CHAPTER 3.0
PROJECT DESCRIPTION

3.1 INTRODUCTION

PXP is proposing development of a water reclamation facility at their Arroyo Grande Oil Field to facilitate continued operations associated with their approved Phase IV Development Plan. The proposed Project involves the following components:

- Construction of infrastructure for water reclamation on five combined building pads ranging in sizes from approximately 100-foot by 150-foot to 175-foot by 450-foot (refer to Figure 3-8);
- Construction of a 20,000 barrel per day (2.5 acre feet per day or 840,000 gallons per day) water reclamation facility (utilizing primarily reverse osmosis treatment technology), on an approximately 150-foot by 125-foot building pad (refer to Figure 3-5);
- Construction of two 210,000 gallon filtered water tanks and two day tanks sized at 420,000 gallons each designed to contain 12 hours of treated water production (see Figure 3-5);
- Construction of a 420,000 gallon Recovery Water Tank (see Figure 3-5);
- Other appurtenances and tanks for storage and conveyance of treatment materials and ancillary equipment as needed (see Figure 3-5);
- Construction of three air stripping towers (air strippers) 70 feet in height to remove organics and heat from the water, two heat exchangers (fin-fan followed by a wet surface heat exchanger); and various tanks and silos on an 175-foot by 450-foot building pad (see Figure 3-5);
- Proposed facility structures including all air stripping towers would be painted a non-reflective gray/green, which best blends with the existing and proposed vegetation, to mitigate any potential aesthetic impacts resulting from the addition of the towers. Final color selection may be negotiated with the County prior to the construction phase of the project;
- New onsite lighting would be low intensity and shielded in a manner that is consistent with County standards;
- Construction of water transmission pipelines within existing facility roadways and piping routes including stub-out pipelines for re-use on / or off-site (see Figure 3-5);
- Creation of a smooth-bottomed tempering pond lined with low-permeability material within an existing dry pond (more detail provided in Section 3.4.3.3) (see Figure 3-4);

- Relocation of existing pipelines within the proposed footprint of the water treatment/reclamation facility, including an existing flare. Relocated pipelines would be placed in existing, above-ground pipe racks (see Section 3.4.3.3);
- Placement of a reclaimed water outfall structure for release of the treated water on an existing rip-rap bank along Pismo Creek (see Figure 3-7);
- Temporary use of two staging areas in idle and abandoned well locations, one being approximately 75-foot by 100-foot and the other approximately 100-foot by 150-foot, located outside of the Phase III/IV project boundary within previously disturbed areas (see Figure 3-4);
- Operation of the proposed project (water reclamation facility) including discharge and potential re-use;
- Discharge of the treated produced water into Pismo Creek (see Figure 3-3); and,
- Potential re-use of the treated produced water (i.e., agriculture) by adjoining property owners in the vicinity of the project site, as well as re-use in the oil field. Re-use pipelines are located outside of the existing Phase III/IV project boundary and proceed to the north and south toward adjacent properties.

3.2 PROJECT LOCATION

The Arroyo Grande Oil Field is located in Price Canyon about three miles northeast of the City of Pismo Beach in San Luis Obispo County, California. The project site is located east and west of Price Canyon Road near its intersection with Ormonde Road, between Highway 101 and Highway 227. Refer to Figure 3-1 for a site vicinity map. The majority of the proposed project lies within the 264-acre Phase III development project approved by the San Luis Obispo Planning Commission (SLOPC) in Resolution 94-49, Development Permit No. D910026D, which was delineated in the 1994 Shell Western Development Plan EIR [Phase IV Development Plan (County, 2005)]. However, portions of the re-use pipelines and the proposed reclamation facility lie outside this boundary. The facility site lies primarily within the 320-acre Arroyo Grande Oil Field, which is within the larger 1,480-acre Price Canyon Unit as defined by the California Division of Oil, Gas & Geothermal Resources (DOGGR). Refer to Figure 3-2.

3.3 PROJECT OBJECTIVES

The primary purpose of the proposed project is to enhance the recovery of oil reserves via treatment and reuse of excess produced water. Inherent to this enhanced recovery is dewatering the oil-bearing formation by reducing return water flows from the existing oil-water separation process.

