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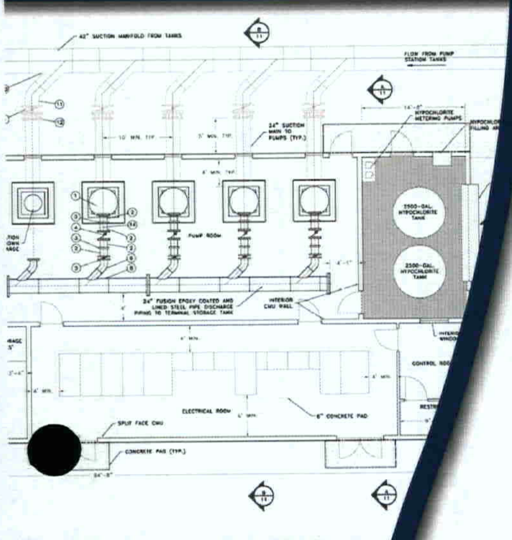

VIDLER

WATER. QUALITY. LIFE

Fish Springs Water Supply Project

Preliminary Design Report

February 2006

Prepared for:

Vidler Water Company, Inc.
704 West Nye Lane, Suite 201
Carson City, Nevada 89703

Prepared by:

ECO:LOGIC Engineering
10381 Double R Boulevard
Reno, Nevada 89521
(775) 827-2311
Project No. VIDL05-001

PROFESSIONAL ENGINEER-STATE OF NEVADA
DAVID S. KERSHAW
Exp 6/30/07
CIVIL
No. 15049
2/21/06

ECO:LOGIC

Consulting Engineers

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PROJECT SUMMARY

Vidler Water Company is proposing construction of the Fish Springs Water Supply Project to meet future water demands for the Stead, Silver Lake and Lemmon Valley areas (North Valleys) within the Truckee Meadows Service Area. The project consists of a new substation off of the Alturas Transmission Line, groundwater production wells, a pump station, a transmission pipeline and terminal water storage tank to convey water from Fish Springs Ranch to the North Valleys. The project will supply 8,000 acre-feet of water per year (AFA). Retail water service and operation will be provided by Washoe County.

The project includes six new production wells generally adjacent to existing irrigation wells located on Fish Spring Ranch property that are currently used for irrigation of alfalfa. The facilities will include a buried 12" to 30" diameter water collection main from the individual wells to two storage tanks located adjacent to the pump station in the southwest area of Fish Springs Ranch. A pump station, with a minimum reliable capacity of 6,000 gallons per minute (gpm), will be constructed to pump the water from these storage tanks over the east flank of the Fort Sage Mountains and south to Lemmon Valley via approximately 28 miles of buried 30-inch diameter transmission main.

The transmission main will terminate at a storage tank to be constructed on a hillside between Lemmon Valley and Antelope Valley, immediately east of and near the high point of Matterhorn Boulevard on public property (BLM).

A layout of the proposed facilities and pipeline alignment is presented in Figures 1 through 3. Much of the transmission pipeline route will parallel the existing Tuscarora natural gas pipeline right-of-way, with deviation from the gas pipeline right-of-way near the northern and southern ends of the water pipeline route.

A reliable, year-round electrical power supply will also be developed to operate the production wells and pump station at the Fish Springs Ranch area. Sierra Pacific Power Company is currently contracted to design and construct a new substation on the Alturas 345 kV transmission line near the proposed pump station site and construct approximately 10 miles of 25 kV overhead electrical distribution line to serve the wells.

PURPOSE

Given the magnitude of the project and the required timeline for design and construction of the facilities, the project will be designed and constructed in phases. As a result, portions of the project will be under construction while other portions are still in design. The purpose of this Preliminary Design Report is to present the overall basis of design for the project facilities. The intent of this document is to provide a master plan that will be followed during the final design for all facilities and to coordinate design and construction of various phases with one another. This document presents the preliminary layout of all facilities, key design parameters, and anticipated project phasing.

ORGANIZATION OF THIS REPORT

This report is organized into the following major sections:

- Well Field Layout
- Production Well Design and Collection System

- Pump Station Design and Layout
- Preliminary Substation Design and Layout
- Storage Tank Design and Site Layouts
- Transmission Main Design and Alignment
- Control Strategy
- Construction Phasing

The following information describes these facilities in greater detail and identifies the basis of design for the various facilities.

WELL FIELD LAYOUT

The proposed Fish Springs Water Supply Project will be designed to extract and deliver 8,000 AFA to the North Valleys area. A total of six production wells will be provided. The approximate location of the wells is presented on Figures 1 and 2A.

Currently, there are five irrigation wells in operation at Fish Springs Ranch. Each of the existing wells is equipped with a line-shaft vertical-turbine pump powered by a diesel engine. It is estimated that these irrigation wells have sustainable production rates ranging from 800 gpm to 1,700 gpm, although some wells have been test pumped for extended periods at more than 3,000 gpm. Only one of the current irrigation wells meets current Nevada Division of Health regulations for public water supply wells. In addition to several new wells, the existing wells will be replaced with new wells in order to meet current construction standards and improve operating efficiency. All the production wells will be located on private property owned by Fish Springs Ranch. Final locations and design parameters will be determined based on field investigations to be performed as part of this project and review of groundwater data accumulated as the project unfolds. Additional wells may be required if extraction rates of the newly constructed wells are not sufficient to meet the minimum combined design flow rate of 6,000 gpm. Any additional production wells will be located on Fish Springs Ranch property.

At one of the existing irrigation wells, the Wilson Well, historical arsenic concentrations exceed the new water quality standard for arsenic that took effect in January 2006. The new well at this site will be relocated further to the east with the intent of avoiding water-bearing strata with excessive amounts of arsenic. In the event this approach is unsuccessful, an arsenic removal facility or blending arrangements may eventually be required for this new well.

Professional personnel will be onsite to monitor the drilling, construction, and testing of the six wells, analyze the test data, and document the results in a comprehensive report. The well development process will consist of drilling the well in two passes. The first pass will entail the drilling of a pilot hole. The information obtained from each pilot hole will be used to design the production well. The second pass will entail reaming the pilot hole to the design diameter and depth. Professional personnel will orchestrate well performance and aquifer stress tests of each completed well. Washoe County Department of Water Resources typically requires municipal wells completed in fractured rock terrain to be test pumped for a period of 10 days. However, because the existing wells have already been test pumped extensively by the County, 72-hour duration tests are proposed, unless unexpected results are observed. If that occurs, testing durations might need to be extended to satisfy questions raised by Washoe County Department of Water Resources. The testing program will include a short (4 hour duration) step test to assess the efficiency of the well followed by an overnight recovery period, and a 72-hour duration constant-discharge aquifer-stress test followed by a 72-hour duration recovery period.

The resulting production well will be gravel packed, constructed with sanitary seals to a depth of at least 100 feet below the surface, and will be equipped with water lubricated, electric driven vertical turbine pumps. Well screens will be constructed of corrosion-resistant materials such as Type 304 or 316L stainless steel.

PRODUCTION WELL DESIGN AND COLLECTION SYSTEM

Pertinent design criteria for the wells are summarized in Table 1. Figures 4 through 6 present the proposed floor plan, building elevations and site plan.

Each wellhead will be enclosed in a masonry block structure meeting current International Building Code construction standards and Washoe County minimum design requirements. The structures will be constructed on a foundation elevated slightly above the surrounding grade to help minimize the potential for facility flooding. Each structure will contain all above-ground piping, shutoff valve, check valve, flow meter, air release valve, electrical equipment and telemetry. It is estimated that the structure will have an approximate footprint of 19 feet wide by 26 feet long. Enclosure of the equipment will protect facilities from vandalism and weather, helping to minimize the amount of maintenance and prolong the life of the facility. Each well will be controlled via telemetry by water levels in the pump station storage tanks. Figures 4 through 6 depict a typical floor plan, building elevations and typical site plan for the proposed production wells. Actual pipe and pump sizes will be determined after production well testing is completed.

Power will be provided via overhead electric distribution lines from the substation to be located on the west side of the Ranch. Engine driven pumps for each of the wells were considered as an alternative, but were rejected due to maintenance, noise and air emissions concerns. On-site pad mounted transformers will be supplied and maintained by Sierra Pacific Power Company, with each well house having an individual service meter. The project will include a diesel-powered standby generator at two well sites that will operate the well in the event of a power outage on the overhead electric distribution system. The location and sizing of the generators will be dependent on the final design of the production wells, but is envisioned to be located at the eastern-most set of wells.

Table 1 summarizes the preliminary design parameters for the wells.

Minor grading will be required to construct each well house site. Cut and fill slopes will have a maximum slope of 3:1 horizontal to vertical. An all-weather compacted gravel access road will be constructed from the existing Washoe County maintained dirt road. A 30-foot wide access and utility easement for each production well will be dedicated to Washoe County. An area to be determined during design will be sub-divided to allow for the property around each production well to be conveyed to the future water purveyor, or a permanent non-revocable easement will be established for each production well. Access into each of the well sites will be restricted by a chain link fence with three-strand barbwire around the facilities. The fencing will be vinyl coated with an approved neutral color to minimize visual impacts. In addition, facilities will include an alarm system that will notify appropriate personnel in case of unauthorized entry.

TABLE 1 – WELL DESIGN CRITERIA

Design Flow Rate	TBD (Anticipated 500 - 2,000 gpm)
Static Head	250 – 290 feet
Total Dynamic Head	325 – 390 feet
Well Type	Stainless steel screen with gravel pack
Sanitary Well Seal	Grouted to a depth of 100 feet below grade
Well Depth	300 – 500 feet
Well Bore Diameter	26 – 28 inches
Production Casing Diameter	16 – 18 inches
Screened Interval	TBD
Pump Intake Level	TBD
Design Pumping Water Level	TBD
Well Discharge Pressures	130 – 170 psi
Pump Type	Vertical Turbine (water lubricated) 150-300 hp per pump, 1,800 rpm
Starter	4 wells with soft starters 2 wells with variable frequency drives
Design Voltage	460 V
Back-up Power	Engine generator located at two wells. All wells provided with auxiliary power connections per Washoe County standards.
Blow-off to Waste	Using solenoid controlled pressure sustaining valves, or equal
Flow Meter	Magnetic flow meter at each well
Disinfection System	To be located at main pump station. Well house design to allow for retrofit of each structure with disinfection system at later date, if desired.
Structure Type	Masonry block building with metal roof
Maximum Discharge Velocity	10 fps
Other Instrumentation & Sensors	System pressure Well level sensor Security sensors and/or switches Temperature sensors – interior and exterior Water quality instruments Power quality monitor

The well field water collection system will consist of a transmission main with water lines stubbed out to each well site. Well field collection piping design criteria are presented in Table 2. Figure 2A presents the alignment for the collection piping.

Well field collection piping will convey flows from the individual wells to the pump station storage facility located on the west side of the ranch. The water level in the pump station storage tanks will control the operation of the wells via telemetry. When called for, the wells will pump to the pump station storage tanks, which in turn will provide a positive suction supply to the main pump station. Fiber optic telemetry cables will be used to communicate between the main pump station storage tanks and the individual wells. The telemetry control system will allow for the rotation of well groups and prioritization of which well groups to operate based on preset parameters, as well as to convey a multitude of information to the pump station telemetry system and ultimately back to Washoe County. Telemetry improvements and the control summary for each facility are included in Appendix A.

Preliminary design indicates that sizes will vary from 12" to 30" in diameter with the largest diameters located closest to the pump station storage tanks. Between the groundwater supply wells and the pump station, several sections of pipeline will be located on private easements and public property. Final design will determine the actual pipeline diameters. The water piping will have a minimum burial depth of 3 feet. Appurtenant facilities will include gate valves and/or butterfly valves with valve boxes, and small (3'x2') traffic rated concrete vaults containing air release valves and blow-off valves at strategic locations with associated access routes to the various facilities. A fire hydrant will also be provided at each well site within the fenced area. Design shall allow for the use of PVC, steel or ductile iron pipe with a minimum working pressure rating of 200 psi.

A fiber optic telemetry cable will be located in a common trench with the water main between the wells and the pump station to provide communications. The proposed installation method consists of installation of a 2-inch inner diameter HDPE conduit in the bottom and to one side of the water transmission main trench. The conduit is to be bedded in ¾ inch or smaller material with a minimum cover of 4 inches. Pipe bedding material above the conduit bedding material will consist of 3 inch or smaller material. Splice boxes will be located approximately every 5,000 feet to allow for the fiber optic cable to be blown into the conduit.

TABLE 2 – WELL FIELD COLLECTION PIPING DESIGN CRITERIA

Collection Piping Material	Up to 200 psi rated working pressure, PVC, Steel, Ductile
Minimum Pipe Burial	36 inches
Maximum Pipe Velocity	5 fps
Fire Protection	Fire Hydrant to be provided at each well with 1,500 gpm fire flow and minimum 20 psi residual pressure, no wells in operation
Telemetry & Control	Fiber optic

PUMP STATION DESIGN AND LAYOUT

The pump station will be designed to pump water from two adjacent storage tanks at an approximate pad elevation of 4243 feet over the east shoulder of the Fort Sage Mountains at a maximum elevation of 5515 feet, to the storage facility located at the southern terminus of the pipeline. The pump station design criteria are summarized in Table 3. Figures 7 through 13 present the preliminary site layout, floor plan and elevations for the pump station facility, the system curve and the electric substation site plan.

The preliminary design includes installation of a below-grade manifold with five suction barrels. Four of the pump barrels will be equipped with 2,000 gpm vertical turbine pumps to provide a maximum capacity of 8,000 gpm. Other pump types were considered, but vertical turbine pumps are the most appropriate pump type for the design flow and heads anticipated. A minimum reliable capacity of 6,000 gpm will be provided, assuming one pump is used for standby. The pump station piping and appurtenances will be designed to provide a peak hydraulic capacity of 10,000 gpm.

TABLE 3 – PUMP STATION DESIGN CRITERIA

Minimum Reliable Capacity	6,000 gpm (with one pump as standby)
Peak Design Flow Rate	10,000 gpm
Static Head	1,330 feet
Total Dynamic Head	1,425-1,650 feet (6,000 – 10,000 gpm)
Net Positive Suction Head Available	70 feet
Pump Type	Vertical Turbine with Flooded Suction Barrel
Number of Suction Barrels	5
Number of Pumps Provided	4
Design Capacity (per pump)	2,000 gpm
Estimated Motor Horsepower (per pump)	1,250 hp
Starter	Soft starters
Design Voltage	4,160 V
Back-up Power	Reliable capacity provided by sub-station site and conduit provided at pump station for future on-site standby generator, if required
Surge Facility	Designed for 10,000 gpm flow rate with power loss, limit surge to 133% of pipe working pressure
Max. Suction Velocity	3 fps
Max. Discharge Velocity	10 fps
Flow Meter	Magnetic flow meter on suction manifold
Disinfection System	To be located at main pump station. Flow paced metering feed pumps from 2 – 2,500 gallon chemical storage tanks to selectable injection points in inflow pipe to tanks and suction manifold
Structure Type	Masonry block building
Suction Supply	Two 500,000 gallon tanks, providing 820,000 gallons of operating storage and 180,000 gallons for fire protection
Fire Protection	Fire Hydrant to be provided with 1,500 gpm fire flow and minimum 20 psi residual pressure, no wells in operation. Fire sprinklers to be provided in chemical storage area
Telemetry & Control	Fiber optic, with radio interface to County facilities from the terminal tank

The pump station will be a masonry block building with approximate dimensions of 95 feet long by 42 feet wide. The pump station facility will meet current International Building Code construction standards and Washoe County minimum design requirements. Figures 8 through 11 show the preliminary pump station site plan, floor plan and elevations. The pump station will also house the required electrical/control equipment, chemical storage facilities (liquid sodium hypochlorite), the pressure surge tank, air compressors, and associated facilities. A small restroom and office space will also be provided for operations and maintenance personnel. Details for an on-site septic tank and leach field system will be provided during final design.

Power will be provided via overhead electric distribution lines from the substation to be located approximately 2,500 feet west of the pump station. On-site pad mounted transformers will be supplied and maintained by Sierra Pacific Power Company at the pump station site. A small generator will be provided within the building to keep the lights and heat on, and the telemetry system functioning during a power outage.

