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SWMU No. 1 (Aeration Basin) WORKPLAN

NEW MEXICO
ENVIRONMENT DEPARTMENT

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

January 11, 2017

Mr. Ed Riege
Remediation Manager
Western Refining, Southwest Inc., Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

**RE: APPROVAL
REVISED INVESTIGATION REPORT
SOLID WASTE MANAGEMENT UNIT (SWMU) NO. 1 AERATION BASIN AND SWMU NO. 14 OLD API SEPARATOR
WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-13-001**

Dear Mr. Riege:

The New Mexico Environment Department (NMED) has received the revised *Investigation Report Solid Waste Management Unit (SWMU) No. 1 Aeration Basin and SWMU No. 14 Old API Separator* (Report) revised June 2014 and August 2015 and submitted on April 26, 2016 on behalf of Western Refining Southwest Inc., Gallup Refinery (Permittee). The Permittee's response to NMED's March 17, 2016 Rejection letter is adequate. NMED hereby issues this Approval with the following comments and clarifications.

NMED also received the Permittee's *Investigation Work Plan Solid Waste Management Unit (SWMU) No. 1 Aeration Basin and SWMU No. 14 Old API Separator* (Work Plan), dated July 2015 regarding proposed additional investigations at the SWMUs. NMED's comments regarding this Report should be addressed during further investigations in order to define the extent of contamination at the SWMUs. NMED's review and comments regarding the Work Plan are pending.

NMED's comments are separated into three sections regarding the April 1, 2014 Disapproval, the May 11, 2014 Disapproval, and the revised Report.

Permittee Response (August 24, 2015) to NMED Response (May 11, 2015) to Permittee Response to April 1, 2014 Disapproval Comments

Permittee Response to NMED Comment 2a

The Permittee's response to NMED's Comment 2a states "Western appreciates the clarification regarding use of DAFs. Our experience has clearly shown that groundwater impacts are associated with primary sources (e.g., leaking tanks or pipelines) and not minor secondary sources (e.g., stained soils with low concentrations of petroleum hydrocarbons, even well above DAF 20 values)." Soil DAF values are meant to assess the risk over time of contaminants present in soils to migrate to groundwater, so while groundwater may not immediately be affected by soils containing contaminant concentrations well above the DAF 20, the risk exists that the contamination may, over time, reach groundwater. At this point, because groundwater is already affected by contaminants, calculation and discussion of DAF is not necessary. No revision is required.

Permittee Response to NMED Comment 2b

The Permittee's response states, "Western notes that the report refers to 'vertical impacts to soil.' Although Western does not accept NMED's observation that 'hazardous waste has been in direct contact with groundwater,' both the Aeration Basin and OAPIS have contained waste materials that was in direct contact with refinery wastewater and Western believes this 'impacted' water transported contaminants vertically through soils in some locations. A review of the soil borings for SWMU 1 and SWMU 14 does not indicate any of the soil borings encountered waste materials." There appears to be a typographical error and the intent of NMED's comment was to refer to hazardous waste constituents rather than waste itself. The Permittee's response regarding the vertical impacts to soils is accurate.

Permittee Response to NMED Comments 2c and 8d

NMED's Response to Comments, Comment 2c related to the Permittee's risk assessment states, "[t]he results obtained from the screening analysis (risks for soil under a residential scenario at $1x10^{-3}$ exceed NMED target risk of $1x10^{-5}$ using DAF=461 while the hazard index is 1.5; for groundwater, the risk is again above $1x10^{-3}$ and the hazard index is 910) indicate the SWMUs must be further evaluated (potentially, with a more detailed, site-specific risk assessment) and/or that remediation of soil and groundwater is necessary. The Permittee may calculate separate DAFs for each SWMU to aid in the assessment of soil contamination. In addition to calculating separate site-specific DAFs, the Permittee may want to perform a screening analysis of the sediments in the Aeration Basin." The Permittee's response to NMED's Comment 2c states, "[b]ased on previous characterization of sediments, as provided in the Trihydro Report and process knowledge, Western assumes the sediments in the Aeration Basin will require that a remedy be implemented. A screening analysis does not appear to be warranted." The Permittee must take into account that the Aeration Basin received listed and characteristic hazardous waste and hazardous constituents and the regulatory impacts this has on site closure. NMED's

Comment 8d stated, "[g]iven the high risk estimates, a more detailed screening analysis that focuses on the potential risks and hazards posed by each SWMU is warranted. Further evaluation may also be necessary. Addressing the SWMUs as separate exposure units will facilitate more informed and resource-effective risk management decisions related to corrective action and remedy selection." To which the Permittee responded, "Western needs more explanation of NMED's statement that 'Further evaluation will be necessary.' Remediation is expected for both SWMUs and so Western questions what further risk evaluation could be necessary to arrive at that conclusion." NMED's comment was meant to clarify options for the Permittee, because of the high risk estimates at the SWMUs and to also point out that contaminated soils in one SWMU may delay cleanup progress at the other SWMU if they are connected. The Permittee separated the SWMUs; no revision is required.

Permittee Response to NMED Comment 5

The Permittee's response to NMED's Comment 5, which required a description of the construction and composition of the pond berms, provides excerpts from a geotechnical document regarding the proposed construction of the Aeration Basin titled *Technical Specification for Construction of an Aerated Lagoon API Separator Effluent Treatment Facility* dated 1986. The Permittee notes that, "[f]rom the following design description, it is clear that Giant Industries took great care to ensure the berms were properly constructed to minimize any exfiltration from the Aeration Basin." The design specifications for the Aeration Basin provide details regarding plans; however, there is no evidence (unless the Permittee can provide as-built drawings or a final construction report) that the ponds and berms were constructed as planned. Additionally, GWM-2 and GWM-3, which were installed to determine whether or not the Aeration Basin was leaking, frequently contained water after their installation. Once the Aeration Basin started drying out, the wells became dry, indicating leakage from the Aeration Basin. The Permittee asserts that "[d]uring the operational life of the Aeration Basin there were no indications of any seepage along the western and northern sides of the Aeration Basin where the berms are above grade." However, the presence of water in GWM-2 and -3 and contamination in GWM-1 demonstrate that this assertion is not accurate as does the discussion in Report Section 4.2.2 (see Comment 3). No revision is required; however, in future submittals regarding the Aeration Basin ensure that a discussion is included regarding seepage of wastewater from the Aeration Basin.

Permittee Response to NMED Comment 7a

The Permittee's response to NMED's Comment 7a states, "Western is interested in NMED's suggestion to perform fingerprint analyses and would like to discuss this further and hopefully obtain examples from NMED of how other Permittees have used fingerprint analysis to determine site-specific screening levels with NMED's approval of the methodology and any associated calculations. Western would note that when it comes to analysis for [*total petroleum hydrocarbons*] TPH, it is less important to know what the original release material was but rather what constituents remain in the subject environmental medium today, thus the analysis for [*gasoline range organics*] GRO, [*diesel range organics*] DRO and [*motor oil range organics*] MRO that are capable of providing the fractionation of the TPH." There has not been a situation at another facility where use of a less conservative screening level has been proposed.

Fingerprint analysis may narrow down the specific component, but it is also possible that it may not, so the most conservative value will be used for comparison. NMED cannot make a determination without data. In the future, if the Permittee wishes to use a less conservative screening value, evidence must be presented to demonstrate that the proposed, less conservative value, is the most appropriate based on the hydrocarbon fractions present and as identified by an off-site laboratory analysis; otherwise, the unknown oil value must be used.

NMED Response to Permittee Response to May 11, 2014 Disapproval Comments

Permittee Response to NMED Comment 4

Regarding NMED Comment 4, the Permittee responds "NMED comments that the data tables have values with too many significant digits and then refers to the 'proper number of significant digits." The data tables provided in the July 2014 Investigation Report contain the same values as those included in the original February 2013 copy of the Investigation Report for which NMED did not indicate any problems regarding the number of significant digits. Western does not understand why the presentation of a more accurate result containing more significant digits would elicit a comment from NMED. Regardless, Western searched the Permit and NMED guidance to identify what NMED is referencing as the 'proper number of significant digits' and did not find any reference to significant digits in either of these guiding documents. Western reviewed the electronic copy of the New Mexico Soil Screening Levels (Table A-1) that are provided on your website and observed the values are provided to 15 significant digits while the screening values included in the 2014 Risk Assessment Guidance for Site Investigation and Remediation show three significant digits expressed in scientific notation. Western has reported the exact values provided by the laboratory via electronic data delivery in Excel format and deferred to the reporting laboratory to determine the 'proper number of significant digits' for the detected results." It is common practice to report data in units appropriate to its use. For future submittals, tables must report data using the same units as soil and groundwater cleanup levels and must report data to three significant digits to allow for easy comparison between screening levels and the data. No revision is required.

NMED Comments on the Revised Report

The following comments are NMED's comments regarding the revised Report.

Comment 1

The Permittee presents conflicting statements regarding releases from the Old American Petroleum Institute Separator (OAPIS). In Section 2.2.2 (Prior Maintenance Activities), the Permittee states, "[t]he concrete was patched in numerous locations in both bays and the weir wall down-stream of the pipe skimmer was rebuilt on both bays. Stained soil (approx. 4,500 lbs) identified around the perimeter of the separator was removed and sent off-site for disposal as hazardous waste (K051)." However, in Section 2.2.3 (Historical Site Investigations) the Permittee states, "[t]here have not been any documented historical releases from the OAPIS with the aforementioned noted exception of the identification of some surface soils with hydrocarbon stains around the sides of the unit. These stained soils were removed and this limited volume of material did not indicate an obvious significant release." And then, in Section 2.1.2 (Prior Maintenance Activities) regarding the Aeration Basin, the Permittee lists release incidents where the OAPIS was the source of releases to the Aeration Basin. Additionally, soil boring analytical data from this investigation indicate that there were additional releases beneath the OAPIS. No revision is required; however, in the future statements must be supported by data.

Comment 2

In Section 3.1.2 (SWMU No. 14 Old API Separator) the Permittee states, "[t]wo of the planned deep borings (SWMU 14-5 and SWMU 14-8 located on the north side and northwest corner of the OAPIS) had to be installed with a hand auger instead of the hollow-stem auger (HSA) method due to access limitations with the drilling rig (Figure 3)." The majority of the borings installed at the OAPIS terminated two feet below the ground surface. Soil analytical data demonstrates that contaminant concentrations often increase in the 1.5-2.0 foot interval. While access limitations may affect collection of data from deeper intervals, the Permittee must demonstrate that the vertical extent of contamination has been defined. Borings 14-7 and 14-9 demonstrate that contamination outside the footprint of the OAPIS may reach a depth of 6 to 8 feet below ground surface (bgs). Generally, samples must be collected at the depth immediately below the base of the unit and at the fill-native soil interface, five feet below the base of the structure, and five feet below the water table (Permit Section IV.J.2.d.ii Soil and Rock Sampling). The Permittee submitted an additional Investigation Work Plan for SWMU 1 and 14, dated June 2014 that is currently under NMED review. The additional proposed sampling locations are not within the footprint of the OAPIS and do not address and delineate potential vertical contamination. The Permittee must delineate the vertical impacts and must propose soil borings within the footprint of the OAPIS in the Work Plan.

Comment 3

The Permittee discusses shallow groundwater that is present in the investigation area, in Section 4.2.2 (Hydrogeology):

> "The presence of shallow groundwater in the area of the Aeration Basin and OAPIS appears to be associated with fluids managed in these two SWMUs. All of the deeper soil borings immediately surrounding the Aeration Basin encountered saturation or at least moist conditions where more permeable horizons (e.g., clayey sand) were present at elevations at or below the water levels in the Aeration Basin (Figure 7). Saturation was not encountered in similarly permeable soils at elevations above the water levels in the Aeration Basin, nor are any of the measured water levels in the shallow wells above the water levels in the Aeration Basin. Saturation was not encountered in borings (e.g., SWMU 14-1, SWMU 14-6, SWMU 14-7, SWMU 1-20, and SWMU 1-38) located further away from the Aeration Basin and OAPIS, with the exception of boring SWMU 14-23. There was an indication of saturation within a sandy clay interval in SWMU 14- 23; however, no water was produced from a temporary well completion installed in the soil boring. In addition, as discussed above in Section 2.1.3,

> there have been low concentrations of constituents reported in shallow groundwater from samples collected nearby the Aeration Basin and OAPIS that have also been detected in water and sediment samples collected from the Aeration Basin. All of the evidence points to the Aeration Basin in particular as a source of recharge to the discontinuous permeable zones (e.g., clayey sand) that have been identified in borings adjacent to the Aeration Basin. These saturated intervals produce very little water. Temporary well completions were installed in soil borings SWMU 1-2, SWMU 1-3, SWMU 1-4, SWMU 1-5, SWMU 1-6, SWMU 1-7, SWMU 1-8, SWMU 1-24, and SWMU 14-3. In every case, it was difficult to obtain sufficient volumes of water to complete scheduled sample collection activities and at SWMU 1-5, there was not a sufficient volume of water to allow analyses for all analytes."

NMED agrees that the presence of shallow groundwater appears to be influenced by fluids managed in the SWMUs. However, historic documents demonstrate the presence of seeps in the area prior to construction of the Aeration Basin (see: *Geotechnical Investigation Three Cell Sludge Pond*, dated July 22, 1986). There are naturally occurring saturated intervals in the upper Chinle/Alluvium found in the subsurface as a discontinuous permeable zone and seen in borings as sand lenses (or sand stringers). The Aeration Basin, in particular, likely affected shallow groundwater levels, because there was a noticeable drop in groundwater levels in GWM-1, -2, -3, and OAPIS-1 when use of the Aeration Basin ceased. Evidence points to the connection between the natural water in the area with the wastewater held in the Aeration Basin. Any proposed remediation at the Aeration Basin must address groundwater contamination and the recharge of groundwater from, and now to, the Aeration Basin.

Comment 4

Many of the hand auger soil samples were completed to a total depth of two feet below ground surface or less, which is not necessarily representative of conditions at the SWMUs. As an example, one soil sample was collected (SWMU 1-19) from 0-0.5 feet bgs and then the boring was terminated due to refusal in gravel. Soil sample collection at the ground surface is useful if the investigation involves an area where, for instance, there were past releases that resulted in surface contamination that were not immediately remediated, but in this case the purpose of this investigation was to investigate whether or not the Aeration Basin contaminants seeped to the surrounding soils. NMED notes that fifteen hand auger borings 1-12, 1-17, 1-18, 1-19, 1-21, 1-23, 1-25, 1-26, 1-29, 1-31, 1-32, 1-33, 1-34, 1-36, 1-39 were terminated at two feet below ground surface or less and are not representative of subsurface conditions at the Aeration Basin.

Comment 5

In Section 7.1 (Conclusions), regarding soil cumulative risk calculations, the Permittee states, "[t]he cumulative carcinogenic risk is 1.36×10^{-3} assuming residential land use and 6.3×10^{-5} for non-residential land use at SWMU No. 1. The cumulative carcinogenic risk is 1.41×10^{-3} assuming residential land use and 6.93×10^{-5} for nonresidential land use at SWMU No. 14. The hazard index for residential land use is 0.56 and for non-residential land use is 0.126 at SWMU

No. 1. The hazard index for residential land use is 1.30 and for non-residential land use is 0.384 at SWMU No. 14." The Permittee did not define the extent of contamination at the Aeration Basin; therefore, the cumulative risk calculations are not necessarily representative of site conditions. Cumulative risk must be calculated after the site has been fully characterized.

Comment 6

In Section 7.1 (Conclusions), regarding groundwater cumulative risk calculations, "[a] cumulative risk evaluation for groundwater is presented in Tables 14 and 15 for SWMUs No. 1 and No. 14, respectively. The evaluation was conducted by taking the maximum reported concentration of each constituent detected in groundwater, which is based on the totals analyses for metals, and dividing by the risk-based residential screening levels, as shown in the equation above in the discussion for soil. The cumulative carcinogenic risk level is calculated to be 1.74×10^{-3} for SWMU No. 1 and 1.48×10^{-3} for SWMU No. 14. The hazard index is 147.04 for SWMU 1 and 79.55 for SWMU 14." Groundwater contaminant concentrations must meet the lower of the EPA Maximum Contaminant Levels (MCLs) or the WQCC standards as specified in Permit Section IV.D.1. It is noted that the calculated risk for groundwater is unacceptable even though the extent of contamination has not been defined.

Comment 7

In Section 7.1.1 (Aeration Basin) the Permittee states, "[b]enzene was the only constituent detected above the DAF screening level in soil boring SWMU 1-28 at a depth of 1.5 – 2.0' bgl (2.53 mg/kg vs. 0.796 mg/kg). Soil boring SWMU 1-28 is located on the northern boundary of the Aeration Basin and the 1.5 – 2.0' interval is composed of a clayey gravelly sand, which was damp, but not saturated. The boring was terminated at 4 feet bgl in the same material." The Permittee did not collect a soil sample at the bottom of this boring; therefore, it is not known if benzene concentrations increase at depth. The highest PID reading from the boring was from the 2-4 foot sample interval (although the PID reading was low at 4.8). Further investigation of the vertical extent of contamination must be conducted. It is also not clear why a sample was not collected from the bottom of this boring, generally, when attempting to define the vertical extent of contamination; samples are collected for laboratory analyses from the bottom of boreholes.

Comment 8

In Section 7.1.1 (Aeration Basin), under the "Soils" heading, page 63, the Permittee states, "[o]verall, there were few exceedences of the DAF screening levels in the soil samples collected around the Aeration Basin. Only 3 (SWMU 1-1 (2-4'), SWMU 1-1 (10-12'), and SWMU 1-28 (1.5-2') out of 103 soil samples collected around the Aeration Basin exceeded DAF screening levels. The vertical impacts to soil were found to extend to the uppermost groundwater-bearing horizons in some borings around the Aeration Basin." Not surprisingly, the borings advanced around the Aeration Basin contained relatively low contaminant concentrations, but no borings were collected on the inner part of the berms, the berms separating the ponds, or within the ponds themselves; therefore, the unit has not been fully characterized. The groundwater analytical results demonstrate that there was migration of contaminants from the Aeration Basin.