Figure 3-1. Site Vicinity Map

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Figure 3-2. Site Location Map

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3.4 PROJECT DESCRIPTION

3.4.1 Background

PXP currently produces approximately 1,600 BOPD from about 125 producing wells in the 320-acre Arroyo Grande Oil Field, whose boundary is defined by the DOGGR. Produced water volume has also risen as a result of the Phase III drilling program. The Arroyo Grande Oil Field and the Price Canyon Unit are shown in Figure 3-2. Many of the existing wells on the property are co-located with steam injection wells, which provide steam for enhanced oil recovery. Other existing production facilities include above-ground pipelines, six steam generators (four west of Price Canyon Road; two east of the road), “steam headers” (which distribute steam to the steam injection wells), a dehydration facility for the entire field and a gas plant. The dehydration and gas plants are located on the west side of Price Canyon Road. The dehydration plant has several associated facilities, including heater treaters, oil storage tanks, vapor recovery compression, water softening equipment, and sand filters. The gas plant processes about 1.5 million standard cubic feet per day of associated gas (“casing gas”) that contains in excess of 50% CO_2, and 40,000 ppm hydrogen sulfide (H_2S), which is removed using a patented absorption process. The resulting waste stream is re-injected into CDOGGR approved injection wells. All hydrocarbon pipelines crossing underneath Price Canyon Road and above Pismo Creek are contained within “conductor pipelines,” which are intended to contain any fluid release that could occur from these pipelines.

In 2005, PXP received approval from the County of San Luis Obispo for issuance of a Conditional Use Permit for:

- Grading of 4 new well pads (total disturbance of about 2.68 acres);
- Grading on 18 existing well pads (total disturbance of about 4.22 acres);
- Construction of 95 new production wells;
- Construction of 30 new injection wells;
- Construction of 5 wastewater disposal wells within the Arroyo Grande Field boundaries;
- Construction of 3 new steam generators (previously approved in the 1994 Phase III Development Plan); and,
- Increasing production of marketable quality crude oil from 1,800 - 1,900 BPD to 5,000 BPD (1,825,000 barrels of oil annually).

3.4.1.1 Existing Produced Water Management Practices

Producing wells currently pump (water in emulsion with oil) at a ratio of eight barrels of water to one barrel of oil (water output to oil output)[1]. Approximately three barrels of steam are

[1] This ratio is the difference of the oil to steam ratio (OSR), which is the ratio of oil output to steam or water input. The OSR for current operations is 0.32.

required to produce one barrel of oil. Water recovered per barrel is a combination of the condensed steam pumped into the ground and water located naturally in the reservoir rock with the oil such that the volume of water recovered is greater than three times the oil recovered. This recovered water is called “produced water” and when separated from the oil, the produced water is used in the steam generators to produce steam for thermal injection or disposal to approved subsurface disposal zones via water injection wells.

The produced water must undergo filtration and processing prior to use in the steam generators. The existing water treatment system utilized to accomplish this task is located as shown in Figure 3-4. The system includes a water holding tank, flotation cells, sand filters and water softening units. Water entering the treatment system comes principally from the free water knockout vessels and the heater treaters. Small volumes of water may enter from other process sources. The water first passes through the wash tanks and then enters a flotation cell where entrained oil is removed from the produced water. The oil is then returned to the tank battery system and then sent to storage. The water passes through a series of sand filter vessels to remove particulate matter. After the sand filtering, the water passes through an ion exchange water softening unit and then is pumped to the steam generators.

Produced water is sent to the flotation cell, then that portion not used for steam generators is sent to the sand filters to remove entrained oil, and then reinjected through waste water injection wells to approved subsurface disposal zones as per DOGGR requirements. This water is currently not treated to a point where it is suitable for irrigation or creek discharge.

3.4.1.2 Pilot Project

The applicant (PXP) conducted an extensive pilot testing program during a seven-month period between 2005 and 2006. The pilot testing was used to validate the design concept of the proposed Project as well as demonstrate consistent performance results of various treatment plant components. The pilot plant tested each of the processes sequentially as seen in the block flow diagram (Figure 3-6) (Entrix, 2007).