Chlorination will be used to provide disinfection of the groundwater and to maintain a chlorine residual in the transmission pipeline. The planned method of chlorination is the use of 12.5% Sodium Hypochlorite solution. Two 2,500 gallon storage tanks with appropriate appurtenances and secondary containment facilities will be provided in the pump station building. The tank size is based on a chemical feed rate of 1 ppm for 30 days at a pumping rate of 10,000 gpm. Also, the chemical tank volume provides for efficient chemical deliveries. The local chemical supply truck has an approximate maximum delivery volume of 4,500 gallons.

Table 3 summarizes the preliminary design parameters for the pump station and adjacent storage tanks. Figure 12 presents the various system curves for the pump station.

Minor grading will be required to construct the proposed pump station. Cut and fill slopes will have a maximum slope of 3:1 horizontal to vertical. Improved access to the site will be along the dedicated 50-foot wide access and utility easement for Rainbow Way and across Fish Springs Ranch property as shown in Figure 7. Access roads and surfaces around the pump station facility will be constructed with an all-weather surface such as compacted aggregate base with a surface of crushed rock. Access into the pump station site will be restricted by a chain link fence with three-strand barbwire around the facilities. The fencing will be vinyl coated with an approved neutral color to minimize visual impacts. In addition, facilities will include an alarm system that will notify appropriate personnel in case of unauthorized entry.

The water level in the terminal storage tank will control the operation of the pump station via telemetry. As the terminal tank level lowers, additional pumps will be turned on to supply water. As the pump station lowers the level in the supply tanks the wells will be called on. When called for, the wells will pump to the pump station storage tanks, which in turn will provide a positive suction supply to the main pump station. A direct-burial fiber optic telemetry cable will be located in a common trench between the main pump station and the terminal storage tank. Fiber optic telemetry cables will be used to communicate between the main pump station and the individual wells. Telemetry improvements and the control summary for each facility are included in Appendix A.

PRELIMINARY SUBSTATION DESIGN AND LAYOUT

Sierra Pacific Power Company (SPPCo) is proposing to construct a new 345kV to 25kV electric substation to provide the required electric service for the proposed Fish Springs Water Supply Project (filed for PUCN approval under separate UEPA by Fish Springs Ranch, LLC). Onsite electric generation systems using natural gas were considered, but ultimately rejected due to reliability, cost and long term operation and maintenance considerations. Figures 7 and 13 show the substation location and site plan.

The SPPCo project will consist in general of a new 345 to 25kV substation and approximately 10 miles of 25kV overhead distribution lines to supply the pump station and well field. The substation (Fort Sage Substation) will be located primarily in-line with the existing Alturas 345kV Transmission Line, near the booster pump station. The substation will be comprised of two 345kV line terminals and two terminals for the two 345/25kV transformers, and the associated bus work, switches and circuit breakers. A line reactor will be relocated from the existing

Bordertown Substation. Both transformers shall be maintained in an energized state; one to be used as the main step-down transformer, one to be used as a back-up transformer in the event of failure of the first transformer. Appropriate protection schemes will be developed to ensure that this proposed line fold does not impact the reliability or the integrity of the Alturas 345kV facilities. In addition, the substation will be designed with sufficient redundancy to allow for maintenance without requiring an outage on the 345Kv line. Additional breakers (total of seven) will be installed to allow for phased substation maintenance.

SPPCo will provide one dark optical fiber that will be extended to the booster pump station. This will back up the communications system by allowing a secondary channel to be set up from the SPPCo termination point in Reno to County facilities. On the low side of the 345/25 kV transformers, the 25kV bus with switches and a breaker will be installed to connect to a single 25 kV distribution line.

The substation will be located under the existing Alturas 345kV Transmission Line with the line located to the southwestern portion of the substation site. The pad construction will be approximately 880 feet by 420 feet. Standard 6-foot chain link fencing with top rail barbed wire out rigging will be installed around the substation. Please reference Figure 13 for the preliminary substation layout. The substation will be comprised of two 345kV line terminals and two terminals for the two 345/25kV transformers, and the associated bus work, switches and circuit breakers. The terminals will be constructed of tubular steel A-frames. Line taps from the existing Alturas line will be accomplished using jumpers. Seven (7) breakers will be installed to allow for adequate switching ability to perform maintenance on either end of the Alturas line while maintaining service to the Fish Springs Ranch pumping facility. During this transition, the Alturas line will be maintained in a single pole tripping scheme.

The substation network will consist of tubular steel bus work with supporting tubular steel portal structures. Equipment such as breakers and transformers will be set on concrete pads with the appropriate oil containment as required. A complete grounding grid with switching platforms will be installed along with appropriate substation gravel to address any step and touch potential within the area. An estimated cut / fill volume required to construct the substation pad is 70,000 cubic yards. A projected 12 foot fill is anticipated on the northern portion of the pad with a projected 14 foot cut on the southern portion.

STORAGE TANKS DESIGN AND SITE LAYOUTS

The project includes the construction of at least four storage tanks at various locations. Two 500,000 gallon storage tanks will be located adjacent to the pump station to provide suction supply and fire protection. A 200,000 gallon tank is proposed on top of Fort Sage Pass to supplement the surge suppression system. Lastly, a 1,000,000 gallon tank for operational storage is proposed at the southern terminus of the transmission main adjacent to Matterhorn Boulevard. Additional facility planning for the Lemmon Valley Area may identify the need for more storage capacity at the terminal tank location. The special use permit is approved for construction of up to five million gallons of storage.

The storage tanks located adjacent to the pump station will provide operational and fire storage for the well buildings and main pump station. The two 500,000-gallon capacity welded steel storage tanks will be designed and constructed in accordance with AWWA D100. Preliminary dimensions of each tank are 24 foot tall walls with an approximate diameter of 61 feet. Tanks will be constructed on compacted gravel foundations and will be painted an approved neutral color to minimize visual impacts. The site will require a minor amount of grading to provide a level area to construct the tanks. Cut and fill slopes will be limited to 3 feet horizontal to 1 foot vertical (3:1) with tanks located completely in cut. Figures 14 and 15 present the preliminary site plan and elevations of the pump station storage tanks.

The 200,000 gallon storage tank located at the top of Fort Sage Pass will provide operational storage to maintain positive pressure (a full pipe) in the transmission main during shut down. Preliminary surge evaluations indicate that a minimum amount of storage is required at the top of the pass during power losses to maintain positive pressure in the transmission main between the pass and the southern terminus of the transmission main. The tank will act as a stand-pipe during instantaneous power losses. Without this facility, air release-vacuum valve facilities may allow a significant length of pipe at the pass to dewater during these events, which could encourage the introduction of contaminants into the transmission main. ARVs will need to be provided, however, to allow the tank to be taken out of service for maintenance.

It is anticipated that inlet control valves, a pressure relief valve and outlet bypass valving will be required for this storage tank. As the flow rate in the pipeline increases, the hydraulic grade line at the tank will increase. This will cause the tank to fill until a predetermined elevation / storage volume is reached, which will shut off the inlet control valve. If a power failure occurs with the pump station in operation, the outlet bypass valve will open immediately and keep the pipeline full of water until the pressure surge within the pipeline cycles down to a static state.

The pressure relief valve will help keep the pipeline from exceeding the design pressure and will discharge directly to the tank. If the water level in the tank exceeds its maximum design elevation, an alarm will be sent back to the pump station that will shut down the pumps and notify the appropriate personnel of the issue. The design intent is to monitor the discharge manifold pressure with pressure transducers, and shut down the pumps if the pressure increases beyond a preset point. However, the pressure relief valve will also be monitored and act as a redundant safety feature and alarm.

Preliminary tank dimensions are 24 foot tall walls with an approximate diameter of 40 feet. The tank will be constructed on compacted gravel foundations unless seismic constraints require a firmer foundation to prevent over-turning. The site will require a minor amount of grading to provide a level area to construct the tank and construction of an access road. Cut and fill slopes will be limited to 3 feet horizontal to 1 foot vertical (3:1) with tanks located completely in cut. It is proposed at this time to run electrical wires with the fiber optic from the pump station up to the tank at the pass to supply 24V power to the pressure transducers.

The terminal storage tank will be located on BLM property at the southern terminus of the transmission main near the high point on Matterhorn Boulevard. The proposed 1,000,000 gallon tank will have a dedicated inlet and magnetic flow meter from the transmission main and a dedicated outlet for supplying demands to the south. Preliminary dimensions of the AWWA D100 welded steel tank are 24' to 32' tall walls with an approximate diameter of 90 feet. The tank will be constructed on compacted gravel foundations and will be painted an approved neutral color to minimize visual impacts. The site will require a minor amount of grading to provide a level area to construct the tank. Cut and fill slopes will be limited to 3 feet horizontal to 1 foot vertical (3:1) with tanks located completely in cut. Figures 16 and 17 present the preliminary site plan and elevation of the terminal storage tank. The terminal storage tank water surface elevation will control the pump station. This site will also be used to relay operational information for the entire supply system back to the Washoe County SCADA system.

An all-weather compacted gravel access road will be constructed from existing roads to the pump station and terminal tank sites. Access into each of the tank sites will be restricted by a chain link fence with three-strand barbwire around the facilities. The fencing will be vinyl coated with an approved neutral color to minimize visual impacts. The terminal tank site fencing shall include slats of a similar color to match the fencing. The design will include standard locking features all located in enclosures to minimize the potential for access to the interior. In addition, facilities will include an alarm system that will notify appropriate personnel in case of unauthorized entry.

TRANSMISSION MAIN DESIGN AND ALIGNMENT

The final design will be based on a supply of 8,000 acre-feet annually, and a peak design flow rate of 10,000 gpm. The sustainable well production capacity will limit the actual peak pumping capacity of the entire supply facility. Based on the Final EIS and permitting for the project, the maximum capacity/diameter for the transmission main is 30 inches. Figures 1 through 3 depict the pipeline alignment and hydraulic profile of the transmission main. Estimated working pressures at the peak design flow rate of 10,000 gpm are summarized in Table 4.

The transmission main consists of approximately 28 miles of buried, 30-inch diameter pipeline from the pump station over the east shoulder of the Fort Sage Mountains, across upper portions of Dry Valley, through Bedell Flat, into Antelope Valley, with termination of the pipeline at a storage facility located between Lemmon and Antelope Valley off of Matterhorn Boulevard at an approximate elevation of 5,510 feet. The transmission main has been sized to reduce the amount of energy required to convey flows from Fish Springs Ranch to Lemmon Valley and to provide some peaking capacity.

Most of the alignment follows the existing Tuscarora Natural Gas Pipeline right-of-way into the Bedell Flat area where the water pipeline changes direction and heads south towards Antelope Valley. Once in Antelope Valley, the transmission main will parallel Antelope Valley Road within the existing right-of-way until the intersection with Matterhorn Boulevard, at which point the pipeline turns left and parallels Matterhorn Boulevard to the south within the existing right-of-way. The pipeline continues to the south until it reaches the high point of Matterhorn Boulevard where it diverges from the right-of-way, travels east across a small section of private property and terminates at a storage tank site located on public land (BLM). Figures 1 through 3 present the alignment.

Tuscarora Gas Transmission Company and Sierra Pacific Power Company have been consulted regarding the proposed project that will parallel and cross the existing gas and electrical transmission facilities. Several design constraints have been identified regarding the proximity of the proposed water main to existing facilities and minimum design requirements for crossing of the existing gasline. The Transmission Main alignment is primarily constrained by the Tuscarora gas pipeline, the Alturas powerline transmission towers, and the EIS boundary in the Fort Sage Pass segment (Phase I), the Tuscarora gas pipeline and the EIS boundary in the Dry Valley segment (Phase II), and the EIS boundary and other existing utilities in the Bedell-Antelope Valley segment (Phase III). Secondary constraints include minimizing access road crossings, drainage area crossings, and side slope construction.

Sierra Pacific Power Company has indicated that the proposed water main should be located at least 40 feet from any existing electrical transmission structures, guy wires or anchors.

Tuscarora has indicated that a 50-foot separation between the gas and water transmission facility is acceptable for portions of the alignment that parallel the gas main. Details have been provided that will govern how crossing of the pipeline will be achieved with minimum separation identified. In addition, Tuscarora preferred that the water main generally be located down slope of the existing gas transmission main when reasonable, minimize the number of crossings, coordinate the design of the active corrosion protection system due to the fact that the gas main has an impressed current, coordinate and review blasting activities in the vicinity of the gas main, limit vehicle traffic on top of the gas main, and provide engineered vehicle crossings over the gas main.

In a negotiated agreement between Sierra Pacific Power Company and Tuscarora Gas Transmission Company, a variance to the separation criteria is acceptable in the vicinity of Tower No. 500, whereby the transmission main will pass between the gas line and the tower leg with a minimum of 25-feet separation from each utility. This variance effectively eliminates the need for two additional gas pipeline crossings.

For project accessibility and maintenance purposes, a permanent easement of at least 50 feet in width will be provided where necessary. Large equipment will be able to mobilize with the ability to perform excavation, valve replacement, general maintenance and repairs within these constraints.

The transmission pipeline will be 30 inches in diameter, with a minimal burial depth of 3 feet for elevations less than 5,000 feet and 3.5 feet for elevations above 5,000 feet. Pending the results of the geotechnical investigation, it is anticipated that screened native materials may be used for pipe bedding and backfill.

A fiber optic telemetry cable will be located in a common trench with the water transmission pipe between the main pump station and the terminal storage tank to provide communications. The proposed installation method consists of installation of a 2-inch inner diameter HDPE conduit in the bottom and to one side of the water transmission main trench. The conduit is to be bedded in ¾ inch or smaller material with a minimum cover of 4 inches. Pipe bedding material above the conduit bedding material will consist of 3 inch or smaller material. Splice boxes will be located approximately every 5,000 feet to allow for the fiber optic cable to be blown into the conduit.

Table 4 presents the approximate working pressure for the transmission main. Due to topography, much of the transmission main will operate at pressures over 150 pounds per square inch (psi). Discharge pressure at the main pump station will be approximately 720 psi. The horizontal alignment is predicated on the use of either steel pipe, designed in accordance with AWWA C200, or cylinder pipe, designed in accordance with AWWA C303. Pipe lining for AWWA C200 pipe will be determined during final design. Pending results from the corrosion investigation, pipe coating for AWWA C200 pipe will be a dielectric coating (tape wrap or fusion bonded epoxy) with a mortar "rock shield" outer coating. Lining and coating for AWWA C303 pipe will be cement mortar in accordance with AWWA C303. In either case, the engineered pipe can be designed with a beveled end, allowing for up to five degrees of design deflection. This equates to a horizontal curve with a minimum radius of 458 feet, utilizing 40-foot pipe lengths. Using 20-foot pipe lengths, the minimum radius is shortened to 229 feet. Additionally, depending upon the joint type utilized, up to 1.5 degrees of joint pull tolerance is available. However, this additional available joint deflection will not be incorporated into the design, and will be utilized for field adjustments only, if necessary.

Both horizontal and vertical curves in the proposed alignment will be utilized to the extent practicable in an effort to minimize the use of mitered fittings. Mitered fittings are expensive to fabricate, develop large localized stress at the interior angles, are inefficient to install, generate potentially large thrust forces, and are a source of head loss. The tradeoff between the use of mitered fittings and multiple sticks of 20-foot pipe lengths must be analyzed on a case by case basis.

TABLE 4 – TRANSMISSION MAIN WORKING PRESSURES AT 10,000 GPM

Miles from Pump Station	Working Pressure (psi)
0 (Pump Station)	720
1	490
2	350
3	200
3.5 (Fort Sage Pass)	130
4	170
5	250
6	340
7	420
8	380
9	430
10	450
11	390
12	330
13	320
14	310
15	280
16	290
17	290
18	290
19	240
20	170
21	140
22	160
23	180
24	160
25	180
26	180
27	150
28	60
28.4 (Terminal Tank)	10

The horizontal and vertical alignment will be designed with considerations given to minimizing the need for air and vacuum valves associated with high points in the alignment, while concurrently limiting trench depth and/or additional pipe length. This objective is to minimize the use of mechanical air devices, which are costly installations, prone to maintenance and possible vandalism. Access points for construction and maintenance will be installed at approximately 1-mile intervals and isolation valves at approximately 5-mile intervals. Other appurtenant facilities include blow-off valves, fiber optic splice vaults, cathodic protection facilities, surge suppression facilities, and pipe alignment markers.