Comment 9

Depth to bedrock appears to vary greatly around the Aeration Basin. The depth to bedrock can be correlated to the depth of shallow groundwater. Shallow groundwater is present in the area of the Aeration Basin and the OAPIS, contrary to the Permittee's statement that shallow groundwater is coming from leaks from the Aeration Basin and the OAPIS, the shallow groundwater is also naturally occurring. In Section 7.1.1 (Aeration Basin), under the "Groundwater" heading, page 65, the Permittee states,

> "Based on the field evidence of potential impacts at borings SWMU 1-4 and SWMU 1-24, two additional soil borings (SWMU 1-20 and SWMU 1-38) were drilled west of the Aeration Basin.
> At location SWMU 1-20 (located southwest of SWMU 1-4), bedrock was encountered at a depth of only 10 feet bgl and there was no indication of saturation in the boring or the clayey sand deposits, which were identified in SWMU 1-4. No groundwater sample was collected at SWMU 1-20 as the boring was dry. Soil boring SWMU 1-38 was drilled west-northwest of SWMU 1-4 and bedrock was encountered at a depth of only 6 feet bgl. Once again, the clayey sand deposits, which were saturated in boring SWMU 1-4, were not present at this location to the west of the Aeration Basin. No groundwater sample was collected at SWMU 1-38 because the boring was dry. Based on the results of borings SWMU 1-20 and SWMU 1-38, it does not appear that the saturated zones found in SWMU 1-4 and SWMU 1-24 extend beyond the base of the slope on the west side of the Aeration Basin where borings SWMU 1-20 and SWMU 1-38 were completed."

Bedrock is present anywhere from 6 feet to over 30 feet below the ground surface at the facility. Between the top of bedrock and the ground surface, the Chinle (bedrock)/Alluvium Interface and other relatively coarser-grained intervals often contain groundwater. In Section 7.1.1 (Aeration Basin), page 65, under the "Groundwater" heading the Permittee states, "SWMU 1-24 was drilled to a depth of 34 feet, but bedrock was not encountered. A saturated interval of clayey silt/sand was identified from 24 to 28 feet bgl. A groundwater sample collected from this boring found benzene, 1-methylnaphthalene, DRO, and naphthalene at concentrations above their screening levels." Boring SWMU 1-24 is located on the western berm of EP-1. The clayey sand interval is unpredictable and difficult to trace and may be present in some borings and not in others or may be present with more frequency in some borings compared to others. In Section 7.1.1 (Aeration Basin), under the "Groundwater" heading, page 64, the Permittee states, "soil boring SWMU 1-2 was drilled along the southwest side of the Aeration Basin and encountered bedrock at a depth of 19.5 feet bgl. There were several saturated soil intervals encountered in this boring including clayey sand from 8 to 11 feet, 14 to16 feet, 17 to 17.25 feet, and 18.25 to18.5 feet bgl." The shallow groundwater and the clayey sand layers represent groundwater flow paths throughout the facility that can allow contaminants to migrate. Any proposed remedy for the

Aeration Basin or the OAPIS must take into account the presence of these groundwater contaminant flow paths. See also Comment 3. No revision is required.

Comment 10

In Section7.1.1 (Aeration Basin), under the "Groundwater" heading, page 66, the Permittee states, "[t]he saturated intervals in most locations consist of clayey sand, which was found to not be very productive during sample collection activities. The clayey sand intervals do not appear to be laterally continuous at most locations based on the inability to correlate zones between most of the soil borings completed around the perimeter of the Aeration Basin. It also appears that the source of recharge to the saturated intervals found in the borings around the Aeration Basin is the wastewater, which has been maintained in the Aeration Basin. As the Aeration Basin is removed from service and the liquids are removed, it is probable that the saturation observed in borings SWMU 1-2, SWMU 1-3, SWMU 1-4, SWMU 1-5, SWMU 1-6, SWMU 1-7, SWMU 1-8, SWMU 1-24, and SWMU 1-37 will dissipate." While the hydraulic conductivity of the clayey sand layers may not be very high, the interval(s) represent contaminant migration pathways. Additionally, it has been assumed that the Aeration Basin was set into dense clay that acted as a barrier for the unlined ponds; it is obvious now that the permeability of some soils allowed wastewater to seep into the surrounding soils. It also appears that the same soil permeability allowed groundwater to seep into the Aeration Basin. See also Comments 3 and 10. No revision is required.

Comment 11

In Section 7.1.2 (Old API Separator), under the "Soils" heading, page 67, the Permittee states, "[t]he highest concentrations were found in soil samples collected directly beneath the former location of the OAPIS at borings SWMU 14-12, SWMU 14-13, and SWMU 14-14, and at borings immediately adjacent to the OAPIS (e.g., SWMU 14-15, SWMU 14-16, and SWMU 14 -17). In addition, there is an area of elevated concentrations at depths of 8 to 12 feet bgl located near the west end of the former OAPIS, near borings SWMU 14-6 and SWMU 14-7, and extending north towards the location of the former benzene strippers." The high concentrations of contaminants detected in the soils demonstrate that wastewater was likely historically released from the OAPIS. See also Comment 2.

Comment 12

In Section 7.1.2 (Old API Separator), under the "Soils" heading, page 67, the Permittee states, "[a]ll constituents except benzene were found below their respective DAF screening levels to the east of the OAPIS in boring SWMU 1-23. Benzene was detected at 1.1 mg/kg vs. a DAF screening level of 0.796 mg/kg in silty clay at a depth of 12 – 14 feet in SWMU 14-23." The constituents detected in boring SWMU 14-23 may be from a source other than the OAPIS. No response is required, although further investigation may be warranted to determine if there is an upgradient source of soil contamination east of the OAPIS.

Comment 13

In Section 7.1.2 (Old API Separator), under the "Soils" heading, page 67, the Permittee states, "[t]he extent of impacts to soil was not defined to the north toward the Aeration Basin, as demonstrated by impacts found in soil boring SWMU 14-3, which is located approximately half way between the former OAPIS and the Aeration Basin. It is possible that the impacts to soil may extend continuously between the OAPIS and the Aeration Basin, which are separated by only a short distance of approximately 60 feet. The vertical impacts to soil were found to extend to the uppermost groundwater-bearing horizons in borings SWMU 14-2 and SWMU 14-3." The Permittee recommends, on page 68, that "[t]he area between the OAPIS and the Aeration Basin is relatively small and does not warrant additional investigation to determine if there is possible separation of impacts sourced from the two different SWMUs." NMED concurs that further investigation is not needed in this area between the units; however, any earth moving or excavation in this area must include sampling to demonstrate that all contaminated soils are addressed. No revision is required.

Comment 14

In Section 7.1.2 (Old API Separator), under the "Groundwater" heading, page 68, the Permittee states, "[s]oil boring SWMU 14-2 was drilled to a depth of 26 feet, but did not encounter bedrock, nor was there any distinct saturated interval logged in this boring. Soil boring SWMU 14-3 was also drilled to a depth of 26 feet and did not encounter bedrock. An indication of potential saturation was observed near the top of a clay horizon in SWMU 14-3 at 14 feet bgl. Groundwater production was very slow from both of these locations, indicating the lack of a true aquifer." The Permittee is aware that there is shallow groundwater at the facility and that meets the definition of groundwater in Permit Section I.I and therefore must meet the groundwater cleanup standards. Low flow groundwater sampling techniques are used at the facility because of low recharge rates in many of the groundwater monitoring wells; the Permittee is aware that many groundwater wells have slow recharge rates at the facility. See also Comment 3 and Comment 10.

Comment 15

The manner in which the Permittee presents the soil analytical data for the Aeration Basin and the OAPIS makes it difficult to interpret because soil sample depths are not presented in order (e.g., from the top of the soil strata to the bottom of the borehole). The data presentation makes it more difficult than necessary to visualize any trends in the data set. In the future, please ensure that data tables present data in a way that makes sense for interpretation. No revision is required.

If you have questions regarding this Approval, please contact Kristen Van Horn of my staff at 505-476-6046.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain NMED HWB
K. Van Horn NMED HWB
C. Chavez OCD
A. Hains WRG
C. Johnson WRG
L. King EPA Region 6, 6MM-RC

File: Reading File and WRG 2017 File
HWB-WRG-13-001

June 7, 2012

Mr. John E. Kieling, Acting Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg 1
Santa Fe, New Mexico 87505-6303

RE: DISAPPROVAL - INVESTIGATION WORK PLAN
SOLID WASTE MANAGEMENT UNIT (SWMU) NO. 1 - AERATION BASIN
WESTERN REFINING COMPANY, SOUTHWEST, INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-12-001

Dear Mr. Kieling:

Please find enclosed the subject investigation work plan, which has been revised pursuant to your letter of May 15, 2012. The Corrective Measures Evaluation (CME) Report will be revised to include the results of the investigation. Because we have not yet received approval to implement the investigation work plan, it is unlikely that it will be possible to complete the investigation and submit the revised CME Report on the original due date of July 30, 2012. Please consider providing a new due date for the revised CME Report based on the date you grant authorization to proceed with the investigation.

The following responses have been prepared pursuant to your letter, which provided comments prepared by your staff on the *Investigation Work Plan Solid Waste Management Unit (SWMU) No. 1 Aeration Basin* (Work Plan), dated February 2012 for the Western Refining Company, Southwest Inc. ("Western"), Gallup Refinery. Your comments are repeated below followed by Western's response.

Comment 1

In the cover letter the Permittee states, "[d]ue to the fact that the Aeration Basin currently is in service and contains wastewater, no borings are currently planned beneath the basin to avoid the risk of inadvertently causing a release or exacerbating the migration of any existing impacts." In section 4.1.2 (Drill Activities), page 12, the Permittee states, "if significant evidence of impacted groundwater is encountered at shallower depths, then Western may terminate borings to prevent creating a potential conduit for vertical migration. In such instances, it may be necessary to install a protective surface casing." Some vertical migration of water will occur with appropriate boring abandonment, the vertical migration will be negligible and not be deleterious to the environment. No revision is necessary.

Response: No response required.

Comment 2
In Section 4.1 (Investigation), the Permittee states, "[a]s necessary, investigation beneath the Aeration Basin may be conducted at a later date, after the Aeration Basin is no longer in service and does not contain any free liquids. Any such investigation could potentially be conducted under the Corrective Measures Implementation Work Plan." If the Permittee chooses to not sample beneath the Aeration Basin during this phase of work, then the Permittee must propose to install a groundwater monitoring network in the Corrective Measures Implementation (CMI) Work Plan.

Response: Western understands that a groundwater monitoring network will be required for any remedies that do not result in complete remediation of the waste in the basin and any impacted environmental media (i.e., corrective action complete without controls) for SWMU No. 1.

Comment 3
In Section 2.1 (Aeration Lagoons AL-l and AL-2), the Permittee discusses that benzene above the regulatory limit of 0.5 mg/L has entered the lagoons; additionally, there have been discharges of F037/F038 waste in the lagoons as well (while aerators were not operating). Revise the Work Plan to describe all instances of hazardous constituents discharged to or generated in the Aeration Basin.

Response: This comment requests a description of all instances of "hazardous constituents" discharged to or generated in the Aeration Basin. Based on the context of the discussion, Western assumes that the New Mexico Environment Depart (NMED) is requesting this information for "hazardous wastes" and not "hazardous constituents." The requested information has been added to Section 2.1 for more recent spills occurring since 2005 and for which documentation is available.

Comment 4
In Section 2.1.3 (Historical Site Investigations), the Permittee states, "[t]wo groundwater monitoring wells (GWM-1 and GWM-2) were installed immediately downgradient of the aeration lagoons in 2004." This statement in inaccurate, GWM-1 was installed in 2004; GWM-2 and GWM-3 were installed in 2005. Revise the Work Plan to include the accurate dates of well installation.

Response: The dates for installation of GWM-1 and GWM-2 have been corrected in the revised text.

Comment 5
There are several issues within Section 2.1.3 (Historical Site Investigations). On page 5, paragraph 1, the Permittee states, "[b]oth GWM-2 and GWM-3 were dry during the 2007 annual sampling event." GWM-2 and GWM-3 were intended to be dry wells; their purpose is to determine whether or not the aeration lagoons and EP-1 leak. On page 5, paragraph 2, the Permittee states, "[i]n 2008 GWM-1 was sampled on July 10 and results are submitted to NMED annually." It is accurate to describe GWM-1 as sampled quarterly with results reported in the Annual Facility-Wide Groundwater Monitoring Report. Also in paragraph 2, the Permittee states, "GWM-2 and GWM-3 were not scheduled for sampling during the 2008 annual sampling event." This statement is not accurate, GWM-2 and

GWM-3 are scheduled to be checked for presence of water quarterly; if sufficient water is present a sample is collected. Water was present in GWM-2 in 2008, so a sample was collected (MTBE was detected at 0.028 mg/L). Revise the Work Plan to describe the monitoring and sampling accurately.

Response: The fact that GWM-2 and GWM-3 were dry during the 2007 sampling event was stated in the investigation work plan so that anyone reading the work plan would clearly understand why only results for GWM-1 water samples were discussed. Western agrees with NMED's characterization of the purpose of GWM-2 and GWM-3 and notes that GWM-1 was also originally installed to monitor for the presence of shallow groundwater near the Aeration Basin and to detect potential leakage from the Aeration Basin. NMED states that it is accurate to describe GWM-1 as sampled quarterly, but actually the investigation work plan does not mention quarterly sampling. No change is being made to the investigation work plan relative to this issue, but for clarification Western notes that water samples were required to be collected from GWM-1 on an annual basis in 2007, until the new Facility Work Plan was approved on August 25, 2010, which requires quarterly sampling.

The description of the monitoring requirements for GWM-2 and GWM-3 has been revised. As NMED indicated, these wells were scheduled to be checked for the presence of water quarterly and a sample collected for analysis if water was found to be present. The work plan has been revised to reflect the first recorded occurrence of groundwater in GWM-2 occurred on February 18, 2008 and that a sample was collected for analysis. As more recent chemical analyses are now available for GWM-1, GWM-2, and GWM-3, new tables have been added in Appendix A to show analytical results for BTEX and MTBE, as well as other constituents, through March 2012.

Comment 6

In Section 2.1.3 (Historical Site Investigations), page 6, paragraph 1, the Permittee states, "[a]dditionally, since the measurements and calculations are in-situ calculations, the SurvCAD program applied no allowances for expansion or compaction to the calculated estimates. Removal of the material from the lagoons or exposure to ambient air reducing the percent moisture of the sediment may impact the volume of material." The Permittee seems to have adequate information to perform the geotechnical calculations necessary to estimate the volume of material to be removed as part of the complete removal remedial alternative; such an estimate must be included in the revised CME Report and be included in the cost estimates.

Response: Western did provide an estimate of the volume of material to be removed as part of the "complete removal remedial alternative" (i.e., Offsite Disposal Alternative) and this volume estimate was used in the cost estimate included as Table A-1.1 in the CME Report dated October 2010 (revised April 2011). The estimate assumed a 10% increase in volume with the introduction of materials to stabilize the sludge.

Comment 7

In the Executive Summary the Permittee states, "[i]n addition, information will be collected to help determine the source of groundwater that has been observed in monitoring wells GWM-2 and GWM-3." The Work Plan does not describe the proposed methods to determine the source of the groundwater in GWM-2 and GWM-3. Revise the Work Plan to specify the proposed methods to determine the source of water in the wells.

Response: The method to determine the source of water in the wells is primarily chemical analysis combined with field observations to note the occurrence of saturation during installation of the soil borings and the subsurface lithology. Fluid levels in the deep soil borings and monitoring wells may also provide some insight into the source of water in GWM-2 and GWM-3, as well as new soil boring locations. Additional discussion has been added to Section 4.1 in regards to the installation of the deeper soil borings and the collection of information that may help to determine the source of water in GWM-2 and GWM-3. Also chloride, fluoride, and sulfate have been added to the list of analytes in Section 4.1.8 to facilitate a comparison with water samples collected from the Aeration Basin. These three constituents have been detected in fairly high concentrations in the Aeration Basin and are conservative solutes (i.e., they are not retarded during migration as organic constituents are), thus they should be good indicator constituents for evaluation of migration from the impoundments.

Comment 8
It is not clear why the discussion of AL-I and AL-2 is separate from EP-1; combine Sections 2.1(Aeration Lagoons AL-I and AL-2) and Section 2.3 (EP-1). Revise the Work Plan to discuss AL-I, AL-2, and EP-1 in the same section.

Response: Sections 2.1 and 2.3 are now combined into Section 2.1.

Comment 9
In Section 3.2 (Subsurface Conditions), page 9, paragraph 4, the Permittee states, "[t]he location of the groundwater monitoring wells, which are near to the aeration lagoons and evaporation pond, is presented in Figure 4-1. A copy of the boring logs for KA-1, KA-2, and KA-3, GWM-1, GWM-2, and GWM-3 are provided in Appendix C." Groundwater monitoring wells KA-1 and KA-2 were replaced by groundwater monitoring wells NAPIS-1, NAPIS-2, and NAPIS-3 in 2008 (KA-1 and KA-2 were abandoned). The old KA-wells may be used to describe the lithology around the Aeration Basin (page 9, paragraph 3); however, if describing the current groundwater monitoring wells reference only the NAPIS wells and KA-3. Revise Figure 4-1 to depict only the current wells and provide the corresponding boring logs and well construction diagrams. Revise the Work Plan accordingly.

