EXHIBIT P

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Mr. Michael Finch
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Subject: Review of RWQCB Tentative CAO
Government Lease- Poso Creek Oil Field
Kern County, California

Dear Mr. Finch:

Geosyntec Consultants Inc. (Geosyntec) has reviewed the Regional Water Quality Control Board's (RWQCB) Tentative Cleanup and Abatement Order (CAO) for the E&B Natural Resources (E&B) Government Lease in the Poso Creek Oil Field. The Poso Creek Oil Field is located approximately 10 miles north of Bakersfield in the southern San Joaquin Valley (Tentative CAO, Attachment A). It is our understanding that E&B took over Poso Creek Oil Field operations in August 2010 and currently operates a petroleum production wastewater discharge facility in the oil field as part of their oil extraction operations. The Tentative CAO dated April 3, 2015 (RWQCB, 2015) proposes an investigation of three surface impoundments or ponds located on the E&B Government Lease in the Poso Creek Oil Field. Historically, the ponds were used as part of the oil field's wastewater discharge facility. E&B has reported that the three ponds are only used sporadically at this time and have been generally inactive since August 2010. Because the ponds are not actively used, E&B is proposing that the ponds be closed.

E&B has requested that Geosyntec evaluate the necessity of performing a hydrogeological evaluation of the ponds as proposed in the Tentative CAO. To facilitate this evaluation Geosyntec has reviewed documents made available by E&B, as well as published documents. The salient background information from this review is summarized below.

BACKGROUND INFORMATION

Impoundment/Pond Locations and Descriptions

There are currently three inactive surface waste water impoundments (ponds) located on the E&B Government Lease in the Poso Creek Oil Field. The pond locations are shown on the Tentative CAO, Attachment B. The RWQCB (2015) reported that two of the ponds are approximately 90 feet long, 65 feet wide and 10 feet deep. These ponds are located directly adjacent to each other and are referred to as Ponds 1 and 2 (RWQCB, 2015). A third pond is approximately 16 feet long, 8 feet wide and 8 feet deep. This small pond is referred to as Pond 3. Pond 3 is located approximately 1,000 feet southwest of Ponds 1 and 2. In the Tentative CAO the RWQCB indicated that the ponds are unlined. However, the last WDR for the facility (WDR 94-213) indicated that the impoundments are lined. WDR 94-213 is presented in **E&B Exhibit H.**

The two large ponds (Ponds 1 and 2) were part of the former wastewater treatment system operated prior to approximately August 2010 when E&B purchases the Poso Creek Oil Field leases. Ponds 1 and 2 were not used for disposal purposes, but rather they were used for water treatment purposes. The ponds were used to skim residual crude oil from the water surface after the bulk of the crude oil was separated from the produced water in the wash tanks. After the skimming operations in the ponds, the wastewater underwent a series of treatments and then was discharged to a surface drainage which is a tributary to Poso Creek. Poso Creek is located approximately 1 ½ miles south of the lease. A figure showing the location of Poso Creek in relation to the wastewater treatment operations is presented in **E&B Exhibit H, Attachment A**. A water treatment flow diagram that was presented in WDR 94-213 is presented in E&B **Exhibit H, Attachment B**. The historical use of the small pond (Pond 3) is not known. E&B reports that they have not used Pond 3 since taking over the oil field operations.

A letter from Bellaire Oil Company to the RWQCB dated August 16, 1996 (as cited by Envirotech Consultants, 2009) indicates that all wastewater discharges to ephemeral streams were halted in July 1996. After July 1996 wastewater generated from the oil field operation was injected directly back into the oil bearing formations and discharge to the surface drainage was largely curtailed. However, the ponds were used for skimming crude oil (i.e., for treatment purposes) before the wastewater was injected back into the oil bearing formation. E&B has reported that after their purchase of the Poso Creek Oil Field operations in August 2010 wastewater was not discharged into the ponds with the exception of some irregular maintenance operations. E&B directly injects the wastewater back into the oil formation after the water and oil are separated in the washer tanks. A current wastewater flow diagram is presented in **E&B Exhibit A**

that shows the separation of the oil and water in two washer tanks and a clarifier tank, and the bypassing of the ponds (sumps).

Historical Waste Discharge Requirement Orders

Two Waste Discharge Requirement (WDR) Orders were reviewed by Geosyntec. WDR Order No. 82-140 is presented in **E&B Exhibit G**. The WDR and the attached information sheet for El Aquitaine Oil and Gas Inc., Poso Creek Oil field indicates that the ponds located in the oil field are unlined. The Effluent Limitations presented in the WDR are based on the Basin Plan objectives and are as follows:

Specific Conductance	1,000 µmhos/cm
Chlorides	200 milligrams per liter (mg/l)
Boron	1.0 mg/l
Oil and Grease	45 mg/l

The 1982 WDR information sheet also indicates that "The majority of the wastewater discharged to the unlined ponds and surface water drainages meets the limitations [Effluent Limitations set by the WDR]."