Most of these appurtenances will be located below existing grades in traffic rated, lockable, concrete vaults that will vary in dimension. Generally, these vaults will be located outside of traffic areas and may require small location markers extending above the surface several feet. Vault dimensions may range from 2'x3' to 8'x12' with depths approaching 8 feet. The location of these facilities will be based on existing topography and will be determined during final design. Maintenance access will be provided and coordinated with existing roads in areas where appropriate. Details of any required cathodic protection system will be provided during final design.

CONTROL STRATEGY

The proposed facility control strategy consists of designing the entire facility as an independent system based on a preprogrammed set of operating parameters and constraints that periodically relay vital information, or requested information, to Washoe County Department of Water Resources via radio telemetry from the Terminal Tank Site. Approved remote users of the control system will be able to monitor the system and change set points and operating parameters.

In general, the primary pump station will be controlled by the water level in the Terminal Tank, and the wells will be controlled by the water level in the Pump Station Tanks, which provide feed water to the pump station pumps. Individual, or groups of wells, will be called on in sequence based on a set of preprogrammed conditions. Appendix A contains information that details the proposed telemetry and control design as well as major electrical components for the facility.

CONSTRUCTION PHASING

To expedite project completion, construction of the project will be performed in multiple phases by developing several independent design packages. Individual design packages will be awarded to various contractors, resulting in multiple construction headings. Each design package will be based on the design parameters contained in this design report. Intermediate and final design packages will be provided for review and approval by Washoe County Department of Water Resources prior to construction. At this time, it is anticipated that the facility design and construction will be divided into the following design packages, arranged generally in order of the estimated start of construction:

- Well Drilling & Testing (6 wells total)
- Pump Station (5 cans, 4 pumps, surge facility, disinfection, telemetry & control)
- Electric Sub-Station and Distribution
- Transmission Main Phase 1 – Fort Sage (25,000'± of 30" pipe)
- Transmission Main Phase 2 – Dry Valley (38,000'± of 30" pipe)
- Transmission Main Phase 3 – Bedell-Antelope Valley (88,000'± of 30" pipe)
- Storage Tanks
  - Pump Station Tanks: 2 – 500,000 gallon steel tanks
  - Fort Sage Pass Tank: 1 – 200,000 gallon steel tank
  - Terminal Storage Tank: 1 – 1,000,000 gallon steel tank
- Well Field Piping (52,400' 12" to 30" pipe)
- Well Equipping (6 wells total)

Figure 18 presents a preliminary schedule for the project and the design packages. The estimated 90% completion date for the various design packages are shown, at which time each design package will be submitted to the Washoe County Department of Water Resources for review. Upon receiving comments, each design package will be finalized for final approval by the various agencies before going to construction.

Fish Springs Ranch Water Supply Project

List of Figures

Fish Springs Water Supply Project

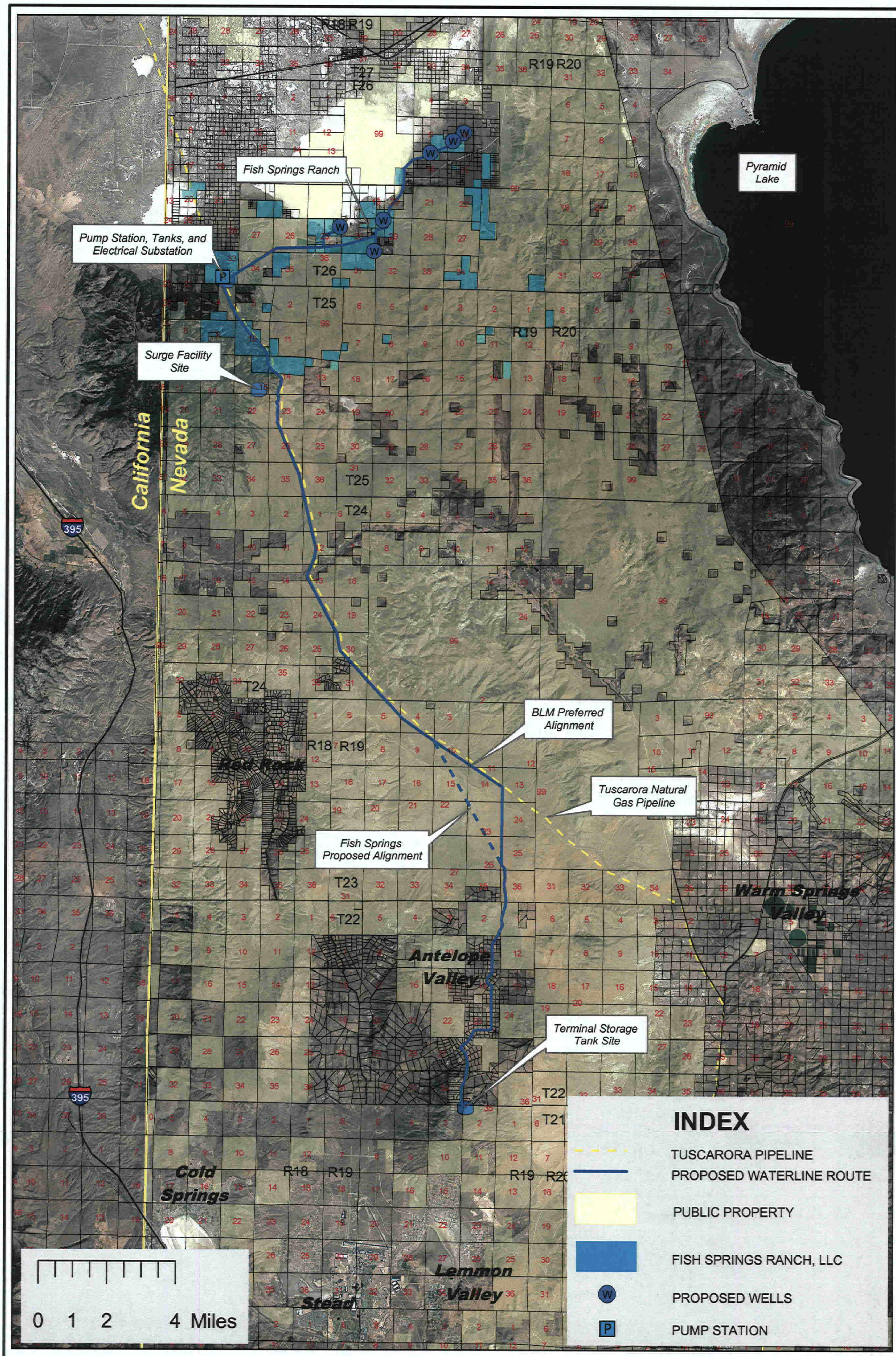


FIGURE 1 - VICINITY MAP

February 2006

ECO:LOGIC

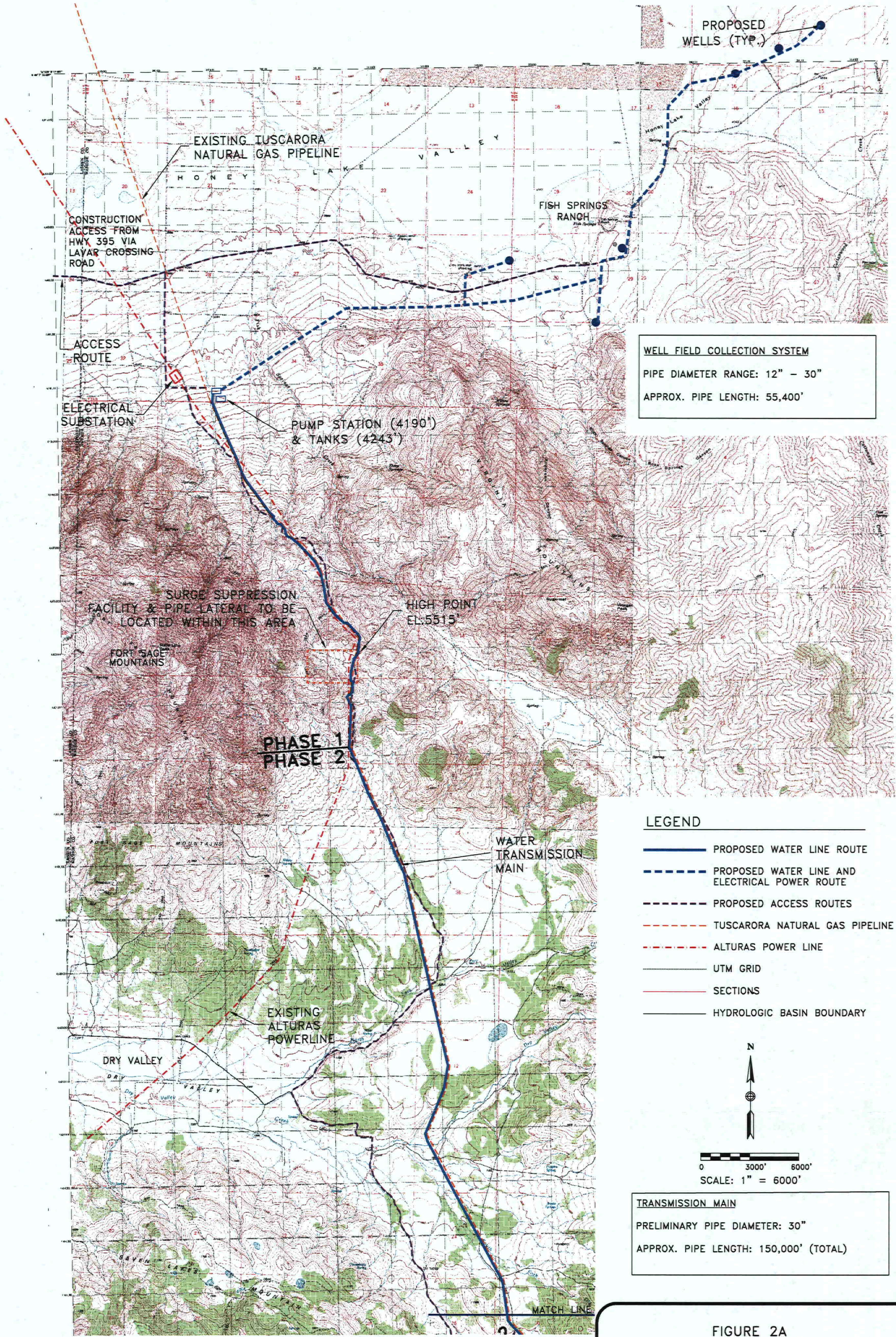


FIGURE 2A
LAYOUT MAP
NORTHERN SECTION
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK

Scale: 1" = 6000'
Project: VIDL05-001
File: Figures2A&2B.dwg

ECO:LOGIC
Consulting Engineers

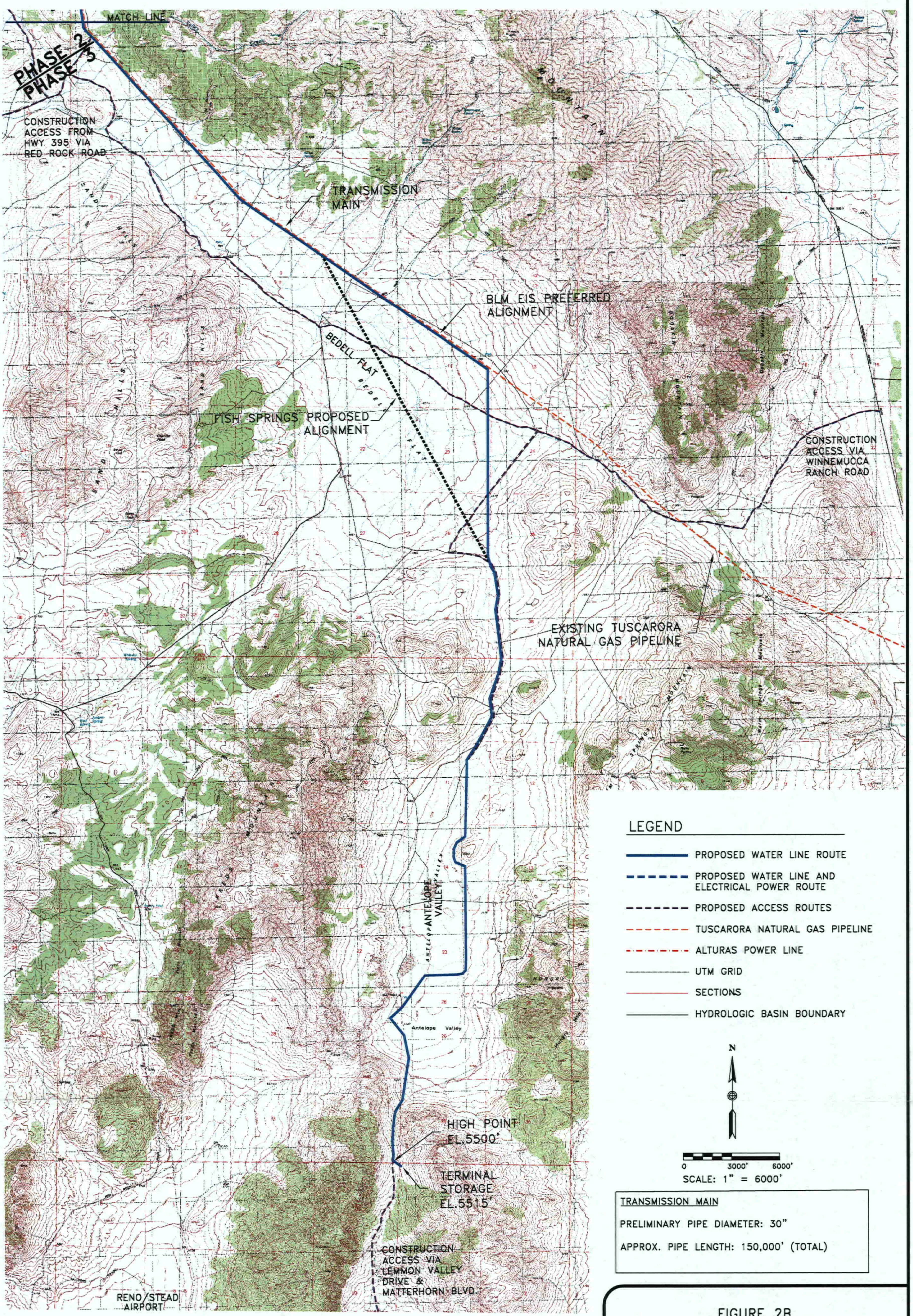
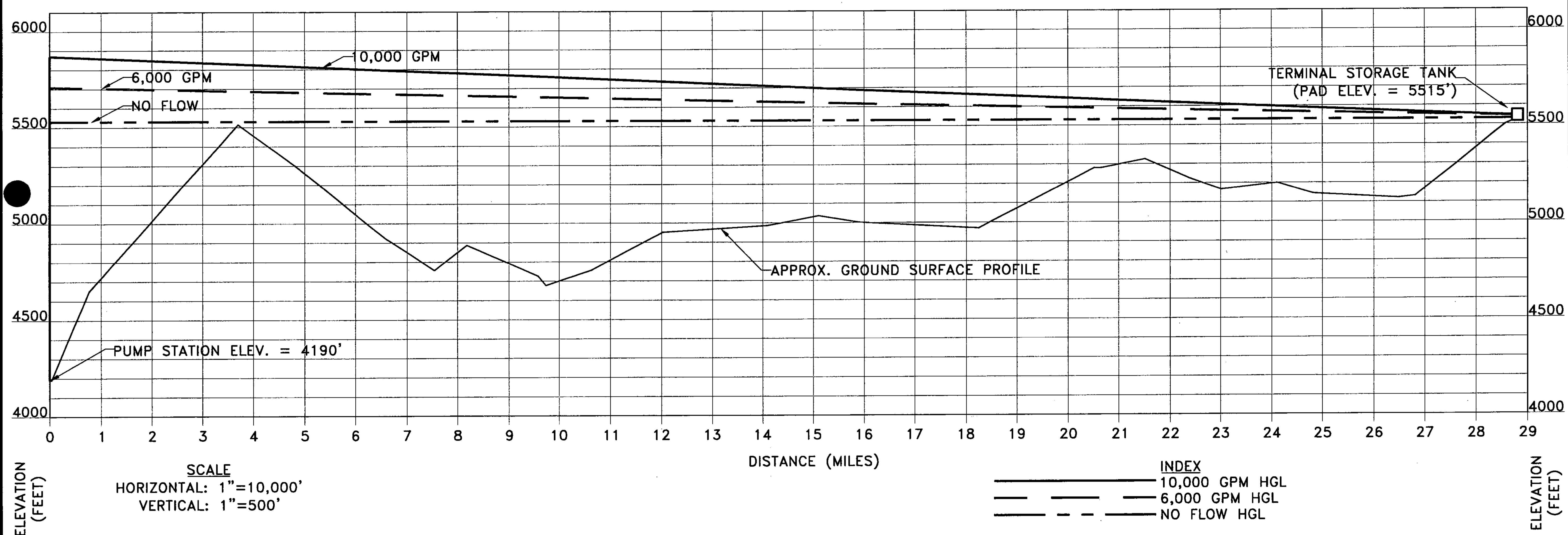