Response: The purpose of including the wells logs for KA-1, KA-2, and KA-3 is strictly for examining the subsurface lithology. These well logs were purposely included instead of the logs for the replacement wells (NAPIS-1, NAPIS-2, and NAPIS-3) because the replacement wells were not continuously sampled with a specific sampling tool, but rather were logged off cuttings from the augers. Figure 4-1 has been revised to note that wells KA-2 and KA-3 are plugged and abandoned and the text in Section 3.2 is also been revised to note these two wells were replaced by the NAPIS wells.

Comment 10
In Section 3.2 (Subsurface Conditions), page 9, paragraph 4, the Permittee states, "[t]he occurrence of shallow groundwater in the area is sporadic and temporal, as displayed with the recent absence of groundwater in GWM-2 and GWM-3, as discussed above." NMED's January 23, 2012 letter, Comment 3, required the Permittee to find the source of the water in the wells; it is not clear how the Permittee determined that the water detected in GWM-2 and GWM3 is naturally fluctuating groundwater. The wells were installed in 2005 to monitor

whether or not the aeration lagoons leak and were intended to be dry wells. Water was detected in the wells starting in 2008 and continues to appear. The Gallup area has experienced below average precipitation over the last several years, whereas the groundwater levels in GWM-2 and GWM-3 have increased. The Permittee must determine if the groundwater levels have been measured and recorded properly, if there is an increase in the groundwater table that can be correlated to other wells in the vicinity (e.g. NAPIS-1, 2 3), or if the ponds are leaking. Compare the groundwater data from the Aeration Basin to other groundwater wells (around the facility. Propose to evaluate whether or not water in GWM-2 and GWM-3 is natural groundwater or wastewater leaking from the Aeration Basin and discuss, in detail, the proposed methods to determine the water source. See also Comment 4.

Response: NMED indicates that Western has "determined that the water detected in GWM-2 and GWM-3 is naturally fluctuating groundwater." We have not been able to locate any discussion in the work plan where Western makes any such determination, but rather the information that will be collected under the work plan should help to determine the source of water in these wells. There is no information indicating the water levels have been measured and recorded improperly. Care will be taken in future measurement events to ensure that water levels measurements are taken and recorded properly. Section 3.2 has been revised to clarify the discussion on the occurrence of water within the clay soils that overlie the Chinle Formation.

NMED references Comment 4, but we believe this reference should be to Comment 7. Revisions have been made to the work plan as discussed above in Comment 7 to address the collection of information that may help to determine the source of water in GWM-2 and GWM-3. It is should be noted that Western provides an evaluation of the water levels measured in GWM-1, GWM-2, and GWM-3, as well as, the chemical analyses of water samples collected from these wells and the Aeration Basin in the Annual Ground Water Report that is prepared for the entire facility. The information in this report, which is provided to NMED annually, has shown similar constituents in water samples collected from GWM-2 and GWM-3, and water samples collected from the Aeration Basin. Since the same wastewater is handled in the Aeration Basin and the API separators, it may not be possible to conclusively determine the source of the constituents. However, the information previously presented should clearly demonstrate that chemical constituents (e.g., MTBE) have impacted shallow groundwater in the vicinity of the Aeration Basin. And, if nothing else the fact that GWM-2 and GWM-3 are located immediately adjacent to the Aeration Basin and further away from the API separators (located on opposite side of Aeration Basin) suggests the chemical constituents have migrated from the Aeration Basin. Additional information collected under the work plan should help to further clarify the source of the water and constituents detected in the water at GWM-2 and GWM-3.

Comment 11

In Section 4.1 (Investigation), the Permittee states, "[t]his investigation will include surface (0-6") and shallow subsurface (18-24") samples collected on 50-ft spacings around the perimeter of the Aeration Basin (Figure 4-1). In addition, seven soil borings will be installed around the perimeter as shown in Figure 4-1 to determine if constituents have migrated laterally from the surface impoundments impacting either soils or groundwater." In Section 4.1.1 (Soil Sample Field Screening and Logging), the Permittee states, "[d]iscrete soil samples will be collected for laboratory analyses from within the following intervals: 0-6" (at soil borings with evidence of significant impacts near the land surface and all hand auger locations); 6-24" (at soil borings with evidence of significant impacts near the land surface and all hand auger locations); >24" (from the interval in each soil boring with the greatest apparent degree of contamination, based on field observations and field screenings; From a one foot interval, which lies approximately five feet below the bottom of the Aeration Basin (all soil borings); From the 6" interval at the top of saturation (applicable only to borings that reach saturation); and Any additional intervals as determined based on field screening results." Revise the sampling plan to ensure that samples are collected at the bottom of each borehole. In the revised Work Plan propose that a percentage of the hand auger bore holes be advanced at least 6 inches below the bottom of the berm material if the berm material is present deeper than 24 inches (to be determined in the field). Describe in more detail the "significant impacts" that will determine whether or not a sample will be collected from 0-6 inches and 6-24 inches. Add additional soil borings, one near GWM-2 and one near GWM-3 to further characterize the area. Revise the Work Plan as needed.

Response: The text in Section 4.1 has been revised to include a soil sample from the bottom of each borehole. In addition, an inconsistency was identified and corrected to clarify that soil samples at hand auger locations will be collected from 18-24 inches. Twenty percent (i.e., each fifth boring) of the hand auger borings will be advanced to a depth at least 6 inches below the bottom of the berm material if the berm material is thicker than 24 inches. Additional clarification has been added to Section 4.1.1 to determine when soil samples in the deep borings will be collected from the shallow intervals (i.e., 0-6 inches and 18-24 inches) based on "significant impacts."

NMED requested additional deep soil borings near GWM-2 and GWM-3. As GWM-1, which is a "deep soil boring", is already present near GWM-2, Western does not believe that any additional information will be gained to installing yet another deep soil boring at this same location. One additional deep soil boring has been added near GWM-3.

<u>**Comment 12**</u>

In Section 4.1.2 (Drilling Activities), the Permittee states, "[s]oil borings will be drilled using either cone penetrometer (CPT), hollow-stem auger or if necessary, air rotary methods including ODEX." NMED assumes that CPT refers to direct push technology. Direct push/geoprobe (with CPT) may be an appropriate drilling method, if a problem arises while using direct push/geoprobe, the Permittee must use hollow-stem auger; air rotary is not appropriate to use at the facility. In general, the Work Plan must be sufficiently specific that it can be used to generate information such as an accurate cost estimate and be used to direct field activities.

NMED realizes that contingencies arise during field work; these can be addressed by contacting NMED and also describing any deviations from the work plan in the investigation report. Revise the Work Plan to be more specific; the Permittee must propose to use either direct push and/or hollow stem auger for soil borings.

Response: The work plan has been revised to use only hollow-stem augers for the deep soil borings. Depending on the thickness of the berm material, it may be necessary to use hollow-stem augers for some of the "hand auger locations."

<u>**Comment 13**</u>

Section 4.1.2 (Drilling Activities), page 13, paragraph 13, the Permittee states, "[s]oil samples will be collected continuously and logged by a qualified geologist or engineer." This statement is not accurate. Soil borings will be sampled continuously, but soil samples

(discrete) will be collected as described in Section 4.1.1 (Soil Sample Field Screening and Logging). Revise the Work Plan to provide more accurate phrasing.

Response: Western believes the phrasing is accurate. We will use hollow-stem augers to drill the deep borings and hand augers for the shallow borings in an attempt to collect soil samples continuously while boring through the subsurface. These soil samples will be field screened and logged. If using a CPT, then possibly one could "sample" the subsurface soils without actually physically collecting a sample. However, as Western proposes to use hollow-stem augers we believe it will be necessary to physically collect the soil samples in order to conduct field screening and logging. To help reduce any potential for confusion, the phrase in Section 4.1.1, "Discrete soil samples will be collected for laboratory analyses . . . ." has been replaced with "Discrete soil samples will be retained for laboratory analyses . . ."

Comment 14

Figure 4-1 (Proposed Sample Locations) shows the proposed locations of the hand auger borings and direct push/hollow stem auger boring locations. Ensure that all of the boring locations are labeled (location and boring designation) on the final sample location figure in the investigation report. Additionally, in revised Figure 4-1 include the additional borings required by Comment 11 and update the groundwater monitoring wells as required by Comment 9.

Response: All of the boring locations will be labeled (location and boring designation) on the final sample location figure in the investigation report. Additionally, the revised Figure 4-1 includes the additional borings required in response to Comment 11 and revisions pursuant to our response to Comment 9.

Comment 15

Appendix A (Appendices I-1 and I-2 of the RCRA Post-Closure Permit Application) contains information regarding SWMU 1 (the Aeration Basin) and SWMU 2 (the Evaporation Ponds). This information has previously been submitted to NMED. It is not clear why information about the Evaporation Ponds is included (Appendix A is referenced in Section 1 (Introduction); if it is meant to be evidence that EP-1 is part of SWMU 1, NMED agreed in its letter from January 23, 2012, Comment 2, that EP-1 is part of SWMU 1). It is not clear why the appendix was included; remove Appendix A from the Work Plan.

Response: The original content of Appendix A has been removed.

Comment 16

Appendix B (Trihydro Report, June 2008) contains a sediment investigation report for the Aeration Basin. This report has been previously submitted to NMED; therefore, including a copy in the Work Plan is not necessary. Reference the Trihydro Report in the appropriate sections of the Work Plan and NMED will utilize the existing copy to confirm the references. Remove Appendix B from the Work Plan.

Response: The Trihydro Report has been removed from Appendix B and is now only referenced in the text as appropriate.

If there are any questions regarding the investigation work plan, please contact me at (505) 722-0217.

Certification

I certify that the information contained in or accompanying this submission is true, accurate and complete. As to those identified portions of this submission for which I cannot personally verify the truth and accuracy, I certify as the company official having supervisory responsibility for the person(s) who, acting upon my direct instructions, made the verification, that this information is true, accurate, and complete.

Sincerely,

Mr. Ed Riege
Environmental Manager
Western Refining Southwest, Inc. – Gallup Refinery

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Revised Investigation Work Plan
Solid Waste Management Unit (SWMU) No. 1
Aeration Basin

Gallup Refinery
Western Refining Southwest, Inc.
Gallup, New Mexico

EPA ID# NMD000333211

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(Revised June 2012)

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Executive Summary

The Gallup Refinery, which is located 17 miles east of Gallup, New Mexico, has been in operation since the 1950s. Pursuant to the terms and conditions of the facility Post-Closure Care Permit and 20.4.1.500 New Mexico Administrative Code, this Investigation Work Plan has been prepared for the Aeration Basin that is listed as Solid Waste Management Unit (SWMU) No. 1 in the facility's Resource Conservation and Recovery Act (RCRA) Post-Closure Care Permit.

The planned activities include sampling of soils and groundwater surrounding the Aeration Basin to determine if there has been a release to the environment and to delineate any such release. In addition, information will be collected to help determine the source of groundwater that has been observed in monitoring wells GWM-2 and GWM-3.

Section 1
Introduction

The Gallup Refinery is located approximately 17 miles east of Gallup, New Mexico along the north side of Interstate Highway I-40 in McKinley County. The physical address is I-40, Exit #39 Jamestown, New Mexico 87347. The Gallup Refinery is located on 810 acres. Figure 1-1 presents the refinery location and the regional vicinity.

The Gallup Refinery is a crude oil refinery currently owned and operated by Western Refining Southwest, Inc., formerly known as Giant Industries Arizona, Inc. and formerly doing business as Giant Refining Company Ciniza Refinery, an Arizona corporation. The Gallup Refinery generally processes crude oil from the Four Corners area transported to the facility by pipeline or tanker truck.

Various process units are operated at the facility, including crude distillation, reforming, fluidized catalytic cracking, alkylation, isomerization, sulfur recovery, merox treater, and hydrotreating. Current and past operations have produced gasoline, diesel fuels, jet fuels, kerosene, propane, butane, and residual fuel.

The Aeration Basin, which is designated as SWMU No. 1 in the facility's RCRA Post-Closure Care Permit, was constructed within original Pond No. 1 in 1987. The location and extent of the Aeration Basin is documented in the Post-Closure Care Permit, Attachments – Post-Closure Permit Application Volume III. The Aeration Basin includes three cells, which were created within original Pond No.1 to facilitate the addition of aeration units to the facility's wastewater treatment. These three cells are identified in the RCRA Permit as Inlet Aeration Basin, Second Aeration Basin and Holding Pond. Subsequently, the first two cells (Inlet Aeration Basin and Second Aeration Basin) have become known as the aeration lagoons or more specifically, AL-1 and AL-2. The third cell (Holding Pond) is now commonly referred to as EP-1, although it is not an evaporation pond and is not part of the area covered by SWMU No. 2 - Evaporation Ponds. Hereafter, the currently used designations of AL-1, AL-2 and EP-1 are used to refer to the three cells of SWMU No. 1 – Aeration Basin.

Section 2
Background

This section presents background information for each of the aeration lagoons and EP-1, including a review of historical waste management activities for each location to identity the following:

- Type and characteristics of all waste and all contaminants handled in the subject SWMU;
- Known and possible sources of contamination;
- History of operations; and
- Prior investigations.

2.1 Aeration Lagoons AL-1 and AL-2 and EP-1

The two aeration lagoons and EP-1 were constructed in 1987 and have been in operation since that time. The aeration lagoons cover an area approximately 275 feet by 150 feet and have an estimated holding capacity of 1 million gallons. EP-1 is approximately 225 feet by 250 feet and has an estimated holding capacity of 3 million gallons. Three benzene air strippers are located between the refinery's API separator and the aeration lagoons to prevent characteristically hazardous waste from being discharged to the aeration lagoons. Monitoring data of the effluent from the two original benzene air strippers, which discharges into the inlet aeration lagoon, and flows into AL-2 has indicated that concentrations of benzene above the toxicity characteristic (TC) regulatory threshold of 0.5 milligrams per liter (mg/l) have entered these impoundments.

2.1.1 Operational History

The refinery process wastewater generated (approximately 178 gallons per minute (gpm) average flows for calendar year 2011) at the Gallup Refinery is managed first by physical treatment in an API separator, and then the volatile components are removed via benzene air strippers. The final treatment (biological) occurs in two aeration lagoons operated in series (AL-1 and AL-2). Water then flows to EP-1, before being discharged to the evaporation ponds. The lagoons and EP-1 are earthen surface impoundments with natural clay functioning as a bottom liner. AL-1 and AL-2 are equipped with surface aerators to oxygenate the water and stimulate biological activity.

Wastewater from AL-1, subject to aggressive biological treatment, is routed to AL-2 through an overflow pipe. Flows to the aeration lagoons measured as totalized flow from the API Separator averaged 178 gallons per minute (gpm) for calendar year 2011. Totalizer readings were recorded weekly. Daily average flows were calculated based on elapsed time between readings. Western has installed a real time electronic data system that captures minute by minute flow data.

2.1.2 Prior Maintenance Activities

Western has experienced intermittent discharges of oil and oily water into the lagoons as documented in previous correspondence to NMED. Most of these occurrences were the result of unit upset/large storm events affecting the old API Separator. Some recent examples are described below:

- A release of oily water from the old API separator and its inlet box occurred on August 3, 2005 with approximately 17 cubic yards of impacted soils excavated from AL-1 and AL-2;

- Approximately 13 cubic yards of impacted soils were excavated from AL-1 and AL-2 after a release of oily water from the old API separator occurred on August 15, 2005;

- On June 15, 2006, Western submitted a letter to NMED requesting a "contained-in" determination regarding soil excavated from AL-1, AL-2 and EP-1 to remediate releases of oily water containing F037/F038, which occurred in the fall of 2005;

- A release of approximately 700-800 gallons of oil from the new API separator (NAPIS) occurred on March 3, 2007 to AL-1, AL-2, and EP-1, which resulted in the collection additional effluent samples at AL-1, AL-2 and EP-1. In July 2007, the impacted bank soils were removed from the aeration lagoons (AL-1 and AL-2), EP-1 and evaporation pond EP-2. NMED stated in their letter of August 15, 2007, that the oily wastewater contained benzene (D018) and F037/F038-listed waste; however, the excavated soils were determined to meet the contained-in criteria and the excavated materials were appropriately disposed off-site pursuant to NMED's direction;

- On June 23, 2007 and July 19, 2007, oily wastewater reported to contain benzene (D018) and F037/F038-listed waste was released from the weir box at the NAPIS. The impacted soils were removed and subsequent analyses demonstrated the soils met the contained-in criteria for management as non-hazardous waste; and

- On August 3, 2008, 756 gallons of oily wastewater was discharged from the NAPIS to the Aeration Basin. The impacted soils were removed and disposed off-site pursuant to NMED's approval.

2.1.3 Historical Site Investigations

Soil sampling was conducted near the aeration lagoons and EP-1 during the RFI in the early 1990s. Based on the analytical results from the samples, the EPA concurred on January 7, 1994 with Giant's determination that no significant impact had occurred and thus no further action was required for SWMU #1. EPA requested that on-going soil sampling be conducted at the lagoons every two years, which was later reduced to a frequency of five years. The first "monitoring" event was completed in October, 1996. Soil samples were collected from depths of four feet to 20 feet below ground surface with some borings angled to allow collection of samples beneath the lagoons. Neither volatile nor semi-volatile organics were detected in 25 of the samples. Two samples collected near the side wall of the inlet aeration lagoon at a depth of four feet had very low concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX). The highest concentration was 2.2 mg/kg of xylenes.

A visual assessment of the lagoons was conducted in 1998, which concluded that the lagoons were in active service, functioning normally, oxygenating wastewater, and stimulating biological activity. The lagoons were found to have been placed in an appropriate geologic setting in which the underlying bentonitic soils exhibited a very low hydraulic conductivity of 10^{-7} cm/sec, effectively serving as an aquitard. The noted concentrations of BTEX near the inlet were considered common and predictable for the service.

