AP - 111

EVAPORATION POND REPAIRS REV. 1 (1 of 4)

2017

February 17, 2017

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

RE: RESPONSE TO DISAPPROVAL LETTER REPORT
EVAPORATION POND 7 DIKE BREACH AND SUMMARY REPORT EVAPORATION POND REPAIRS
WESTERN REFINING SOUTHWEST, INC. GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-15-006

Dear Mr. Kieling:

The enclosed revised Report was prepared pursuant to your disapproval letter dated August 22, 2016 mentioned above. Your twelve comments have been addressed in the attached letter from Axis Group Inc. and incorporated into the Revised Summary Report, Evaporation Pond Repairs, as appropriate. Two bound paper copies and also an electronic copy that includes a redline-strikeout version of the Report are enclosed.

If there are any questions regarding the enclosed Report, please contact Mr. Ed Riege at (505) 722-0217.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Mr. Daniel J. Statile
VP Refining
Western Refining Southwest, Inc. – Gallup Refinery

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

cc C. Chavez, OCD
A. Hains, WR El Paso

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Littleton, CO 80120
303.332.5757

February 16, 2017

Ed Riege
Remediation Manager
Western Refining Southwest, Inc.
92 Giant Crossing Road
Gallup, NM 87301

Re: Responses to NMED Comments
Summary Report – Evaporation Pond Repairs
Western Gallup Refinery
Gallup, New Mexico

Dear Ed:

At Western Refining Southwest's (Western's) request, this letter provides Axis Group Inc.'s (Axis') responses to New Mexico Environment Department's (NMED's) August 22, 2016 comments regarding the *Summary Report-Evaporation Pond Repairs* dated December 17, 2015. Responses to the NMED's comments have been incorporated into the Revised Summary Report, Evaporation Pond Repairs as appropriate.

Comment 1:

A: *In Section III (Miscellaneous), Part B (Pond Integrity), the Permittee states, "NMED's April 8, 2015 letter states 'seepage is likely occurring' and 'there is evidence that the berms are still in need of repair.' NMED notes that the basis for this observation is information from an August 2014 U.S. Environmental Protection Agency (EPA) RCRA compliance inspection. EPA's Inspection Report indicated that EPA had observed what it believed was moisture at a pond dike, and included several photographs, all of Pond 6.*

No response needed for Comment 1A.

B: *Western received EPA's Inspection Report in Fall 2014 and completed significant berm improvements on Pond 6 in March 2015, prior to receiving NMED's April 8th letter. Western also completed improvements to other pond dikes during this same time period.*

No response needed for Comment 1B.

C: *Section 2.4.3 (Pond 7/8 West Berm Soil Borings) describes the soils as "[t]he berm fill soil was characterized as a red, silt to clay moist soil, until the native material was encountered around 12 feet deep. Native material was characterized as gray fine sand overlaying a stiff wet red clay." Soil boring logs presented in Appendix D (Soil Boring Logs) indicate that there are "wet" layers in the soils within the evaporation pond berms along Ponds 7 and 8. Sand layers are also identified in the berm boring logs. The boring logs provided in Appendix C indicate water was present when those borings were installed in 2000.*

Response to Comment 1C:

During the December 2000 boring program (Appendix C), 3 borings were installed on the Pond 7/8 west berm. The borings showed moist soil at depths ranging from 1 to 5 feet to final depth. No borings indicated wet soil or water. During the October 2015 boring program (Appendix D), four borings were installed on the Pond 7/8 west berm and indicated moist soil (indicative of the phreatic surface) at depths between 4 to 5 feet below the crest. Wet soil was observed at the berm fill - native soil interface in three of the four borings.

The depth to moist soil in the October 2015 borings is similar to the depth of water in the nearest piezometer (4-feet to moist soil in the boring versus 6.33-feet to water in the piezometer). The piezometer reading was used to model the phreatic surface during the slope stability modeling, as the water elevation in the pond was deeper than the elevation where the moist soil was encountered.

Soil classifications in the boring logs from the Pond 7/8 west berm in the December 2000 program correspond to classifications in the boring logs from the October 2015 program. The sandy layer encountered and described on the October 2015 boring logs SB-8N and SB-8S, is at a depth of 11.5 to 12 feet below the current crest elevation and is at the transition from berm fill material to native soil.

D: *For example Boring 8 (Southwest Corner of Pond 9A) indicates that the depth to water is 18 feet with a note "water bearing at 18', water rises to 6'2" after 24-hours and stabilizes." From 10 feet below the berm surface and down, the soil descriptions are "slightly sandy" at 10 feet, "very sandy" at 15 feet, and "sandy" at 20 feet. This is evidence that the evaporation pond berms allow water to seep through in spite of the calculated 1.9 X 10-7 cm/sec permeability. In the revised Report, discuss the permeability of the berms the sand layers, and whether or not the water observed in the borings presents a risk for berm failure. See also Comment 4.*

Response to Comment 1D:

Western does not agree with the interpretation of the boring log stated in the comment above. The log from the December 2000 program for Boring 8 at southwest corner of Pond 9 indicates “Clay” as the major descriptor with minor descriptors of various portions of sand (e.g. very sandy or slightly sandy).

Water encountered at a depth of 18-feet and then rising over 24-hours to a depth of 6-feet 2-inches is an indication of an artesian condition with water below a confining layer (i.e. clay). Western does not agree with NMED’s interpretation that this is evidence the evaporation pond berms allow water to seep through.

The 1.9 X 10-7 cm/sec permeability test result referred to in NMED’s comment is from a borrow sample taken during the October 2015 program and not from the Pond 9 soil obtained in the December 2000 program. The soil sample taken from the 2015 borrow pit was tested at a geotechnical laboratory for permeability using a flex-wall permeameter method described under ASTM 5084. Appendix B contains the geotechnical data and laboratory test results for the berm improvement activities.

Comment 2:

In Section III (Miscellaneous) point B, bullet I the Permittee discusses the placement of additional evaporation blowers to help in lowering the amount of water in the evaporation ponds. In the revised Report discuss the frequency (e.g., continuous, as needed) the blowers will be used.

Response to Comment 2:

The evaporation blowers operate continuously during the peak evaporation season (about April through October) except when the evaporation blowers are shut down for maintenance purposes or when the temperature makes evaporation inefficient. The evaporation blower operation is discussed in Section 5.2 of the Revised Summary Report.

Comment 3:

In Section III (Miscellaneous) point B, bullet 3 the Permittee discusses new staff gauges that were installed to measure current storage, remaining storage volume, and freeboard in the evaporation ponds. The Permittee must keep track of these measurements and report the data in table format in the annual Facility-wide Groundwater Monitoring Report. Additionally, the Permittee must also report on evaporation pond inspections, maintenance, *and/or repairs to the evaporation pond berms in the annual Facility Wide Groundwater Monitoring Report.*

Response to Comment 3:

Western will provide a staff-gage log in table format with the annual Facility-Wide Groundwater Monitoring Report. Western will also include copies of inspection records along with records of maintenance and improvements that have been conducted.

Comment 4:

In Section 2.4.4 the Permittee states, "[w]ater levels (if present) have been measured in the drive-point piezometers three times since installation (as of November 11, 2015) and that data is contained in the piezometer logs in Appendix E. Due to the low permeability clay soil in the berms, as of December 2015, the water levels in the piezometers have not yet completely stabilized. Western will continue to monitor the water levels in the piezometers as needed. The drive-point piezometer logs also visually illustrate the location of the phreatic surface."