WDR Order No. 94-213 is presented in **E&B Exhibit H**. The WDR lists Naftex Holding Ltd as the owner. The WDR notes that the discharger indicates that the sumps used in the oil field's waste water operations were lined. The Effluent Limitations presented in the WDR are as follows:

Specific Conductance	1,000 µmhos/cm
Chlorides	175 milligrams per liter (mg/l)
Boron	1.0 mg/l
Oil and Grease	35 mg/l

The 1994 WDR indicates that the historical water quality of discharged water was as follows: Specific Conductance – 440 umhos/cm, chlorides – 54 mg/l, boron – 0.13 mg/l, and oil and grease – 9.0 m/l. These reported concentrations are below the effluent limitations.

Site Topography and Adjacent Land Use

The topography of the lease is characterized by eroded foothills of the Serra Nevada. Surface materials in the oil field area include alluvial sediments and Kern River Formation. Surface water drainages in the oil field are ephemeral and are tributaries of

Poso Creek which is located approximately 1 ½ miles south of the Government Lease (**E&B Exhibit H, Attachment A**).

Land immediately adjacent to the oil field is reported to be used for cattle grazing (Envirotech Consultants, 2009). The nearest agricultural fields are located approximately 3 miles west of the Government Lease.

Regional and Site Hydrogeology

The Poso Creek Oil Field is located in the Kern County Subbasin of the San Joaquin Valley Groundwater Basin (USGS, 2011 and DWR, 2003). The principal groundwater bearing unit beneath the oil is field is the Kern River Formation. The Kern River Formation includes 500 to 2,000 feet of poorly sorted lenticular deposits of clay, silt, sand and gravel derived from erosion of the Serra Nevada (DWR, 2003). The Kern River Formation is characterized as moderately to highly permeable and is capable of yielding water to wells.

The regional groundwater flow direction is generally thought to be westward, from the Serra Nevada toward the center of the San Joaquin Valley. The regional groundwater gradient in the vicinity of the oil field was reported to be westward by the RWQCB in the 1982 WDR and a 2010 groundwater level contour map published by the DWR[1] shows the groundwater flow direction to be generally westward in the general region of the oil field.

A well survey was performed by E&B (Ellison, 2015) that included a well record search at Kern County Water Agency offices and inspection of aerial photographs. Results of the survey indicate that there are 3 water wells located within approximately 1 mile of the center of the Government Lease. A memorandum and attached map showing well locations is presented in **E&B Exhibit O**. Based on their general locations and aerial photograph reconnaissance it appears the wells are used for either oil field or cattle ranching operations. One of the 3 wells (Well #1) is located on the Government Lease approximately 475 feet westward of Ponds 1 and 2. **Figure 1** shows the location of

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[1] DWR, Groundwater Information Center, http://www.water.ca.gov/groundwater/data_and_monitoring/south_central_region/GroundwaterLevel/gw_level_monitoring.cfm)

Well #1. A driller's log for the water well (Well #1 or Well 27S/27E-14) is presented in **E&B Exhibit O**. E&B reports that Well #1 is used for oil field operations. The driller's log shows the well to be 976 feet deep and the top of the perforated interval to be at a depth of 575 feet. The drillers log shows the subsurface lithology to be generally interbedded clays and sands with some layers of gravel. The log shows that there is a substantial amount of clay material in the formation including within the upper 500 feet of the subsurface. No water level data are presented in the driller's log. Well #2 appears to be used for cattle ranching operations, based on aerial reconnaissance. E&B reports that Well #3 is owned by Linn Energy and is used for oil field operations. E&B reported that additional well (Well #4) is located approximately 2 ½ miles southwest of the Government Lease (**E&B Exhibit O**).

E&B performed a density/neutron log study for a mud waiver evaluation (Ellison, 2014) that showed groundwater levels at depths ranging from 435 feet 620 feet below ground surface in the Poso Creek Field (Ellison, 2014). Specifically, groundwater levels in Well #1 located near the ponds (or well 27S/27E-14) was estimated at a depth of 508 feet below ground surface. Based on the westward regional groundwater gradient, it is assumed that Well #1 is located downgradient of Ponds 1 and 2. Envirotech Consultants (2009) reported that groundwater in a well located in Section 10 (northeast of the Government Lease) was measured at a depth of 448 feet in 1977. This well appears to be shown as Well #2 in **E&B Exhibit O**.