FIGURE 2B
LAYOUT MAP
SOUTHERN SECTION
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK

Scale: 1" = 6000'
Project: VIDL03-001
File: Figures2-3.dwg

ECO:LOGIC
Consulting Engineers

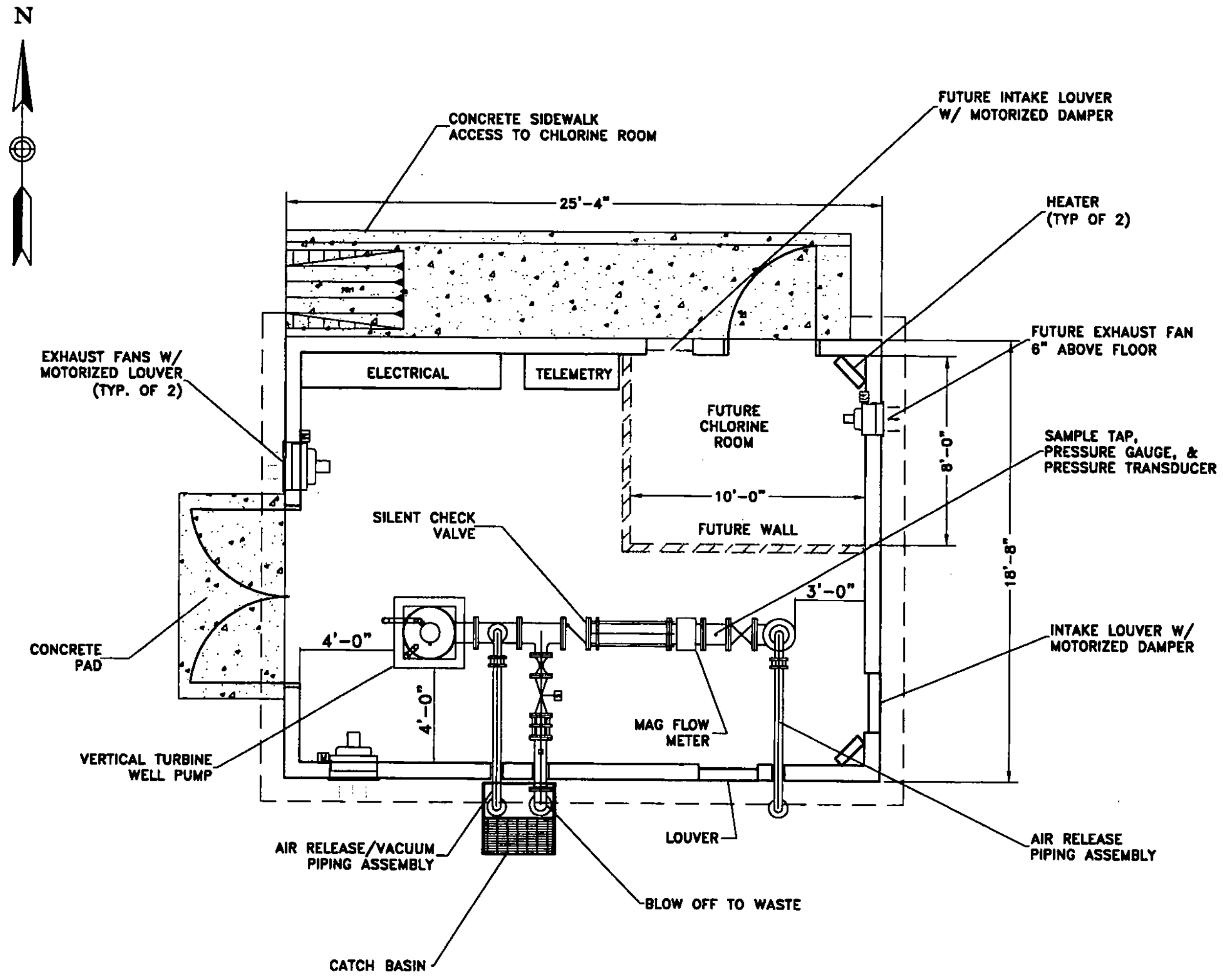


ECO:LOGIC
Consulting Engineers

FIGURE 3
HYDRAULIC PROFILE
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: JPB
File: Figure3.dwg

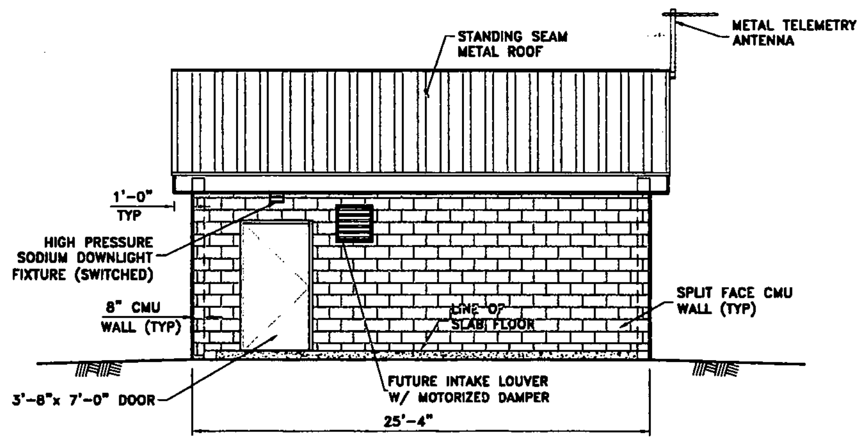
SCALE: AS SHOWN
Project: VDLR05-001



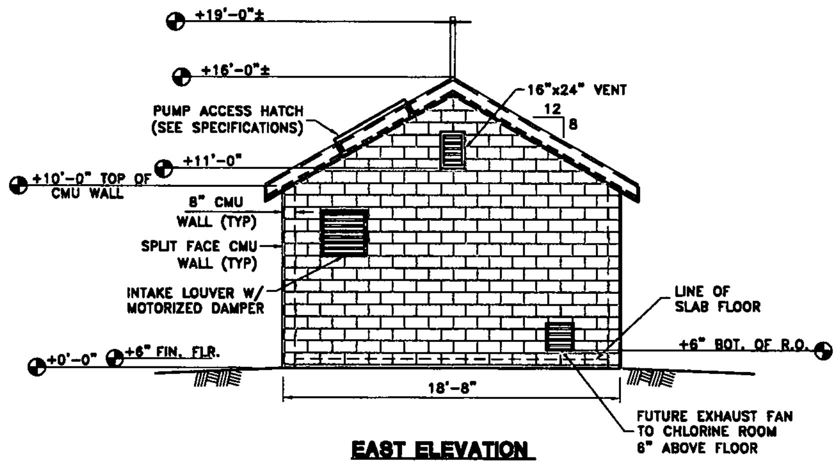
ECO·LOGIC
Consulting Engineers

FIGURE 4
PRELIMINARY PRODUCTION WELLS
TYPICAL FLOOR PLAN
FISH SPRINGS WATER SUPPLY PROJECT

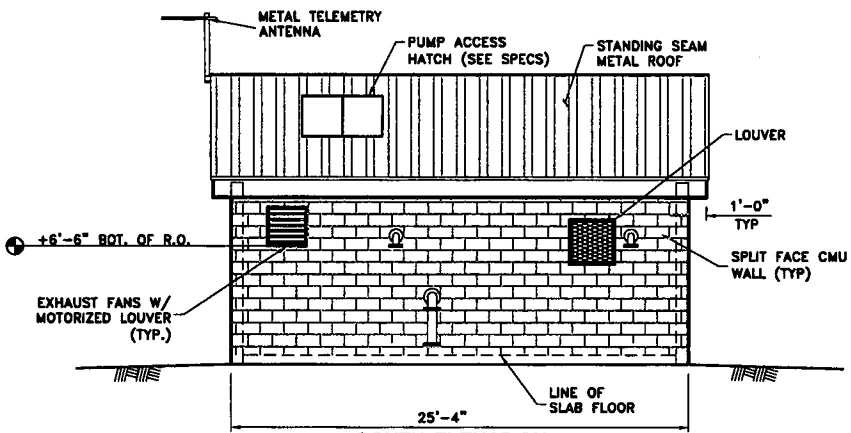
Date: 2/2006 Scale: 1/8"=1'
Designed By: DSK Project: VIDL05-001
Drawn By: DSK
File: Figures4,5,6 Wells.dwg



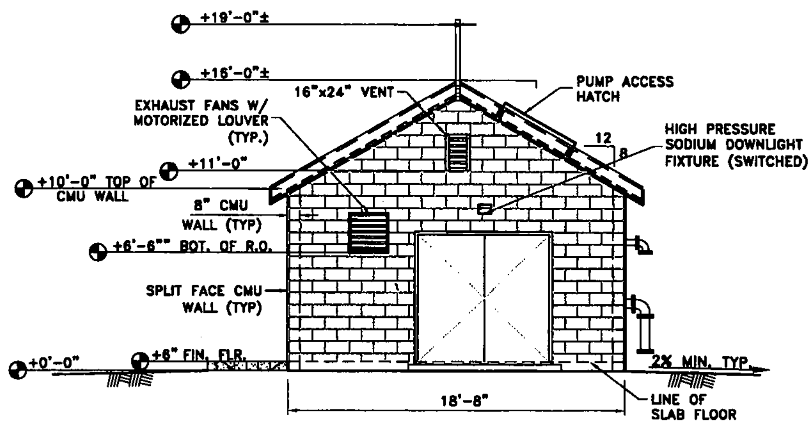
NORTH ELEVATION
SCALE: NONE



EAST ELEVATION
SCALE: NONE



SOUTH ELEVATION
SCALE: NONE

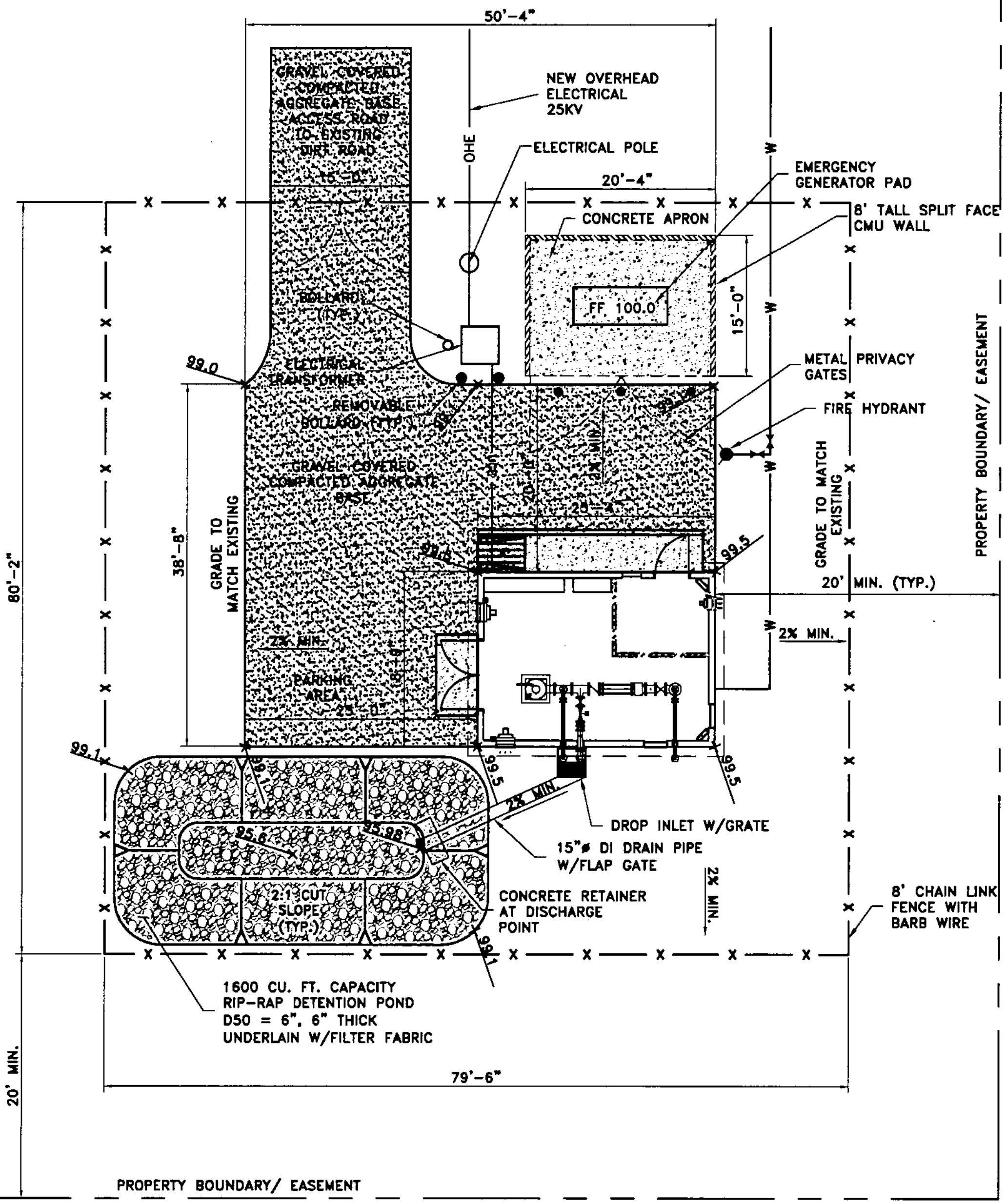


WEST ELEVATION
SCALE: NONE

ECO·LOGIC
Consulting Engineers

FIGURE 5
PRELIMINARY PRODUCTION WELLS
TYPICAL BUILDING ELEVATIONS
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Scale: NONE
Designed By: DSK
Project: VIDL05-001
Drawn By: DSK
File: Figures4,5,6 Wells.dwg



NOTES:
1. CUT AND FILL SLOPES WILL BE LIMITED TO A MAXIMUM SLOPE OF 3'(HOR.) TO 1'(VERT.) UNLESS OTHERWISE NOTED
2. AT LEAST ONE WELL SITE WILL BE PROVIDED WITH A BACKUP GENERATOR.