The piezometer logs indicate that surface water is entering the casing at the ground surface in a few of the piezometers (e.g., Pond 6, Piezometer E), ensure that the casing is constructed so that surface water cannot infiltrate the casing. Additionally, in the revised Report discuss how often water levels in the piezometer will be monitored and reference that the information will be reported in an annual status report (See Comment 3). Also, discuss whether or not the piezometric surface is below the potential or existing sliding surface or below the stability threshold for the berm slopes and discuss what measures will be taken if the water levels in the piezometers increase to the point where slope failure is possible.

Response to Comment 4:

Western continued improvements to the earth berms after the December 2015 Report was provided to NMED. The drive-point piezometers installed in the berms of Ponds 7, 8, and 9 during October 2015 were abandoned during these ongoing improvements.

Western will install new piezometers in the downstream slopes of the earth berms along cross-sections that will be used in an updated numerical slope stability analysis. The new piezometers will be installed with casings and bentonite seals above the screen interval to prevent surface water intrusion. Piezometers will be installed in borings at selected cross-sections in the following earth berms:

- Pond 7/8 west berm
- Pond 6 west berm
- Pond 9 north berm

The water levels will be recorded monthly and when stable (about three months), the water levels will be incorporated into the updated numerical slope stability analysis. Afterward, the water levels in the piezometers will be measured as appropriate and reported in the Facility Wide Groundwater Report.

Due to the slopes and access constraints, the borings for the piezometers will likely be hand-augured at each location. Soil samples will be collected using a hand-drive sampler as needed in the hand-auger borings.

The hand-auger will be used to advance a 4-inch diameter hole to depths required to install the new piezometer and collect the soil samples. The hand-drive sampler has a barrel that holds brass sleeves for the soil samples. The barrel is driven into the soil and then retrieved. The brass liners are extracted from the barrel, sealed using Teflon™ patches, plastic caps, and tape. Each sleeve will be sealed in the field, labeled as required, and provided to a geotechnical laboratory for analysis. Soil analysis is expected to include:

- Soil characterization and classification
- West and dry unit weights with moisture content
- Atterberg Limits
- Sieve analysis
- Effective stress strength parameters (c’ and Ø’) from a triaxial sheer test

Western will also discuss the presence or absence of the phreatic surface, its relation to the theoretical slip circle identified in the slope stability output, and the potential effects on the numerical slope stability. Note however that Western does not believe that the water levels (as observed in the temporary drive-point piezometers) will rise to the point where the slope stability is in jeopardy. Western will provide the updated numerical slope stability evaluation in an addendum to the revised report.

Comment 5:

The stability of the embankment slopes was evaluated using total stress rather than effective stress analysis methods. Total stress analyses involve less sophisticated (and less costly) laboratory strength test methods than effective stress analyses and were in common usage thirty or more years ago. It has since become clear to the engineering profession that the strength behavior of soil is best characterized in terms of effective stresses, where the pressure of the water within the pores of the soil is explicitly accounted for. In total stress analyses, by comparison, pore water pressures are simply lumped into the soil strength value without quantification. The total stress method, because of the soil testing methodology employed, can potentially involve computations that involve artificially high values of soil cohesion, which, in turn, may lead to falsely high computed factors of safety (FS). Although the stability of the embankment slopes may indeed be satisfactory, that conclusion cannot reasonably be drawn from the data presented.

In order to assess whether the stability of each embankment lies within an acceptable range (for example, the FS = 1.5 for long term stability of the downstream face), all stability analyses must be repeated using the effective stress method in the context of the Bishop Method or the Morgenstern Price method. This requires retesting the soils to determine their effective stress shear strength parameters (Ø and c) using, for example, the direct shear method (a drained test) or the triaxial test (a drained test or, alternatively, an undrained test with pore pressure measurement). Provide a work plan proposing to collect additional soil data from the evaporation pond berms.

Response to Comment 5:

Western does not agree that total stress analysis is not applicable in the cases presented in the report. It is acceptable to use the total stress analysis for slope stability for the end-of-construction analysis and for partially saturated soil (refer to “EM 1110-2-1902”, USACE 2003, “Geotechnical Engineering Techniques and Practices”, Hunt 1986). Based on historical and current soil borings, the soil in the berms is best categorized as partially saturated.

Western updated the previous slope stability work conducted in December 2002 (Appendix C of the report) using the available soil strength data and applied the revised cross-sections after the new berm fill material was placed (through 2015). The updated slope stability work used the December 2002 slope stability triaxial sheer strength data (these were total stress parameters) to estimate the updated factor of safety.

Western used the Morgenstern Price method of analysis in the updated slope stability analysis in Appendix F of the December 2015 report. The updated slope stability analysis conducted on the revised berm cross-sections resulted in increased factors of safety in each updated analysis. The minimum factor of safety calculated for the updated cases was 4.5, clearly in excess of the minimum acceptable factor of safety of 1.5.

Note that the effective stress strength parameters on a clay soil typically result in a lower cohesion value (c value) and an increase in the internal angle of friction value. (Ø value) when compared to total stress strength parameters. While there are changes to be expected in the strength parameters between total stress and effective stress, Western does not expect the changes to be significant.

Western will install new piezometers in the downstream slopes of the earth berms along cross-sections that will be used in an updated numerical slope stability analysis. The new piezometers will be installed with casings and bentonite seals above the screen interval to prevent surface water intrusion. Piezometers will be installed at selected cross-sections in the following earth berms:

- Pond 7/8 west berm;
- Pond 6 west berm;
- Pond 9 north berm;

Due to the slopes and access constraints, the borings used to install the piezometers will likely be hand-augured at each location. Soil samples will be collected using a hand-drive sampler as needed in the hand-auger borings.

The hand-auger will be used to advance a 4-inch diameter hole to depths required to install the new piezometer and collect the soil samples. The hand-drive sampler has a barrel that holds brass sleeves for the soil samples. The barrel is driven into the soil and then retrieved. The brass liners are extracted from the barrel, sealed using Teflon™ patches, plastic caps, and tape. Each sleeve will be sealed in the field, labeled as required, and provided to a geotechnical laboratory for analysis.

Soil analysis is expected to include:

- Soil characterization and classification;
- West and dry unit weights with moisture content;
- Atterberg Limits;
- Sieve analysis; and
- Effective stress strength parameters (c' and Ø') from a triaxial sheer test.

The soil data collected from this investigation will be used to update the numerical slope stability evaluation. The cross-sections used in the 2002 and 2015 slope stability work, will be used in the updated slope stability evaluation, with minor adjustments to the locations to evaluate the critical cross section. The following will be incorporated into the updated slope stability evaluation:

- Morgenstern Price limit-equilibrium analysis via GeoStudio 2012;
- Updated berm topography at slope stability cross-sections (through 2016);
- Updated phreatic surface based on newly installed piezometers;
- Soil properties confirmed during the new geotechnical investigation; and
- Effective stress soil strength parameters cohesion (c) and angle of internal friction, phi (Ø).

Comment 6:

The slope stability analyses did not include an assessment of potential seismic loading conditions. A pseudo-seismic analysis must be performed for this purpose. As required by 40 CFR § 257.74(3)(e)(iv) and discussed in Seed, H.B. 1979. Geotechnique Vol. 29, No.3. An appropriate peak ground acceleration (PGA) should be applied to determine if the proposed slopes are stable under a seismic load. It is recommended that a PGA (2% over 50 years) of 0.081g based on current mapping be applied. The liquefaction potential of the berm material must also be evaluated.

Response to Comment 6:

The reference provided for a pseudo-seismic analysis is confusing. The reference provided [i.e. 40 CFR §257.74(3)(e)(iv)] appears to be for structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The CCR referred to in the reference supplied is for Coal Combustion Residuals and does not apply to this facility. Also, the berms are not new and there is no lateral expansion being considered. Based on Western's review of this comment and the citation, a pseudo-seismic analysis is not required or warranted.