Two groundwater monitoring wells (GWM-1 and GWM-2) were installed immediately down-gradient of the aeration lagoons in 2004 and 2005, respectively. Analyses of groundwater samples collected at GWM-1 and GWM-2 have indicated only very low concentrations of constituents such as BTEX and methyl tertiary butyl ether (MTBE) that would indicate a potential for historical releases from the lagoons. GWM-3 is also located nearby, adjacent to EP-1. Both GWM-2 and GWM-3 were dry during the 2007 annual sampling event.

In 2008 GWM-1 was sampled on July 10 and results are submitted to NMED annually. Detections at concentrations greater than established comparison criteria included benzene (0.011 mg/L), MTBE (0.12 mg/L), arsenic (0.070 mg/L), manganese (3.6 mg/L) and iron (14 mg/L). Iron and manganese detections may be indicative of reducing groundwater conditions that could alter inorganic valence states leading to elevated concentrations of iron and manganese in groundwater.

GWM-2 and GWM-3 were checked quarterly in 2008 to determine if any water was present in the wells. Water was first encountered in GWM-2 on February 18, 2008 and a sample was subsequently collected on February 28, 2008 and analyzed for petroleum hydrocarbons and volatile organic compounds (VOCs). The only constituent detected was MTBE at a concentration of 0.028 milligrams per liter. GWM-2 was checked again on March 17, 2008, May 21, 2008, September 10, 2008, and November 3, 2008, but it was found to be dry each time. GWM-3 was also checked on these same dates and found to be dry. Both wells were checked quarterly during 2009 and found to be dry on each occasion.

Water levels continued to be checked quarterly in GWM-2 and GWM-3 and during the second quarterly inspection in 2010 both wells indicated the presence of water. An estimated water column thickness of 1.5 feet and 0.88 feet was measured at GWM-2 and GWM-3, respectively. Water has been present in both wells and samples have been collected for analysis on a quarterly basis since, through March 2012. The results of the chemical analyses are summarized in the Tables included in Appendix A. As indicated in the tables, there have been a number of constituents detected in water samples collected from GWM-1, GWM-2, and GWM-3 that are at concentrations above potentially applicable action levels. Water level measurements are also included in Appendix A.

An investigation of the aeration lagoons and EP-1 was conducted in April 2008 to characterize the volume and nature of sediments in each lagoon. A copy of the report of the investigation prepared by Trihydro Corporation was previously provided as an appendix in the Corrective Measures Evaluation (CME) Report (revised April 2011). Based on this investigation, there appears to be two layers of sludge/sediment in the aeration lagoons. The upper layer ("soft sediment") is described as a soft, loose, and unconsolidated, as opposed to the lower layer ("hard pack sediment") that is more compact and dense. In some areas, the distinction between the two layers is indiscernible.

The investigation of EP-1 did not yield a similar distinction of sediment layers. The sediment in EP-1 exhibits similar physical characteristics to the soft sediment found in AL-1 and AL-2. Sixteen sediment depth measurements were made in EP-1, however only 5 measurements resulted in sediment depths greater than 2 feet. The sediment appearance was described as a black sludge with fluid in the upper portion and an increasing silt content moving deeper through the sample

Trihydro used the software program SurvCAD to produce calculations estimating the volumes of sediment in each lagoon and EP-1. Appendix E of the Trihydro Report found in Appendix C of the CME report provides the input parameters used in the program. The SurvCAD program produced the following estimates for sediment in the two lagoons and EP-1.

Table 2-1
Estimated Volumes of Sludge in AL-1 and AL-2

Unit	Soft Sediment Thickness Min/Max (ft)	Soft Sediment Avg Thickness (ft)	Estimated Soft Sediment Volume (cy)	Hardpack Sediment Thickness Min/Max (ft)	Hardpack Sediment Avg Thickness (ft)	Estimated Hardpack Sediment Volume (cy)	Total Estimated Sediment Volume (cy)
AL-1	3.2-5.9	4.4	1,464	0-2.5	0.52	229	1,693
AL-2	5.8-8.5	7.47	3,404	0-2.2	0.96	430	3,834

Table 2-2
Estimated Volumes of Sludge in EP-1

Unit	Average Sediment Depth (ft)	Maximum Sediment Depth (ft)	Estimated Sediment Volume (cy)
EP-1	1.59	5.04	3,178

Trihydro notes that the observed distinction between the two types of sediment in the aeration lagoons was not as evident as expected and therefore, it is suggested that sediment in the lagoons be considered and treated as a single sediment layer. Additionally, since the measurements and calculations are in-situ calculations, the SurvCAD program applied no allowances for expansion or compaction to the calculated estimates. Removal of the material from the lagoons or exposure to ambient air reducing the percent moisture of the sediment may impact the volume of material. Sample log sheets for each location can be found in the Trihydro Report (Trihydro Corporation, 2008).

2.2 The Three Benzene Strippers

The three benzene stripper units were installed as part of the wastewater treatment system. No record of previous spills or releases is noted. An investigation of the area near the benzene strippers will be conducted pursuant to an Investigation Work Plan prepared for the Old API Separator.

Section 3
Site Conditions

3.1 Surface Conditions

A topographic map of the area near the aeration lagoons and EP-1 is included as Figure 3-1. Local site topographic features include high ground in the southeast gradually decreasing to a lowland fluvial plain the northwest. Elevations on the refinery property range from 7,040 feet to 6,860 feet. The area of the site near the ponds is at an approximate elevation of 6,910 feet above mean sea level (msl).

The soils in the immediate vicinity of the Aeration Basin include two soil types. The McKinley County soil survey indicates that the soil type changes near the midline across the aeration lagoons. Surface soils from the northern section of the aeration lagoons and evaporation ponds are primarily Rehobeth silty clay loam. The southern end of the aeration lagoons are constructed within the bordering Simitarq-Celavar sandy loams. Rehobeth soil properties include a pH ranging from 8 to 9 standard units and salinity (naturally occurring and typically measuring up to approximately 8 mmhos/cm). The Simitarq-Celavar soils are well drained with a conservative permeability of 0.20 in/hr and minimal salinity. Simitarq soils have nearly neutral pH values ranging from 7.2 to 7.4 standard units.

Regional surface water features include the refinery evaporation ponds and aeration lagoons and a number of small ponds (one cattle water pond and two small unnamed spring fed ponds). The site is located in the Rio Puerco valley, north of the Zuni Uplift with overland flows directed northward to the tributaries of the Rio Puerco. The Rio Puerco continues to the east to the confluence with the Rio Grande. The South Fork of the Puerco River is intermittent and retains flow only during and immediately following precipitation events.

3.2 Subsurface Conditions

The shallow subsurface soils consist of fluvial and alluvial deposits comprised of clay and silt with minor inter-bedded sand layers. Very low permeability bedrock (e.g., claystones and siltstones) underlie the surface soils and effectively form an aquitard. The Chinle Formation, which is Upper Triassic, crops out over a large area on the southern margin of the San Juan Basin. The uppermost recognized local member is the Petrified Forest and the Sonsela Sandstone Bed is the uppermost recognized regional aquifer. Aquifer test of the Sonsela Bed northeast of Prewitt indicated a transmissivity of greater than 100 ft^2/day (Stone and others, 1983). The Sonsela Sandstone's highest point occurs southeast of the site and slopes downward to the northwest as it passes under the refinery. The Sonsela Sandstone forms a water-bearing reservoir with artesian conditions throughout the central and western portions of the refinery property.

The diverse properties and complex, irregular stratigraphy of the surface soils across the site cause a wide range of hydraulic conductivity ranging from less than 10^{-2} cm/sec for gravel like sands immediately overlying the Chinle Formation to 10^{-8} cm/sec in the clay soils located near the surface (Western Refining, 2009). Generally, shallow groundwater at the refinery follows the upper contact of the Chinle Formation with prevailing flow from the southeast to the northwest.

Three monitoring wells were installed near the new API Separator (KA-1, KA-2, and KA-3) in June 2007, which also provide information on the subsurface lithology near the Aeration Basin. Wells KA-2 and KA-3 were subsequently plugged and abandoned and replaced with three new wells (NAPIS-1, NAPIS-2, and NAPIS-3) in March 2008 at the direction of NMED. The predominantly lithology of the materials overlying the Chinle Formation was logged as a sandy lean clay. The boring log for GWM-1, which is located immediately west of AL-2, indicated that clay was present from the land surface to a depth of 21.5 feet, where a sandy gravel extends from 21.5 feet to 22.5 feet at the top of a mudstone bedrock (Petrified Forest Member of the Chinle Formation).

The location of the groundwater monitoring wells, which are near to the aeration lagoons and evaporation pond, is presented in Figure 4-1. A copy of the boring logs for KA-1, KA-2, KA-3, GWM-1, GWM-2, and GWM-3 are provided in Appendix B. Historical analyses of groundwater collected at GWM-1 and GWM-2 indicated low concentrations of BTEX and MTBE. The occurrence of shallow groundwater within the clay soils in the area is sporadic and temporal, as displayed with the water level measurements in GWM-2 and GWM-3, as discussed above.

Section 4
Scope of Services

The site investigation of surrounding soils and groundwater will be conducted to facilitate the remedy selection and final design process. The investigation will commence upon approval of this investigation work plan by NMED.

4.1 Investigation

An investigation of soils that surround the Aeration Basin (AL-1, AL-2, and EP-1) will be conducted to ensure that all impacted soils are identified so that they may be addressed in the final remedy selected by NMED. This investigation will include surface (0-6") and shallow subsurface (18-24") samples collected on 50-foot spacings around the perimeter of the Aeration Basin (Figure 4-1). There are estimated to be approximately 28 of these shallow soil borings and each fifth boring will be extended at least 6 inches below the bottom of the berm material if the berm material is deeper than 24 inches. In addition, seven deep soil borings will be installed around the perimeter as shown in Figure 4-1 to determine if constituents have migrated laterally from the surface impoundments impacting either soils or groundwater and to help determine the source of water found in GWM-2 and GWM-3.

As necessary, additional investigation of soils and groundwater will be conducted to define the lateral extent of any identified releases. If a release is indicated at the shallow hand-auger locations (50-foot spacings), then additional locations will be selected beyond the previous location based on field observations and/or initial analytical results, stepping outward until the lateral extent of the surface impacts are defined. For the deep soil borings, if there are indications of lateral migration of constituents away from the Aeration Basin within subsurface soils and/or groundwater, then additional borings/temporary monitoring wells will be completed within approximately 50 feet of the original boring location. Additional borings/temporary wells will continue to be added in a similar manner, as necessary, to define the lateral and vertical extent of impacts to soil and/or groundwater. Selection of additional sample locations will be coordinated with the NMED.

As necessary, investigation beneath the Aeration Basin may be conducted at a later date, after the Aeration Basin is no longer in service and does not contain free liquids. Any such investigation could potentially be conducted under the Corrective Measures Implementation Work Plan. All of the information recorded during field screening and logging of the soils and the analytical results from the chemical analyses of samples collected under this work plan will be used to help determine the source of water found in GWM-2 and GWM-3. For example, subsurface soils will be examined for the presence of any transmissive materials (e.g., silts and sands) that could act as a conduit for water to migrate from the Aeration Basin. Also, the chemical analyses will be compared to analyses of water samples previously collected from the Aeration Basin to determine if similar chemicals are present in either soil or groundwater samples collected from around the Aeration Basin. Static water levels in soil borings may also be compared to water levels in the Aeration Basin and/or other nearby wells.

4.1.1 Soil Sample Field Screening and Logging

All soil borings will be continuously logged and samples field screened, including the hand auger locations. Samples obtained from the soil borings (i.e., penetrations below two feet) will be screened in the field on 2.0 foot intervals for evidence of contaminants. Field screening results will be recorded on the exploratory boring and excavation logs. Field screening results will be used to aid in the selection of soil samples for laboratory analysis. The primary screening methods include: (1) visual examination, (2) olfactory examination, and (3) headspace vapor screening for volatile organic compounds. Additional screening for site- or release-specific characteristics such as pH or for specific compounds using field test kits may be conducted where appropriate.

Visual screening includes examination of soil samples for evidence of staining caused by petroleum-related compounds or other substances that may cause staining of natural soils such as elemental sulfur or cyanide compounds. Headspace vapor screening targets volatile organic compounds and involves placing a soil sample in a plastic sample bag or a foil sealed container allowing space for ambient air. The container will be sealed and then shaken gently to expose the soil to the air trapped in the container. The sealed container will be allowed to rest for a minimum of 5 minutes while vapors equilibrate. Vapors present within the sample bag's headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature will be recorded on the field boring or test pit log for each sample.

The monitoring instruments will be calibrated each day to the manufacturer's standard for instrument operation. A photo-ionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp or a combustible gas indicator will be used for VOC field screening. Field screening results may be site- and boring-specific and the results may vary with instrument type, the media screened, weather conditions, moisture content, soil type, and type of contaminant, therefore, all conditions capable of influencing the results of field screening will be recorded on the field logs.

Discrete soil samples will be retained for laboratory analyses from within the following intervals:

- 0-6" (at soil borings with evidence of significant impacts near the land surface and all hand auger locations);
- 18-24" (at soil borings with evidence of significant impacts near the land surface and all hand auger locations);
- > 24" (from the interval in each soil boring with the greatest apparent degree of contamination, based on field observations and field screening);
- From a one-foot interval, which lies approximately five feet below the bottom of the Aeration Basin (all soil borings);
- From the bottom of each borehole (all soil borings);
- From the 6" interval at the top of saturation (applicable only to borings that reach saturation); and
- Any additional intervals as determined based on field screening results.

The description of "significant impacts" used above cannot be quantified, but rather may involve a combination of factors (e.g., PID readings elevated above background readings, visible hydrocarbons stains, and/or strong hydrocarbon odors).

The physical characteristics of the samples (such as mineralogy, ASTM soil classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations will be recorded in the field log by a qualified geologist or engineer. Detailed logs of each boring will be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling, will be recorded on the logs.

Quality Assurance/Quality Control (QA/QC) samples will be collected to monitor the validity of the soil sample collection procedures as follows:

- Field duplicates will be collected at a rate of 10 percent; and
- Equipment blanks will be collected from all sampling apparatus at a frequency of one per day.

4.1.2 Drilling Activities

Soil borings will be drilled using hollow-stem augers. The drilling equipment will be properly decontaminated before drilling each boring. The "shallow sample" locations where 0-6" and 18-24" samples will be collected for analysis may be completed using a decontaminated hand auger.

All deep soil borings (excluding the two-foot hand auger locations) will be drilled to the top of saturation. As directed by NMED, the deep borings will target the sand layer identified in GWM-1 at a depth of 21.5 feet, which lies on top of the Chinle Formation; however, if significant evidence of impacted groundwater is encountered at shallower depths, then Western may terminate borings to prevent creating a potential conduit for vertical migration. In such instances, it may be necessary to install a protective surface casing.

The NMED will be notified as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the specified depths or at planned sampling locations. Appropriate actions (e.g., installation of protective surface casing or relocation of borings to a less threatening location) will be taken to minimize any negative impacts from investigative borings. If contamination is detected at the water table, then the boring will be drilled five feet below the water table or to refusal, whichever occurs first. Soil samples will be collected continuously and logged by a qualified geologist or engineer.

Both sample information and visual observations of the cuttings and core samples will be recorded on the boring log. Known site features and/or site survey grid markers will be used as references to locate each boring. The boring locations will be measured to the nearest foot, and locations will be recorded on a scaled site map upon completion of each boring.

4.1.3 Groundwater Sample Collection

If groundwater is encountered in the soil borings, then groundwater will be sampled and analyzed. Groundwater samples will be collected within 24 hours of the completion of well purging using dedicated bailers or disposal bailers. Alternatively, well sampling may also be conducted in accordance with the NMED's Position Paper *Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring* (October 30, 2001, as updated). Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures will be in accordance with the procedures presented below in Section 4.1.4.

Groundwater samples intended for metals analysis will be submitted to the laboratory as both total and dissolved metals samples. QA/QC samples will be collected to monitor the validity of the groundwater sample collection procedures as follows:

- Field duplicate water samples will be obtained at a frequency of ten percent, with a minimum, of one duplicate sample per sampling event;
- Equipment rinsate blanks will be obtained for chemical analysis at the rate of ten percent or a minimum of one rinsate blank per sampling day. Equipment rinsate blanks will be collected at a rate of one per sampling day if disposable sampling equipment is used. Rinsate samples will be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample will be placed in the appropriate sample container and submitted with the groundwater samples to the analytical laboratory for the appropriate analyses; and
- Trip blanks will accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks will consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank will be prepared by the analytical laboratory prior to the sampling event and will be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks will be analyzed at a frequency of one for each shipping container of samples to be analyzed for VOCs.

4.1.4 Sample Handling

At a minimum, the following procedures will be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves will be worn when collecting samples. New disposable gloves will be used to collect each sample;
2. All samples collected of each medium for chemical analysis will be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in Encore® samplers. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis; and
3. Sample labels and documentation will be completed for each sample following procedures discussed below. Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described below, will be followed for all samples collected. All samples will be submitted to the

laboratory soon enough to allow the laboratory to conduct the analyses within the method holding times.

Chain-of-custody and shipment procedures will include the following:

1. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site.
2. Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage. Temperature blanks will be included with each shipping container.
3. Each cooler or other container will be delivered directly to the analytical laboratory.
4. Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.
5. Plastic containers will be protected from possible puncture during shipping using cushioning material.
6. The chain-of-custody form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.
7. Chain-of-custody seals will be used to seal the sample-shipping container in conformance with EPA protocol.
8. Signed and dated chain-of-custody seals will be applied to each cooler prior to transport of samples from the site.
9. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory and copies will be returned to the relinquishing party.
10. Copies of all chain-of-custody forms generated as part of sampling activities will be maintained on-site.

4.1.5 Collection and Management of Investigation Derived Waste

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) associated with soil borings will be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. All purged groundwater and decontamination water will be characterized prior to disposal unless it is disposed in the refinery wastewater treatment system upstream of the API Separator. An IDW management plan is included as Appendix C.