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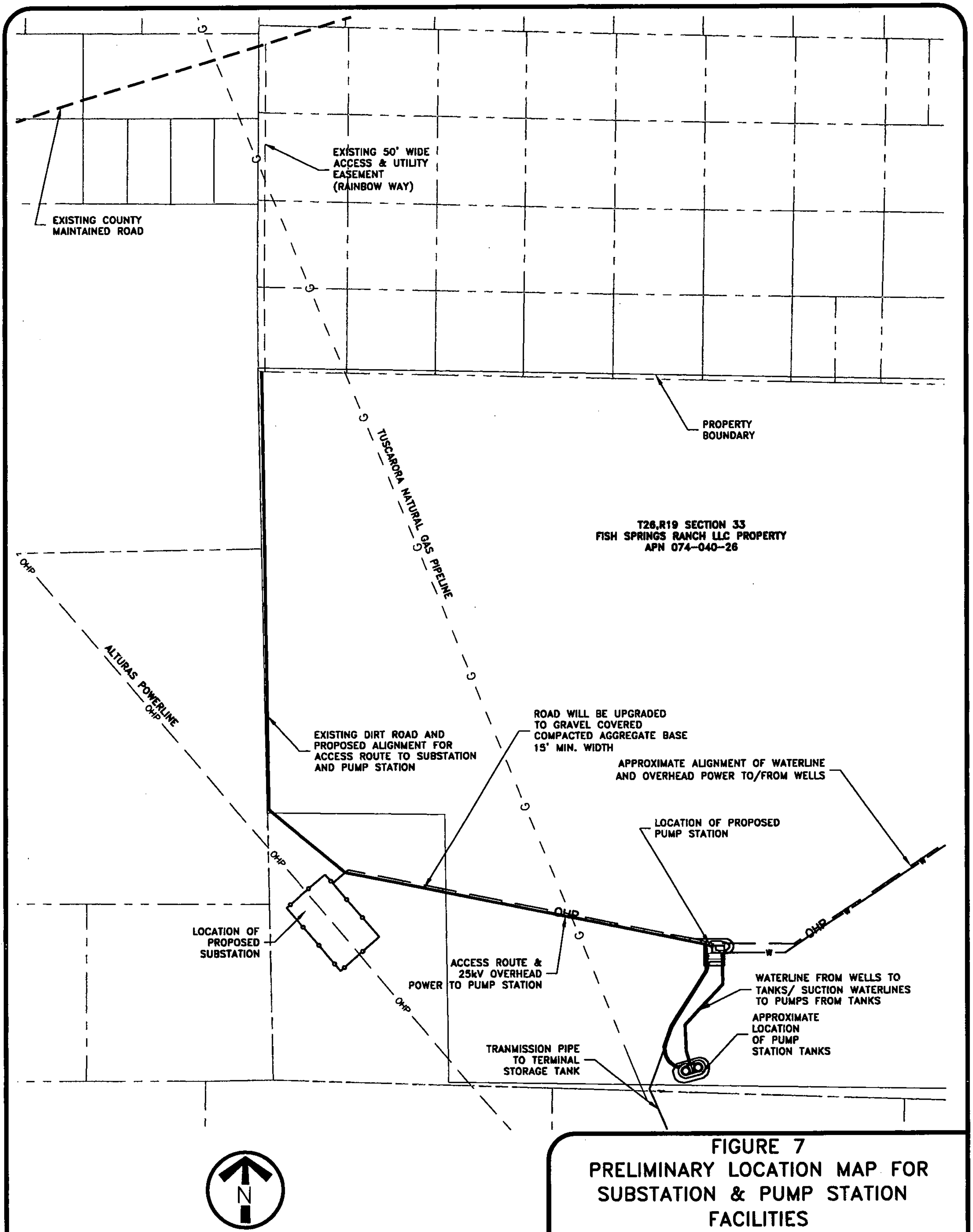
FIGURE 6
PRELIMINARY PRODUCTION WELLS
TYPICAL SITE PLAN
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006 Scale: 1"=20'
Designed By: DSK Project: VIDL05-001
Drawn By: DSK
File: Figures4,5,6 Wells.dwg



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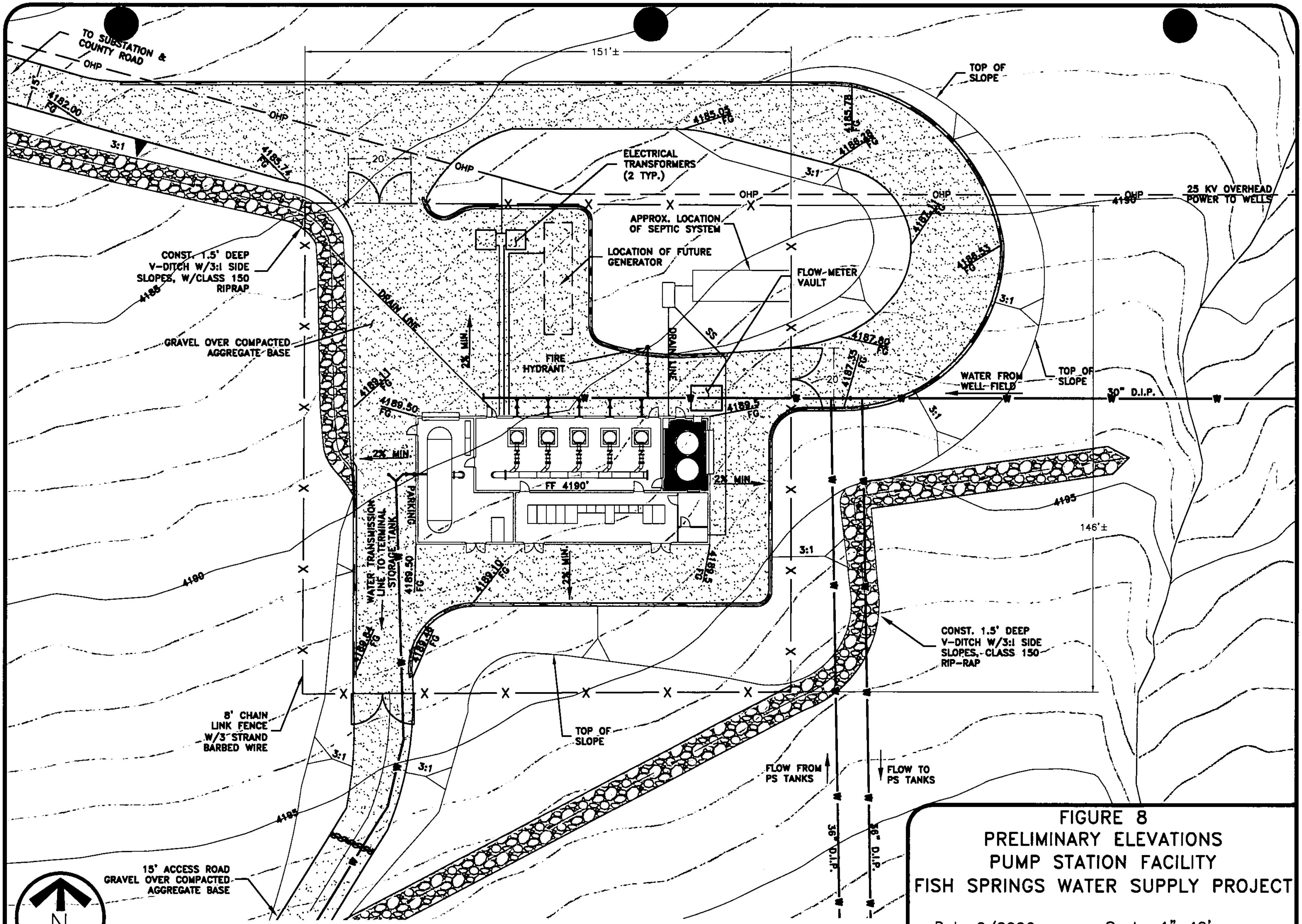
Consulting Engineers

FIGURE 7
PRELIMINARY LOCATION MAP FOR SUBSTATION & PUMP STATION FACILITIES
FISH SPRINGS WATER SUPPLY PROJECT

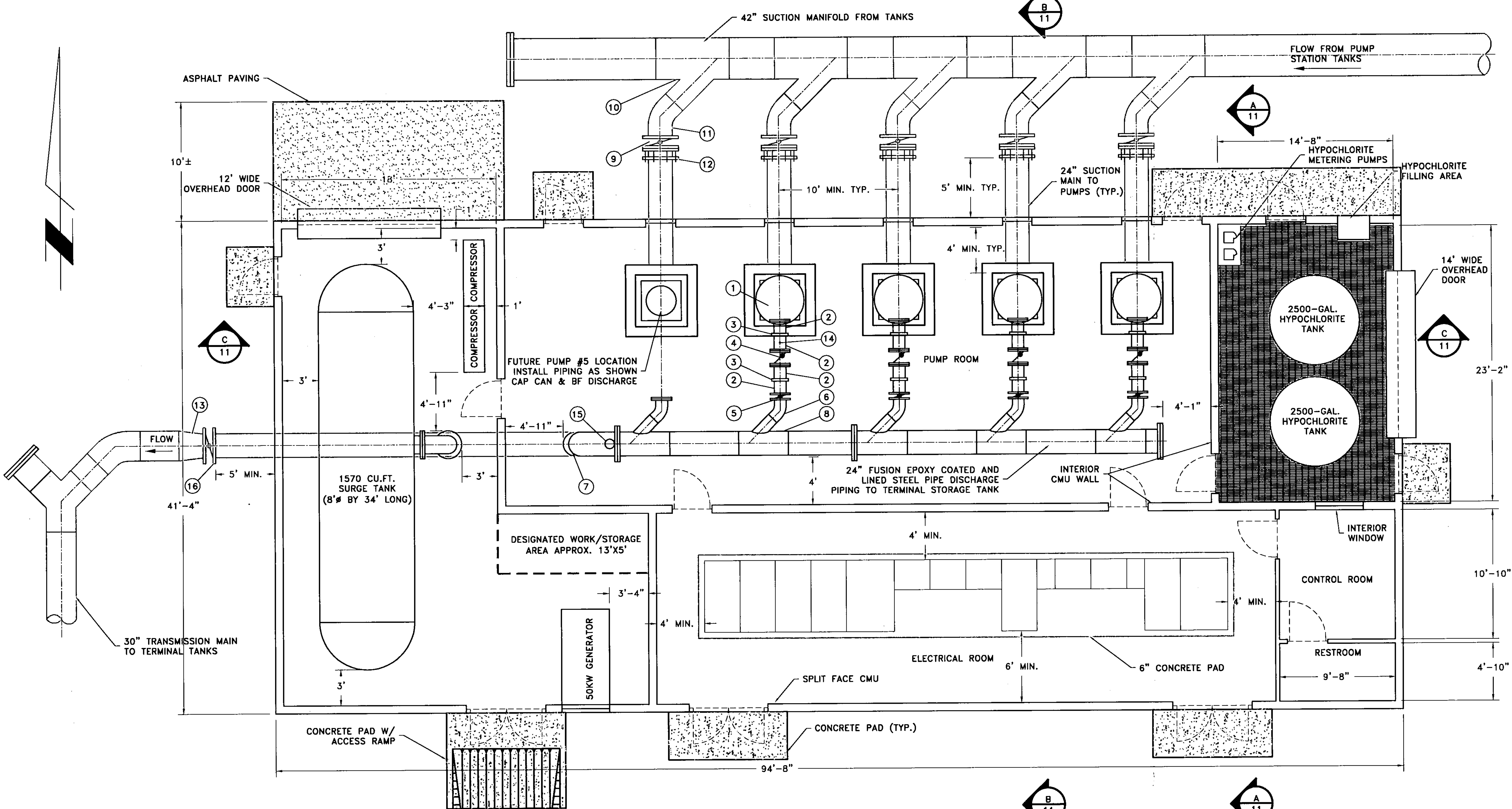
Date: 2/2006
Designed By: DSK
Drawn By: DSK
File: Figure7.dwg
Scale: 1" = 1000'
Project: VDLR05-001



ECO:LOGIC
Consulting Engineers

FIGURE 8
PRELIMINARY ELEVATIONS
PUMP STATION FACILITY
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: EPQ
File: PS-Figures9,10A,10B,11.dwg
Scale: 1"=40'
Project: VIDL05-001



MATERIAL LIST: PARTS ARE TYPICAL OF FOUR PUMP ASSEMBLIES.

1. 1250 HP VERTICAL TURBINE BOOSTER PUMP (TYP.)
2. 12" FLANGED X GROOVED END STEEL MAIN (TYP.)
3. 12" GRUVLOK HIGH PRESSURE COUPLING FIG. 7004 HPR (TYP.)
4. 12" APCO SILENT CHECK VALVE SERIES 600 (TYP.)
5. 12" BRAY BUTTERFLY VALVE SERIES 42 (TYP.)
6. 12" WLD X FLG 45° ELBOW (TYP.)
7. 24" WLD X FLG 60° ELBOW (TYP.)
8. 24" X 12" WLD LATERAL (TYP.)
9. 24" BUTTERFLY VALVE (TYP.)
10. 42" X 24" WLD LATERAL (TYP.)
11. 24" 45° WLD X FLG ELBOW (TYP.)
12. 24" FLEX COUPLING ADAPTER (TYP.)
13. 30" WLD X 24" FLG STL REDUCER
14. 1" MANAUAL AIR RELEASE VALVE
15. 3" APCO AIR/VACUUM VALVE MODEL NO. 146DAT
16. 24" BRAY BUTTERFLY VALVE SERIES 42

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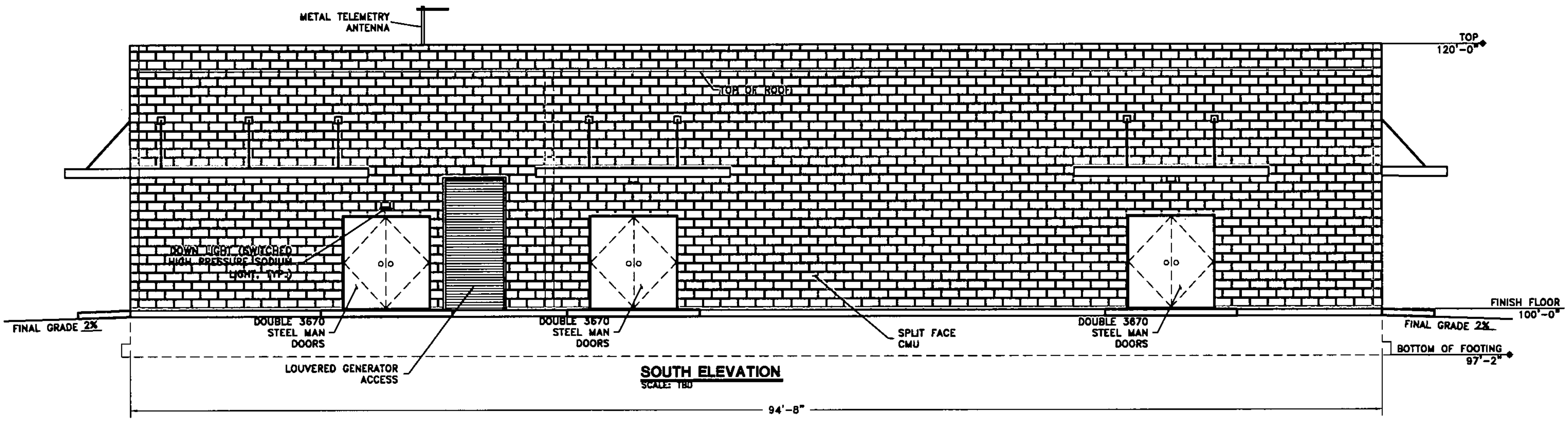
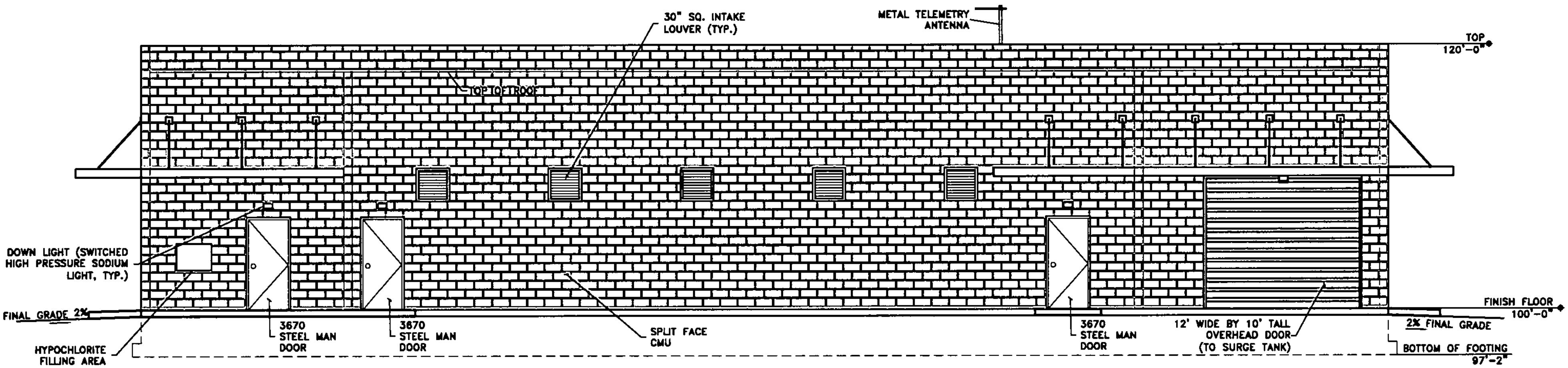
Consulting Engineers