In addition, Western does not agree that the liquefaction potential for the berm material needs to be evaluated. Based on observations of the earth berms, there is insufficient flow or seepage at the toe of the downstream slope to require analysis for seepage forces and liquefaction potential.

Comment 7:

It is not clear how the water level was determined for the Pond 9 north rebuild section. It does not appear that piezometers were installed in the embankment. In addition, boring logs in the area seem to present conflicting information. Provide information regarding how the groundwater levels were determined for this section and to discuss the method used to measure the water level.

Response to Comment 7:

The Pond 9 north rebuild section is modeling the cross section from December 2002 slope stability work with no new additional soil or groundwater data.

However, work in 2016 added fill material to the Pond 9 north berm. The numerical slope stability of the Pond 9 north berm will be evaluated using the updated topography and soil strength parameters.

Comment 8:

A: *The Report does not provide information on how the strengths and unit weights for each soil type were determined, nor does it provide information as to how the delineations of soil materials were determined.*

Response to Comment 8A:

Section 2.4.5 in the Report provides a discussion of soil properties used. As discussed, soil unit weight and strength properties from the December 2002 slope stability analysis were used in the 2015 updated slope stability work. The purpose of the 2015 slope stability work was to update the 2002 slope stability analysis to include the new earth berm geometry. Based on a review of the boring logs and borrow soil sample data, it was determined that the soil classifications were sufficiently similar. Accordingly, the soil and strength properties from the December 2002 slope stability analysis were used (i.e. unit weight, cohesion, and internal friction angles). This information was also provided in tabular format in Table 1 of the Report. Average properties were determined for native material and berm fill.

Similarly, the discussion in Section 2.4.5 also indicated that the soil material delineations were based on historic topography and current topography survey data after additional fill material was added to the earth berm slopes.

B: *Boring logs from 2002 do not contain elevations and no geotechnical lab data were provided concerning the soil material used to complete repairs in 2013 and 2015. The analysis must include this information so that slope stability analyses are accurate and also so that a technical evaluation of the soils geotechnical information may be completed. If historic boring logs do not include elevations and geotechnical laboratory data, then the Permittee must provide a schedule to submit a work plan proposing to collect additional soil boring data.*

Response to Comment 8B:

Though the boring logs from 2002 engineering report do not contain elevations, the historic topography was discussed in Sections 2 and 3 and shown in cross-sections on Figure 6b of the Report. The geotechnical data for the December 2002 work was provided in Appendix C of the Report. In addition, geotechnical data from the 2013 and 2015 improvement work was provided in Appendix B of the Report. As shown on Table 1 of the Report, the soil properties do not vary greatly for the berm fill throughout the various earth berm sample locations.

Comment 9:

The Report does not specify whether rapid drawdown will be employed during site operations. If rapid drawdown is expected to occur, then a rapid drawdown analysis must be conducted to investigate the stability of interior slope faces of any pond embankment that is potentially subject to instances of abrupt lowering of the water level in the pond. Under such circumstances, the rate of dissipation of pore water pressures in the embankment soils, which have developed under long term steady state conditions, cannot keep pace with the lowering of the pond level. This results in excess pore pressures in the embankment that are likely to reduce embankment stability below that of long term steady state conditions. If the Permittee expects rapid drawdown at the evaporation ponds, then this analysis must be conducted. Please revise the Report accordingly.

Response to Comment 9:

A rapid drawdown analysis is not warranted since Western does not expect a rapid drawdown at the evaporation ponds.

Comment 10:

The Report does not specify whether loading to the berms is anticipated. The analyses were run assuming there would be no loadings on the berms (that is, no vehicular axle loadings and no dead loads). Traffic or high loadings on the berms must be included in the analysis if, in fact, such loadings are present or may occur.

Response to Comment 10:

Surcharge loading on the berms is not expected other than occasional light vehicle traffic. Should berm loading beyond light vehicle traffic be required, the loadings will be analyzed as appropriate.

Comment 11:

The graphical output profile of the Slope/W runs is confusing. Although the output file appears to provide a detailed summary of the specific run, the delineation of materials and zones is unclear. Also, in some runs, the critical failure plane is cut off and not within the limits of the profile. The graphical output must be portrayed at a scale that shows the full profile and is clear and understandable so that the stability of the slope can be confidently evaluated. Revise the Report accordingly.

Response to Comment 11:

The slip surfaces and the phreatic surface in the model output were displayed. However, additional detail will be added on the slope stability output for future slope stability evaluations. The additional detail will more clearly delineate the material type and properties used in each zone. In addition, the cross sections will provide sufficient vertical scale to illustrate the complete theoretical slope stability failure plane. Western expects to provide the updated numerical slope stability evaluation in an addendum to the Revised Summary Report, Evaporation Pond Repairs.

Comment 12:

In the revised Report, the following design scenarios must be evaluated in order to determine whether their inclusion would significantly impact embankment stability:

1. *Utilize a more conservative estimate of the groundwater elevation through the embankment for Pond 6 (west to east) and Pond 8 (south to north), using the November 11, 2015 readings from Piezometers A and E.*

Response to Comment 12 (1)

The November 2015 water levels from piezometers A and E were used to evaluate the phreatic surface in the 2015 numerical slope stability analysis. In a location where water was not detected, the phreatic surface was conservatively estimated to be at the bottom of the piezometer. Where surface water intrusion was encountered at the toe of the slope, the phreatic surface was estimated to be at the toe of the slope. The water levels used in the 2015 numerical slope stability analysis were obtained from temporary piezometers and that more permanent piezometers will be installed. Date from the new piezometers will be used in the future numerical slope stability analysis.

Please note the following:

- In Pond 6 North to South, piezometer A (middle of the crest) was dry for the last two measurements and piezometer E was initially dry but subject to surface water infiltration at the toe of the slope from a storm event and therefore not reliable.
- Similarly, for the Pond 8 South to North section, piezometer A (middle of the crest) was dry for the first two measurements and measured about 1.2 feet of water on the last measurement and piezometer E was initially dry but subject to surface water infiltration at the toe of the slope from a storm event and therefore not reliable.

2. *In the Slope/W runs, larger entry/exit ranges with more convergence/slip surfaces for each point must be utilized to increase confidence that the critical failure surface (that is, the surface with the lowest factor of safety) had, in fact, been identified.*

Response to Comment 12 (2)

In the updated 2015 slope stability analysis, entry/exit ranges were chosen that cover the entire length of the berm. This forced deeper slip surfaces in order to identify the critical potential failure surface.

3. *The Report does not explicitly state why the sections were cut where they were. Revise the Report to discuss the decision process. Additionally:*

a) move Section 6 to the southwest and extending Section 6 into the bottom of Pond 7 to enable a stability analysis of the interior slopes of Ponds 6 and 7, including a surcharge loading (as appropriate). [See Annotated Drawing 6a, note 5];

b) move Section 8 slightly to the west to capture the low point of the pond, corresponding to what appears to be the tallest and most appropriate embankment section for the analysis of stability. [See Annotated Drawing 6a, note 6]; and

c) extend Section 9A directly north into the Pond 6 bottom, so the stability analysis is performed of the interior slopes of Ponds 6 and 9, with the inclusion of surcharge loads, as appropriate. [See Annotated Drawing 6a, note 7]."

Response to Comment 12 (3)

Western selected the critical section for each pond system based on geometry, typically in a section with the greatest height for each pond system, and near the locations where the temporary drive-point piezometers were installed. In the future numerical slope stability work, the cross-sections will be adjusted as appropriate to address Comment 12.

<u>Closing Remarks:</u>

Axis Group Inc. appreciates the opportunity to continue working with Western on this important project. Please call me at 303-332-5757 with questions.

