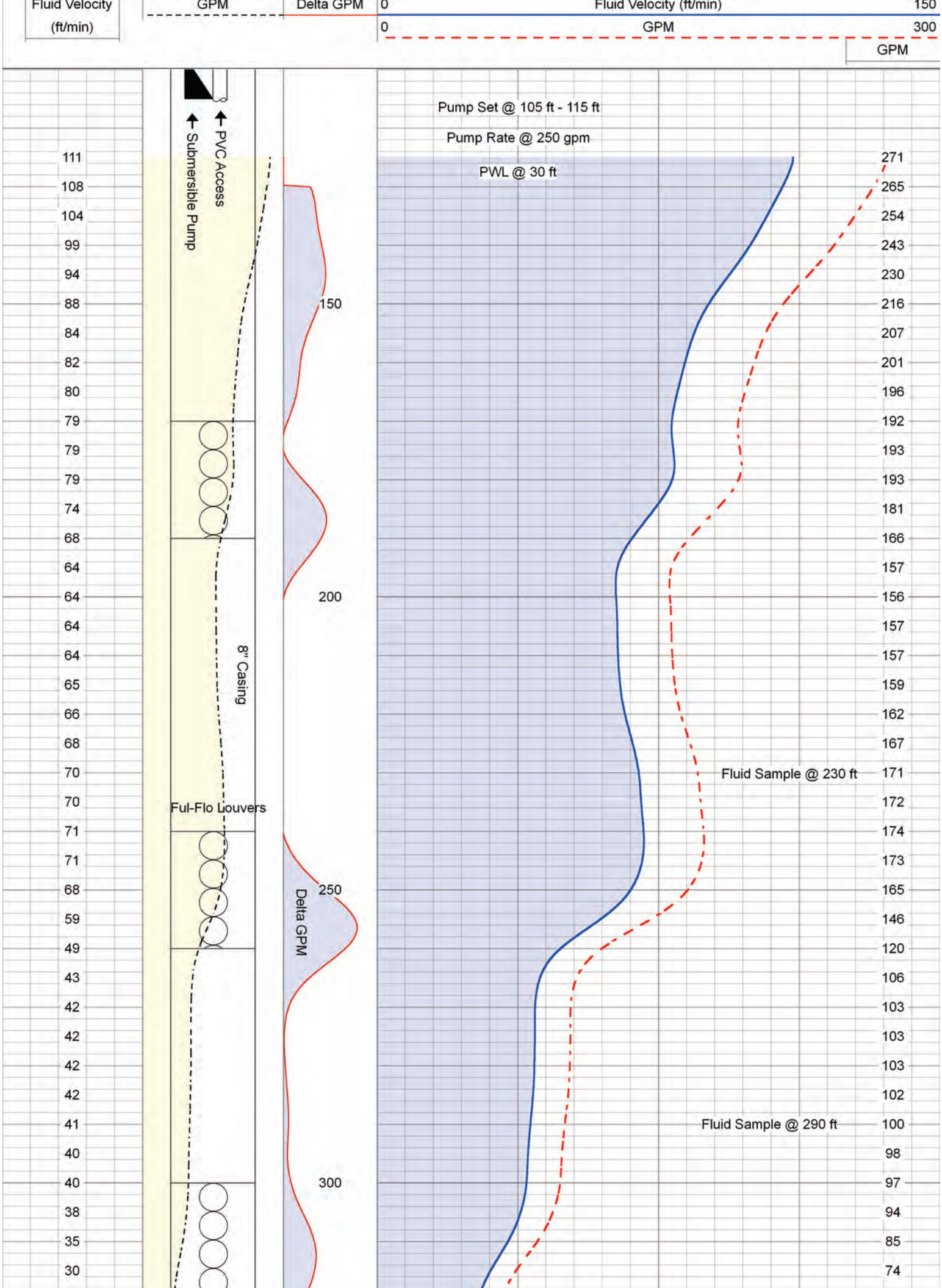
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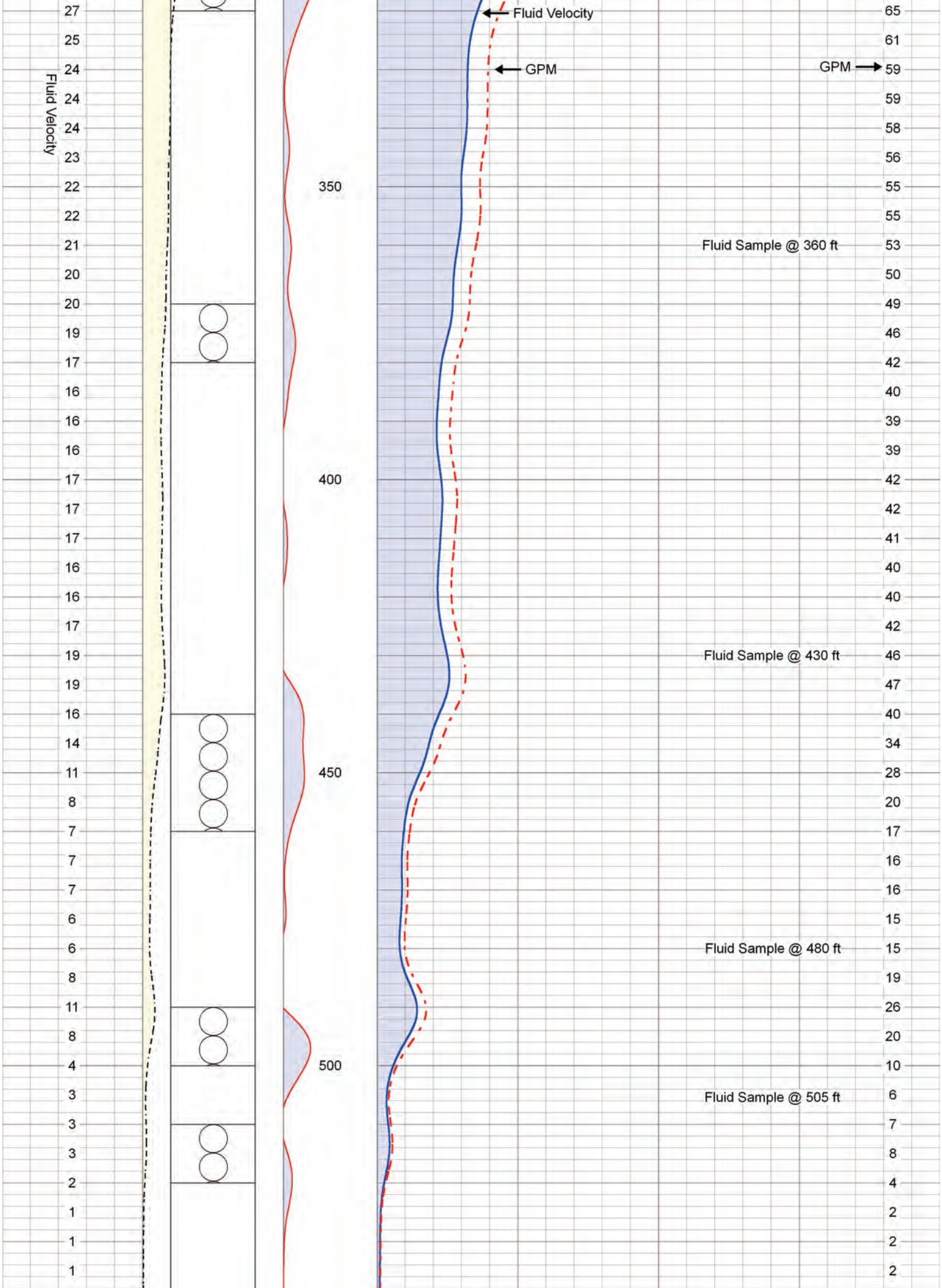
All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

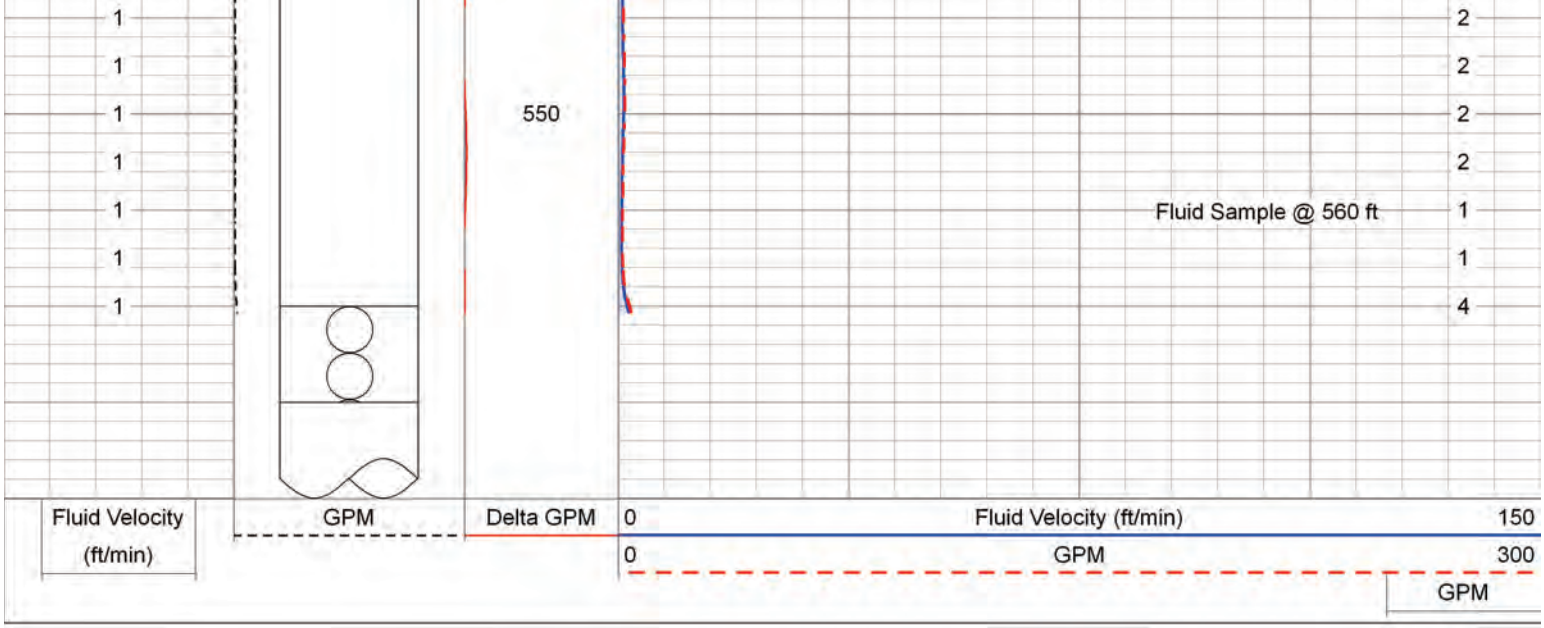
Comments

FLUID SAMPLE COLLECTED AT:
230 FT
290 FT
360 FT
430 FT
480 FT
505 FT
560 FT

Database File 33369.db
Dataset Pathname 33369_fldgpm
Presentation Format spinnerg
Dataset Creation Mon Apr 14 15:15:09 2025 Imported depthlog
Charted by Depth in Feet scaled 1:240


Fluid Velocity (ft/min)
GPM
Delta GPM
0
Fluid Velocity (ft/min)
150
0
GPM
300
GPM
Pump Set @ 105 ft - 115 ft
Pump Rate @ 250 gpm
PWL @ 30 ft
Submersible Pump
PVC Access
8" Casing
Ful-Flo Louvers
Delta GPM
150
200
250
300
Fluid Sample @ 230 ft
Fluid Sample @ 290 ft
111
108
104
99
94
88
84
82
80
79
79
79
74
68
64
64
64
65
66
68
70
70
71
71
68
59
49
43
42
42
42
42
41
40
40
38
35
30
271
265
254
243
230
216
207
201
196
192
193
193
181
166
157
156
157
157
159
162
167
171
172
174
173
165
146
120
106
103
103
103
102
100
98
97
94
85
74


Fluid Velocity
Fluid Velocity
GPM
GPM
350
400
450
500
Fluid Sample @ 360 ft
Fluid Sample @ 430 ft
Fluid Sample @ 480 ft
Fluid Sample @ 505 ft


1
1
1
1
1
1
1
550
Fluid Sample @ 560 ft
2
2
2
2
1
1
4
Fluid Velocity (ft/min)
GPM
Delta GPM
0
Fluid Velocity (ft/min)
150
0
GPM
300
GPM

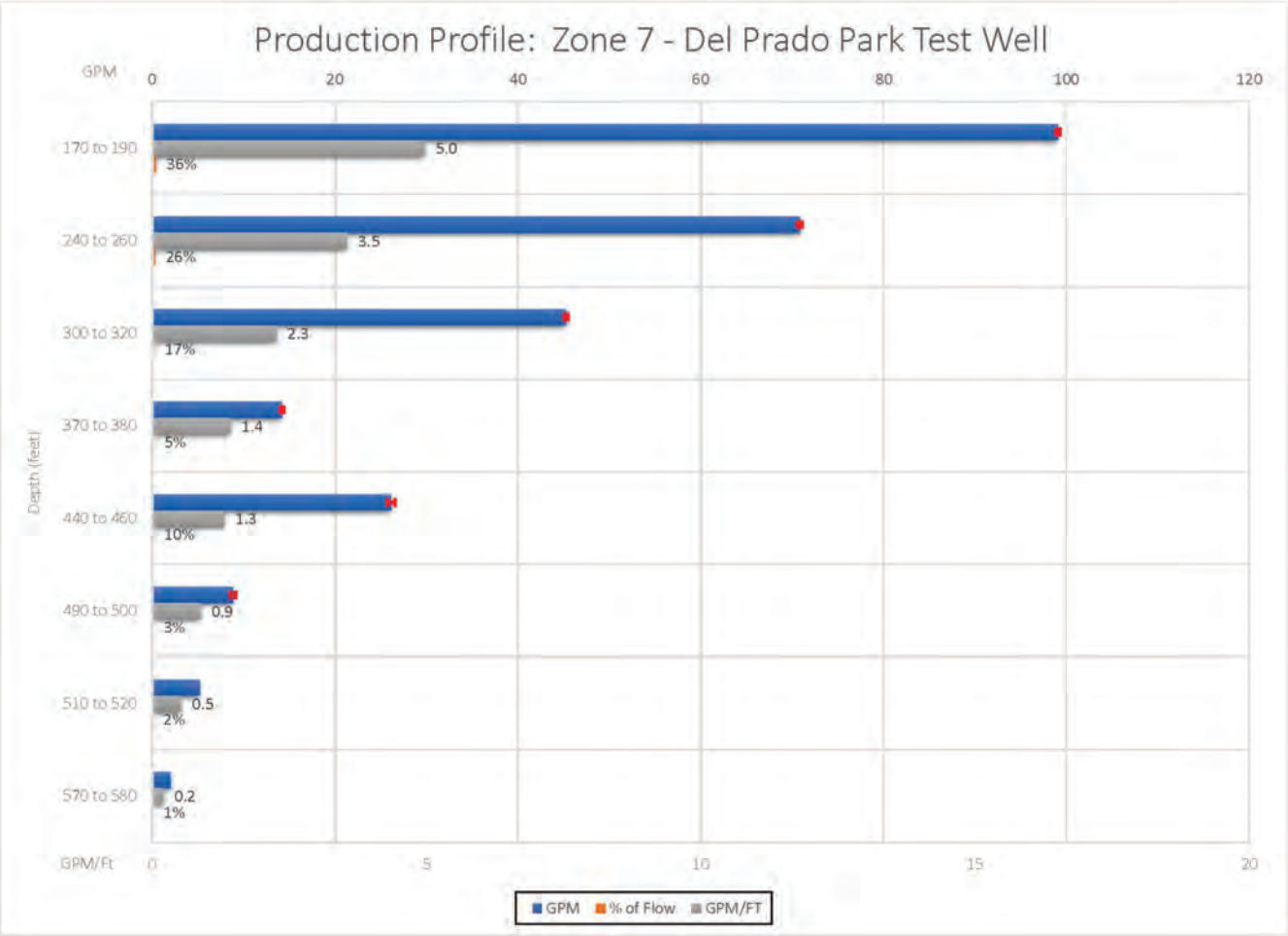
SPINNER LOG ANALYSIS

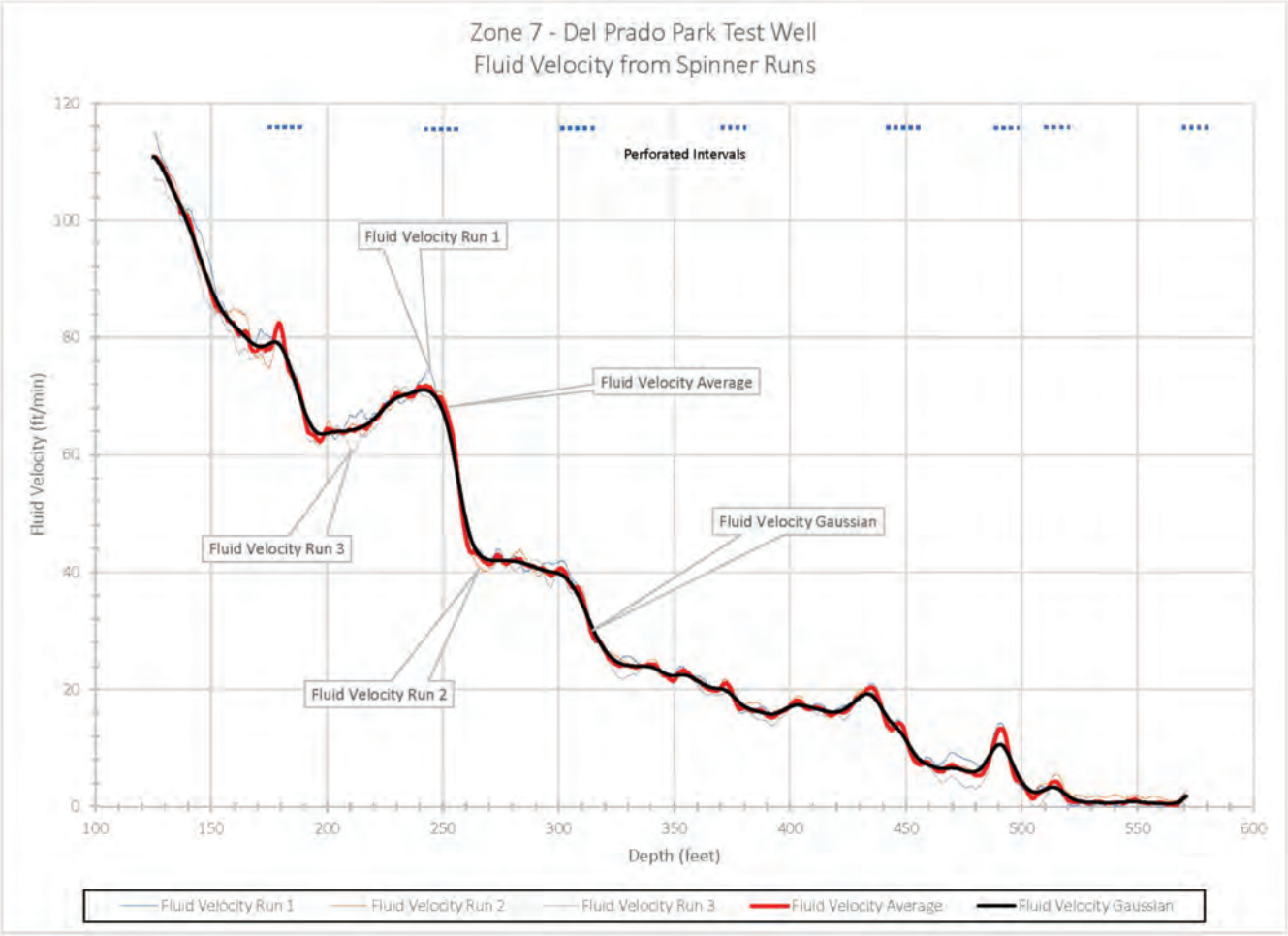
Pacific Surveys
geophysical well logging

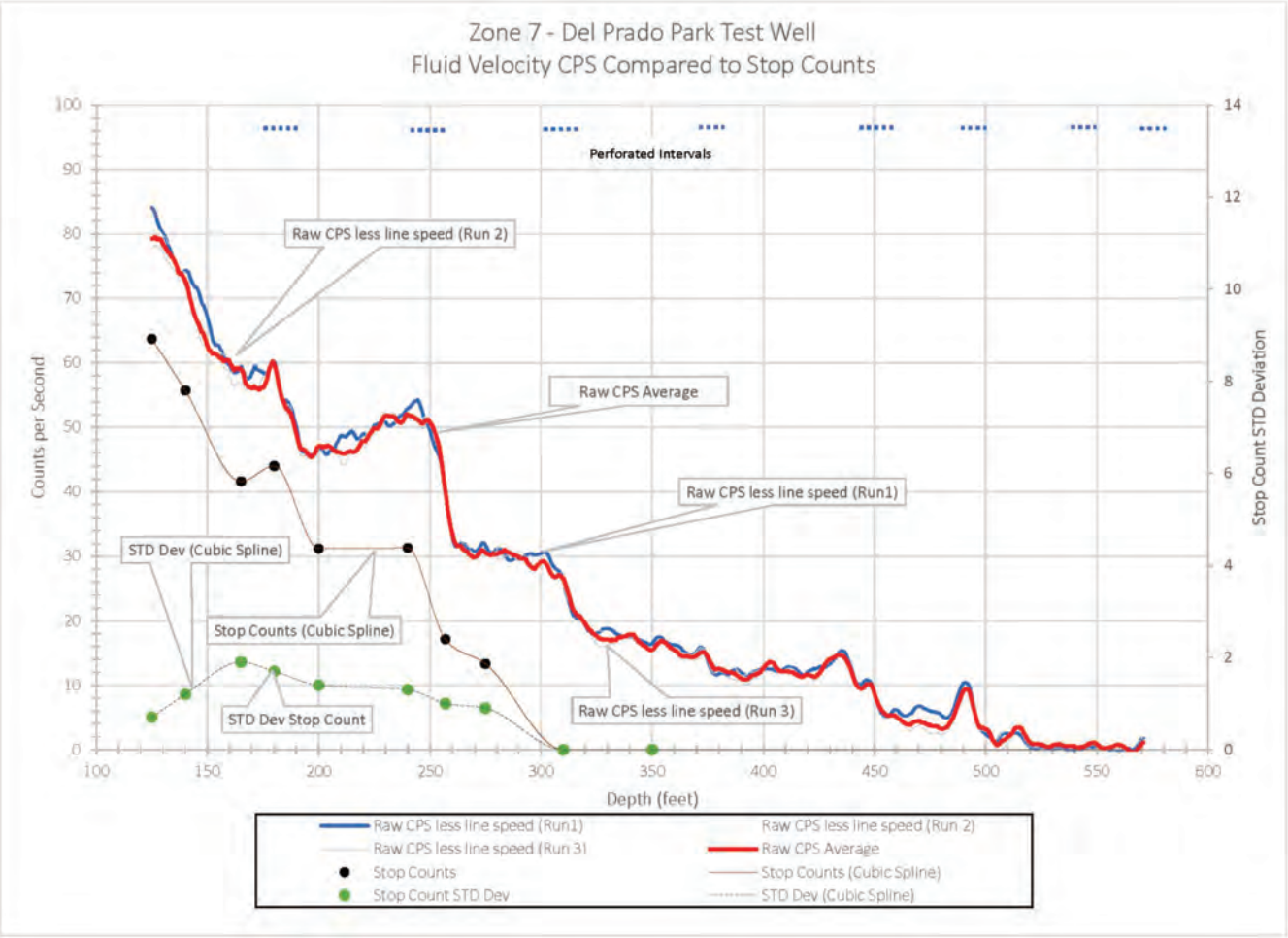
Company: Luhdorff & Scalmanini
Well: Zone 7- Del Prado Park Test Well
County: Alameda

27-Mar-2025
Job No. 33369

SURFACE FLOW RATE	272	GPM			
FLUID SAMPLE ZONES	PRODUCTION (GPM)	% OF FLOW (ZONES)	GPM/FT	STD DEV (GPM)	STD ERROR (+/- GPM)
170 to 190	99	36.5%	5.0	8	0.7
240 to 260	71	26.1%	3.5	2	0.2
300 to 320	45	16.7%	2.3	3	0.2
370 to 380	14	5.2%	1.4	3	0.3
440 to 460	26	9.6%	1.3	2	0.2
490 to 500	9	3.2%	0.9	4	0.4
510 to 520	5	1.9%	1	3	0.3
570 to 580	2	0.7%	0	2	0.2


Production Profile: Zone 7 - Del Prado Park Test Well
GPM
0
20
40
60
80
100
120
170 to 190
5.0
36%
240 to 260
3.5
26%
300 to 320
2.3
17%
370 to 380
1.4
5%
440 to 460
1.3
10%
490 to 500
0.9
3%
510 to 520
0.5
2%
570 to 580
0.2
1%
Depth (feet)
GPM/Ft
0
5
10
15
20
GPM
% of Flow
GPM/FT


Zone 7 - Del Prado Park Test Well
Fluid Velocity from Spinner Runs
Perforated Intervals
Fluid Velocity Run 1
Fluid Velocity Average
Fluid Velocity Run 3
Fluid Velocity Gaussian
Fluid Velocity Run 2
Fluid Velocity (ft/min)
Depth (feet)
120
100
80
60
40
20
0
100
150
200
250
300
350
400
450
500
550
600
Fluid Velocity Run 1
Fluid Velocity Run 2
Fluid Velocity Run 3
Fluid Velocity Average
Fluid Velocity Gaussian

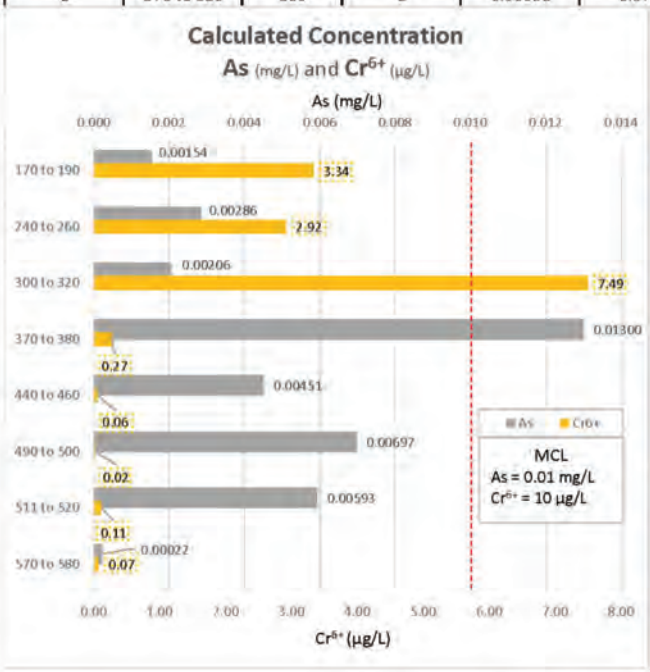

Zone 7 - Del Prado Park Test Well
Fluid Velocity CPS Compared to Stop Counts
Perforated Intervals
Raw CPS less line speed (Run 2)
Raw CPS Average
Raw CPS less line speed (Run1)
STD Dev (Cubic Spline)
Stop Counts (Cubic Spline)
STD Dev Stop Count
Raw CPS less line speed (Run 3)
Counts per Second
Stop Count STD Deviation
Depth (feet)
Raw CPS less line speed (Run1)
Raw CPS less line speed (Run 2)
Raw CPS less line speed (Run 3)
Raw CPS Average
Stop Counts
Stop Counts (Cubic Spline)
Stop Count STD Dev
STD Dev (Cubic Spline)

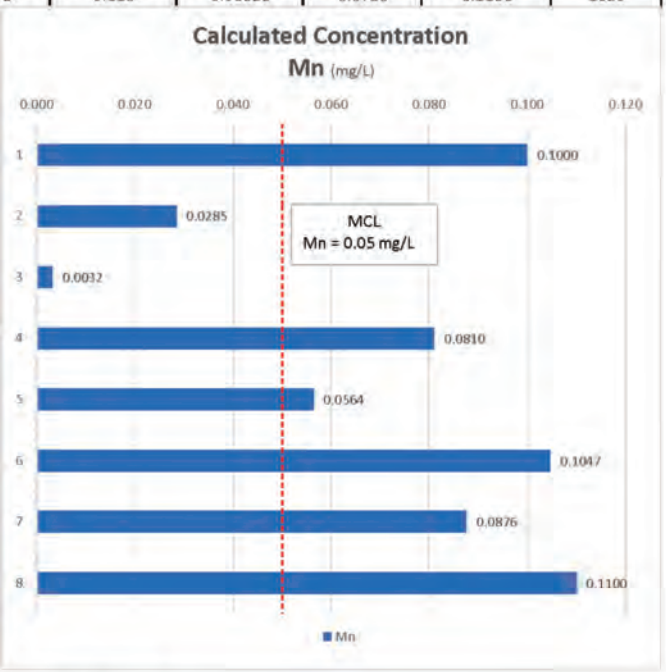
Zone 7 - Del Prado Park Test Well

Mass Balance Analysis

March 27, 2025

Sample Zone	Sample Zone Depth (feet)	Sample Depth (feet)	Flowrate (GPM)	Measured Concentration			Calculated Concentration			Measured
				As mg/L	Cr^{6+} µg/L	Mn mg/L	As mg/L	Cr^{6+} µg/L	Mn mg/L	Spec. Cond. µmhos/cm
1	170 to 190	Surface	99	0.00310	3.250	0.060	0.00154	3.3369	0.1000	965
2	240 to 260	230	71	0.00400	3.200	0.037	0.00286	2.9155	0.0285	907
3	300 to 320	290	45	0.00480	3.400	0.043	0.00206	7.4942	0.0032	815
4	370 to 380	360	14	0.00700	0.110	0.075	0.01300	0.2720	0.0810	890
5	440 to 460	430	26	0.00500	0.056	0.073	0.00451	0.0578	0.0564	917
6	490 to 500	480	9	0.00580	0.053	0.100	0.00697	0.0188	0.1047	990
7	511 to 520	505	5	0.00430	0.097	0.094	0.00593	0.1066	0.0876	1000
8	570 to 580	560	2	0.00022	0.073	0.110	0.00022	0.0730	0.1100	1030





800.919.7555
909.625.6262

1785 w. arrow rte., bldg. d, ste 3,4
upland, ca 91786
www.pacificsurveys.com

fax: 909.399.3180

APPENDIX A

A-7 Static Spinner Survey

PACIFIC SURVEYS

STATIC SPINNER
DOWN & UP RUN
NON-PUMPING CONDITION

Job No. 33377

File No.

Company LUHDORFF & SCALMANINI

Well ZONE 7 TEST WELL 2

Field PLEASANTON

County ALAMEDA State CA

Location:

DEL PRADO PARK
GPS: 37.6687 -122.9067

Sec. Twp. Rge.

Other Services:

Permanent Datum	T.O.C.	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Log Measured From	T.O.C.		
Drilling Measured From	T.O.C.		

Date	04-10-2025
Run Number	ONE
Depth Driller	590'
Depth Logger	577'
Bottom Logged Interval	575'
Top Log Interval	15'
Pump Set @	N/A
Time Pumping Prior to Survey	N/A
Pumping Water Level	16' SWL
Max. Recorded Temp.	N/A
Pump Rate (GPM)	N/A
Time Well Ready	0800
Time Logger on Bottom	0830
Equipment Number	PS-12
Location	SAC
Recorded By	SCHUMACHER
Witnessed By	B. KEARNY

Perforation Record

Type	Slot Size	From	To
FUL-FLO	0.060"	170'	190'
FUL-FLO	0.060"	240'	260'
FUL-FLO	0.060"	300'	320'
FUL-FLO	0.060"	370'	380'

Perforation Record

Type	Slot Size	Top	From	To
FUL-FLO	0.060"	0'	440'	460'
FUL-FLO	0.060"		490'	500'
FUL-FLO	0.060"		510'	520'
FUL-FLO	0.060"		570'	580'

Casing Record	Size	Wgt/Ft	Bottom
Surface String			
Camera Tube			
Production String	8" ID	0.25" WALL	590'
Liner			

All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

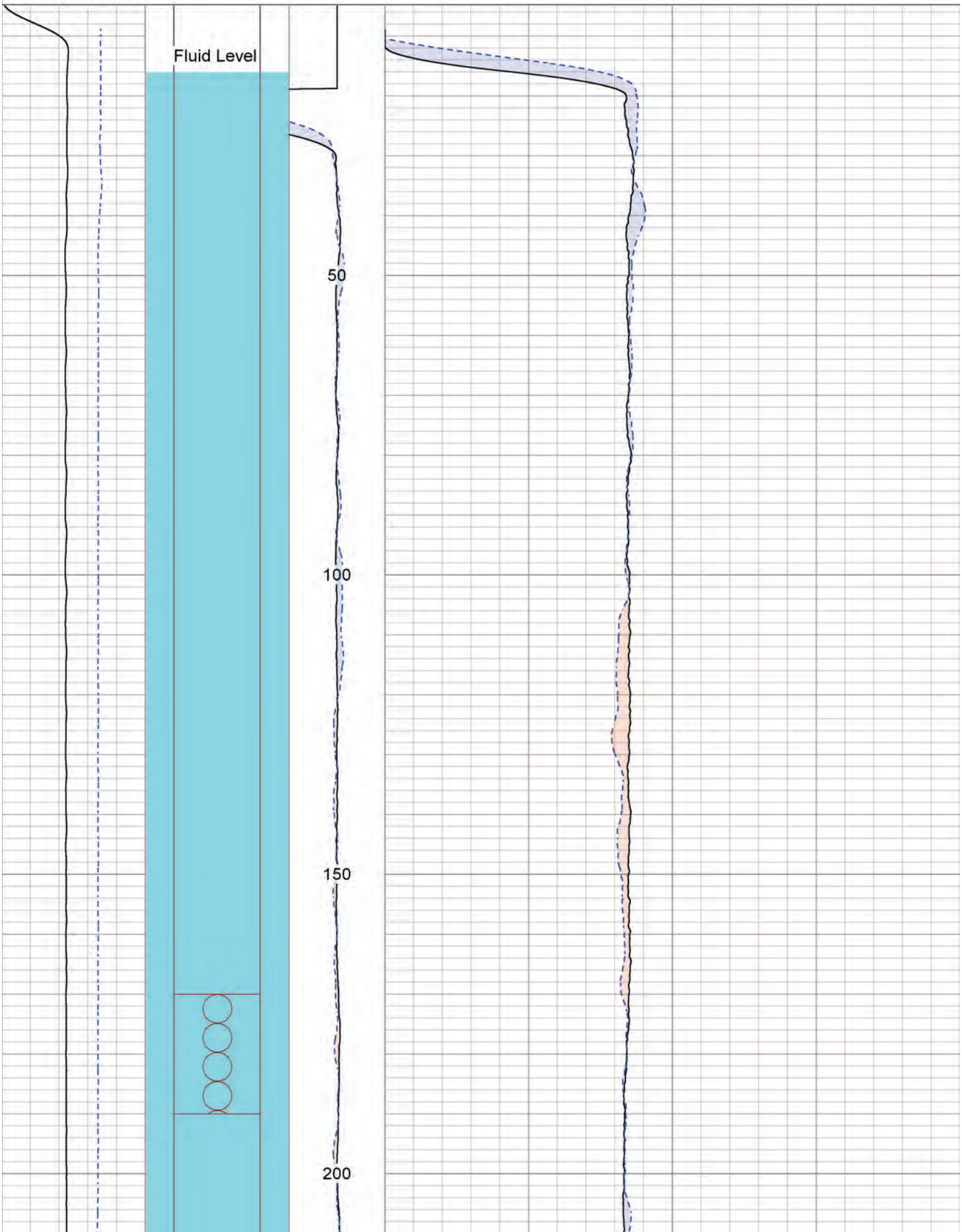
Comments

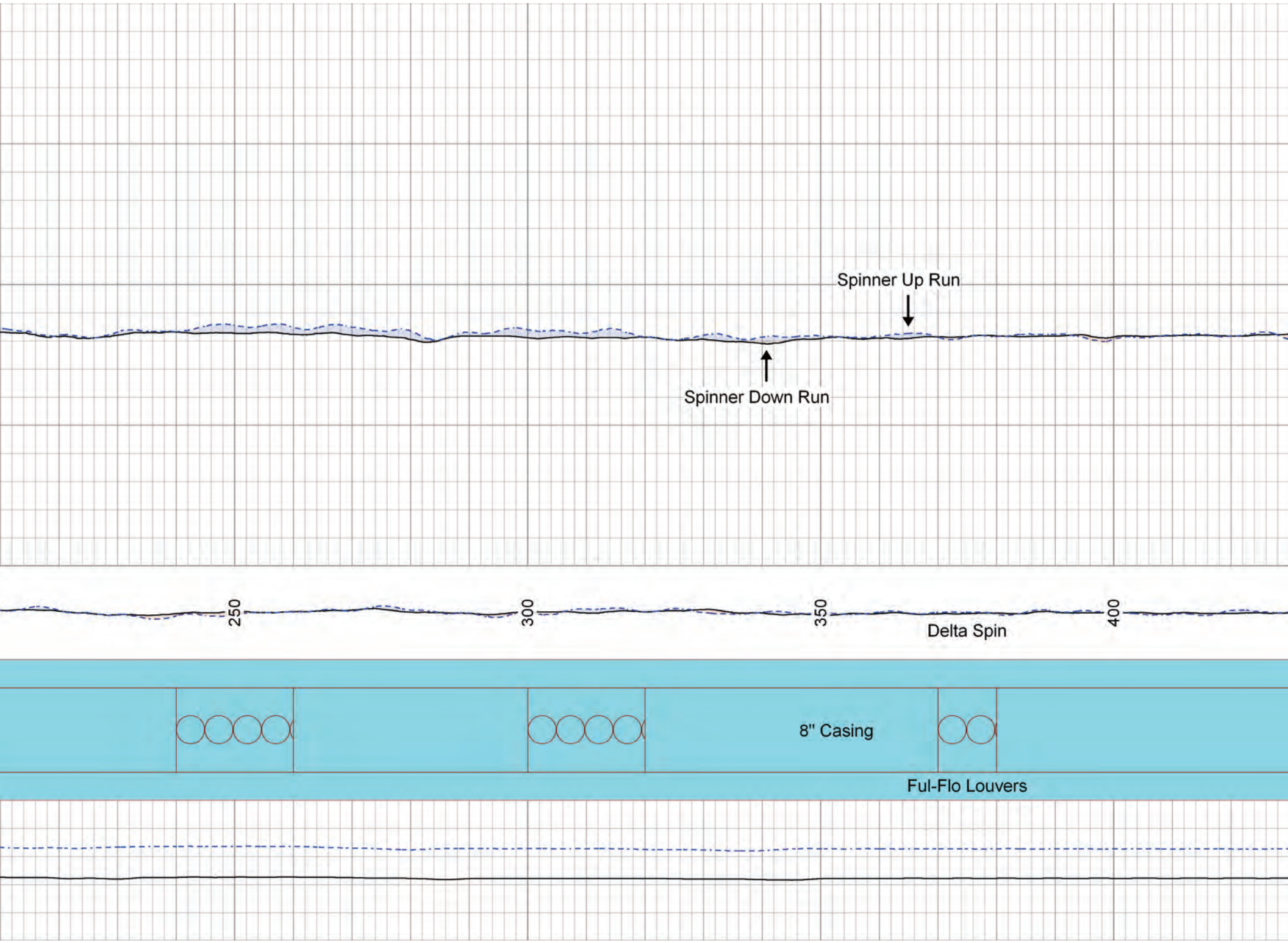
FLUID SAMPLE COLLECTED AT:
230 FT
290 FT
360 FT
430 FT
480 FT
505 FT
560 FT

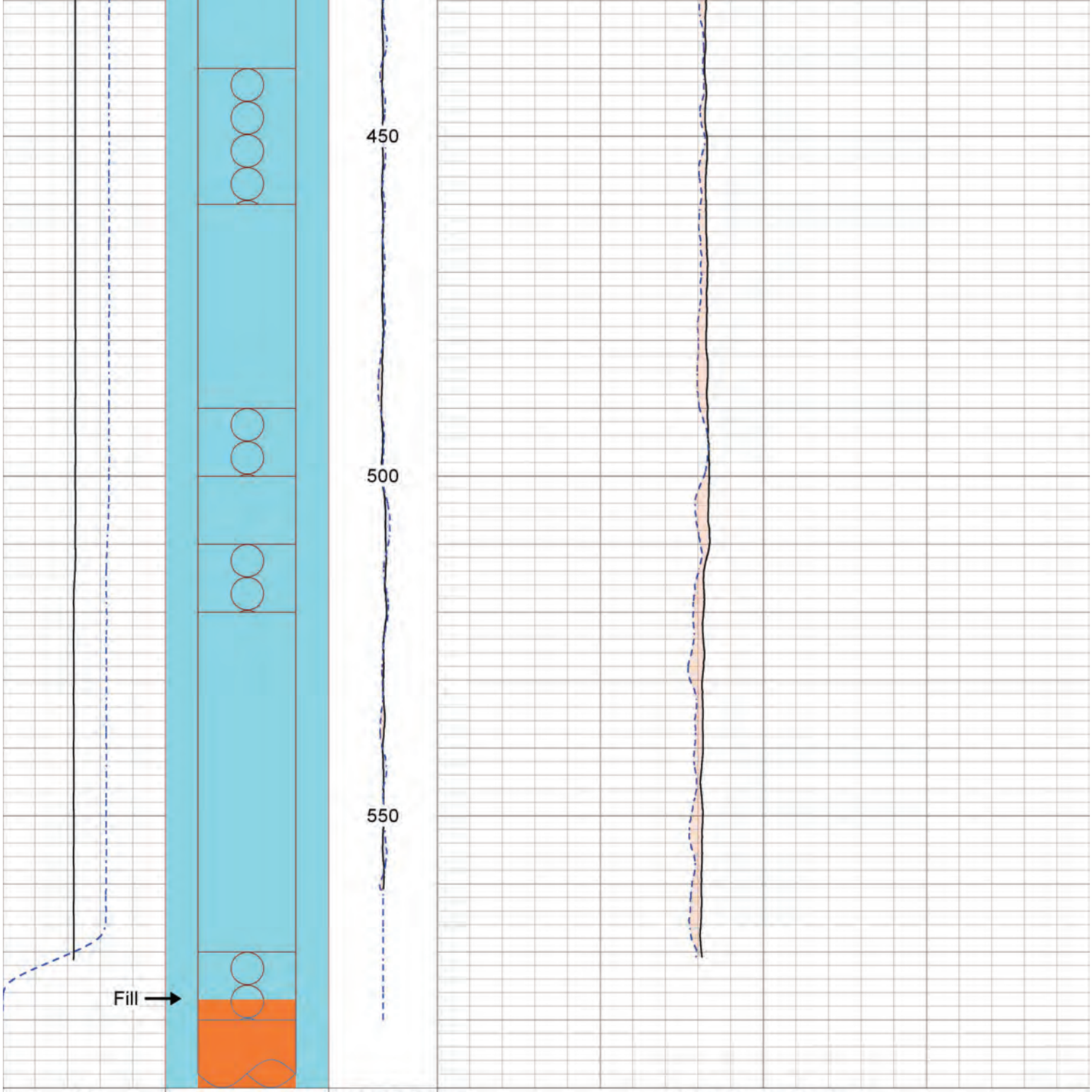
3"

Database File 33377.db
Dataset Pathname spnD2
Presentation Format spinnerg
Dataset Creation Thu Apr 10 09:06:00 2025
Charted by Depth in Feet scaled 1:240

LS			
0	(ft/min) -150		
0	LS (ft/min)150		
Delta Spin	0	Spinner Down Run (cps)	60
Delta Spin	9.5	Spinner Up Run (cps)	69.5




Spinner Up Run
Spinner Down Run
250
300
350
400
Delta Spin
8" Casing
Ful-Flo Louvers



LS		Delta Spin	0	Spinner Down Run (cps)	60
0	(ft/min) -150	Delta Spin	9.5	Spinner Up Run (cps)	69.5
0	LS (ft/min) 150				

APPENDIX A

A-8 Testing, Sampling, and Analysis Plan

JANUARY 2025

TESTING, SAMPLING, AND ANALYSIS PLAN

PREPARED FOR

ZONE 7 WATER AGENCY AND
CITY OF PLEASANTON

PREPARED BY



Luhdorff & Scalmanini
Consulting Engineers

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ATTACHMENTS

Attachment 1 Zonal Analyte Table

Attachment 2 Title 22 Analyte Table

Appendix A Field Forms

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
°C	degree Celsius
°F	degree Fahrenheit
CCR	California Code of Regulations
City	City of Pleasanton
Cm	Centimeter
COC	Chain of custody
DO	dissolved oxygen
EPA	Environmental Protection Agency
Kg	Kilogram
Lbs	Pounds
ml	milliliter
Mpa	Megapascal
OD	Outside Diameter
ORP	oxygen reduction potential
Plan	Testing, Sampling, and Analysis Plan
PSI	Pounds per Square Inch
QA	quality assurance
QC	quality control
Scope	Regional Groundwater Facilities Project Feasibility Study
SP	specific conductance
spinner	spinner flowmeter
SVOC	semi volatile organic compound
T	temperature
T	Time
Zone 7	Zone 7 Water Agency
µm	micrometer

1. INTRODUCTION AND PURPOSE

This Testing, Sampling, and Analysis Plan (plan) was prepared to satisfy Task 2 of the scope of work described in the Regional Groundwater Facilities Project Feasibility Study (Scope) for the Zone 7 Water Agency (Zone 7) and the City of Pleasanton (City), dated September 17, 2024. This Plan details the procedures, methods, timelines, analytes, test methods, sample control, chain of custody forms and documentation, and turnaround times for the sampling that will be completed on the newly constructed test wells that will be constructed under Task 1 of the Scope. Each well will be pump tested to assess well performance, subject to spinner analysis to characterize zonal flow within the well, and collection of zonal and composite water samples for analysis.

Groundwater sampling activities will include Title 22 drinking water analysis as described in the California Code of Regulations (CCRs). Constituents, laboratory analytical methods, and practical quantitation limits are summarized in **Attachments 1 and 2**.

The purpose of this Plan is to provide guidance to qualified professional personnel engaging in the collection of well performance data and analysis of groundwater quality data. Use of this Plan intends to promote the collection of high-quality data, thereby supporting data usability. Testing and sampling procedures and protocols outlined herein are in accordance with pertinent current Environmental Protection Agency (EPA) Standard Methods, California Code of Regulations Title 22, and current industry standards and practices.

2. WELL AND AQUIFER TESTING

After final development and when the well meets the specified performance requirements, tests will be performed. The first test will be an 8-hour step pumping test to determine the target design capacity of the well. The second test will be an 8-hour constant rate pumping test at the final design capacity as determined by the Engineer based upon evaluation of well performance during the step test. The test capacities will be determined by the Engineer before or during the testing based upon the results of development and test pumping. Well and aquifer testing shall not exceed 20 hours without written direction from the Engineer/Owner.

2.1. Well and Aquifer Testing Procedures

A. Static Water Level
    a. At the start of each day of pumping, the Contractor shall record the static water level in the well (see Section 5.1). At all other times, the static water level shall be considered to be attained when three successive water level measurements spaced ten minutes apart show no appreciable change.

B. Flow Metering
    a. During each test or step, the discharge of the pump shall be measured with an accurate, calibrated totalizing and instantaneous flow meter, or other type as approved by the Engineer. The pump discharge rate shall be maintained at all times during the test within

plus or minus 5 percent of the pump test rate by means of an approved gate valve in concert with engine speed.

b. Throughout the test, the Contractor shall frequently record flow rate and totalizer readings to ensure that the pumping rate remains constant.

C. Measurements

a. The Contractor shall measure the depth to water to the nearest 0.01 feet, flow rate, and sand content at the time intervals specified herein.

b. Each well test shall be monitored by the Contractor with data recorded according to the following applicable time schedules:

i. Turn the pump on to the approved test pumping capacity at time (t) = 0.

ii. The contractor shall measure and record the depth to water as follows:

1. each minute, from t = 1 to t = 10.
2. each 2 minutes, from t = 10 to t = 20.
3. each 5 minutes from t = 20 to t = 50.
4. each 10 minutes from t = 50 to t = 100.
5. at t = 120, t = 150, t = 180, t = 240, and t = 300.
6. each 100 minutes after t = 300.

c. Each recovery test shall be recorded according to the following applicable schedule:

i. The contractor shall measure the depth to water and record as follows (t' refers to time since pump shut off):

1. each minute, t' = 1 to t' = 10
2. each 2 minutes, t' = 10 to t' = 20
3. each 5 minutes, t' = 20 to t' = 50
4. each 10 minutes, t' = 50 to t' = 100
5. at t' = 120, t' = 150, t' = 180, t' = 240, t' = 300

D. Pump Failure

a. In the case of failure or interruption of the pump operation for a period greater than one (1) percent of the elapsed pumping time from t = 0, the test shall be suspended until the static water level has been attained. Should the test be aborted as a result of a deficiency on the part of the Contractor's equipment or personnel, all time consumed in waiting for complete water level recovery and in resuming the pump test to the point where it was aborted shall be at no cost to the Owner.

E. Completion

a. After the well testing has been completed, the record of water level measurements shall be delivered to the Engineer on the forms provided as part of these documents. The test pump shall not be removed from the well until the Engineer has evaluated the data and authorized its removal.

3. SPINNER/FLOWMETER, AND DISCRETE DEPTH SAMPLING STANDARD OPERATING PROCEDURE, PACIFIC SURVEYS

3.1. Applicability

The main application of Spinner/Flowmeter logging is subsurface characterization of the vertical fluid movement within the well-bore. The impeller or spinner flowmeter (spinner) uses an impeller that revolves in response to fluid flow. As fluid moves through the impeller blades, they rotate at a known speed based on the pitch of the impeller blades. The number of impeller revolutions per second is automatically recorded and used to calculate the velocity of the fluid. Spinner measurements can be made while ascending or descending in the opposite direction of the fluid movement to generate a continuous flow profile. Additionally, spinner stop count measurements can be recorded at a particular depth while the tool is held stationary to measure flow at a specific location in the well-bore. Once the flow profile of the well-bore has been identified, depth-specific samples can be collected at the identified flow zones.

3.2. Scope

The geophysical logging contractor's responsibility is to provide a qualified logging Engineer (a qualified person familiar with logging equipment, operations & procedures) and the following:

- Properly calibrated logging tools.
- Sufficient backup tools to ensure that all requested services will be successfully performed.
- Ensure that all measurements have a common depth basis (i.e., depth-matched data).
- Borehole corrected data.
- Paper copy field prints of all logs at the proper depth and horizontal scales.
- Paper and reproducible copy final prints of all logs at the proper depth and horizontal scales.
- Log ASCII standard containing all digitally measured and processed log data.
- Log PDF files of all logs at the proper depth and horizontal scales.

3.3. Data Collection

Measurements are made as the tool is ascended or descended in the well-bore at a constant rate on a multi-conductor or coaxial armored cable (or wireline) using a power supply at the surface. Measurement depth is controlled by passing the cable over a calibrated sheave wheel. Downhole data is transmitted via the cable to a data acquisition system (i.e., processing system) and transmitted to a computer at the surface where the data is stored and processed. Geophysical logs are paper copy records of borehole measurements plotted with amplitude on the horizontal axis and depth on the vertical axis. Other information presented in the geophysical logs include:

A. Borehole identification number
B. Client name
C. Borehole location (city, county, state GPS coordinates if available)
D. Date

E. Casing/borehole size
F. Surface elevation (if available)
G. Services requested (logs run)
H. Perforated intervals
I. Pump depth
J. Pump rate
K. Drill depth or completed depth
L. Logging depth

3.4. Logging Order

The spinner/flowmeter is normally run prior to the depth-specific sampling program. The spinner log will help determine where the samples will be collected based on the well-bore flow profile.

3.5. Calibration

The spinner log will be run at multiple tool velocities to develop a slope and ensure repeatability of the fluid velocities within the well-bore.

Basically, there are three types of tool calibration standards:

1. Primary calibration standards involve permanent test pits, which are primarily used to calibrate logging tool prototypes and shop standards.
2. Secondary or shop calibration standards are transportable calibration standards that are referenced to the primary standards. Shop standards are often too bulky to be easily transported to field sites. Logging sondes should be checked against these standards on a monthly basis.
3. Tertiary or field standards are compact enough that they can easily be taken to the field to verify that the sondes calibration has not drifted from the shop calibration at each logging job.

3.6. Standard Procedure for Logging Operation

Pacific Surveys logging equipment is fixed and mounted within a vehicle. It consists of a winch that spools the wireline, a data processing system that powers up and processes the data, and a computer that collects and plots the data.