A seven month pilot period was selected to allow enough time to observe performance of the pretreatment and treatment steps and to observe chemical and power consumption levels over a variety of operational conditions. Key findings of the pilot operations were 1) that the proposed water treatment process consistently achieves the quality needed to comply with the California Regional Water Quality Control Board - Central Coast Region Basin Plan (which includes Maximum Contaminant Levels (MCLs) for organic and inorganic contaminants in drinking water), the California Code of Regulations Title 22 water quality for crop irrigation, and the California Toxics Rule standards for protection of human health and the environment; 2) provided pilot scale operational data to generate the power and chemical consumption levels stated herein, and; 3) provided data upon which to estimate waste stream composition and volumes (Entrix, 2006). The produced water would not be treated to drinking water standards (i.e. disinfection standards), and no additional treatment system for disinfection, required for residential re-use, is currently proposed.

Figure 3-3. Site Property Layout

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Figure 3-4. Facility Area Plan

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Figure 3-5. Facility Site Plan

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Figure 3-6. Block Flow Diagram

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3.4.2 Proposed Project

The proposed Project consists of development of a treatment facility for the produced water resulting from oil recovery activities, including delivery systems and a discharge outfall. Disposal routes would include an outfall to Pismo Creek (primary disposal option) and re-use disposal routes to the north and south of the project site. Project specific details are provided in subsequent subsections. Figure 3-3 shows the layout of the PXP property; Figures 3-4 and 3-5 show the layout of the project area and proposed facility site plan, respectively. Characteristics of each proposed Project component are described in the following section. This includes a discussion of the proposed treatment facility, waste streams, delivery systems, and a description of the treatment process and predictability. A process diagram provides a summary (see Figure 3-6, Block Flow Diagram). Implementation of the proposed produced water reclamation facility would not increase the number of production wells, as permitted under the Phase IV project discussed above, but is intended to increase the ratio of oil to water produced at individual wells, thereby allowing for increased rates of production as allowable under the Phase IV Expansion.

The air stripping towers discussed above would be painted a non-reflective gray/green, which best blends with the existing and proposed vegetation, to mitigate any potential aesthetic impacts resulting from the addition of the towers. Final color selection may be negotiated with the County prior to the construction phase of the project. Additionally, new onsite lighting would be low intensity and shielded in a manner that is consistent with County standards.

3.4.2.1 Treatment Facility

The treatment facility would be sized to produce an estimated 20,000 barrels of water per day (2.5 acre feet per day or 0.84 million gallons per day) of treated water at a fairly constant daily and yearly flow pattern, with flow interruptions associated with maintenance and un-scheduled events. The design of the water reclamation facility is based on extensive field pilot testing from October 10, 2005 to April 24, 2006.

The treatment facility would consist of lime-softening for silica removal, water softening using ion exchange softeners, and reverse osmosis (RO) membranes to produce the treated water. Chemical and power requirements are summarized in Table 3-2. Water would be directed from the existing water handling system (i.e., discharge from the existing sand filters) through the following process (see Figure 3-6):

- Lime softener and solids removal system;
- Walnut shell filters;
- Ion Exchange softener;
- Heat exchangers;
- Microfiltration;
- pH caustic adjustment;
- RO filtration; and,

- Air cooling/refrigeration;
- Permeate storage tank and cooling.

The solids produced from the pilot plant have been tested and meet the non-hazardous criteria for disposal at a Class II Disposal Facility (Entrix, 2006). The reject water from the plant also meets the criteria for Class II Injection wells per DOGGR requirements (Entrix, 2006).

The permeate storage tanks are planned to be 420,000 gallons each and sized to contain the volume produced during 12 hours of operation. From the permeate tank, water would pass through additional cooling steps as-needed to further reduce water temperature. The three air strippers would be located within the RO plant area and would be 14 feet in diameter and 70 feet in height.

Anticipated chemical and power requirements associated with the proposed treatment process are shown in Table 3-1. The facility would be designed to store approximately two weeks worth of each chemical at chemical tanks located south of the treatment facility and inline with the existing salt tanks.