Regards,

John Billiard

John W. Billiard, P.E.
Technical Services Director

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REVISED SUMMARY REPORT
EVAPORATION POND REPAIRS

Prepared for:

Western Refining Southwest, Inc.
Gallup Refinery
92 Giant Crossing Road
Gallup, NM 87301
Original Date: December 17, 2015
Revision 1 Date: February 15, 2017

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ABBREVIATIONS AND ACRONYMS

Axis	Axis Group Inc.
cm/sec	Centimeters per Second
Facility	Western Refining Southwest, Inc. Gallup Refinery
FOS	Factor of Safety
gpm	Gallons per Minute
NMED	New Mexico Environment Department
OCD	Oil Conservation Division of the Energy, Minerals and Natural Resources Department
Ponds	Evaporation Ponds
RCRA	Resource Conservation and Recovery Act
Refinery	Western Refining Southwest, Inc., Gallup Refinery
RO	Reverse Osmosis (a treatment and filter method)
Site	Western Refining Southwest, Inc. Gallup Refinery
STP-1	Sewage Treatment Pond 1
Western	Western Refining Southwest Inc.
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

Western Refining Southwest Inc. (Western) Gallup Refinery (Site) performed a significant amount of work on the evaporation pond earth berms in 2014, 2015, and 2016, and is planning additional work in 2017. Western's Summary Report, Evaporation Pond Repairs (December 17, 2015) was reviewed and comments were provided by the NMED Hazardous Waste Bureau (letter dated August 22, 2016). This report is revised to address the comments provided by the NMED and to include additional improvement work conducted in 2016 and potential future work.

Work related to the Site evaporation pond earth berms includes the following:

1. 2014 Geotechnical investigation of borrow soil;
2. 2014 Improvements to Ponds 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B;
3. 2015 Improvements to Ponds 4, 5, 6, 7, and 8;
4. 2016 Improvements to Ponds 7 and 8, 9, 11, 12A, and 12B;
5. 2016 Improvements to the stormwater channel area proximate to Pond 6 and 9;
6. 2014, 2015, 2016 land surveying for updated topography on all pond berms;
7. 2015 Soil boring investigation in Pond 7 and Pond 8 west berm;
8. 2015 Drive point piezometers installed in Ponds 6, 7, 8, and 9;
9. 2015 Updated numerical slope stability analysis on Pond 6, 7, 8, and 9;
10. 2014 to Present: Ongoing improvements to reduce water usage;
11. 2014 to Present: Ongoing improvements to increase evaporation;
12. Ongoing improvements to Pond berms as required.

Previously in 2002, the containment earth berms were numerically evaluated for slope stability and the slopes were determined to be stable with sufficient Factors of Safety. Western updated the numerical slope stability analysis using the 2002 soil strength parameters, recent investigation data, and new berm geometry after the construction improvements in 2015. The results of the updated slope stability evaluation were included in the December 2015 Summary Report and indicated that the containment earth berms remain stable with appropriate Factors of Safety.

Western continued to improve the earth berms addressed in the 2015 numerical slope stability work that were the subject of comments by the NMED. Accordingly, revising the numerical slope stability work to address the NMED comments is not appropriate until additional work is conducted as described in Section 4 of this report. The planned additional slope stability work includes collecting updated geotechnical values, evaluating the numerical slope stability after additional soil strength parameters are obtained, and providing an updated numerical slope stability analysis in a future addendum to this revised report.

1.0 INTRODUCTION

Axis Group Inc. (Axis) prepared this revised report to summarize the repair and upgrade work conducted on the evaporation pond containment earth berms at the Western Refining Southwest, Inc. (Western) refinery in Gallup, New Mexico (Site). This report has been revised from the Summary Report submitted to the New Mexico Environment Department Hazardous Waste Bureau (NMED HWB) in December 2015. The revisions address the comments from NMED in their letter dated August 22, 2016 and include a summary of the additional improvement work conducted at the ponds during 2016.

Figure 1 illustrates the location of the Site and Figure 2 is a location map showing each of the evaporation ponds. As shown on Figure 2, the evaporation ponds lie west of the Site process areas and tank farms. In total, the evaporation ponds are approximately 110 acres in aerial extent and are numbered 2, 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B. In this report Ponds 7 and 8 are identified as Pond 7/8.

In summary, the ponds are operated as follows:

1. Water from the Waste Water Treatment Plant (WWTP) and the nearby Pilot Travel Center enters the Sewage Treatment Pond 1 (STP 1);
2. Water is pumped from STP 1 to Pond 2;
3. A portion of the Reverse Osmosis (RO) reject water from the process units flows directly to Pond 2 with the remaining RO water being recycled to the facility cooling towers;
4. As needed, WWTP operators move water from one pond to another using siphons or temporary diesel-powered pumps;
5. Water flows in a cascade fashion from Pond 2 through Ponds 3, 4, 5, then 6;
6. Water is also pumped from Pond 2 to Pond 12B and then flows in a cascade fashion into Ponds 12A, 11, and 7/8.

2.0 WORK COMPLETED IN 2014 AND 2015

This section of the report describes the evaporation pond improvement work completed by Western during 2014 and 2015. Photographs of the work are included in Appendix A.

2.1 Summary of 2014 Berm Repair and Upgrades

During January through April 2014 and November through December 2014, Western conducted repairs and upgrades to the containment berms surrounding Ponds 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B. These repairs and upgrades included the following:

1. Adding additional new fill material to the outside slopes and crests of the containment berms;
2. Shaping the berm slopes; and
3. Building up the berm crest height and width;

The west berm of Pond 7/8 was shaped such that the crest was widened and aligned further to the east so that the overall outer slope would be flatter and more stable.

Western's earth work contractor used on-site borrow areas for fill material (borrow locations shown on Figure 2). Fill material was excavated from the borrow areas using a track hoe and front-end loader, brought to the containment berms via off-road haul trucks, and placed using a Caterpillar D-6 dozer. The dozer was used to place, shape, and compact the fill material. Soil fill material consisted of a silty to sandy clay, similar in character to the soil that was used to construct the original earth berms.

Figures 3a, 3b, and 3c illustrate the pond limits and crest heights prior to the improvements made in 2014. Figures 4a, 4b, and 4c illustrate the pond limits and crest heights after 2014 upgrades and repairs were complete. Figure 7b provides cross sections illustrating the limits where additional fill material was placed on the pond containment berms during 2014. Photographs of the 2014 berm upgrade activities are included in Appendix A (Photos #1 through #6).

2.2 Summary of 2015 Berm Repair and Upgrades

During March through October 2015, Western continued conducting repairs and upgrades to the containment berms surrounding Ponds 4, 5, 6, and 7/8. These repairs and upgrades included the following:

1. Adding additional new fill material to the outside slopes of the containment berms;
2. Shaping the berm slopes; and
3. Building out the berm crest width;

The fill material was taken from an on-site borrow area (see Figure 2) via scraper to the berm area under construction, placed in horizontal lifts, and compacted using the scraper and a sheep-foot vibratory roller. Each soil lift was placed on a horizontal flat surface at a maximum depth of 8-inches, keyed into the existing berm slope, and compacted to a minimum of 95-percent (95%) of a standard Proctor. A motor grader shaped the slopes as they were being constructed.

Figures 5a, 5b, and 5c illustrate the pond limits and crest heights after the 2015 upgrades and repairs were complete. Figure 7b provides cross sections illustrating the limits where additional fill material was placed on the pond containment berms during 2015. Photographs of the 2015 berm upgrade activities are included in Appendix A (Photos #7 through #14).

2.3 Geotechnical Work in 2015

The following section describes the 2015 field investigation Western conducted at the Site to collect soil geotechnical material properties and determine the phreatic surface (i.e. water table surface) within the berms. To accomplish this investigation, Western drilled four soil borings along the crest of Pond 7/8 and installed 11 drive points at various locations in the Pond 6 and Pond 7/8 berms. Figure 7a illustrates the locations where soil borings and drive-point piezometers were installed.