3.6.1. Pacific Surveys Logging Procedures consist of the following steps:

1. Parking and securing the logging vehicle at the well/borehole.
2. Rigging up, consisting of hanging a sheave wheel or using a boom to support the wireline during logging operations.
3. Rigging up the sondes and centering them within the well/borehole.
4. Powering up the sonde and checking the acquisition system's outputs for correct voltage, tool current and applicable tool measurements.
5. Zeroing the tool to the log datum (i.e., ground surface, top of casing).

6. Lowering the sonde into the well/borehole to the desired depth.
7. Initiating the recording process once at the desired depth (i.e., record up or Down).
8. Retrieving the sonde from the well/borehole and decontaminating.
9. Rigging down of sheave wheel and spooling wire-line into the vehicle.

3.7. Theory of Operation

Pacific surveys offers many different sondes which can characterize various different geologic, hydrologic and physical properties of the well/wellbore.

3.7.1. Spinner (Flowmeter)

Spinner/Flowmeter measures vertical fluid velocity in a pumping or non-pumping well. A sensor counts the revolutions of a mechanical impeller as the tool descends or ascends in the well. A production profile of the pumping well can be determined over the entire perforated interval. With a continuous record, Q values from any interval can be measured without interpolation. Hydraulic conductivity can be derived, aiding in well design and ascertaining production problems. Combined with a depth-specific fluid sampling system, the spinner can be used to determine the concentration of specific constituents when chemical analysis is available. In non-pumping wells, the spinner can locate confining zones and calculate fluid velocity between zones.

Spinner diameters are either 1-inch or 1-11/16-inch. Depending on the configuration, the length can range from 24 inches to 5 feet. The 1-inch spinner is primarily used in small tubing or when tight clearances, such as pump bowls, need to be passed.

A. Spinner/Flowmeter

SPECIFICATIONS AT A GLANCE

Diameter: 1.6875-inches

Length: 24-inch

Weight: 8 Lbs (3.6 Kg)

Temperature Rating: 350° F (176.7° C) Make Up Length (as shown): 24-inch (60.96 centimeter [Cm]) Pulses: 12 per revolution

Pressure: 15,000 Pounds per square inch (PSI) (103 Mpa)

3.7.2. Depth-Specific Fluid Sampling

Retrieve down-hole sealed fluid samples under pumping or non-pumping conditions from any depth in well. Procedure for collecting and decontaminating sampler complies with EPA guidelines.

Procedure: The sample chamber is evacuated using a vacuum pump, sealed and sent down-hole to a specific depth. The upper intake valve is opened electronically from the surface and the fluid sample is taken. The upper intake valve is closed before returning to the surface. Once at the surface the sampler is removed from the wire line and the sample is dispensed to collection bottles (see section 5). The in-situ

sample is under pressure and temperature similar to where it was collected, ensuring integrity. All sampler chambers and parts are constructed of stainless steel. Samplers are fully decontaminated between each trip into the well, further ensuring sample integrity.

- 2-1/8-inch OD sampler capable of collecting up to 6 liters per trip in well
- 1.70-inch OD sampler capable of collecting 2 liters per trip in well
- 1 3/8-inch OD sampler capable of collecting 1 liter per trip in well

The 1-3/8-inch sampler is often used with the 1-inch spinner to pass by tight restrictions, such as pump bowls, column pipe that is adjacent to camera entry ports, and thru-chlorine tubing that runs below the pump intake.

Samplers complement spinner surveys where Mass Balance calculation of analyzed constituents can be used to determine the concentration at depth. We can also provide onsite analysis of particular constituents.

A. 2.135-inch Dia. 2 Liter Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 2.135-inch

Length: 82-inch

Housing: Stainless Steel Weight: 32 Lbs

Temperature Rating: 250 °F Pressure Rating: 5000 PSI

B. 1.75-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.75-inch

Length: 48.75-inch Housing: Stainless Steel Weight: 22 Lbs.

Temperature Rating: 250 °F

Pressure Rating: 5000 PSI

C. 1.38-inch Dia. 500 ml. Fluid Sampler

SPECIFICATIONS AT A GLANCE

Diameter: 1.38-inch

Length: 64-inch

Housing: Stainless Steel Weight: Lbs

Temperature Rating: 250 °F

Pressure Rating: 5,000 PSI

4. EQUIPMENT, CALIBRATION, AND DECONTAMINATION

4.1. Equipment

Field personnel shall be adequately equipped to perform field activities described herein. The following list is not a comprehensive list of all instrumentation, equipment, gear, and consumables that may be needed to complete the field activities. The list merely states key items that are specific to this project

1. Electrical sounder with 0.01-foot graduation to support direct readings with a resolution of 0.01 foot.
2. Multi-parameter water quality meter or individual sensors for measurement of specific conductance (SP), temperature, (T), pH, oxygen reduction potential (ORP), and dissolved oxygen (DO).
3. Turbidity meter
4. Consumables such as powder-free nitrile gloves and single-use in-line filters (0.45 µm).
5. Decontamination supplies including Alconox® (or other phosphate-free detergent) and deionized water.

All instrumentation is to have manufacturers' specifications for accuracy and precision reflective of standards commonly used in environmental groundwater monitoring applications comparable to the Zone 7 sites. Instrumentation is to be kept clean and to be stored and handled appropriately.

4.2. Calibration

Shop and field calibration of instrumentation shall be conducted following the manufacturer's instructions and guidelines using appropriate standard solutions (primary and secondary, as appropriate) and procedures and at manufacturer-recommended intervals. Documentation of calibration activities shall recorded on specified forms (Section 6). The electrical sounder and thermometer are factory-calibrated and do not require calibration by the user. The ORP sensor shall be cleaned and conditioned according to the manufacturer's instructions.

4.3. Decontamination

Prior to the first use at the Zone 7 sites, the portion of the electrical sounder that will be entering the wells shall be washed with an Alconox® (or a comparable phosphate-free detergent) solution and thoroughly rinsed with deionized water. The portion of the electrical sounder that enters the well is not to contact the ground or otherwise be subjected to potential contamination. Between wells, the portion of the electrical sounder that entered the well is to be thoroughly rinsed with deionized water.

The portions of water quality meters and individual sensors that come into contact with purged water shall be thoroughly rinsed with deionized water between wells.

5. PROCEDURES AND SAMPLE COLLECTION

Upon arrival at each test well site, the well identification shall be checked against project information (e.g., location map, description, or photographs). The well structure shall inspected for evidence of damage, tampering, and vandalism.

5.1. Depth-to-Water Measurements

1. A static depth-to-water reading shall be obtained prior to turning on the well pump.
2. An electric water level sounder shall be used in accordance with the manufacturer's instructions to obtain a depth-to-water measurement from a specified reference point (i.e., top of sounding tube, top of well casing, etc.). The sounder shall have a 0.01-foot graduation to support direct readings with a resolution of 0.01 feet. The reading shall be taken in duplicate or more to ensure that an accurate measurement is obtained and recorded.
3. The static water level, in conjunction with well construction information, well used to calculate the volume of water in the test well. This information will used to determine the minimum volume of water to be purged prior to sample collection (i.e., a minimum of three wet casing volumes).

5.2. Purging Protocol

1. Wells are to be purged and sampled using the dedicated sampling port on the temporary well pump.
2. Wells are to be purged of a minimum of three wet casing values and,
3. Wells are purged until indicator parameters stabilize. Stabilization is defined as consecutive readings at approximately 5-minute intervals, where parameters do not vary more than 5 percent between readings.
4. The following indicator parameters are monitored during the well purging:
    b. temperature (°C)
    c. pH (standard pH-units)
    d. electrical conductivity (µS/cm)
    e. dissolved oxygen (percent saturation or mg/L)
    f. oxygen reduction potential (mV)
    g. turbidity (NTU)
    2. Visual (color, occurrence of solids), olfactory (odor) and other observations (e.g., wellhead conditions, well access, ground conditions, weather) are noted as appropriate.
    3. Purge water shall be disposed of according to project specifications.

5.3. Sample Collection

1. Upon completion of purging activities, sample containers shall be filled such that the designated sample tap or container does not come into contact with the sample container.
2. The sampler shall not touch the inside of the lip or the inside of the sample container.
2. The cap of the sample container shall never be laid down and shall be held facing down to minimize particles settling inside the cap.
3. The sample container shall remain closed until the sample is ready to be retrieved.
4. The sample container shall not be allowed to overflow.
5. The sample shall not come into contact with any other surface prior to entering the sample container.
6. The cap is closed without delay to minimize exposure to potential contaminants.

7. Filled sample containers shall be immediately placed on ice in an ice chest and kept at a temperature not exceeding 6°C until received by the laboratory.
8. Samples shall be shipped to the laboratory within the specified sample hold time.
9. Sample containers shall be marked with laboratory-supplied labels and recorded on associated chain-of-custody documentation.
10. Order of Sample Collection: Sample containers shall be filled based on decreasing volatility of the constituents to be quantified (e.g., Semi-volatile organic compounds [SVOCs], metals, and general minerals).

6. LOGISTICS AND DOCUMENTATION

1. The calibration of instrumentation shall be documented by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Calibration Record Sheet is provided in **Attachment 3**.
2. Depth-to-water readings shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Field Data Sheet is provided in **Attachment 3.**
3. During purging, activities shall be recorded by field personnel on form sheets provided to them or on form sheets approved by project management. A sample Purge Record Sheet is provided in **Attachment 3**.
4. The analytical laboratory shall be provided with chain of custody (COC) forms, sample containers, container labels, duplicates, and blanks.
5. The COC forms shall specify each test well, identify associated containers, preservatives, and other pertinent information.
6. The COC shall be filled out completely at the time that the samples are collected. All samples are to be accompanied at all times by the COC. Field personnel are responsible for the care and custody of the samples until they are relinquished. The individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time on the COC. The individual receiving the samples shall verify that the information on the labels matches the information on the COC and that all samples are accounted for.
7. Samples shall only be collected in containers provided by the analytical laboratory. Field personnel shall completely fill out and affix the appropriate labels on individual sample containers. Each container shall be uniquely identified and cross-referenced on the COC by field personnel.

7. METHODS AND TIMELINES

7.1. Methods

Depth specific water samples from individual screen intervals will be analyzed for selected analytes summarized in **Attachment 1**, which also includes units, laboratory analytical methods, and method detection and reporting limits.

Composite water samples from the well discharge assembly will be analyzed for Title 22 Drinking Water Analysis. Title 22 constituents, units, laboratory analytical methods, and method detection and reporting limits are summarized in **Attachment 2**.

7.2. Timeline

After completion of purging activities, grab groundwater quality samples are collected in laboratory-supplied bottles with or without preservatives (depending on analyses to be conducted). Bottles are labeled with laboratory-supplied labels, immediately placed on ice, and kept in an ice chest (at 6 °C) until delivered to the laboratory.

Samples shall be delivered with the proper chain-of-custody documentation within the required holding time. A chain-of-custody (COC) form shall be used to record sample identification numbers, type of samples (matrix), date and time of collection, and analytical tests requested. In addition, times, dates, and individuals who had possession of the samples are documented to record sample custody.

Unless otherwise specified, the standard laboratory turn-around time will be requested. The standard laboratory turn-around time is approximately 15 business days.

8. QUALITY ASSURANCE PROCEDURES

Quality assurance (QA) is an overall management plan used to guarantee the integrity of data collected. This includes the above guidelines for groundwater level measurements, purging protocol, and sampling handling and recording. Quality control (QC) is a component of QA that includes analytical measurements used to evaluate the quality of the data. This includes blanks and spiked samples.

The source of contamination introduced in the field or laboratory can be deduced by comparing blank results. An equipment blank could potentially be contaminated in the field, during transport to the laboratory, or in the laboratory. A method blank could only be contaminated in the laboratory. A field duplicate sample provides a measure of natural variability

8.1. Field Quality Control

8.1.1. Equipment Blank

The equipment blank only applies when decontaminated equipment is used.

Purpose: Assess the adequacy of the decontamination process. Assess contamination from the total sampling, sample preparation, and measurement process when decontaminated sampling equipment is used to collect samples.

Procedure: A sample of analyte-free water is poured through decontaminated field sampling equipment prior to the collection of test well samples.

Frequency: 1 blank per 20 samples.

8.1.2. Field Blank

Purpose: Assess contamination from field conditions during sampling. Assess contamination from the total sampling, sample preparation, and measurement process, minus the decontamination process.

Procedure: A sample of analyte-free water is poured into the container in the field, preserved and shipped to the laboratory with the test well samples.

Frequency: 1 blank per 20 samples.

8.1.3. Field Duplicate

Purpose: Assess the precision (i.e., repeatability) of sampling results as influenced by the natural variability of concentrations during sampling.

Procedure: A duplicate sample is retrieved immediately following retrieval of the test well sample.

Frequency: 1 duplicate per 20 samples.

8.2. Laboratory Quality Control

8.2.1. Method Blank

Purpose: Assess contamination introduced during sample preparation activities in the laboratory.

Procedure: The laboratory is currently certified by ELAP to conduct the requested analyses. A blank is prepared to represent the matrix as closely as possible. The method blank is prepared/extracted/digested and analyzed exactly like the test well samples.

Frequency: 1 blank per batch.

8.2.2. Other Quality Control Measures

The laboratory is to employ laboratory blanks, fortified blanks, and duplicate analyses and document percent recovery and relative percent differences to assess laboratory contamination sources, accuracy, and precision.

8.2.3. Laboratory Analytical Methods

Analysis shall be performed using the appropriate USEPA methods as defined in **Attachments 1 and 2**, equal or superior methods. All instruments and equipment shall be properly calibrated and maintained for accuracy.

8.3. Laboratory Reports

Laboratory reports shall identify the analyst, analytical methods, reporting limits, method detection limits, results of test well samples and associated blanks and duplicate samples, units, dilution factors, applicable qualifiers, and flags, date of analysis, and all applicable QA/QC information. The laboratory supervisor shall supervise all analytical work performed in the laboratory and sign the laboratory reports.

APPENDIX A

A-9 Post Airlift Water Quality Summary

Zone 7 Water Agency
Del Prado Park Test Well
Water Quality Summary - Post Airlift

ANALYTE	UNITS	REPORTING LIMIT	METHOD	1/20/2025	2/13/2025
INORGANICS					
Antimony	µg/L	2.0	200.8	ND	NS
Arsenic	µg/L	2.0	200.8	ND	NS
Barium	µg/L	5.0	200.8	50	NS
Beryllium	µg/L	1.0	200.8	ND	NS
Cadmium	µg/L	1.0	200.8	ND	NS
Chromium (Total)	µg/L	5.0	200.8	ND	NS
Hexavalent Chromium	µg/L	1.0	218.6	0.66	NS
Copper	µg/L	3.0	200.8	3.4	NS
Lead	µg/L	5.0	200.8	ND	NS
Manganese	µg/L	10	245.1	300	NS
Mercury	µg/L	0.4	245.1	ND	NS
Nickel	µg/L	5.0	200.8	ND	NS
Selenium	µg/L	2.0	200.8	ND	NS
Silver	µg/L	5.0	200.8	ND	NS
Thallium	µg/L	1.0	200.8	ND	NS
Vanadium	µg/L	1.0	200.8	ND	NS
Zinc	µg/L	10.0	200.8	30	NS
OTHER ANALYSES					
Turbidity	NTU		Field	43.7	17.89
pH	SU		SM 4500-H B	8.95	9.12
Chlorine (Total Residual)	mg/L	0.10	SM 4500-CL-G	ND	ND
Cyanide	mg/L	0.0050	SM 4500-CN-E	ND	ND
Sulfate	mg/L	0.50	300.0	ND	ND
Purgeable Organic Compounds (VOC's)	µg/L	5.0	624.1	ND	ND
Chloroform	µg/L	5.0	624.1	8.4	7
SVOC's	µg/L	*	625.1	ND	ND
TPH as Gasoline	µg/L	50	8015B	ND	ND
TPH as Diesel	mg/L	0.11	8015B	ND	0.23
TPH (C13-C28)	mg/L	0.1	8015B	NS	ND
TPH (C29-C44)	mg/L	0.33	8015B	NS	ND
PFAS	ng/L	2.00	537.1	ND	ND

ND = Non-Detect
NS = Not Sampled

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APPENDIX B

B-1 Summary of Title 22 Sampling

Zone 7 Water Agency
Del Prado Park Test Well
Water Quality Summary Table

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	Title 22 3/26/2025
CATIONS					
Calcium	mg/L	0.10	200.7		82
Magnesium	mg/L	0.050	200.7		48
Potassium	mg/L	1.0	200.7		1.9
Sodium	mg/L	0.50	200.7		77
Hardness as $CaCO_3$	mg/L	0.50	Calculation		400
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	65
Fluoride	mg/L	0.050	300.0	2[1]	0.11
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	9.8
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.43
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	ND
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	88
Total Alkalinity	mg/L	4.1	SM 2320B		360
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1
pH	pH units	0.05	150.1	6.5/8.5[4]	8.35
Methylene Blue Active Substance	mg/L	0.20	SM 5540C	0.5[2]	ND
Electrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	965
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	860
Odor	Odor Units	1.0	SM 2150B	3[2]	ND[5]
Turbidity	NTU	0.10	180.1	5[2]	7.5
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.54
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00024 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0031
Arsenic (Dissolved)	mg/L	0.010	200.8		0.0025 J
Barium	mg/L	0.010	200.7	1[1]	0.23
Beryllium	mg/L	0.01	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.48
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium (Total)	mg/L	.010	200.7	0.050[1]	0.0051 J
Chromium (Dissolved)	mg/L	0.01	200.7		0.0028 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	3.2
Copper	mg/L	0.010	200.7	1.0[2]	0.0012 J
Iron	mg/L	0.05	200.7	0.3[2]	0.66
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00046 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.060
Manganese (Dissolved)	mg/L	0.010	200.7		0.044
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.1[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0012 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.0028	200.7	0.05[3]	0.0046 J
Zinc	mg/L	0.050	200.7	5[2]	ND

Zone 7 Water Agency
Del Prado Park Test Well
Water Quality Summary Table

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	Title 22 3/26/2025
RADIOCHEMISTRY					
Ra 226	pCi/L		903.0/9315		0.294 ± 0.305
Ra 228	pCi/L		904/9320		0.0190 ± 0.639
Strontium-90	pCi/L		905	8[1]	0.756 ± 0.392
Tritium	pCi/L		906	20,000[1]	188 ± 260
Uranium	pCi/L	1.0	D5174	20[1]	3.90 ± 0.254
OTHER ANALYSES					
Ammonia as N	mg/L	0.20	350.1		0.19 J
Asbestos	MFL	5.0	600/R-94/134	7[1]	ND
Benzo-a-pyrene	µg/L	0.12	525.2	0.2[1]	ND
Bromate	µg/L	1.0	317	10[1]	ND
Carbamates	µg/L	*	531.1		ND
Chlorinated Herbicides	µg/L	*	515.1		ND
Chlorite (ClO2)	mg/L	0.0050	300.1	1.0[1]	ND
Cyanide (Total)	mg/L	0.005	335.4	0.15[1]	ND
1,2-Dibromo-3-Chloropropane DBCP	µg/L	.01	504.1	0.2[1]	ND
Di(2-ethylhexyl)adipate	µg/L	1.2	525.2	400[1]	ND
Di(2-ethylhexyl)phthalate	µg/L	3.6	525.2	4[1]	0.13 J
Diquat and/or Paraquat	µg/L	4.0	549.2	20[1]	ND
Endothall	µg/L	45	548.1	100[1]	ND
Ethylene Dibromide EDB	µg/L	.01	504.1	0.05[1]	ND
Glyphosate	µg/L	25	547	700[1]	ND
Hydrogen Sulfide (H2S)	mg/L	0.10	SM-4500SH		ND
Methane	µg/L	0.001	RSK175M		0.22
Nitrogen/Phosphorus Pesticides	µg/L	*	525.2		ND
Organochlorine Pesticides and PCBs	µg/L	*	508		ND
Perchlorate	mg/L	0.0010	314.0	0.006[1]	ND
PCB's	µg/L	0.20	8082		ND
Phosphorus (Total)	mg/L	0.050	365.4		0.018 J
Purgeable Organic Compounds (VOCs)	µg/L	*	524.2		ND
Sulfide (Total)	mg/L	0.10	SM-4500SD		ND
Sulfide (Dissolved)	mg/L	0.10	SM-4500SD		ND
2,3,7,8-TCDD (Dioxin)	pg/L	10	1613B	0.00003[1]	ND
1,2,3-Trichloropropane	µg/L	0.25	SRL 524M-TCP	0.005[1]	ND
Total Haloacetic acids (five) HAA5	µg/L	1.0	552.3	60[1]	ND
Total Organic Carbon	mg/L	1.0	SM5310C		0.46 J
Total Trihalomethanes (TTHM)	µg/L	2.0	524.2	80[1]	ND
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

* - Various reporting and detection limits
1 - Primary MCL
2 - Secondary MCL (recommended/upper range)
3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Analyzed out of hold time
6 - EPA Method 533 analysis includes 25 Perflourinated Alkyl Acids
ND = Non-Detect
J-Flag = Estimated value above method detection limit and below reporting limit.

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Consulting Engineers

APPENDIX B

B-2 Summary of Discrete Zone Sampling

Zone 7 Water Agency
Del Prado Park Test Well
Water Quality Summary Table - 230 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	230 Ft. (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		67
Magnesium	mg/L	0.050	200.7		37
Potassium	mg/L	1.00	200.7		1.6
Sodium	mg/L	0.50	200.7		97
Hardness as $CaCO_3$	mg/L	0.50	Calculation		320
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	78
Fluoride	mg/L	0.050	300.0	2[1]	0.092
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	6.5
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.88
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.65
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	59
Total Alkalinity	mg/L	4.1	SM 2320B		330
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	7.99[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.21
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	907
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	930
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	1.9
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.11
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00018 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0040
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0012 J
Barium	mg/L	0.010	200.7	1[1]	0.21
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.66
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	.010	200.7	0.050[1]	0.0044 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0038 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	3.2[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0047 J
Iron	mg/L	0.050	200.7	0.3[2]	0.14
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00011 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.037
Manganese (Dissolved)	mg/L	0.010	200.7		0.044
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00094 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0033 J
Zinc	mg/L	0.050	200.7	5[2]	0.021 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range) 3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Analyzed out of hold time
6 - EPA Method 533 analysis includes 25 Perflourinated Alkyl Acids
ND = Non-Detect

Luhdorff & Scalmanini
Consulting Engineers

Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 290 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	290' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		42
Magnesium	mg/L	0.050	200.7		23
Potassium	mg/L	1.00	200.7		1.3
Sodium	mg/L	0.50	200.7		100
Hardness as $CaCO_3$	mg/L	0.50	Calculation		200
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	79
Fluoride	mg/L	0.050	300.0	2[1]	0.088
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	3.7
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	0.88
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.049[5]
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	36
Total Alkalinity	mg/L	4.1	SM 2320B		290
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	8.23[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.047[5]
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	815
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	880[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	15[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.061
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00026 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0048
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0032
Barium	mg/L	0.010	200.7	1[1]	0.19
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	0.69
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0049 J
Chromium (Dissolved)	mg/L	0.010	200.7		0.0023 J
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	3.4[5]
Copper	mg/L	0.010	200.7	1.0[2]	0.0014 J
Iron	mg/L	0.050	200.7	0.3[2]	0.20
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00013 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.043
Manganese (Dissolved)	mg/L	0.010	200.7		0.043
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0013 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.023 J
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range) 3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
6 - EPA Method 533 analysis includes 25 Perflourinated Alkyl Acids
ND = Non-Detect

Luhdorff & Scalmanini
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Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 360 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	360' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		31
Magnesium	mg/L	0.050	200.7		16
Potassium	mg/L	1.00	200.7		1.1
Sodium	mg/L	0.50	200.7		150
Hardness as $CaCO_3$	mg/L	0.50	Calculation		140
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	120
Fluoride	mg/L	0.050	300.0	2[1]	0.086
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	0.13 J
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	ND
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	18
Total Alkalinity	mg/L	4.1	SM 2320B		280
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.27[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.15
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	890
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	750[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	2.9
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.19
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00029 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0070
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0056
Barium	mg/L	0.010	200.7	1[1]	0.23
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	1.1
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0015 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.11[5] J
Copper	mg/L	0.010	200.7	1.0[2]	ND
Iron	mg/L	0.050	200.7	0.3[2]	0.34
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00014 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.075
Manganese (Dissolved)	mg/L	0.010	200.7		0.067
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00060 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.092
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

1 - Primary MCL
2 - Secondary MCL (recommended/upper range) 3 - Notification Level
4 - Suggested lower/upper acceptable range
5 - Flagged with data qualifier by lab
6 - EPA Method 533 analysis includes 25 Perflourinated Alkyl Acids
ND = Non-Detect

Luhdorff & Scalmanini
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Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 430 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	430' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		27
Magnesium	mg/L	0.050	200.7		14
Potassium	mg/L	1.00	200.7		1.0
Sodium	mg/L	0.50	200.7		160
Hardness as $CaCO_3$	mg/L	0.50	Calculation		130
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	130
Fluoride	mg/L	0.050	300.0	2[1]	0.079
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	0.11 J
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.053 J
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	15
Total Alkalinity	mg/L	4.1	SM 2320B		280
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	8.38[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	ND
Electrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	917
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	900[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	11[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.25
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	ND
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0050
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0045
Barium	mg/L	0.010	200.7	1[1]	0.23
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	1.2
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium (Total)	mg/L	0.010	200.7	0.050[1]	ND
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.056 J
Copper	mg/L	0.010	200.7	1.0[2]	ND
Iron	mg/L	0.050	200.7	0.3[2]	0.32
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00020 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.073
Manganese (Dissolved)	mg/L	0.010	200.7		0.067
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00056 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.18
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

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ND = Non-Detect

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Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 480 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	480' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		31
Magnesium	mg/L	0.050	200.7		16
Potassium	mg/L	1.00	200.7		1.1
Sodium	mg/L	0.50	200.7		160
Hardness as $CaCO_3$	mg/L	0.50	Calculation		140
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	160
Fluoride	mg/L	0.050	300.0	2[1]	0.076
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	0.053 J
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	18
Total Alkalinity	mg/L	4.1	SM 2320B		270
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	1.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.38[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.089 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	990
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	790[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	7.5
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.50
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00011 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0058
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0048
Barium	mg/L	0.010	200.7	1[1]	0.22
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	1.3
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.019 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.053[5] J
Copper	mg/L	0.010	200.7	1.0[2]	0.0014 J
Iron	mg/L	0.050	200.7	0.3[2]	1.1
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00030 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.10
Manganese (Dissolved)	mg/L	0.010	200.7		0.092
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	ND
Selenium	mg/L	0.0020	200.8	0.050[1]	0.0011 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.17
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

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ND = Non-Detect

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Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 505 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	505' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		39
Magnesium	mg/L	0.050	200.7		20
Potassium	mg/L	1.00	200.7		1.3
Sodium	mg/L	0.50	200.7		150
Hardness as $CaCO_3$	mg/L	0.50	Calculation		180
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	150
Fluoride	mg/L	0.050	300.0	2[1]	0.070
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	ND
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	33
Total Alkalinity	mg/L	4.1	SM 2320B		290
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0[5]
pH	pH units	0.05	150.1	6.5/8.5[4]	8.38[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.043 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	1000
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	950[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	19[5]
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	0.85
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00013 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0043
Arsenic (Dissolved)	mg/L	0.0020	200.8		0.0039
Barium	mg/L	0.010	200.7	1[1]	0.24
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	1.1
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0032 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.097[5] J
Copper	mg/L	0.010	200.7	1.0[2]	ND
Iron	mg/L	0.050	200.7	0.3[2]	2.1
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	0.015[3]	0.00040 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.094
Manganese (Dissolved)	mg/L	0.010	200.7		0.084
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0027 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00090 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	ND
Zinc	mg/L	0.050	200.7	5[2]	0.098
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

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ND = Non-Detect

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Zone 7
Del Prado Park Test Well
Water Quality Summary Table - 560 ft Zone

ANALYTE	UNITS	REPORTING LIMIT	METHOD	MCL	560' (3/27/2025)
CATIONS					
Calcium	mg/L	0.100	200.7		55
Magnesium	mg/L	0.050	200.7		28
Potassium	mg/L	1.00	200.7		1.6
Sodium	mg/L	0.50	200.7		150
Hardness as $CaCO_3$	mg/L	0.50	Calculation		250
ANIONS					
Chloride (Cl)	mg/L	0.50	300.0	250/500[2]	130
Fluoride	mg/L	0.050	300.0	2[1]	0.062
Nitrate (as NO3)	mg/L	0.44	300.0	45[1]	ND
Nitrite (as NO2)	mg/L	0.20	300.0	3.28[1]	ND
Nitrate/Nitrite (as N)	mg/L	0.10	353.2	10[1]	1.6
Sulfate (as SO4)	mg/L	1.0	300.0	250/500[2]	54
Total Alkalinity	mg/L	8.2	SM 2320B		300[5]
PHYSICAL PARAMETERS					
Color (A.P.H.A)	Color Units	1.0	SM 2120B	15[2]	2.0
pH	pH units	0.05	150.1	6.5/8.5[4]	8.19[5]
Methylene Blue Active Substance	mg/L	0.10	SM 5540C	0.5[2]	0.070 J
Elelctrical Conductivity @ 25°C	µmhos/cm	1.0	SM 2510 B-1997	900/1,600[2]	1030
Total Dissolved Solids (TDS)	mg/L	33	SM 2540C	500/1,000[2]	1000[5]
Odor	Odor Units	1.0	SM 2150B	3[2]	ND
Turbidity	NTU	0.10	180.1	5[2]	21
INORGANICS					
Aluminum	mg/L	0.050	200.7	1[1]/0.2[3]	1.2
Aluminum (Dissolved)	mg/L	0.050	200.7		ND
Antimony	mg/L	0.0020	200.8	0.006[1]	0.00022 J
Arsenic	mg/L	0.0020	200.8	0.010[1]	0.0025
Arsenic (Dissolved)	mg/L	0.010	200.8		ND[5]
Barium	mg/L	0.010	200.7	1[1]	0.31
Beryllium	mg/L	0.010	200.7	0.004[1]	ND
Boron	mg/L	0.10	200.7	1[3]	1.0
Cadmium	mg/L	0.001	200.8	0.005[1]	ND
Chromium	mg/L	0.010	200.7	0.050[1]	0.0040 J
Chromium (Dissolved)	mg/L	0.010	200.7		ND
Hexavalent Chromium	µg/L	0.20	218.6	10[1]	0.073 J
Copper	mg/L	0.010	200.7	1.0[2]	0.0079 J
Iron	mg/L	0.050	200.7	0.3[2]	1.4
Iron (Dissolved)	mg/L	0.050	200.7		ND
Lead	mg/L	0.0010	200.8	.015[3]	0.00064 J
Manganese	mg/L	0.010	200.7	0.050[2]	0.11
Manganese (Dissolved)	mg/L	0.010	200.7		0.084
Mercury	mg/L	0.0002	245.1	0.002[1]	ND
Nickel	mg/L	0.010	200.7	0.100[1]	0.0038 J
Selenium	mg/L	0.0020	200.8	0.050[1]	0.00081 J
Silver	mg/L	0.010	200.7	0.1[2]	ND
Thallium	mg/L	0.0010	200.8	0.002[1]	ND
Vanadium	mg/L	0.010	200.7	0.05[3]	0.0029 J
Zinc	mg/L	0.050	200.7	5[2]	0.052
PFAS					
Perfluorinated Alkyl Acids	ng/l	1.79	533[6]		ND

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APPENDIX C

Well Capacity Estimates TM

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Well Capacity Estimates for Zone 7/Pleasanton Test Well Sites

An 8-inch diameter test well was constructed at Del Prado Park, Tennis Park, and Hansen Park. Each well was developed, had step-drawdown pumping tests conducted, and had constant rate pumping tests conducted for 8 hours. The data derived from the constant rate pumping tests, combined with data regarding the range of expected regional groundwater levels, were reviewed for the development of full-scale production well pumping capacity estimates at each location.

It should be noted that while well capacity estimates described below are based on some very specific input values (e.g., for specific capacity, assumed static groundwater levels), the final production capacity for each well cannot be precisely known until the large-diameter production wells are drilled and tested. This is due in large part to considerable uncertainty in the well efficiency input parameter, which is as much a function of the well efficiency and quality of work done by the drilling subcontractor as it is a function of the engineering oversight and design specifications (e.g., filter pack gradation, screen slot size). Thus, while the well capacity estimates described below may represent a best estimate at this time, they could vary by several hundred gpm more or less than the values described below.

Background and Considerations in Low-End Well Capacity Estimates

The basis for the low-end production rate well capacity analysis is the occurrence of worst-case (critical years with maximum municipal/agricultural groundwater pumping) groundwater basin conditions. Groundwater elevation contour maps were reviewed for recent critical drought years, including Fall 2015, Fall 2021, and Fall 2022. In addition, total municipal/agricultural well pumping and City of Pleasanton (a subcomponent of total municipal/agricultural pumping) groundwater pumping were reviewed for these three critical dry years, along with the last ten years overall (**Table 1**). Overall, the lowest groundwater elevations occurred in the Fall of 2021 and Fall 2022, consistent with the highest rates of total municipal and agricultural groundwater pumping (over the past 10 years), ranging from 21,500 to 23,600 AFY, and relatively high City of Pleasanton groundwater pumping between about 2,600 and 3,800 AFY.

Table 1. Summary of Municipal Well Pumping and Groundwater Elevations at Test Well Sites Over Past Ten Years[1]				
Year	Water Year Type	City of Pleasanton Annual Pumping (AF)	Total Municipal and Agricultural Pumping (AF)[2]	Test Well Spring/Fall GWE (ft msl)
2015	Critical	2,775	8,874	265-270/270
2016	Dry	3,752	9,860	
2017	Wet	4,222	11,369	
2018	Below Normal	3,913	12,657	
2019	Wet	3,785	15,309	
2020	Dry	2,701	17,069	
2021	Critical	3,802	23,597	260-275/250-255
2022	Critical	2,587	21,497	265-270/245-255
2023	Wet	270	9,987	
2024	Above Normal	0	7,104	

1. Annual pumping derived from Table D-3 in 2024 Water Year Annual Report (Zone 7, March 2025).
2. Total Municipal and Agricultural Pumping includes City of Pleasanton pumping.

A summary of the proposed top of well screen, high and low depths to (static) water, and calculated available drawdown at each test well site are summarized in **Table 2**.

Table 2. Summary of Test Well Sites Critical Year Depth to Water					
Well	Depth to Top of Screen	High DTW (ft bgs)	Low DTW (ft bgs)	Maximum Available Drawdown (ft)	Minimum Available Drawdown (ft)
Tennis	195	16.7	75	178	120
Hansen	298	24.5	75	273.5	223
Del Prado	170	16.7	65	153	105
Notes: DTW = Depth to Water					

Based on the analysis summarized above, the regional groundwater level conditions assumed for the well capacity analysis are based on a time of maximum overall municipal/agricultural groundwater pumping (since at least 1974) and relatively high City of Pleasanton groundwater pumping (2,600 to 3,800 AFY vs. long-term average of 3,100 AFY). Thus, the well capacity analysis assumes that groundwater pumping at the test well sites is occurring in addition to maximum historical municipal pumping (since at least 1974), which is likely a very conservative assumption for this assessment (i.e., the new test well sites are expected to supplement and be used in conjunction with existing Zone 7 municipal well sites, and not constitute additional pumping at a time of maximum pumping of existing municipal production wells).

Methodology

The well capacity calculation methodology requires input values for specific capacity, available drawdown, and assumed production well efficiency. Specific capacity varies (declines) with time, although the rate of

decline decreases dramatically after about 24 hours for most high-capacity wells. Given the planned long-term continuous operation of the new wells, 30-day and 90-day specific capacity values were evaluated along with the typical 24-hour specific capacity value used in most well yield calculations. Available drawdown relates to regional groundwater elevations and varies seasonally and year to year, depending on how wet or dry the recent and preceding years have been. Well capacities were estimated for relatively high and low available drawdown estimates. Well efficiency can be highly variable and is heavily dependent on well engineering design considerations (e.g., screen slot size, filter pack quality and gradation, well drilling/development specifications) and drilling contractor performance (e.g., driller efficiency, driller adherence to drilling specifications). Each of these three key inputs is described in more detail below.

Data from the constant rate aquifer tests were reviewed to calculate the 24-hour specific capacity by extending the trend of water level declines (on a semi-log time-drawdown plot) from the 8-hour test out for a 24-hour period. The 24-hour specific capacity was calculated by dividing the average pumping rate during the 8-hour constant rate test by the total estimated drawdown over a 24-hour period. In addition, specific capacity values were determined in a similar manner (extending the semi-log plot time-drawdown line from 8 hours to 30 days and 90 days) for 30-day and 90-day continuous pumping scenarios to evaluate the difference in assumptions regarding specific capacity values. The specific capacity values for different time periods are summarized in **Table 3**.

Table 3. Summary of Test Well Specific Capacity Values

Well ID	Pumping Rate (gpm)	24-hr DD (ft)	24-hr Q/s (gpm/ft)	30-Day DD (ft)	30-Day Q/s (gpm/ft)	90-Day DD (ft)	90-Day Q/s (gpm/ft)
Tennis Park	549	9.6	57.2	10.3	53.3	10.6	51.8
Hansen Park	594	19.5	30.5	21.5	27.6	22.5	26.4
Del Prado Park	252	15.6	16.2	16.2	15.3	17.2	14.7

As summarized above Tennis Park specific capacity ranges from 57 to 52 gpm/ft, Hansen Park specific capacity ranges from 30.5 to about 26.5 gpm/ft, and Del Prado Park ranges from 16.2 to 14.7 gpm/ft for 24 hours to 90 days of pumping.

Given the relatively high groundwater elevations at the time of the pumping tests, the measured groundwater level at the start of testing was used as the basis for the high-end well capacity estimate. The difference between the measured groundwater level and the top of the uppermost screen was used as the available drawdown for the well capacity estimate. As described above, historical groundwater elevation contour maps (for critical dry years) and municipal pumping were reviewed to determine an appropriate regional groundwater elevation to use at the test well sites as the basis for low-end well capacity estimates. The water years considered for the low-end estimate were 2021 and 2022. The difference between groundwater elevations in these dry years and the top of the well screen were used as available drawdown for low-end estimates.

Well efficiency relates to the difference between the pumping water level inside a production well casing and the groundwater level in the aquifer formation just outside the well filter pack. In theory, a well would be 100% efficient if these water levels are the same; in practice, this rarely occurs for high-capacity production wells. The difference between water levels inside a well casing and in the adjacent aquifer formation refers to the well efficiency needed for well capacity estimates. For example, if the water level in the wells declines by 100 feet during pumping but the aquifer groundwater level just outside the well filter pack declines by 50 feet, the well efficiency is considered to be 50%. A reasonable well efficiency target to strive for in most high-capacity production well drilling operations is 70 to 80%. For the purposes of the well capacity estimates (based on 24-hour specific capacity) described below, it was assumed that a production well at the Del Prado Park site could achieve a 75% well efficiency, while the production wells at the Tennis Court and Hansen Park sites were conservatively estimated to have 50% well efficiency. Lower well efficiencies were assumed at the higher specific capacity sites (Tennis and Hansen) primarily because in highly permeable sediments, the flow of water at higher pumping rates has a greater tendency to become turbulent, which increases friction losses and reduces well efficiencies.

Del Prado Park Well Capacity Estimate

The upper end well capacity estimate for the Del Prado Park test well is summarized in **Table 4**. The average pumping rate of 252 gpm combined with a projected 24-hour drawdown of 15.6 feet yields a specific capacity of 16.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 170 feet bgs, yields an available drawdown of 153 feet. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 153 feet yields an interim well capacity calculation of about 2,500 gpm. Applying a well efficiency factor of 75% yields a final upper-end well yield estimate of approximately 1,900 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 17 feet bgs was substituted with a drought year assumed depth to water of 65 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 105 feet compared to 153 feet for the upper end well capacity calculation. Multiplying the specific capacity of 16.2 gpm/ft times the available drawdown of 105 feet yields an interim well capacity calculation of 1,700 gpm. Applying a well efficiency factor of 75% yields a final lower-end well yield estimate of approximately 1,300 gpm (**Table 4**).

Tennis Park Well Capacity Estimate

The upper end well capacity estimate for the Tennis Park test well is summarized in **Table 4**. The average pumping rate of 549 gpm combined with a projected 24-hour drawdown of 9.6 feet yields a specific capacity of 57.2 gpm/ft. The April 2025 static water level of 17 feet below ground surface (bgs), combined with depth to top of first screen of 195 feet bgs, yields an available drawdown of 178 feet. Multiplying the specific capacity of 57.2 gpm/ft times the available drawdown of 178 feet yields an interim well capacity calculation of 10,200 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 5,100 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level

of 17 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 120 feet compared to 178 feet for the upper end well capacity calculation. Multiplying the specific capacity of 57.2 gpm/ft times the available drawdown of 120 feet yields an interim well capacity calculation of 6,900 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Hansen Park Well Capacity Estimate

The upper end well capacity estimate for the Hansen Park test well is summarized in **Table 4**. The average pumping rate of 594 gpm combined with a projected 24-hour drawdown of 19.5 feet yields a specific capacity of 30.5 gpm/ft. The April 2025 static water level of 24.5 feet below ground surface (bgs), combined with depth to top of first screen of 298 feet bgs, yields an available drawdown of 273.5 feet. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 273.5 feet yields an interim well capacity calculation of 8,300 gpm. Applying a well efficiency factor of 50% yields a final upper-end well yield estimate of approximately 4,200 gpm.

The lower end well capacity estimate is based on the same specific capacity, top of upper well screen, and well efficiency calculations/assumptions as summarized above. However, the April 2025 static water level of 24.5 feet bgs was substituted with a drought year assumed depth to water of 75 feet bgs based on review of groundwater elevation contour maps for 2021 and 2022, which yields an available drawdown of 223 feet compared to 273.5 feet for the upper end well capacity calculation. Multiplying the specific capacity of 30.5 gpm/ft times the available drawdown of 223 feet yields an interim well capacity calculation of 6,800 gpm. Applying a well efficiency factor of 50% yields a final lower-end well yield estimate of approximately 3,400 gpm (**Table 4**).

Table 4. Summary of Test Well Pumping Capacity Estimates

Well ID	Proposed Top of Screen (ft bgs)	24-Hr Q/s (gpm/ft)	High Available DD (ft)	Low Available DD (ft)	Assumed Well Efficiency (%)	High Pumping Capacity (gpm)	Low Pumping Capacity (gpm)
Tennis Park	195	57.2	178	120	50	5,100	3,400
Hansen Park	298	30.5	273.5	223	50	4,200	3,400
Del Prado Park	170	16.2	153	105	75	1,900	1,300

Comparison to Existing Production Well Capacities

A summary of pumping test data available from DWR WCR for other production wells in the general project area is provided in **Table 5**. The range of specific capacities for these existing wells ranges from 10 to 123 gpm/ft, compared to a range of specific capacities from 16 to 57 gpm/ft for the new test well sites. Thus, the new test well sites are consistent with existing sites in terms of specific capacity.

Table 5. Summary of Existing Production Well Specific Capacities							
Well ID	Pumping Rate (gpm)	Well Diameter/ Slot Size (Inches)	Pumping Duration (hr)	DD (ft)	Q/s (gpm/ft)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)
Hopyard 6	4,550	18/0.075	0.5	61	75	215	490
Hopyard 7	1,200	22/0.085	8	101	12	150	415
Hopyard 9	1,000	18/0.080	24	102	10	NA	NA
Pleasanton 5	2,820	18/ 2 1/2 x 1/8	100	23	123	149	650
Pleasanton 6	3,052	18/ 2 1/2 x 1/8	NA	28	109	165	647
Pleasanton 7	4,000	18/	68	115	35	120	440
Pleasanton 8		20/0.085				200	490
SFPUC A	1,200	18/0.070	12	88	14	196	320
SFPUC B	2,100	18/0.070	10	93	23	189	326

Evaluation of 30-Day and 90-Day Specific Capacities

Due to the potential continuous operation of the new test well sites on a continuous basis for weeks to months and associated slightly lower specific capacity values, an evaluation was conducted in terms of the required difference in assumed well efficiency that is needed to maintain the same pumping capacities. This evaluation provides both the pumping capacity using the longer-term specific capacity combined with the original well efficiency assumptions, along with the estimated new well efficiency required to maintain the original pumping capacity (**Table 6**).

The longer-term specific capacity was estimated based on straight-line projection of drawdown vs. time (on semi-log paper) for constant rate pumping of the test well. It should be noted that unknown boundary conditions (recharge or discharge) may occur at later time and not be reflected in projection of time-drawdown data from an 8-hour test, which may result in higher or lower long-term specific capacities.

Table 6. Evaluation of Long-Term Specific Capacity and Low-End Well Yield Analysis						
Well ID	24-Hr Well Yield (gpm)	24-Hr Well Efficiency Assumption (%)	30-Day Well Yield [1] (gpm)	30-Day Well Efficiency Assumption[2] (%)	90-Day Well Yield [1] (gpm)	90-Day Well Efficiency Assumption[2] (%)
Tennis Park	3,400	50	3,200	54	3,100	55
Hansen Park	3,400	50	3,100	55	2,950	58
Del Prado Park	1,300	75	1,200	80	1,150	83
[1]Well yield estimate at the original assumed well efficiency. [2]Required well efficiency assumption to maintain the original 24-hour baseline pumping capacity.						

As indicated in **Table 6**, use of longer-term specific capacities results in either slightly lower pumping capacities (generally, a reduction of 10% or less) or the need to assume slightly higher well efficiencies (from 50% to as much as 58%, and from 75% to as much as 83%). Overall, the impact of accounting for longer-term specific capacities (in and of itself) does not appear to require adjustments to the original well capacity estimates (because the increased well efficiencies are still reasonably attainable). Additional discussion of the combination of longer-term specific capacities and mutual well interference is provided below.

Mutual Well Interference Considerations

Methodology

Calculations of mutual well interference using the Theis equation requires input values for transmissivity, storativity, time of continuous pumping, and pumping rate. Calculations were made for continuous pumping durations of 30 and 90 days. Assigned pumping rates were 3,400 gpm for Tennis and Hansen Park well sites, and 1,300 gpm for the Del Prado Park well site. Transmissivity and storativity were initially estimated based on calibrated model parameters with subsequent slight adjustments based on reviewed of observation well drawdowns measured for each constant rate pumping test. The final assigned values of transmissivity and storativity associated with pumping from each well are summarized below in **Table 7.**

Table 7. Summary of Assigned Transmissivity and Storativity Values		
Well ID	Transmissivity (gpd/ft)	Storativity
Tennis Park	190,000	0.0008
Hansen Park	200,000	0.0015
Del Prado Park	200,000	0.0015
Note: Distances between wells are as follows – Tennis to Hansen = 1,900 ft.; Tennis to Del Prado = 3,550 ft.; and Hansen to Del Prado = 3,450 ft.		

Scenarios

Four different scenarios of pumping well combinations were evaluated:

- Tennis, Hansen, and Del Prado
- Tennis and Hansen
- Tennis and Del Prado
- Hansen and Del Prado

The mutual well interference drawdown at each of the three new test well sites from pumping at each of the other new test well sites is summarized below in **Table 8**. For each combination of pumping wells, the cumulative or total well interference drawdown from pumping of the other one or two wells is provided in **Table 8**.

Table 8. Summary of Test Well Site Production Well Interference Estimates

Pumping Well	30 Days Continuous Pumping			90 Days Continuous Pumping		
	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)	Tennis DD (ft)	Hansen DD (ft)	Del Prado DD (ft)
Tennis	NA	13	11	NA	15	13
Hansen	11	NA	9	13	NA	11
Del Prado	3	3	NA	4	4	NA
Cumulative	14	16	20	17	19	24
Tennis	NA	13	-	NA	15	-
Hansen	11	NA	-	13	NA	-
Cumulative	11	13	-	13	15	-
Tennis	NA	-	11	NA	-	13
Del Prado	3	-	NA	4	-	NA
Cumulative	3	-	11	4	-	13
Hansen	-	NA	9	-	NA	11
Del Prado	-	3	NA	-	4	NA
Cumulative	-	3	9	-	4	11

The cumulative well interference drawdowns ranged from 14 to 20 feet when all three test wells are pumping for 30 days and 17 to 24 feet when all three test wells are pumping for 90 days. The cumulative well interference drawdowns ranged from 3 to 13 feet, with two wells pumping over 30 days and 4 and 15 feet with two wells pumping over 90 days.

Assessment of Test Well Site Production Well Capacity with Consideration of Mutual Well Interference and Longer-Term Specific Capacities

An extreme (and unlikely) scenario is that the mutual well interference drawdown calculations summarized above would be additive to the groundwater elevations observed during the Fall of 2021/2022. It is not anticipated that all the existing wells would be operating at the same time as the new test well sites. Assuming that the groundwater elevations observed in Fall 2021 and Fall 2022 reflect operation of all the existing wells (as is generally indicated by review of historical annual municipal groundwater pumping since 1974), the mutual well interference drawdowns calculated above would not apply to the relatively low groundwater elevations observed in Fall 2021/2022.

However, in the case that Fall 2021 and Fall 2022 groundwater elevations are representative of the future conditions without any new production wells at the test well sites operating, and that three new production wells at the test well sites are operating as additional pumping capacity, the following analysis may warrant consideration. **Table 9** summarizes the assessment of how the original baseline minimum well capacities may be impacted by the mutual well interference with all three test well sites pumping simultaneously for 30 and 90 days continuously. The results are characterized both by reduced well capacities that would result, and also by what the change would have to be in the well efficiency assumptions to obtain the same original well pumping capacity estimates. The results for Tennis Park and Hansen generally indicate a reduction in well capacities by approximately 10 percent or the need to assume well efficiencies on the order of 55 to 60 percent instead of 50 percent. In the case of Del Prado Park, either well capacities are reduced from 1,300 gpm to between 1,000 and 1,050 gpm, or well efficiencies of 93 to 99 percent would need to be assumed.

Table 9 also shows the combination of long-term specific capacity assumptions (for 30 and 90 days) and mutual well interference drawdowns (for three test well sites pumping). This maximum worst-case scenario indicates Tennis Park and Hansen Park have well capacities reduced from 3,400 gpm to between 2,600 and 2,900 gpm, or the need to assume well efficiencies ranging from 59 to 66 percent. For Del Prado Park, well capacities for this worst case drop from 1,300 gpm to between 880 and 975 gpm, or assumed well efficiencies of 100 percent or greater (not possible).

Overall, this maximum worst-case scenario indicates that it is still reasonable to assume the original low-end well capacities at Tennis Park and Hansen Park can be maintained, because achieving well efficiencies up to 66 percent is reasonable. However, well efficiencies of 100 percent or greater are not reasonable to assume for Del Prado Park, and it is likely that a reduced well capacity would occur under these worst-case conditions. However, on additional consideration, it is noted that these low-end well capacity estimates are based on Fall groundwater level conditions, whereas drought-year pumping will occur throughout the year when water levels may be slightly higher. Therefore, even in the worst-case scenario, the decline in well capacity may be limited to the Fall season.