FIGURE 9
PRELIMINARY FLOOR PLAN
PUMP STATION FACILITY
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: JPB
File: PS–Figures9,10A,10B,11.dwg
Scale: 1/8" = 1'
Project: VIDL05–001



SOUTH ELEVATION
SCALE: TBD



NORTH ELEVATION
SCALE: TBD

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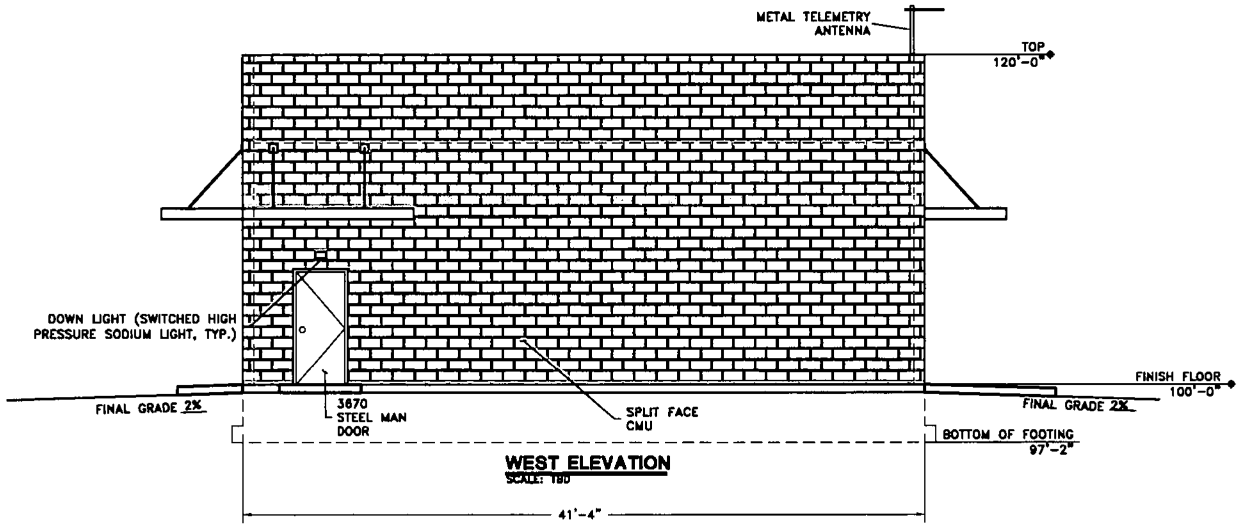
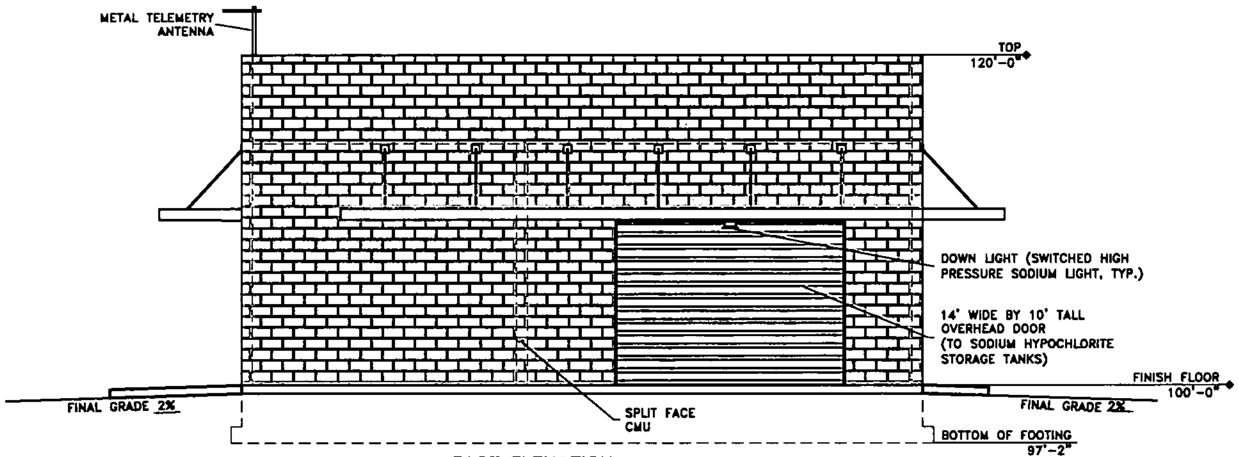
Consulting Engineers

FIGURE 10 A
PRELIMINARY ELEVATIONS
PUMP STATION FACILITY
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK
File: PS-Figures9,10A,10B,11.dwg
Scale: None
Project: VIDL05-001



WEST ELEVATION
SCALE: TBD



EAST ELEVATION
SCALE: TBD

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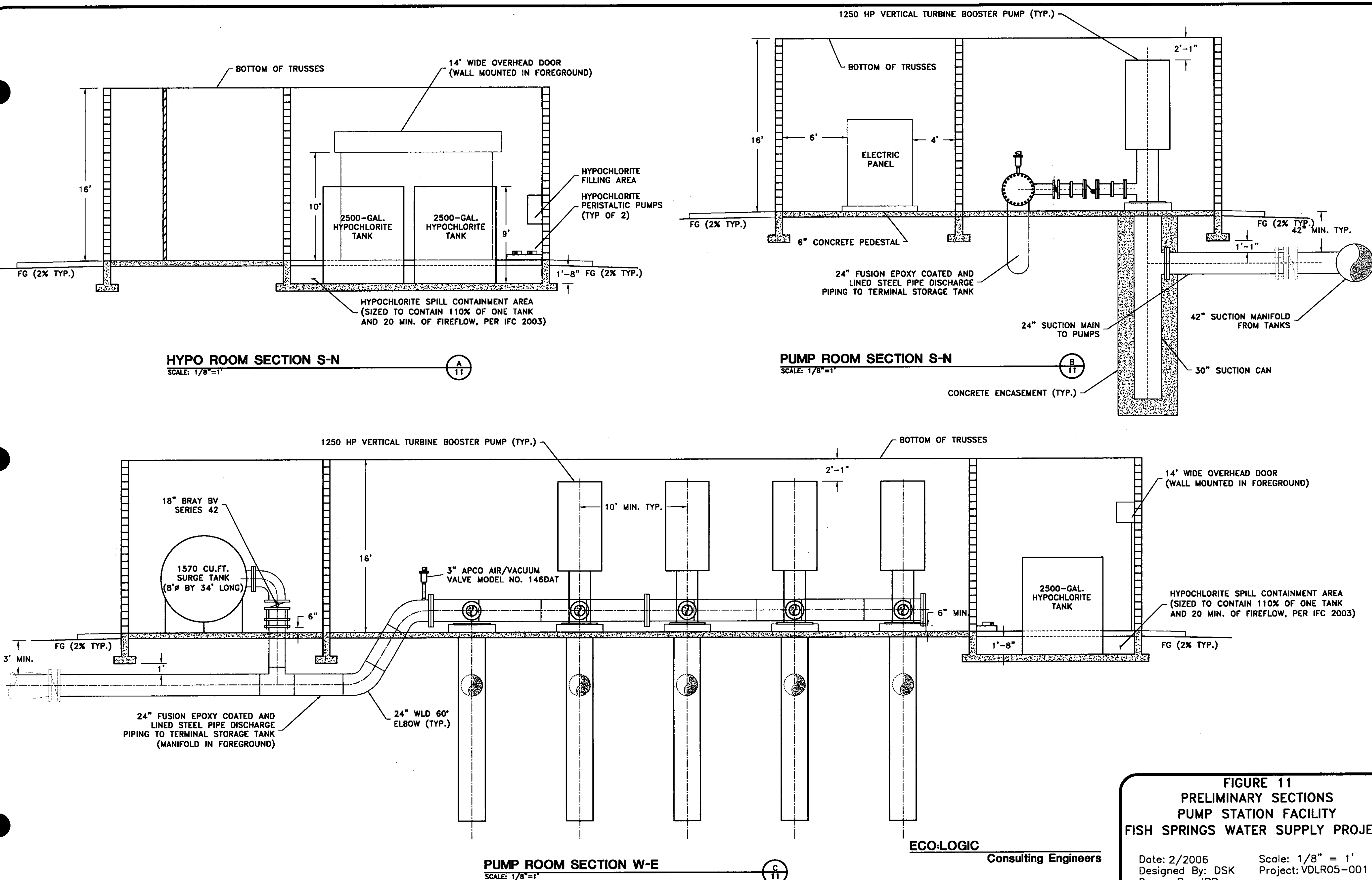
Consulting Engineers

FIGURE 10 B
PRELIMINARY ELEVATIONS
PUMP STATION FACILITY
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK
File: PS-Figures9,10A,10B,11.dwg
Scale: None
Project: VIDL05-001

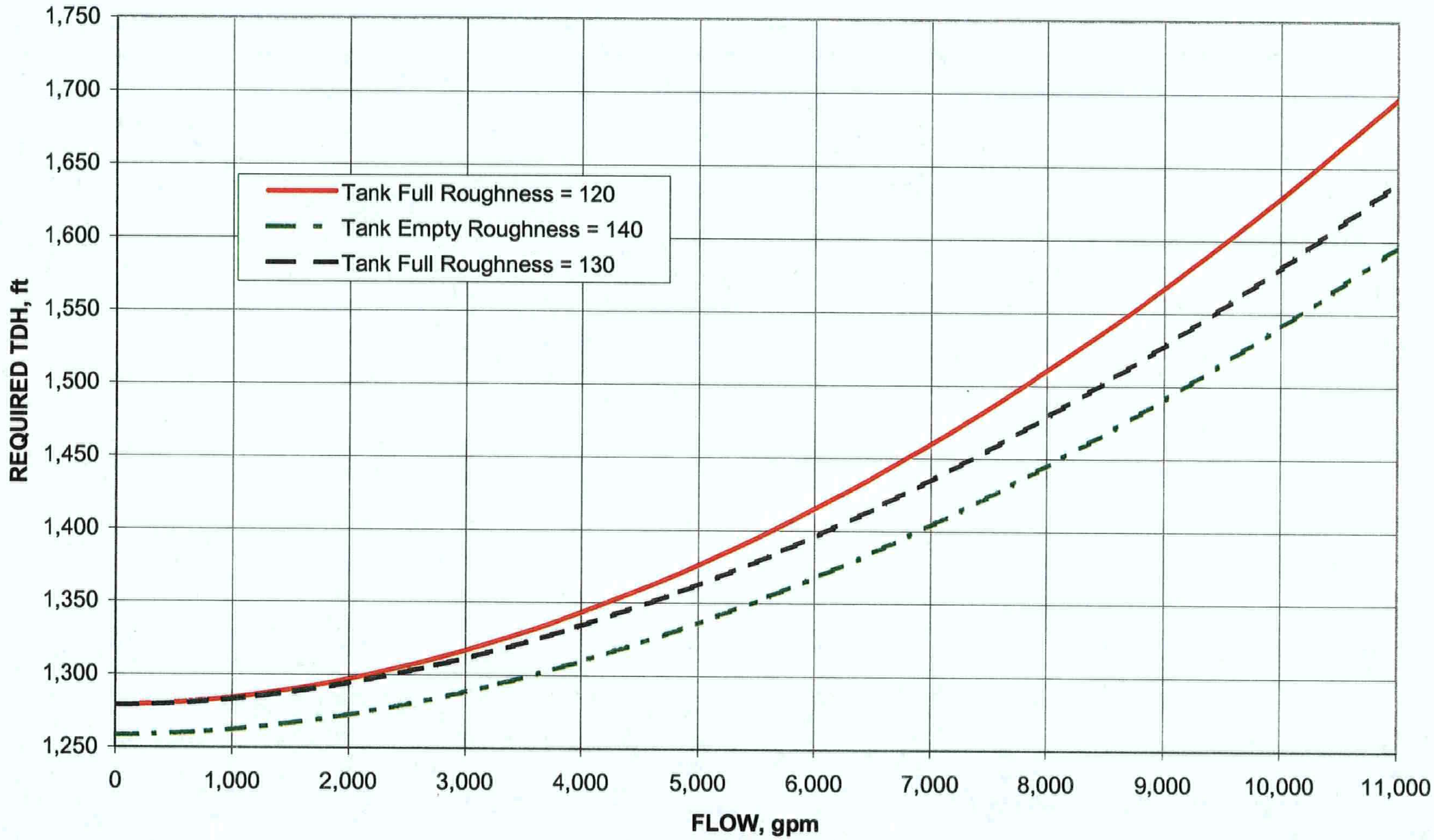


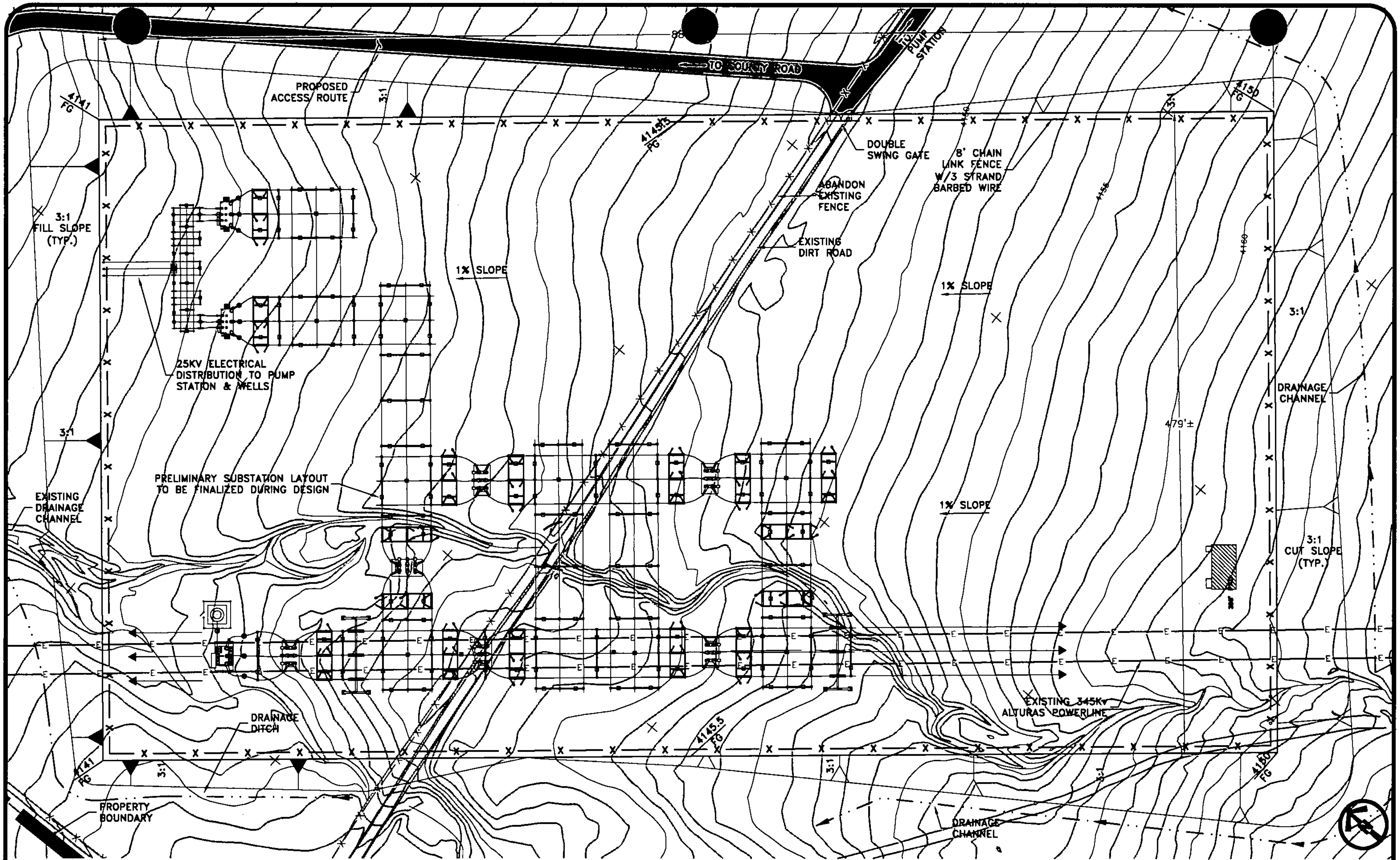
ECO:LOGIC
Consulting Engineers

FIGURE 11
PRELIMINARY SECTIONS
PUMP STATION FACILITY
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: JPB
File: PS-Figures9,10A,10B,11.dwg
Scale: 1/8" = 1'
Project: VDLR05-001

FIGURE 12: FISH SPRINGS WATER SUPPLY PROJECT
REQUIRED PUMP TDH VS. FLOW
2/2006





ESTIMATED CUT/FILL VOLUME = 70,000 CU.YD.