2.3.1 Soil Geotechnical Properties

In 2015 a soil sample was collected from the on-site borrow area and analyzed for geotechnical parameters which included the following:

1. Proctor values (i.e. laboratory maximum compaction and optimum water content);
2. Classification;
3. Sieve analysis (i.e. particle size gradation);
4. Field density and moisture content tests;
5. Permeability via flex-wall permeameter;

The on-site borrow soil that was used to repair and improve the earth berms is classified as a silty to sandy clay. Based on a flex-wall permeameter test, soil permeability for the borrow material is 1.9 X 10^{-7} cm/sec. Appendix B contains the laboratory results of the geotechnical tests conducted on the soil borrow material.

2.3.2 Pond 7/8 West Berm Soil Borings

Western installed four soil borings along the west berm of Pond 7/8 as shown on Figure 7a and the boring logs in Appendix D. The borings were conducted to visually examine the berm soil at various depths, collect soil samples for potential geotechnical analysis, and to locate the phreatic surface within the earth berm (if present).

Characterization soil samples collected from the soil borings indicated a relatively uniform soil material (i.e. no significant changes in soil type) within each boring from the crest down to the final boring depth. The berm fill soil was characterized as moist red silt and clay. The native material was encountered around 12 feet deep and was characterized as lenses of gray fine sand overlaying a stiff wet red clay. Boring logs for these four soil borings are included in Appendix D.

Western evaluated and compared some historical borings advanced in December 2000 to the borings advanced 2015. During the December 2000 boring program (Appendix C), 3 borings were installed on the Pond 7/8 west berm. The borings showed moist soil at depths ranging from 1 to 5 feet to final depth. None of the borings advanced in Pond 7/8 during 2000 indicated wet soil or water.

During the October 2015 boring program, the four borings indicated moist soil (indicative of the phreatic surface) at depths between 4 to 5 feet below the crest. Wet soil was observed at the berm fill/ native soil interface in three of the four borings. Appendix D contains the logs for each boring in Pond 7/8.

Soil classifications in the December 2000 Pond 7/8 boring logs correspond to classifications in the October 2015 boring logs. The sandy layer encountered and described on the 2015 boring logs SB-8N and SB-8S, is at a depth of 11.5 to 12 feet below the current crest elevation. This depth is consistent with the interface transition from berm fill material to native soil.

2.3.3 Temporary Drive Point Piezometers

In order to determine the phreatic surface within the Pond 6 and Pond 7/8 berms in 2015, Western installed 11 temporary drive-point piezometers at locations shown on Figure 7a.

Water levels (if present) were measured in the drive-point piezometers on three separate occasions since their installation. The water level data is shown on the piezometer logs in Appendix E. The drive-point piezometer logs also illustrate the phreatic surface. The depth to moist soil in the October 2015 borings is similar to the depth of water in the nearest piezometer (4-feet to moist soil in the boring versus 6.33-feet to water in the piezometer). The water level collected from the piezometer reading was used to model the phreatic surface during the slope stability modeling, as the water elevation in the pond was deeper than the elevation where the moist soil was encountered.

Note that piezometers installed at the toe of the berm slopes had screens that were close to the ground surface and therefore influenced by precipitation infiltration. Where precipitation infiltration was noted, the water level in that piezometer was not used for berm evaluation work.

The temporary drive-point piezometers installed in the Pond 7/8 berms were abandoned during the ongoing berm improvement activities which continued into 2016. Western will install new piezometers with casings that preclude surface water infiltration into the piezometers. A proposed piezometer installation and monitoring schedule is provided in Section 4.3 of this report. Piezometer water level data will be collected monthly for three months and the data will be provided in the annual Facility-Wide Groundwater Report.

3.0 WORK COMPLETED IN 2016

This section of the report describes the evaporation pond improvement work completed by Western during 2016. Figures 6a, 6b, and 6c illustrate the pond limits and crest heights after the 2016 upgrades and repairs were complete. Photographs of the work are included in Appendix A. The 2016 repairs and upgrades included the following:

1. Reworked and repaired the outer berms surrounding Ponds 11, 12A, and 12B;
2. Improved the Pond 9 north berm;
3. Regraded the stormwater drainage channel between Pond 6 and Pond 9;
4. Added fill material to buttress the Pond 7/8 west berm;

3.1 Ponds 11, 12A, and 12B Outer Berms

In 2016, Western reworked and repaired the soil material of the outer containment berms around Ponds 11, 12A, and 12B. During routine pond inspections, Western noted that soils in the upper two to three feet of the Pond 11, 12A, and 12B outer berms needed to be repaired. Figure 6a illustrates the 2016 repair work limits for Pond 11, 12A and 12B berms. Photographs of this work are included in Appendix A.

The 2016 repair work of the Pond 11, 12A, and 12B berms began by stripping vegetation from the upper three-feet of the berms. From stations 36+00 to 28+00 and 20+00 to 0+00, the upper 3 feet of soil was scraped from the berms and stockpiled at the toe of the slope where it was reworked and cleaned of any large pieces of wood or rocks. This reworked soil was then replaced on the outer slopes of the berms to flatten the outer slope. From stations 28+00 to 20+00, the upper 3 feet of soil was removed and placed in the nearby borrow area for future use. The removed soil could not be cast to the outer slope in this area as the berm is too close to the existing Land Treatment Unit.

Clay soil from the on-site borrow area was then used to rebuild the upper three feet of the berms to their original crest elevations. Prior to placing the first lift, the berm soil was scarified as appropriate, wetted, and then the borrow soil was placed in horizontal layers up to 8-inches thick. Each lift was moisture conditioned and compacted to a minimum of 95-percent (95%) of a standard Proctor as outlined in the specifications. The outer slopes were then graded meet the final design grades resulting in compacted and flatter outer slopes.

3.2 Pond 7/8 Berms

In 2016, Western improved the Pond 7/8 berms from Station 68+95 to Station 41+00 by adding fill material to buttress the outer slopes of the south and west berms. Figure 6a illustrates the 2016 repair work limits for Pond 7/8 berms. Photographs of this work are included in Appendix A.

Prior to beginning the improvement work, the west property line fence was temporarily removed and relocated to allow for construction vehicle access along the base of Pond 7/8 west berm. The construction area along the base of the Pond 7/8 outer slope was graded flat, scarified, and compacted.

Geotextile fabric was then placed onto the prepared surface as outlined in the design documents. Clay borrow soil was then placed in a horizontal layer on the geotextile fabric and compacted. These soils were placed in maximum of 8-inch lifts which were keyed into the existing berm slope and compacted as outlined in the project specifications.

Soil placement in uniform lifts continued until the outer slope was over-built and then graded back to the design grades. When completed, the toe of the outer slope was located adjacent to the west property boundary line. Once the berm improvement work was complete, the fence was relocated back to the property line and the disturbed area was restored by with seed and mulch.

3.3 Pond 9 North Berm

In 2016, the Pond 9 north berm was improved between Station 15+00 and Station 36+00. Figure 6c illustrates the work limits for Pond 9 completed in 2016. Photographs of this work are included in Appendix A.

Prior to beginning the improvement work, the existing power lines were removed from the toe of the Pond 9 outer north berm. Once the power lines were removed, the power poles were cut off at the base and removed. The power poles were not dug out to avoid disturbing the soil at the toe of the berm.

Once the area was cleared for improvements, soil deemed unacceptable to use as a base material was excavated and removed from the toe of the Pond 9 north berm outer slope. This material was placed on the inside slope of Pond 9 north berm and compacted. Once the soil was removed from the toe of the outer slope, the area was graded flat and geotextile fabric was placed on the prepared surface as outlined in the design documents.