Table 9. Evaluation of Mutual Well Interference Impact and 30/90-Day Specific Capacity on Minimum Production Well Capacity					
Well ID	**Case**	**Pumping Rate[1]**	**Assumed Efficiency[2]**	**Pumping Rate[3]**	**Assumed Efficiency[4]**
Tennis Park	Baseline	3,400	50	-	-
Tennis Park	Including MWI (3 Wells Pumping 30 days)	3,400	-	3,000	57
Tennis Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	2,850	60
Tennis Park	Including MWI and 30-Day Q/s	-	-	2,800	61
Tennis Park	Including MWI and 90-Day Q/s	-	-	2,600	66
Hansen Park	Baseline	3,400	50	-	-
Hansen Park	Including MWI (3 Wells Pumping for 30 days)	3,400	-	3,200	54
Hansen Park	Including MWI (3 Wells Pumping 90 days)	3,400	-	3,100	55
Hansen Park	Including MWI and 30-Day Q/s	-	-	2,900	59
Hansen Park	Including MWI and 90-Day Q/s	-	-	2,700	64
Del Prado Park	Baseline	1,300	75	-	-
Del Prado Park	Including MWI (3 Wells Pumping for 30 days)	1,300	-	1,050	93
Del Prado Park	Including MWI (3 Wells Pumping 90 days)	1,300	-	1,000	99
Del Prado Park	Including MWI and 30-Day Q/s	-	-	975	100
Del Prado Park	Including MWI and 90-Day Q/s	-	-	880	110[5]

[1] Baseline minimum pumping capacity based on 24-hour Q/s and no mutual well interference

[2] Baseline assumed well efficiency

[3] Minimum pumping capacity accounting for mutual well interference or mutual well interference plus longer term
specific capacity

[4] Assumed well efficiency to maintain the original baseline pumping capacity

[5] Well efficiency cannot exceed 100%

Appendix D

Zone 7 – Status of Potable Water Quality Targets

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Table 2 - Status of Potable Water Quality Targets

Key Parameters of Concern	Water Quality Target[1]	2022-2024* Delivered Water Quality Data**			Target Currently Met	Requires Optimization	Requires Capital Investment
		Avg	Min[2]	Max[2]			
Appearance	Minimize air bubbles/cloudiness events[3]	NA	0	0	✓		
Boron (mg/L)	<2.0 mg/L at turnouts	0.3	<0.1	1.0	✓		
Disinfectant Residual/Nitrification Control							
Total Disinfectant Residual (mg/L as Cl_2)	2.0 - 2.5 mg/L as Cl2 from water treatment plants (WTPs), wells to be operated as close to this target as possible	3.0	2.5	3.4	X	✓	
Free Ammonia Residual (mg/L as N)	<0.15 mg/L as N from WTPs; wells to be operated as close to this target as feasible	0.04	<0.01	0.12	✓	✓	
Nitrite (mg/L as N)	<0.02 mg/L as N at turnouts	<0.01	<0.01	0.02	✓	✓	
Minimize odor	Chloraminate above pH 8.0 for WTPs[6]	8.8	8.4	9.2	✓	✓	
Chromium VI, Cr6 (µg/L)[4]	<8 µg/L at turnouts	1.4	<1	5.3	✓	✓	
Corrosion Control	non-corrosive or Aggressive Index (AI) ≥ 12.0	12.3	11.4	13.3	✓[5]	✓	
	pH leaving WTP at +/- 0.2 units of target	0.1	0.0	0.3	✓[5]	✓	
Disinfection By-Products (DBPs)							
Maximum Leaving Surface WTP	Total Trihalomethanes (TTHMs) <64 µg/L	31	14	70	✓[5]	✓	
	Five Haloacetic acids (HAA5) <48 µg/L	19	4	48	✓		
	Bromate <8 µg/L	<2	<2	6	✓		
N-Nitrosodimethylamine (NDMA) (ng/L)	<10 ng/L @ turnouts	<2	<2	5	✓		
Earthy-Musty Taste and Odor (T&O)							
Odor Threshold Concentrations							
2-Methylisoborneol (MIB)(ng/L)	<9 ng/L	<2	<2	11	✓[5]	✓	
Geosmin (ng/L)	<4 ng/L	<2	<2	10	✓[5]	✓	
Events[3]	No events	NA	0	3	X	✓	
Salinity & Hardness							
Chloride (mg/L)	<100 mg/L at turnouts	59	10	117	✓[5]	✓	✓
Total Dissolved Solids (TDS) (mg/L)	<500 mg/L at turnouts	290	85	650	✓[5]	✓	✓
Hardness (mg/L as $CaCO_3$)	<150 mg/L as $CaCO_3$ at turnouts	138	20	461	✓[5]	✓	✓
Per- and Polyfluoroalkyl Substances (PFAS)							
Perfluoro-octanoic acid (PFOA)[7]	<3.2 ng/L	<2	<2	4	✓	✓	
Perfluoro-octane sulfonic acid (PFOS)[7]	<3.2 ng/L	7	<2	32	X	✓	✓
Perfluoro-hexane sulfonic acid (PFHxS)[7]	<8 ng/L	6	<2	26	✓[5]	✓	✓
Perfluorobutane sulfonic acid (PFBS)[8]	<400 ng/L	2	<2	7	✓	✓	
Perfluorononanoic acid (PFNA)[7]	<8 ng/L	<2	<2	<2	✓	✓	
Hexafluoropropylene oxide dimer acid (GenX)[7]	<8 ng/L	<2	<2	<2	✓	✓	
Perfluoro-hexanoic acid (PFHxA)[9]	<800 ng/L	<2	<2	5	✓	✓	

NOTES:

NA = Not Applicable/Available. *Data through September 2024. **Online data are used when available and pulled out every 4 hours.

1. Targets are either less than 80% of the primary MCLs or less than the secondary MCLs except for a few parameters of concern listed in the table above.
2. 5th percentile and 95th percentile values are used in lieu of minimium and maximum values, respectively, for online data to exclude instrument related spikes and null values.
3. An event is defined as when three or more similar complaints are received in a 7-day period.
4. The state MCL for Cr6 is 0.010 mg/L (effective October 2024). Total chromium data is reported in lieu of Cr6 data. All WTP samples were non-detect.
5. Averages met target.
6. Data is for Surface WTPs only.
7. Targets are based on 80% of the federal PFAS MCLs which must be complied by April 2029.
8. Target is based on 80% of the notification level by the state Division of Drinking Water (DDW).
9. Target is based on 80% of the proposed notification level by the state Office of Environmental Health Hazard Assessment (OEHHA) in September 2024.

Units: **Milligrams per liter (mg/L):** a unit expressing the concentration of chemical constituent in solution as weight (milligram) of solute per unit volume (liter) of water; equivalent to one part per million (ppm).

Micrograms per liter (µg/L): equivalent to one part per billion (ppb).

Nanograms per liter (ng/L): equivalent to one part per trillion (ppt).

Appendix E

Groundwater Modeling Monthly Assigned Pumping Rates

LSCE

	Total Production (AFY)	Production Proportion	Jan Production (AFY)	Feb Production (AFY)	Mar Production (AFY)	Apr Production (AFY)	May Production (AFY)	June Production (AFY)	July Production (AFY)	Aug Production (AFY)	Sep Production (AFY)	Oct Production (AFY)	Nov Production (AFY)	Dec Production (AFY)	Total (AFY)
Monthly Production Proportion			0.04	0.04	0.05	0.06	0.13	0.13	0.13	0.12	0.11	0.07	0.07	0.05	1.00
Scenario 1															
Drought Year Target	9,000		360.0	360.0	450.0	540.0	1170.0	1170.0	1170.0	1080.0	990.0	630.0	630.0	450.0	9000.0
Tennis		0.42	151.2	151.2	189.0	226.8	466.1	451.1	466.1	453.6	415.8	264.6	264.6	189.0	
Hanson		0.42	151.2	151.2	189.0	226.8	466.1	451.1	466.1	453.6	415.8	264.6	264.6	189.0	
Del Prado		0.16	57.6	57.6	72.0	86.4	177.6	171.8	177.6	172.8	158.4	100.8	100.8	72.0	
Total 3 Wells		1.00	360.0	360.0	450.0	540.0	1109.7	1073.9	1109.7	1080.0	990.0	630.0	630.0	450.0	8783.4
Shortfall			0.0	0.0	0.0	0.0	60.3	96.1	60.3	0.0	0.0	0.0	0.0	0.0	216.6
Max Production			1109.7	1002.3	1109.7	1073.9	1109.7	1073.9	1109.7	1109.7	1073.9	1109.7	1073.9	1109.7	
Hours/Day			7.8	8.6	9.7	12.1	24.0	24.0	24.0	23.4	22.1	13.6	14.1	9.7	
Scenario 1															
Average/Wet Year Target	6,500		260.0	260.0	325.0	390.0	845.0	845.0	845.0	780.0	715.0	455.0	455.0	325.0	6500.0
Tennis		0.44	114.4	114.4	143.0	171.6	371.8	371.8	371.8	343.2	314.6	200.2	200.2	143.0	
Hanson		0.40	104.0	104.0	130.0	156.0	338.0	338.0	338.0	312.0	286.0	182.0	182.0	130.0	
Del Prado		0.16	41.6	41.6	52.0	62.4	135.2	135.2	135.2	124.8	114.4	72.8	72.8	52.0	
Total 3 Wells		1.00	260.0	260.0	325.0	390.0	845.0	845.0	845.0	780.0	715.0	455.0	455.0	325.0	6500.0
Shortfall			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Production			1322.1	1194.1	1322.1	1279.4	1322.1	1279.4	1322.1	1322.1	1279.4	1322.1	1279.4	1322.1	
Hours/Day			4.7	5.2	5.9	7.3	15.3	15.9	15.3	14.2	13.4	8.3	8.5	5.9	
Scenario 2															
Drought Year Target	9,000		360.0	360.0	450.0	540.0	1170.0	1170.0	1170.0	1080.0	990.0	630.0	630.0	450.0	9000.0
Tennis		0.50	180.0	180.0	225.0	270.0	465.8	450.8	465.8	465.8	450.8	315.0	315.0	225.0	
Hanson		0.50	180.0	180.0	225.0	270.0	465.8	450.8	465.8	465.8	450.8	315.0	315.0	225.0	
Total 2 Wells		1.00	360.0	360.0	450.0	540.0	931.6	901.6	931.6	931.6	901.6	630.0	630.0	450.0	8018.0
Shortfall			0.0	0.0	0.0	0.0	238.4	268.4	238.4	148.4	88.4	0.0	0.0	0.0	982.0
Max Production			931.6	841.5	931.6	901.6	931.6	901.6	931.6	931.6	901.6	931.6	901.6	931.6	
Hours/Day			9.3	10.3	11.6	14.4	24.0	24.0	24.0	24.0	24.0	16.2	16.8	11.6	
Scenario 2															
Average/Wet Year Target	6,500		260.0	260.0	325.0	390.0	845.0	845.0	845.0	780.0	715.0	455.0	455.0	325.0	6500.0
Tennis		0.53	137.8	137.8	172.3	206.7	447.9	447.9	447.9	413.4	379.0	241.2	241.2	172.3	
Hanson		0.47	122.2	122.2	152.8	183.3	397.2	397.2	397.2	366.6	336.1	213.9	213.9	152.8	
Total 2 Wells		1.00	260.0	260.0	325.0	390.0	845.0	845.0	845.0	780.0	715.0	455.0	455.0	325.0	6500.0
Shortfall			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Production			1102.9	996.2	1102.9	1067.3	1102.9	1067.3	1102.9	1102.9	1067.3	1102.9	1067.3	1102.9	
Hours/Day			5.7	6.3	7.1	8.8	18.4	19.0	18.4	17.0	16.1	9.9	10.2	7.1	
Scenario 3															
Drought Year Target	9,000		360.0	360.0	450.0	540.0	1170.0	1170.0	1170.0	1080.0	990.0	630.0	630.0	450.0	9000.0
Tennis		0.72	259.2	259.2	324.0	388.8	463.6	448.7	463.6	463.6	448.7	453.6	448.7	324.0	
Del Prado		0.28	100.8	100.8	126.0	151.2	180.3	174.5	180.3	180.3	174.5	176.4	174.5	126.0	
Total 2 Wells		1.00	360.0	360.0	450.0	540.0	643.9	623.1	643.9	643.9	623.1	630.0	623.1	450.0	6591.2
Shortfall			0.0	0.0	0.0	0.0	526.1	546.9	526.1	436.1	366.9	0.0	6.9	0.0	2408.8
Max Production			643.9	581.6	643.9	623.1	643.9	623.1	643.9	643.9	623.1	643.9	623.1	643.9	
Hours/Day			13.4	14.9	16.8	20.8	24.0	24.0	24.0	24.0	24.0	23.5	24.0	16.8	
Scenario 3															
Average/Wet Year Target	6,500		260.0	260.0	325.0	390.0	845.0	845.0	845.0	780.0	715.0	455.0	455.0	325.0	6500.0
Tennis		0.73	189.8	189.8	237.3	284.7	585.1	566.2	585.1	569.4	522.0	332.2	332.2	237.3	
Del Prado		0.27	70.2	70.2	87.8	105.3	216.4	209.4	216.4	210.6	193.1	122.9	122.9	87.8	
Total 2 Wells		1.00	260.0	260.0	325.0	390.0	801.5	775.6	801.5	780.0	715.0	455.0	455.0	325.0	6343.6
Shortfall			0.0	0.0	0.0	0.0	43.5	69.4	43.5	0.0	0.0	0.0	0.0	0.0	156.4
Max Production			801.5	723.9	801.5	775.6	801.5	775.6	801.5	801.5	775.6	801.5	775.6	801.5	
Hours/Day			7.8	8.6	9.7	12.1	24.0	24.0	24.0	23.4	22.1	13.6	14.1	9.7	

Appendix F

Groundwater Modeling Scenario Pumping by Well and Layer

LSCE

Model		Del Prado					Tennis					Hansen				
Layer #	Layer Description	Start	End	Thickness	Feet of Screen	Flow %	Start	End	Thickness	Feet of Screen	Flow %	Start	End	Thickness	Feet of Screen	Flow %
1	Clay oberburden	0	47.7	47.7			0	46.2	46.2			0	52.8	52.8		
2	Upper Aquifer	47.8	125.8	78			46.3	120	73.7			52.9	121.9	69		
3	Clay Aquitard	125.9	143.5	17.6			120.1	135.2	15.1			122	147	25		
4	Lower Aquifer (Qaut. Alluvium)	143.6	203.3	59.7	20	36.5	135.3	197.6	62.3	20	13.8	147.1	214.5	67.4		
5	Clays/Silts	203.4	223.5	20.1			197.7	239.2	41.5	0	0	214.6	254	39.4		
6	Lower Aquifer (Qaut. Alluvium)	223.6	283.3	59.7	20	26.2	239.3	301.5	62.2	20	13.8	254.1	351.1	97	20	15.4
7	Clays/Silts	283.4	303.3	19.9			301.6	301.6	0			351.2	392.1	40.9		
8	Lower Aquifer (Upper Livermore fm)	303.4	463.2	159.8	50	31.4	301.6	503.5	201.9	93.5	52.3	392.2	581.3	189.1	120	69.2
9	Lower Livermore Fm	463.3	1050.4	587.1	30	5.9	503.6	1056.7	553.1	106.5	20.1	581.4	1057.6	476.2	60	15.4
					120	100				240	100				200	100

Note: Bottom of Layer 9 is bottom of model.

Del Prado Well Construction and Flow Profile

Top	Bottom	Flow %	Screen Length	
170	190	36.5	20	
240	260	26.2	20	
300	320	16.6	20	
370	380	5.2	10	
440	460	9.6	20	
490	500	3.3	10	
510	520	1.9	10	
570	580	0.7	10	
		100	120	

Tennis Well Construction and Flow Profile

Top	Bottom	Flow %	Screen Length	
195	215	27.6	20	
220	240		20	
300	320	27.2	20	
380	420	16.4	40	
470	520	17.9	50	
560	600	3.2	40	
700	730	5.2	30	
740	760	2.5	20	
		100	240	

Hansen Well Construction and Flow Profile

Top	Bottom	Flow %	Screen Length	
298	318	15.4	20	
458	518	49	60	
518	578	20.2	60	
608	628	4.2	20	
656	676	5.2	20	
736	756	6	20	
		100	200	

Appendix G

City of Pleasanton Regional Water Supply Augmentation Project Feasibility Evaluation (30 September 2025)

LSCE

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30 September 2025

MEMORANDUM

To: Ken Minn, PE, Zone 7 Water Agency

From: Anona Dutton, PG, CHg, Environment & Water, Inc. (EKI)
Aaron Lewis, PE, PG, EKI
Nathan Cutler, EKI

Subject: **City of Pleasanton Regional Water Supply Augmentation Project Feasibility Evaluation** (EKI C20037.02)

EKI Environment & Water, Inc. (EKI) is pleased to present to Zone 7 Water Agency (Zone 7) this technical memorandum (TM) summarizing EKI's feasibility evaluation of the City of Pleasanton Regional Water Supply Augmentation Project completed with the Livermore Valley Basin Groundwater Flow and Transport Model (Model). This work was completed as part of EKI's ongoing *Livermore Valley Basin Hydrogeologic Investigations and Groundwater Flow Model Update* Project and is intended to support Zone 7's ongoing Regional Project Feasibility Study. A more detailed breakdown of specific efforts completed pursuant to EKI's existing Scope of Work is provided below.

EXECUTIVE SUMMARY

Since the 1960s, Zone 7 has actively managed the Livermore Valley Groundwater Basin (Basin) by applying a conjunctive water management approach, including offsetting groundwater production with direct delivery and artificial groundwater recharge of imported surface water supplies through local arroyos. These artificial recharge operations are ongoing and vary annually with the availability of surface water, treatment plant capacity, and available groundwater storage space within the Basin. Zone 7's artificial recharge program has helped strengthen water supply reliability for the Tri-Valley area and ensure Zone 7 can continue to manage the Basin sustainably during periods of imported water supply scarcity.

Zone 7 is currently performing a Feasibility Study of the proposed City of Pleasanton Regional Water Supply Augmentation Project (Regional Project). As part of this effort, Zone 7 recently requested EKI conduct a predictive modeling analysis with the calibrated Model to evaluate the feasibility of augmenting groundwater production in the Basin under the Regional Project. EKI's modeling analysis evaluated the potential impacts of the Regional Project on groundwater elevations, well interference, and perfluorooctane sulfonate (PFOS) fate and transport conditions throughout the Basin.

EKI's modeling analysis indicates that, without additional artificial recharge, the Regional Project is likely to reduce groundwater elevations throughout the Bernal and Amador Subareas of the Basin and may increase the probability of periodic Minimum Threshold (MT) and Measurable Objective (MO) exceedances at Zone 7's Sustainable Groundwater Management Act (SGMA) water level Representative Monitoring Sites (RMS-WLs) over the long term. However, as the Project Scenarios represent additive demand on the Basin relative to the Baseline (No-Project) Scenario, the Project Scenarios presented in this analysis are likely an overestimate of the actual groundwater demand that will occur during the 20-

year predictive period and thus represent a "worst case scenario" of future groundwater level declines owing to the Project. It is concluded that under the current set of predictive modelling assumptions, these SGMA MT and MO exceedances likely would not result in an Undesirable Result for Chronic Lowering of Water Levels as defined in 2021 Alternative Groundwater Sustainability Plan for the Livermore Basin (2021 Alternative GSP).

The predictive PFOS fate and transport simulations do not indicate the occurrence of PFOS concentrations exceeding the 4.0 parts per trillion (ppt) Maximum Contaminant Level (MCL) designated by the California State Water Resources Control Board (SWRCB) at any of the Regional Project wells throughout the 20-year predictive simulation period based on the current representation of the existing PFOS footprint, source locations and loading in the Model including two additional sites with available PFOS monitoring data obtained from the SWRCB GeoTracker database. Initial PFOS concentrations and source loading assumptions were assigned to the predictive model based on the best available current data and information; however, if additional PFOS contamination is discovered or Zone 7's understanding of PFOS source loading mechanisms in the Basin change over time, predicted PFOS concentrations in the Regional Project wells may change accordingly. As such, results from the PFOS fate and transport modeling for Project Scenarios are best evaluated on a relative basis to the Baseline (No-Project) Scenario and should continue to be refined over time as additional information becomes available regarding PFOS contamination within the Basin.

Zone 7 is currently implementing its per- and polyfluoroalkyl substances (PFAS) management strategy, including operationally managing PFAS concentrations by pumping and treating and diversifying groundwater sources. As such, optimization and coordination of the volume, spatial distribution, and timing of groundwater extractions from the Regional Project wells and existing Zone 7 production wells may help to reduce both the risk of MT and MO exceedances at RMS-WL wells and the risk of PFOS MCL exceedances in production wells. Further monitoring of PFOS concentrations in response to ongoing extractions will inform how optimization of groundwater production can be performed to mitigate the risks of groundwater level decline and PFOS footprint expansion.

BACKGROUND

Zone 7 is currently performing a Feasibility Study of the proposed City of Pleasanton Regional Water Supply Augmentation Project (Regional Project). The Regional Project consists of the development of up to three new production wells located in the Bernal Subarea of the Basin completed in the Lower Aquifer underlying the City of Pleasanton. As of August 2025, test wells have been drilled, constructed, and developed at the Tennis Park, Hanson Park, and Del Prado Park sites, and short-term aquifer pumping tests have been conducted. As part of the Feasibility Study, Zone 7 requested that EKI conduct a predictive modeling analysis with the calibrated Model to evaluate the feasibility of augmenting groundwater production in the Basin at the three Regional Project well locations relative to the following criteria:

(1) **Groundwater elevation** impacts relative to existing Sustainable Management Criteria (SMCs) defined at Zone 7's SGMA RMS-WLs;

(2) **Well interference** impacts at existing Zone 7 production wells and other water supply wells within the Bernal Subarea of the Main Basin; and

(3) **Water quality** impacts at the proposed Regional Project wells relative to established PFOS MCLs.

Regional Project feasibility modeling evaluations were completed by developing three unique Project Scenarios reflecting future Regional Project operations over a 20-year predictive model timeframe and comparing Model outputs to a Baseline (No-Project) predictive model scenario that reflects the best available information regarding future water supply availability, demand, and Zone 7 and Retailer operational assumptions within the Basin. The methodology and results of this analysis are further detailed below.

METHODOLOGY

Baseline (No-Project) Predictive Flow and Transport Model

EKI developed the Model in 2025 to further enhance Zone 7's abilities to simulate Basin-wide groundwater flow and transport conditions using the latest hydrogeologic, water supply, and hydrologic data and information[1]. The Model is calibrated to observed groundwater level, streamflow, water quality data collected between Water Years (WY) 2004 through 2023 (i.e., 10/2003 – 09/2023). The Model was developed using MODFLOW 6 and is configured to run at monthly stress periods throughout the 20-year historical period. Calibrated hydraulic parameters are validated and further refined by applying aquifer pumping test data collected from Zone 7 and other production wells throughout the Basin, including those conducted at the three Regional Project test well sites.

For this analysis, EKI used the calibrated Model to develop a 20-year Baseline (No-Project) predictive scenario using hydrologic assumptions from an analog historical period that is representative of long-term average hydrology and its interannual variability, projected water supply availability and demand assumptions obtained from regional planning documents,[2] and water supply operational frameworks (e.g., well-specific production rates) provided by Zone 7. The attached **Figure 1** presents a schematic of the historical and analog future hydrologic assumptions used for predictive modeling evaluations.

For the predictive scenarios, the model grid was refined to achieve a finer resolution by applying a Localized Grid Refinement (LGR) to the Model consisting of a 100 x 100-foot cell size grid covering the majority of the Bernal, Amador, Mocho II, Dublin, and Camp Subareas along with the principal 500 x 500-foot cell size regional grid covering the remaining extent of the Basin. The LGR allows simulation of groundwater flow and chemical transport processes occurring throughout the entire Basin while providing

[1] Full LBGFTM documentation to be transmitted in September 2025.
[2] Supply and demand projections include data and information obtained from the 2020 Tri-Valley Municipal and Industrial Water Demand Study (Woodard & Curran, 2021), the 2022 Water Supply Evaluation Update (Hazen & EKI, 2023), or otherwise provided directly by Zone 7.

for a more refined estimation of those processes within the area of interest surrounding the Regional Project test wells.

A single chemical of the PFAS class, perfluorooctane sulfonate (PFOS), was used as a proxy to simulate predictive PFAS fate and transport conditions in the groundwater system under the Baseline (No-Project) and Project Scenarios. Initial PFOS concentrations were assigned in the Model using the latest water quality monitoring data provided by Zone 7 and attributed to each Model layer based on sampling depths collected from Zone 7's water quality monitoring wells (typically at midpoint of well screen). The predictive scenario also includes PFOS loading assumptions throughout the duration of the simulation to represent additional PFOS mass entering the groundwater domain over time. Specifically, PFOS loading is represented in the Model using constant concentration assignments in Model cells corresponding with Zone 7 monitoring well locations with minimum of three historical PFOS detections, and at two additional sites with available PFOS monitoring data obtained from the California State Water Resources Control Board GeoTracker database. These include the Livermore-Pleasanton Fire Training Center (Geotracker Site ID # T10000017059) and Livermore-Pleasanton Fire Station #10 (#T10000017063).

Project Scenarios

The Baseline (No-Project) Scenario was subsequently adjusted to develop three Project Scenarios that are intended to evaluate the feasibility of the Regional Project based on a specified set of criteria. Specifically, under each Project Scenario an additive, annual groundwater pumping stress was applied for dry/critical and normal/wet water year types through a unique combination of monthly extraction rates from two or more of the Regional Project wells as specified by Zone 7. All Regional Project groundwater extractions were assumed to be additive to the groundwater extractions specified in the Baseline (No-Project) Scenario. The annual groundwater extraction volumes for each Project Scenario are detailed by well in **Table 1** below.

Table 1. Project Scenarios Well Production Summary

Regional Project Well	Annual Water Year Production Volume (acre-feet per year)					
	Scenario 1		Scenario 2		Scenario 3	
	Dry/Critical Year	Normal/Wet Year	Dry/Critical Year	Normal/Wet Year	Dry/Critical Year	Normal/Wet Year
Tennis Park	3,689	2,860	4,009	3,445	4,746	4,631
Hansen Park	3,689	2,600	4,009	3,055	-	-
Del Prado Park	1,405	1,040	-	-	1,846	1,713

Project Feasibility Criteria

For each Project Scenario, the modeling results were compiled and evaluated relative to the following criteria:

(1) **Groundwater elevation** impacts relative to existing MTs and MOs established at Zone 7's SGMA RMS-WLs in the 2021 Alternative GSP;

(2) **Well interference** impacts resulting from Regional Project-induced drawdown at existing Zone 7 production wells and other water supply wells within the Bernal Subarea of the Main Basin; and

(3) **Water quality** impacts at the proposed Regional Project wells relative to the 4.0 ppt PFOS MCL established by the SWRCB.

The results of this feasibility evaluation are presented for each Project Scenario below.

RESULTS

Groundwater Elevation Impacts

Simulated groundwater elevations at each of the 12 SGMA RMS-WL wells in the Basin were compared to their respective SMCs. The attached **Table 2** shows the simulated MT and MO exceedance count and percentage rate calculated on a stress period (monthly) basis. **Attachment A** includes plots of simulated groundwater elevations over the entire predictive simulation period at the RMS-WLs in the Main Basin and Northwest Fringe Management Areas.

The Project Scenario simulations result in a slightly greater number of MT and MO exceedances at the Bernal, Amador East, and Amador West Lower Aquifer RMS-WL wells throughout the 20-year simulation period. These MT and MO exceedances tend to periodically occur during drought periods (e.g., during predictive simulation WY 2033 – 2037 and WY 2040 – 2043) and at the Northwest Fringe RMS well during the later years of the simulation period. Simulated MT and MO exceedances were relatively similar in number and distribution between the three Project Scenarios. However, under the current set of predictive modelling assumptions these MT and MO exceedances likely would not result in an Undesirable Result for Chronic Lowering of Water Levels, which is defined in the 2021 Alternative GSP as follows:

> *Undesirable Results for Chronic Lowering of Groundwater Levels would be experienced in the Basin if water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years.*

Well Interference Impacts

Regional Project-induced drawdowns were analyzed at the Regional Project wells by calculating the difference in simulated groundwater elevations under the Baseline (No-Project) Scenario and Project Scenarios. **Table 3** below shows the average drawdown in each of the three Regional Project wells under each Project Scenario over the 20-year predictive simulation period. **Attachment B** includes plots of simulated drawdown over the entire 20-year predictive simulation period in each of the Regional Project wells.

Table 3. Regional Project Well Drawdown Summary

Regional Project Well	Average Drawdown (feet)		
	Scenario 1	Scenario 2	Scenario 3
Tennis Park	59	61	64
Hansen Park	59	61	32
Del Prado Park	45	33	45

Regional Project-induced well interference impacts were evaluated at the existing Zone 7 production wells and other active water supply wells within the Bernal Subarea (i.e., the San Francisco Public Utilities Commission [SFPUC] and Fairgrounds wells) under a similar manner. **Table 4** below shows the average drawdown in each existing Zone 7 production well/wellfield and at the SFPUC and Fairgrounds wells under each Project Scenario over the 20-year predictive simulation period. **Attachment C** includes plots of simulated drawdown over the entire 20-year predictive simulation period in each of the Zone 7 production wells and at the SFPUC and Fairgrounds wells.

Table 4. Existing Production Well Drawdown Summary

Existing Production Well	Average Drawdown (feet)		
	Scenario 1	Scenario 2	Scenario 3
Hopyard 6	40	39	36
Hopyard 9	37	37	32
Mocho Wellfield	30	29	25
Stoneridge	27	27	23
COL Wellfield	24	23	20
SFPUC A	30	26	24
SFPUC B	25	23	22
Fairgrounds	31	30	26

Regional Project-induced well interference is expected to occur across the Bernal and Amador Subareas over the long-term. Simulated groundwater levels indicate drawdown may exceed 20 feet as far east as the COL wellfield on average over the 20-year simulation period. Well interference appears slightly reduced in Project Scenario 3, whereby a greater majority of pumping is occurring from the western-most Project well (Del Prado Park), than in Project Scenarios 1 and 2.

Water Quality Impacts

Water quality impacts of the Regional Project were evaluated by comparing simulated PFOS concentrations to the 4.0 ppt MCL at each of the three Regional Project wells throughout the entire 20-year simulation period. **Attachment D** includes plots of simulated PFOS concentrations over the entire predictive simulation period in each of the Regional Project production wells.

The PFOS fate and transport simulations indicate that PFOS concentrations will not exceed the MCL of 4.0 ppt in any of the three Regional Project wells within the 20-year simulation period under the Baseline and Project Scenarios based on the current representation of source locations and solute loading in the Model. The highest simulated PFOS concentrations occur in the Tennis Park well, likely due to its closer proximity to the existing known PFOS footprint in the Amador Subarea, and tend to increase over time. Final simulated PFOS concentrations are slightly higher in the Tennis Well under Scenario 1 (1.45 ppt) than in Scenario 2 (1.30 ppt) and Scenario 3 (0.88 ppt), likely owing to a greater majority of pumping occurring from the eastern-most Project wells (Tennis Park and Hansen Park).

Tables

Table 2. Simulated MT and MO Exceedances for RMS-WL Wells

Figures

Figure 1. Historical and Analog Future Hydrologic Sequence

Attachments

Attachment A. Plots of simulated groundwater elevations at RMS-WL wells.

Attachment B. Plots of simulated drawdown at Regional Project production wells.

Attachment C. Plots of simulated drawdown at existing production wells.

Attachment D. Plots of simulated PFOS concentrations at Regional Project production wells.

References

Zone 7, 2021. Alternative Groundwater Sustainability Plan for Livermore Valley Groundwater Basin, prepared for Zone 7 Water Agency, dated December 2021.

Hazen & EKI, 2023. 2022 Water Supply Evaluation Update, prepared for Zone 7 Water Agency, dated May 2023.

Woodard & Curran, 2021. 2020 Tri-Valley Municipal and Industrial Water Demand Study, prepared for Zone 7 Water Agency, dated July 2021.

Table 2. Simulated MT and MO Exceedances for RMS-WL Wells

Water Level Representative Monitoring Site (RMS-WL)	Management Area (Subarea)	Aquifer	MT Exceedance Count[1] and Rate[2] (%)				MO Exceedance Count[3] and Rate[4] (%)			
			Baseline	Scenario 1	Scenario 2	Scenario 3	Baseline	Scenario 1	Scenario 2	Scenario 3
KEY_BERN_L	Main (Bernal)	Lower	0	0	0	0	0	19 -7.90%	18 -7.50%	10 (4.2%)
KEY_BERN_U	Main (Bernal)	Upper	0	0	0	0	0	3 -1.30%	1 (0.4%)	0
KEY_AME_L	Main (Amador E)	Lower	0	7 -2.90%	6 (2.5%)	4 -1.70%	10 -4.20%	30 (12.5%)	30 (12.5%)	28 (11.7%)
KEY_AME_U	Main (Amador E)	Upper	0	0	0	0	0	4 -1.70%	4 -1.70%	3 -1.30%
KEY_AMW_L	Main (Amador W)	Lower	2 -0.80%	23 (9.6%)	22 (9.2%)	18 (7.5%)	13 -5.40%	46 (19.2%)	47 (19.6%)	38 -15.80%
KEY_AMW_U	Main (Amador W)	Upper	0	0	0	0	0	0	0	0
KEY_MO2_L	Main (Mocho II)	Lower	0	0	0	0	0	0	0	0
KEY_MO2_U	Main (Mocho II)	Upper	0	0	0	0	0	0	0	0
3S1E06F003	NW Fringe (Dublin)	Fringe	0	15 -6.30%	12 -5.00%	1 -0.40%	0	77 (32.1%)	77 (32.1%)	85 (35.2%)
3S2E21K009	Uplands	Uplands	0	0	0	0	0	0	0	0

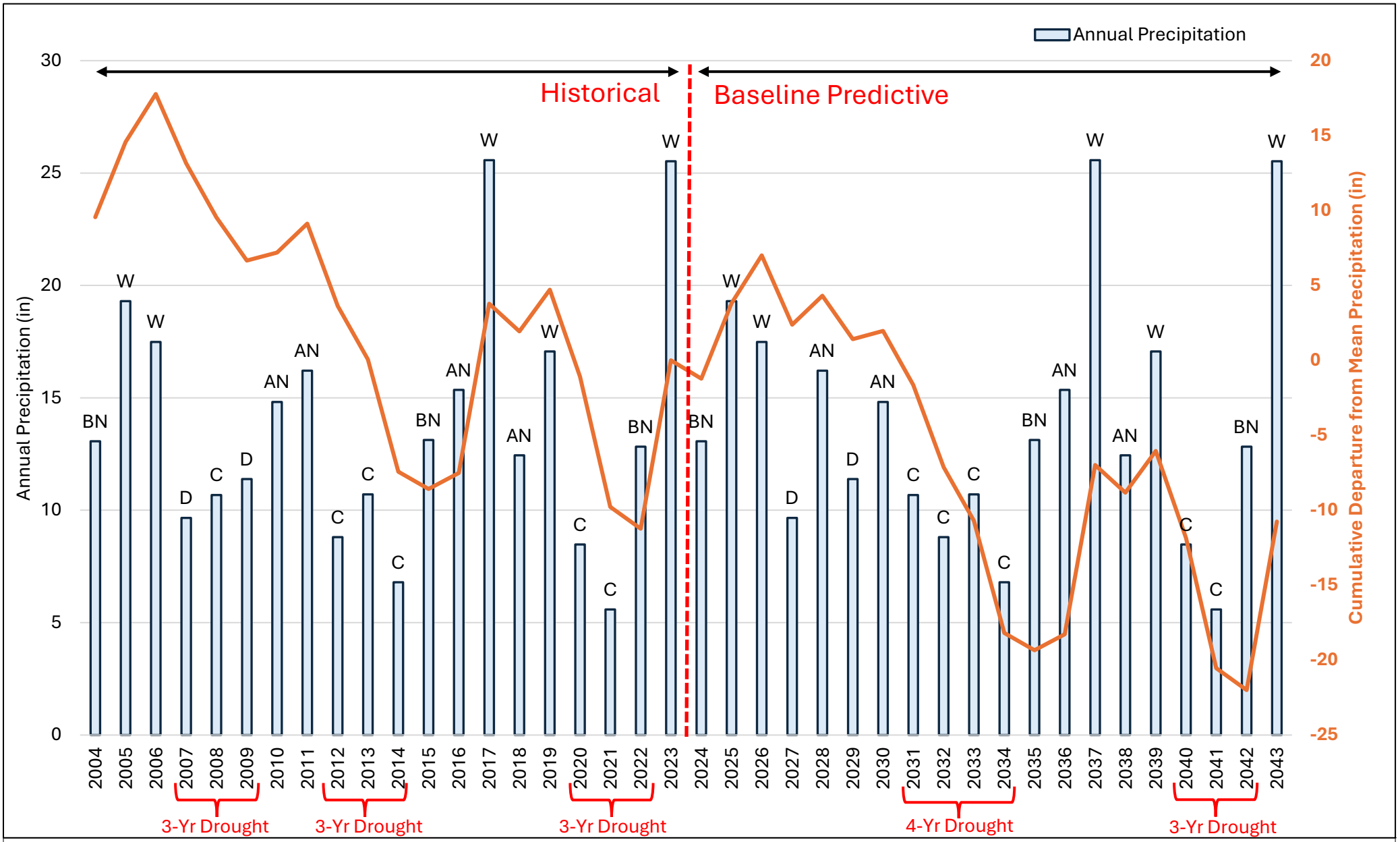
Abbreviations:

MO = Measurable Objective

MT = Minimum Threshold

Notes:

1. Counts are reported as individual simulation stress periods with simulated groundwater elevations below the well MT.
2. Rates are reported as percentage of simulation stress periods with simulated groundwater elevations below the well MT.
3. Counts are reported as individual simulation stress periods with simulated groundwater elevations below the well MO.
4. Rates are reported as percentage of simulation stress periods with simulated groundwater elevations below the well MO.



Historical and Analog Future Hydrologic Sequence

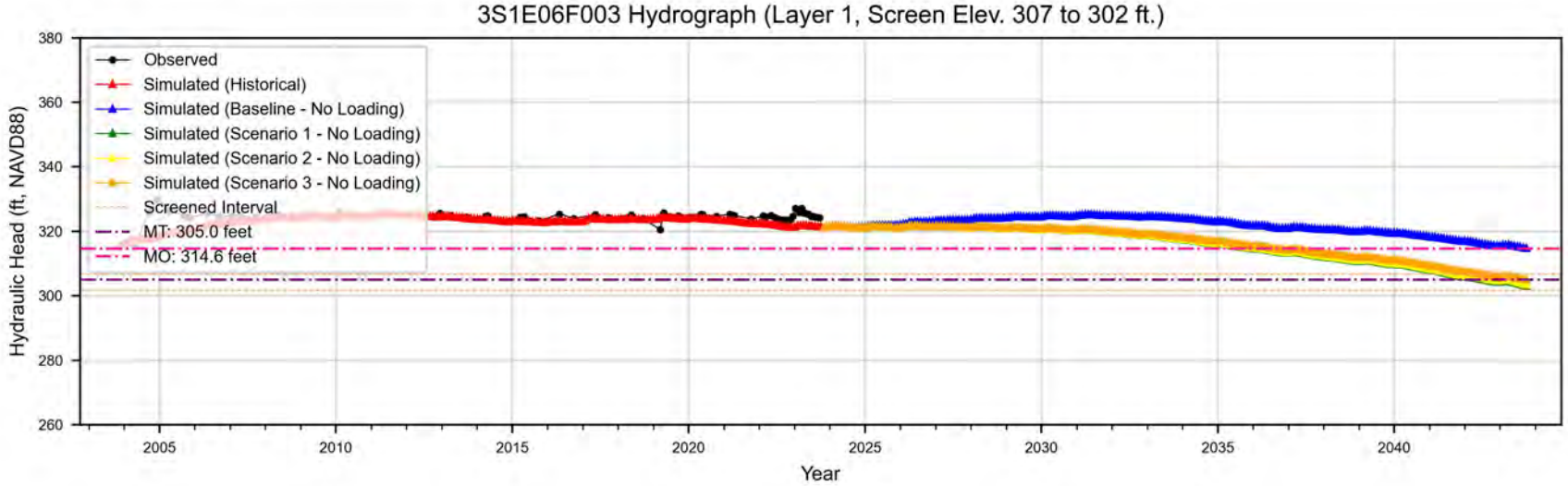
City of Pleasanton Regional Water Supply Augmentation
Project Feasibility Evaluation
August 2025
C20037.02

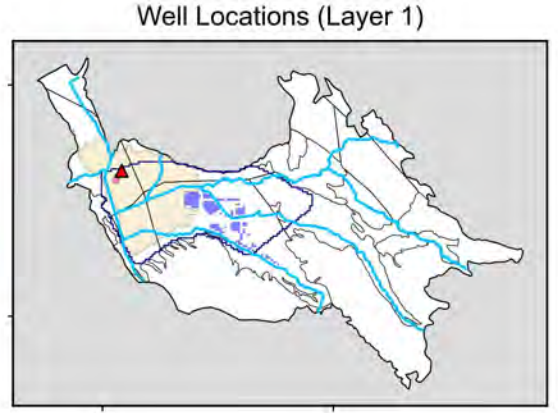
eki environment & water

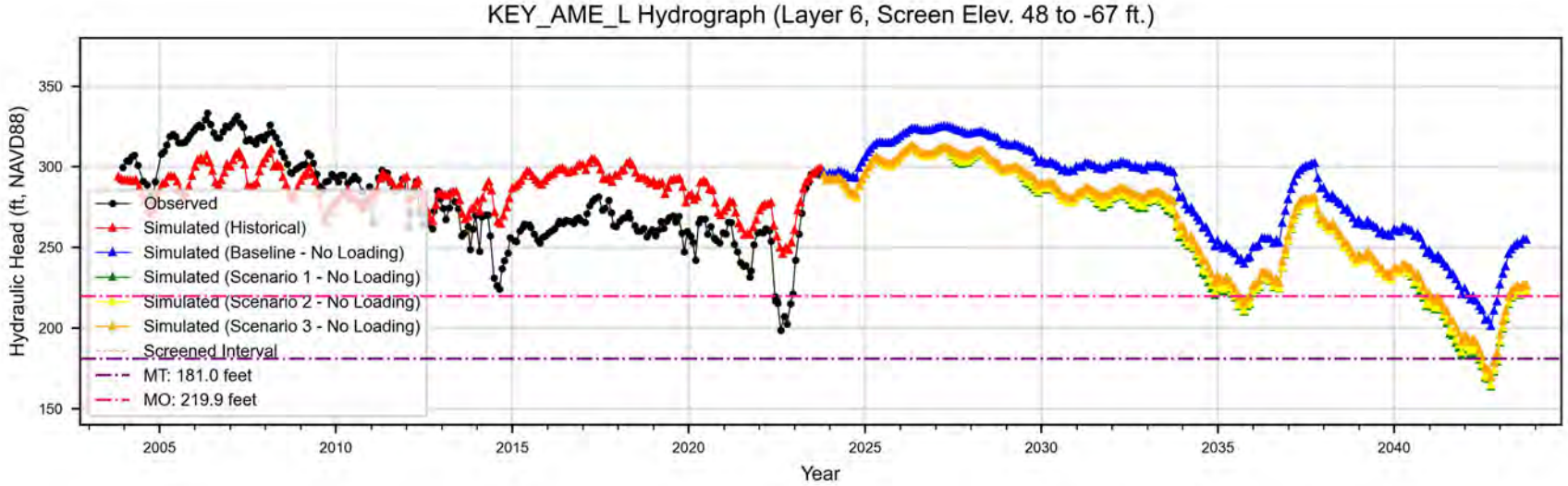
Figure 1

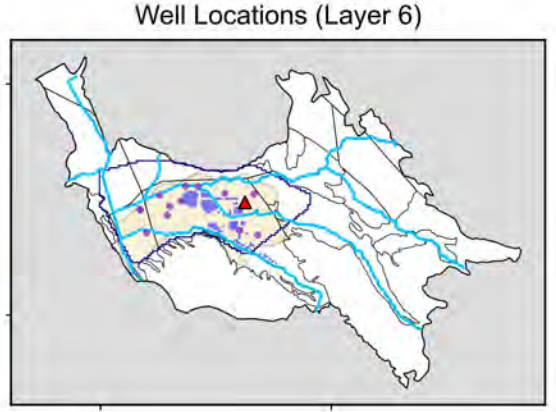
ATTACHMENT A

Plots of Simulated Groundwater Elevations at RMS-WL Wells

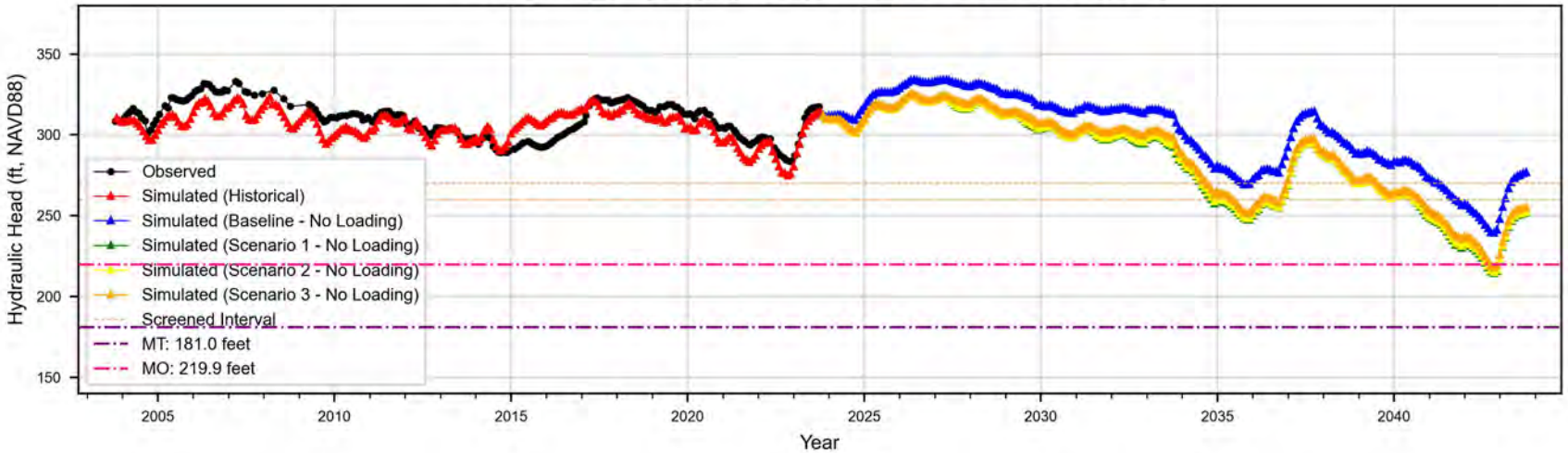

3S1E06F003 Hydrograph (Layer 1, Screen Elev. 307 to 302 ft.)
Observed
Simulated (Historical)
Simulated (Baseline - No Loading)
Simulated (Scenario 1 - No Loading)
Simulated (Scenario 2 - No Loading)
Simulated (Scenario 3 - No Loading)
Screened Interval
MT: 305.0 feet
MO: 314.6 feet
Hydraulic Head (ft, NAVD88)
380
360
340
320
300
280
260
2005
2010
2015
2020
2025
2030
2035
2040
Year


Well Locations (Layer 1)

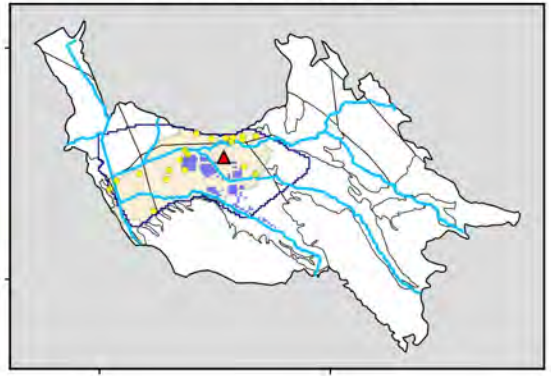

KEY_AME_L Hydrograph (Layer 6, Screen Elev. 48 to -67 ft.)
Hydraulic Head (ft, NAVD88)
350
300
250
200
150
2005
2010
2015
2020
2025
2030
2035
2040
Year
Observed
Simulated (Historical)
Simulated (Baseline - No Loading)
Simulated (Scenario 1 - No Loading)
Simulated (Scenario 2 - No Loading)
Simulated (Scenario 3 - No Loading)
Screened Interval
MT: 181.0 feet
MO: 219.9 feet


Well Locations (Layer 6)

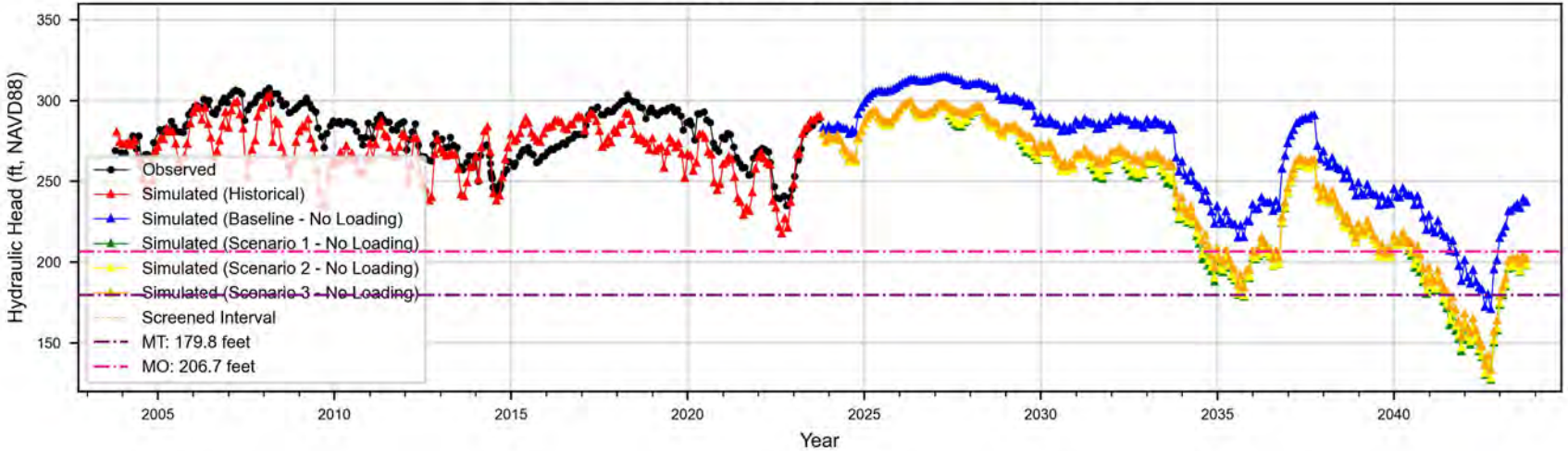
KEY_AME_U Hydrograph (Layer 4, Screen Elev. 270 to 260 ft.)



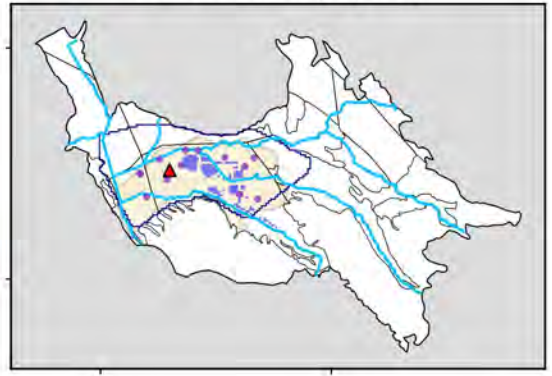
Well Locations (Layer 4)

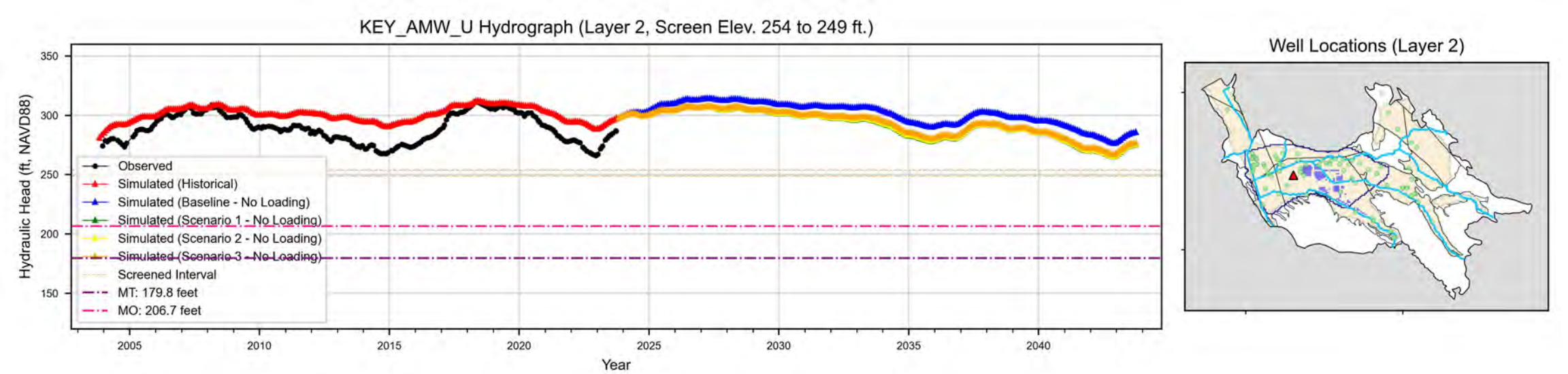


KEY_AMW_L Hydrograph (Layer 6, Screen Elev. 65 to 45 ft.)