4.1.6 Field Equipment Calibration

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks will be conducted daily, or at other intervals approved by the Department, and the instruments will be recalibrated, if necessary. Calibration measurements will be recorded in the daily field logs. If field equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument will be used.

4.1.7 Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded in a field log book. Copies of the completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink will be used to record all field activities. Photographic documentation of field activities will be performed, as appropriate. The daily record of field activities will include the following:

1. Site or unit designation;
2. Date;
3. Time of arrival and departure;
4. Field investigation team members including subcontractors and visitors;
5. Weather conditions;
6. Daily activities and times conducted;
7. Observations;
8. Record of samples collected with sample designations and locations specified;
9. Photographic log, as appropriate;
10. Field monitoring data, including health and safety monitoring;
11. Equipment used and calibration records, if appropriate;
12. List of additional data sheets and maps completed;
13. An inventory of the waste generated and the method of storage or disposal; and
14. Signature of personnel completing the field record.

4.1.8 Chemical Analyses

All samples collected for laboratory analysis will be submitted to an accredited laboratory. The laboratory will use the most recent standard EPA and industry-accepted analytical methods for target analytes as the testing methods for each medium sampled. Chemical analyses will be performed in accordance with the most recent EPA standard analytical methodologies and extraction methods.

Groundwater and soil samples will be analyzed by the following methods:

- SW-846 Method 8260 for Skinner List volatile organic compounds;

- SW-846 Method 8270 for Skinner List semi-volatile organic compounds; and
- SW-846 Method 8015B gasoline range (C5-C10), diesel range (>C10-C28), and motor oil range (>C28-C36) organics.

Groundwater and soil samples will also be analyzed for the following Skinner List metals and iron and manganese using the indicated analytical methods shown in Table 4-1. Groundwater samples will also be analyzed for chloride, fluoride, and sulfate.

Table 4-1
Inorganic Analytical Methods

Analyte	Analytical Method
Antimony	SW-846 method 6010/6020
Arsenic	SW-846 method 6010/6020
Barium	SW-846 method 6010/6020
Beryllium	SW-846 method 6010/6020
Cadmium	SW-846 method 6010/6020
Chromium	SW-846 method 6010/6020
Cobalt	SW-846 method 6010/6020
Cyanide	SW-846 method 335.4/335.2 mod
Lead	SW-846 method 6010/6020
Mercury	SW-846 method 7470/7471
Nickel	SW-846 method 6010/6020
Selenium	SW-846 method 6010/6020
Silver	SW-846 method 6010/6020
Vanadium	SW-846 method 6010/6020
Zinc	SW-846 method 6010/6020
Iron	SW-846 method 6010/6020
Manganese	SW-846 method 6010/6020

As discussed previously, if collected, groundwater field measurements will be obtained for pH, specific conductance, dissolved oxygen concentrations, oxidation-reduction potential, and temperature.

4.1.9 Data Quality Objectives

The Data Quality Objectives (DQOs) were developed to ensure that newly collected data are of sufficient quality and quantity to address the projects goals, including Quality Assurance/Quality

Control (QA/QC) issues (EPA, 2006). The project goals are established to determine and evaluate the presence, nature, and extent of releases of contaminants at specified SWMUs. The type of data required to meet the project goals includes chemical analyses of soil and groundwater to determine if there has been a release of contaminants at the SWMU.

The quantity of data is SWMU specific and is based on the historical operations at individual locations. Method detection limits should be 20% or less of the applicable background levels, cleanup standards and screening levels.

Additional DQOs include precision, accuracy, representativeness, completeness, and comparability. Precision is a measurement of the reproducibility of measurements under a given set of circumstances and is commonly stated in terms of standard deviation or coefficient of variation (EPA, 1987). Precision is also specific to sampling activities and analytical performance. Sampling precision will be evaluated through the analyses of duplicate field samples and laboratory replicates will be utilized to assess laboratory precision.

Accuracy is a measurement in the bias of a measurement system and may include many sources of potential error, including the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques (EPA, 1987). An evaluation of the accuracy will be performed by reviewing the results of field/trip blanks, matrix spikes, and laboratory QC samples.

Representativeness is an expression of the degree to which the data accurately and precisely represent the true environmental conditions. Sample locations and the number of samples have been selected to ensure the data is representative of actual environmental conditions. Based on SWMU specific conditions, this may include either biased (i.e., judgmental) locations/depths or unbiased (systematic grid samples) locations. In addition, sample collection techniques (e.g., field monitoring and decontamination of sampling equipment) will be utilized to help ensure representative results.

Completeness is defined as the percentage of measurements taken that are actually valid measurements, considering field QA and laboratory QC problems. EPA Contract Laboratory Program (CLP) data has been found to be 80-85% complete on a nationwide basis and this has been extrapolated to indicate that Level III, IV, and V analytical techniques will generate data that are approximately 80% complete (EPA, 1987). As an overall project goal, the completeness goal is 85%; however, some samples may be critical based on location or field screening results and thus a sample–by-sample evaluation will be performed to determine if the completeness goals have been obtained.

Comparability is a qualitative parameter, which expresses the confidence with which one data set can be compared to another. Industry standard sample collection techniques and routine EPA analytical methods will be utilized to help ensure data are comparable to historical and future data. Analytical results will be reported in appropriate units for comparison to historical data and cleanup levels.

Section 5
References

EPA, 1987, Data Quality Objectives for Remedial Response Activities; United States Environmental Protection Agency, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, OSWER Directive 9355.0-7B, 85p

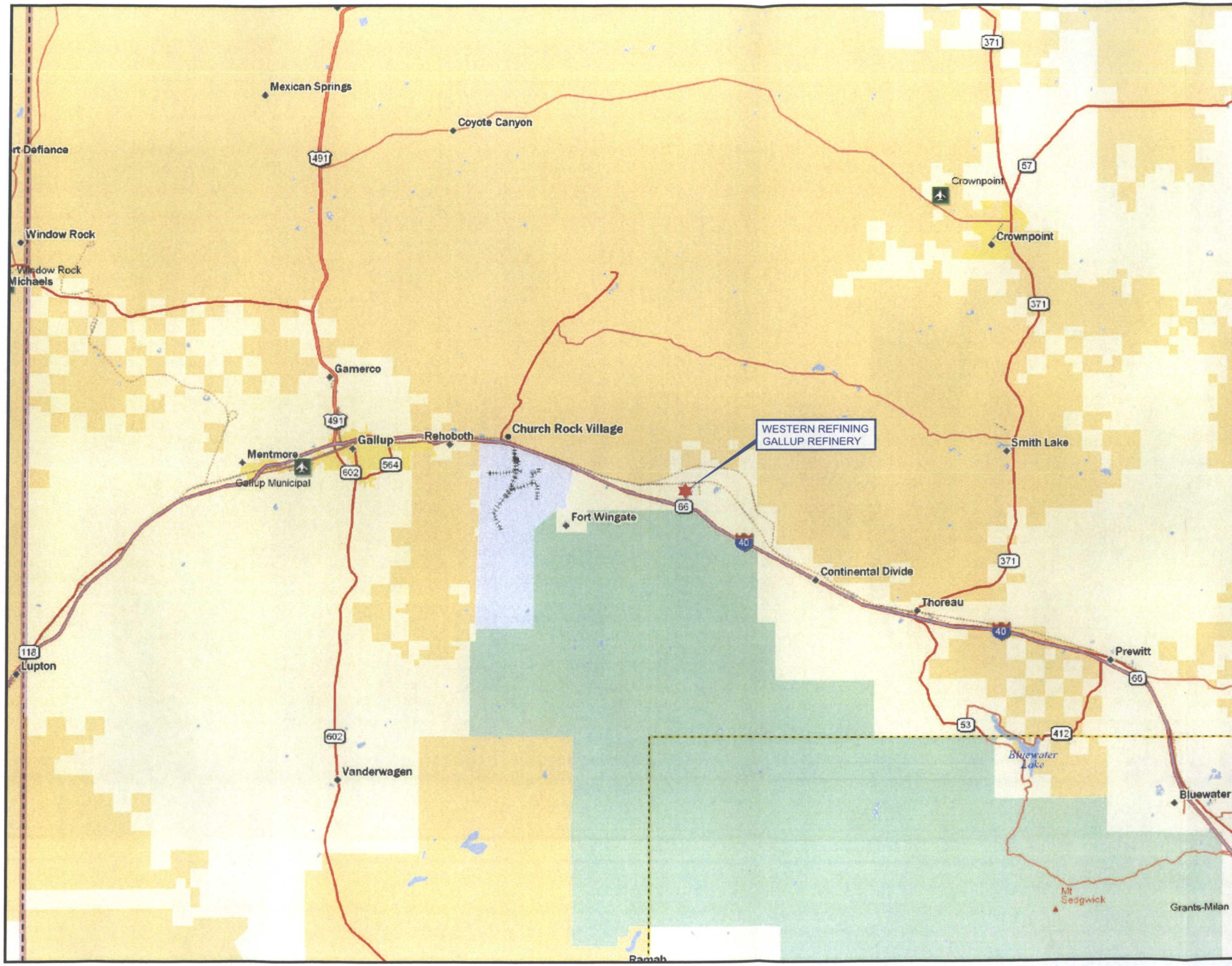
EPA, 2006, Guidance on Systematic Planning Using the Data Quality Objectives Process, United States Environmental Protection Agency, Office of Environmental Information; EPA/240/B-06/001, p. 111.

Stone, W.J., Lyford, F.P., Frenzel, P.F., Mizel, N.H., and Padgett, E.T., 1983, Hydrogeology and Water Resources of San Juan Basin, New Mexico; Hydrogeologic Report 6, New Mexico Bureau of Mines and Mineral Resources, p. 70.

Trihydro Corporation, 2008, Aeration Lagoons 1 and 2 Evaporation Pond 1 – Sediment Investigation, Western Refining Company, Gallup Refinery, Gallup New Mexico, p. 14.

Western Refining Company, 2009, Facility-wide Groundwater Monitoring Plan: Gallup Refinery, p. 97.

Figures



Map Source: DeLorme Street Atlas USA 2007 Plus.

N

0 5
SCALE IN MILES

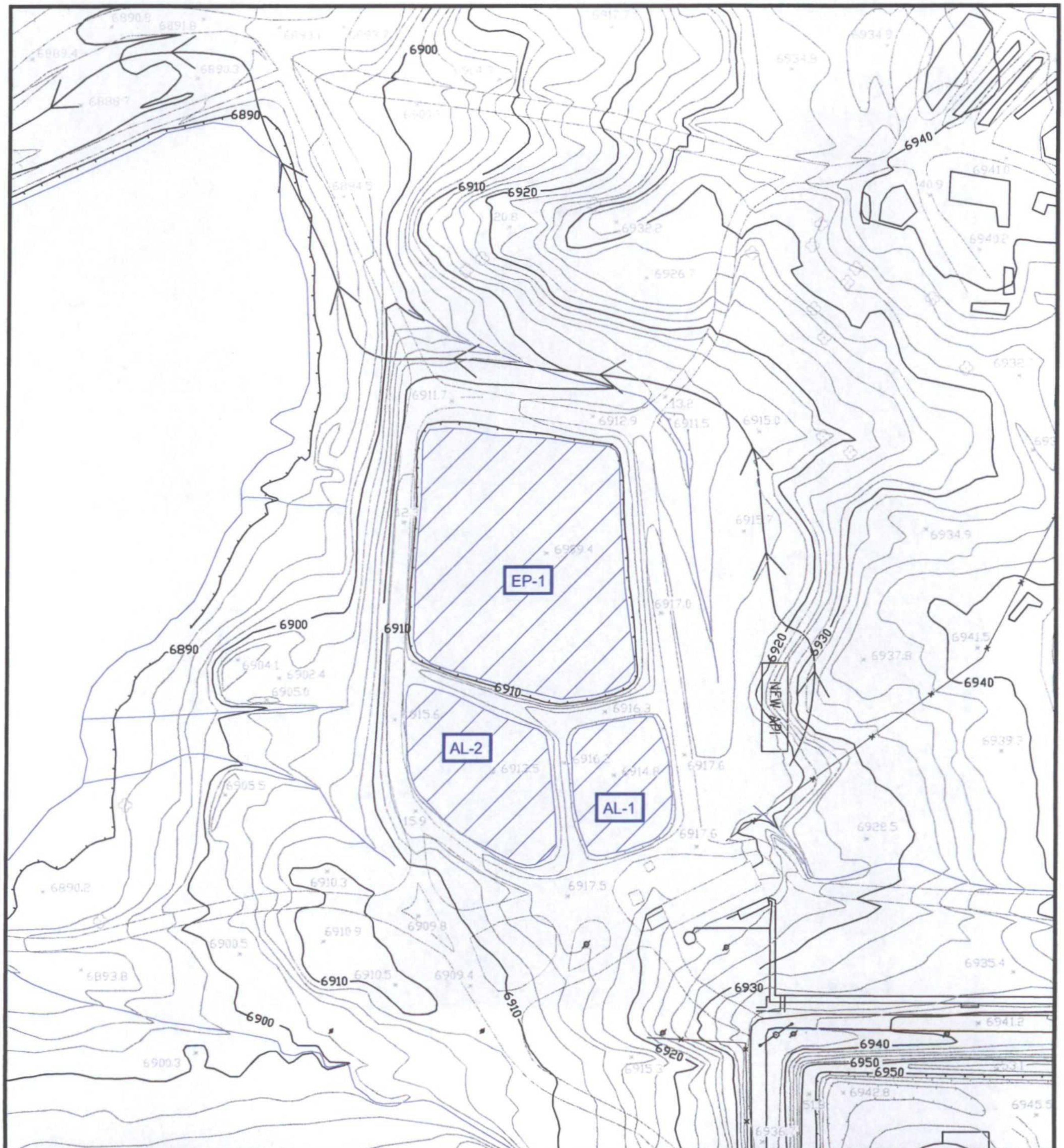
Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 07/26/09	FILE: WestRef-B35

FIGURE 1-1
SITE LOCATION MAP
GALLUP REFINERY

RPS

Cielo Center
1250 S. Capital of Texas Highway,
Building 3, Suite 200
Austin, Texas 78746



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

0 150
SCALE IN FEET

NEW MEXICO

QUADRANGLE LOCATION

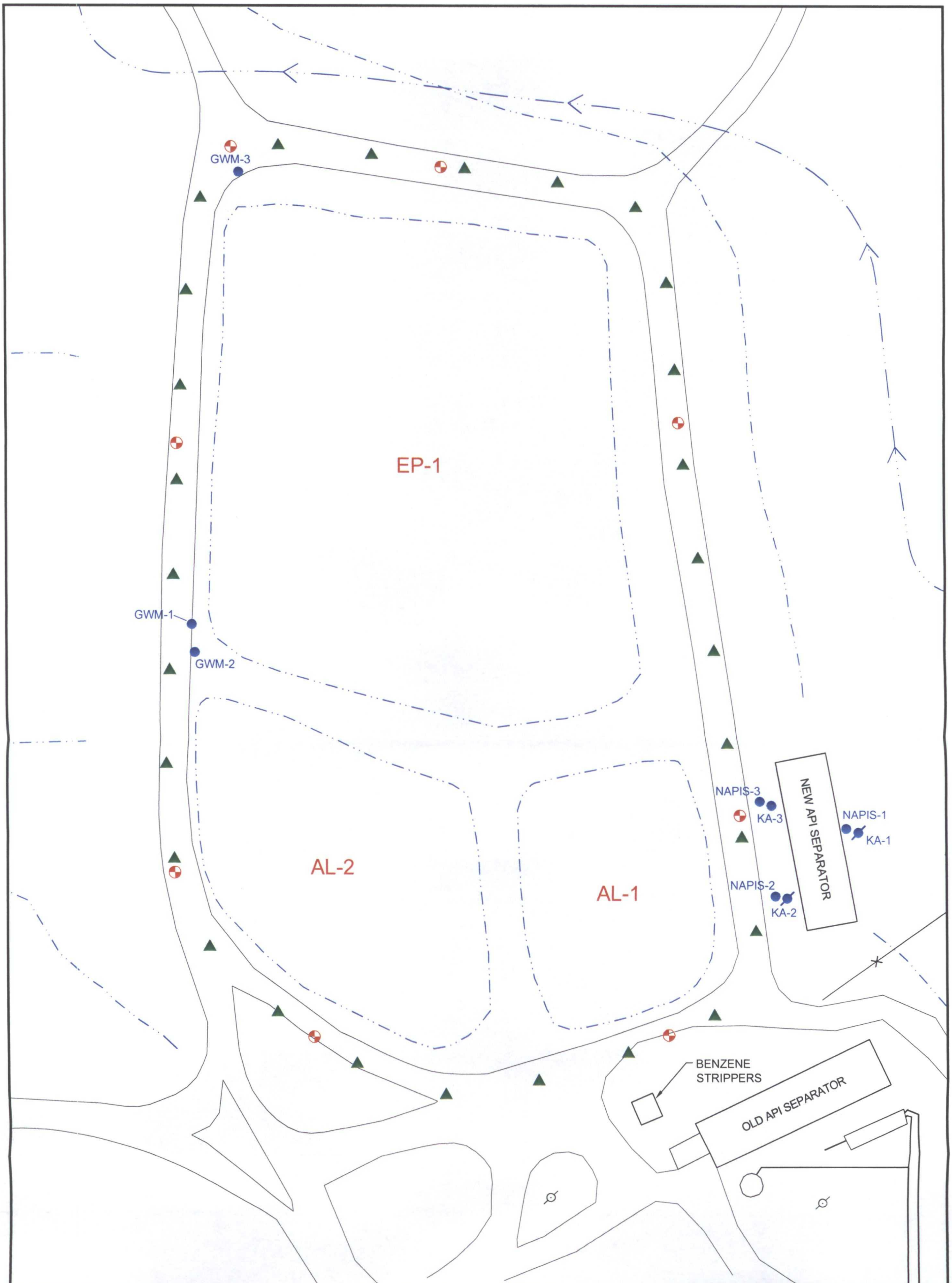
Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 07/26/09	FILE: WestRef-A33