Clay borrow soil was then placed in a horizontal layer on the geotextile fabric and compacted. These soils were placed in a maximum of 8-inch lifts which were keyed into the existing berm slope and compacted as outlined in the project specifications.

Soil was placed in uniform lifts and continued until the outer slope was graded to meet the original design grades.

3.4 Stormwater Channel Improvements

Non-contact stormwater is directed from the Site areas westward to the drainage channel between Pond 6 and Pond 9. From here, the non-contact stormwater collects at retention ponds located west of Pond 6 and south of Pond 7/8.

The stormwater channel between Pond 6 and Pond 9 was improved during the Pond 9 north berm work described in the previous section and shown on Figures 6b and 6c. Non-contact stormwater flow is directed into the improved channel which is sloped to drain to the west side of Pond 6.

During slope improvement work on the Pond 7/8 south berm, soil was placed between about Station 46+00 to about Station 49+00 south of the toe of the south berm. This strip of soil will act as a buffer and deter erosion between the existing stormwater detention basin and the toe of Pond 7/8 south berm.

4.0 SLOPE STABILITY ANALYSIS

The following sections describe the previous and planned numerical slope stability work for the evaporation pond berms. Based on the uniform soil and earth berm construction, the previous numerical slope stability analysis used an arc slip-type slope stability evaluation (versus block or other type of failure analysis). The resulting calculated Factor of Safety values were all greater than 1.0 in every analysis, indicating that the evaluated slopes are stable.

4.1 2002 Geotechnical and Slope Stability Analysis

In 2002, Precision Engineering, Inc. completed a geotechnical investigation as part of a slope stability analysis for the evaporation pond berms. The investigation included 10 soil borings and 7 Dutch Cone soundings. Soil samples and Shelby Tube samples were also collected from various strata throughout the investigation. Soil geotechnical properties derived from those samples (e.g. triaxial shear strength, cohesion, internal angle of friction, and unit weights) were used for the slope stability analysis.

A total of 13 cross-sections were evaluated for the 2002 slope stability analysis resulting in a Factor of Safety ranging from 2.5 to 10. A summary of the 2002 soil geotechnical properties are included in Table 1. Table 2 summarizes the results from the 2002 slope stability analysis. A copy of the Precision Engineering Inc. report is included in Appendix C.

The soil strength parameters used in the numerical analysis included the total stress parameters for cohesion (c) and the angle of internal friction, phi (Ø). It is recognized that total stress strength parameters are appropriate for numerical slope stability analysis for end-of-construction analysis and for partially saturated soil. Based on historical and current soil borings, the soil in the berms is best categorized as partially saturated and therefore, the analysis method is considered appropriate.

4.2 Planned Slope Stability Investigation

In the original Summary Report, Evaporation Pond Repairs (December 2015), Western updated the 2002 numerical slope stability analysis. For completeness, the slope stability work is now provided in Appendix F of this Revised Summary Report, Evaporation Pond Repairs. Since the slopes on several evaporation ponds have already been changed, no adjustments to the 2015 updated numerical slope stability analysis have been made. Changes to the numerical slope stability analysis will be made after additional soil properties have been obtained as described below.

As described in Section 3 of this report, Western continued improving the earth berms in 2016 for evaporation ponds 7/8, 9, 11, 12A, 12B, and the stormwater channel between Pond 6 and Pond 9. During this work, the temporary drive-point piezometers installed to provide initial phreatic surface water levels in the earth berms, were abandoned. Additionally, the outer slopes of the evaporation ponds identified above have been significantly improved. Accordingly, the numerical slope stability work provided in 2015 will be updated with the current topography and updated phreatic water surface.

The NMED comments on the 2015 updated slope stability analysis indicated that effective stress strength parameters should be used to evaluate the effects of additional fill material on the outer slopes. NMED also indicated that more permanent piezometers should be installed in the outer downstream slopes of the berms.

Western intends to install new piezometers in the outer slopes of the earth berms along cross-sections that will be used in an updated numerical slope stability analysis. The new piezometers will be installed in borings with casings and bentonite seals above the screen interval to prevent surface water intrusion and interference. Piezometers will be installed in borings at selected cross-sections in the following earth berms:

- Pond 7/8 west berm
- Pond 6 west berm
- Pond 9 north berm

The water levels will be recorded monthly and when stable (likely 3 months), the water levels will be incorporated into the updated numerical slope stability analysis. Afterward, the water levels in the piezometers will be measured as appropriate and the water level data reported in the Facility Wide Groundwater Report.

Due to access constraints on the outer slopes, the borings for the piezometers will likely be hand-augured at each location. Soil samples will be collected using a hand-drive sampler as needed in the hand-auger borings.

The hand-auger will be used to advance a 4-inch diameter hole to depths required to install the new piezometer and collect the soil samples. The hand-drive sampler has a barrel that holds brass sleeves for the soil samples. The barrel is driven into the soil and then retrieved.

The brass liners are extracted from the barrel, sealed using Teflon™ patches, plastic caps, and tape. Each sleeve will be sealed in the field, labeled as required, and provided to a geotechnical laboratory for analysis. Soil analysis is expected to include:

- Soil characterization and classification
- West and dry unit weights with moisture content
- Atterberg Limits
- Sieve analysis
- Effective stress strength parameters (c' and Ø') from a triaxial sheer test

The soil data collected from this investigation will be used to update the numerical slope stability analysis. The cross-sections used in the 2002 and 2015 slope stability work will be used in the updated slope stability evaluation, with minor adjustments to the locations to evaluate the critical cross section. The following will be incorporated into the updated slope stability evaluation:

- Morgenstern Price limit-equilibrium analysis via GeoStudio 2012;
- Updated berm topography at slope stability cross-sections;
- Updated phreatic surface based on newly installed piezometers;
- Soil properties confirmed during the new geotechnical investigation; and
- Effective stress soil strength parameters cohesion (c) and angle of internal friction, phi (Ø).

The results will be prepared and submitted as an addendum to this report. The results will include the following:

- Description of the updated geotechnical parameters;
- Figure identifying the location of the geotechnical samples;
- Description of the slope stability work;
- Discussion of the phreatic surface and its potential affect on slope stability;
- Graphical output from the slope stability program; and
- Tabulated factor of safety for each critical cross-section.

4.3 Proposed Work Schedule

Western intends to install the new piezometers in the appropriate locations by the end of Q4 2017. Once the geotechnical report is available with the updated soil data described above, Western will prepare a revised numerical slope stability analysis. Western expects this work to be complete by the end of Q2 2018 and an addendum report prepared and submitted by the end of Q3 2018.

5.0 ONGOING IMPROVEMENT WORK

5.1 Water Use Reduction

Western is continually improving operations at the evaporation ponds. For example, Western has implemented several water saving measures at the process units to minimize the amount of water being routed to the evaporation ponds. As of November 2015, the flow rate of water to the evaporation ponds is approximately 150 gpm, down from the previous average of 340 gpm.

Part of the work included minimizing the reverse osmosis (RO) reject water flow to Pond 2. The majority of RO water is now directed to the cooling towers with the net effect of minimizing RO reject water to Pond 2.

5.2 Additional Evaporation

In 2014, Western added two additional evaporation blowers to improve evaporation rates at the ponds. As shown on Figure 2, two blower units are located on the west berm of Pond 2 and the two newer blower units are located on the west berm of Pond 3.

The evaporation blowers operate continuously during the peak evaporation season (about April through October) except when they are shut down for maintenance purposes or when the temperature makes evaporation inefficient. Western is internally evaluating additional improvements to enhance evaporation at the ponds.