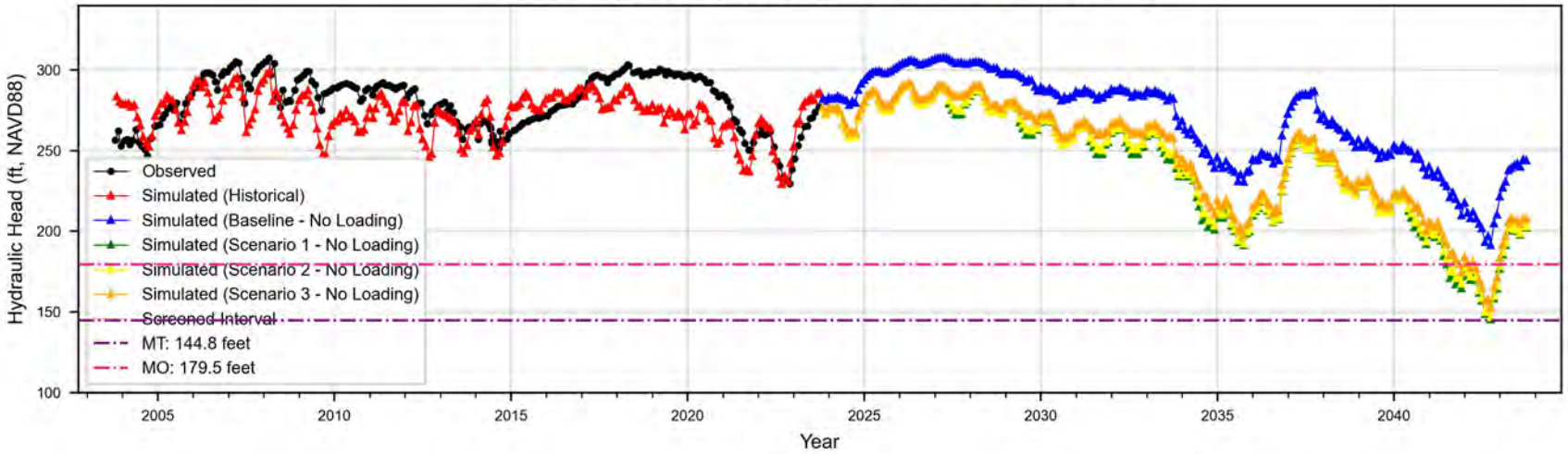


Well Locations (Layer 6)

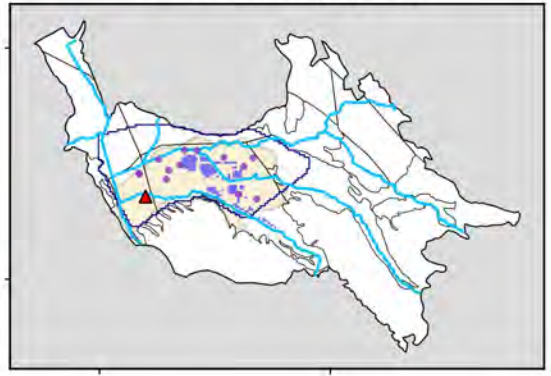



KEY_AMW_U Hydrograph (Layer 2, Screen Elev. 254 to 249 ft.)
Hydraulic Head (ft, NAVD88)
350
300
250
200
150
2005
2010
2015
2020
2025
2030
2035
2040
Year
Observed
Simulated (Historical)
Simulated (Baseline - No Loading)
Simulated (Scenario 1 - No Loading)
Simulated (Scenario 2 - No Loading)
Simulated (Scenario 3 - No Loading)
Screened Interval
MT: 179.8 feet
MO: 206.7 feet
Well Locations (Layer 2)

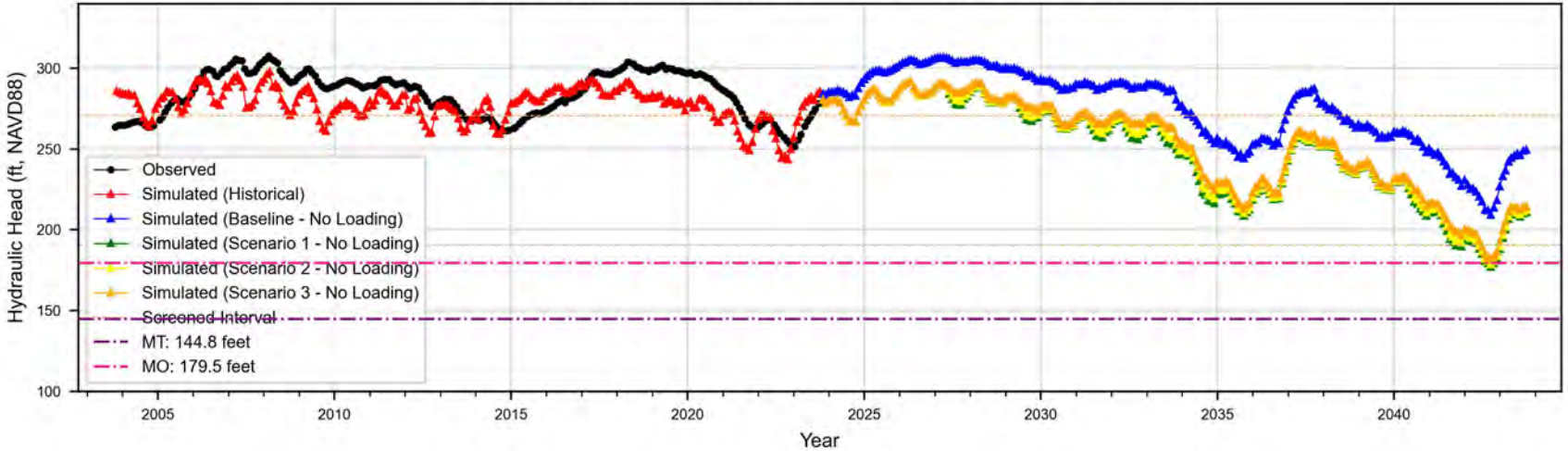
KEY_BERN_L Hydrograph (Layer 6, Screen Elev. 41 to 21 ft.)



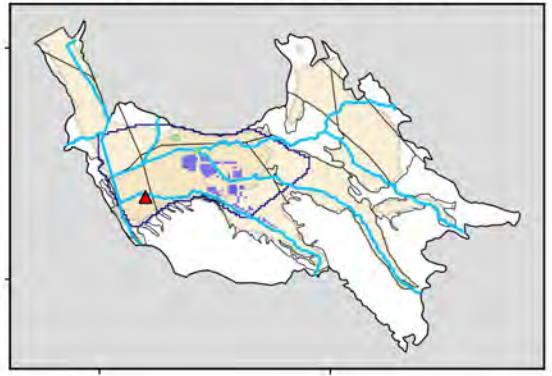
Well Locations (Layer 6)



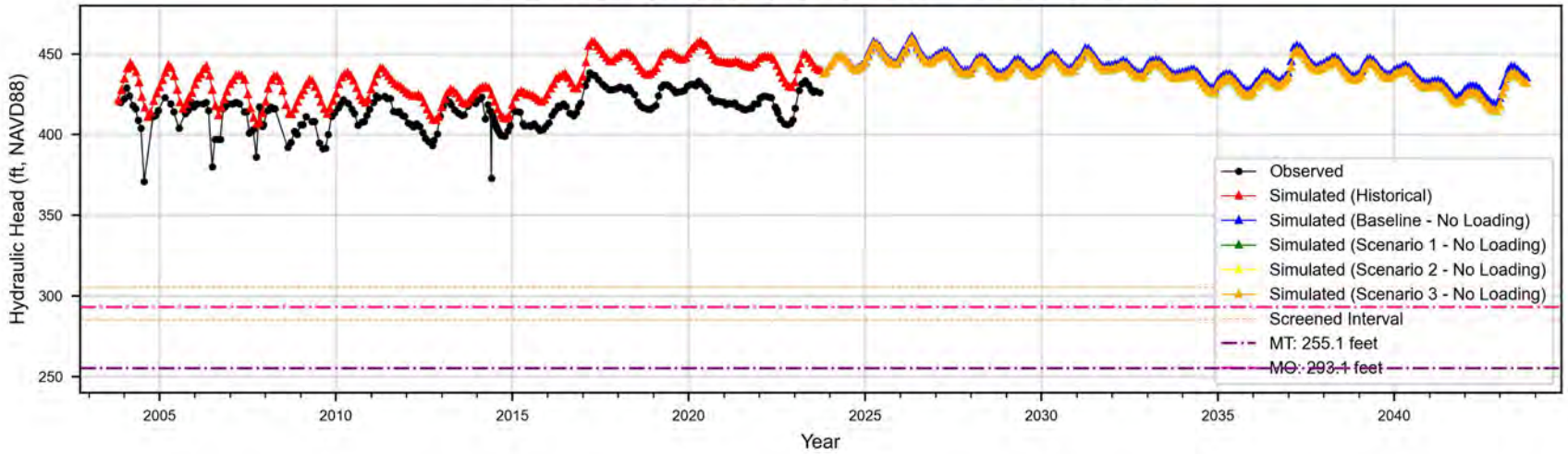
KEY_BERN_U Hydrograph (Layers 2 & 4, Screen Elev. 271 to 191 ft.)



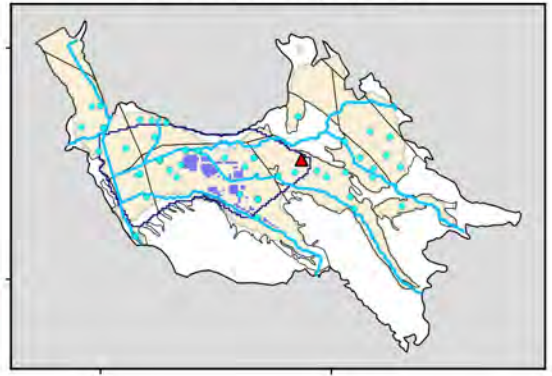
Well Locations (Layers 2 & 4)



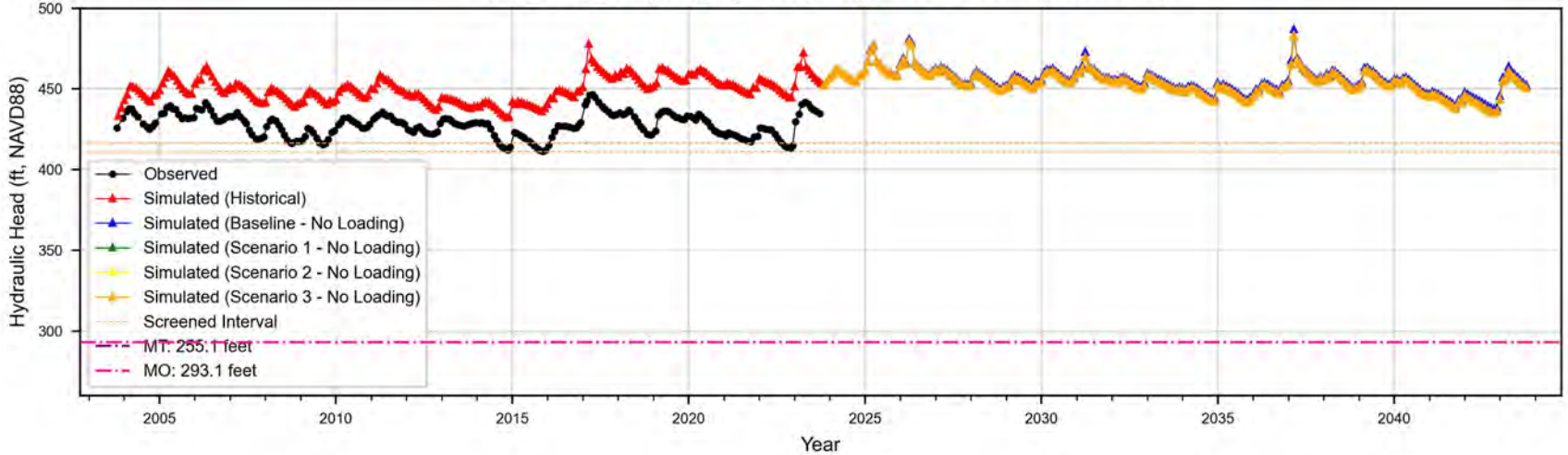
KEY_MO2_L Hydrograph (Layer 8, Screen Elev. 305 to 285 ft.)



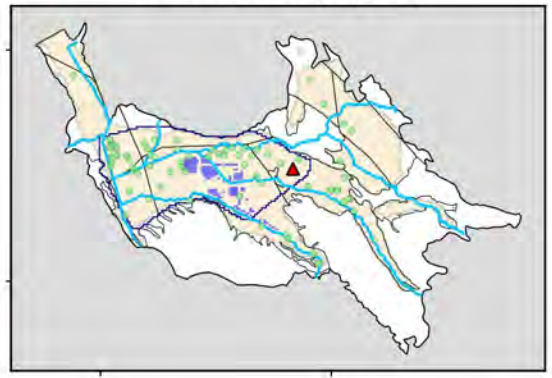
Well Locations (Layer 8)



KEY_MO2_U Hydrograph (Layer 2, Screen Elev. 416 to 411 ft.)

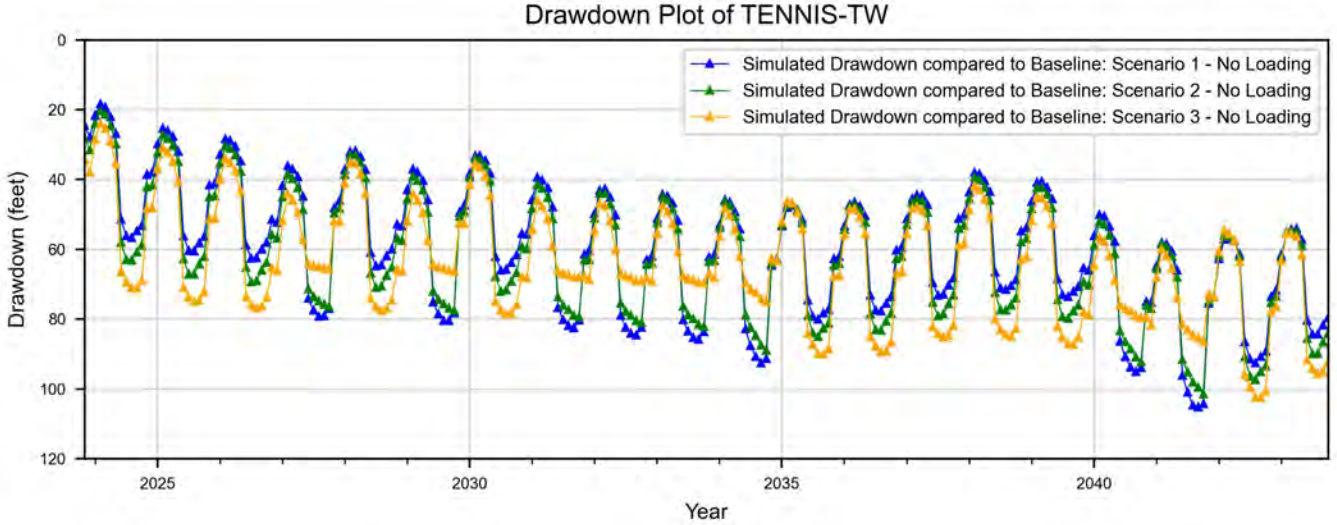


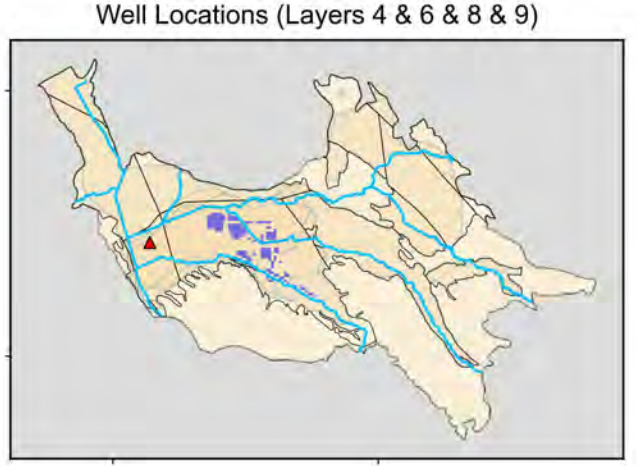
Well Locations (Layer 2)

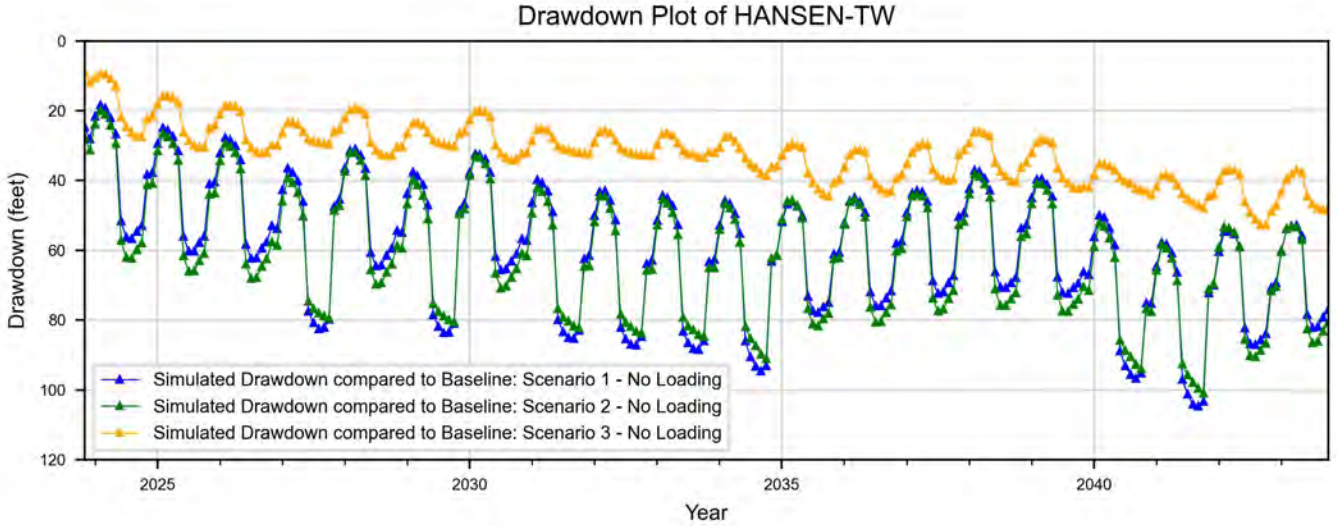


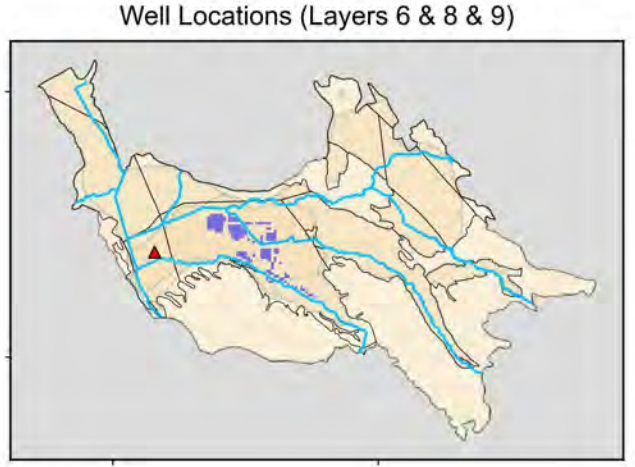
ATTACHMENT B

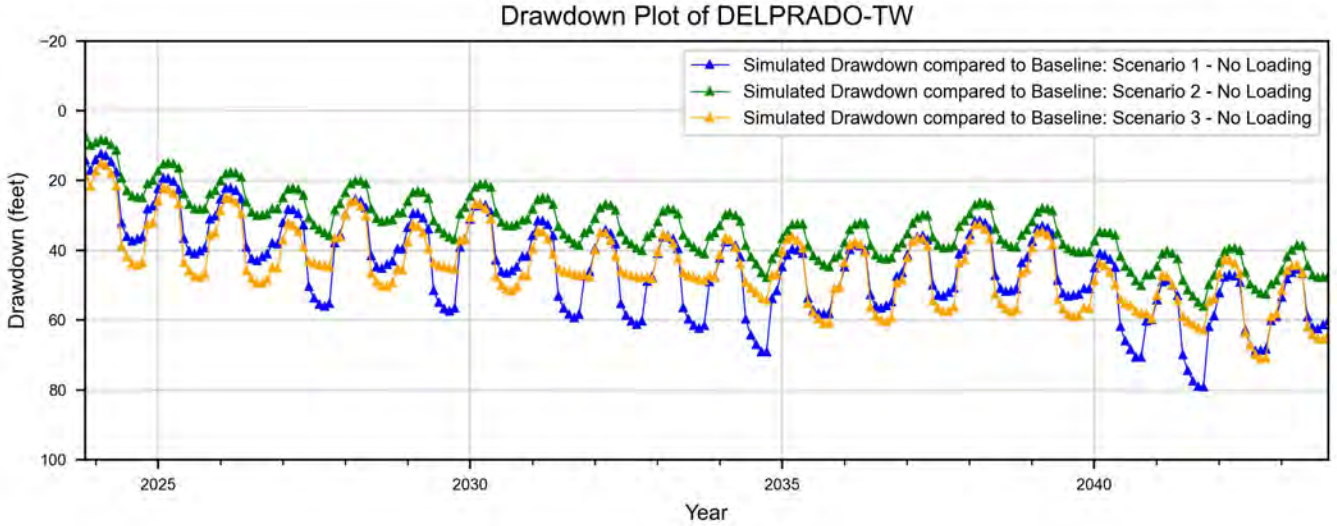
Plots of Simulated Drawdown at Regional Project Production Wells

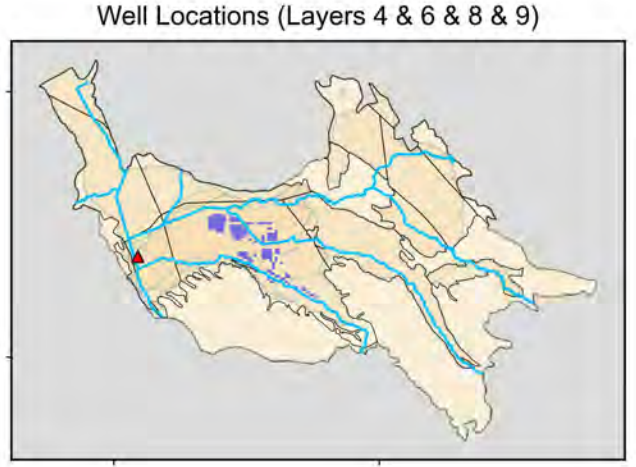

Drawdown Plot of TENNIS-TW
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
0
20
40
60
80
100
120
2025
2030
2035
2040
Year


Well Locations (Layers 4 & 6 & 8 & 9)


Drawdown Plot of HANSEN-TW
Drawdown (feet)
0
20
40
60
80
100
120
2025
2030
2035
2040
Year
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading

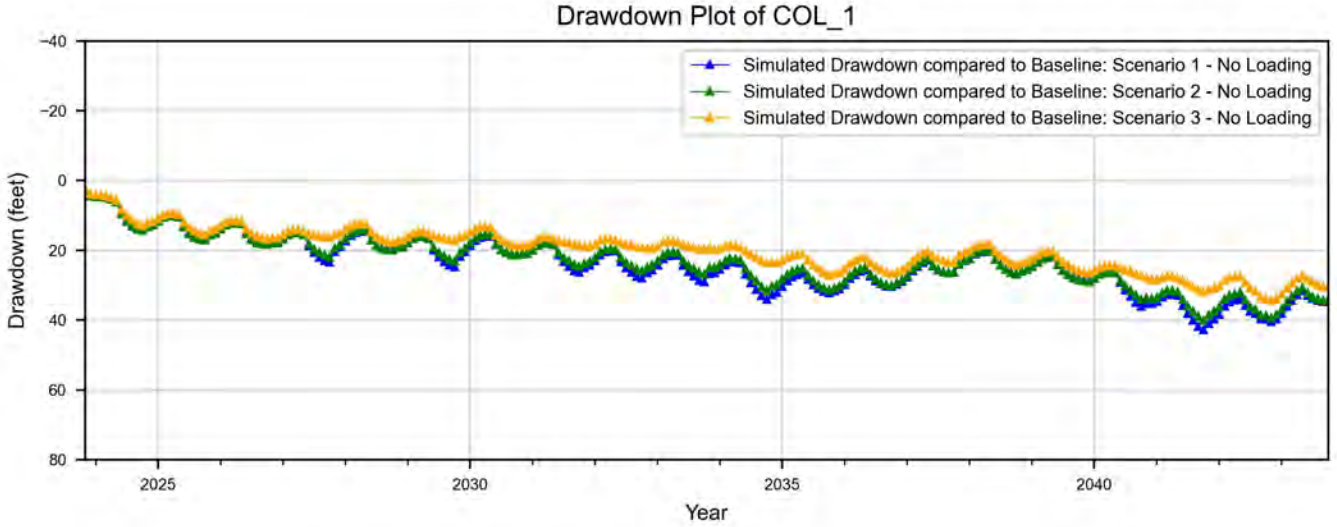

Well Locations (Layers 6 & 8 & 9)

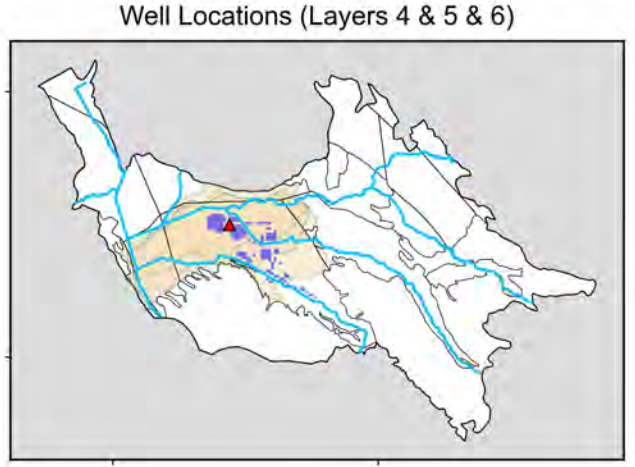

Drawdown Plot of DELPRADO-TW
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-20
0
20
40
60
80
100
2025
2030
2035
2040
Year

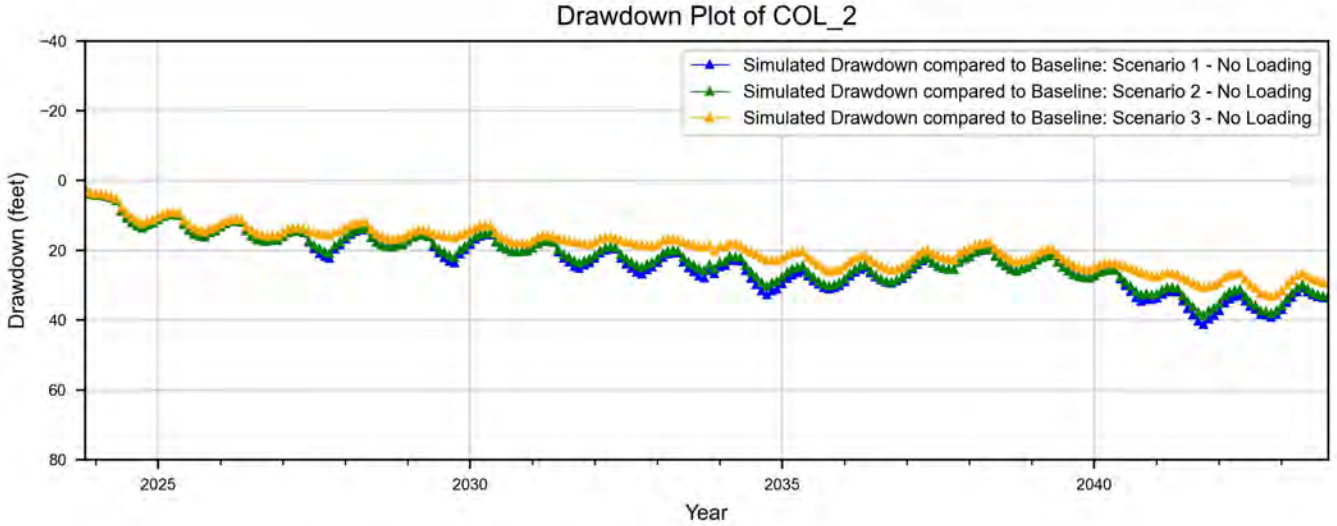

Well Locations (Layers 4 & 6 & 8 & 9)

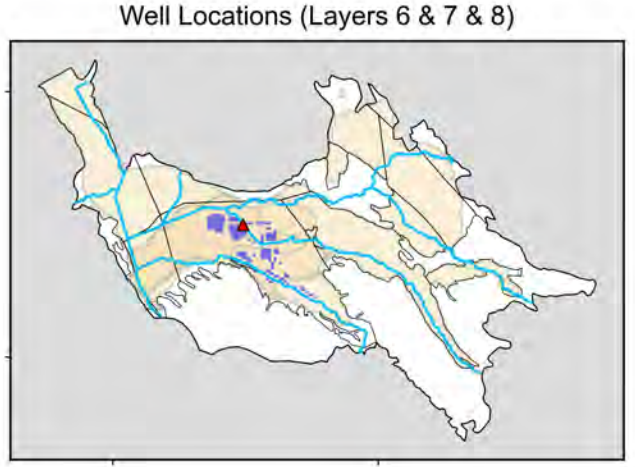
ATTACHMENT C

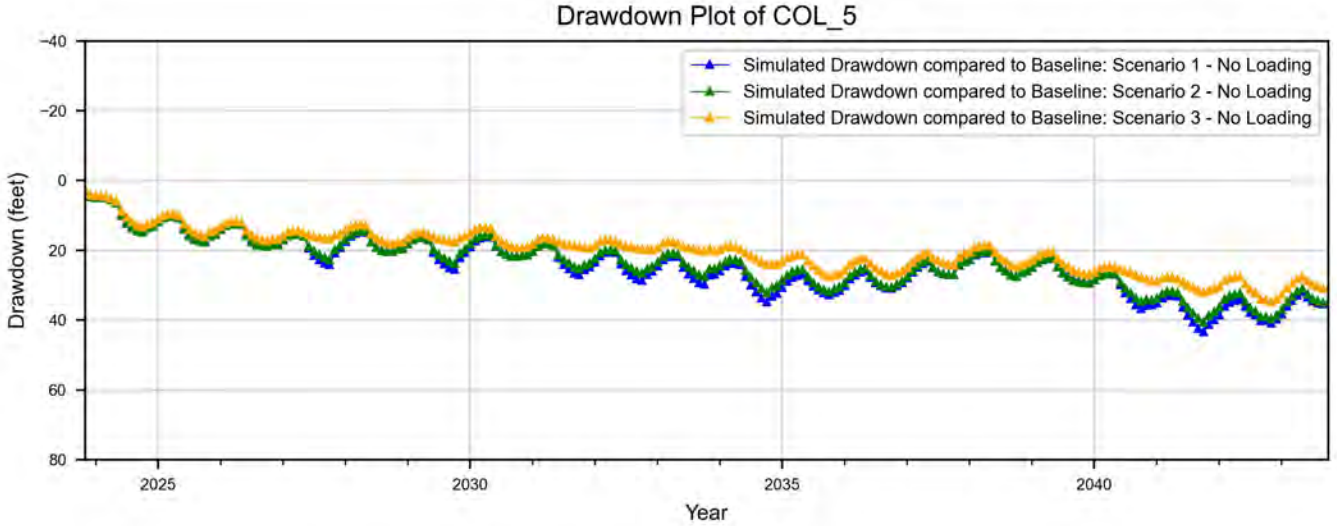
Plots of Simulated Drawdown at Existing Production Wells

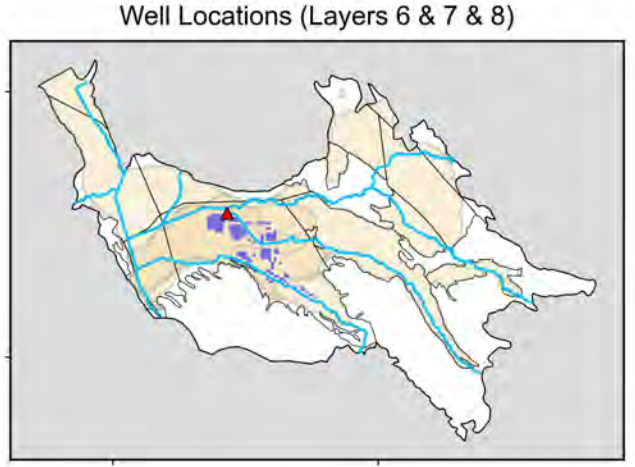

Drawdown Plot of COL_1
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

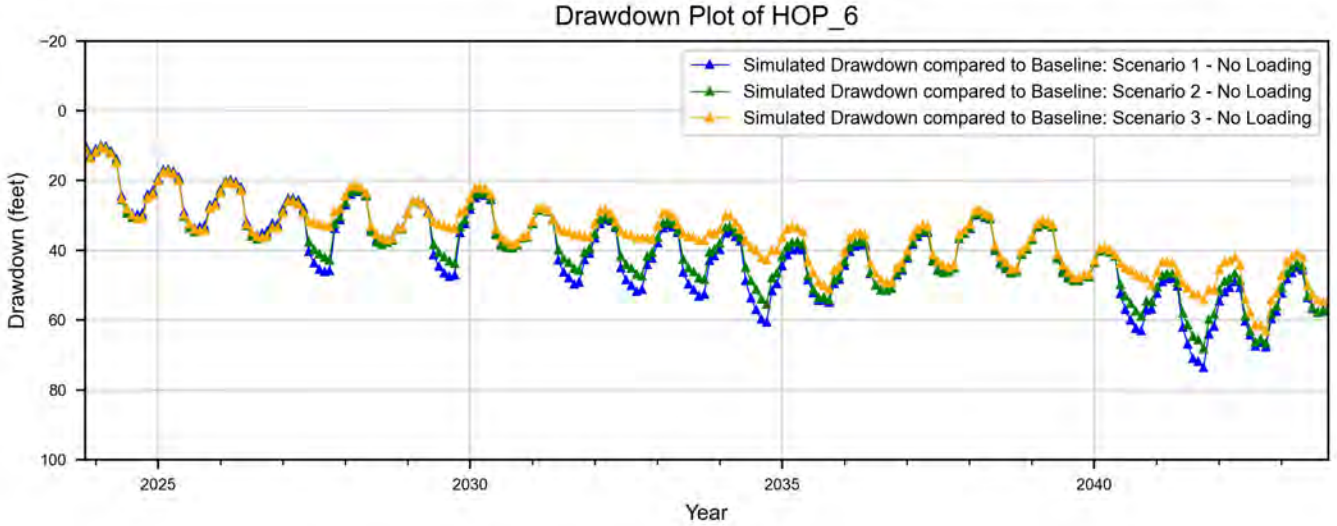

Well Locations (Layers 4 & 5 & 6)

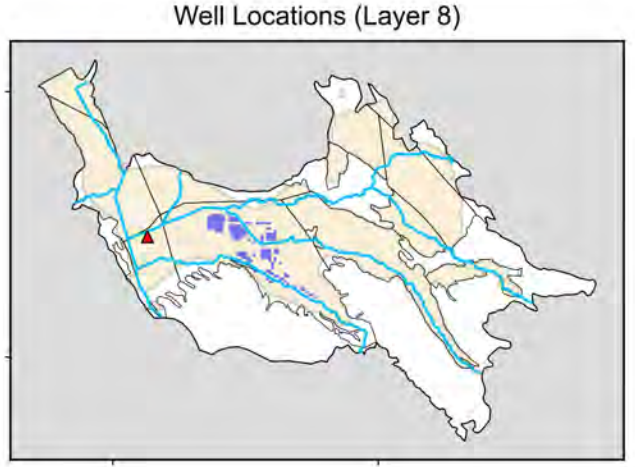

Drawdown Plot of COL_2
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

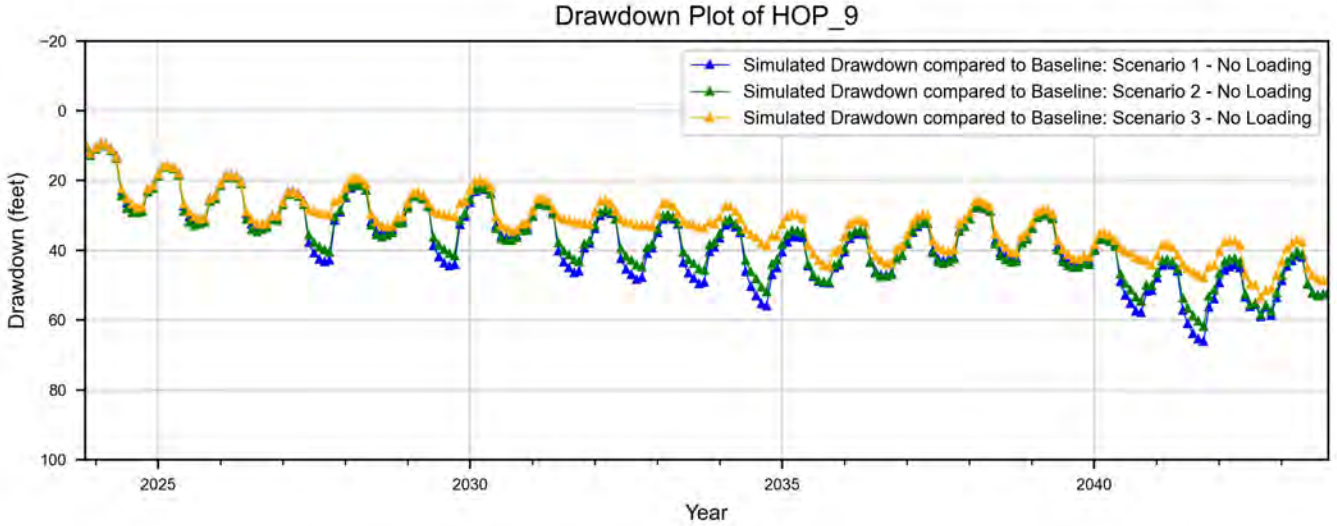

Well Locations (Layers 6 & 7 & 8)

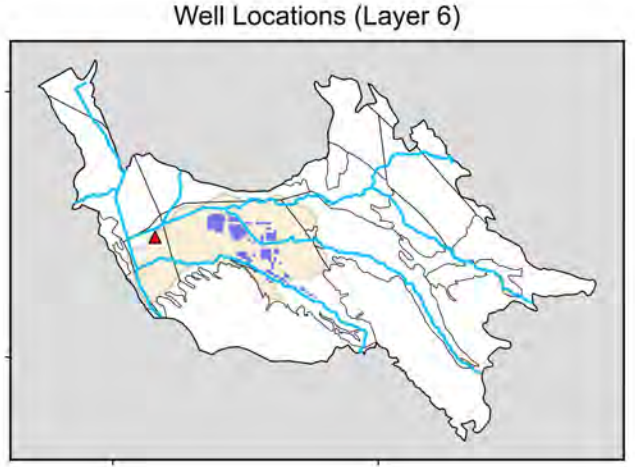

Drawdown Plot of COL_5
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

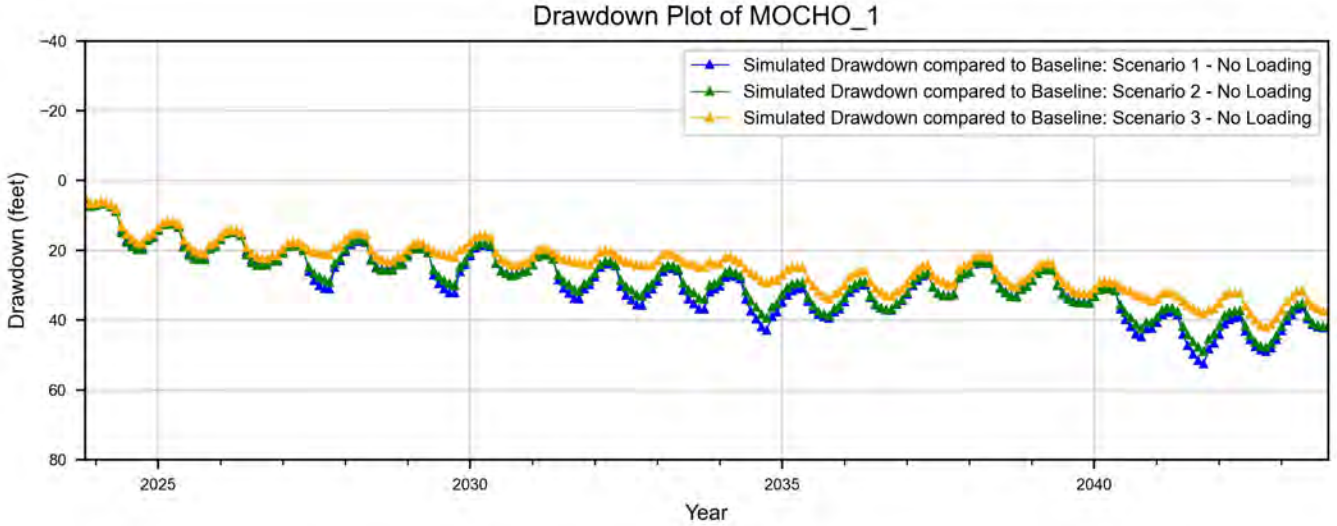

Well Locations (Layers 6 & 7 & 8)

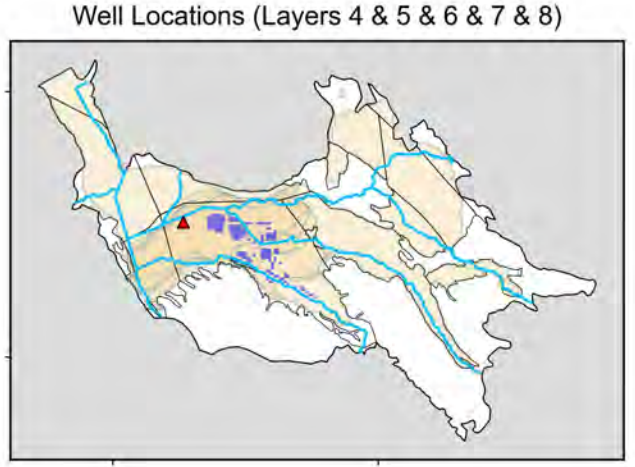

Drawdown Plot of HOP_6
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-20
0
20
40
60
80
100
2025
2030
2035
2040
Year

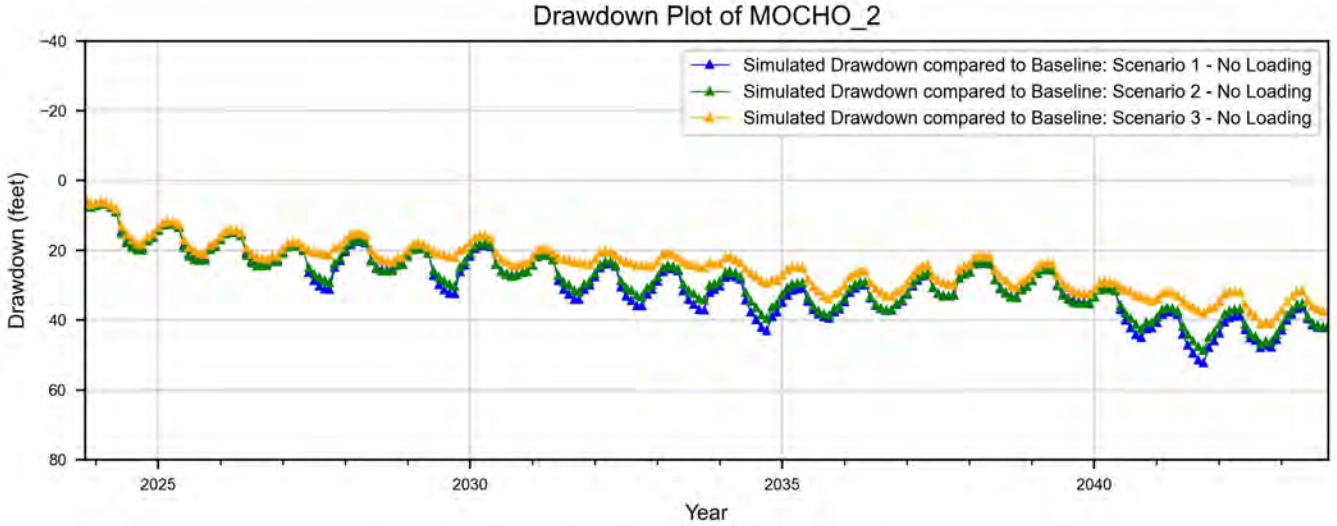

Well Locations (Layer 8)

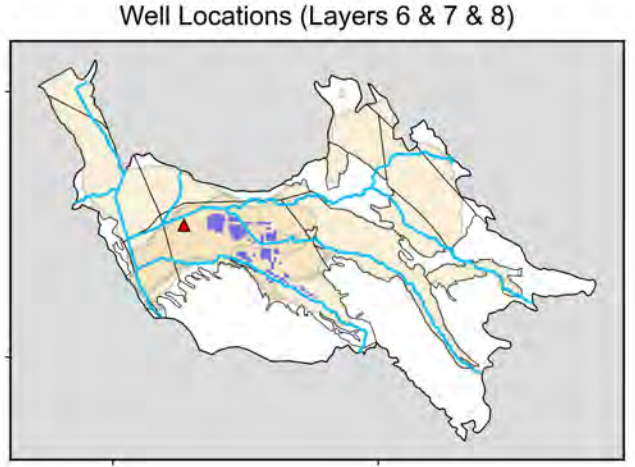

Drawdown Plot of HOP_9
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-20
0
20
40
60
80
100
2025
2030
2035
2040
Year

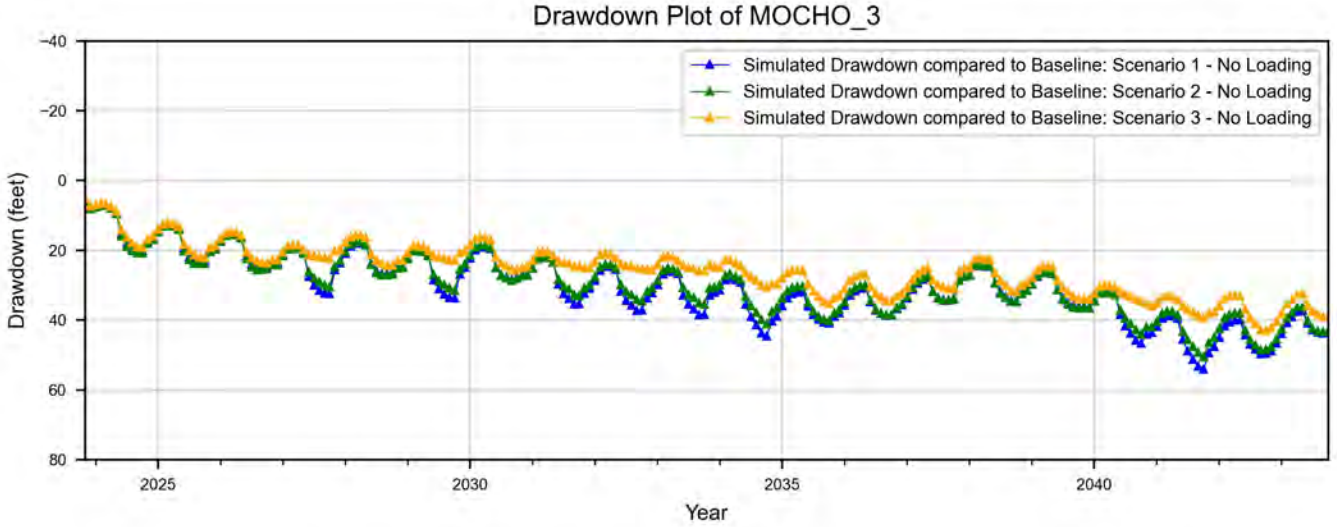

Well Locations (Layer 6)

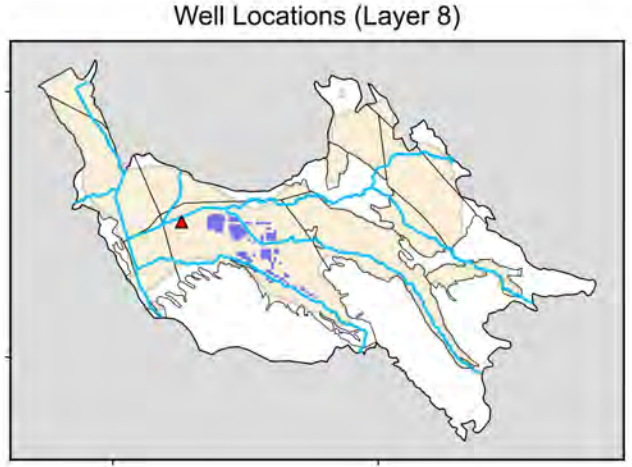

Drawdown Plot of MOCHO_1
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

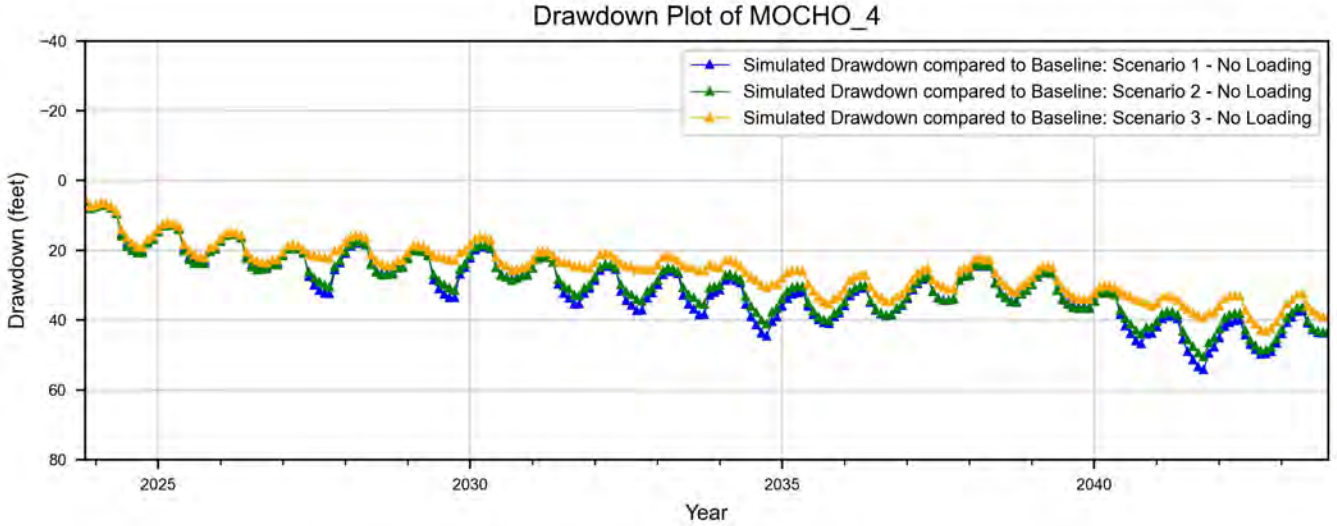

Well Locations (Layers 4 & 5 & 6 & 7 & 8)

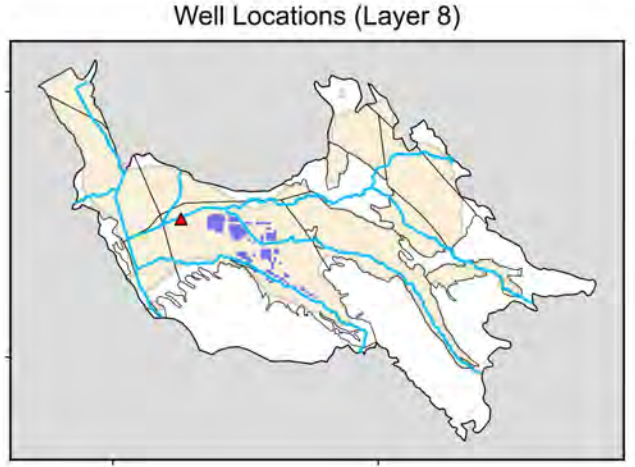

Drawdown Plot of MOCHO_2
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

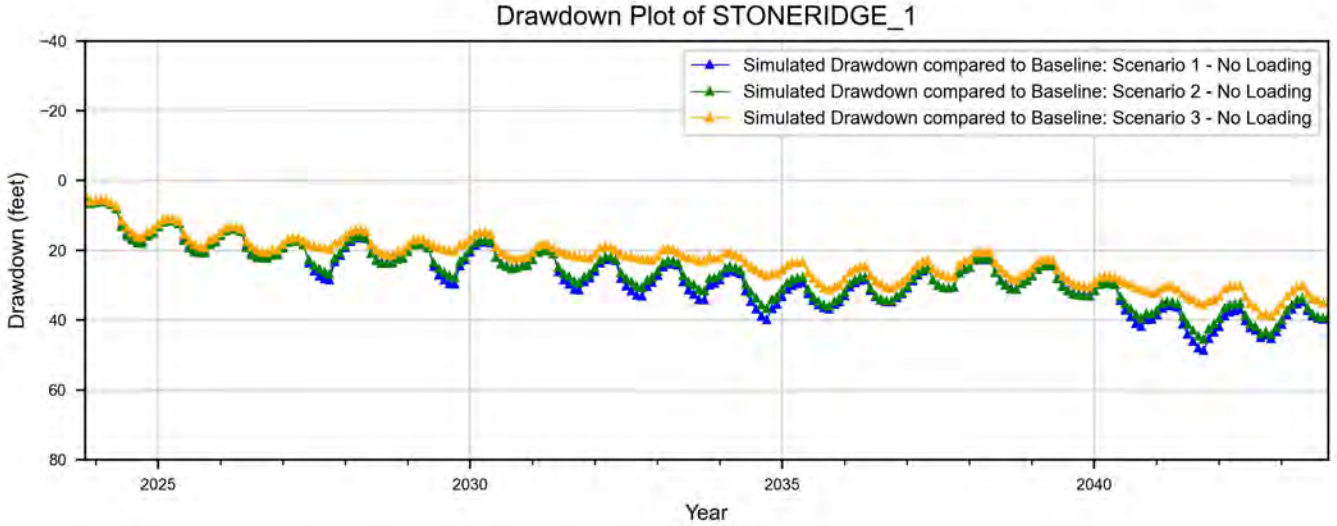

Well Locations (Layers 6 & 7 & 8)