FIGURE 3-1
TOPOGRAPHIC MAP
GALLUP REFINERY

RPS

Cielo Center
1250 S. Capital of Texas Hwy, Building 3, Suite 200
Austin, Texas 78746



LEGEND

- PERIMETER DEEP SOIL BORING LOCATION
- SURROUNDING SHALLOW SOIL SAMPLE LOCATION
- GWM-1 GROUNDWATER WELL LOCATION
- KA-1 PLUGGED & ABANDONED MONITOR WELL LOCATION

Western Refining
GALLUP REFINERY

PROJ. NO.:Western Refining	DATE:05/22/12	FILE:WestRef–B119

FIGURE 4-1
PROPOSED SAMPLE LOCATIONS
GALLUP REFINERY

RPS
Cielo Center
1250 S. Capital of Texas Highway
Building 3, Suite 200
Austin, Texas 78746
TBPE No. 1298

Appendix A

Historical Groundwater Monitoring Data

QUARTERLY WATER LEVEL MEASURMENTS
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY

Well ID	Measurement date	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Total Well Depth (ft)	Depth to Water	Groundwater Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
GWM-1	2/18/2008	6,910.22	6,912.61	26.20	19.91	6,892.70	17.5 - 23.5
	5/21/2008	6,910.22	6,912.61		19.47	6,893.14	
	9/10/2008	6,910.22	6,912.61		20.24	6,892.37	
	11/3/2008	6,910.22	6,912.61		20.55	6,892.06	
	2/11/2009	6,910.22	6,912.61		19.81	6,892.80	
	5/4/2009	6,910.22	6,912.61		19.56	6,893.05	
	8/10/2009	6,910.22	6,912.61		20.32	6,892.29	
	10/27/2009	6,910.22	6,912.61		20.57	6,892.04	
	3/3/2010	6,910.22	6,912.61		19.81	6,892.80	
	6/3/2010	6,910.22	6,912.61		18.14	6,894.47	
	9/16/2010	6,910.22	6,912.61		17.90	6,894.71	
	11/2/2010	6,910.22	6,912.61		18.41	6,894.20	
	2/16/2011	6,910.22	6,912.61		15.99	6,896.62	
	6/15/2011	6,910.22	6,912.61		15.82	6,896.79	
	9/26/2011	6,910.22	6,912.61		16.42	6,896.19	
	12/14/2011	6,910.22	6,912.61		16.08	6,896.53	
GWM-2	2/18/2008	6,910.32	6,913.09	18.81	18.45	6,894.64	3.2 - 16.2
	3/17/2008	6,910.32	6,913.09		DRY	DRY	
	5/21/2008	6,910.32	6,913.09		DRY	DRY	
	9/10/2008	6,910.32	6,913.09		DRY	DRY	
	11/3/2008	6,910.32	6,913.09		DRY	DRY	
	2/11/2009	6,910.32	6,913.09		DRY	DRY	
	5/4/2009	6,910.32	6,913.09		DRY	DRY	
	8/10/2009	6,910.32	6,913.09		DRY	DRY	
	10/27/2009	6,910.32	6,913.09		DRY	DRY	
	3/3/2010	6,910.32	6,913.09		DRY	DRY	
	6/3/2010	6,910.32	6,913.09		17.57	6,895.52	
	9/16/2010	6,910.32	6,913.09		17.30	6,895.79	
	11/2/2010	6,910.32	6,913.09		18.87	6,894.22	
	2/16/2011	6,910.32	6,913.09		15.08	6,898.01	
	6/15/2011	6,910.32	6,913.09		15.02	6,898.07	
	9/26/2011	6,910.32	6,913.09		15.89	6,897.20	
	12/14/2011	6,910.32	6,913.09		15.40	6,897.69	
GWM-3	2/18/2008	6,907.35	6,910.25	17.80	DRY	DRY	3 - 15
	5/21/2008	6,907.35	6,910.25		DRY	DRY	
	9/10/2008	6,907.35	6,910.25		DRY	DRY	
	11/3/2008	6,907.35	6,910.25		DRY	DRY	
	2/11/2009	6,907.35	6,910.25		DRY	DRY	
	5/4/2009	6,907.35	6,910.25		DRY	DRY	
	8/10/2009	6,907.35	6,910.25		DRY	DRY	
	10/27/2009	6,907.35	6,910.25		DRY	DRY	
	3/3/2010	6,907.35	6,910.25		DRY	DRY	
	6/3/2010	6,907.35	6,910.25		17.17	6,893.08	
	9/16/2010	6,907.35	6,910.25		16.92	6,893.33	
	11/2/2010	6,907.35	6,910.25		17.83	6,892.42	
	2/16/2011	6,907.35	6,910.25		12.84	6,897.41	
	6/15/2011	6,907.35	6,910.25		14.20	6,896.05	
	9/26/2011	6,907.35	6,910.25		15.64	6,894.61	
	12/14/2011	6,907.35	6,910.25		14.35	6,895.90	
NAPIS 1 (KA-1R)	4/11/2008	6,913.62	6,913.86	13.53	8.58	6,905.28	3.7 -13.7
	7/11/2008	6,913.62	6,913.86		8.98	6,904.88	
	11/4/2008	6,913.62	6,913.86		8.83	6,905.03	
	3/23/2009	6,913.62	6,913.86		8.92	6,904.94	
	5/28/2009	6,913.62	6,913.86		8.67	6,905.19	
	8/11/2009	6,913.62	6,913.86		9.06	6,904.80	
	11/23/2009	6,913.62	6,913.86		10.28	6,903.58	
	3/8/2010	6,913.62	6,913.86		8.69	6,905.17	
	6/8/2010	6,913.62	6,913.86		8.37	6,905.49	
	9/15/2010	6,913.62	6,913.86		7.77	6,906.09	
	11/2/2010	6,913.62	6,913.86		7.62	6,906.24	
	3/2/2011	6,913.62	6,913.86		7.47	6,906.39	
	6/15/2011	6,913.62	6,913.86		7.96	6,905.90	
	9/27/2011	6,913.62	6,913.86		7.30	6,906.56	
	12/14/2011	6,913.62	6,913.86		7.45	6,906.41	

Well ID	Measurement date	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Total Well Depth (ft)	Depth to Water	Groundwater Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
NAPIS 2 (KA-2R)	4/11/2008	6,913.40	6,912.65	13.61	8.83	6,903.82	4.2 - 14.2
	7/11/2008	6,913.40	6,912.65		8.96	6,903.69	
	11/4/2008	6,913.40	6,912.65		9.23	6,903.42	
	3/23/2009	6,913.40	6,912.65		9.35	6,903.30	
	5/28/2009	6,913.40	6,912.65		9.22	6,903.43	
	8/11/2009	6,913.40	6,912.65		9.39	6,903.26	
	11/23/2009	6,913.40	6,912.65		9.72	6,902.93	
	3/8/2010	6,913.40	6,912.65		9.19	6,903.46	
	6/8/2010	6,913.40	6,912.65		8.93	6,903.72	
	9/15/2010	6,913.40	6,912.65		8.57	6,904.08	
	11/2/2010	6,913.40	6,912.65		8.55	6,904.10	
	3/2/2011	6,913.40	6,912.65		9.14	6,903.51	
	6/15/2011	6,913.40	6,912.65		8.67	6,903.98	
	9/27/2011	6,913.40	6,912.65		8.18	6,904.47	
	12/14/2011	6,913.40	6,912.65		8.20	6,904.45	
NAPIS 3 (KA-3R)	4/11/2008	6,913.38	6,912.76	30.42	14.98	6,897.78	25.4 - 30-4
	7/11/2008	6,913.38	6,912.76		9.72	6,903.04	
	11/4/2008	6,913.38	6,912.76		8.71	6,904.05	
	3/23/2009	6,913.38	6,912.76		9.93	6,902.83	
	6/15/2009	6,913.38	6,912.76		8.59	6,904.17	
	8/31/2009	6,913.38	6,912.76		8.39	6,904.37	
	11/23/2009	6,913.38	6,912.76		21.62	6,891.14	
	3/8/2010	6,913.38	6,912.76		9.24	6,903.52	
	6/10/2010	6,913.38	6,912.76		8.87	6,903.89	
	9/15/2010	6,913.38	6,912.76		7.31	6,905.45	
	11/2/2010	6,913.38	6,912.76		8.65	6,904.11	
	3/2/2011	6,913.38	6,912.76		8.11	6,904.65	
	6/15/2011	6,913.38	6,912.76		7.89	6,904.87	
	9/27/2011	6,913.38	6,912.76		7.74	6,905.02	
	12/14/2011	6,913.38	6,912.76		8.30	6,904.46	
KA-3	11/4/2008	6,913.29	6,912.52	23.20	9.01	6,903.51	15 - 25
	3/23/2009	6,913.29	6,912.52		9.23	6,903.29	
	5/28/2009	6,913.29	6,912.52		9.12	6,903.40	
	8/31/2009	6,913.29	6,912.52		9.36	6,903.16	
	11/23/2009	6,913.29	6,912.52		9.60	6,902.92	
	3/8/2010	6,913.29	6,912.52		8.74	6,903.78	
	6/10/2010	6,913.29	6,912.52		8.39	6,904.13	
	9/15/2010	6,913.29	6,912.52		8.69	6,903.83	
	11/2/2010	6,913.29	6,912.52		8.52	6,904.00	
	3/2/2011	6,913.29	6,912.52		8.51	6,904.01	
	6/15/2011	6,913.29	6,912.52		8.44	6,904.08	
	9/27/2011	6,913.29	6,912.52		8.11	6,904.41	
	12/14/2011	6,913.29	6,912.52		8.08	6,904.44	

QUARTERLY GROUNDWATER ANALYSES
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY

			Parameters				
			Benzene (mg/L)	Toluene (mg/L)	Ethyl Benzene (mg/L)	Total Xylenes (mg/L)	MTBE (mg/L)
WQCC 20NMAC 6.2.3103 (Oct 2006)			**0.01**	**0.75**	**0.75**	**0.62**	**NE**
40 CFR 141.62 MCL (May 2009)			**0.005**	**1**	**0.7**	**10**	**NE**
EPA RSL for Tap Water (Nov 2011)			**0.00041**	**0.86**	**0.0013**	**0.19**	**0.012**
Well ID	DATE SAMPLED	METHOD					
GWM-1[1]							
	3/20/2012	8260B	**0.0057**	<0.001	**0.0019**	0.007	**0.054**
	12/14/2011	8260B	**0.0085**	0.0019	**0.0042**	0.014	**0.054**
	9/26/2011	8260B	**0.0096**	0.0052	**0.0059**	0.03	**0.051**
	6/15/2011	8260B	**0.0074**	0.0027	**0.0053**	0.026	**0.047**
	2/16/2011	8260B	**0.0095**	0.0034	**0.0054**	0.023	**0.057**
	11/2/2010	8260B	**0.0069**	0.0023	**0.0035**	0.022	**0.062**
	9/16/2010	8260B	**0.0075**	0.0049	**0.0067**	0.03	**0.053**
	7/20/2010	8260B	**0.008**	0.002	**0.0068**	0.03	**0.077**
	3/3/2010*	8260B	**0.012**	0.005	**0.011**	0.05	**0.078**
	7/27/2009	8260B	**0.0089**	0.002	**0.0074**	0.034	**0.085**
	7/10/2008	8260B	**0.011**	0.0021	**0.0039**	0.019	**0.12**
	5/24/2007	8260B	**0.016**	<0.001	<0.001	<0.003	**0.23**
	10/27/2006	8260B	**0.012**	<0.001	>0.001	<0.003	**0.16**
GWM-2[2]							
	3/20/2012	8021B	<0.005	<0.005	<0.005	<0.001	<0.012
	12/14/2011	8021B	<0.001	<0.001	<0.001	<0.001	0.0027
	9/26/2011	8260B	<0.001	<0.001	<0.001	<0.0015	0.0026
	6/15/2011	8260B	<0.001	<0.001	<0.001	<0.0015	0.003
	2/16/2011	8260B	<0.001	<0.001	<0.001	<0.0015	0.0083
	10/4/2010	8260B	<0.001	<0.001	<0.001	<0.003	0.011
	9/16/2010	8260B	<0.001	<0.001	<0.001	<0.003	0.011
GWM-3[2]							
	3/20/2012	8021B	<0.005	<0.005	<0.005	<0.001	<0.012
	12/14/2011	8021B	<0.001	<0.01	<0.001	<0.002	<0.0025
	9/26/2011	8260B	<0.001	<0.001	<0.001	<0.002	<0.0025
	6/15/2011	8260B	<0.001	<0.001	<0.001	<0.0015	0.002
	2/16/2011	8260B	<0.001	<0.001	<0.001	<0.0015	0.0081
	10/4/2010	8260B	<0.001	<0.001	<0.001	<0.003	0.0092
	9/16/2010	8260B	<0.001	<0.001	<0.001	<0.003	0.009

DEFINITIONS
NE = Not established
NA = Not analyzed
NL = Not listed on laboratory analysis
NR = Not requested
Bold and highlighted values represent values above the applicable standards

STANDARDS
WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.
a) Human Health Standards: b) Other Standards for Domestic Water

NOTES:

[1]*GWM-1 sample schedule is on an annual basis. For this sampling period, technician used the unapproved Facility Work Plan (FWP) at the beginning of 2010. which called for this well to be sampled on a quarterly basis. The FWP was approved on August 25, 2010.*

[2]*GWM-2 and GWM-3 are normally dry wells. During inspection of well, water was present and subsequently well was sampled and purged dry.*

9/26/2011 Quarterly sampling combined with Annual sampling event

QUARTERLY GROUNDWATER ANALYSES
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY

Well ID	DATE SAMPLED	METHOD	Arsenic (mg/L)	Barium (mg/L)	Calcium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Selenium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Silver (mg/L)	Mercury (mg/L)	Uranium (mg/L)	Zinc (mg/L)
WQCC 20NMAC 6.2.3103 (Oct 2006)			0.1	1.0	NE		0.05	1.0	1.0	0.05	NE		0.05	NE	NE		0.002	0.03	10
40 CFR 141.62 MCL (May 2009)			0.01	2.0	NE		0.1	1.3	NE	0.015	NE		0.05	NE	NE		0.002	0.03	NE
EPA RSL for Tap Water (Nov 2011)			0.000045	2.9	NE		NE	0.62	11	NE	NE		0.078	NE	NE		0.00063	0.047	4.7
GWM-1																			
	3/20/2012	200.7/200.8	**0.073**	**1.1**		<0.002	<0.006	<0.006	**8.9**	**0.0058**	2.5	0.0058	0.01			<0.005	<0.001	0.0069	0.016
	12/17/2011	200.7/200.8	**0.097**	0.67	<10		<0.006	0.029	**15**	**0.023**	2.5		0.0047	4.0	1100		<0.002	0.02	0.041
	9/26/2011	200.7/200.8	0.12	1.5	290		<0.006	<0.006	17	<0.005	67		0.0082	3.2	1100		<0.0002	0.007	0.025
	6/15/2011	200.7/200.8	**0.14**	**1.5**	270		<0.006	<0.006	17	0.01	65		0.015	<5.0	1000		<0.0002	0.0084	0.026
	2/16/2011	200.7/200.8	**0.16**	0.94	310		0.0089	0.0089	17	0.0098	71		0.02	4.3	1200		<0.002	0.015	0.038
	11/2/2010	6010B	**0.14**	**1.4**	310		<0.006	<0.006	**7.9**	0.0095	75		<0.05	2.9	1100		<0.0002	0.009	0.025
	9/16/2010	6010B	**0.12**	0.87	310		<0.006	0.0098	**15**	0.012	76		<0.05	2.8	1200		<0.0002	0.015	0.023
	7/20/2010	6010B	**0.16**	**1.2**	310		<0.006	0.019	**20**	0.011	70		<0.05	3.1	1200		<0.0002	0.011	0.031
	3/3/2010	6010B	**0.098**	0.42	280		<0.006	0.0072	**15**	0.0078	57		<0.05	2.9	1200		<0.0002	0.0224	0.03
	7/27/2009	6010B	**0.114**	0.53	310		<0.006	<0.006	**14**	0.0072	78		NL	3.0	1300		<0.0002	0.0159	0.025
	7/10/2008	6010B	**0.07**	0.45	350		<0.006	0.014	**14**	0.01	81		<0.05	3.3	1400		<0.0002	NL	<0.05
	5/24/2007	6010B	**0.081**	0.44	360		<0.006	NL	NL	<0.005	87		<0.05	3.7	1300		<0.0002	NL	NL
	10/26/2006	6010B	**0.077**	0.53	380		<0.006	NL	NL	NL	93		NL	4.2	1400		<0.0002	NL	NL
GWM-2 [1]																			
	12/14/2011	200.7³			620						120			4.1	1500				
	9/26/2011	200.7³			620						110			4.2	1600				
	6/15/2011	200.7³			570						120			4.2	1600				
	2/16/2011	200.7³			460						74			3.7	1000				
	10/4/2010	200.7³			420						77			3.0	910				
	9/6/2010	200.7³			430						76			3.2	950				
GWM-3 [1]																			
	12/14/2011	200.7³			440						79			4.6	1300				
	9/26/2011	200.7³			500						91			5.1	1300				
	6/15/2011	200.7³			470						83			5.7	1200				
	2/16/2011	200.7³			450						81			7.9	1200				
	10/4/2010	200.7³			450						89			7.6	1300				
	9/16/2010	200.7³			540						120			8.2	1400				