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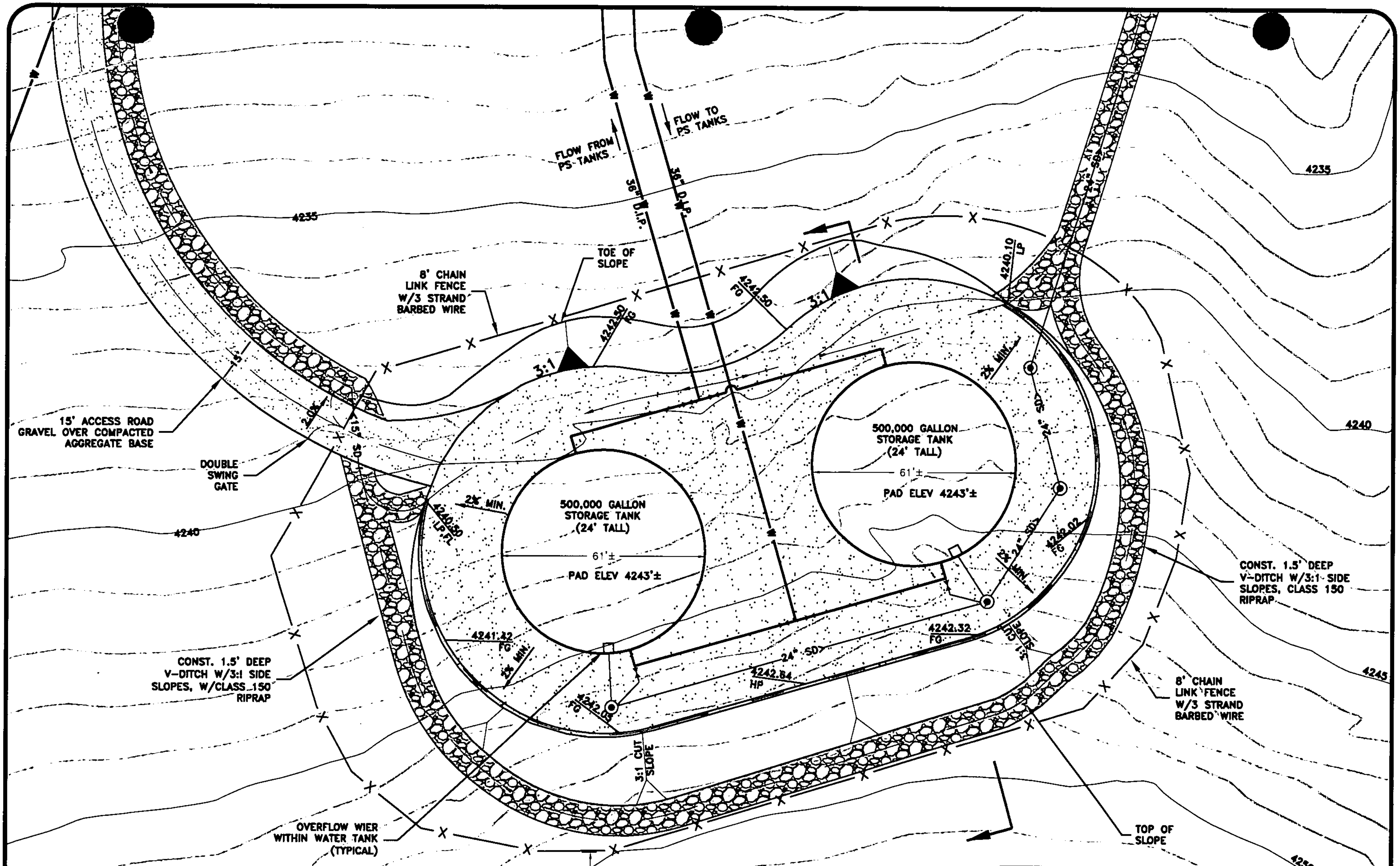
Consulting Engineers

FIGURE 13
PRELIMINARY SITE PLAN
ELECTRICAL SUBSTATION
FISH SPRINGS WATER SUPPLY PROJECT

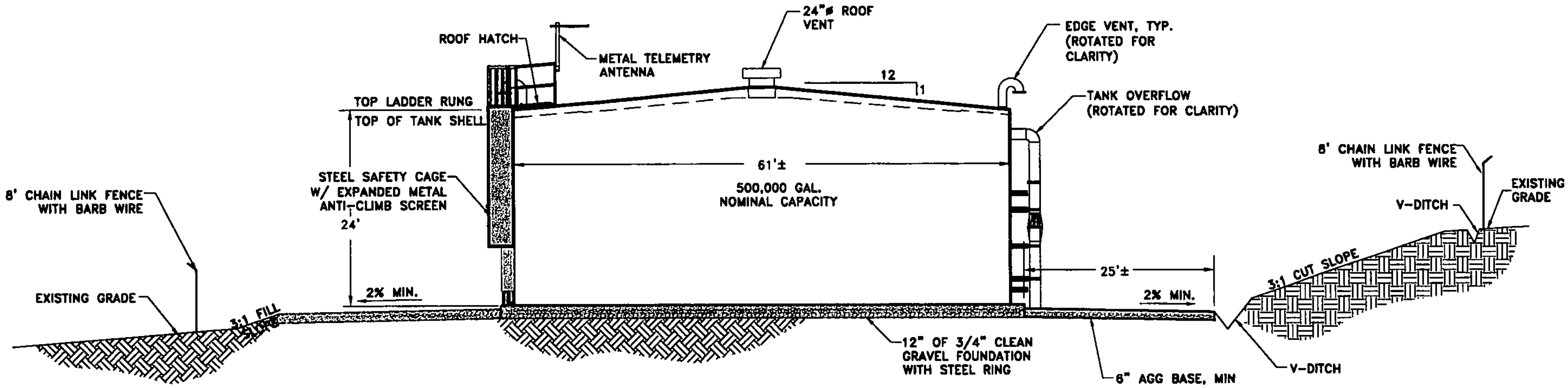
Date: 2/2006
Scale: 1" = 100'
Designed By: SPPCo
Project: VIDL05-001
Drawn By: DSK
File: Figure 13.dwg



ECO:LOGIC
Consulting Engineers

FIGURE 14
PRELIMINARY SITE PLAN
PUMP STATION TANKS
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: EPQ
File: PS–Figures9,10A,10B,11.dwg
Scale: 1"=40'
Project: VIDL05–001

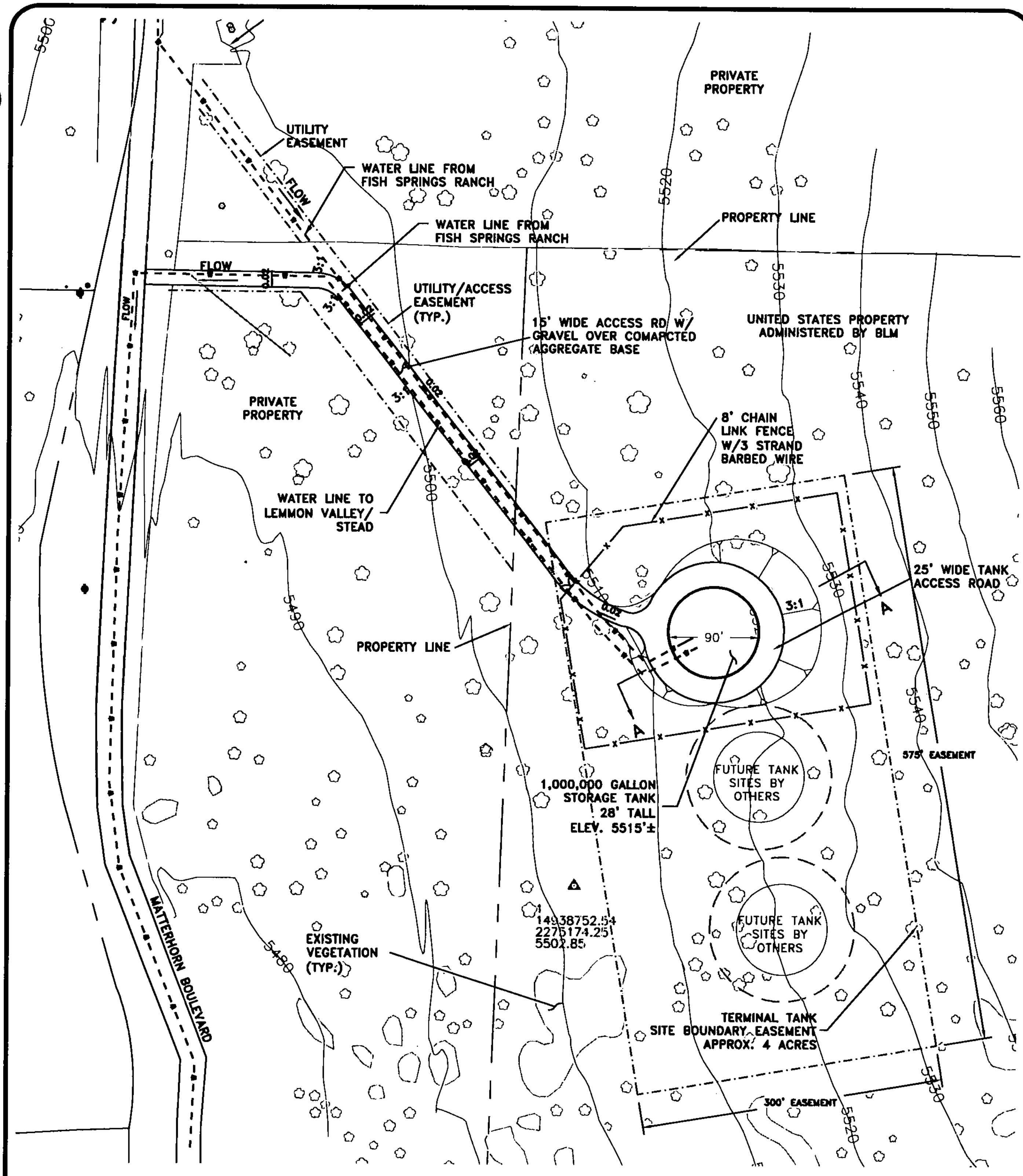


TANK ELEVATION A–A

ECO:LOGIC
Consulting Engineers

FIGURE 15
PRELIMINARY ELEVATION FOR
PUMP STATION TANKS
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK
File: Figures7,8,14,15.dwg
Scale: 1" = 20'
Project: VIDL05-001



NOTE:
ROAD TO MATCH EXISTING WITH AN APPROXIMATE 5% SLOPE TO BRING UP TO TANK PAD ELEVATION. GRADE 2% HORIZONTALLY IN A SOUTHERLY DIRECTION TO ALLOW FOR RUNOFF DURING STORM EVENTS.

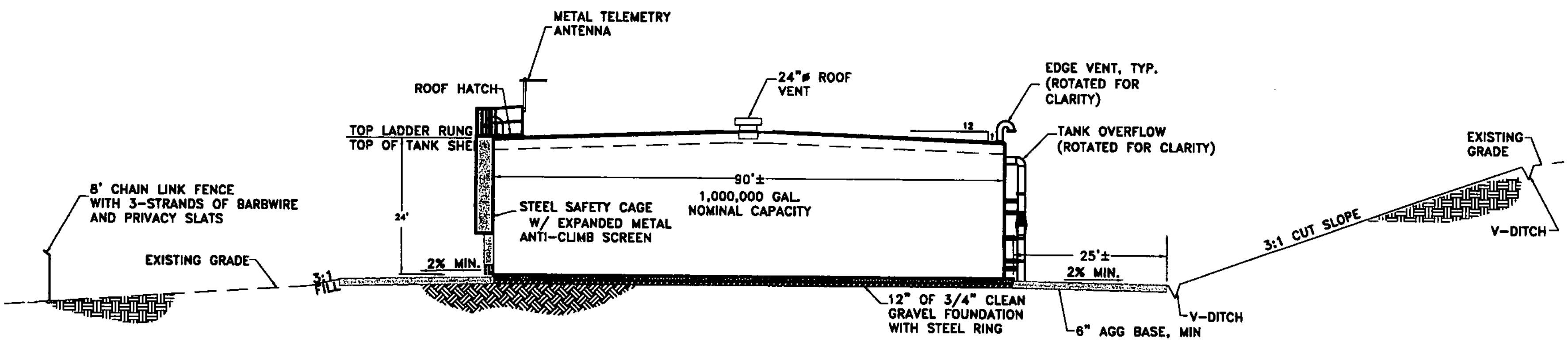
N

ECO:LOGIC
Consulting Engineers

FIGURE 16
PRELIMINARY SITE PLAN
TERMINAL STORAGE TANK
FISH SPRINGS WATER SUPPLY PROJECT

Date: 2/2006
Designed By: DSK
Drawn By: DSK

Scale: 1" = 140'
Project: VIDL05-001
File: Figures16,17.dwg



TANK ELEVATION A-A

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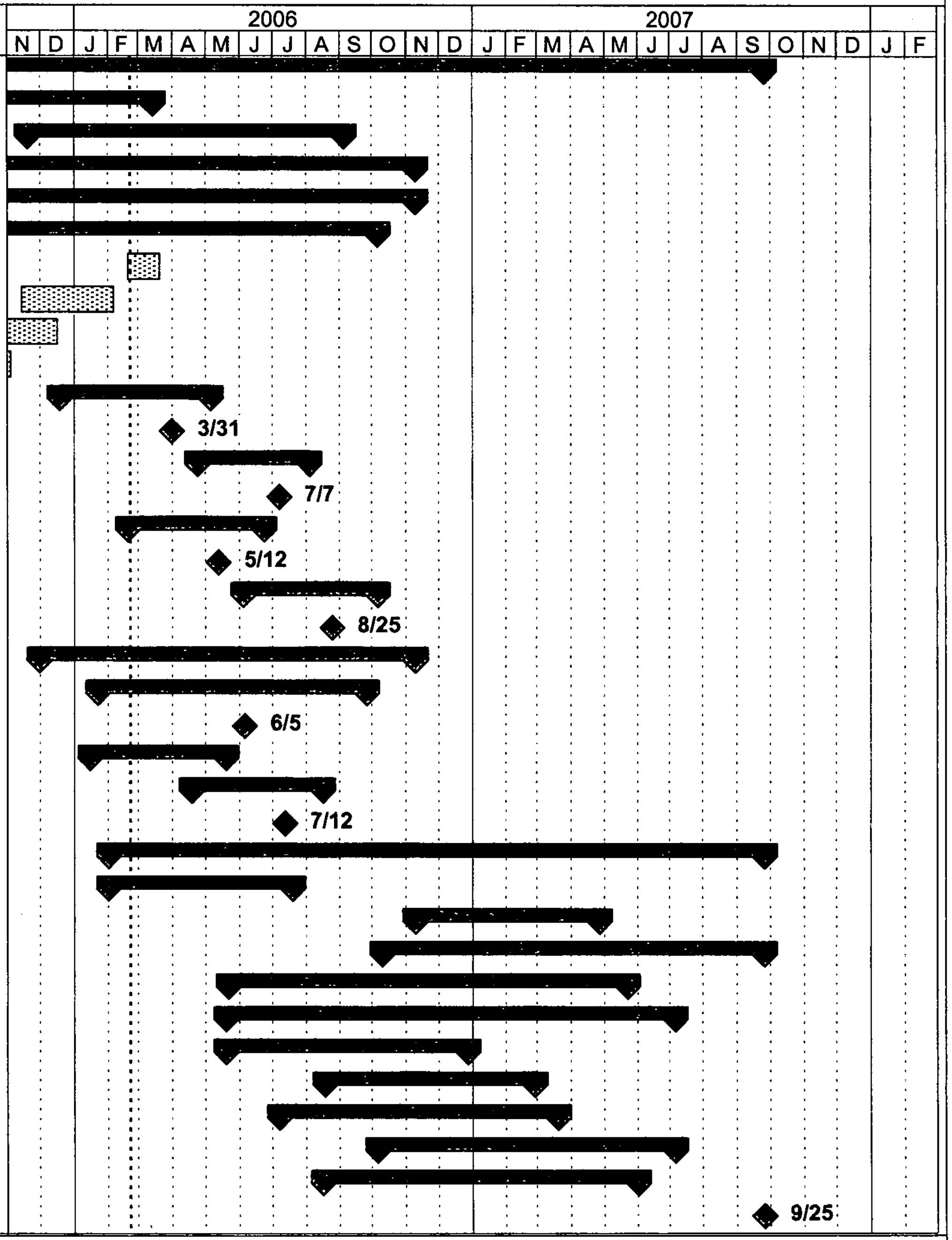
Consulting Engineers