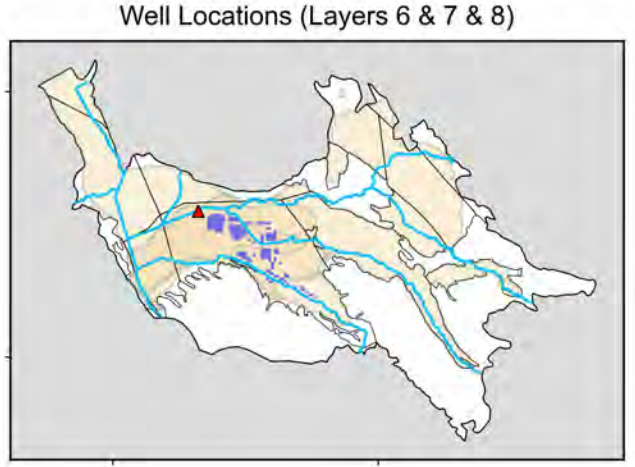

Drawdown Plot of MOCHO_3
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

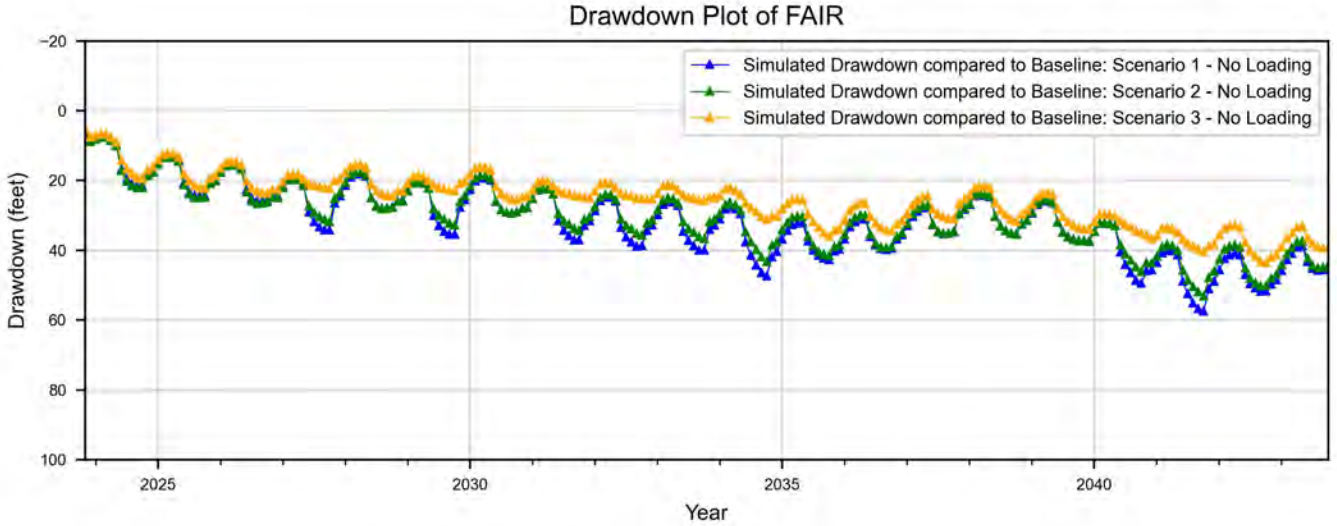

Well Locations (Layer 8)

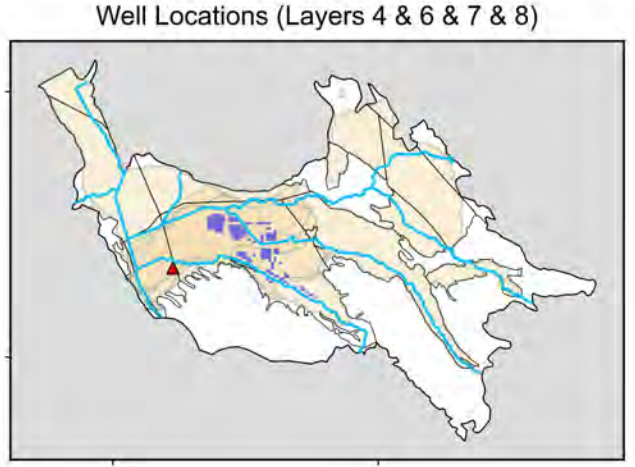

Drawdown Plot of MOCHO_4
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

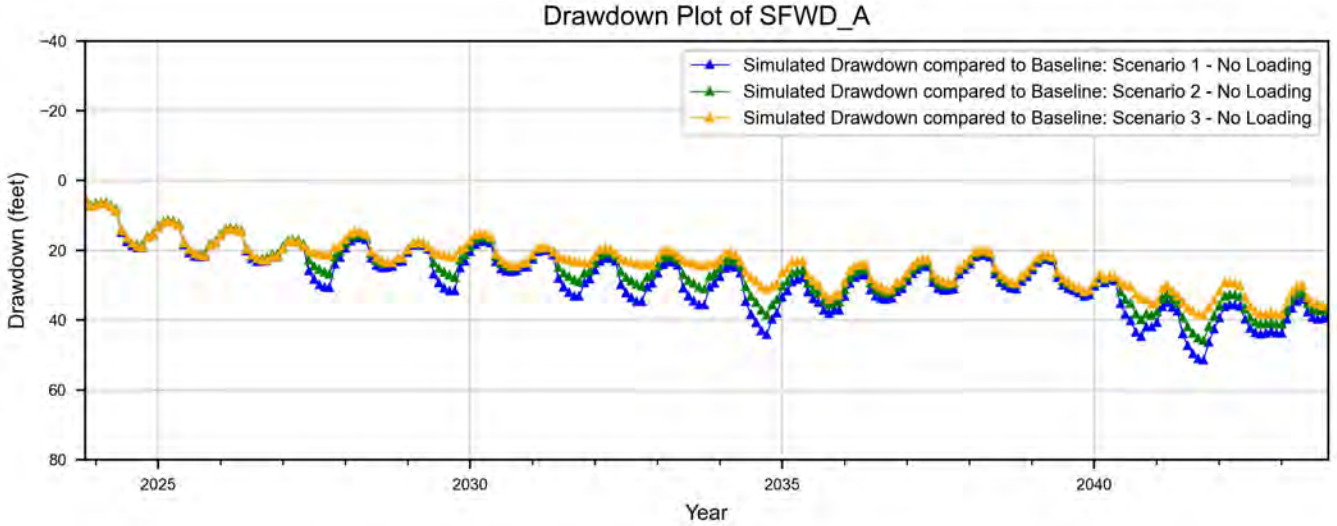

Well Locations (Layer 8)

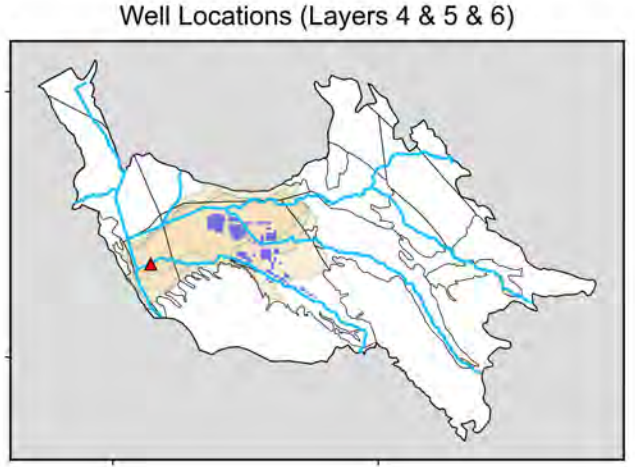

Drawdown Plot of STONERIDGE_1
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year

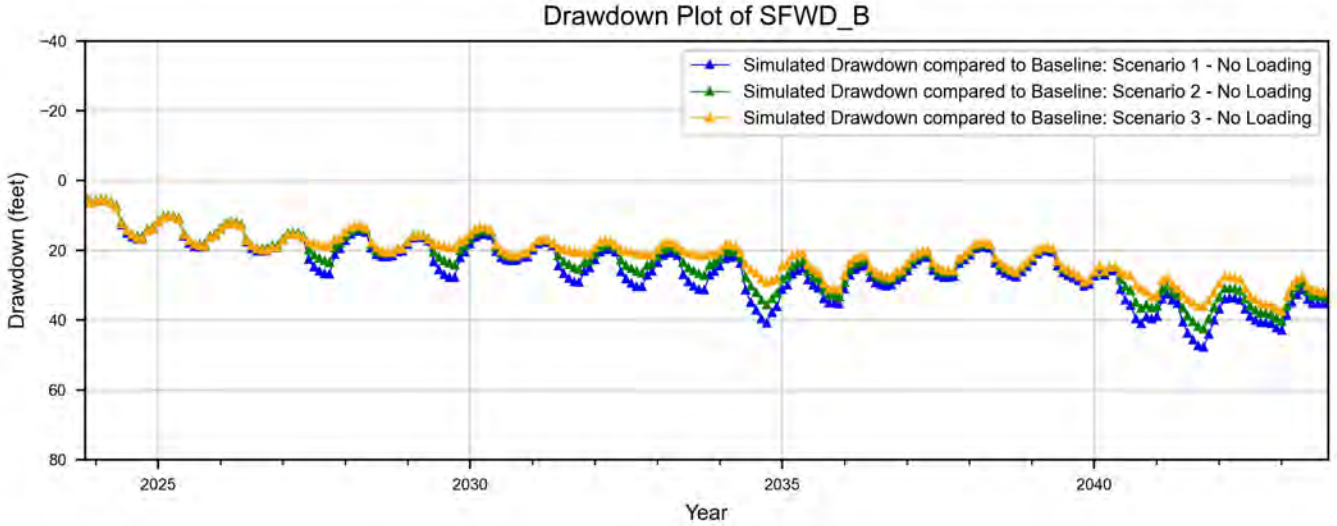

Well Locations (Layers 6 & 7 & 8)

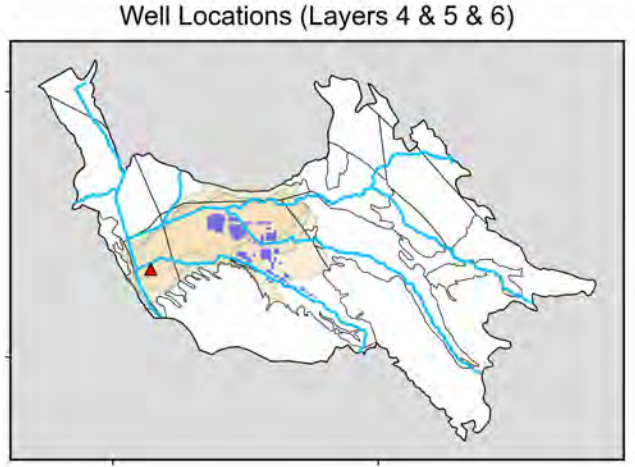

Drawdown Plot of FAIR
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-20
0
20
40
60
80
100
2025
2030
2035
2040
Year


Well Locations (Layers 4 & 6 & 7 & 8)


Drawdown Plot of SFWD_A
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year


Well Locations (Layers 4 & 5 & 6)

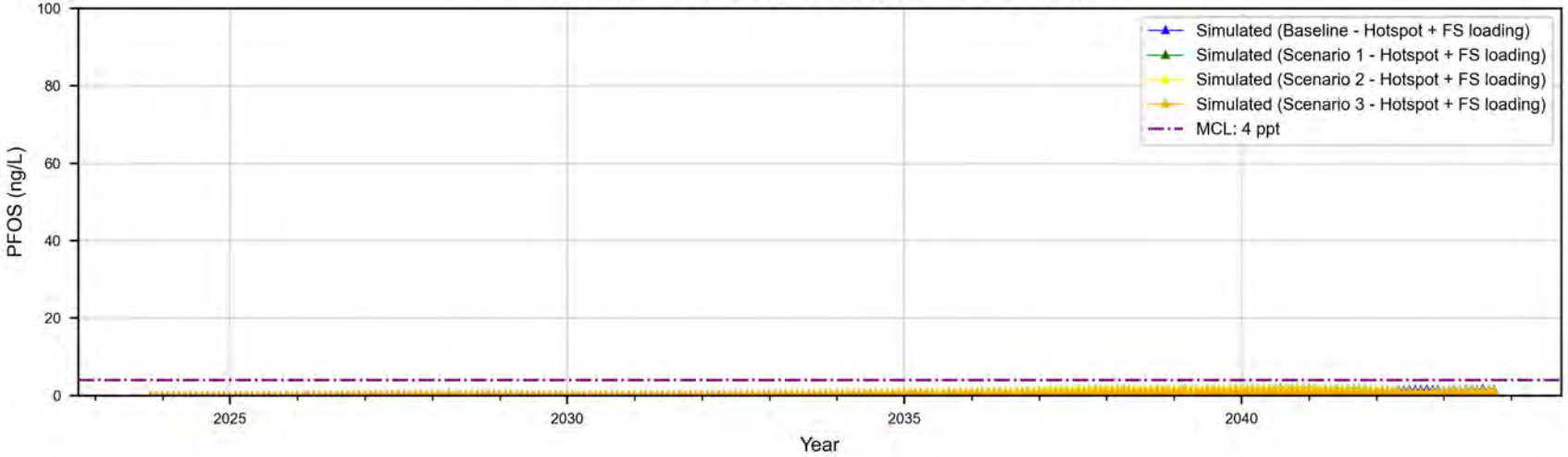

Drawdown Plot of SFWD_B
Simulated Drawdown compared to Baseline: Scenario 1 - No Loading
Simulated Drawdown compared to Baseline: Scenario 2 - No Loading
Simulated Drawdown compared to Baseline: Scenario 3 - No Loading
Drawdown (feet)
-40
-20
0
20
40
60
80
2025
2030
2035
2040
Year


Well Locations (Layers 4 & 5 & 6)

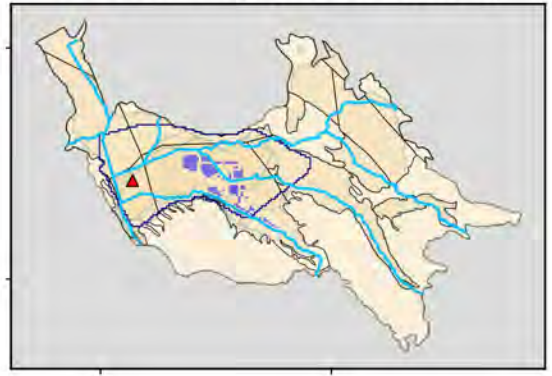
ATTACHMENT D

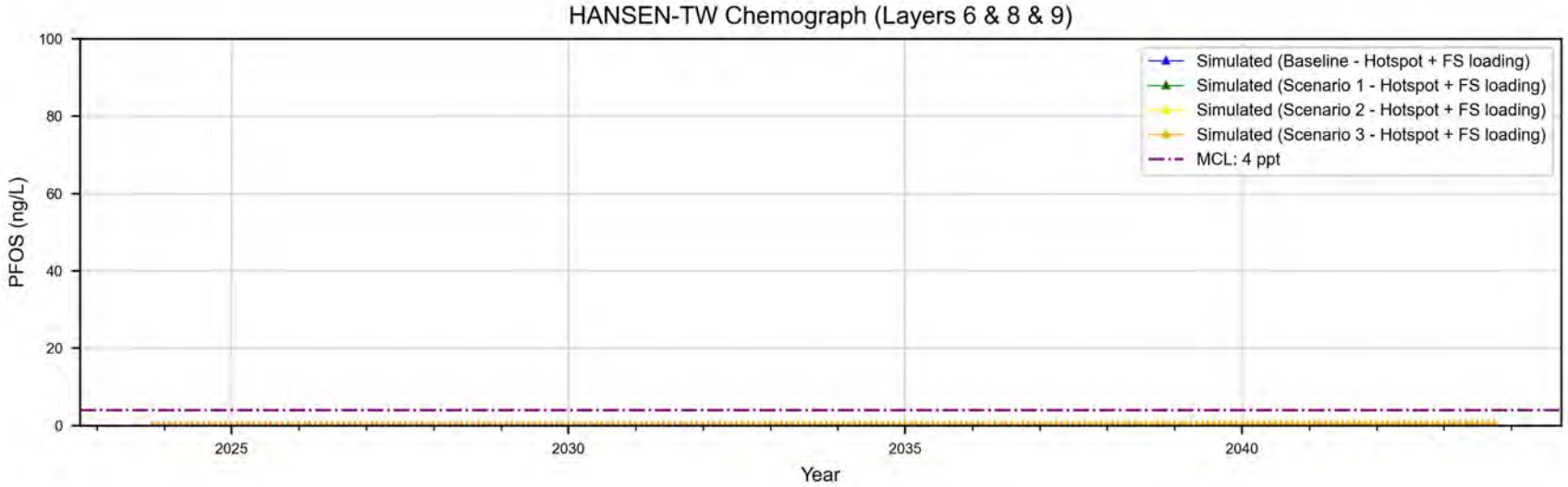
Plots of Simulated PFOS Concentration at Regional Project Production Wells

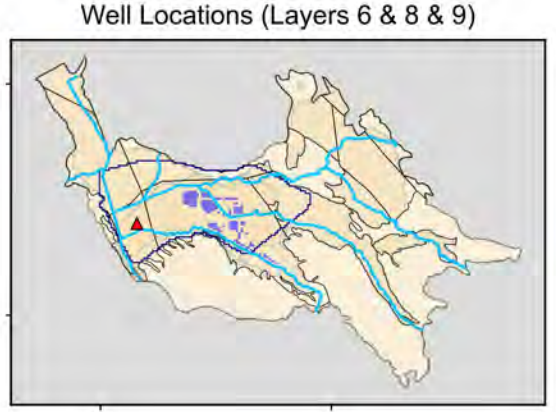
TENNIS-TW Chemograph (Layers 4 & 6 & 8 & 9)



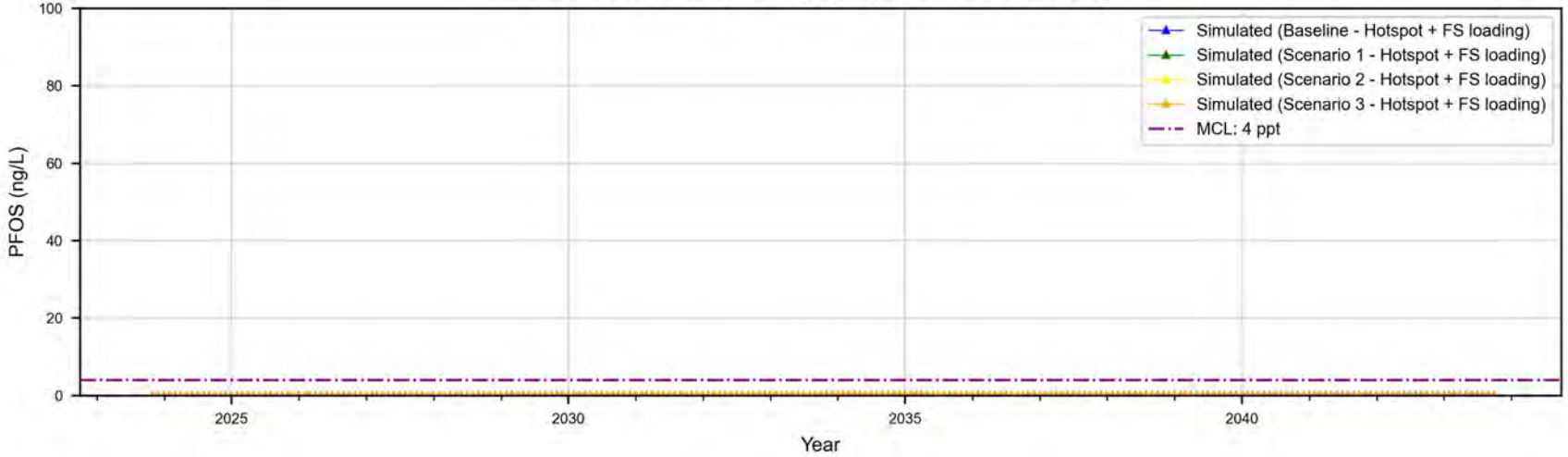
Well Locations (Layers 4 & 6 & 8 & 9)



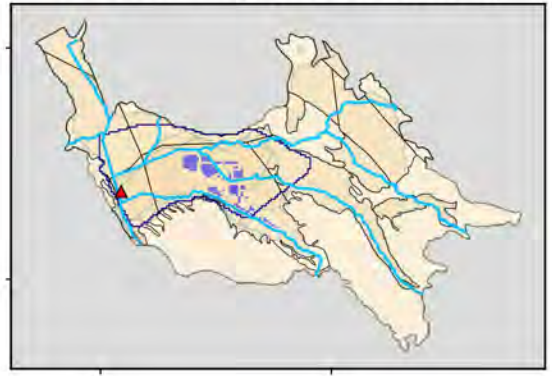

HANSEN-TW Chemograph (Layers 6 & 8 & 9)
Simulated (Baseline - Hotspot + FS loading)
Simulated (Scenario 1 - Hotspot + FS loading)
Simulated (Scenario 2 - Hotspot + FS loading)
Simulated (Scenario 3 - Hotspot + FS loading)
MCL: 4 ppt
PFOS (ng/L)
100
80
60
40
20
0
2025
2030
2035
2040
Year


Well Locations (Layers 6 & 8 & 9)

DELPRADO-TW Chemograph (Layers 4 & 6 & 8 & 9)



Well Locations (Layers 4 & 6 & 8 & 9)



Appendix H

Project Alternative Capital Cost Estimates (Class 5)

LSCE

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 1 - Tennis Park Well

ESTIMATED MIDPOINT OF CONSTRUCTION: May 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$400,000	$400,000		5% of Total Cost
	Total					$400,000	
2	**Transmission Main**						
	18-inch Ductile Iron Pipeline	1400	LF	$450	$630,000		Assumed $25/in/lf
	Total					$630,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,437,500	$3,437,500		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,437,500	
4	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$7,467,500**	
	Sales Tax on 50% of Direct Costs	10.25	%			$390,000	
	SUBTOTAL					**$7,857,500**	
	Estimating Contingency	30	%			$2,360,000	
	SUBTOTAL					**$10,217,500**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (May 2027, 5% Annually)	8.5	%			$870,000	
	SUBTOTAL					**$11,087,500**	
	General Conditions, Contractor Overhead, & Profit	15	%			$1,670,000	
	SUBTOTAL					**$12,757,500**	
	CONSTRUCTION COST SUBTOTAL					**$12,757,500**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$8,940,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$19,140,000**	
	Engineering, Legal, and Admin	30	%			$3,827,250	
	TOTAL PROJECT COST					**$16,584,750**	

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 2 - Tennis Park and Hansen Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: August 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$700,000	$700,000		5% of Total Cost
	Total					$700,000	
2	**Transmission Main**						
	24-inch Ductile Iron Pipeline	4000	LF	$600	$2,400,000		Assumed $30/in/lf
	Total					$2,400,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	$1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,437,500	$3,437,500		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,437,500	
4	**Hansen Park Well Construction**						
	Hansen Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Hansen Park Well Facility	1	LS	$3,575,000	$3,575,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,575,000	
5	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$15,112,500**	
	Sales Tax on 50% of Direct Costs	10.25	%			$780,000	
	SUBTOTAL					**$15,892,500**	
	Estimating Contingency	30	%			$4,770,000	
	SUBTOTAL					**$20,662,500**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (August 2027, 5% Annually)	9.8	%			$2,030,000	
	SUBTOTAL					**$22,692,500**	
	General Conditions, Contractor Overhead, & Profit	15	%			$3,410,000	
	SUBTOTAL					**$26,102,500**	
	CONSTRUCTION COST SUBTOTAL					**$26,102,500**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$18,280,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$39,160,000**	
	Engineering, Legal, and Admin	30	%			$7,830,750	
	TOTAL PROJECT COST					**$33,933,250**	

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 3 - Tennis Park and Del Prado Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: August 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	General						
	Mobilization	1	LS	$700,000	$700,000		5% of Total Cost
	Total					$700,000	
2	Transmission Main						
	24-inch Ductile Iron Pipeline	6100	LF	$600	$3,660,000		Assumed $30/in/lf
	Total					$3,660,000	
3	Tennis Park Well Construction						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facillity	1	LS	$3,437,500	$3,437,500		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,437,500	
4	Del Prado Well Construction						
	Del Prado Park Well Drilling & Casing Installation	1	LS	$1,250,000	$1,250,000		
	Del Prado Park Well Facility	1	LS	$2,750,000	$2,750,000		Estimated at 80% of Tennis Park Well Facility cost since pump, piping, appurtenances, EI&C, etc. will be smaller than Tennis Park. However, the facility will occupy roughly the same footprint as Tennis Park
	Total					$4,000,000	
5	Hopyard 6 Chloramination Upgrades						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$14,797,500**	
	Sales Tax on 50% of Direct Costs	10.25	%			$760,000	
	SUBTOTAL					**$15,557,500**	
	Estimating Contingency	30	%			$4,670,000	
	SUBTOTAL					**$20,227,500**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (June 2027, 5% Annually)	9.8	%			$1,990,000	
	SUBTOTAL					**$22,217,500**	
	General Conditions, Contractor Overhead, & Profit	15	%			$3,340,000	
	SUBTOTAL					**$25,557,500**	
	CONSTRUCTION COST SUBTOTAL					**$25,557,500**	
					LOW RANGE CONSTRUCTION COST TOTAL (-30%)	**$17,900,000**	
					HIGH RANGE CONSTRUCTION COST TOTAL (+50%)	**$38,340,000**	
	Engineering, Legal, and Admin	30	%			$7,667,250	
	TOTAL PROJECT COST					**$33,224,750**	

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 4 - Tennis Park, Del Prado Park, and Hansen Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: September 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$1,100,000	$1,100,000		5% of Total Cost
	Total					$1,100,000	
2	**Transmission Main**						
	30-inch Ductile Iron Pipeline	7500	LF	$750	$5,630,000		Assumed $30/in/lf
	Total					$5,630,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,437,500	$3,437,500		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,437,500	
4	**Del Prado Park Well Construction**						
	Del Prado Park Well Drilling & Casing Installation	1	LS	$1,250,000	$1,250,000		
	Del Prado Park Well Facility	1	LS	$2,750,000	$2,750,000		Estimated at 80% of Tennis Park Well Facility cost since pump, piping, appurtenances, EI&C, etc. will be smaller than Tennis Park. However, the facility will occupy roughly the same footprint as Tennis Park
	Total					$4,000,000	
5	**Hansen Park Well Construction**						
		10.25					
	Hansen Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Hansen Park Well Facility	1	LS	$3,575,000	$3,575,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,575,000	
6	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$22,742,500**	
	Sales Tax on 50% of Direct Costs	10.25	%			$1,170,000	
	SUBTOTAL					**$23,912,500**	
	Estimating Contingency	30	%			$7,180,000	
	SUBTOTAL					**$31,092,500**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (June 2027, 5% Annually)	9.8	%			$3,050,000	
	SUBTOTAL					**$34,142,500**	
	General Conditions, Contractor Overhead, & Profit	15	%			$5,130,000	
	SUBTOTAL					**$39,272,500**	
	CONSTRUCTION COST SUBTOTAL					**$39,272,500**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$27,500,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$58,910,000**	
	Engineering, Legal, and Admin	30	%			$11,781,750	
	TOTAL PROJECT COST					**$51,054,250**	

Appendix I

Project Alternative O&M Cost Estimates

LSCE

Estimated Annual Costs for Regional Groundwater Project Alternatives[12,14,15]

	Project Alternative #1 Tennis	Project Alternative #2 Tennis & Hansen	Project Alternative #3 Tennis & Del Prado	Project Alternative #4 Tennis, Hansen, & Del Prado
Drought production rate (gpm)	3,400	6,800	4,700	8,100
Annual Production Assumed (AFY)[13]	**4,113**	**7,000**	**5,686**	**7,000**
Average annual runtime (hrs/day/site)	18	15	18	13
Estimated Project Capital Cost[1]	$16,584,750	$33,933,250	$33,224,750	$51,054,250
Staffing (annual)[2]	$109,500	$219,000	$219,000	$328,500
Chemical Treatment (annual)[3]	$85,719	$145,881	$118,494	$145,881
Well Rehabilitations[4]	$3,343	$6,687	$6,687	$10,030
Well Pump Replacements[5]	$18,388	$36,777	$31,762	$50,150
Routine Electrical/Instrumentation Maintenance (annual)[6]	$50,000	$100,000	$100,000	$150,000
Electrical/Instrumentation Overhauls[7]	$16,717	$33,433	$26,747	$43,463
Pumping Electrical Power (annual)[8]	$1,372,342	$2,385,568	$1,862,464	$2,352,821
Annual O&M Costs ($/AF)[9]	**$403**	**$418**	**$416**	**$440**
Annualized Capital Costs ($/AF)[10]	**$157**	**$188**	**$227**	**$283**
Total Annual Costs ($/AF)[11]	**$559**	**$607**	**$643**	**$724**
Total Annual Costs ($/yr)[11]	**$2,300,583**	**$4,246,178**	**$3,656,449**	**$5,065,094**

Notes

1 Refer to Project Alternative Capital Cost estimate worksheet for detail (Appendix I).
2 Annual labor for operations, maintenance, reporting, and compliance. Assumes 2 hr/site/day at $150/hr loaded rate (wages, benefits, overhead).
3 Annual chemical supply costs. Assumes $3/gal 12.5% NaOCl, $1.50/gal 25% Aq. NH_3. Chloramine residual maintained at 3 ppm ($NaOCl:NH_3$ ratio 5:1; 0.6 ppm NH_3).
4 Equivalent Uniform Annual Cost (EUAC) of planning-level rehabilitation measures (mechanical/chemical). Assumes $100,000 per well per event (year 20 and 40) in 2025 dollars.
5 EUAC of full pump replacement (column, motor, and bowl assembly) at year 20 and 40. Assumes $550,000, $550,000, and $400,000 per well for Hansen, Tennis, and Del Prado, respectively.
6 Annual SCADA/PLC maintenance and instrumentation replacement/calibration. Includes per-site allowance for routine repairs and testing.
7 EUAC of major electrical renewal (e.g., cabinets, breakers, PLC/SCADA upgrades, VFDs, etc.). Assumes $500k, $500k, and $300k per site for Hansen, Tennis, and Del Prado, respectively.
8 Annual pumping energy cost. Assumes electrical input power of 250 hp, 700 hp, and 730 hp at drought flowrates for Del Prado, Tennis, and Hansen sites; $0.40/kWh power cost.
9 Does not include financing costs, permitting, land acquisition, administrative overhead, or other soft costs.
10 EUAC of estimated project capital costs.
11 Sum of estimated annual O&M costs and annualized project capital costs.
12 Estimates do not account for emergency repairs, catastrophic equipment failures, or changes in regulatory standards.
13 Alternatives 1 and 3 cannot achieve Zone 7's 7,000 AFY minimum production goal under drought-year conditions without exceeding the 75% reliability limit (18 hr/day), as shown in red.
14 EUAC figures assume 50 year project life with 3% discount rate and Capital Recovery Factor (CRF)
15 All costs are estimates, expressed in 2025 dollars (constant, no escalation) with no allowance for future inflation or changes in labor/chemical/energy prices.

Appendix J

Basis of Design Report (BODR), 10% Design, and Construction Estimate for New Wells, Raw Water Pipeline, and HCF Improvements

LSCE

Municipal Supply Wells, Transmission Pipelines, and Potential Future Treatment



Regional Groundwater Facilities Basis of Design Report

December 2025 / FINAL

Municipal Supply Wells, Transmission Pipelines, and Potential Future Treatment

Regional Groundwater Facilities Basis of Design Report

December 2025 / FINAL

This document is released for the purpose of information exchange review and planning only under the authority of Darren G. Baune, December 10, 2025, California C-68899.

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Abbreviations

3D	three-dimensional
AACE	Advancement of Cost Engineering
AFY	acre-feet per year
AWWA	American Water Works Association
bgs	below ground surface
BODR	*Regional Groundwater Facilities Basis of Design Report*
Carollo	Carollo Engineers
CIP	clean-in-place
City	City of Pleasanton
CMU	concrete masonry unit
COLTP	Chain of Lakes Treatment Plant
DIP	ductile iron pipe
DSRSD	Dublin San Ramon Services District
EBCT	empty bed contact time
EDR	electrodialysis reversal
EPA	Environmental Protection Agency
fps	feet per second
GAC	granular activated carbon
gfd	gallons per square foot per day
GIS	geographic information system
gpm	gallons per minute
HLR	hydraulic loading rate
hp	horsepower
IX	ion exchange
kV	kilovolts
LAVWMA	Livermore-Amador Valley Water Management Agency
lf	linear feet
LSCE	Luhdorff & Scalmanini Consulting Engineers
mgd	million gallons per day
MGDP	Mocho Groundwater Demineralization Plant
mg/L	milligrams per liter
NF	nanofiltration
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
PFHxS	perfluorohexane sulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid

PG&E	Pacific Gas and Electric
PLC	programmable logic controller
PQL	Practical Quantitation Level
Project	Regional Groundwater Facilities project
psi	pounds per square inch
PVC	polyvinyl chloride
RO	reverse osmosis
sf	square feet
SMP	salt management program
SRTP	Stoneridge Treatment Plant
TDS	total dissolved solids
U.S.	United States
V	volt
VFD	variable frequency drive
WQMP	water quality management program
Zone 7	Zone 7 Water Agency

SECTION 1 INTRODUCTION

1.1 Purpose

This *Regional Groundwater Facilities Basis of Design Report* (*BODR*) describes the basis of design to construct municipal supply wells and transmission pipelines for the Regional Groundwater Facilities project (Project). The purpose of this *BODR* is the following:

- Develop the basis of design for the Tennis and Hansen Park project alternative. The basis of design describes the well facilities, siting, capacity, transmission pipelines, and chloramination improvements at Zone 7 Water Agency's (Zone 7) Hopyard Chloramination Facility.
- Estimate the cost of the Tennis Park and Hansen Park Well alternative.
- Identify next steps to implement the Project.
- Develop the basis of design for potential future water treatment systems.

1.2 Introduction

Zone 7 and the City of Pleasanton (City) are collaborating to develop the planning phase of the Project. The planning phase evaluates constructing new potable water supply wells and pipelines to supplement Zone 7's and the City's water supply. Luhdorff & Scalmanini Consulting Engineers (LSCE) is leading the study as the prime consultant and Carollo Engineers (Carollo) is assisting LSCE with the conceptual engineering of the project facilities.

LSCE began the planning phase of the Project in November 2024, which includes the following key tasks and investigations. LSCE is leading Tasks 1 through 6 and Carollo is leading Tasks 7 and 8.

- Task 1: Drilling project oversight.
- Task 2: Water quality sampling and analysis.
- Task 3: Yield testing and flow profiling.
- Task 4: Define and coordinate modeling of initial and future groundwater pumping.
- Task 5: Exploratory test drilling findings report.
- Task 6: Prepare feasibility report.
- Task 7: Develop basis of design to construct municipal supply wells, transmission pipeline, and treatment plant upgrades.
- Task 8: Prepare basis of design for potential future treatment systems.

This *BODR* is organized based on the following sections:

- Section 1 "Introduction."
- Section 2 "Tennis Park and Hansen Park Well Project Basis of Design" (Task 7).
- Section 3 "Potential Future Treatment Facilities" (Task 8).

1.3 Background

Zone 7 supplies treated water to multiple agencies in the Tri-Valley, including the City. The City has historically met their potable water demands by purchasing treated water from Zone 7 (about 11,000 acre-feet per year [AFY]) and operating City owned groundwater wells (Wells 5, 6, and 8). The City found per- and polyfluoroalkyl substances (PFAS) contamination in Wells 5, 6, and 8 in 2020 and removed the wells from service in 2022. The City has increased its water purchase from Zone 7 since that time.

The City developed the basis of design for the PFAS Treatment and Wells Rehabilitation project from 2020 to 2022 to evaluate a project to return wells to service and implement a centralized PFAS treatment facility. This project evaluated rehabilitating Well 8, constructing new Wells 9 and 10, and constructing a centralized PFAS treatment facility. The PFAS Treatment and Wells Rehabilitation project was advanced to the 50 percent design level in 2022 and put on hold. While the project was on hold, the City reviewed other potential projects under the *Water Supply Alternatives Study*.

The *Water Supply Alternatives Study* identified the Two New City Wells project as the preferred option in 2023, which considered constructing two new wells outside of the PFAS contamination plume. At that time, Zone 7 recognized the opportunity to evaluate a regional project that could both support the City's groundwater production and enhance Zone 7's overall drought resiliency and supply reliability.

With recognition of potential regional benefits, the City and Zone 7 elected to jointly evaluate whether a regional project could increase water supply reliability, cost-effectiveness, and basin management benefits rather than independent projects. LSCE was hired as the lead consultant with technical/engineering support from Carollo. Since project initiation, Zone 7, the City, and the consultant team have conducted multiple workshops and technical meetings with the Zone 7 board and Zone 7/City leadership to review hydrogeologic findings, define evaluation criteria, and advance alternatives to a detailed feasibility-level assessment.

A central driver of this Project is the ongoing challenge of PFAS contamination in the Livermore Valley groundwater basin. Both Zone 7 and the City must balance the need to expand local groundwater supplies with avoiding PFAS-impacted zones and protecting long-term basin sustainability. Without coordinated action, the ability of either agency to reliably meet demands during droughts or surface water interruptions is uncertain.

1.4 Project Goals

The City and Zone 7 share the following project objectives, including: providing customers with safe water, addressing long-term water supply reliability challenges, and capturing cost savings through economies of scale.

Project goals specific to Zone 7 include continuing PFAS and total dissolved solids (TDS) management and protection of the groundwater basin given proximity to known PFAS footprints and enhancing local drought resilience through additional regional groundwater production capacity.

City-specific project goals include regaining use of their groundwater production quota to provide a source of water supply which, in turn, provides economic savings in lieu of purchasing water from Zone 7 at the wholesale rate.

1.5 Feasibility Study

LSCE completed the *Feasibility Study* under Task 6 of this Project to identify the recommended project alternative. The *Feasibility Study* evaluated the following project alternatives:

- Project Alternative No. 1 – Tennis Park.
- Project Alternative No. 2 – Tennis Park and Hansen Park.
- Project Alternative No. 3 – Tennis Park and Del Prado Park.
- Project Alternative No. 4 – Tennis Park, Hansen Park, and Del Prado Park.

The project alternatives were scored and ranked based on the following criteria:

- Water production capacity.
- Groundwater and basin sustainability.
- Community and environmental impacts.
- Capital cost.
- Water quality/treatment impacts.
- Implementation schedule.
- Operational flexibility and resilience.
- Operations and maintenance cost.

Based on the alternatives evaluation, the *Feasibility Study* found that Project Alternative No. 2 – Tennis Park and Hansen Park is the recommended project. This project includes the construction of two new groundwater production wells, a raw water transmission pipeline, and chloramination improvements at the Hopyard Well 6 site.

SECTION 2 TENNIS PARK AND HANSEN PARK WELL PROJECT BASIS OF DESIGN

2.1 Project Overview

The Tennis Park and Hansen Park Well Project includes two new groundwater production wells located at Tennis Park (5801 Valley Avenue, Pleasanton, California) and Hansen Park (5697 Black Avenue, Pleasanton, California), a transmission pipeline from the wells to the Hopyard Chloramination Facility, and improvements to the Hopyard Chloramination Facility to increase chloramination capacity. The transmission main alignment is located in Hopyard Road and Hansen Drive within the City. Figure 1 shows an overview of the potential new well locations and transmission main alignment.



Figure 1 Project Overview

2.2 Design Well Capacity

As described in the *Feasibility Study,* test wells were drilled at Tennis Park, Hansen Park, and Del Prado Park, to determine the estimated production capacities of each potential well site. Results of test well capacity testing established the estimated design capacity of each well site. The estimated minimum and maximum design flows for Tennis Park and Hansen Park are presented in Table 1. The design flow for a new permanent well at Del Prado Park is not included in Table 1 because it is not included in the scope of the project alternative selected by the City and Zone 7, as described in this *BODR*.

Table 1 Tennis Park and Hansen Park Design Flow(1)

Month	Design Flow (gpm)	Design Flow (mgd)
Tennis Park		
Drought Year Conditions	3,400	4.90
Average Year Conditions	4,250	6.12
Wet Year Conditions	5,100	7.34

Month	Design Flow (gpm)	Design Flow (mgd)
Hansen Park		
Drought Year Conditions	3,400	4.90
Average Year Conditions	3,800	5.47
Wet Year Conditions	4,200	6.05

Notes:
gpm - gallons per minute; mgd - million gallons per day.
(1) Refer to LSCE's *Feasibility Study* for discussion of the design flows presented in this table.

2.3 Tennis Park Well Facility

Tennis Park (5801 Valley Avenue, Pleasanton, California) is centrally located within the City along Hopyard Road. The new well facility will either be located at the eastern end of the park adjacent to Hopyard Road or just north of the parking lot, as shown in Figure 1. Major design elements of the new well facility include:

- Groundwater production well with well casing and well screen.
- Maximum estimated 700 horsepower (hp) vertical turbine well pump with associated mechanical piping and appurtenances.
- Well to pump-to-waste discharge piping and air gap structure.
- Concrete masonry unit (CMU) well building with a pump room and electrical room.
  - » Building architecture will require coordination and permitting with the City's planning department. It is anticipated public outreach would occur to facilitate architectural design.
- Well building access driveway.
- 4160 volt (V) medium voltage switchgear with integral transformer.
- 800 hp variable frequency drive (VFD).
- Low voltage panelboards and transformer.
- Outdoor utility pad-mounted transformer.
- Water sampling station.

The following section describes the well facility's major design elements in more detail.

2.3.1 Well Siting

As shown in Figure 1, Zone 7 and the City are considering two potential sites for the new Tennis Park well facility. Zone 7 and the City will continue to evaluate potential well sites within Tennis Park during final design. Selection of the Tennis Park well facility location will consider routine site access, special operations and maintenance (O&M) access (i.e., portable generators, equipment removal with cranes), storm drain capacity for pump-to-waste operation (see Section 2.3.5.2), ease of Pacific Gas and Electric (PG&E) service, and noise ordinance (construction and operation).

Figure 2 shows the well building sited at the eastern side of Tennis Park at the corner of Valley Avenue and Hopyard Road as Option 1. This location was identified by Zone 7 and the City during a design coordination meeting held on June 27, 2025. This location is desirable because the well facility would be surrounded by trees which reduces visual and noise impacts. However, it is likely that tree removal will be required to provide access to this well facility location.

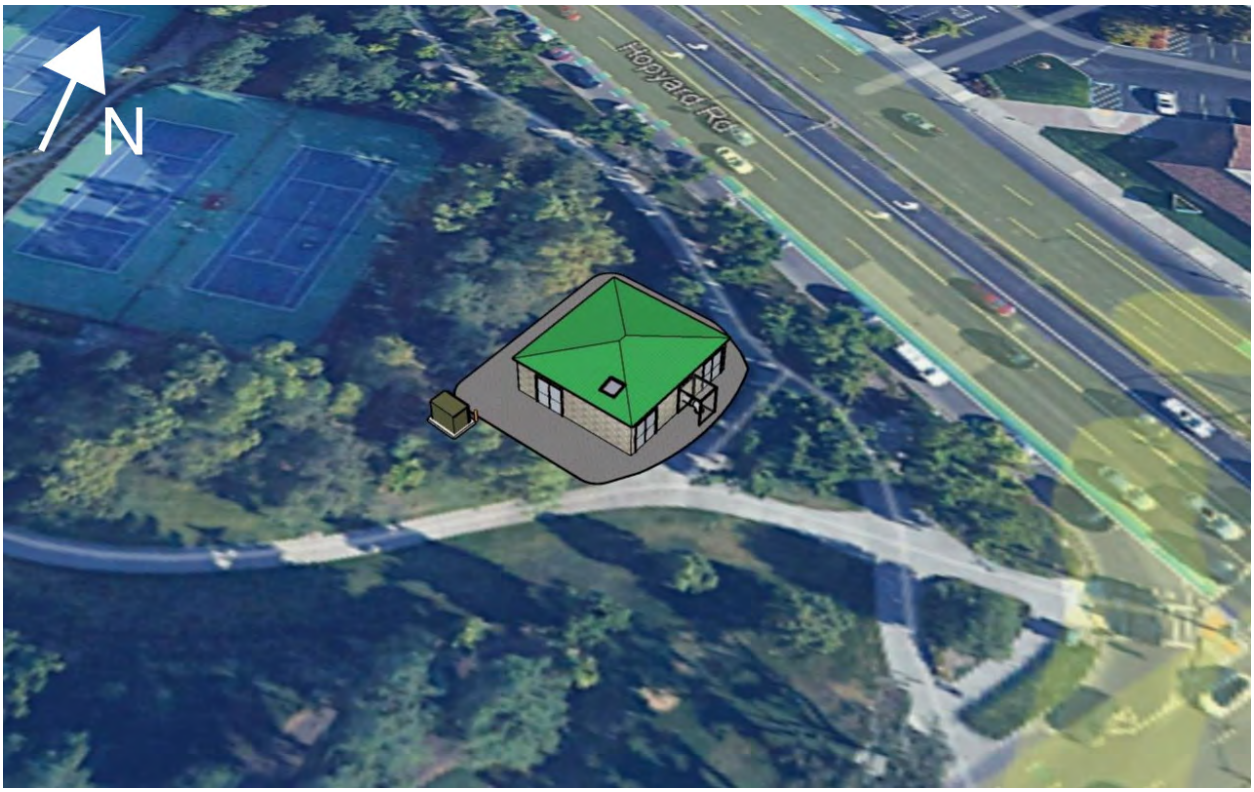


Figure 2 Tennis Park Well Facility Option 1 - Three-Dimensional (3D) Isometric

Figure 3 shows the well building sited adjacent to the northwest corner of the parking lot connected to Valley Avenue as Option 2. This location was identified by the City and Zone 7 during the Regional Groundwater Facilities *BODR* Review Workshop held on November 14, 2025. Similar to Option 1, this location is desirable because the well facility would be surrounded by trees which reduces visual and noise impacts from the well facility. In addition, this location is adjacent to an existing parking lot which would reduce impacts to the park.

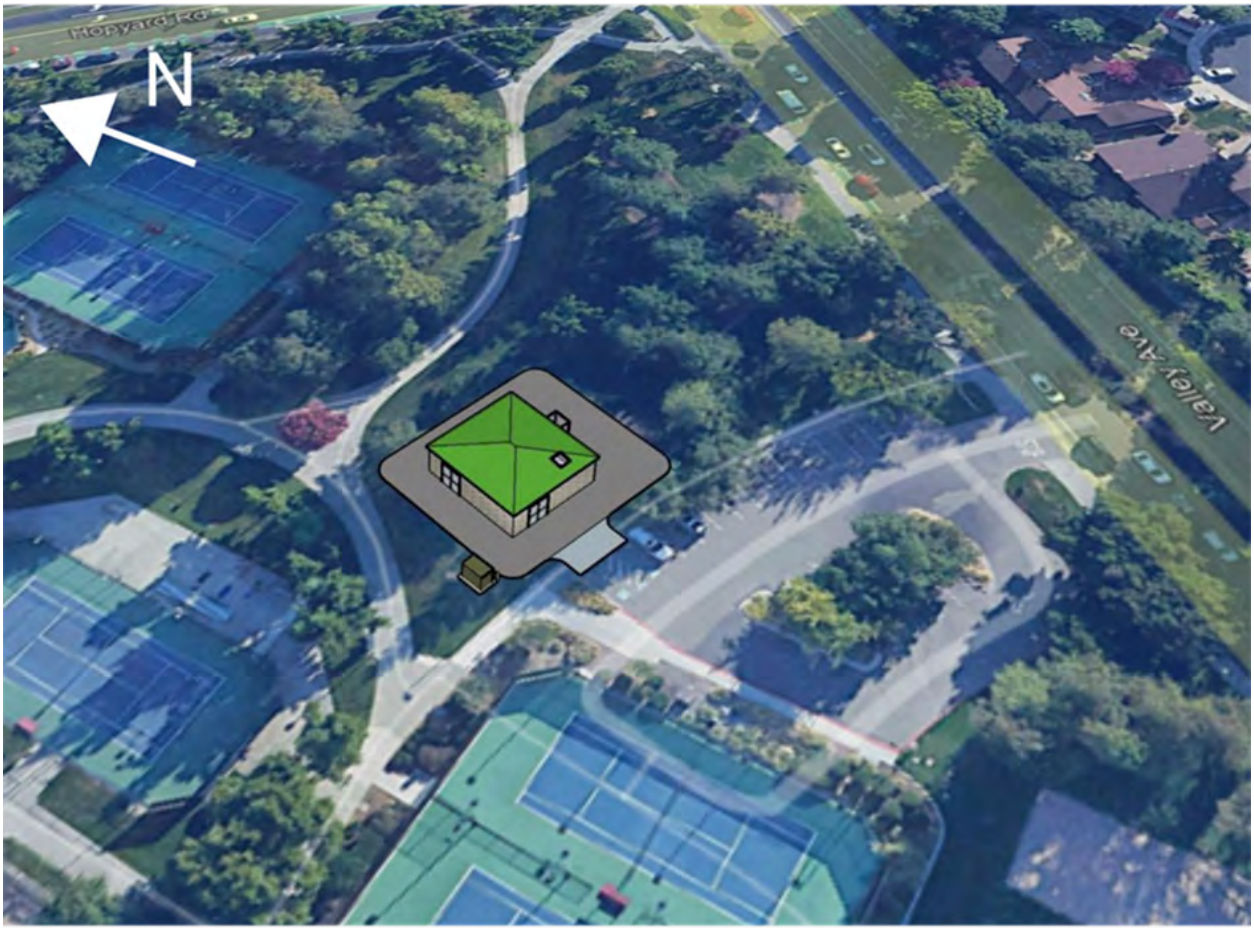


Figure 3 Tennis Park Well Facility Option 2 - 3D Isometric

2.3.1.1 Access

Tennis Park is large and contains numerous recreational facilities including basketball and tennis courts which attract a high amount of pedestrian and vehicle traffic from the public. Access to the new well facility must minimize impacts to existing park and avoid tree removal as feasibly possible.

Zone 7 and City O&M staff informed the design team that the new well facility will be accessed daily by a pickup truck (e.g., Ford F-150). As such, access to proposed production well Option 1 will include a driveway through the park connecting Valley Avenue to the well building, parking, and a turnaround. Access to proposed production well Option 2 will utilize the existing parking lot connected to Valley Avenue and include a short driveway through the park connecting the parking lot to the well building and a turnaround. The existing parking lot can be utilized for O&M staff parking at this potential well building location.

For proposed production well Option 1, Valley Avenue along the northeast corner of Tennis Park appears to be the best location for an access driveway since it minimizes driveway length and interruption to most recreational activities at the park. However, this driveway alignment may require tree removal and coordination with the City's traffic engineer considering the proximity to the intersection of Valley and Hopyard Roads.

For proposed production well Option 2, the northwest corner of the existing parking lot connected to Valley Avenue is the best location for an access driveway since the length of the parking lot can be used for O&M ingress/egress which minimizes driveway length and interruption to most recreational activities at the park. In addition, this driveway access driveway alignment may avoid the need for tree removal.

The following should also be considered when siting the driveway.

- Access to the well facility from Hopyard Road was rejected as a feasible location by the City and Zone 7.
- The material of the driveway should be designed to support frequent O&M vehicle traffic and will be determined during final design.
- The alignment of the driveway should accommodate future well and pump installation and maintenance staging area requirements.
- The driveway should be installed around the perimeter of the well building.
- The location of the driveway has not been determined at this time.

2.3.1.2 Security

As discussed with Zone 7 and the City during design coordination meetings, the well facility will not be fenced. The intent of the preliminary design is to allow the public to walk adjacent to the well building, similar to Zone 7's Mocho Well 3 facility, as shown in Figure 4.



Figure 4 Mocho Well 3 Facility

Security measures for the site will be limited to heavy-duty double doors with securable centers, intrusion monitors on doors into the well building and a small, pad-locked enclosure around the air gap structure at the exterior of the building. For more details on the air gap structure see Section 2.3.5.2.