DEFINITIONS	STANDARDS
NE = Not established	WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.
NA = Not analyzed	a) Human Health Standards; b) Other standards for Domestic Water
NL = Not listed on laboratory analysis	
NR = Not requested	40 CFR 141.62 Detection Limits for Inorganic Contaminants
Bold and highlighted values represent values above the applicable standards	[1]National Primary Drinking Water Regulation (May 2009), Action Level

NOTES

1 *Major Cations and Anions analysis only requested*

**GWM-1 sample schedule is on an annual basis. For this sampling period, technician used the unapproved Facility Work Plan (FWP) at the beginning of 2010. which called for this well to be sampled on a quarterly basis. The FWP was approved on August 25, 2010.*

9/26/2011 Quarterly sampling combined with Annual sampling event

Metals results reported as total metals

QUARTERLY GROUNDWATER ANALYSES
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY

			Parameters									
			1,2,4-Trimethyl benzene (mg/L)	1,3,5-Trimethyl benzene (mg/L)	Naphthalene (mg/L)	1-Methyl naphthalene (mg/L)	2-Methyl naphthalene (mg/L)	Acetone (mg/L)	Isopropyl benzene (mg/L)	n-Butyl benzene (mg/L)	n-Propyl benzene (mg/L)	2,4-Dimethyl phenol (mg/L)
WQCC 20NMAC 6.2.3103 (Oct 2006)			NE	NE	0.03	NE	NE	NE	NE	NE	NE	NE
40 CFR 141.62 MCL (May 2009)			NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
EPA RSL for Tap Water (Nov 2011)			0.015	0.087	0.00014	0.00097	0.027	12	NE	0.78	NE	0.27
Well ID	DATE SAMPLED	METHOD										
GWM-1												
	3/20/2012	8260B	0.0018	<0.001	<0.002	<0.004	<0.004	0.011	<0.001	<0.001	0.0011	NL
	12/14/2011	8260B	0.004	<0.001	<0.002	**0.0052**	<0.004	<0.01	0.0013	<0.001	0.0022	NL
	9/26/2011	8260B	**0.019**	0.0029	**0.0044**	**0.028**	<0.004	<0.01	0.0019	<0.01	0.0027	NL
	6/15/2011	8260B	**0.018**	0.0031	**0.0055**	**0.024**	0.0062	<0.01	0.0018	<0.01	0.0028	NL
	2/16/2011	8260B	0.008	<0.001	<0.002	**0.01**	<0.004	<0.01	0.0014	<0.001	0.0018	NL
	11/2/2010	8260B	0.0075	<0.001	<0.02	**0.011**	<0.004	<0.01	<0.001	0.0016	0.0012	NL
	9/16/2010	8260B[1]	0.012	0.0019	NA	NA	NA	NA	NA	NA	NA	NA
	7/20/2010	8260B/8270C	0.013	<0.001	**0.0035**	**0.0072**	<0.004	0.012	0.0016	0.0019	0.0015	0.052
	3/3/2010	8260B	0.0081	<0.005	<0.01	<0.02	<0.02	<0.05	<0.005	<0.005	<0.005	NL
	7/27/2009	8260B/8270C	0.0064	0.0011	**0.0024**	**0.0097**	<0.004	<0.01	0.0026	<0.001	0.0002	0.064
	7/10/2008	8260B	0.0046	<0.002	<0.002	<0.008	<0.008	<0.02	<0.002	<0.002	<0.002	0.028
	5/24/2007	8260B/8270C	<0.01	<0.01	<0.02	<0.04	<0.04	<0.1	<0.01	<0.01	<0.01	<0.01

DEFINITIONS	STANDARDS
NE = Not established NA = Not analyzed NL = Not listed on laboratory analysis NR = Not requested Bold and highlighted values represent values above the applicable standards	WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or less. a) Human Health Standards; b) Other Standards for Domestic Water

NOTES:

[1]*Method 8260B volatiles short list only run*

9/26/2011 Quarterly sampling combined with Annual sampling event

QUARTERLY GROUNDWATER ANALYSES
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY

Well ID	DATE SAMPLED	METHOD	Parameters: Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Phosphorus (mg/L)	Sulfate (mg/L)	pH	Specific Conductance (µmhos/cm)	DRO (mg/L)	GRO (mg/L)
WQCC 20NMAC 6.2.3103 (Oct 2006)			**1.6**	**250.0**	**NE**	**NE**	**10**	**NE**	**600.0**	**6 to 9**	**NE**	**0.2[1]**	**NE**
40 CFR 141.62 MCL (May 2009)			**4.0**	**NE**	**NE**	**1**	**10**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
EPA RSL for Tap Water (Nov 2011)			**NE**	**NE**	**NE**	**1.6**	**25**	**0.00031**	**NE**	**NE**	**NE**	**NE**	**NE**
GWM-1[2]													
	3/20/2012	300.0/8015B	3.6	**1200**	3.2	<0.5	<0.5	<2.5	130	NR	NR	**3.6**	1
	12/14/2011	300.0/8015B	1.2	**1300**	2.5	<1.0	<1.0	<10	54	NR	NR	**2.9**	0.81
	9/26/2011	300.0/8015B	**3.5**	**1300**	1.5	<4.0	<4.0	<2.5	47	NR	NR	**3.9**	0.65
	6/15/2011	300.0/8015B	**2.6**	**1200**	2.6	<2.0	<2.0	<2.5	64	NR	NR	**4.0**	0.53
	2/16/2011	300.0/8015B	**2.8**	**1400**	2.5	**2.1**	2.1	<0.5	47	NR	NR	**5.4**	0.7
	11/2/2010	300.0/8015B	**3.5**	**1300**	NL	<1.0	<1.0	<5.0	26	NR	NR	**6.0**	0.68
	9/16/2010	300.0/8015B	**2.9**	**1400**	NL	<4.0	<4.0	<5.0	48	NR	NR	**7.7**	0.71
	7/20/2010	300.0	**2.9**	**1500**	2.6	<4.0	<4.0	<2.5	57	7.18	6400	NR	NR
	3/3/2010	300.0/8015B	**2.1**	**1600**	2.7	<4.0	<4.0	<0.5	88	NR	NR	**3.9**	0.88
	7/27/2009	300.0	**2.1**	**1600**	NL	<4.0	<4.0	<0.5	73	7.03	6200	NR	NR
	7/10/2008	300.0	**1.7**	**1800**	NL	<2.0	<2.0	<0.5	110	6.92	7400	NR	NR
	5/24/2007	300.0	**1.9**	**1800**	NL	<2.0	<2.0	<0.5	120	NL	NL	NL	NL
	10/26/2006	300.0	**2.0**	**3700**	NL	<2.0	<2.0	<2.5	120	6.87	NR	NR	NR
GWM-2[3]													
	3/20/2012	300.0/8015B	**3.6**	**1500**	4.4	<0.5	<0.5	<2.5	**1300**	NR	NR	2.4	<0.25
	12/14/2011	300.0/8015B	0.48	**2100**	4	**25**	**25**	<10	**1000**	NR	NR	<1.0	<0.05
	9/26/2011	300.0/8015B	**16**	**2200**	4.9	**52**	**52**	<2.5	**1200**	NR	NR	<1.0	<0.05
	6/15/2011	300.0/8015B	**3.1**	**2200**	4.9	**66**	**66**	<2.5	**1100**	NR	NR	<1.0	<0.05
	2/16/2011	300.0/8015B	0.43	**910**	3.3	**2.6**	2.6	<0.5	**660**	NR	NR	<1.0	<0.05
	10/4/2010	300.0/8015B	0.52	**1800**	3.4	<4.0	<4.0	<0.5	**740**	NR	NR	<1.0	<0.05
	9/16/2010	300.0/8015B	0.46	**1400**	NL	<4.0	<4.0	<5.0	**700**	NR	NR	<1.0	<0.05
GWM-3[3]													
	3/20/2012	300.0/8015B	**4.9**	**1300**	2.8	<0.5	<0.5	<2.5	**1600**	NR	NR	**2.7**	<0.25
	12/14/2011	300.0/8015B	**5.0**	**1400**	2.5	**51**	**51**	<10	**1800**	NR	NR	**1.3**	<0.05
	9/26/2011	300.0/8015B	**5.3**	**1000**	2.5	**130**	**130**	<2.5	**2500**	NR	NR	**2.7**	<0.05
	6/15/2011	300.0/8015B	**5.5**	**610**	2.3	<2.0	<2.0	<2.5	**1900**	NR	NR	**1.1**	0.12
	2/16/2011	300.0/8015B	**4.2**	**1100**	2.1	**61**	**61**	<0.5	**1900**	NR	NR	<1.0	<0.05
	10/4/2010	300.0/8015B	**5.9**	**1800**	2.3	**61**	**61**	<0.5	**1500**	NR	NR	**1.3**	0.12
	9/16/2010	300.0/8015B	**4.7**	**2000**	NL	**66**	**66**	<5.0	**1500**	NR	NR	**3.7**	0.066

DEFINITIONS
NE = Not established
NA = Not analyzed
NL = Not listed on laboratory analysis
NR = Not requested
Bold and highlighted values represent values above the applicable standards

STANDARDS
WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.
[1] NMED Table 2a. TPH Screening Guidelines for Potable Ground Water (GW-1). (Oct 2006)

NOTES
[2] *GWM-1 sample schedule is on an annual basis. For this sampling period, technician used the unapproved Facility Work Plan (FWP) at the beginning of 2010, which called for this well to be sampled on a quarterly basis. The FWP was approved on August 25, 2010.*
[3] *GWM-2 and GWM-3 are normally dry wells. During inspection of well, water was present and subsequently well was sampled and purged dry.*
9/26/2011 Quarterly sampling combined with Annual sampling event

Appendix B

Monitoring Well Logs

Sheet: 1 OF 2
Bore Point: SW corner of Pond 1

Water Elevation: Not Encountered
Boring No.: GWM-1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

Log of Test Borings

File #: 03-118
Site: Ciniza
Boundry Wells

Elevation: TBD
Date: 7/8/2004

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	0-1.5		o/o/o/o/ o/o/o/o/ o/o/o/o/		**Clay**, gravelly, red-brown, wet				
	1.5-20.0		/////////	2.5 / 5.0 / 7.5 / 10.0 / 15.0 / 20.0	**Clay**, red-brown, wet				
	20-21.5		/////////		**Clay**, black, wet,				

SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger

LOGGED BY: NS

C:\unzipped\Boundry Well Locations\[GWM-1.xls]Sheet1

Sheet: 2 OF 2
Bore Point: SW corner of Pond 1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 03-118
Site: Ciniza
Boundry Wells

Water Elevation: Not Encountered
Boring No.: GWM-1

Log of Test Borings

Elevation: TBD
Date: 7/8/2004

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	21.5-24.0		////////// //////////	22.0	**Sand**, gravelly				
	22.5-24.0		////////// ////////// //////////		**Petrified Forest Formation, Painted Desert Member, Mudstone**, weathered, red-purple, reduction spots, hard, moist, blocky/crumbly				
	24.0				T.D.				
				25.0					
					Screened interval 18-24'				
				30.0					
				35.0					
				40.0					
					Clay, black, wet,				

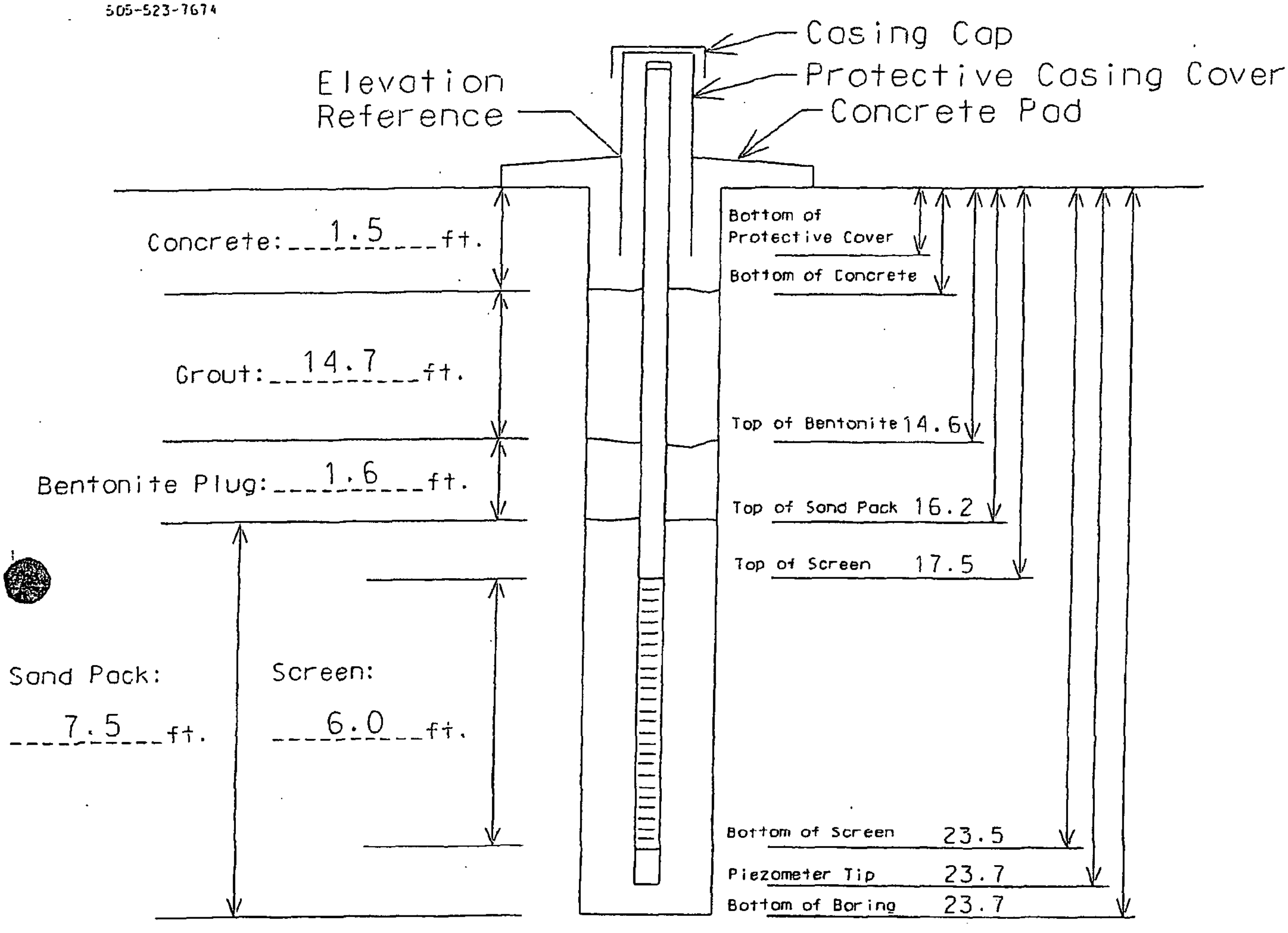
should be 22.5'

SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger — LOGGED BY: NS

505-523-7674

Installation Diagram

Monitoring Well No. GWM-1



Boring Diameter: 8 5/8"

Sand Type: 20-40 SILICA

Bollards. Type/Size: NONE INSTALLED

Bentonite: 3/8" CHIPS

Screen Type/Size: 2", #10 SLOT, SCH 40 PVC

Cement/Grout: 6% BENTONITE/CEMENT

Riser Type/Size: 2", SCH 40 PVC

Water: NONE

Locking Expandable Casing Plug? YES

Site Northing: TBD

Other: ---

Bottom Cap Used? YES

Site Easting: TBD

Project #: 03-118

Project Name: POND 1 GROUNDWATER OBSERVATION

Elevation: TBD

Sheet: 1 OF 1
Bore Point: 10' S, 4'E of GMW-1
Water Elevation: Not Encountered
Boring No.: GWM-2