Table 3-1. Chemical and Power Requirements

Chemical/Constituent	Purpose	Estimated Requirements[2]
Lime	Lime softening for silica and hardness removal	12.3 tons per day
Salt	For regeneration of Salt Softeners	2 ton per day
Caustic soda (Sodium Hydroxide) at 50% by weight	To adjust pH from 6.3 to 11.5	4.6 tons per day
Soda Ash	Provide for Lime Softener	4.4 tons per day
Sulfuric Acid at 93% by weight	pH adjustment of water for discharge to Pismo Creek	4.8 tons per day
Soda Ash	Water conditioning of permeate for sodium adsorption ration and other prior to delivery for irrigation	Included above
Magnesium oxide	Aid in solids precipitation	3 tons per day
Anionic and cationic polymers	Aid in flocculation	0.04 tons per day
Liquid antiscalant	Dispersant aid	0.1 tons per day
Electrical power	Power supply to various chemical pumps, monitoring equipment, lighting, and permeate/reject water pumps.	~2,000 Hp; 2 megawatts

[2] The adopted PXP Arroyo Grande Field AB-2185 Business Plan dated November 21, 2005, includes caustic soda, HCL, and sodium hypochlorite (NaOCl). Volumes noted above are incremental amounts above that currently used on site.

3.4.2.2 Waste Streams

Wastes that would result from the proposed project are characterized in the following Table 3-2.

Table 3-2. Waste Streams

Waste Stream	Composition	Volume and Plan for Disposal
Solids resulting from lime softening step	Analyzed during pilot plant and found to qualify for non-hazardous waste disposal	21.6 ton per day solids containing 25% bound water for transport to properly licensed landfill
Reject water off of RO membranes	Meets DOGGR criteria for class II disposal wells	7,500 barrels (315,000 gallons) per day for disposal at existing DOGGR permitted injection wells
Air emissions	Low levels of organic material	Would be emitted under air discharge permit with SLO APCD

3.4.2.3 Delivery Systems

Treated water would be piped from the treatment facility described above, exiting the final cooling step, and flowing either north in a 10-inch pipeline to the existing storage pond(s) as a final cooling and polishing step, or flowing southeast to Pismo Creek. Refer to Figure 3-4 for a layout of the proposed delivery system.

A range of operational patterns would be followed during the life of the proposed water reclamation facility, ranging from year-round discharge to Pismo Creek to seasonal delivery of treated water to potential re-use combined with winter flows to Pismo Creek. Well field operations and varying water-to-oil ratios experienced in operating wells would result in varying flow rates at the treatment plant.

Tempering Pond. The existing pond proposed for use as a tempering pond does not lie on a natural waterway and is currently dry (refer to Figure 3-4). Prior to use as a tempering pond, the bottom would be smoothed and lined with a low-permeability material to minimize the potential for releases of the highly-treated water to groundwater.

The treatment plant is being designed to comply with specific water quality parameters such that treated water may be delivered directly from the proposed day tanks to Pismo Creek and for potential reuse (please refer to Section 5.5.2.2 for a discussion of water quality requirements). The tempering pond is intended for additional operational flexibility particularly for temperature control such that mechanical cooling requirements may be minimized prior to creek disposal. In the event that the mechanical cooling system is down for routine maintenance, the tempering pond would be utilized as an alternative water storage and cooling area. The tempering pond would also be needed to allow any trapped air in the water from the stripping process to dissipate prior to creek disposal and in the event one of the 10,000-gallon day-tanks was out of service for maintenance or repair. In general, construction of the tempering pond would provide additional flexibility in the operation of the produced water reclamation facility.

When in use, water levels within the tempering pond would vary daily to take advantage of high radiant cooling (i.e., higher levels during clear, cool nights, etc.). Maintenance of the tempering pond would likely occur during turnarounds for the treatment plant, which would consist of the pond being emptied, cleaned of debris and vegetation, and inspection. Any required repairs would be completed prior to putting the pond back into service.

Pismo Creek Discharge Outfall. The portion of Pismo Creek within the vicinity of the PXP property is comprised of a densely wooded riparian corridor with steep banks typical along this reach of the creek. Bedrock is evident at regular intervals along the creek, indicative of the shallow alluvium in this area. The Pismo Creek outfall structure would consist of pipe laid onto existing reinforced creek bank comprised of rip-rap. The pipe would be approximately 10 feet long and contain slots to allow discharge. The discharge rate would vary with operational scenarios and seasonal reuse demands similar to natural flow variations in the creek. At times when full treatment plant production is discharged to the creek, the flow rate would average 1.3 cubic feet per second. The pipe is anticipated to be a low-carbon steel, and anchored to the existing rip rap to prevent damage, removal, or entrainment of flood flows in Pismo Creek. Refer to Figure 3-7 - Discharge Schematic.