TABLES

Table 1: Summary of Triaxial Shear Results 2002 Investigation

Sample #	Boring	Depth	phi (degrees)	Cohesion (psi)	Unit Weight (pcf)	Description
Shallow Sample Results						
38631	2	5-7	10	5	137.3	Pond 7 West berm
38640	8	5-7	2	6	140.1	Pond 9 Southwest berm
38645	9	5-7	8	5	137.4	Pond 6 South berm
38650	10	5-7	7	5.5	139.5	Pond 6 West berm
Native Ground Sample Results						
38641	8	10-12	0	8	141.3	Pond 9 Southwest berm
38647	9	15-16	0	7	138.9	Pond 6 South berm
38648	9	16-17	2	2	139.9	Pond 6 South berm
38652	10	15-17	0	4	141.4	Pond 6 West berm

Notes:
Results from Precision Engineering investigation 2002.

Table 2: Previous Slope Stability Summary

Section	Location	Height	Width	Freeboard	Factor of Safety FOS
1	9-SW	5	11	2.5	5.5
2	9-W	4	8	2.2	10.0
3	6-SW	7.6	10	2.2	3.0
4	6-W	7.6	10	2.2	3.0
5	*N/A**	4.2	10	0.9	6.2
6	9-N	5.5	7	1	10.0
7	8-W	7.3	16	1	6.0
8	7-W	7.3	12	2.7	4.9
9	7-W	5.5	12	2.6	7.0
10	11-E	3.9	12	3	10.0
11	12A-S	5	10	2	9.4
12	8-S	8.6	9	3	2.5
13	3-N	4	6	1	5.4

Notes:
Summary of Results from Precision Engineering 2002 report.
* Section not shown on figure in Precision Engineering 2002 report. Location unknown.

Table 3: Summary of 2015 Slope Stability Analysis

Berm	FOS before repair work	FOS after repair work	Factor of Safety remodeled cross section
Pond 6 North	4.3	4.6	
Pond 6 West	4.2	4.5	
Pond 7 West	4	N/A[1]	
Pond 8 North	4.1	4.6	
Pond 9 North	6.8	7.1	9.3[2]

Notes:

1. No change in berm conditions.
2. Used inputs from Precision 2002 stability analysis of the same section in the current modeling software.

FIGURES

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 1 – Cover Sheet.dwg ELundborg Plotted: Dec 17, 2015 – 9:02am

LOCATION MAP
N.T.S.

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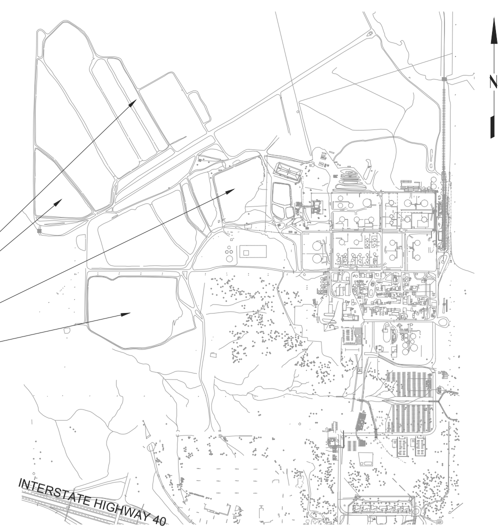
6b	POND BERM CROSS SECTIONS
7	ONGOING REPAIR (POND 9)
8	ONGOING REPAIR (PONDS 11, 12a, 12b)



VICINITY MAP
1" = 600'

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EVAPORATION POND UPGRADES
GALLUP REFINERY, NEW MEXICO

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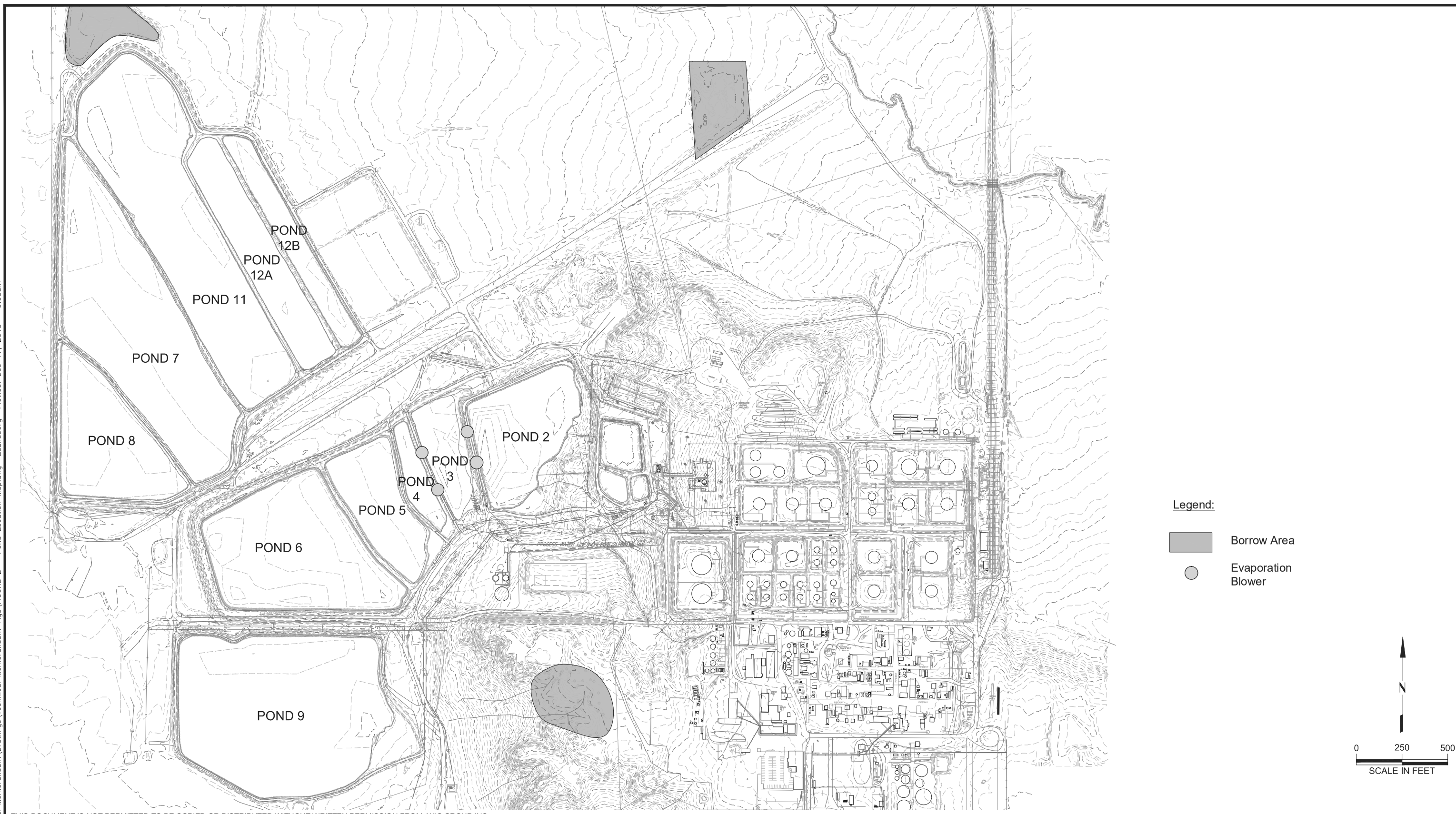
EVAPORATION PONDS UPGRADE
SITE LOCATION COVER SHEET