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 05-099
Site: Giant-Ciniza

Elevation: 6913.17
Date: 9/25/2005

Log of Test Borings

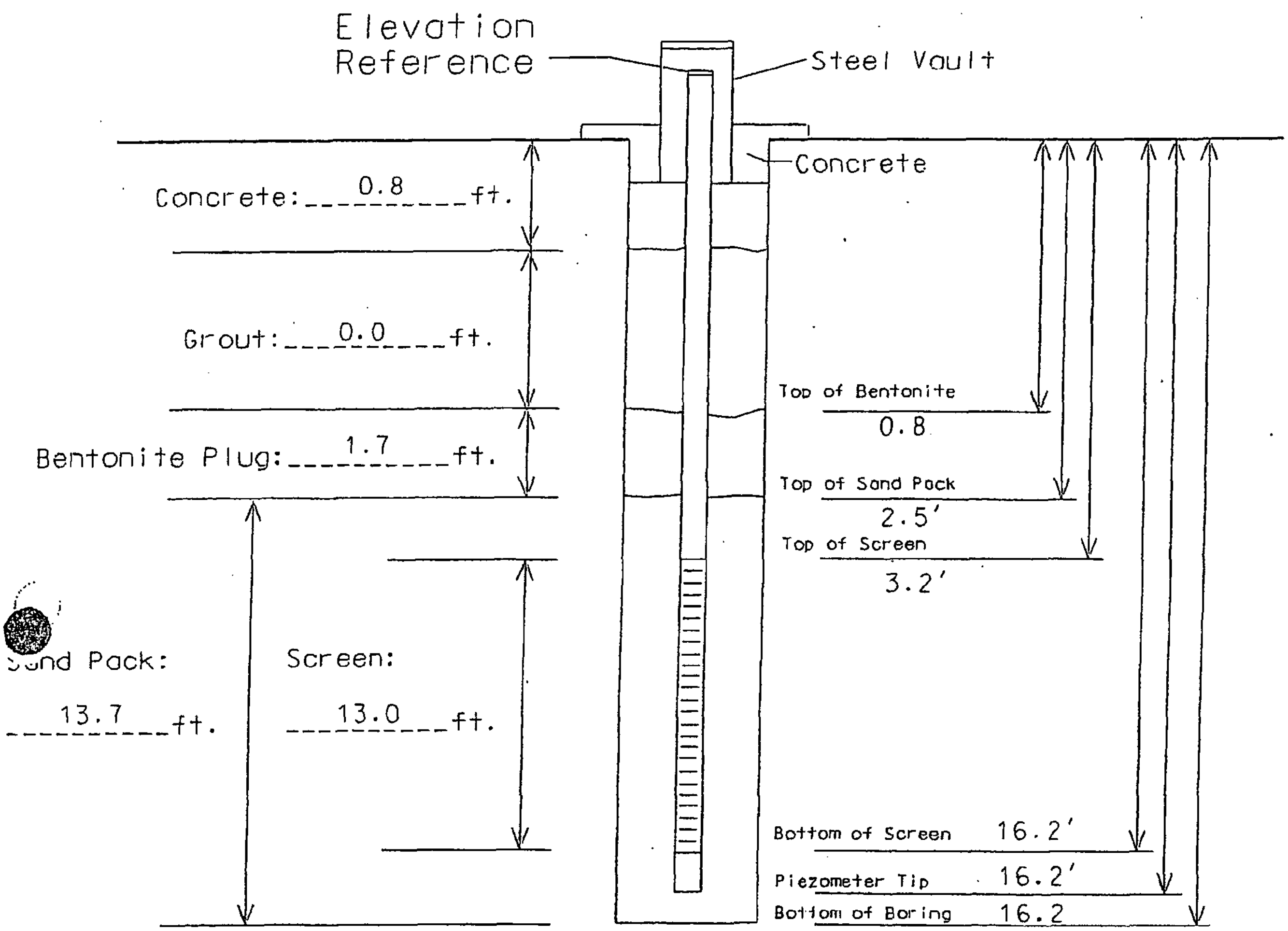
LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	0.0-0.5				Clay, Gravelly (From Roadfill), Wet, Sandy, Red/Brown				
	0.5-5.0			2.5	Clay, Red/Brown, Some Silt, Very Fine Sand In Thin Seams, Wet, Firm				
	5.0-10.0			5.0 7.5	**Same As Above**				
	10.0-14.7			10.0	**Same As Above**, No Sand				
	14.7-15.0			15.0	Clay, Fine Sand, Red/Brown, Soft, Root Matter, Wet				
	16.2			20.0	TD Set Well @ 16.2' 13.0' - 2" PVC Sch. 40 #10 Slot Screen 3.2' - 2" PVC Sch. 40 Riser to Ground Surface 10-20 Sand From Bottom of Hole to 2.5' Below Ground Surface, 3/8 Bentonite Chip to 8" Below Ground Surface, Hydrated Chips Set Above Ground Surface Finish with 4'x4' Concrete Pad. Top of Casing ~ 3.0' Above Ground Surface				

IZE & TYPE OF BORING: 4 1/4" ID HOLLOW STEMMED AUGER LOGGED BY: WHK

PRECISION ENGINEERING, INC.
505-523-7674

Installation Diagram

Monitoring Well No. GWM 2



Boring Diameter: $8\frac{5}{8}$"

Sand Type: 10-20 Silica

Bollards. Type/Size: NA

Bentonite: 3/8" Chips

Screen Type/Size: 2" PVC Sch. 40, 0.10" Slotted

Cement/Grout: NA

Riser Type/Size: 2" PVC Sch. 40

Water: Potable

Locking Expandable Casing Plug? Yes

Site Northing: 2244.46

Bottom Cap Used? Yes

Site Easting: 3864.28

Other:

Project #: 05-099

Project Name: Cinizo Refinery

Elevation: 6913.17

Sheet: 1 OF 1
Bore Point: NW Corner of Pond 1
Water Elevation: Not Encountered
Boring No.: GWM-3

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 05-099
Site: Giant-Ciniza

Elevation: 6912.65
Date: 9/25/2005

Log of Test Borings

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	0.0-0.25				**Clay**, Gravelly, Hard, Red Brown, Wet				
	0.25-5.0				**Clay**, Very Silty, Sandy, Very Sandy, Wet, Red/Brown, Stiff				
				2.5					
				5.0					
	5.0-10.0				**Clay**, Very Sandy, Slightly Silty, Wet, Red/ Brown, Stiff				
				7.5					
				10.0					
	10,0-15.0				**Clay**, Wet, Red/Brown, Firm, Root Matter @ 14.5'				
				15.0					
	16.0								
	16.0-16.1				**Clay**, Sandy, Some Gravel, Very Wet, Moisture on Surface, Red/Brown				
	16.1-16.5				**Clay**, Some Pebbles, Wet, No Free Water, Red/Brown				
	16.5				TD				
				20.0	Plug Boring with 3/8 Bentonite Chips to 15.0' 12.0' of 2" Sch. 40 PVC #10 Slot Screen, 3.0' of 2" Sch. 40 PVC Riser, Above Ground Finish with 4'x4' Concrete Pad. 10-20 Sand from 15.0' to 2.0', 3/8 Bentonite Chips from 2.0' to Surface Top of Casing ~ 3.0' Above Ground Surface				

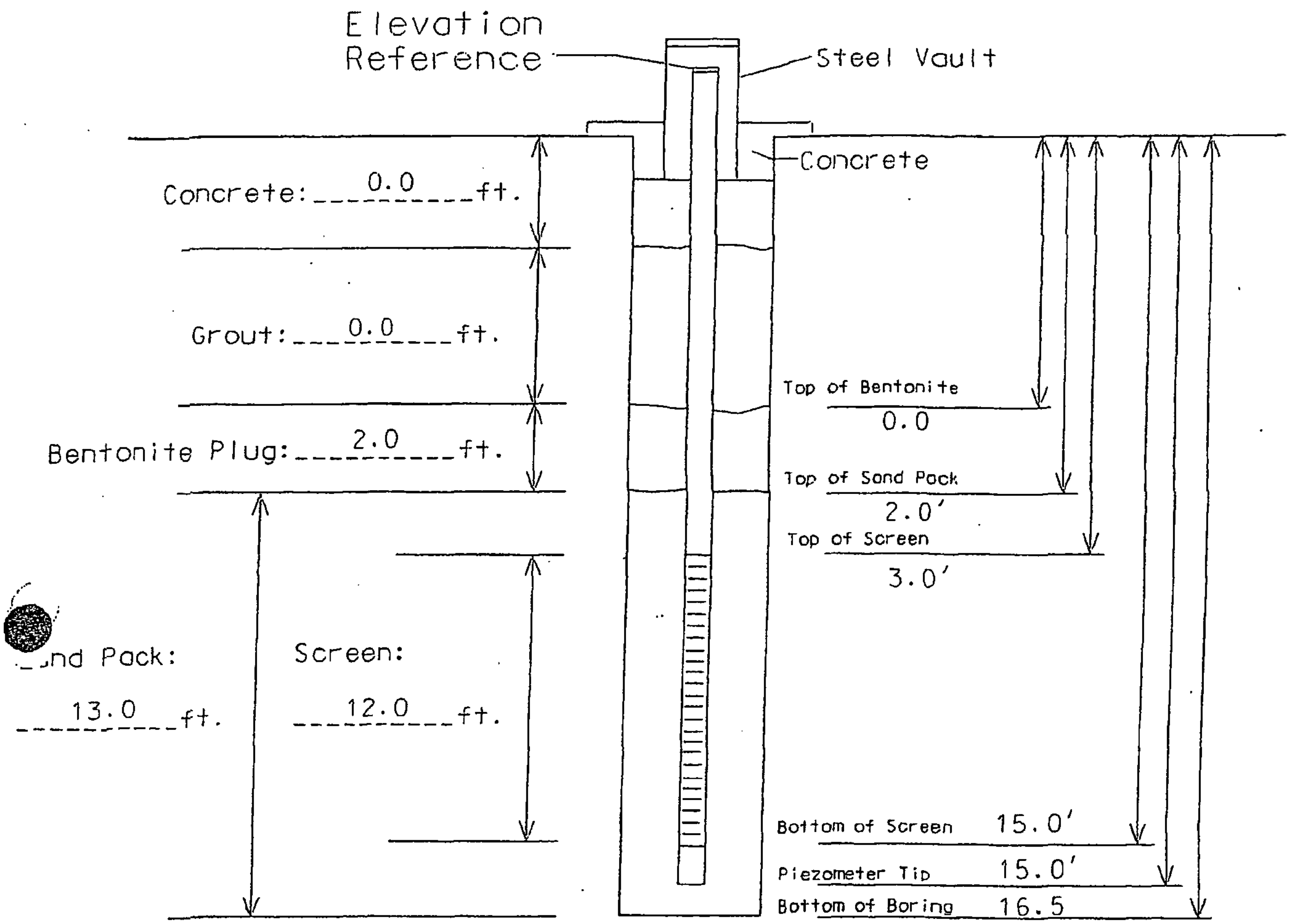
IZE & TYPE OF BORING: 4 1/4" ID HOLLOW STEMMED AUGER

LOGGED BY: WHK

PRECISION ENGINEERING, INC.
505-523-7674

Installation Diagram

Monitoring Well No. GWM 3



Boring Diameter: 8 5/8"

Sand Type: 10-20 Silica

Bollards, Type/Size: NA

Bentonite: 3/8" Chips

Screen Type/Size: 2" PVC Sch. 40, 0.10" Slotted

Cement/Grout: NA

Riser Type/Size: 2" PVC Sch. 40

Water: Potable

Locking Expandable Casing Plug? Yes

Site Northing: 2233.38

Bottom Cap Used? Yes

Site Easting: 4110.05

Other:

Project #: 05-099

Project Name: Cinizo Refinery

Elevation: 6912.65

KLEINFELDER

Monitoring Well Log

Date		Project Number	Project	Well No.
	Started: 6/12/2007	84679	Ciniza Refinery Monitor Well Install	KA-1
	Completed: 6/12/2007			
	Backfilled: 6/12/2007	Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:		Longitude:	Location:	

Sample Type:
- CS - 3.5" I.D. Continuous Sampler
- D - Disturbed Sample
- G - Grab Sample
- SPT - 2" O.D. 1.38" I.D. Tube Sample
- ST - 3" O.D. Thin-Walled Shelby Tube
- U - 3" O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
9.5	11:10:00 AM	6/12/2007
8.22	9:21:00 AM	6/21/2007

Groundwater Depth (ft.)	Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONST.
	0							CLAYEY SAND (SC) - fine to medium grained, subangular to subrounded, red brown to dark red, dry to moist, poorly cemented, sand content decreasing with depth, no hydrocarbon odor	Vault
						0.6 ppm	KA1@1		
				G				Note: Borehole was hand augered from ground surface to 5 ft bgs.	Bentonite cement grout
									2" Sch. 40 PVC casing
	5					1.9 ppm	KA1@5	5.0' SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, red brown to dark red, moist, poorly cemented, 30-35% sand, no staining or hydrocarbon odor	
				CS				7.0' SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, dark red, moist, poorly cemented, 10-20% sand, sand content decreasing with depth, no hydrocarbon odor	10/20 Sand
▽ (9.5)									0.010" Slot Screen (4.5-9.5')
▽ (8.22)									End Cap
	10					1.2 ppm	KA1@10	10.0'	3/8" Bent. chips

Total Depth 10.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date	Depth (ft)	Hour	Date	Depth (ft)	Hour	Date

KLEINFELDER

Monitoring Well Log

Date		Project Number	Project	Well No.
Started: 6/11/2007	Completed: 6/11/2007	84679	Ciniza Refinery Monitor Well Install	KA-2
Backfilled: 6/11/2007		Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:		Longitude:	Location:	

Sample Type:
CS - 3.5" I.D. Continuous Sampler
D - Disturbed Sample
G - Grab Sample
SPT - 2" O.D. 1.38" I.D. Tube Sample
ST - 3" O.D. Thin-Walled Shelby Tube
U - 3" O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
9.5	11:10:00 AM	6/12/2007
8.54	9:18:00 AM	6/21/2007

Depth (ft.)	Sample Type	PID Headed Headspace Reading, ppm	Analytical Sample Number	Visual Classification	Well Const.
0	G	2.5 ppm		SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, reddish gray, dry to moist, poorly cemented, 30-35% sand, no hydrocarbon odor Note: Borehole was hand augered from ground surface to 5 ft bgs.	Vault; 3/8" Bentonite chips; 2" Sch 40 PVC Casing
5	CS	8.4 ppm	KA2@5	5.0' SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded, reddish gray, dry to moist, poorly cemented, 25-30% sand decreasing with depth, no hydrocarbon odor	0.010" Slot Screen (4.5-9.5)
				6.0' SANDY LEAN CLAY (CL) - dark red, moist to very moist, poorly cemented, 5-15% fine to medium grained sand, substantial hydrocarbon staining at 9 feet bgs, noticable hydrocarbon odor	10/20 Sand
9		79.1 ppm	KA2@9		End Cap
10		37.4 ppm	KA2@10	10.0'	3/8" Bentonite chips

Total Depth 10.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date	Depth (ft)	Hour	Date	Depth (ft)	Hour	Date

KLEINFELDER

Monitoring Well Log

Date		Project Number	Project	Well No.
	Started: 6/11/2007	84679	Ciniza Refinery Monitor Well Install	KA-3
	Completed: 6/11/2007			
	Backfilled: 6/11/2007	Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:		Longitude:	Location:	

Sample Type:
- CS - 3.5" I.D. Continuous Sampler
- D - Disturbed Sample
- G - Grab Sample
- SPT - 2" O.D. 1.38" I.D. Tube Sample
- ST - 3" O.D. Thin-Walled Shelby Tube
- U - 3" O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
12.5	10:15:00 AM	6/12/2007
8.5	9:15:00 AM	6/21/2007

Depth (ft.)	Sample Type	PID Headed Headspace Reading, ppm	Analytical Sample Number	Visual Classification	Well Const.
0					Vault
		3.2 ppm		SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, redish tan to tan, dry to moist, poorly cemented, 30-35% sand, no hydrocarbon odor	
	G			Note: Borehole was hand augered from ground surface to 5 ft bgs.	
3.0'				SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, dark red, dry to moist, poorly cemented, 20-25% sand decreasing with depth, no hydrocarbon odor	
5		14.9 ppm			
6.0'				SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, red brown to dark brown with gray hydrocarbon staining, moist, poorly cemented, 10-15% sand, grey hydrocarbon staining at 9 feet bgs, at 9-10 ft bgs noticable hydrocarbon odor.	Bentonite cement grout
	CS				
10		14.9 ppm	KA3@10		2" Sch 40 PVC Casing
12.5'	CS	37.6 ppm	KA3@12.5	POORLY GRADED SAND WITH CLAY (SP-SC) - fine to medium grained, red brown to dark red, wet, poorly cemented, 10-15% clay and silt, no noticable hydrocarbon odor	3/8" Bentonite chips
14.0' / 15.0'		13.6 ppm		SANDY LEAN CLAY (CL) - fine to medium grained sand, subangular to subrounded, dark red, moist, poorly cemented, 25-30% sand, no hydrocarbon odor	
	CS			SANDY LEAN CLAY (CL) - with intervals of poorly graded sand with clay (SP-SC) at 16 ft bgs and 17.5 ft bgs fine to medium grained sand, red brown to dark red, wet, poorly cemented, 10-15% clay and silt, no hydrocarbon odor	
18.0'				MUDSTONE (CHINLE FORMATION) - weathered, highly fractured dark red to reddish gray with light gray reduction spots, wet in fractures, moderately to well cemented, no noticable hydrocarbon odor	0.010" Slot Screen (15-25ft)
20		3.2 ppm			10/20 Sand
22.0'	CS	1.9 ppm	KA3@22.5	MUDSTONE (CHINLE FORMATION) - minor to trace fractures dark red to reddish gray with light gray reduction spots, dry to moist, moderately to well cemented, no noticable hydrocarbon odor	
25.0'		1.2 ppm	KA3@25		End Cap

Total Depth 25.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date	Depth (ft)	Hour	Date	Depth (ft)	Hour	Date

Appendix C

Investigation Derived Waste Management Plan

Investigation Derived Waste (IDW) Management Plan

All IDW will be properly characterized and disposed of in accordance with all federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste.

A dedicated decontamination area will be setup prior to any sample collection activities. The decontamination pad will be constructed so as to capture and contain all decontamination fluids (e.g., wash water and rinse water) and foreign materials washed off the sampling equipment. The fluids will be pumped directly into suitable storage containers (e.g., labeled 55-gallon drums), which will be located at satellite accumulation areas until the fluids are disposed in the refinery wastewater treatment system upstream of the API separator. The solids captured in the decontamination pad will be shoveled into 55-gallon drums and stored at the designated satellite accumulation area pending proper waste characterization for off-site disposal.

Drill cuttings generated during installation of soil borings will be placed directly into 55-gallon drums and staged in the satellite accumulation area pending results of the waste characterization sampling. The portion of soil cores, which are not retained for analytical testing, will be placed into the same 55-gallon drums used to store the associated drill cuttings.

The solids (e.g., drill cuttings and used soil cores) will be characterized by testing to determine if there are any hazardous characteristics in accordance with 40 Code of Federal Regulations (CFR) Part 261. This includes tests for ignitability, corrosivity, reactivity, and toxicity. If the materials are not characteristically hazardous, then further testing will be performed pursuant to the requirements of the facility to which the materials will be transported. Depending upon the results of analyses for individual investigation soil samples, additional analyses may include TPH and polynuclear aromatic hydrocarbons (PAHs).

Purge water generated during groundwater sampling activities will be containerized in 55-gallons drums and then disposed in the refinery wastewater treatment system upstream of the API separator. All miscellaneous waste materials (e.g., discarded gloves, packing materials, etc.) will be placed into the refinery's solid waste storage containers for off-site disposal.