The proposed discharge location is downstream of the PXP “Hyla Crossing” near an existing pipe bridge as shown in Figure 3-4. This site is readily accessible and the creek channel has rip-rap in place to protect the banks from erosion. The banks are steep such that the discharge pipes may be laid above-grade on this already disturbed area (refer to Figure 3-7). The outfall pipes would be spread over an area long enough to minimize water velocity and erosion of channel banks and the creek bed. The existing rip-rap bank armors this location of the stream, and no additional modifications to the channel are required. Specifically, the outfall pipes would be anchored with a series of Sonotube concrete columns. Additionally, the existing rip-rap beneath the outfall pipes would be coated with gunite to allow flow of treated water directly into Pismo Creek, thereby reducing the potential for erosion.

Re-Use Disposal Options. A portion of the treated water would be used to displace groundwater use on the Arroyo Grande Oilfield. In addition to the discharge of treated water to Pismo Creek, the proposed project would also include a treated water re-use option. This would consist of the placement of two pipelines that would run from the proposed treatment facility to both the northern and southern project boundaries, respectively, for the purpose of supplying treated water for reclamation, such as landscape irrigation or for non-edible crops. However, it should be noted that no reclamation re-use options have been identified at this time. Additionally, the produced water would not be treated to drinking water standards (i.e. disinfection standards), and therefore would not be available to residential users. An additional treatment system for disinfection, such as a chlorination system would be required for residential re-use, which is not proposed as part of the project.

Figure 3-7. Discharge Schematic

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Delivery to any future reclamation use would be dictated by the locations of the irrigation system connection points within the vicinity of the proposed northern and southern pipeline routes illustrated on Figure 3-3. Lastly, the northern re-use pipeline route is located along both the west and east sides of Price Canyon Road. At this time, no partners have formally committed to accepting the water.

Pipeline(s). The pipeline(s) to be constructed in support of the potential re-use options located north and south of the facility would be placed on pipe racks (if available), or within existing facility roadways (see Figure 3-3). All pipelines to be constructed from the water plant to the Pismo Creek discharge outfall and potential re-use options would be eight- to ten-inches in diameter and placed in trenches approximately four feet wide by three feet in depth. Similar to the potential re-use pipelines discussed above, the treatment facility/outfall pipelines are expected to be buried; however, at some locations the pipelines may be placed in existing pipe racks along the road system (i.e., within existing disturbed areas). A four-foot wide buffer alongside the roadside shoulders may also be used as necessary for staging purposes and to avoid buried existing pipelines in the roadway. A jack-and-bore technique would be utilized to place proposed outfall pipeline(s) beneath Price Canyon Road. Please refer to Figure 3-3 for an illustration of the proposed pipeline routes.

Existing facility pipelines would be relocated to facilitate the project, including both in-service and out-of-service pipelines. They include various water lines to and from existing infrastructure (i.e., softeners and tanks), and out-of-service distribution, gathering, and production lines. If any pipelines need to be relocated, they would either be placed on pipe racks (if available), or within existing facility roadways.

3.4.2.4 Treatment Process Description

The water plant can be divided into two parts (see Figure 3-6). The first part would consist of pretreatment to soften, filter, and cool the produced water. The second part of the process would consist of RO and air stripping to remove the regulated constituents prior to discharge. The following describes the treatment plant, the removal of constituents of concern, process predictability and process reliability.

The water plant would consist of a series of processes starting with warm-lime softening, walnut shell filtration, strong-acid cation softening (ion exchange) and cooling. The warm-lime softener would remove most of the scale-forming minerals in the produced water (i.e., calcium, magnesium, alkalinity, silica, etc.) The walnut shell filters would remove residual particulate matter from the water. Each of the filters would be operated at a flow rate to optimize particulate removal. The cation softeners would remove residual hardness. At this point in the process, the water is of a quality to be used for high-pressure steam generation (i.e., free of hardness and highly filtered). The balance of the water would then be cooled to 80 °F to 90 °F prior to the introduction into the membrane processes.