FIGURE 17
PRELIMINARY ELEVATION
TERMINAL STORAGE TANK
FISH SPRING WATER SUPPLY PROJECT

Date: 2/2006 Scale: 1" = 30'
Designed By: DSK Project: VIDL05-001
Drawn By: DSK
File: Terminal-Figures16,17.dwg

FIGURE 18 - PRELIMINARY FISH SPRINGS RANCH WATER SUPPLY PROJECT PLANNING SCHEDULE

ID	Task Name	Calendar Days
1	FSR WATER SUPPLY PROJECT	1434
2	ENVIRONMENTAL IMPACT STATEMENT	874
19	PRELIMINARY DESIGN REPORT	125
30	PERMITTING	591
64	PROJECT DESIGN	530
65	Pipeline Plan and Profile	497
66	Corrosion Consultant	30
67	Geotechnical	84
68	Surveying	112
69	Aerial Photo Work	84
70	Phase 1 - North Slope Fort Sage	140
80	90% Completion & Review	0
82	Phase 2 - Dry Valley	105
92	90% Completion & Review	0
94	Phase 3 - Bedell & Antelope	0
104	90% Completion & Review	0
106	Phase 4 - Wellfield Piping	126
116	90% Completion & Review	0
118	Well Field Design	345
137	Pump Station Design	269
147	90% Completion & Review	0
149	Sub-Station & Transmission Design	126
151	Storage Design	120
162	90% Completion & Review	0
164	PROJECT CONSTRUCTION	600
165	Well Drilling	168
174	Well Equipping	319
181	Pump Station Construction	350
190	Sub-Station & Distribution Construction	367
195	Pipeline Construction	493
196	Phase 1 - Fort Sage (25,000')	210
204	Phase 2 - Dry Valley (38,000')	185
212	Phase 3 - Bedell & Antelope (88,000')	252
220	Phase 4 - Wellfield Piping	250
228	Storage Construction	331
235	PROJECT COMPLETION	0



Fish Springs Water Supply Project

Summary of Facilities for Electrical Improvements

Wells & Structures (6 total)

- Vertical turbine pump (250 - 350 HP) 460V
- 2 pumps with variable frequency drives
- 4 pumps with reduced voltage solid state starters
- Designed for blow-off to waste at startup (solenoid control pressure sustain valve)
- Electrical heater (2 per structure)
- Exhaust fans (2 per structure)
- Lights
- Auxiliary power connections for emergency lighting, power tools,
- Auxiliary power connections for future hypochlorite generation system and metering pumps (110/220V)
- Telemetry & controls including alarms
- 1 – Engine generator connected to two wells
- Connections for portable generator at each well
- Electrical service provided by SPPCo with on-site transformer
- Video surveillance cameras and controls (1 inside and 1 outside camera)
- Ferrell well electrical service will need to have adequate capacity for possible future arsenic treatment plant.

Pump Station

- 5 - Suction cans and corresponding electrical conduits for 5 pumps
- 4 - Equipped vertical turbine pumps (1,250 HP) 4,160V
- Reduced voltage solid state starters
- Electrical heaters
- Building cooling
- Exhaust fans
- Chemical metering pumps, sized to provide 1.0 ppm on max day demand with pumps running 24 hours, 4-20 mA flow paced control
- Residual analyzer tied to controls to reduce flows or shut down production pumps if residual drops below settable point
- Lights
- Auxiliary power connections for emergency lighting and power tools
- Telemetry & controls including alarms
- Connections for portable generator
- Electrical conduit for future on-site engine-generator at specified site
- Small generator for maintaining telemetry system and lights during power outage

- Power connection for surge tank facility including air compressors
- Power connection and lights for personnel workstation to include desk and computer, and security monitoring system
- Power connection for active cathodic protection system (impressed current)
- Underground power feed and communication conduits to adjacent storage tanks and meter vaults
- Electrical service provided by SPPCo with on-site transformers
- Meter vault will include telemetry and power (including heat tape application)

Pump Station Tanks

- Power for control sensors, intruder alarms and telemetry
- Auxiliary power connections for emergency lighting and power tools
- Controls and Telemetry

Fort Sage Pass Surge Tank

- 24V power supply via underground conduit from pump station for control sensors, intruder alarms and telemetry
- Controls and telemetry

Terminal Storage Tank

- Power for control sensors, intruder alarms and telemetry
- Auxiliary power connections for emergency lighting and power tools
- Power for radio transmitter and local telemetry panel
- Power connection for active cathodic protection system (impressed current)
- Power for meter vault
- Controls and telemetry
- Power for irrigation controller and small pump

Antelope Valley Fire Supply Facility (Solenoid Controlled FCV)

- Power for control sensors, intruder alarms and telemetry
- Auxiliary power connections for emergency lighting and power tools.
- Power for control valve/meter vault
- Controls and telemetry

Fish Springs Water Supply Project

Summary of Facilities for Telemetry Improvements

Project Summary: The project consists of six groundwater production wells located at the northern end of the project. The wells will pump into two storage tanks located adjacent to the primary pump station. These tanks will feed water to the pump station, which will convey the water over a high point in the 28-mile long, 30-inch water transmission main referred to as Fort Sage Pass. The transmission main will end at the Terminal Storage Tank facility located at the southern end of the project near the high point in Matterhorn Boulevard above Lemmon Valley. A small equalization tank with an altitude shutoff valve will be located at Fort Sage Pass to maintain water in the transmission main during shutdown and a pressure relief valve to avoid over-pressurizing the transmission main. One or two fire supply points will be located in Antelope Valley and will consist of telemetry controlled valves. Other appurtenances will include air/vacuum valve assemblies and flush valve assemblies at key locations along the pipe alignment. Fiber optic splice boxes will also be located along the pipe alignment for construction and maintenance.

The following summarizes the anticipated telemetry and control needs for the Fish Springs Water Supply Project.

List of sites to receive telemetry:

6 Production wells
Pump station & pump station storage tanks
Fort Sage Pass surge tank
Terminal storage tank
Antelope Valley fire supply facilities
Electrical substation – Fiber optic for communications backup

Telemetry Desired at Sites:

Well & Wellhouse (6 Total)

Information sent to pump station control unit
Video image from two cameras sent to pump station recording/control unit

Discrete Signals
Main power failure
Communications failure
Alarm signal from VFD
Pump status
Building intrusion alarm (includes doors, roof hatches, motion detectors, etc.)
Fire/smoke alarm
Input for hypochlorite generator alarm (future)
Input for metering pump VFD alarm (future)

Analog Signals
Analog input for level transducer in well
Analog input for flow rate
Analog input for discharge pressure
Analog input for pump speed (if equipped with VFD)
Analog input for hypochlorite tank level (future)
Analog input for arsenic probe (future)

Pump Station (4 pumps to be equipped, 1 future)

Location of primary RTU PLC for entire facility
Information sent to 4930 Energy Way via terminal tank fiber optics and radio

Discrete Signals
Main power failure
Communications failure – switched to backup fiber
Communications failure from well field – switched to backup fiber (in same cable)
Common alarm signals from soft starters
Pump vibration alarm (4)
Pump status (4)
Building intrusion alarm (includes doors, roof hatches, motion detectors, etc.)
Flood alarm
Input for chemical metering pump VFD alarm (2)
Hypochlorite tank leak detection alarm
Fire sprinkler system alarm
Fire/smoke alarm
Residual analyzer tied to controls to shut down pumps if residual drops below settable point
Lead/lag and rotation operation
Surge facility general alarm
Surge tank high and low alarms
Compressor alarms (2)
Air pressure alarms (high or low)
Heating/cooling system alarm
Active cathodic protection system failure
Image feed for surveillance cameras with on-site video storage

Analog Signals
Analog input for flow rate
Analog input for suction pressure
Analog input for discharge pressure
Analog input for pump amperage (4)
Analog input for pump speed
Analog input for hypochlorite tank level
Analog input for chlorine residual
Analog input for arsenic probe (future)
Analog input for surge receiver tank pressure
Analog input for structure temperature and external temperature

Storage Tanks at Pump Station Site

Information sent to pump station

Discrete Signals
Main power failure
Intruder switches on access hatches
High and low level floats for redundant alarms

Analog Signals
Analog level transducer (submersible) (2)

Fort Sage Pass Surge Tank & Pressure Relief Valve

Information sent to pump station

Discrete Signals
Power failure
Pressure relief valve switch
Intruder switches on access hatches
Overflow alarm (high level alarm derived from level signal)

Analog Signals
Analog input for battery level (if applicable for solar system)
Analog level transducer (submersible)

Terminal Tank (1 Tank Now, up to 2 more Tanks in the future)

Information sent to pump station control unit
Radio transmission facility for relaying operational information to 4930 Energy Way
Video image from two cameras sent to pump station recording/control unit

Discrete Signals
Communications failure – switched to backup fiber (in same cable)
Main power failure
High and low level floats for redundant alarms (3 tanks)
Intruder switches on access hatches (3 tanks)
Information sent to pump station
Active cathodic protection system failure

Analog Signals
Analog level transducer (submersible) (3 tanks)
Analog input for flow meter (inflow)
Analog input for flow meter (outflow)

Antelope Valley Fire Supply Facility (Solenoid Controlled FCV)

Information sent to pump station

Discrete Signals
Main power failure
Solenoid control shutoff
Intruder switches on access hatches

Analog Signals
Analog input for flow meter (with flow alarm)

Control Sequences

Wells

The well field shall be controlled by the pump station tank level. Control of wells shall allow for lead/lag arrangement of the well groups (lead/lag/reserve) and the ability to switch or alternate well groups between lead, lag, and reserve. Well selection shall also allow for prioritization of various wells based on the water level in wells and/or volume pumped between wells to allow for arsenic blending. Control RTU PLC for the project shall be located at the pump station with local RTUs at each well.

At least two of the wells will be equipped with Variable Frequency Drives (VFD) with other wells equipped with solid state reduced voltage starters (soft starters). Control for the VFDs will allow for the pump speeds to be governed by tank level and water level in the well.

Solenoid controlled valves for water lube supply shall be energized at least 60 seconds prior to startup of well pumps.

At wells with VFDs, the flow meter signal at each well will provide 4-20 mA analog signals for future hypochlorite metering pumps. Controls at each well shall allow for the wells to initially be discharged to waste via a solenoid pressure relief control valve, which shall be normally closed and energized to open.

Wells with VFDs will be programmed to ramp up to a preset speed during startup while the blow-off to waste valve is open. The blow-off to waste valve will be energized to open immediately prior to pump startup. Once the blow-off valve is de-energized (adjustable closing rate) the pump will ramp up to the design speed or to the allowable motor amperage. The design shall include the option for the VFD to be controlled by the flow rate from the meter or well water level. Initial programming during pump startup will ramp up the pump within two seconds such that there is flow from the well during blow-off and at a minimum will be at least 50% speed. During shut down the VFD will ramp down to a predetermined speed before shutting down.

Wells with reduced voltage starters shall be designed to ramp up the pump over a period of at least 20 seconds with all flows going to blow-off. Upon full speed the pressure relief valve shall be de-energized which will divert flows into the transmission main over a given time using closing speed control on the valve. Soft starters shall also be used to ramp down the pump over a 20 second period.

Wells connected to an engine-generator will include automatic transfer switches. If the pump station storage tanks are below a preset level and the primary power supply offline, the engine-generator will be started after a preset delay period. Manual transfer switches and portable generator connections will be provided at all wells without a dedicated engine-generator. Space for a future automatic transfer switch will also be provided in the electrical lineup.

Pump Station Facility

It is the intent that the pump station will contain the on-site RTU PLC for the facility that will continuously monitor the entire supply system from the wells to the terminal tank. The RTU PLC will then periodically transmit information and receive information to/from Energy Way. The SCADA computer will be located at a small work station and desk in the pump station. This computer will provide a human machine interface (HMI) to display system operation graphically, to annunciate alarms, present current operational status, adjust control settings, and log data. Periodically status and alarm information will be sent to Washoe County via the fiber optic lines between the pump station and terminal tank site with a radio connection to Washoe County from the terminal tank site. Backup communications and alarms shall be provided via local telephone line, cell phone and/or Sierra Pacific Power Company substation fiber optic link.

Wells and pump station will be provided with surveillance video cameras with control and recording equipment located at the pump station. Each well house will have at a minimum one inside and one outside camera. The pump station will have surveillance cameras in each room and a minimum of three outside with one monitoring the adjacent tank. A system of video motion sensors combined with a hard-drive based video recorder shall trip on detection and record for either a set time or for as along as motion is sensed while sending an intrusion alarm. A local DVD recorder shall provide for transferring captured video to DVD for permanent storage as evidence. The video on the hard drive shall not be erased until its capacity is consumed; it shall then begin over writing, oldest recordings first.

Additional security measures may include the following, consistent with Washoe County security standards:

- Motion detectors
- Intruder switches on all external doors and hatches
- Fence disturbance detectors
- Manual/electric gate controls on fence gates
- Seismic detectors
- Card lock access control system

In general, the pump station operations will be controlled by the water level in the terminal storage tank with secondary controls associated with the adjacent pump station storage tank water levels. The pump station shall have the ability to alternate pump operation and the ability to recognize a pump failure and start another pump as a replacement. Pumps shall be called in a programmable rotation sequence. The number of pumps called at any point in time will be based on water level set points in the terminal storage tank.

The RTU PLC will be provided with programmable start/shutdown/restart delays for each pump. Reduced voltage starters shall be capable of a minimum 20 second ramp up time from when the pumps start to actually pump water. This will also be required on shut down of each pump.

Secondary pump controls shall include:

- Minimum manifold suction pressure shutoff
- Maximum manifold discharge pressure shutoff
- Maximum amperage shutoff
- Vibration shutoff
- Pump station storage tank minimum level shutoff
- No flow shutoff
- Minimum disinfection residual shutoff
- Surge facility malfunction shutoff
- Fire/smoke shutdown
- Communications failure shutoff with time delay

Via the PLC, the flow meter signal at the pump station will provide 4-20 mA analog signals for hypochlorite metering pumps. Chemical injection locations shall be located on the suction manifold and on the inflow pipe from the wells to the adjacent storage tanks. A minimum of two metering pumps will be provided with controls allowing rotational lead/lag selection of the metering pumps. Sufficient chemical pump capacity shall be provided to allow for the largest metering pump to be removed from service. Failure of the lead metering pump will cause an alarm and allow the lag pump to replace the lead pump.

Surge tank facility at the pump station shall consist of primary surge tank with high and low level pressure contacts, solenoid controlled pressure feed from two compressor/receiving tank units, solenoid controlled pressure relief valving and emergency pressure relief valving. A single control unit will control this facility and provide alarm data to the primary control system at the pump station. This unit will operate the compressors on a rotational lead/lag system.