Wastewater Quality

Past discharge of wastewater has been monitored in accordance with WDR orders. There were numerous analyses of the wastewater generated at the facility conducted between 1977 and 2015 (**E&B Exhibit J**) Most of the samples were collected between 1983 and 1989 and appear to be waters that were discharged to the stream channel, but are considered to be representative of wastewater quality. One sump sample was collected in May 1985.

Table 1 summarizes data pertinent to the effluent limitations presented in the WDRs. With few exceptions the wastewater met water quality objectives set in the Basin Plan and met effluent limitations set by the RWQCB for specific conductance, chlorides, boron, and oil and grease. Overall the general mineral quality of the wastewater produced in the Poso Creek Oil Field is good.

To verify historical wastewater quality information E&B recently collected a sample of produced water from the field on March 23, 2015. Laboratory results are presented in **(E&B Exhibit C).** The specific conductance and the Total Dissolved Solid (TDS) were

measured at 500 micro mhos per centimeter (µmhos/cm) and 350 milligrams per liter (mg/l), respectively. The boron and chloride concentrations were reported at 0.6 mg/l and 56 mg/l, respectively (see **Table 1**). These reported concentrations all meet Basin Plan objectives. The relatively good general mineral water quality of the produced water is thought to be the result of the proximity of the Serra Nevada and the historical flushing of connate water in the oil bearing formations by fresh groundwater from the mountain recharge areas.

Groundwater Quality

E&B collected groundwater samples from Well #1 (well 27S/27E-14) located 475 west (downgradient) of Ponds 1 and 2 in 2014 and 2015. Laboratory results are presented in (**E&B Exhibit N**) Laboratory analyses for the sample collected on May 6, 2014 included general minerals with boron. The specific conductance and TDS of the water were measured at 290 µmhos/cm and 170 mg/l, respectively. Boron was not detected (<0.1 mg/l) and a chloride concentration of 24 mg/l was reported. The relatively low specific conductance measurement, and low boron and chloride concentrations indicates that groundwater in the well has not been significantly impacted by the potential downward migration of wastewater.

A second sample was collected from the well on April 14. 2015. The sample was analyzed for several analytical suites including general minerals, Total Recoverable Petroleum Hydrocarbons by EPA Method 1664 (TRPH), Volatile Organic Compounds by EPA Method 8260B (VOCs), Semi Volatile Organic Compounds by EPA Method 8270C (SVOCs) and selected metals. Current available results and laboratory methodology information are presented in **E&B Exhibit N**. The laboratory results are summarized as follows:

- The specific conductance and TDS of the water were measured at 280 µmhos/cm and 190 mg/l, respectively. Boron was not detected (< 0.1 mg/L) and the chloride concentration was reported at 21 mg/l.
- Total Recoverable Petroleum Hydrocarbons were reported as non-detect (< 5.0 mg/l)
- VOCs were not detected (< 5.0 micrograms per liter [µg/l]).
- SVOCs were not detected (< 10.0 µg/l).
- Selected metals including lithium, mercury and strontium were not detected.

The specific conductance/TDS and chloride concentrations of the water well water are generally about ½ of that reported for the wastewater. In addition no TRPH (oil and grease), VOCs, SVOCs or boron were detected in water samples collected from the well. These laboratory results indicate that groundwater in the water well downgradient of Ponds #1 and #2 has not been impacted by the downward migration of wastewater.

ANALYSIS AND DISCUSSION

An analysis of the above information indicates the following:

1. The three ponds on the Government Lease which are the focus of the tentative CAO are not currently utilized in the site day to day wastewater treatment operations. E&B is proposing to remove the ponds.
2. Groundwater levels beneath the ponds occur at a depth of approximately 500 feet. The lithology between the base of the ponds and the top of groundwater includes layers of clay based on a driller's log for a well located adjacent to the ponds (Well #1 located 475 feet west of Ponds 1 and 2). The log shows that there is a substantial amount of clay material in the formation including within the upper 500 feet of the site subsurface. The occurrence of clay layers beneath the ponds has likely limited the downward migration of water discharged at the site surface. The deep depth of groundwater in the area and the occurrence of clay layers between the bottom of the ponds and groundwater suggests that the potential for migration of contaminants is extremely low.
3. Available laboratory data indicate that the quality of the wastewater generated during historical oil field operations and during present day operations meets Basin Plan Objectives and Effluent Limitations set by the RWQCB. The generally good quality of the wastewater minimizes the potential for impacts to the environment, including aquifers in the area.
4. There appears to be limited use of groundwater in the near vicinity of the Government Lease and the ponds. The nearest agricultural fields are located approximately 3 miles from the impoundment ponds. In addition, based on a recent well survey completed by E&B and known land uses in the near vicinity of the Poso Creek Oil Field, there does not appear to be any wells used for domestic purposes within a one mile radius of the ponds or the Government Lease. The well search indicates that there are only three water wells located within approximately one mile of the Government Lease

including two wells used for oil field operations and one well assumed to be used for cattle ranching.