Pretreated water would then pass through microfilters to remove any residual/fine particulate matter. Microfiltration is a membrane process, similar to RO. In the Price Canyon

Unit, it would be used to protect the RO from fouling. Microfilters would remove sub-micron particulate matter a hundredfold smaller than the walnut shell filters' capability, or other types of media filtration (e.g., sand filters or carbonized zeolite filters). After the microfilters, the water would pass through another set of ion exchange softeners. These are considered guard softeners and would capture any trace levels of hardness that might pass in pretreatment.

At this point in the process, the water is ready to be introduced into the RO system (i.e., highly filtered and free of mineral-scale constituents).

The remainder of the treatment system would consist of two stages of RO and air stripping (i.e., 1st Pass RO followed by air stripping followed by a 2nd Pass RO). These processes would treat the water to meet the discharge criteria for Pismo Creek (as required by RWQCB). Target parameters and constituents of concern are turbidity, pH, temperature, dissolved oxygen, sodium, chloride, sulfate, boron, non-ionic ammonia, acetone and 2-butanone. Occasionally, there are also trace levels of benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX).

To meet discharge requirements, the plant would be designed with a two-pass RO system. The 1st Pass RO would be operated at high pH (11.5) and would remove soluble species of minerals salts, (e.g. sodium, chloride, sulfate and boron). Reject (wastewater) from the 1st Pass RO would be injected back into the oil-producing formation. Permeate (treated water) from the 1st Pass RO would be sent to air strippers. The air strippers would remove some non-ionic ammonia and most of the acetone and 2-butanone. At high pH, 99.5% of the ammonia is in the non-ionic form and is easily stripped. Occasional levels of BTEX would be easily removed to non-detectable levels, because the air strippers are sized to remove acetone and 2-butanone (which are significantly less volatile than BTEX). Additionally, the strippers would cool the water and completely oxygenate it.

The pH of the water from the strippers would be lowered to neutral through the addition of sulfuric acid and fed to the 2nd Pass RO. At neutral pH, 99.0% of the ammonia (not removed by the stripper) would be converted to ionic ammonia. The 2nd Pass RO would readily remove ionic ammonia as well as further reduce the levels of sodium, chloride, sulfate and boron. The permeate from the 2nd Pass RO would have no measurable turbidity. Rejected water from the 2nd Pass RO would be recycled for other uses in the plant. 2nd Pass RO permeate would be discharged to Pismo Creek, delivered for agricultural reuse, or cycled through the tempering pond prior to creek discharge/reuse.

All of the processes described above were part of the pilot testing conducted by PXP.

3.4.2.5 Process Predictability

During pilot testing, a significant amount of data was collected to monitor constituent removal. These data were routinely compared to well established RO and air stripping models which predict performance. RO is a mature technology and has been commercially available for over 30 years. As such, RO membrane manufacturers have developed models that are used to predict permeate quality for a range of waters from low-total dissolved solids to tap water to brackish water to seawater. Prior to pilot testing, several membrane manufacturers were consulted and predictions were developed for the RO components of the treatment plant. These were used to develop the proof-of-concept testing parameters (Entrix, 2007).

Likewise, air stripping is a very common treatment technology used throughout the United States to treat groundwater containing volatile constituents. Air stripper packing manufacturers were consulted to determine the operating requirements for the strippers which were tested in the field.

Pilot test data was validated by manufacturer predictions of performance. The percent removals of the key ionic constituents listed in Section 3.4.3.5, fourth paragraph, are never more than three percent below manufacturer predictions, and in some cases the removals are much greater than these predictions. Pilot test results for the air stripper predict the same removal efficiencies for the volatile compounds.

Based on results of the sampling and analysis of produced (i.e., untreated) water, two Priority Toxic Pollutants Effluent Limits were exceeded for Benzene and Phenol. Benzene in the produced water prior to treatment exceeded the recommended effluent criteria during the January 4 and 18, 2007 sampling events. Phenol exceeded criteria during all three sampling events conducted. As such, PXP chose a treatment process that lowers concentrations of these constituents and recommends implementing a water quality monitoring and reporting program that would monitor effluent from the produced water reclamation facility for both of these constituents at a frequency that is consistent with the *Policy for Implementation of Toxics Standards for inland Surface Waters, Enclosed Bays, and Estuaries of California* (Entrix, 2007).