2.3.2 Well Building

The well building will consist of a new CMU block building with an approximate footprint of 40 feet by 43 feet (1,720 square feet [sf]) and an approximate height of 25 feet. The building will have two separate rooms: pump room and electrical room (climate controlled). Access doors between rooms will be provided. The equipment contained in each room is as follows:

- Pump room:
  - Wellhead and associated accessories.
  - Well pump and associated piping and appurtenances.
  - Water sampling station.
- Electrical room:
  - 4160V medium voltage switchgear with integral transformer.
  - 800 hp VFD.
  - Low voltage panelboards and transformer.

The well building will include a gable-ended pitched roof composed of a steel roof decking material supported by steel beams, similar to Zone 7's other well facilities. A skylight will be provided on the roof to accommodate installation and removal of the well pump from the building. The building will be constructed from CMU block walls with conventional concrete wall footings and a concrete floor slab. It may be necessary to implement architectural treatment of the exterior of the building. This will be determined during final design through coordination with the City's planning department and potential public outreach.

The preliminary size of the electrical room is primarily controlled by the medium voltage switchgear. In accordance with PG&E working requirements and to allow for maintenance of the main breaker, 9 feet of clear space is provided at the front of the switchgear. At the back of the switchgear, 8 feet of clear space is provided to meet PG&E working requirements. The two remaining sides of the switchgear must be 4 feet clear of the double doors according to 2024 International Building Code. Note the size of the electrical room is subject to change during final design.

Figure 5 shows the well building layout in plan view.

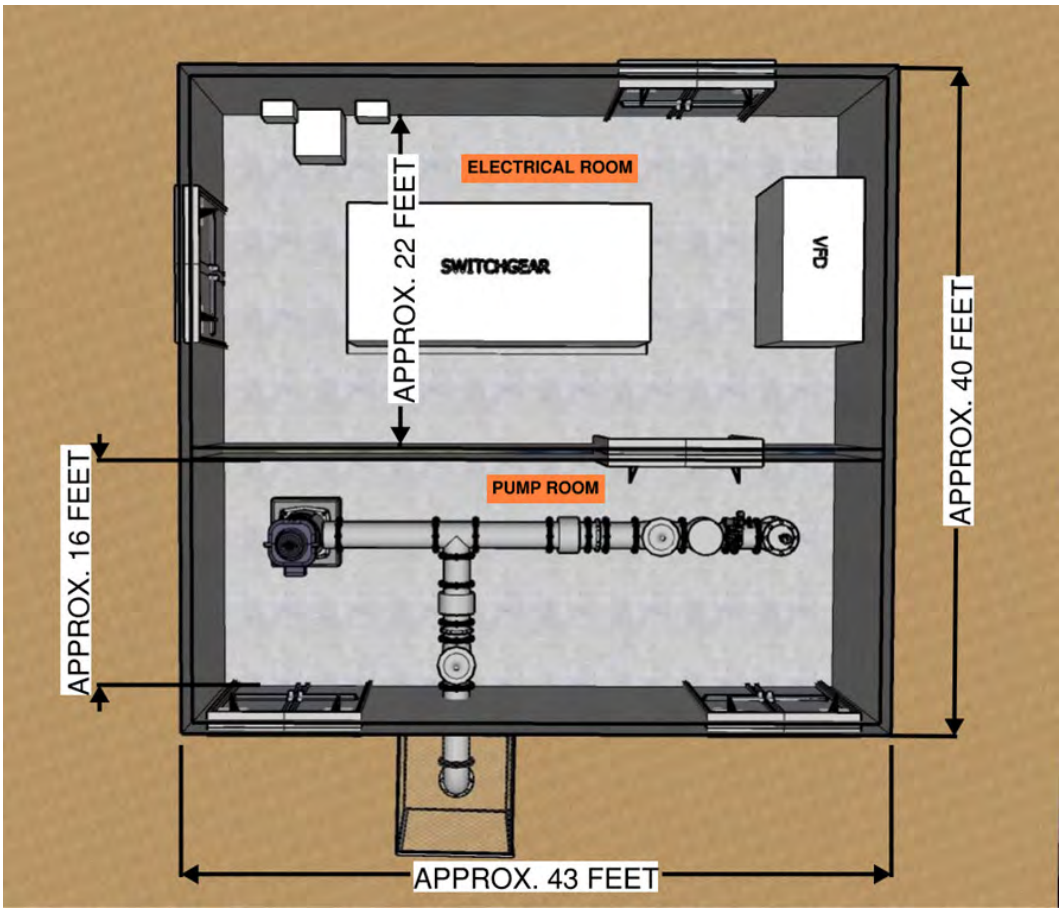


Figure 5 Well Building Plan View

2.3.3 Well Casing and Downhole Improvements

LSCE developed the *Tennis Park Test Well Investigation Summary and Well Design Recommendations* report to provide design recommendations for the permanent well at Tennis Park. The conceptual design is in accordance with Department of Water Resources Water Well Standards, Bulletin 74-81, 74-90; State Water Resources Control Board; Division of Drinking Water; and accepted water well design standards. Table 2 shows a summary of LSCE's design recommendations for the well and downhole improvements. The proposed well design is shown in Figure 6, which includes well screen intervals and additional downhole improvements.

Table 2 Tennis Park Well Design Recommendations

Description	Result
Conductor Casing Borehole Diameter (inches)	60
Conductor Casing Material	ASTM A-139 Grade B Steel
Conductor Casing Outside Diameter (inches)	40
Conductor Casing Thickness (inches)	0.5
Conduction Casing Install Depth Range (feet bgs)	0 – 70

Description	Result
Production Borehole Diameter (inches)	36
Production Borehole Depth (feet bgs)	780
Well Casing Material	ASTM A-778 Type 304L Stainless Steel
Well Casing Inside Diameter (inches)	22
Well Casing Thickness (inches)	0.375
Well Screen Material	ASTM A-778 Type 304L Stainless Steel
Well Screen Slot Size (inches)	0.080
Sounding Tube Material	Schedule 40, Type 304L Stainless Steel
Sounding Tube Diameter (inches)	2
Sounding Tube Install Depth Range (feet bgs)	0 – 199
Gravel Fill Material	6X9 Graded Gravel
Gravel Fill Install Depth Range (feet bgs)	172 – 780
Sand Transition Seal Install Depth Range (feet bgs)	170 – 172
Annular Seal Material	10.3-Sack Sand/Cement Grout
Annular Seal Install Depth Range (feet bgs)	0 – 170

Notes:
bgs - below ground surface.

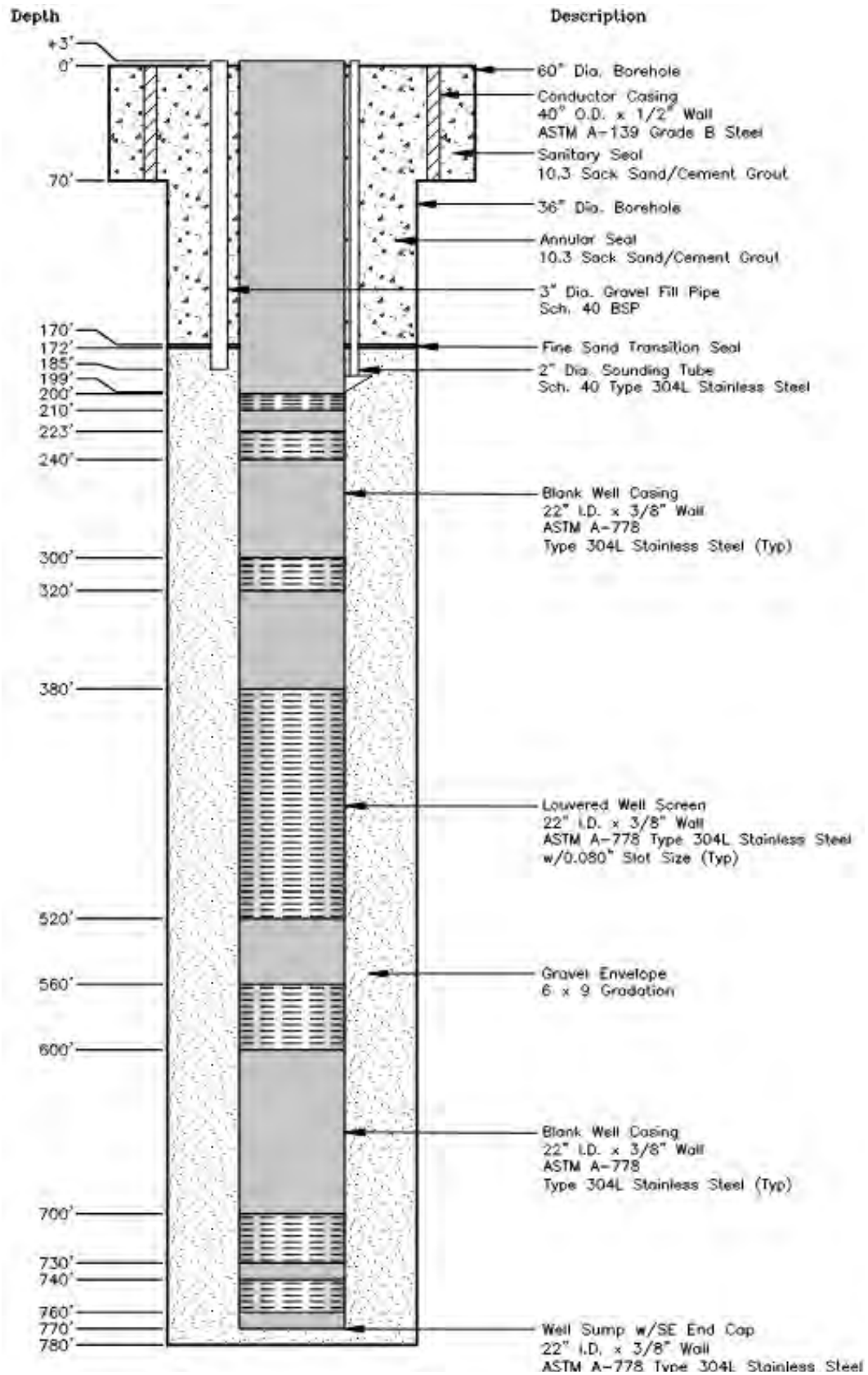


Figure 6 Tennis Park Well Proposed Design - Profile

2.3.4 Well Pump

Table 3 provides a summary of the key differences between vertical turbine lineshaft pumps and submersible vertical turbine pumps.

Table 3 Vertical Lineshaft Turbine and Submersible Turbine Pump Comparison

Component	Vertical Lineshaft Turbine Pump	Submersible Turbine Pump
Operating Cost	Higher motor efficiency (typically 3 to 10% more efficient than submersible). Mechanical losses in shaft bearings.	Lower motor efficiency, higher losses in power cable. Longer T leads can require larger conductors to manage voltage drop compared to vertical lineshaft turbine.
Motor Serviceability	Motor, thrust bearings, and shaft seal accessible at surface. Pump removal is not necessary for servicing.	Motor, thrust bearings, shaft seal and power cable require pump removal for servicing (less accessible).
Borehole Alignment	Borehole must be drilled to tighter tolerances than submersible because of lineshaft alignment.	Can be installed in crooked boreholes.
Pump Adjustment	Impeller clearance must be adjusted prior to initial startup.	Impeller clearance is preset at factory.
Noise	Produces noise which may require mitigation measures, such as: special motor enclosure (e.g., WP-2), acoustic dampening in pump room, acoustic louvers, harmonic filtering (passive or active), noise attenuating plenum.	Essentially silent.
Maintenance	Motor bearing requires routine monitoring for adequate lubrication oil; seal arrangement can be maintained/replaced without removing pump or motor.	Shaft seal cannot be serviced without removing the pump string including the motor.

Noise attenuation is a major consideration at both well facilities because of their proximity to residents. As noted in Table 3, noise mitigation measures will be required with vertical lineshaft turbine pumps to meet the City's residential noise ordinance of less than 60 dBA at 25 feet during all hours of the day. The noise mitigation measures will be determined during final design.

Based on discussions with Zone 7, the preferred pump type is a vertical lineshaft turbine pump. In comparison to a submersible vertical turbine pump, the vertical lineshaft turbine pump provides superior performance, accessibility, and serviceability. In addition, Zone 7's existing wells are equipped with vertical turbine lineshaft pumps which makes the operation of this style of pump more familiar for O&M staff and therefore more easily integrated into Zone 7's infrastructure.

2.3.5 Process Mechanical Piping

Figure 7 shows the aboveground process mechanical piping, valves, and appurtenances located within the well building. The piping and valves are separated into two operational modes of the new well—production and pump-to-waste. When the well is in production mode, raw water from the well is pumped to the transmission main. When the well is in pump-to-waste mode, raw water from the well is pumped to an air gap structure which discharges into the storm drain system. The following section provides details for the process mechanical infrastructure associated with both operational modes.

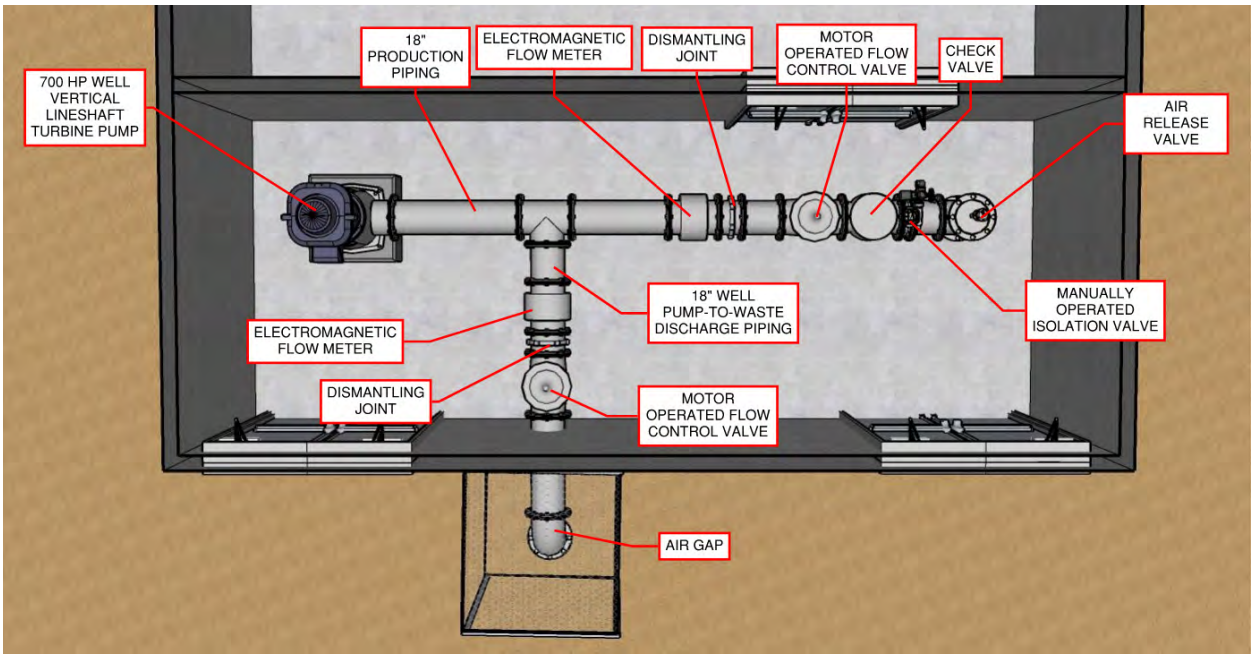


Figure 7 Tennis Park Well Building Process Mechanical Piping - Plan

2.3.5.1 Production Piping, Valves, and Appurtenances

In production operation mode, raw water is pumped from the well to the transmission main via 18-inch piping. From the wellhead, production piping includes a flow meter, two motor operated flow control valves, a manually operated isolation valve, check valve, and air release valve, as shown in Figure 7.

Note that one motor operated flow control valve is dedicated to production piping and the other is dedicated to the pump-to-waste piping. In production mode, the pump-to-waste motor operated flow control valve is closed while the production motor operated flow control valve is open.

2.3.5.2 Pump-To-Waste Piping, Valves, and Appurtenances

The purpose of pump-to-waste mode is to discharge any particulate matter that is suspended during pump startup. As such, suspended solids content is reduced in raw water being conveyed to the Hopyard Chloramination Facility.

In pump-to-waste mode, raw water is pumped from the well to an air gap structure located outside of the well building via 18-inch piping. pump-to-waste piping intersects production piping at a tee connection, as shown in Figure 7. Downstream of the tee connection is a manually operated isolation valve, motor operated flow control valve, and air gap structure. In pump-to-waste mode, the orientation of motor operated flow control valves is opposite of production mode.

An air gap structure is required to provide cross-connection control by physical separation of raw water and the storm drain system. Since the air gap structure will be located on the outside of the well building, a security fence will be provided around it for public safety. An example of an air gap structure is shown in Figure 8.

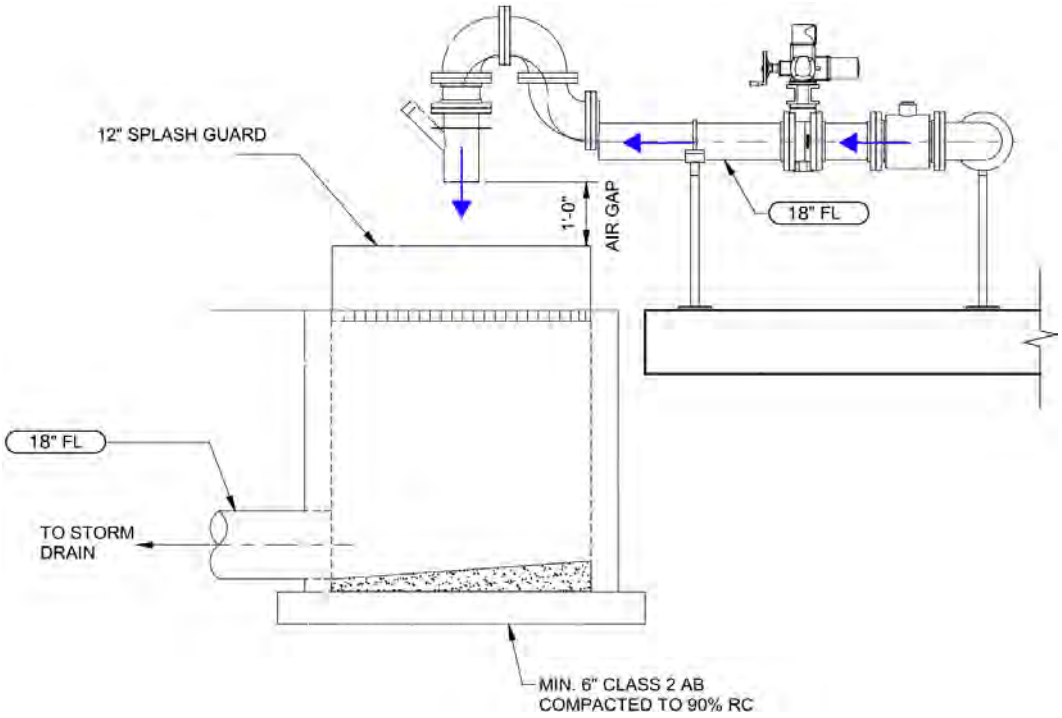


Figure 8 Example of Air Gap Structure

2.3.6 Test Well Exploration and Well Pump Size

LSCE installed a test well at the Tennis Park site to develop the groundwater hydraulics model, evaluate water quality, and to determine the design well capacity. Table 1 shows the estimated well capacity developed during the test well exploration.

Using test well pump data recorded on April 9, 2025, shown in Table 4, LSCE defined well pump design criteria which resulted in preliminary pump sizing as shown in Table 5. The maximum required pump brake horsepower for the Tennis Park well pump is 660 hp. As such, the pump motor will have a preliminary size of 700 hp. Note the pump size is subject to change during well development when the permanent production well is drilled and tested for actual production capacity.

Table 4 Tennis Park Test Well Data

Description	Result
Test Date	**04/09/2025**
Static Water Level (feet bgs)	16.7
Flow Rate (gpm)	549.0
Projected 24-hour Pumping Water Level (feet)	26.3
Projected 24-hour Drawdown (feet)	9.6
Specific Capacity (gpm/feet)	57.2
Top of First Screen (feet bgs)	195.0
Available Drawdown (feet)	178.3
Maximum Well Yield Estimate (gpm)	5,100

Table 5 Tennis Park Preliminary Well Pump Sizing

Description	Result
Seasonal Low Static Water Level Estimate (feet bgs)(1)	75.0
Top of First Screen (feet bgs)	195.0
Available Drawdown (feet)	120.0
Specific Capacity (gpm/feet)	57.0
Maximum Well Yield Estimate (gpm)	5,100
Estimated Bowl Efficiency (%)	75
Estimated Discharge Pressure (psi)	100
Maximum Pump Brake Horsepower Requirement (hp)(2)	660
Nominal Well Pump Motor Size (hp)	700

Notes:
psi - pounds per square inch.
(1) Seasonal low static water level estimations based on lower aquifer groundwater elevation contour maps for 2021, 2022, and 2023.
(2) Assumes pumping water level is equal to top of screens at maximum flowrate.

2.3.7 Yard Piping

Yard piping at the facility consists of new underground piping outside of the well building and includes the following:

- 18-inch raw water discharge.
- 18-inch storm drain.
- 4-inch floor drain.
- Electrical duct bank.

Refer to Figure 9 for a conceptual layout of yard piping at the Tennis Park well facility location Option 1. Tennis Park well facility location Option 2 is close to location Option 1, which would result in a similar conceptual layout of yard piping. As such, the following section applies to both location Options for the Tennis Park well facility.

The 18-inch raw water discharge pipeline is fully restrained ductile iron pipe (DIP) and connects the new groundwater well pump to the 18-inch transmission main in Hopyard Road. In general, the pipeline will be installed with approximately 3.5 feet of cover. Utility investigations will be required in final design to determine the final depth of installation. Since this pipeline is pressurized, the vertical alignment can vary with minimal impacts to hydraulic performance. Location of air and vacuum relief valves and blow offs will be determined when the vertical alignment is finalized.

The 18-inch storm drain is polyvinyl chloride (PVC) and connects the air gap structure at the well building to the nearest existing storm drain manhole. The storm drain pipeline will maintain 4 feet of cover where feasible. Since flow will be gravity-driven restrained joints are not needed. According to storm drain geographic information system (GIS) files provided by the City, an existing 54-inch storm drain on Paseo Santa Cruz is a potential location for the 18-inch storm drain discharge. An analysis of existing storm drain hydraulics is required prior to determining the discharge location for the new 18-inch storm drain.

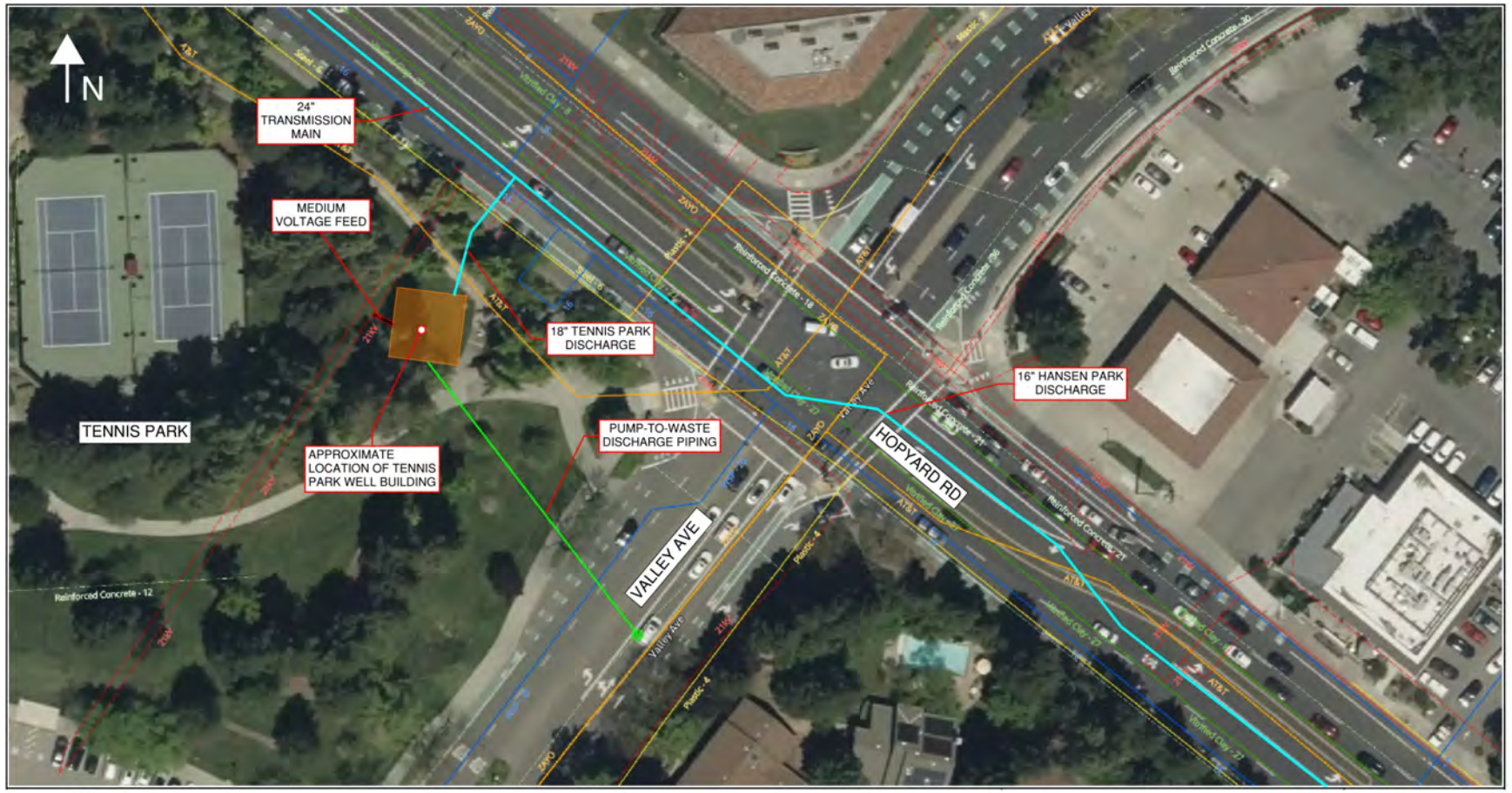


Figure 9 Tennis Park Conceptual Yard Piping

The pump room within the new well building will be provided with a 4-inch floor drain which will discharge to either the storm drain or sanitary sewer system. The 4-inch floor drain will maintain 3 feet of cover where feasible. Further analysis of existing storm drain and sanitary sewer system hydraulics is required prior to determining the discharge location of the 4-inch floor drain.

A concrete electrical duct bank will house electrical conduit spanning from a service connection to equipment in the well building. Further investigation into existing utilities at the site is needed to determine the location of the service connection and the alignment of the duct bank. In general, the duct bank will maintain 2 feet of cover where feasible. The cross-section of the duct bank and the number of conduits housed will be determined in final design.

2.3.8 Electrical

The Tennis Park well facility is a new potable water well and will require a new electrical service from PG&E. Considering the project is in conceptual design, the project team has not contacted PG&E to submit an application for a new power service. According to existing utility records in the vicinity, a buried 21-kilovolt (kV) routed through the park, as shown in Figure 9, is a potential source for facility power. We recommend submitting the application for the new service once the site, well motor hp, and one line diagram for the facility has been finalized during the final design phase.

The electrical elements of the project include the following:

- 4160V medium voltage PG&E service.
- Service entrance rated panel and utility meter for new service.
- Outdoor utility pad-mounted transformer.
- 4160V medium voltage switchgear with integral transformer.
- 800 hp VFD with harmonic mitigating topology and bypass starter.
  - As discussed during the Regional Groundwater Facilities *BODR* Review Workshop held on November 14, 2025, continued coordination between the City and Zone 7 is required to determine if a VFD is needed for this facility.
- Portable backup generator outdoor connection.

Coordination with PG&E is required to determine the location of a new electrical service and associated meter. The PG&E meter enclosure will include service disconnect and secondary metering in accordance with PG&E standards.

The design team is planning to provide a portable generator connection to allow Zone 7 to power the well facility in the event of a power failure. A permanent backup generator is not planned to be installed at this time.

2.3.9 Instrumentation

Instrumentation will be included in the final design to provide automation and protection for the well pump and ancillary facilities. The instrumentation will be powered from programmable logic controller (PLC) cabinets with uninterruptable power system back up. The preferred manufacturers and instrumentation will be developed during final design. A preliminary list of proposed instruments and control components includes:

- PLC.
- Electromagnetic flowmeter.
- Water sampling station.
- Pressure transmitter.
- Pressure switch.
- Pressure gauge.
- Intrusion switches at well-building doors.

The PLC and operator work station will be programmed by a system integrator based on the control narratives developed in final design.

2.4 Hansen Park Well Facility

Hansen Park (5697 Black Avenue, Pleasanton, California) is centrally located within the City along Hansen Road. The new well facility will either be located at the northwest corner of the park adjacent to the intersection of Hansen Road and Calle Ricardo or east of the basketball court centrally located in the park, as shown in Figure 1. The major design elements of the new well facility include:

- Groundwater production well with well casing and well screen.
- Maximum estimated 700 hp vertical turbine well pump with associated mechanical piping and appurtenances.
- Well to pump-to-waste discharge piping and air gap structure.
- CMU well building with a pump room, electrical room, and instrumentation control room.
  - » Building architecture will require coordination and permitting with the City's planning department. It is anticipated public outreach would occur to facilitate architectural design.
- Well building access driveway.
- 4160V medium voltage switchgear with integral transformer.
- 800 hp VFD.
- Low voltage panelboards and transformer.
- Outdoor utility transformer.
- PLC.
- Water sampling station.

The following section describes the well facility's major design elements.

2.4.1 Well Siting

There are two potential locations under consideration for the new Hansen Park well facility, as shown in Figure 1. The City and Zone 7 will evaluate and select the Hansen Park well facility location prior to final design. Selection of the Hansen Park well facility location will consider routine site access, special O&M access (i.e., portable generators, equipment removal with cranes), storm drain capacity for pump-to-waste operation (see Section 2.3.5.2), ease of PG&E service, and noise ordinance (construction and operation).

As shown in Figure 10, Option 1 located at the northwest corner of Hansen Park at the intersection of Hansen Road and Calle Ricardo. This location was identified by the City and Zone 7 during a design coordination meeting held on June 27, 2025. This location is desirable because the well facility is adjacent to both Hansen Drive and Calle Ricardo which simplifies O&M access routes and parking. However, compared to location Option 2, this location is much closer to residential properties and will create greater visual impacts.



Figure 10 Hansen Park Well Facility Option 1 – 3D Isometric

As shown in Figure 11, Option 2 is immediately east of the existing basketball court centrally located in the park. This alternative was identified by the City and Zone 7 during the Regional Groundwater Facilities *BODR* Review Workshop held on November 14, 2025. Compared to location Option 1, this location is

farther away from nearby residential properties and therefore has less visual impact. However, being centrally located within the park, this location will require O&M access routes crossing the park which will impact available space for recreational activities.



Figure 11 Hansen Park Well Facility Option 2 – 3D Isometric

As noted by the City and Zone 7, noise mitigation is a primary concern at both Tennis and Hansen Park well facilities to reduce impacts on residents. Since the Hansen Park well facility will be located nearby residences on Hansen Drive and Calle Ricardo, more extensive noise mitigation measures are anticipated than at the Tennis Park well facility.

2.4.1.1 Access

Hansen Park contains recreational facilities including a basketball court, sport fields, and a playground. Access to the new well facility must minimize impacts to existing park access used by the public and avoid tree removal as feasibly possible.

Zone 7 and City O&M staff informed Carollo that the new well facility will be accessed daily by a pickup truck (e.g., Ford F-150). As such, access to well location Option 1 includes a short driveway from Hansen Drive to the well building, parking, and turnaround. Access to well location Option 2 includes a driveway from Calle Ricardo crossing the park to the well building, parking, and turnaround.

The following should also be considered when siting the driveway:

- The material of the driveway should be designed to support frequent O&M vehicle traffic and will be determined during final design.
- The alignment of the driveway should accommodate future well and pump installation and maintenance staging area requirements.
- The driveway should be installed around the perimeter of the well building.
- The location of the driveway has not been determined at this time.

2.4.1.2 Security

The security measures at the new Hansen Park well facility are the same as the new Tennis Park well facility described in Section 2.3.1.2.

2.4.2 Well Building

The well building at the Hansen Park facility will be the same as the well building at the Tennis Park facility. Refer to Section 2.3.2 for well building details.

In discussions with the City and Zone 7, the group discussed the potential of adding a restroom to the well building. Considering the City and Zone 7 have not made a final decision to include a restroom, the current 3D rendering of the well building does not include a restroom. The restroom can be added during final design if requested. However, special consideration must be taken if a restroom is added so that the well remains compliant with Division of Drinking Water horizontal setback requirements from sanitary sewer lines.

Figure 10 shows a 3D rendering of the Hansen Park well building at production well location Option 1. Figure 5 shows the well building layout in plan view.

2.4.3 Well Casing and Downhole Improvements

LSCE developed the *Hansen Park Test Well Investigation Summary and Well Design Recommendations* report to provide design recommendations for the permanent well at Hansen Park. The conceptual design is in accordance with Department of Water Resources Water Well Standards, Bulletin 74-81, 74-90; State Water Resources Control Board, Division of Drinking Water, and accepted water well design standards. Table 6 shows a summary of LSCE's design recommendations for the well and downhole improvements. The proposed well design is shown in Figure 12, which includes well screen intervals and additional downhole improvements.

Table 6 Hansen Park Well Design Recommendations

Description	Result
Conductor Casing Borehole Diameter (inches)	60
Conductor Casing Material	ASTM A-139 Grade B Steel
Conductor Casing Outside Diameter (inches)	40
Conductor Casing Thickness (inches)	0.5
Conduction Casing Install Depth Range (feet bgs)	0 – 95

Description	Result
Production Borehole Diameter (inches)	40
Production Borehole Depth (feet bgs)	775
Well Casing Material	ASTM A-778 Type 304L Stainless Steel
Well Casing Inside Diameter (inches)	24
Well Casing Thickness (inches)	0.375
Well Screen Material	ASTM A-778 Type 304L Stainless Steel
Well Screen Slot Size (inches)	0.080
Sounding Tube Material	Schedule 40, Type 304L Stainless Steel
Sounding Tube Diameter (inches)	2
Sounding Tube Install Depth Range (feet bgs)	0 – 299
Gravel Fill Material	6X9 Graded Gravel
Gravel Fill Install Depth Range (feet bgs)	262 – 775
Sand Transition Seal Install Depth Range (feet bgs)	260 – 262
Annular Seal Material	10.3-Sack Sand/Cement Grout
Annular Seal Install Depth Range (feet bgs)	0 – 260

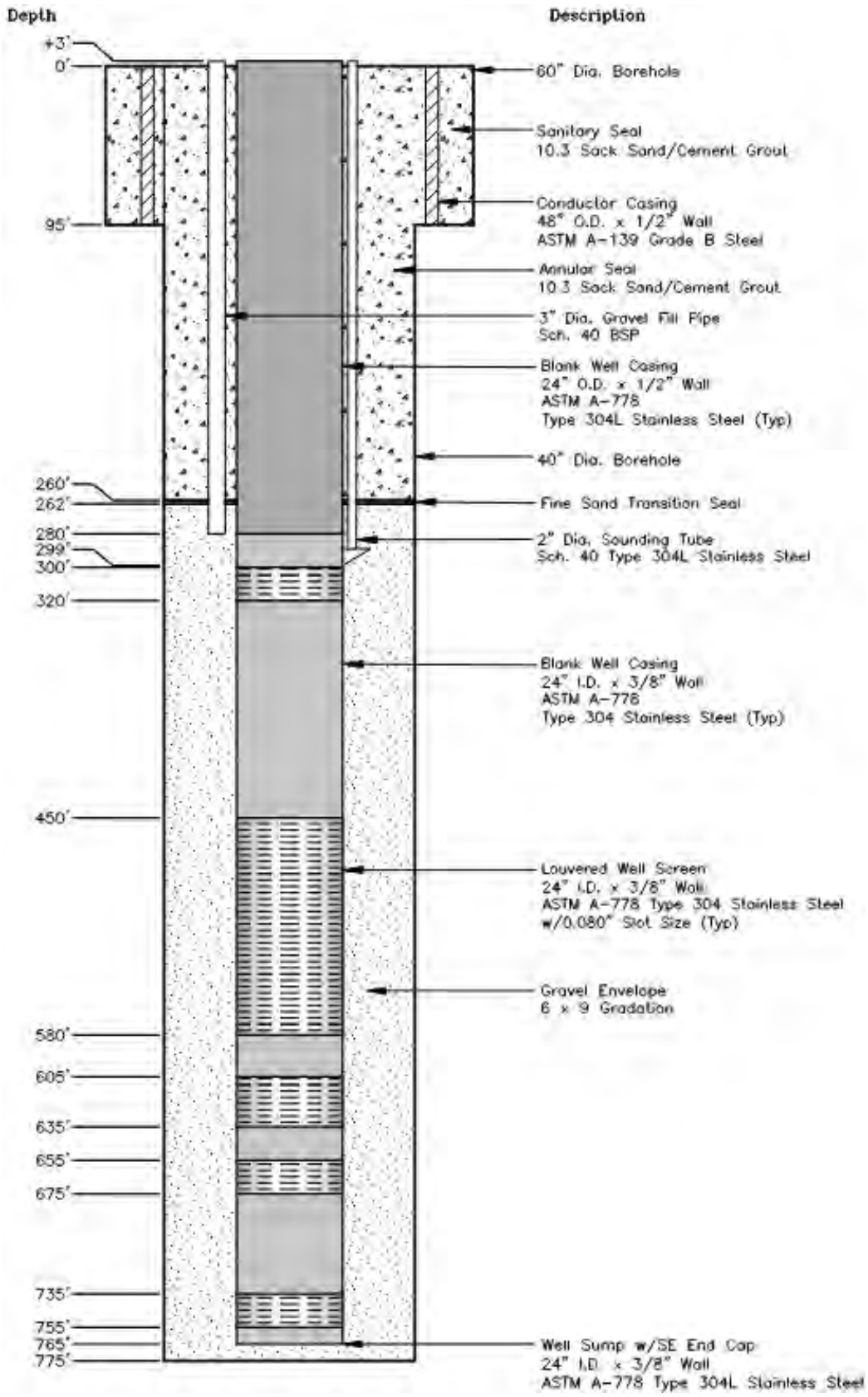


Figure 12 Hansen Park Well Proposed Design - Profile

2.4.4 Well Pump

Similar to the Tennis Park well facility, a vertical lineshaft turbine pump is recommended for the Hansen Park well facility. Refer to Section 2.3.4 for a comparison between vertical lineshaft turbine pumps and submersible vertical turbine pumps.

2.4.5 Process Mechanical Piping

The conceptual layout of aboveground process mechanical piping, valves, and appurtenances at the Hansen Park facility match the Tennis Park facility. However, discharge and pump-to-waste piping are 16 inches in diameter at the Hansen Park facility. Refer to Section 2.3.5 for discussion of process mechanical piping.

2.4.6 Test Well Exploration and Well Pump Size

LSCE installed a test well at the Hansen Park site to develop the groundwater hydraulics model, evaluate water quality, and to determine the design well capacity. Table 1 shows the estimated well capacity for the Hansen Park well.

Using test well pump data recorded on June 3, 2025, shown in Table 7, LSCE defined well pump design criteria which resulted in preliminary pump sizing as shown in Table 8. The maximum required pump brake horsepower for the Hansen Park well pump is 690 hp. As such, the pump motor will have a preliminary size of 700 hp. Note the pump size is subject to change during well development when the permanent production well is drilled and tested for actual hydraulic production capacity.

Table 7 Hansen Park Test Well Data

Description	Result
Test Date	**6/3/2025**
Static Water Level (feet bgs)	24.5
Flow Rate (gpm)	594.0
Projected 24-hour Pumping Water Level (feet)	44.0
Projected 24-hour Drawdown (feet)	19.5
Specific Capacity (gpm/feet)	30.5
Top of First Screen (feet bgs)	298.0
Available Drawdown (feet)	273.5
Maximum Well Yield Estimate (gpm)	4,200

Table 8 Hansen Park Preliminary Well Pump Sizing

Description	Result
Season Low Static Water Level Estimate (feet bgs)(1)	75.0
Top of First Screen (feet bgs)	298.0
Available Drawdown (feet)	223.0
Specific Capacity (gpm/feet)	30.5
Maximum Well Yield Estimate (gpm)	4,200
Estimated Bowl Efficiency (%)	75

Description	Result
Estimated Discharge Pressure (psi)	100
Maximum Bowl Brake Horsepower Requirement (hp)(2)	690
Nominal Well Pump Motor Size (hp)	700

Notes:
(1) Seasonal low static water level estimations based on lower aquifer groundwater elevation contour maps for 2021, 2022, and 2023.
(2) Assumes pumping water level is equal to top of screens at maximum flowrate.

2.4.7 Yard Piping

Yard piping at the facility consists of new underground piping outside of the well building and includes the following:

- 16-inch raw water discharge.
- 16-inch storm drain.
- 4-inch floor drain.
- Electrical duct bank.

Refer to Figure 13 for a conceptual layout of yard piping at the Hansen Park well facility location Option 1. Hansen Park well facility location Option 2 is close to location Option 1, which would result in a similar conceptual layout of yard piping. As such, the following section applies to both location Options for the Hansen Park well facility.

The 16-inch raw water discharge pipeline is fully restrained DIP and connects the new groundwater well pump to the 16-inch transmission main in Hansen Road. In general, the pipeline will be installed with 3.5 feet of cover. Utility investigations will be required in final design to determine the final depth of installation. Since this pipeline is pressurized, the vertical alignment can vary with minimal impacts to hydraulic performance. Location of air and vacuum relief valves and blow offs will be determined when the vertical alignment is finalized.

The 16-inch storm drain is PVC and connects the air gap structure at the well building to the nearest existing storm drain manhole. The storm drain pipeline will maintain 4 feet of cover where feasible. Since flow will be gravity-driven restrained joints are not needed. According to storm drain GIS files provided by the City, an existing 30-inch storm drain on Hansen Drive is a potential location for the 16-inch storm drain discharge. An analysis of existing storm drain hydraulics is required prior to determining the discharge location for the new 16-inch storm drain.

The pump room within the new well building will be provided with a 4-inch floor drain which will discharge to either the storm drain or sanitary sewer system. The 4-inch floor drain will maintain 3 feet of cover where feasible. Further analysis of existing storm drain and sanitary sewer system hydraulics is required prior to determining the discharge location of the 4-inch floor drain.

A concrete electrical duct bank will house electrical conduit spanning from a service connection to equipment in the well building. Further investigation into existing utilities at the site is needed to determine the location of the service connection and the alignment of the duct bank. In general, the duct bank will maintain 2 feet of cover where feasible. The cross-section of the duct bank and the number of conduits housed will be determined in final design.



Figure 13 Hansen Park Conceptual Yard Piping

2.4.8 Electrical

The electrical design elements of the Hansen Park well facility match the Tennis Park well facility. Refer to Section 2.3.8 for discussion of electrical design of the well facility.

According to existing utility records in the vicinity, a buried 21 kV routed along Hansen Drive, as shown in Figure 13, is a potential source for facility power.

Coordination with PG&E is required to determine the location of a new electrical service and associated meter. The PG&E meter enclosure will include service disconnect and secondary metering in accordance with PG&E standards.

2.4.9 Instrumentation

The instrumentation design elements of the Hansen Park well facility match the Tennis Park well facility. Refer to Section 2.3.9 for discussion of instrumentation design of the well facility.

2.5 Transmission Main

The City and Zone 7 selected the transmission main alignment shown in Figure 14 during a coordination meeting on July 31, 2025. The transmission main hydraulically connects the new Hansen Park and Tennis Park wells to the Hopyard Chloramination Facility. The transmission main ranges in pipe size from 16 to 24 inches in diameter. The following section describes the transmission main's key design considerations.



Figure 14 Transmission Main Alignment

2.5.1 Alignment

As shown in Figure 14, the majority of the transmission main is located along the edge of Hopyard Road which was identified as the preferred location by the City and Zone 7 during an alignment alternative meeting held on July 31, 2025. Approximately 2,920 linear feet (lf) of the transmission main is in Hopyard Road with a small segment, approximately 1,050 lf, in Hansen Drive.

The alignment of the transmission main should remain along roadway edges and avoid the roadway centerline as much as possible to mitigate safety hazards during operation and maintenance activities.

Refer to Appendix A for the conceptual alignment of the transmission main. Pipe alignment is subject to change following utility investigations recommended to be conducted during final design.

2.5.1.1 Canal Crossing

As shown in Figure 14, between Tennis Park and Hopyard 6 Water Treatment Plant, the transmission main crosses the Pleasanton Canal. Four 60-inch culverts convey canal flow below Hopyard Road. According to as-built markups, the top of all four culverts are 6.5 feet from the surface of Hopyard Road. As such, it is likely feasible to install the new 24-inch transmission main above the culverts and avoid crossing beneath the culverts using a trenchless installation method. However, field verification of existing utility locations is needed prior to finalizing design for the Pleasanton canal crossing.

Refer to Figure 15 for a section view sketch of the Pleasanton canal crossing and potential location for the transmission main.

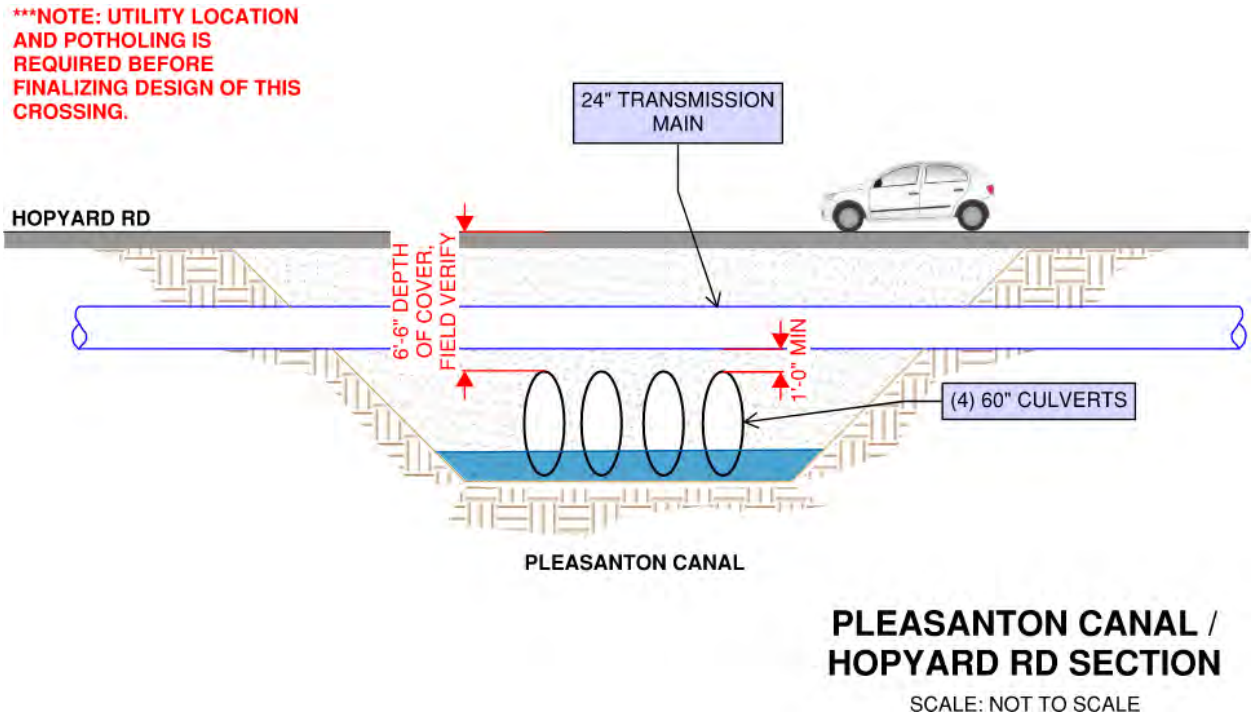


Figure 15 Pleasanton Canal Crossing - Section

2.5.2 Pipe Size

The transmission main is sized to convey up to 9,300 gpm which is the combined maximum design capacity of the Tennis and Hansen Park wells. The pipeline is sized to maintain a velocity between 5 to 7 feet per second (fps). Carollo typically sizes pipelines with a velocity between 5 and 7 fps to reduce the dynamic friction loss in the system. The following summarizes the size of the pipelines:

- The pipeline from Hansen Park to the Tennis Park/transmission main tee connection is 16-inch.
- The pipe from Tennis Park to the transmission main is 18-inch.
- Downstream of the Tennis Park/transmission main connection, the transmission main conveys flow from both wells and therefore, is sized at 24 inches in diameter to the Hopyard Chloramination Facility.

2.5.3 Pipeline Materials

We recommend considering the following materials for the transmission pipeline:

- DIP (American Water Works Association [AWWA] C151).
- Welded steel pipe (AWWA C200).
- PVC pipe (AWWA C900).

The characteristics and suitability of each pipeline material are further discussed in the following sections. Other pipeline materials were considered and dismissed because of inability to meet size and pressure requirements of this project or high-cost relative to the suitable materials listed previously.

We recommend ductile iron pipe for the transmission main pipeline for the following reasons:

- DIP is typically less expensive than welded steel at diameters less than 36 inches.
- DIP has better long-term durability as compared to PVC.

2.5.3.1 Welded Steel

Welded steel pipes can operate under high working pressures and are used often in water transmission and distribution pipelines. Welded steel pipelines can be custom designed for system pressures up to 250 psi or greater. Welded steel pipe is manufactured in accordance with AWWA C200 for diameters from 6 to 144 inches. Pipe wall thickness varies and is designed in general accordance with recommendations of AWWA M11 design manual for steel pipe.

Welded steel pipe fittings with standard bend angles of 11.25, 22.5, 45, and 90 degrees are used to accommodate horizontal and vertical changes in direction. In addition, welded steel pipe fittings can be custom fabricated to achieve exact bend angles.

Pipe segments and fittings are connected with welded joints that are made in the field. As such, welded steel pipe has a lower production rate than DIP and PVC pipe. Cement mortar lining and coating is typically installed on welded steel pipe for water conveyance projects. Additional cathodic protection may be required following a recommended corrosion analysis along the length of the proposed pipeline alignment.

2.5.3.2 Polyvinyl Chloride

PVC pipelines are commonly used for pressure transmission and distribution pipelines. PVC pipes are manufactured in accordance with AWWA C900 for sizes 4-inch through 60-inch are provided with integral bell gaskets for push-on joints and come in standard lengths of 20 feet. The maximum available pressure class rating for PVC pipe of 24-inch diameter or less is 305 psi (Dimension Ratio 14). Pressure class designations include an allowance for pressure surges above the maximum sustained operating pressure.

Horizontal and vertical changes in direction for PVC can be accommodated by deflecting pipe joints or by using standard elbow fittings. Joint deflections are used where bends less than standard fitting angles (11.25, 22.5, 45, and 90 degrees) are needed. From past project experience, Carollo recommends joint deflection is limited to 0.5 degrees, specifically for PVC pipe because joints with greater deflections are more difficult to install correctly and are typically locations for leakage.

PVC fittings are not readily available in the pressure required for this project; therefore, ductile iron fittings would be required. Ductile iron fittings typically require corrosion protection at each fitting. Thrust restraint can be provided by thrust blocks, restrained push-on joints, or with more expensive restrained mechanical joints and harnesses.

Pipe structural design would be in accordance with AWWA M23 PVC design manual.

2.5.3.3 Ductile Iron

DIP is also commonly used for pressure transmission and distribution pipelines. For pipe sizes considered in this project (see Section 6.2), DIP is manufactured in 200 psi pressure class through 350 psi as well as special thickness classes 50 through 56. Standard lay lengths for DIP are 18 feet or 20 feet.

Similar to PVC, DIP can deflect at joints or use standard fittings to accommodate horizontal and vertical changes in direction. From past project experience, Carollo recommends DIP joint deflection is limited to 50 percent of the manufacturer's recommended maximum joint deflection angle.

Unrestrained joints are push-on, gasketed joints. DIP is available with a variety of self-restrained joints including mechanical bells, locking gaskets, and locking segmented joints. Carollo recommends locking segmented joints for restrained pipe based on cost, past project performance, and the speed of installation. Restrained mechanical joints, where required, would be a mechanical joint bell end with a restraining gland. Standard ductile iron fittings are available in 11.25-, 22.5-, 45-, and 90-degree bends and are rated up to 350 psi working pressure.

DIP is typically cement mortar lined and asphaltic coated with a polyethylene sleeve to serve as a dielectric barrier to inhibit corrosion cell formation along the pipeline. Additional cathodic protection may be required following a recommended corrosion analysis along the length of the proposed transmission main alignment. Pipe structural design will be in general accordance with the recommendations of AWWA M41 design manual for DIP.

2.6 Hopyard Chloramination Facility Improvements

The transmission pipeline from the Tennis Park and Hansen Park wells will connect to Zone 7's existing system near the Hopyard Chloramination Facility. Increasing the capacity of the well supply also requires improvements to the existing chloramination facility at the Hopyard Chloramination Facility. This section summarizes the pipeline connection and chemical system improvements required at the Hopyard Chloramination Facility.