5. The closest water well to the ponds (Well #1) is located 475 feet west of the large impoundments (Ponds #1 and #2) and is used for oil field operations. The water well is assumed to be located downgradient of the two ponds, based on regional groundwater flow. Recent laboratory analyses of water samples collected from the well indicate the groundwater is of good quality and contains relatively low concentrations of specific conductance/TDS, chloride and boron (non-detect) relative to past wastewater produced in the oil field. In addition the TPRH (oil and grease), VOCs and SVOCs were not detected in the well. These results indicate that water in Well #1 has not been impacted by oil field operations including the wastewater treatment operations.

The above information indicates groundwater beneath and downgradient of the ponds has not been impacted due to past wastewater treatment operations at the site.

Geosyntec estimates that the cost of any hydrogeological evaluation that includes the installation of deep monitoring wells as suggested in the CAO would be very high. Geosyntec estimates that costs of a hydrogeological evaluation that included the installation of three deep monitoring wells and long-term monitoring would be in the range of $750,000 to $1,000,000.

Based upon Geosyntec's evaluation of currently existing information it is our opinion that past operation of E&B Gov't lease has not impacted groundwater. The proposed hydrogeologic investigation, based upon depth to groundwater and location in an oil producing field, is not appropriate. Closure of the sumps as proposed by E&B pursuant to a plan approved by the Board and BLM should be protective of the environment and groundwater.

Sincerely,
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Ellison, B.R., 2015, McVan Water Well Study, April 24, 2015

EnviroTech Consultants, Inc., 2009, Phase 1 Environmental Site Assessment, Poso Creek Oil Field, Kern County, July 29, 2009.

Regional Water Quality Control Board, 2015, Tentative Cleanup and Abatement Order and Public Hearing, for E and B Natural Resources Management, Gov't Lease, Poso Creek Oil Field, Kern County, April 3, 2015.

USGS, 2011, Groundwater Quality in the Kern County Subbasin, California, Fact Sheet 2011-3150.

Table 1

Summary of Specific Conductance, Chloride, Boron and Oil/Grease Data

Poso Creek Oil Field Wastewater

Lab Received Date	Sample Description	Specific Conductance (umhos/cm)	Chlorides (mgl/l)	Boron (mg/l)	Oil and/or Grease (mg/l or mg/kg)
April 1977	Produced Water	460	58.8	0.55	--
Sept. 1978	Produced Water	--	--	--	1.0
Sept. 1983	Wastewater	440	48.6	0.57	17.8
June 1984	None/Spill Water	550	68.1	**1.2**	3.3
October 1984	Discharge Water	500	63.8	0.72	3.5
Jan. 1985	None/Spill Water	500	54.6	0.48	6.8
April 1985	Creek Water	530	73	0.67	1.3
May 1985	Sump Water	490	51.0	0.63	--
July 1985	Creek Water	600	81.5	0.93	14.4
October 1985	Creek Water	**1060**	89.0	**1.5**	19
Dec. 1985	Ditch Water	525	--	0.89	3.3
Jan. 1986	Water to Creek	540	62.7	0.93	2.5
March 1986	Ditch Water	510	--	0.55	10.1
May 1986	Ditch Water	590	57.8	0.84	8.7
July 1986	Ditch Water	500	56.0	0.67	1.6
Sept. 1986	Ditch Water	490	60.9	0.64	6.0
October 1986	Ditch Water	490	64.9	0.60	14.5
Jan. 1987	Ditch Water	470	52.8	0.57	14.8
April 1987	Ditch Water	490	62.4	0.54	5.3
July 1987	Creek Water	410	43.9	0.30	19.2
Oct. 1987	Creek Water	530	58.1	0.41	9
April 1988	Creek Water	510	62.4	0.42	10.0
July 1988	Water	470	56.0	0.68	26.8
July 1988	Ditch Water	375	35.4	0.22	6.2
Oct. 1988	Poso Creek	460	55.6	0.45	5.0
Jan. 1989	Poso Creek	350	36.5	0.16	18.3
April 1989	Ditch Water	470	58.1	0.32	11.3
July 1989	Water	375	40.8	0.16	5.0
July 1996	Discharge Water	413	50.9	0.20	22
May 2014	Mc-VA WO Tank	420	53	0.26	--
March 2015	Produced Water	500	56	0.60	--

umhos/cm: Micro mhos per centimeter

mg/l: millligrams per liter

mg/kg: milligrams per kilogram

Bold: Concentrations exceed WDR effluent limitations

Figure 1 – Water Well #1 Location

Source: E&B Natural Resources, Inc.