Features are proposed to protect Pismo Creek and future potential reuse partners from treated water that fails to meet quality requirements. First, numerous in-line monitors, gauges, and meters would be installed and tied to an alarm system. Response to alarms would include operator response and, in some cases, diversion of flow to storage tanks proposed throughout the treatment process. For example, sufficient permeate storage volume is proposed to contain up to 12 hours of permeate at full treatment plant production.

3.5 CONSTRUCTION CONSIDERATIONS

The water reclamation facility would be installed in modules, supported with storage tanks for water treatment chemicals, heat exchangers, and water storage tanks. New facilities would be constructed within the existing disturbed plant area, plus a two- to three-acre area west of the plant that would require minimal grading. Maximum site disturbance would consist of approximately 13,610 cubic yards of cut and approximately 12,280 cubic yards of fill (with a balance of approximately 1,330 cubic yards), resulting in a total disturbed area of approximately 5.6 acres. Figure 3-8 depicts the grading plan with infrastructure footprints.

The construction force is expected to be six to ten people normally, with a peak of ten to 15 people. Construction would require welding trucks, cranes, backhoes, loaders, dozers, and various vehicles currently used at the existing oil field.

Most of the equipment proposed to be used for construction is already in use at the Arroyo Grande Oilfield. Truck trips associated with the construction phase are estimated as follows:

- Three trucks per day for three days for compaction material for the building pads. Soil borings would be taken during final design, and the determination of whether imported fill would be required to provide adequate compactions characteristics for the pads would be made at that time. Imported fill for base material would represent no more than 10% of the overall fill. Soil testing would require one small drill rig and a crew truck for two to three days;

- Cement trucks: two to three trucks per day for four to six weeks is projected;

- RO equipment deliveries: The exact number of vehicles is not known at this time, but based on similar construction of RO systems or other on-site activities. PXP anticipates two trucks a day for one week;

- Laborer and construction oversight vehicles such as pickup trucks, passenger vans, and utility trucks; and,

- Materials deliveries: three trucks per week for six weeks.

- The construction phase would take approximately six to nine months to complete.

3.6 OPERATIONS

It is anticipated that the water treatment unit may require six or seven additional full time employees during operations. Based on a 25-ton per truck hauling and delivery capacity, liquid chemical deliveries are anticipated at two per week, plus one to two truck trips per week for solid chemical deliveries and three to four truck trips per week to haul waste to a Class II disposal site. All chemicals required for operation and removal of waste from the produced water process are listed in Tables 3-2 and 3-3.

3.6.1 Monitoring

Numerous water quality monitors, gauges, and instruments would be installed throughout the proposed treatment plant to provide and closely monitor data regarding treatment performance. This instrumentation would be tied into a supervisory control and data acquisition system to be used by operators to ensure proper and efficient performance of the plant. The control system would have an alarming function to alert operators to quality excursions, hydraulic events, and other operational issues.

Figure 3-8. Grading Plan

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In the event of an equipment malfunction or other event that causes treated water to deviate from the quality specification, operators would be alerted and one of two options would occur. Depending on the severity of the event, either the control system would trigger a shut-down, or the operator would proceed with manual adjustments. In either case, the two proposed day tanks are sized to contain 12 hours of plant production to store water while the issue is addressed (see Figure 3-5). The day tanks are sized to address such emergency events.

A water quality monitoring program would be implemented as required by the Regional Water Quality Control Board's permit requirements for both creek discharge and reuse for irrigation. Constituents such as temperature, pH, chloride, total dissolved solids, dissolved oxygen, and others would be regularly monitored and reported.

The water quality monitoring program would track Benzene and Phenol at a frequency that is consistent with the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.* Water samples would be collected in a manner that is consistent with Environmental Protection Agency (EPA) Methods 624 and 625 pursuant to 40 CFR 136.4 (a)-(c) and 40 CFR 136.5 (a)-(d) at the point of discharge. All water samples would be analyzed at a laboratory that is certified by the California Department of Health Services, in accordance with the provision of Water Code Section 13176 and would be accompanied by the laboratory QA/QC reports. The results from the water sampled would be submitted to the RWQCB with the required analytical reporting limits and method detection limits at a frequency determined by the RWQCB.

An air quality monitoring program would be implemented as dictated by Air Pollution Control Board requirements.

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