2.6.1 Transmission Main Tie-In

The 24-inch transmission pipeline from the new Hansen and Tennis Park Wells will connect to the existing 24-inch Hopyard Chloramination Facility discharge pipeline as shown in Figure 10. The tie-in will consist of the following:

- Valve and chemical injection vault.
- 24-inch butterfly valve with handwheel operator.
- 24-inch tee fitting.
- Approximately 50 lf of 24-inch piping to replace a portion of the existing 24-inch Hopyard 6 pipeline.
- 24-inch pipeline conveying combined flow from Hopyard 6 well, Tennis Park well, and Hansen Park well.
  - » Length of pipeline to be determined during final design with special consideration of chemical mixing.
- Restrained flexible couplings (as needed).
- Chemical injection quills for ammonia and sodium hypochlorite.
- Isolation joint flange kit.

As shown in Figure 16, downstream of the 24-inch transmission main tie-in, chemicals will be injected into the new 24-inch combined pipeline which conveys combined flows from three production wells during maximum demand scenarios: Hopyard 6 well, Tennis Park well, and Hansen Park well. This chemical injection location is recommended because a single injection point is needed to chemically dose flows from all three production wells.

Hydraulic modeling of Zone 7's transmission system including the new wells is required prior to final design to determine if the existing 24-inch Hopyard Chloramination Facility discharge pipeline will require upsizing to accommodate the flows from the new Tennis Park and Hansen Park wells. Furthermore, all downstream piping from the new 24-inch transmission main tie-in, including the existing 20-inch Hopyard Well 6 and the existing 24-inch Mocho pipelines should be modeled and analyzed for potential upsizing. Hydraulic modeling will also confirm the minimum and maximum system pressures under dynamic flow conditions which will dictate pipe wall thicknesses and well pump design criteria.

Improvements to existing Zone 7 transmission pipelines that may be triggered by this project are not included in the joint project between Zone 7 and the City. Improvements to existing Zone 7 transmission pipelines will be the responsibility of Zone 7. It is the City's understanding that pressures at turnouts will not be significantly impacted by this joint project.

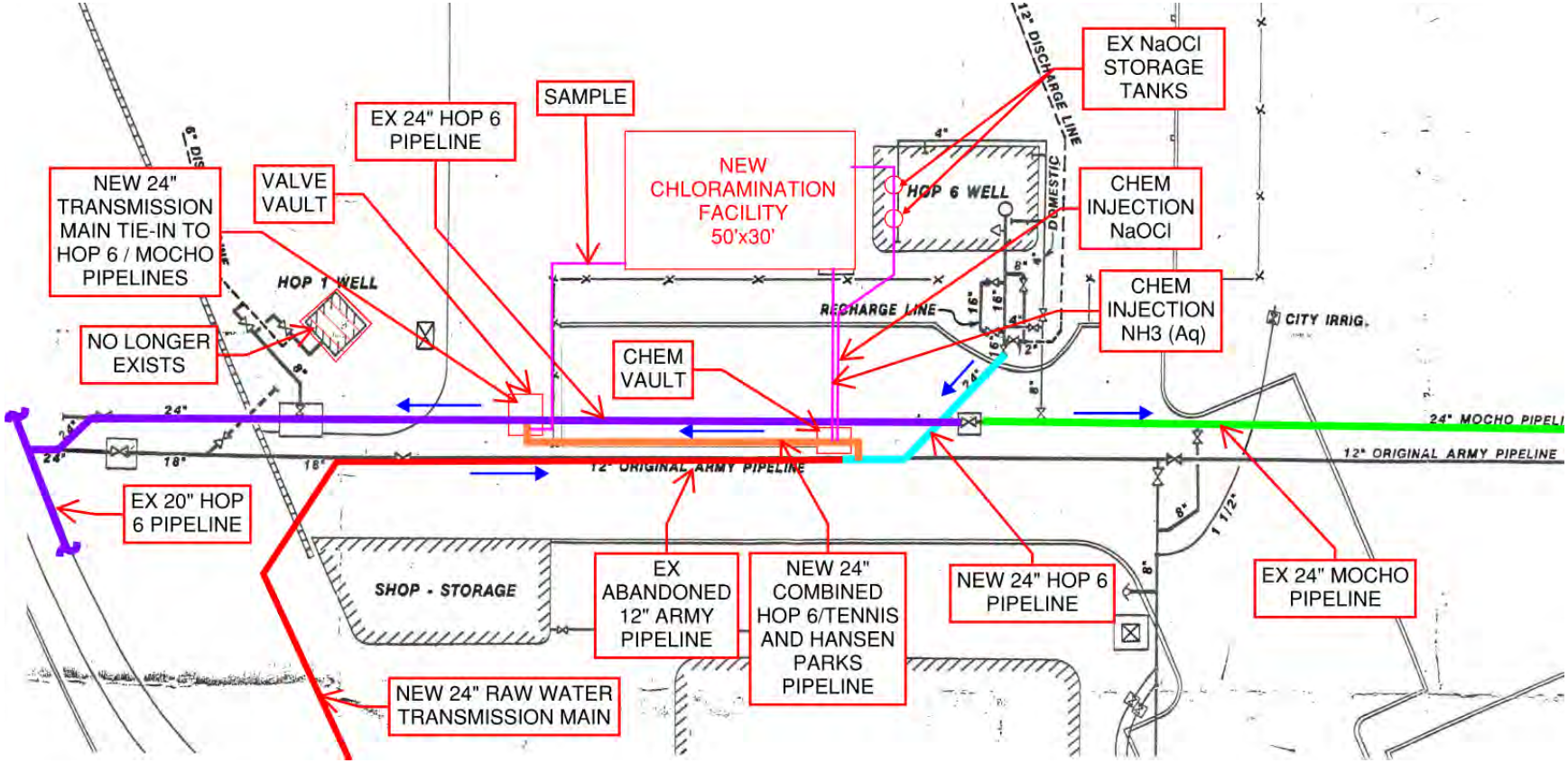


Figure 16 Transmission Main Tie-In to Hopyard Chloramination Facility

2.6.2 Chloramination Facility Improvements

The existing Hopyard Chloramination Facility includes equipment and infrastructure for chlorine and ammonia injection in the existing 24-inch Hopyard Chloramination Facility well discharge pipeline. To accommodate additional flow from Tennis Park and Hansen Park wells, the existing chloramination infrastructure will need to be expanded.

As advised by Zone 7, the existing ammonia storage/feed building (not shown in reference documents provided by Zone 7), will be replaced with a new chloramination facility with an approximate footprint of 30 feet wide by 50 feet long. Note the footprint of the new chloramination building is subject to change in final design and the building is currently designed to be single room. The new chloramination building will house the following equipment to inject both sodium hypochlorite and ammonia into water being discharged into Zone 7's water transmission system:

- Sodium hypochlorite dosing pumps.
- Ammonia dosing pumps.
- 2,000-gallon ammonia storage tank.
- 6,000-gallon sodium hypochlorite storage tank.
- Sodium hypochlorite supply pump.

Note the sodium hypochlorite supply pump will convey sodium hypochlorite from the new chloramination building to existing sodium hypochlorite storage tanks inside the Hopyard Chloramination Facility well building. The new 6,000-gallon sodium hypochlorite storage tank will supplement the existing storage tanks.

Ammonia and sodium hypochlorite equipment will be stored in separate rooms within the new chloramination building.

2.7 Cost Estimate

The following section summarizes the estimated budgetary cost estimate prepared for the Project.

2.7.1 Basis for Estimate

The Project is at the preliminary engineering phase with limited design information. The construction cost estimates are consistent with the Association for the Advancement of Cost Engineering (AACE) International Class 4 estimate with an accuracy range of +50 percent to -30 percent of the actual project cost.

2.7.2 Contingencies

Contingencies are applied to a construction estimate at the design development phase to account for construction items not yet identified and design unknowns. We recommend carrying 30 to 50 percent contingency during the conceptual design phase of a project considering the design details are not known at this time. The contingency will be reduced as the design is developed.

The cost estimate presented in this basis of design report includes a 30 percent contingency, calculated based on the raw construction cost. This is in alignment with the recommendations for a project at an AACE International Class 4 level of development.

2.7.3 Tennis and Hansen Park Well Project Cost Estimate

Table 9 presents a summary of the cost estimate. Refer to Appendix B for the Class 4 cost estimate.

Table 9 Opinion of Probable Project Cost

Cost Item	Cost (rounded)
Mobilization	$800,000
Transmission Main (DIP)	$2,400,000
Tennis Park Well Drilling and Casing Installation	$2,000,000
Tennis Park Well Facility	$5,850,000
Hansen Park Well Drilling and Casing Installation	$2,000,000
Hansen Park Well Facility	$5,850,000
Chloramination Upgrades	$1,000,000
Direct Cost Subtotal	**$15,900,000**
Sales Tax (10.25% on Half the Direct Cost)	$820,000
Contingency (30%)	$5,020,000
Escalation to Mid-Point (5% With Mid-Point in August 2027)	$2,140,000
General Conditions, Contractor Overhead and Profit (15%)	$3,590,000
Construction Change Order Allowance (10%)	$2,750,000
Total Estimated Construction Cost(1)	**$30,220,000**
Estimated Low Range Construction Cost Total (-30%)	**$21,160,000**
Estimated High Range Construction Cost Total (+50%)	**$45,330,000**
Engineering, Legal, and Administration (40%)	$12,088,000
Total Estimated Project Cost(2)	**$42,308,000**

Notes:
(1) Indirect cost factors are applied to the running subtotal of direct costs plus preceding indirect cost.
(2) Cost estimate developed in December 2025; used ENR CCI 15276 (May 2025).

2.8 Next steps

We recommend the following next steps to develop the Project.

- Perform the California Environmental Quality Act study for the selected alternative.
- Identify key permits and begin permit acquisition.
- Develop a hydraulic model of Zone 7's water transmission system with the new Tennis and Hansen Park wells to evaluate impacts from the additional flow conveyed into the existing water transmission system. The hydraulic model should consider the following:
  - Confirm the Tennis Park and Hansen Park motor hp estimates developed by LSCE and reported in this report. Note motor hp cannot be fully confirmed until the production wells are drilled and tested for actual hydraulic production capacity.

  - The discharge pressure of the existing system where the pipeline from the Tennis and Hansen Park wells connects to Zone 7's existing transmission and distribution system.
  - Turnout demands within Zone 7's transmission system.
  - The pressure class of the transmission pipelines.
- Perform a hydraulic surge analysis of the existing Zone 7 transmission system considering the additional supply from the new Tennis and Hansen Park wells. The hydraulic surge analysis should also consider the new transmission pipeline from the wells to the Hopyard Chloramination Facility.
- Perform field investigations including the topographic survey, geotechnical field investigation, and potholing of existing utilities.
- Submit the power service application to PG&E for each new well site. This may be a long lead time item considering the Tennis and Hanson Park wells will likely require a medium voltage service.
- Develop final design of the project, including 30, 60, 90, and 100 percent contract documents:
  - We recommend prioritizing the design and construction of the production wells since well development and testing will directly affect equipment sizing including pumps, motors, electrical service, etc.

SECTION 3 POTENTIAL FUTURE TREATMENT FACILITIES

3.1 Introduction

This section of the *BODR* evaluates potential future treatment systems that may be required to address assumed future water quality as described under Task 8. Preliminary design criteria, layout, and costs are presented for each of the facilities intended to address the following water quality parameters:

- TDS.
- PFAS.
- TDS and PFAS.

3.2 Total Dissolved Solids Removal Facility

Per Zone 7's Salt Management Program (SMP) and Water Quality Management Program (WQMP), Zone 7 targets an annual salt export goal of 4,000 tons of salt removal from the groundwater basin while also improving its delivered water quality by reducing TDS levels to less than 500 milligrams per liter (mg/L) and total hardness to less than 150 mg/L. The current salt export mechanism is reverse osmosis (RO) concentrate from the Mocho Groundwater Demineralization Plant (MGDP).

Though not necessitated by water quality limits at this time, it is anticipated that TDS in the portion of the basin where the current Hopyard wells and future Tennis and Hansen wells are located could increase to levels that would require treatment to meet Zone 7's SMP and WQMP.

This section of the report evaluates centralized TDS removal at the Hopyard Chloramination Facility, for the Hopyard 6, Tennis Park, and Hansen Park wells, with the assumption that Hopyard 9 flows are not to be included. For this evaluation, it is assumed Hopyard 6 contributes 3,800 gpm, and Tennis Park and

Hansen Park contribute a combined 9,300 gpm to the maximum combined treated flow of 13,100 gpm, with future water quality consisting of a TDS of 900 mg/L and total hardness of 500 mg/L.

3.2.1 Overview of Technologies for Total Dissolved Solids Removal

Desalination is the removal of salts and minerals from high-TDS water. Tens of thousands of desalination plants operate worldwide, and most commonly, desalination is used to treat water suitable for human consumption or irrigation.

Several methods are available for desalination. Common options include:

- RO:
  - A pressure-driven process that removes dissolved materials from water by forcing the water through a semi-permeable membrane. RO systems can achieve a high salt rejection rate (over 90 percent). This process has been used to remove TDS from the Mocho Wellfield at MGDP.
- Nanofiltration (NF):
  - A pressure-driven process similar to RO. NF membranes have a lower rejection rate for salt as compared to RO (less than 80 percent) due to the larger pore sizes of the NF membranes but can still be effective in removing hardness. If the goal is to maximize the removal of TDS, RO is the more effective pressure-membrane filtration process and consistent with the technology already used by Zone 7.
- Ion exchange (IX):
  - IX (deionization) resins may also be used to lower TDS. Deionization for salt removal requires using both anion and cation resins to remove the positively charged sodium ions and negatively charged chloride ions. These resins require frequent regeneration with concentrated acid and base that must be discharged.
- Electrodialysis reversal (EDR):
  - An electrically-driven process that removes salts from water using cation- and anion-selective membranes. EDR is often used for niche applications where source waters have high silica concentrations and feed water TDS concentrations less than 3,000 mg/L. EDR is generally not economical when compared to RO for TDS concentrations greater than 3,000 mg/L, despite the additional chemical treatment required for silica removal.
- Thermal processes:
  - The traditional approach is to boil water, leaving any impurities behind, though freezing may also be used. Due to the expensive materials required for thermal desalination, thermal desalination is typically only practiced when there is a source of waste heat.
- Precipitative softening:
  - A process that removes hardness, mainly calcium and magnesium, by converting them into insoluble precipitates through the addition of a chemical (lime or caustic) to raise the pH, driving the formation of calcium carbonate and potentially magnesium hydroxide. These solid particles are then removed, typically through a clarification and filtration process. While the reduction of hardness will lower the TDS of the water, the process will not lower the chloride concentration to maximize TDS removal.

Other desalination technologies such as forward osmosis, capacitive deionization, and others are experimental, not commercially viable, and/or not proven to be reliable enough for a municipal water agency, trusted with providing safe and reliable water to the public for potable use and fire protection, to implement for a large capital project such as the one Zone 7 is considering.

3.2.2 Recommended Technology – Reverse Osmosis

RO is a pressure-driven separation process that employs a semi-permeable membrane to separate water from the dissolved salts. High pressure is used to force the water through the RO membrane, leaving behind the dissolved salts. The products of an RO process are permeate that passes through the membrane, and concentrate which is a brine solution with a high concentration of dissolved salts. The permeate is typically stabilized to manage corrosivity, and disinfected prior to distribution for potable consumption. The concentrate may be ultimately disposed of through ocean outfalls, deep-well injection, or further dewatering.

RO is a global standard for water desalination for applications such as this and is currently utilized at Zone 7's MGDP. If TDS removal is needed in the future, RO can provide a finished water quality consistent with that already produced for Zone 7's transmission system and is the recommended treatment technology, as discussed in further detail in the following sections.

3.2.2.1 Reverse Osmosis System Configurations

Essential components of an RO system include a pump, a pressure vessel containing membrane elements, and a concentrate valve. Those components can be used to create a single-stage system, the most basic RO system possible. In a single-stage system, one stream enters the membrane element and two streams exit. The entering stream is feed water with a high-TDS concentration, and the two streams exiting the membrane are permeate and brine. Since the permeate only passed through a membrane once, such a system would be called a one-pass system.

The total recovery of an RO system can be increased by adding membrane elements in series and staging pressure vessels into arrays to separate additional water from the concentrate. In a two-stage system with concentrate staged arrays, the brine from the first stage becomes the feed water for the second stage, which is shown in Figure 17. Permeate from the second stage combines with permeate from the first stage prior to stabilization and disinfection. MGDP utilizes a two-stage system similar to the simplified flow diagram shown in Figure 17.

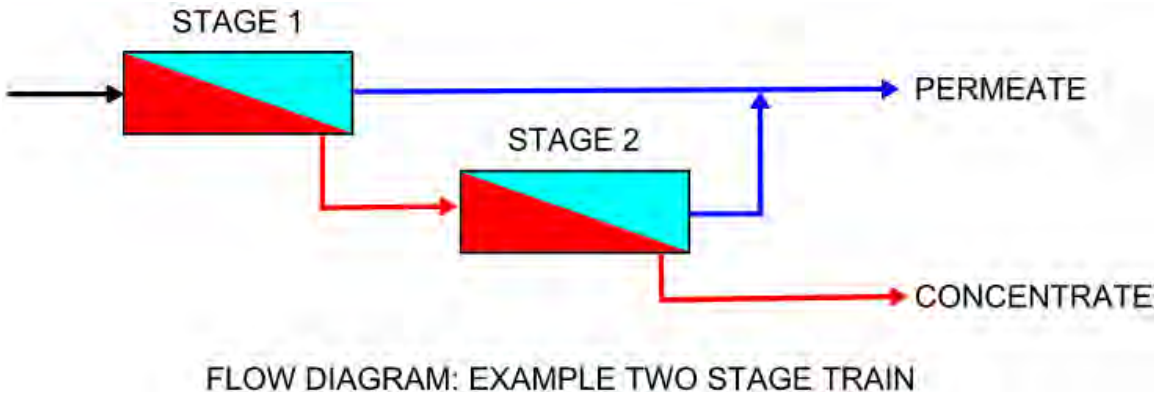


Figure 17 Simplified Two-Stage RO System Flow Diagram

Two-pass systems are used when permeate from one-stage becomes the feed for a second stage. Seawater RO systems often utilize two-pass systems to improve permeate quality.

3.2.2.2 Reverse Osmosis System Performance

The driving force of the RO membrane process is a hydraulic pressure gradient between the feed and permeate sides of the membrane. Typical operating pressures for a seawater RO plant range from 800 to 1,250 psi. Operating pressures for a brackish water RO plant are lower and typically range from 130 to 600 psi (MGDP Stage 1 feed pressures are typically 112 to 120 psi). Factors affecting the operating pressure may include raw water quality, desired permeate quality, desired recovery, membrane age and type, and RO train configuration. Seawater RO plants can have recovery rates ranging from 35 to 60 percent. Brackish water plants can obtain recovery rates between 60 and 90 percent. Historically, MGDP has achieved a recovery rate of 80 percent.

3.2.2.3 Operation and Maintenance Considerations

Pre-treatment and cleaning are a normal part of operating an RO system. Mineral scale, organic matter, or particulate matter deposited on the surface of the membrane can result in higher feed pressures, an increase in permeate TDS concentration, and/or an increase in feed/brine channel differential pressure. A successful pre-treatment and cleaning can remove the particulate matter and maintain membrane production as close to the original operating parameters as possible. A clean-in-place system is incorporated into the overall design of an RO system. The provisions of a clean-in-place system generally include:

- Cleaning solution tank(s) with heater(s).
- Pump(s).
- Cartridge filter(s).
- Miscellaneous valves, pipes, etc.

3.2.2.4 Concentrate Disposal

Currently, brine generated at Zone 7's MGDP RO facility is conveyed to Dublin San Ramon Services District (DSRSD) and is then disposed through the Livermore-Amador Valley Water Management Agency (LAVWMA) pipeline. This pipeline is used to dispose of treated wastewater for DSRSD, the City, and the City of Livermore. The LAVWMA pipeline transports the effluent from DSRSD, 16 miles to San Lorenzo, where it is discharged into East Bay Dischargers Authority's dechlorination facility, and then a deep water outfall in San Francisco Bay.

A similar connection to the LAVWMA pipeline would likely be needed here, as well as a new pipeline to transport concentrate from the Hopyard facility to the LAVWMA pipeline. Concentrate handling alternatives should be further investigated if an RO facility is planned for the future.

3.2.2.5 Additional Treatment

RO water treatment plants commonly blend bypass water or add chemicals into the RO permeate to introduce alkalinity and hardness into the aggressive, RO-treated water. This is important to minimize infrastructure corrosion downstream of the RO system, as well as provide stability of water quality in the finished water transmission system.

For consistency with other treated waters in Zone 7's system, chlorine and ammonia would be added before and after a storage tank or clearwell to provide contact time for primary disinfection and maintain a combined chlorine (chloramine) residual in the finished water transmission system.

3.2.3 Reverse Osmosis System Design Criteria

Design criteria for an RO system sized to meet the following flow and treated water requirements are presented in Table 10:

- Wellfield flow: 13,100 gpm.
- Treated TDS: < 500 mg/L.
- Total hardness: < 150 mg/L.

Table 10 RO Design Criteria

Parameter	Units	Full Wellfield Treatment
Feed Water TDS Concentration	mg/L	900
Feed Water Total Hardness Concentration	mg/L	500
Total Design Flow	gpm	13,100
Bypass Flow	gpm	4,320
Membrane Flow	gpm	8,780
Permeate Flow	gpm	7,020
Concentrate Flow	gpm	1,760
System Recovery	%	80
No. of RO Trains	-	4
No. of RO System Passes	-	1
No. of Stages per Pass	-	2
No. of Stage 1 Pressure Vessels per Train	-	44
Stage 1 Average Flux	gfd	15.4
No. of Stage 2 Pressure Vessels per Train	-	22
Stage 2 Average Flux	gfd	10.2
No. of Elements per Pressure Vessel	-	7
Blended Water TDS Concentration	mg/L	400
Blended Water Total Hardness Concentration	mg/L	191(1)

Notes:
gfd - gallons per square foot per day.
(1) Exceeds Zone 7's internal goal of 80 percent of the secondary maximum contaminant level.

A potential site layout for the RO system building is presented in Figure 18 The building footprint for a system of this size is approximately 22,000 sf. This building would house the RO trains and all necessary support systems, such as chemical storage and feed systems, pumps, electrical gear, etc.



Figure 18 Potential RO System Site Layout

3.2.4 Reverse Osmosis System Cost Estimate

The opinion of probable construction cost presented in Table 11 represents a Class 5 budgetary estimate as defined by AACE International. Bids would be expected to fall within a range of 100 percent over the estimate to 50 percent under the estimate. The opinion of probable construction cost is based on preliminary quantity take-off for RO systems. The capital costs are shown in 2025 dollars and were developed using:

- Budgetary equipment estimates for major components.

- Percentage multipliers for electrical, instrumentation, and mechanical portions of the project based on recently bid projects of similar scope. Conceptual cost opinions and quantity takeoffs are included in Appendix C.

Table 11 Conceptual Cost Opinion

Cost Item	Cost (Rounded)
RO Building	$7,250,000
Brine Pipeline and Pump Station	$2,850,000
Equalization and Chlorine Contact Basin	$2,450,000
Booster Pumps	$600,000
RO System Package(1)	$10,000,000
Decarbonators	$450,000
Caustic Storage and Feed System	$500,000
Scale Inhibitor Storage and Feed System	$300,000
CIP Chemical Storage	$150,000
High-Rate Service Pumps	$1,000,000
Electrical, Instrumentation, and Controls (35% applied to equipment costs)	$4,550,000
Installation (30% applied to equipment and electrical, instrumentation, and control costs)	$5,250,000
Site Work(2) (25% applied to equipment costs)	$3,250,000
Yard Piping and Valves (25% applied to equipment costs)	$3,250,000
Process Piping and Valves (30% applied to equipment costs)	$6,850,000
Site Complexity (5% applied to equipment costs)	$650,000
Direct Cost Subtotal	**$49,300,000**
Sales Tax (10.25% on Half the Direct Cost)	$2,550,000
Undefined Scope Contingency (30%)	$15,550,000
General Conditions, Contractor Overhead & Profit (30%)	$20,200,000
Construction Changer Order Allowance (10%)	$8,750,000
Total Estimated Construction Cost(3)	**$96,300,000**
Estimated Low Range Construction Cost Total (-50%)	**$48,150,000**
Estimated High Range Construction Cost Total (+100%)	**$192,600,000**
Engineering, Legal, and Administration (40%)	$38,500,000
Total Estimated Project Cost	$134,800,000

Notes:
CIP - clean-in-place.
(1) RO system package includes cartridge filters, feed pumps, RO skids, interstage pumps, CIP skid, and instrumentation.
(2) Site work does not include demolition of existing Parkside office facilities.
(3) Indirect cost factors are applied to the running subtotal of direct costs plus preceding indirect cost.

Cost estimates does not consider potential property/easement acquisition or demolition of existing structures.

3.3 Per- and Polyfluoroalkyl Substances Removal Facility

PFAS has not been detected at the location of the Hopyard 6 wells or at the location of the future Tennis and Hansen. PFAS has been detected elsewhere in the basin and at several of Zone 7's existing well facilities (Chain of Lakes, Mocho, and Stoneridge), which has necessitated PFAS treatment at those facilities.

This section of the report evaluates several treatment technologies if future centralized PFAS removal for the Hopyard 6, Tennis Park, and Hansen Park wells is required, with the assumption that Hopyard 9 flows are not to be included. For this evaluation, a maximum combined treated flow of 13,100 gpm has been assumed, as well as the water quality assumptions in Table 12.

Table 12 Assumed PFAS Concentrations and Treated Water Targets

Water Quality Parameter	Assumed Raw Water Concentration(1)	U.S. EPA PQL	Zone 7 Treated Water Goal (<U.S. EPA PQL)(2)
PFOS (ppt)	67	4.0	<4.0
PFOA (ppt)	6	4.0	<4.0
PFHxS (ppt)	50	3.0	<3.0

Notes:
EPA - Environmental Protection Agency; PFHxS - perfluorohexane sulfonic acid; PFOA - perfluorooctanoic acid; PFOS - perfluorooctane sulfonic acid; PQL - Practical Quantitation Level, U.S. - United States.
(1) Assumed raw water PFAS concentrations represent highest values at Zone 7's Mocho well sites.
(2) Note Zone 7's water quality target table in Appendix E of the *Feasibility Study* prepared by LSCE lists concentrations lower than these values.

3.3.1 Technologies for Per- and Polyfluoroalkyl Substances Removal

The following treatment processes have been identified as best available treatment technologies for PFAS removal and will be discussed in this section:

- Granular activated carbon (GAC).
- IX.
- RO or NF.

3.3.1.1 Granular Activated Carbon

GAC is a porous material with a high volumetric surface area that effectively adsorbs many contaminants, including varieties of PFAS. Carbon life for PFAS removal can vary widely depending on the carbon type, target contaminant concentrations, background water quality, and PFAS carbon chain length. In general, GAC adsorbs longer-chain PFAS (e.g., PFOS and PFOA) better than shorter-chain PFAS (e.g., PFHxS).

GAC adsorption systems also require a backwash supply and means for handling the residual backwash flow. This is to address carbon bed compaction, carbon particle degradation (aka carbon fine generation) that can occur during transport, loading, and normal operation of GAC systems. Backwashing is required to reverse carbon bed compression, remove accumulated sediment produced by wells, and remove GAC fines.

This analysis assumes that GAC processes would use pressure contactors in lead/lag configuration to allow water to pass through. The lead/lag series configuration of the pressure vessels means water flows first through one vessel (lead vessel) and then through the second vessel (lag vessel). Piping and valves between the two vessels allow vessels to alternate between the lead and lag position or to bypass the lead vessel if the vessel needs to be offline for media replacement. The lead vessel will always provide treatment, and breakthrough of PFAS will be monitored through the GAC bed and/or between the lead and lag vessels. The lag vessel provides an additional barrier for PFAS treatment and also maximizes media throughput for the lead bed. Once breakthrough is imminent into the lag vessel, the GAC media in the lead vessel will be changed out, and the vessel will then be placed in the lag position.

The exhausted GAC that has been removed can then be thermally regenerated (reactivated) to be returned to service or incinerated for disposal. GAC regeneration would not be practical to perform on-site and would require the spent GAC to be hauled off-site. The regeneration process heats the GAC to burn off the adsorbed contaminants; however, there is still some discussion about whether the temperatures typically used for regeneration are sufficient for PFAS destruction.

Figure 19 shows a typical example of a full-scale GAC pressure adsorption lead/lag pressure vessel system.



Figure 19 Example Pressure GAC Adsorption Lead-Lag Pressure Vessels

3.3.1.2 Ion Exchange

Synthetic IX resins can also be used for PFAS removal. An IX treatment system uses pressure vessels, like GAC pressure contactors, but with an IX resin bed installed. These systems generally do not require backwash supply and disposal, but do typically have additional pre-treatment system(s), like cartridge or bag filters, to protect the IX resin from solids accumulation (see Section 3.4).

The non-regenerable single-use PFAS selective resins most frequently used for PFAS removal at municipal facilities provides typically have a higher capacity for PFAS compounds (i.e., last longer) than GAC media, they require smaller pressure vessels (IX requires less contact time and may be operated at higher hydraulic loading rates [HLR] than GAC), but are more expensive per unit volume of media as compared to GAC.

Once IX removal capacity for the given effluent quality has been reached, it must be sent off-site for disposal and be replaced with virgin media.

This evaluation assumes that IX will use pressure contactors in lead/lag configuration. Figure 20 shows a typical example of full-scale IX vessels.



Figure 20 Example IX Pressure Vessels at Zone 7's Stoneridge Treatment Plant (SRTP)

3.3.1.3 Reverse Osmosis and Nanofiltration

RO and NF are well-established purification processes that use semi-permeable polymeric membranes and a driving force of inlet water pressure to remove dissolved salts. Although originally developed for desalination, they have been demonstrated to effectively remove a wide variety of organic constituents, including PFAS.

In RO and NF, the product water (or permeate) can range from 50 percent to greater than 90 percent of the feed flow, depending primarily on the feedwater chemistry and the resulting concentrate. RO and NF removal efficiencies for selected compounds depend on the membrane selected. No PFAS have been detected in the MGDP RO permeate.

3.3.2 Recommended Technology – Ion Exchange

A previous PFAS feasibility study, *Technical Memorandum 1 - PFAS and Hexavalent Chromium Treatment Feasibility Study* (Carollo 2020), included an alternatives analysis for the different treatment options at different wellhead and centralized treatment locations. Based on the results of that study, IX treatment has been implemented at Zone 7's SRTP and Chain of Lakes Treatment Plant (COLTP). Similarly, IX treatment is recommended here due to the following considerations:

- IX has a smaller footprint than GAC, and the shorter IX pressure vessels will have a smaller visual impact to the community.
- The anticipated location for a centralized PFAS treatment system is on property not currently owned by Zone 7 and would need to be acquired or easements obtained. Smaller property acquisition is preferred.
- Zone 7 has utility and operator familiarity with IX from COLTP and SRTP.

For each of the technologies considered, a pretreatment system is necessary to protect the downstream treatment system. Pretreatment is discussed in further detail in the following section.

3.3.3 Pretreatment Design Criteria

IX resin can become fouled by inorganic precipitation (e.g., iron, manganese, arsenic, etc.) or sediment retention, negatively impacting performance since the adsorption sites are mainly located within media pores. Therefore, pretreatment to remove solids is important for these groundwater treatment systems to protect downstream process equipment. This step is particularly important in the event of a well casing failure or if sand, gravel, or other sediment is present in the well discharge. As indicated in the *Feasibility Study* prepared by LSCE, removal of metals or excessive sediment is not anticipated at this time.

Pretreatment helps mitigate potential damage from sediment, which can increase differential pressure across IX resin beds, leading to more frequent changeouts or the need to manually remove accumulated sediment (and a portion of the IX media). Unlike with GAC, IX media cannot be backwashed due to the uniform size and low density of the beads, which fluidize at low HLRs, and do not re-stratify to generally preserve the PFAS removal mass transfer zone. This study assumes the inclusion of high-flow cartridge filters, configured in duty and standby units, for the influent stream of IX groundwater treatment systems. The design criteria for the cartridge filters are shown in Table 13.

Table 13 Sediment Removal Design Criteria

Parameter	Units	Full Wellfield Treatment
Design Flow	gpm	13,100
Quantity	-	3 (2 duty, 1 standby)
Design Flow per Housing	gpm	7,000
Cartridge Type	-	High flow cartridge type
Cartridge Diameter	inches	6
Cartridge Length	inches	60
No. of Cartridges per Vessel	-	28
Design Flow per Cartridge	gpm	250
Filter Cartridge Rating	micron	5

The site layouts and hydraulic analysis included additional footprint and headloss to add sand separators to the treatment system in the future should the existing wells degrade or future wells produce too much coarse sediment for the cartridge filters to effectively manage. The sand separator units would be added to the system, if required, after initial operations of the PFAS Treatment Facility indicate their need.

3.3.4 Ion Exchange System Design Criteria

The critical design parameters for IX systems are summarized in Table 14. The HLR is the flow through the vessel divided by the vessel cross section area, and is one of the primary considerations when determining the number of vessels. The empty bed contact time (EBCT) is the time for the water to travel from the top of the media to the bottom of the media, driving the height of the vessels. These two parameters are explained further in Figure 21. The benefits to having a higher HLR is fewer vessels, reducing both site footprint and capital costs. The disadvantages are that the media changeouts will need to be more frequent and the system will be operating with a higher pressure differential leading to an increase in operational costs. The IX design criteria are summarized in Table 15.

Table 14 Critical Design Parameters

Parameter	Typical Values	Design Considerations
EBCT (minutes)	2-3	Maximize PFAS removal and meet minimum bed depth.
HLR (gpm/sf)	6-16	AWWA guidance: ≤12 gpm/sf. Manufacturer recommendation: ≤16 gpm/sf (media specific).
Vessel diameter (feet)	12	8, 10, and 12 feet are common diameters. 12 feet is standard size and reduces the number of pressure vessels.

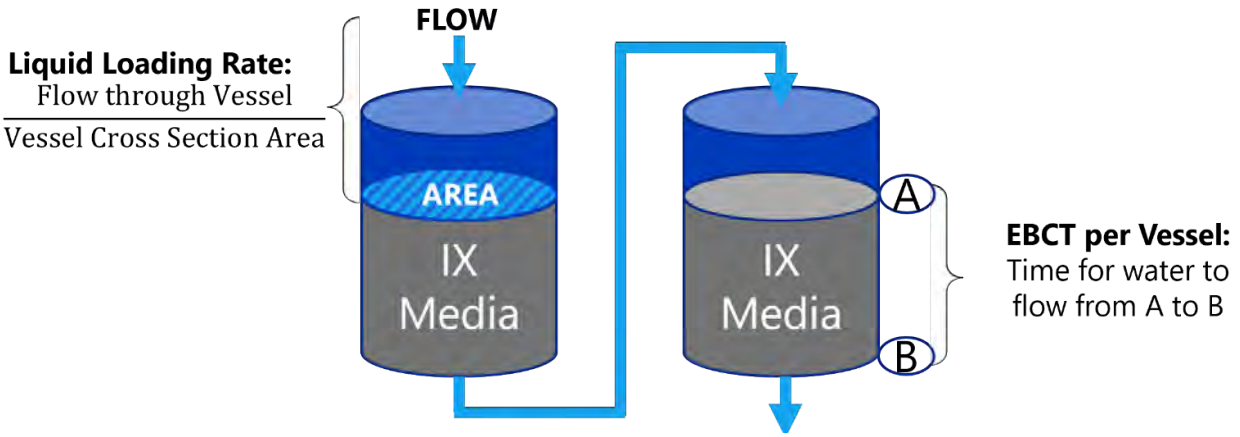


Figure 21 HLR and EBCT Diagram

Table 15 IX Conceptual Design Criteria

Parameter	Units	Full Wellfield PFAS Treatment
Design Flow	gpm	13,100
Configuration	-	Lead-Lag
No. of Treatment Trains	-	10
No. of Contactors per Train	-	2
No. of Contactors	-	20
Vessel Diameter	feet	12
Vessel Height	feet	16.3
Design Flow per Train	gpm	1,310
IX Bed Surface Area/Vessel	sf	113.1
Liquid Loading Rate	gpm/sf	11.6
Media Type	-	Single-use anion exchange resin
Volume of Resin/Vessel	cubic feet	462
IX Resin Bed Depth	feet	4.1
EBCT, Lead+Lag	minutes	5.3

A potential site layout for the IX treatment system is presented in Figure 22. If needed, additional space for sand separators in the pretreatment system and a booster pump station downstream of treatment are shown. The sand separators and pump station were not considered as part of the cost evaluation in the following section.

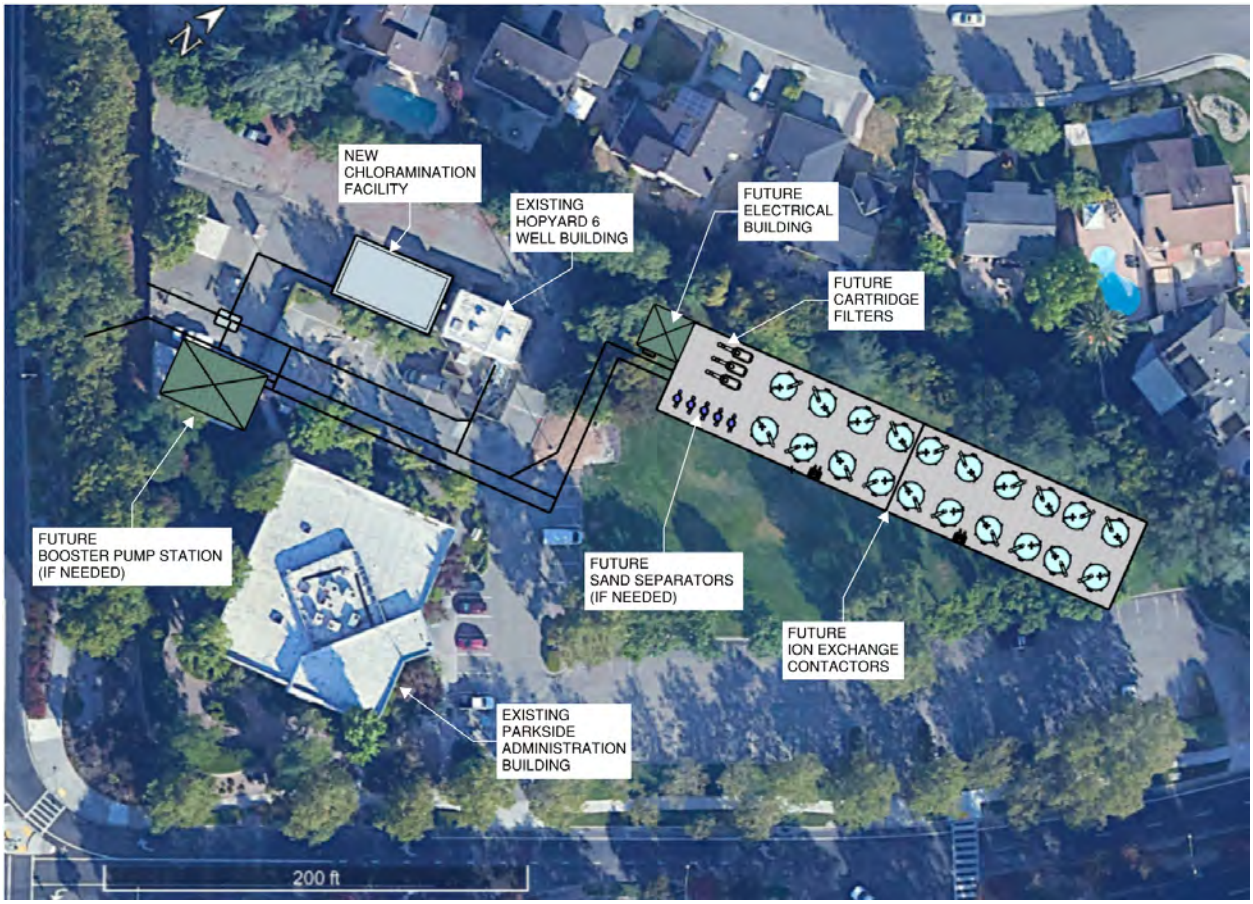


Figure 22 Potential IX System Site Layout

3.3.5 Ion Exchange System Cost Estimate

The opinion of probable construction cost presented in Table 16 represents a Class 5 budgetary estimate as defined by AACE International. Bids would be expected to fall within a range of 100 percent over the estimate to 50 percent under the estimate. The opinion of probable construction cost is based on preliminary quantity take-off for IX systems. The capital costs are shown in 2025 dollars and were developed using:

- Equipment quotes for major components.
- Percentage multipliers for electrical, instrumentation, and mechanical portions of the project based on recently bid projects of similar scope. Conceptual cost opinions and quantity takeoffs are included in Appendix C.

Cost estimate does not consider potential property/easement acquisition, demolition of existing structures, or additional pumping needs.

Table 16 Conceptual Cost Opinion

Cost Item	Cost (Rounded)
Process Equipment Foundation	$400,000
Site Exterior Wall	$1,350,000
Electrical Building	$450,000
IX Vessel Trains	$4,650,000
IX Resin	$3,650,000
Cartridge Filters & Elements	$550,000
Electrical, Instrumentation, and Controls (15% applied to equipment costs)	$1,350,000
Installation (30% applied to equipment and electrical, instrumentation, and controls costs)	$3,100,000
Site Work (15% applied to equipment costs)	$1,350,000
Yard Piping and Valves (15% applied to equipment costs)	$1,350,000
Site Complexity (5% applied to equipment costs)	$450,000
Direct Cost Subtotal	**$18,600,000**
Sales Tax (10.25% on Half the Direct Cost)	$950,000
Contingency (20%)	$3,900,000
General Conditions, Contractor Overhead & Profit (30%)	$7,050,000
Construction Changer Order Allowance (10%)	$1,200,000
Total Estimated Construction Cost(1)	**$31,650,000**
Estimated Low Range Construction Cost Total (-50%)	**$15,850,000**
Estimated High Range Construction Cost Total (+100%)	**$63,300,000**
Engineering, Legal, and Administration (40%)	$12,650,000
Total Estimated Project Cost	**$44,350,000**

Notes:
(1) Indirect cost factors are applied to the running subtotal of direct costs plus preceding indirect cost.

Cost estimate does not consider potential property/easement acquisition, demolition of existing structures, or additional pumping needs.

3.4 Combined Total Dissolved Solids and Per- and Polyfluoroalkyl Substances Removal Facility

If future water quality changes such that TDS and PFAS removal are both needed, as described in Sections 3.2 and 3.3, there are several alternatives that could be constructed and further expanded depending on the sequencing of treatment processes.

3.4.1 Facility Alternatives Overview

As discussed in the previous sections, an RO system and an IX system are the recommended approaches for TDS and PFAS removal, respectively. The following alternatives represent variations of treatment system sequencing and sizing depending on the need for TDS or PFAS removal.

Though not the recommended approach for a scenario in which PFAS removal alone is desired, an RO system is a viable alternative for the removal of both TDS and PFAS and is considered in Alternative 5.

The various treatment system configurations comprising the below alternatives are shown in Figure 23.

Table 17 Alternatives Summary

Parameter	Units	Alternative 1 RO+IX	Alternative 2 RO+IX	Alternative 3 RO+RO	Alternative 4 IX+RO	Alternative 5 RO
1st Phase Treatment System	**-**	**RO**	**RO**	**RO**	**IX**	**RO**
Constituent Target	-	TDS	TDS	TDS	PFAS	PFAS/TDS
Flow Capacity of Treatment System	gpm	8,780	8,780	8,780	13,100	13,100
Bypass Flow	gpm	4,320	4,320	4,320	0	0
Total Flow Recovery	%	80	80	80	100	80
No. of Treatment Trains	-	4	4	4	10	6
Facility Size	sf	22,000	22,000	22,000 (32,000 for buildout)	10,600	32,000
2nd Phase Treatment System	**-**	**IX**	**IX**	**RO**	**RO**	**-**
Target	-	PFAS	PFAS	PFAS	TDS	-
Flow Capacity of Treatment System	gpm	13,100	3,750	13,100	8,780	-
Bypass Flow	gpm	0	0	0	4,320	-
Total Flow Recovery	%	100	100	80	80	-
No. of Treatment Trains	-	10	4	2 additional (6 total)	4	-
Facility Size	sf	10,600	7,000	32,000	22,000	-
Total Production Capacity	gpm	11,340	11,340	10,480	11,340	10,480
Total Capital Cost(1)	Million Dollars	128.0	110.5	125.2	128.0	125.2

Notes:
(1) Refer to Appendix C for AACE Clas 5 cost estimates.

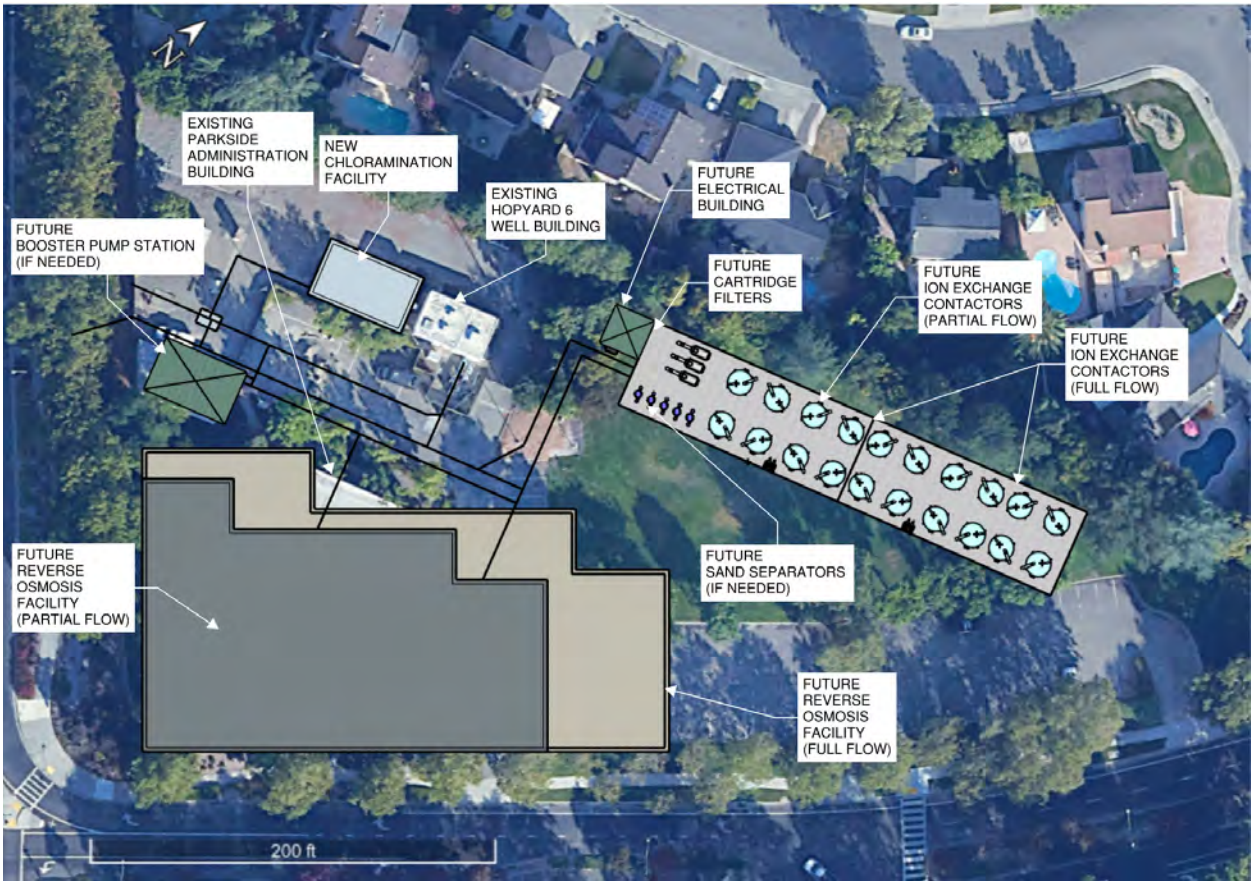


Figure 23 Potential IX and RO System Site Layout

3.4.2 Alternative 1 – Partial Flow Reverse Osmosis, Full Flow Ion Exchange

Alternative 1 describes a scenario in which centralized TDS removal at Hopyard is achieved by an RO facility initially. In this scenario, if PFAS removal is needed at a later date, that could be accomplished by installing an IX system upstream of the RO system, sized to treat the maximum raw water flow assumed in earlier sections (13,100 gpm) to keep PFAS from accumulating in the RO concentrate.

The RO system here would be sized to achieve a final water quality (bypass plus permeate) that meets the standards described in Section 3.2. As such, the RO facility here would be sized as described in Section 3.2.3.

The IX system would be sized to treat the maximum flow assumed in Section 3.3 (13,100 gpm) and would be configured as described in Section 3.3.4.

In this alternative, PFAS will be removed prior to desalination so as not to be impacted by policy changes surrounding the disposal of PFAS concentrate.

3.4.3 Alternative 2 – Partial Flow Reverse Osmosis, Partial Flow Ion Exchange

Alternative 2 utilizes the same-sized RO facility as described in Alternative 1 for TDS removal.

In this scenario, if PFAS treatment is needed after the RO facility is installed, the subsequent IX facility would be sized to treat just the RO system bypass flow. Unlike Alternative 1, Alternative 2 would produce concentrate that contains PFAS.

3.4.4 Alternative 3 – Partial Flow Reverse Osmosis, Full Flow Reverse Osmosis

The RO system in Alternative 3 would be sized just as described in Alternative 1 and Alternative 2, to achieve a final water quality that meets the TDS and hardness removal goals.

If PFAS treatment is needed after the installation of the RO facility, in this alternative, the RO facility would be expanded to treat the entire wellfield flow (13,100 gpm).

Once the expanded RO facility is installed to treat the entire wellfield capacity, water stabilization would be achieved by replacing previously bypassed water with chemicals to achieve the target finished water quality alkalinity and pH.

Using the assumed PFAS concentrations and targets in Table 12, PFOS would limit bypass to about 5 percent of the total flow and would likely not be of significant enough benefit to risk a PFAS exceedance and increased monitoring requirements.

3.4.5 Alternative 4 – Full Flow Ion Exchange, Partial Flow Reverse Osmosis

Unlike the previous alternatives, Alternative 4 is catered to a scenario in which PFAS treatment is needed prior to an observed increase in raw water TDS. The facilities in this scenario are sized as described in Alternative 1; however, the sequence is reversed – first an IX facility to remove PFAS and later an RO facility constructed to remove TDS.

3.4.6 Alternative 5 – Full Flow Reverse Osmosis

Alternative 5 considers a scenario in which PFAS and TDS removal are achieved all at once. In this case, an RO facility would be constructed to treat the entire wellfield capacity to meet PFAS requirements, which would also achieve the desired TDS removal. This option would have the same total flow and final treatment facilities identified in Alternative 3.

3.4.7 Additional Considerations – Concentrate Disposal

As mentioned in Section 3.2.2.4, MGDP concentrate is conveyed to DSRSD and is then disposed through the LAVWMA pipeline, and a similar arrangement would likely be needed for all of the above alternatives.

As part of the *MGDP and Mocho Wellfield PFAS Compliance Conceptual Design Report* (Carollo 2024), Carollo previously coordinated with DSRSD to determine if they anticipated any changes related to PFAS discharges to the LAVWMA pipeline. DSRSD had no plans to affect MGDP concentrate discharges based on PFAS. DSRSD noted they will continue to monitor for the development of regulatory discharge limitations, and then determine the appropriate course of action to take at that time.

If policy surrounding PFAS discharge to the LAVWMA pipeline changes in the future, alternatives which rely on an RO system for PFAS removal (Alternatives 2, 3, and 5) could be impacted and might require further considerations for PFAS concentrate treatment.

APPENDIX A

TRANSMISSION MAIN CONCEPTUAL ALIGNMENT

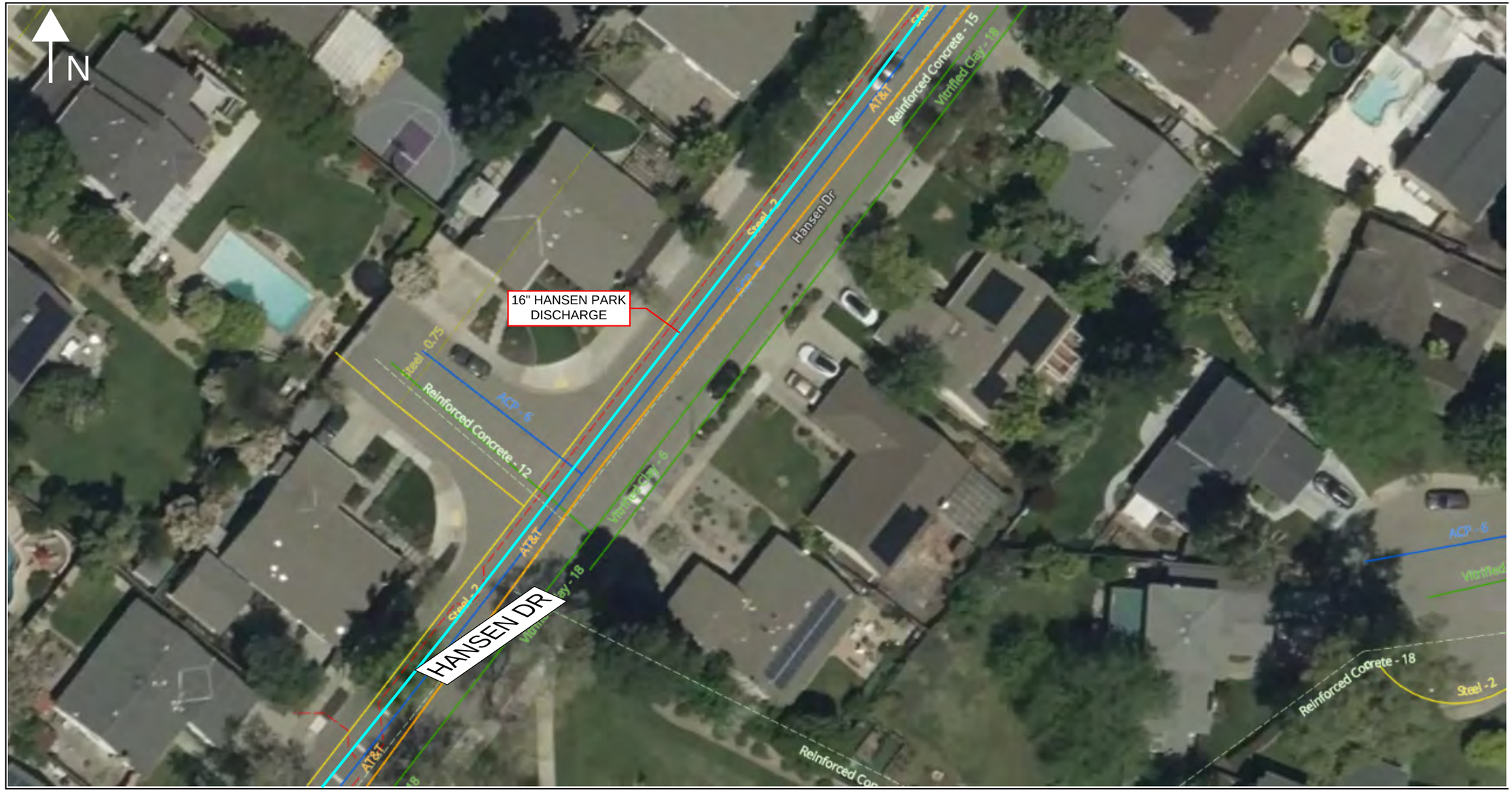


NOTES:
1. THE EXISTING UTILITY LOCATIONS SHOWN ARE APPROXIMATE.
2. THIS DRAWING IS NOT FOR CONSTRUCTION.

carollo

TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 1

SCALE: NOT TO SCALE



NOTES:
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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 2

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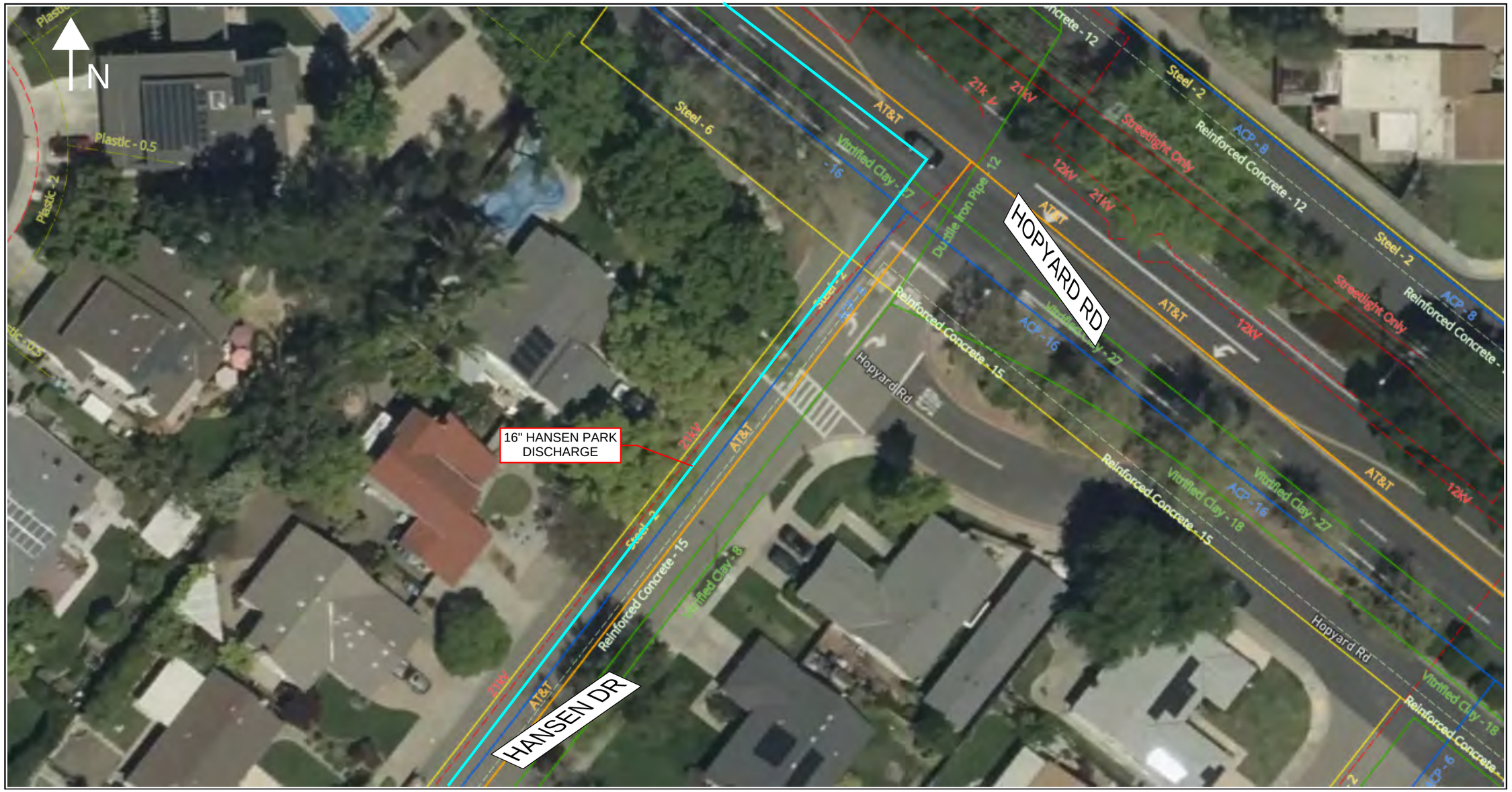


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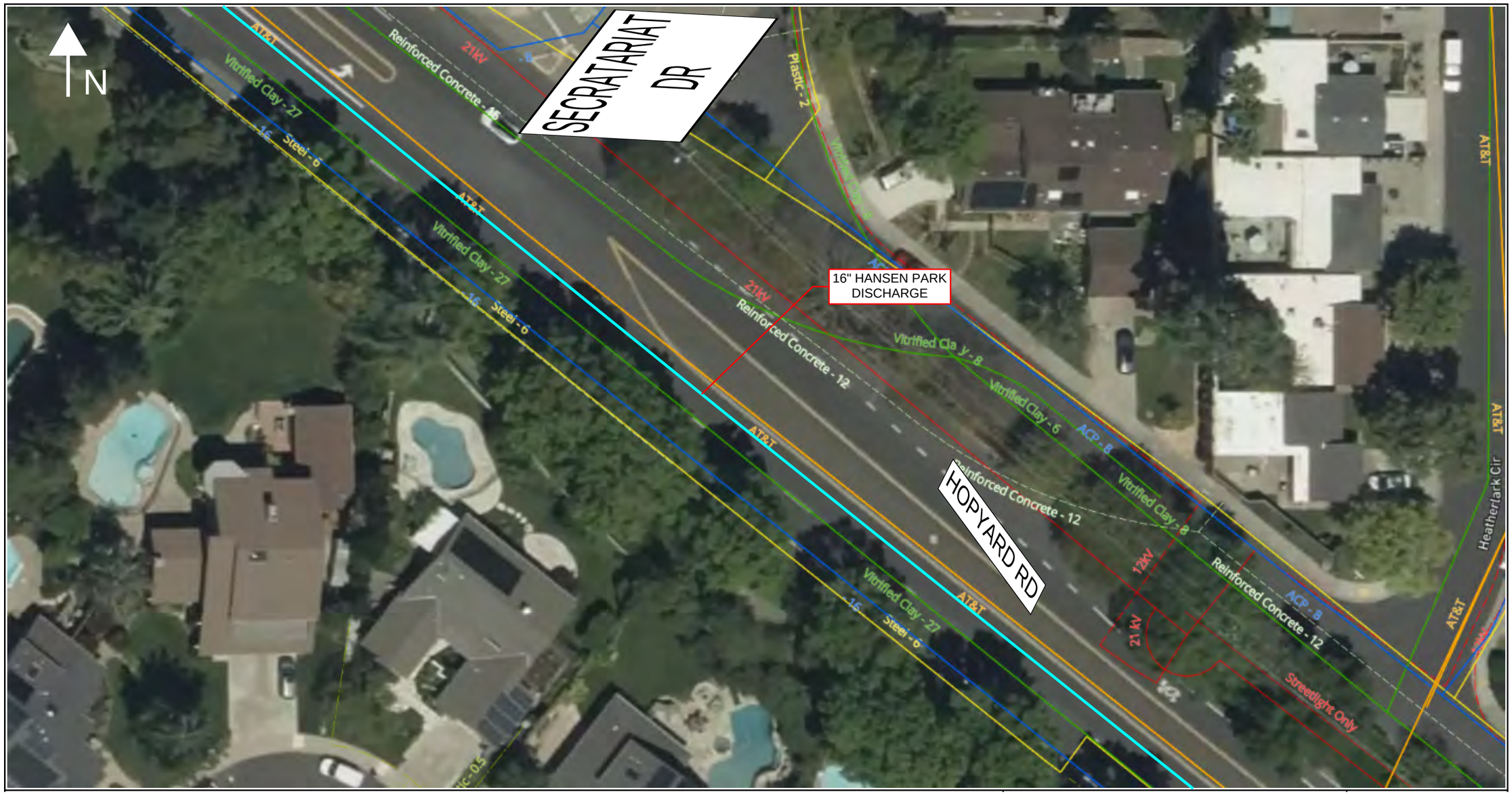


NOTES:
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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 4

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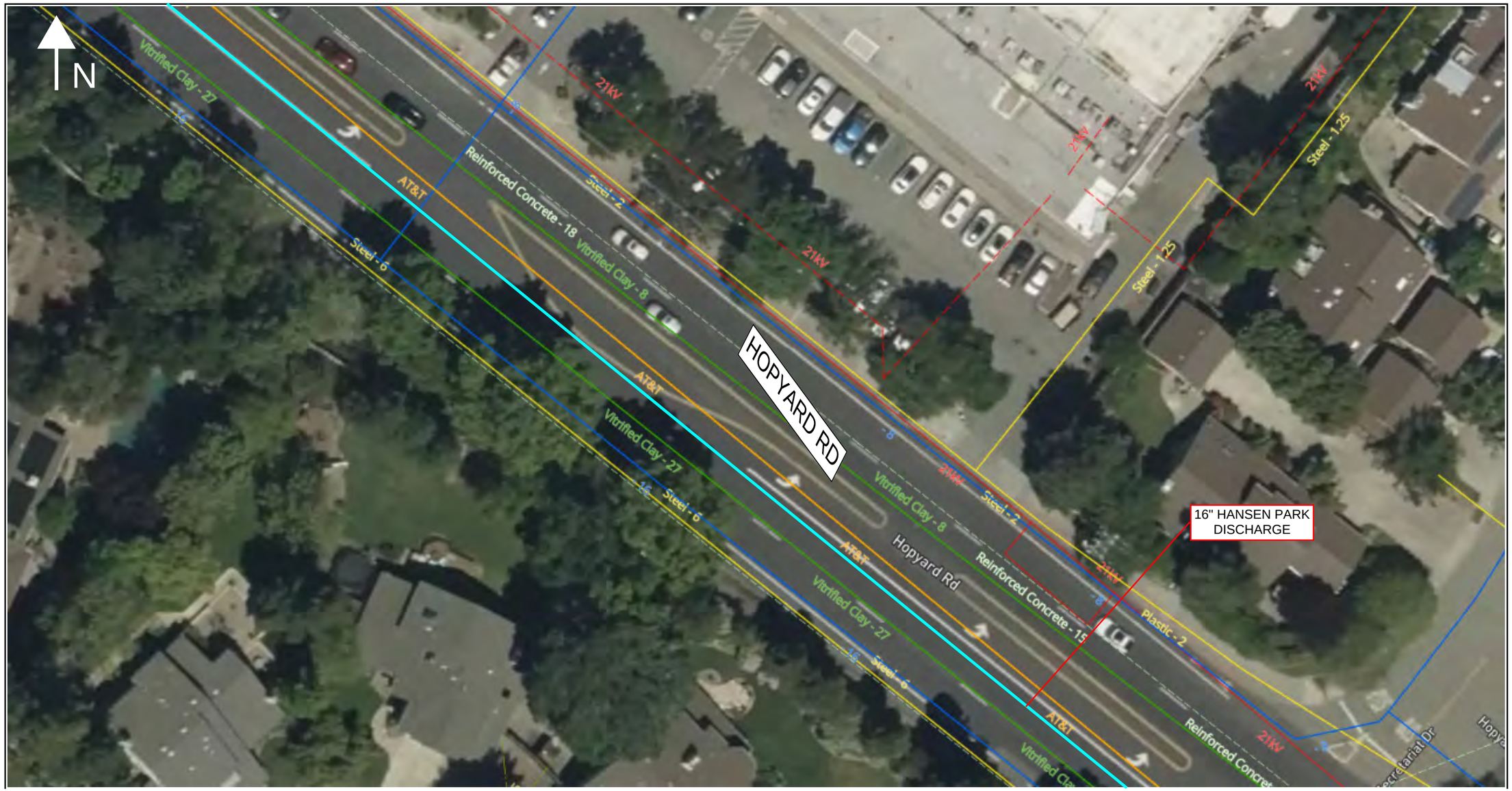


NOTES:
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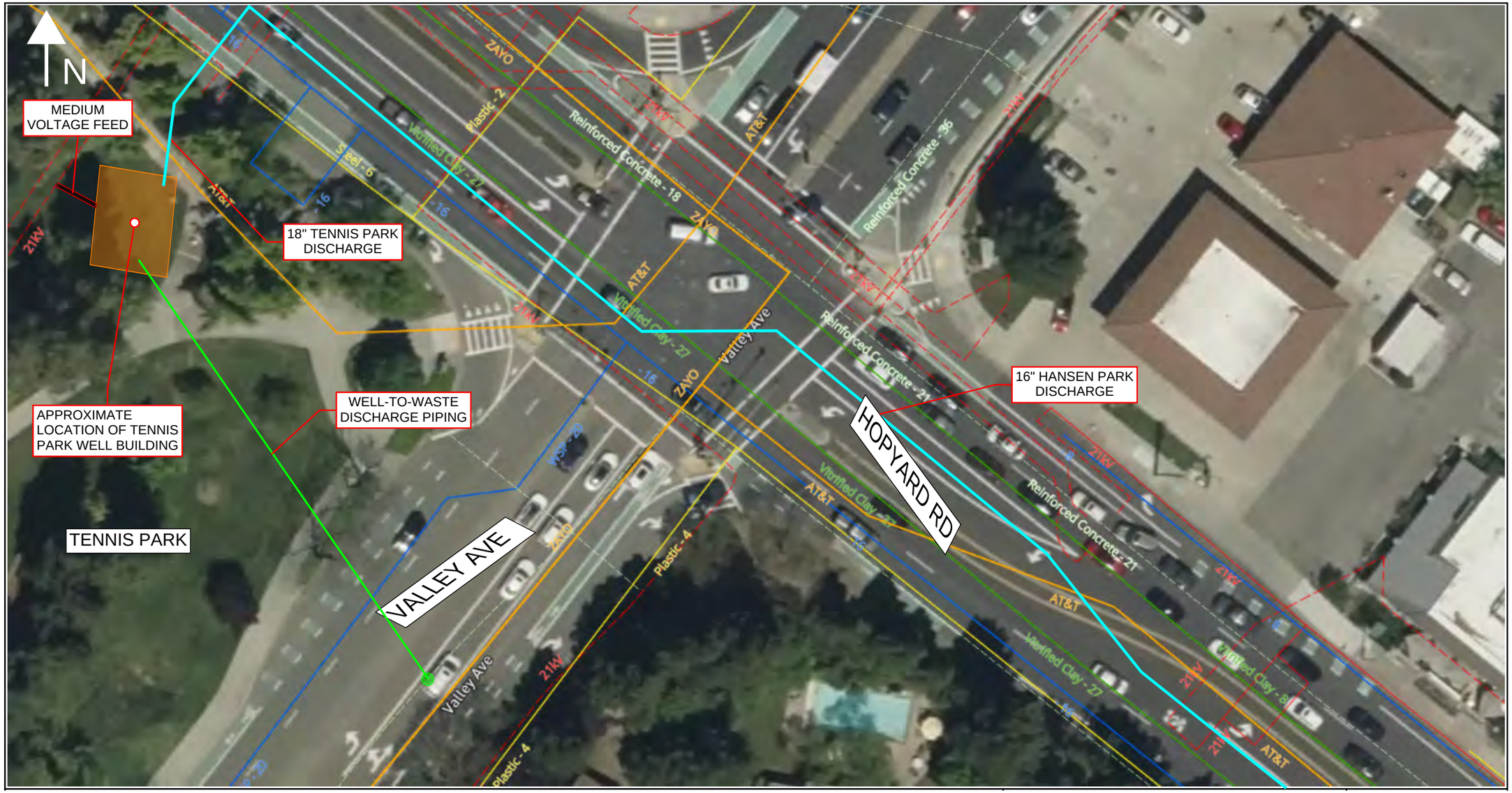


NOTES:
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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 6

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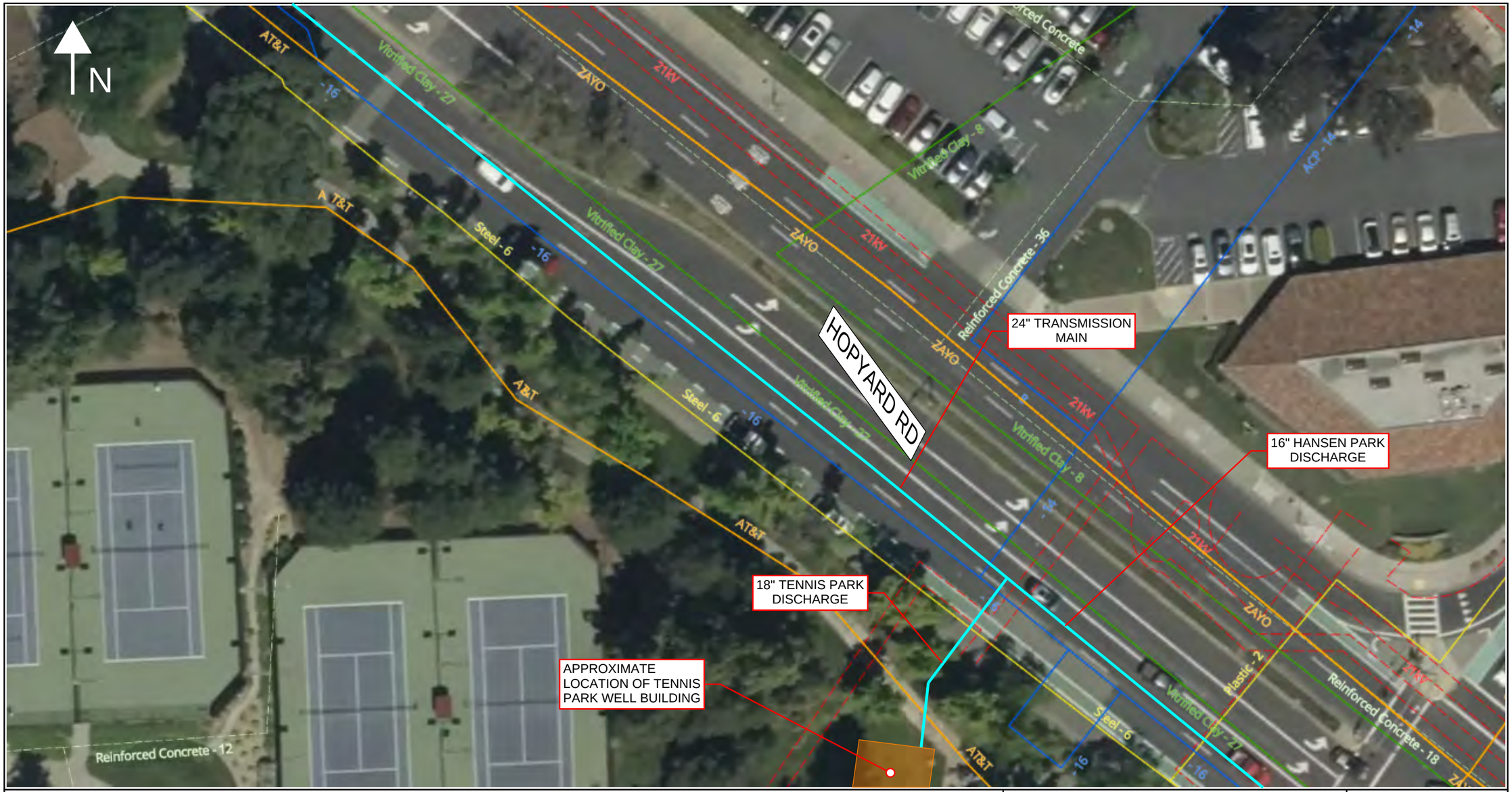


NOTES:
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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 7

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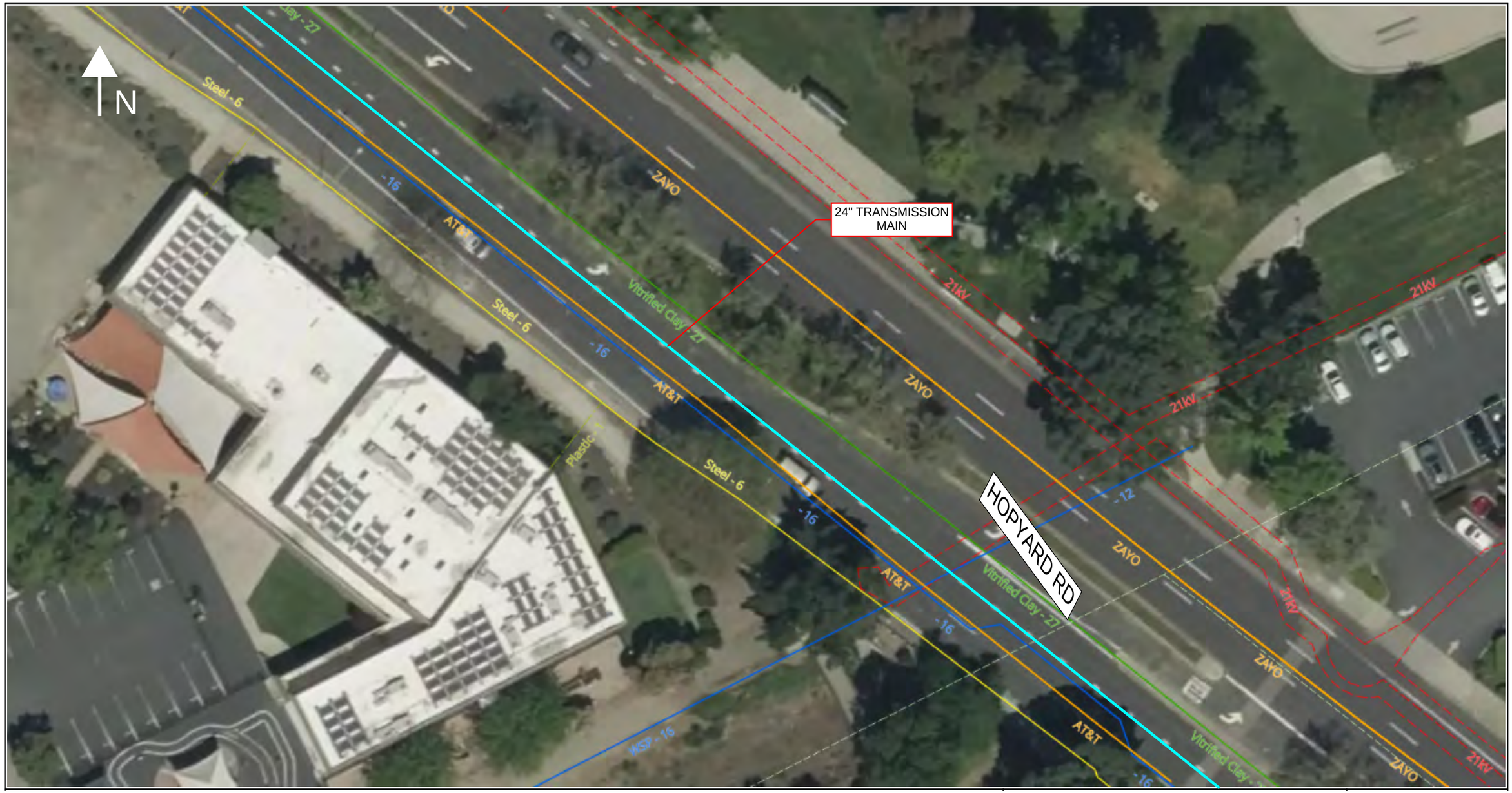


NOTES:
1. THE EXISTING UTILITY LOCATIONS SHOWN ARE APPROXIMATE.
2. THIS DRAWING IS NOT FOR CONSTRUCTION.

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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 8

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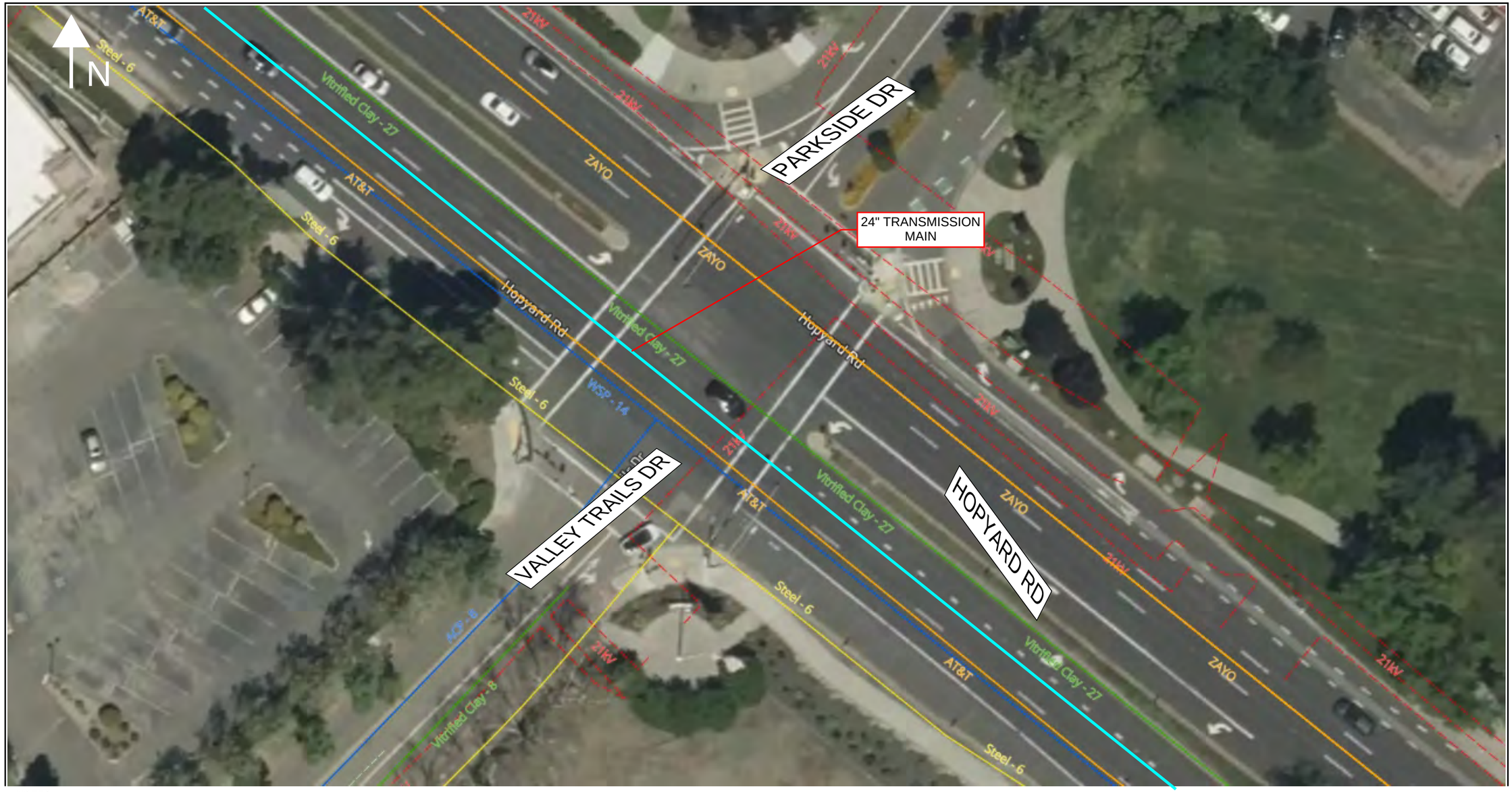


NOTES:
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2. THIS DRAWING IS NOT FOR CONSTRUCTION.

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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 9

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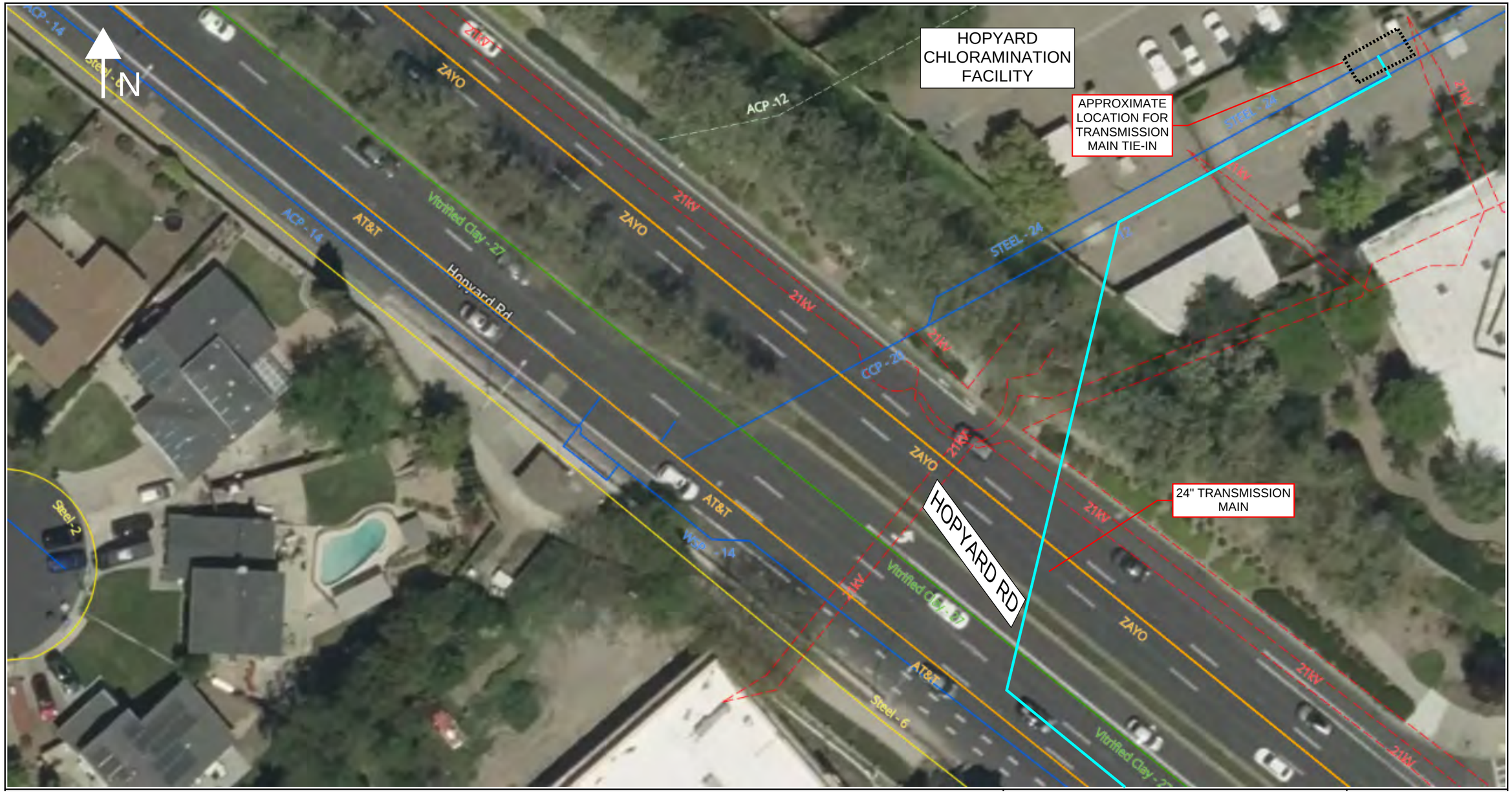


NOTES:
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2. THIS DRAWING IS NOT FOR CONSTRUCTION.

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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 10

SCALE: NOT TO SCALE



NOTES:
1. THE EXISTING UTILITY LOCATIONS SHOWN ARE APPROXIMATE.
2. THIS DRAWING IS NOT FOR CONSTRUCTION.

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TRANSMISSION MAIN CONCEPTUAL ALIGNMENT - 11

SCALE: NOT TO SCALE

LEGEND

ElectricDistribution: Distribution Lines

- Primary Overhead Conductor
- Primary Underground Conductor
- Secondary Overhead Conductor

ElectricDistribution: Distribution Lines (ctd)

- Secondary Underground Conductor
- Other Distribution Lines

ElectricTransmission: Transmission Lines

ElectricTransmission: Transmission Lines (ctd)

- Overhead Transmission Segment
- Underground Transmission Segment
- Other Transmission Lines

Gas: Gas Distribution

- Distribution Main
- Abandoned Gas Pipe
- Other

Sanitary: Sanitary Pipes

- Mains
- Lateral
- Abandoned
- Other

Water: Water Main

- Main
- Abandoned
- Other

Water: Water Service

- Service

RecycledWater: Recycled Water Pipes

- Main
- Abandoned
- Service
- Other

Storm: Storm Pipes

- Mains
- Lateral
- Abandoned
- Other

Geotel: Fiber Routes

APPENDIX B

AACE CLASS 4 COST ESTIMATE

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 1 - Tennis Park Well

ESTIMATED MIDPOINT OF CONSTRUCTION: May 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$400,000	$400,000		5% of Total Cost
	Total					$400,000	
2	**Transmission Main**						
	18-inch Ductile Iron Pipeline	1400	LF	$450	$630,000		Assumed $25/in/lf
	Total					$630,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,850,000	$3,850,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,850,000	
4	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$7,880,000**	
	Sales Tax on 50% of Direct Costs	10.25	%			$410,000	
	SUBTOTAL					**$8,290,000**	
	Estimating Contingency	30	%			$2,490,000	
	SUBTOTAL					**$10,780,000**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (May 2027, 5% Annually)	8.5	%			$920,000	
	SUBTOTAL					**$11,700,000**	
	General Conditions, Contractor Overhead, & Profit	15	%			$1,760,000	
	SUBTOTAL					**$13,460,000**	
	Construction Change Order Allowance	10	%			$1,350,000	
	SUBTOTAL					**$14,810,000**	
	CONSTRUCTION COST SUBTOTAL					**$14,810,000**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$10,370,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$22,220,000**	
	Engineering, Legal, and Admin	40	%			$5,924,000	
	TOTAL PROJECT COST					**$20,734,000**	
	(Present-day value; ENR CCI 15276, May 2025)						

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CLASS 4 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 2 - Tennis Park and Hansen Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: August 2027
COST ESTIMATE PREPARATION DATE December 5, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$800,000	$800,000		5% of Total Cost
	Total					$800,000	
2	**Transmission Main**						
	24-inch Ductile Iron Pipeline	4000	LF	$600	$2,400,000		Assumed $30/in/lf
	Total					$2,400,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,850,000	$3,850,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,850,000	
4	**Hansen Park Well Construction**						
	Hansen Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Hansen Park Well Facility	1	LS	$3,850,000	$3,850,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,850,000	
5	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$15,900,000**	
	Sales Tax on 50% of Direct Costs	10.25	%			$820,000	
	SUBTOTAL					**$16,720,000**	
	Estimating Contingency	30	%			$5,020,000	
	SUBTOTAL					**$21,740,000**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (August 2027, 5% Annually)	9.8	%			$2,140,000	
	SUBTOTAL					**$23,880,000**	
	General Conditions, Contractor Overhead, & Profit	15	%			$3,590,000	
	SUBTOTAL					**$27,470,000**	
	Construction Change Order Allowance	10	%			$2,750,000	
	SUBTOTAL					**$30,220,000**	
	CONSTRUCTION COST SUBTOTAL					**$30,220,000**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$21,160,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$45,330,000**	
	Engineering, Legal, and Admin	40	%			$12,088,000	
	TOTAL PROJECT COST					**$42,308,000**	
	(Present-day value; ENR CCI 15276, May 2025)						

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 3 - Tennis Park and Del Prado Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: August 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$700,000	$700,000		5% of Total Cost
	Total					$700,000	
2	**Transmission Main**						
	24-inch Ductile Iron Pipeline	6100	LF	$600	$3,660,000		Assumed $30/in/lf
	Total					$3,660,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facillity	1	LS	$3,850,000	$3,850,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,850,000	
4	**Del Prado Well Construction**						
	Del Prado Park Well Drilling & Casing Installation	1	LS	$1,250,000	$1,250,000		
	Del Prado Park Well Facility	1	LS	$3,080,000	$3,080,000		Estimated at 80% of Tennis Park Well Facility cost since pump, piping, appurtenances, EI&C, etc. will be smaller than Tennis Park. However, the facility will occupy roughly the same footprint as Tennis Park
	Total					$4,330,000	
5	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$15,540,000**	
	Sales Tax on 50% of Direct Costs	10.25	%			$800,000	
	SUBTOTAL					**$16,340,000**	
	Estimating Contingency	30	%			$4,910,000	
	SUBTOTAL					**$21,250,000**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (June 2027, 5% Annually)	9.8	%			$2,090,000	
	SUBTOTAL					**$23,340,000**	
	General Conditions, Contractor Overhead, & Profit	15	%			$3,510,000	
	SUBTOTAL					**$26,850,000**	
	Construction Change Order Allowance	10	%			$2,690,000	
	SUBTOTAL					**$29,540,000**	
	CONSTRUCTION COST SUBTOTAL					**$29,540,000**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$20,680,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$44,310,000**	
	Engineering, Legal, and Admin	40	%			$11,816,000	
	TOTAL PROJECT COST					**$41,356,000**	
	(Present-day value; ENR CCI 15276, May 2025)						

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CLASS 5 COST ESTIMATE

Project: Zone 7 Well Pipeline Alignment Alternatives
Client: Zone 7
Location: Pleasanton, CA
Element: Scenario 4 - Tennis Park, Del Prado Park, and Hansen Park Wells

ESTIMATED MIDPOINT OF CONSTRUCTION: September 2027
COST ESTIMATE PREPARATION DATE September 11, 2025
By : NLO
Reviewed: DB

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL	COMMENTS
1	**General**						
	Mobilization	1	LS	$1,100,000	$1,100,000		5% of Total Cost
	Total					$1,100,000	
2	**Transmission Main**						
	30-inch Ductile Iron Pipeline	7500	LF	$750	$5,630,000		Assumed $30/in/lf
	Total					$5,630,000	
3	**Tennis Park Well Construction**						
	Tennis Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Tennis Park Well Facility	1	LS	$3,437,500	$3,437,500		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,437,500	
4	**Del Prado Park Well Construction**						
	Del Prado Park Well Drilling & Casing Installation	1	LS	$1,250,000	$1,250,000		
	Del Prado Park Well Facility	1	LS	$2,750,000	$2,750,000		Estimated at 80% of Tennis Park Well Facility cost since pump, piping, appurtenances, EI&C, etc. will be smaller than Tennis Park. However, the facility will occupy roughly the same footprint as Tennis Park
	Total					$4,000,000	
5	**Hansen Park Well Construction**						
		10.25					
	Hansen Park Well Drilling & Casing Installation	1	LS	$2,000,000	$2,000,000		
	Hansen Park Well Facility	1	LS	$3,575,000	$3,575,000		Pump station facility costs are based off a 50% design cost estimate developed in 2022 for construction of Well 9. The 2022 estimate was developed by Carollo's cost estimation group which utilizes current industry cost information. The 2022 costs were escalated to present day cost. Tennis and Hansen Parks include a 5% cost adder because they are slightly larger than Well 9.
	Total					$5,575,000	
6	**Hopyard 6 Chloramination Upgrades**						
	Chloramination Upgrades	1	LS	$1,000,000	$1,000,000		Based on 2023 bid cost escalated to present day cost. Assumes sodium hypochlorite generation and dosing is required. Assumes ammonia dosing required.
	Total					$1,000,000	
	SUBTOTAL					**$22,742,500**	
	Sales Tax on 50% of Direct Costs	10.25	%			$1,170,000	
	SUBTOTAL					**$23,912,500**	
	Estimating Contingency	30	%			$7,180,000	
	SUBTOTAL					**$31,092,500**	Midpoint of Construction (June 2027); 5% Annual Escalation
	Escalation to Mid-Point (June 2027, 5% Annually)	9.8	%			$3,050,000	
	SUBTOTAL					**$34,142,500**	
	General Conditions, Contractor Overhead, & Profit	15	%			$5,130,000	
	SUBTOTAL					**$39,272,500**	
	Construction Change Order Allowance	10	%			$3,930,000	
	SUBTOTAL					**$43,202,500**	
	CONSTRUCTION COST SUBTOTAL					**$43,202,500**	
	LOW RANGE CONSTRUCTION COST TOTAL (-30%)					**$30,250,000**	
	HIGH RANGE CONSTRUCTION COST TOTAL (+50%)					**$64,810,000**	
	Engineering, Legal, and Admin	40	%			$17,281,000	
	TOTAL PROJECT COST					**$60,483,500**	
	(Present-day value; ENR CCI 15276, May 2025)						

APPENDIX C

AACE CLASS 5 COST ESTIMATE - TREATMENT

PROJECT :	**Zone 7 Regional Groundwater Facilities**		
JOB # :	**203958**	**Date:**	December-25
CLIENT :	**Alameda County Flood Control and Water Conservation District, Zone 7**	**By:**	NMA
ELEMENT :	**Partial Wellfield Treatment (8,780 gpm, 4 RO Trains)**	**Reviewed:**	TG

	DESCRIPTION	QUAN/ FACTOR	UNIT	MATERIAL & LABOR	SUBTOTAL	TOTAL
	DIRECT COSTS					
	Site Work (applied to equipment costs)	25%	-	-	$ 3,240,000	
	Yard Piping & Valves (applied to equipment costs)	25%	-	-	$ 3,240,000	
	RO Building Foundation	1,084	CY	$ 607	$ 660,000	
	RO Building	22,000	SF	$ 300	$ 6,600,000	
	Brine Pipeline	1	LS	$ 2,100,000	$ 2,100,000	
	Brine Pump Station	1	LS	$ 750,000	$ 750,000	
	Equalization Basin	1	LS	$ 2,450,940	$ 2,450,000	
	Site Complexity (applied to equipment costs)	5%	-	-	$ 650,000	
	Process Piping & Valves	30%	-	-	$ 6,830,000	
	Process Equipment					
	150 HP Vertical Turbine Booster Pumps in Cans	4	EA	$ 150,046	$ 600,000	
	RO Trains (including Cartridge Filters, Feed Pumps, RO Skids, Interstage Pumps, CIP Skid, Instrumentation)	4	EA	$ 2,500,000	$ 10,000,000	
	Decarbonators	3	EA	$ 150,000	$ 450,000	
	Caustic Storage and Feed System	1	LS	$ 485,386	$ 490,000	
	Scale Inhibitor Storage and Feed System	1	LS	$ 286,819	$ 290,000	
	CIP Chemical Storage	1	LS	$ 137,894	$ 140,000	
	300 HP Horizontal Split Case Pumps	4	EA	$ 248,209	$ 990,000	
	Electrical and I&C (applied to equipment costs)	35%	-	-	$ 4,540,000	
	Installation (applied to equipment and E&IC costs)	30%	-	-	$ 5,250,000	
	TOTAL DIRECT COST					**$ 49,270,000**
	Sales Tax (applied to half of direct costs)	10.3%	-	-	$ 2,530,000	
	Conceptual Level Design Detail Contingency (applied to direct costs)	30%	-	-	$ 15,540,000	
	General Conditions, Overhead, Profit & Risk (applied to direct costs with contingency)	30%	-	-	$ 20,200,000	
	Construction Change Order Allowance	10%			$ 8,750,000	
	TOTAL CONSTRUCTION COST					**$ 96,290,000**
	Design and Engineering	10%			$ 9,630,000	
	Construction Administration	10%			$ 9,630,000	
	Construction Support	20%			$ 19,260,000	
	TOTAL PROJECT COST					**$ 134,810,000**

PROJECT : Zone 7 Regional Groundwater Facilities
JOB # : 203958
CLIENT : Alameda County Flood Control and Water Conservation District, Zone 7
ELEMENT : Full Wellfield Treatment (13,100 gpm, 6 RO Trains)

Date: December-25
By: NMA
Reviewed: TG

	DESCRIPTION	QUAN/ FACTOR	UNIT	MATERIAL & LABOR	SUBTOTAL	TOTAL
	DIRECT COSTS					
	Site Work (applied to equipment costs)	25%	-	-	$ 4,690,000	
	Yard Piping & Valves (applied to equipment costs)	25%	-	-	$ 4,690,000	
	RO Building Foundation	1,576	CY	$ 607	$ 960,000	
	RO Building	32,000	SF	$ 300	$ 9,600,000	
	Brine Pipeline	1	LS	$ 2,100,000	$ 2,100,000	
	Brine Pump Station	1	LS	$ 750,000	$ 750,000	
	Equalization Basin	1	LS	$ 2,450,940	$ 2,450,000	
	Site Complexity (applied to equipment costs)	5%	-	-	$ 940,000	
	Process Piping & Valves	30%	-	-	$ 5,630,000	
	Process Equipment					
	150 HP Vertical Turbine Booster Pumps in Cans	6	EA	$ 150,046	$ 900,000	
	RO Trains (including Cartridge Filters, Feed Pumps, RO Skids, Interstage Pumps, CIP Skid, Instrumentation)	6	EA	$ 2,500,000	$ 15,000,000	
	Decarbonators	5	EA	$ 150,000	$ 750,000	
	Caustic Storage and Feed System	1	LS	$ 485,386	$ 490,000	
	Scale Inhibitor Storage and Feed System	1	LS	$ 485,386	$ 490,000	
	CIP Chemical Storage	1	LS	$ 137,894	$ 140,000	
	300 HP Horizontal Split Case Pumps	4	EA	$ 248,209	$ 990,000	
	Electrical and I&C (applied to equipment costs)	35%	-	-	$ 6,250,000	
	Installation (applied to equipment and E&IC costs)	30%	-	-	$ 7,230,000	
	TOTAL DIRECT COST					**$ 64,050,000**
	Sales Tax (applied to half of direct costs)	10.3%	-	-	$ 3,280,000	
	Conceptual Level Design Detail Contingency (applied to direct costs)	30%	-	-	$ 20,200,000	
	General Conditions, Overhead, Profit & Risk (applied to direct costs with contingency)	30%	-	-	$ 26,260,000	
	Construction Change Order Allowance	10%			$ 11,380,000	
	TOTAL CONSTRUCTION COST					**$ 125,170,000**
	Design and Engineering	10%			$ 12,520,000	
	Construction Administration	10%			$ 12,520,000	
	Construction Support	20%			$ 25,030,000	
	TOTAL PROJECT COST					**$ 175,240,000**

PROJECT :	**Zone 7 Regional Groundwater Facilities**
JOB # :	**203958**
CLIENT :	**Alameda County Flood Control and Water Conservation District, Zone 7**
ELEMENT :	**Partial Wellfield Treatment (4,320 gpm, 4 IX Trains)**

Date:	December-25
By:	NMA
Reviewed:	TG

	DESCRIPTION	QUAN/ FACTOR	UNIT	MATERIAL & LABOR	SUBTOTAL	TOTAL
	DIRECT COSTS					
	Site Work (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Yard Piping & Valves (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Process Equipment Foundation	678	CY	$ 607	$ 410,000	
	Site Exterior Wall	710	LF	$ 1,913	$ 1,360,000	
	New Site Electrical Building	1	LS	$ 420,553	$ 420,000	
	Site Complexity (applied to equipment costs)	5%	-	-	$ 440,000	
	Process Equipment					
	IX Vessel Trains	10	EA	$ 464,591	$ 4,650,000	
	IX Resin	9,240	CF	$ 397	$ 3,670,000	
	Cartridge Filter Housings	3	EA	$ 174,590	$ 520,000	
	Cartridge Filter Elements	96	EA	$ 491	$ 50,000	
	Electrical and I&C (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Installation (applied to equipment and E&IC costs)	30%	-	-	$ 3,070,000	
	TOTAL DIRECT COST					**$ 18,580,000**
	Sales Tax (applied to half of direct costs)	10.3%	-	-	$ 950,000	
	Conceptual Level Design Detail Contingency (applied to direct costs)	20%	-	-	$ 3,910,000	
	General Conditions, Overhead, Profit & Risk (applied to direct costs with contingency)	30%	-	-	$ 7,030,000	
	Construction Change Order Allowance	10%			$ 1,190,000	
	TOTAL CONSTRUCTION COST					**$ 31,660,000**
	Design and Engineering	10%			$ 3,170,000	
	Construction Administration	10%			$ 3,170,000	
	Construction Support	20%			$ 6,330,000	
	TOTAL PROJECT COST					**$ 44,330,000**

PROJECT :	**Zone 7 Regional Groundwater Facilities**
JOB # :	**203958**
CLIENT :	**Alameda County Flood Control and Water Conservation District, Zone 7**
ELEMENT :	**Full Wellfield Treatment (13,100 gpm, 10 IX Trains)**

Date:	December-25
By:	NMA
Reviewed:	TG

	DESCRIPTION	QUAN/ FACTOR	UNIT	MATERIAL & LABOR	SUBTOTAL	TOTAL
	DIRECT COSTS					
	Site Work (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Yard Piping & Valves (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Process Equipment Foundation	678	CY	$ 607	$ 410,000	
	Site Exterior Wall	710	LF	$ 1,913	$ 1,360,000	
	New Site Electrical Building	1	LS	$ 420,553	$ 420,000	
	Site Complexity (applied to equipment costs)	5%	-	-	$ 440,000	
	Process Equipment					
	IX Vessel Trains	10	EA	$ 464,591	$ 4,650,000	
	IX Resin	9,240	CF	$ 397	$ 3,670,000	
	Cartridge Filter Housings	3	EA	$ 174,590	$ 520,000	
	Cartridge Filter Elements	96	EA	$ 491	$ 50,000	
	Electrical and I&C (applied to equipment costs)	15%	-	-	$ 1,330,000	
	Installation (applied to equipment and E&IC costs)	30%	-	-	$ 3,070,000	
	TOTAL DIRECT COST					**$ 18,580,000**
	Sales Tax (applied to half of direct costs)	10.3%	-	-	$ 950,000	
	Conceptual Level Design Detail Contingency (applied to direct costs)	20%	-	-	$ 3,910,000	
	General Conditions, Overhead, Profit & Risk (applied to direct costs with contingency)	30%	-	-	$ 7,030,000	
	Construction Change Order Allowance	10%			$ 1,190,000	
	TOTAL CONSTRUCTION COST					**$ 31,660,000**
	Design and Engineering	10%			$ 3,170,000	
	Construction Administration	10%			$ 3,170,000	
	Construction Support	20%			$ 6,330,000	
	TOTAL PROJECT COST					**$ 44,330,000**