DRAWING NO.: 1



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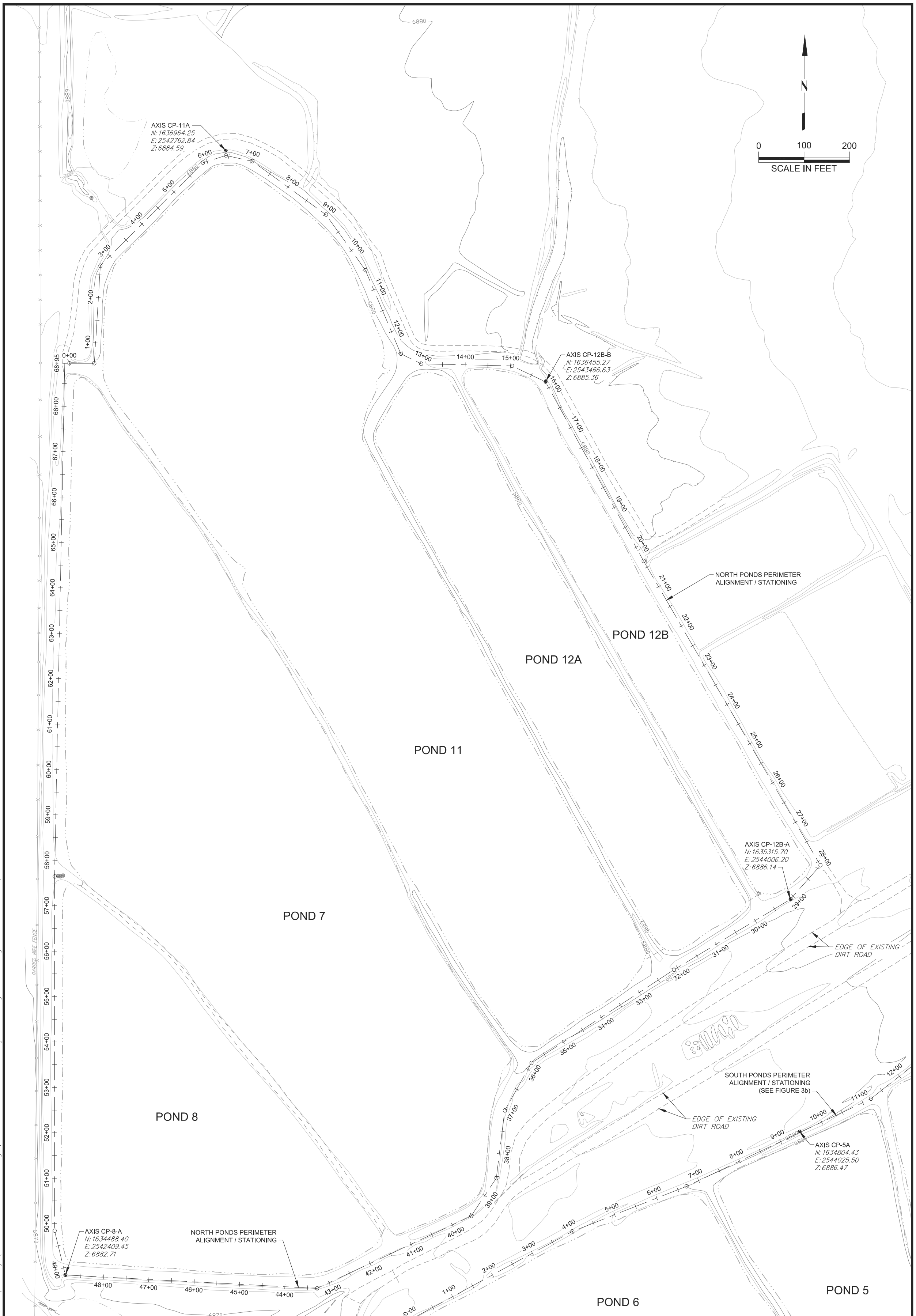
POND LOCATION MAP

DRAWING NO.: 2



SEE FIGURE 3b

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PRE-2014 TOPOGRAPHY
NORTH PONDS

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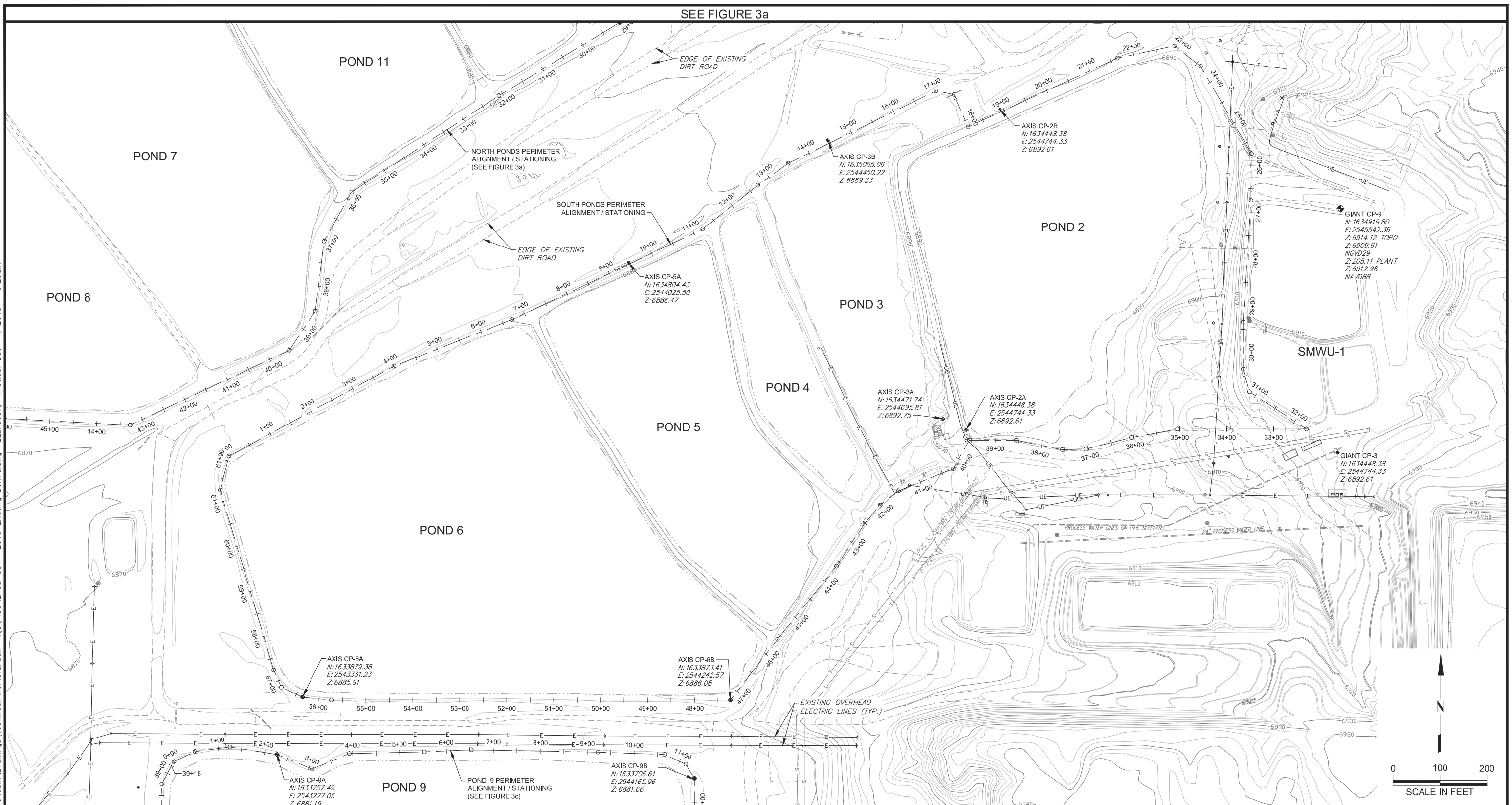
X:\15-112 — WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 3a — 2010 Existing Berms.dwg ELundborg Plotted: Dec 17, 2015 — 9:21am



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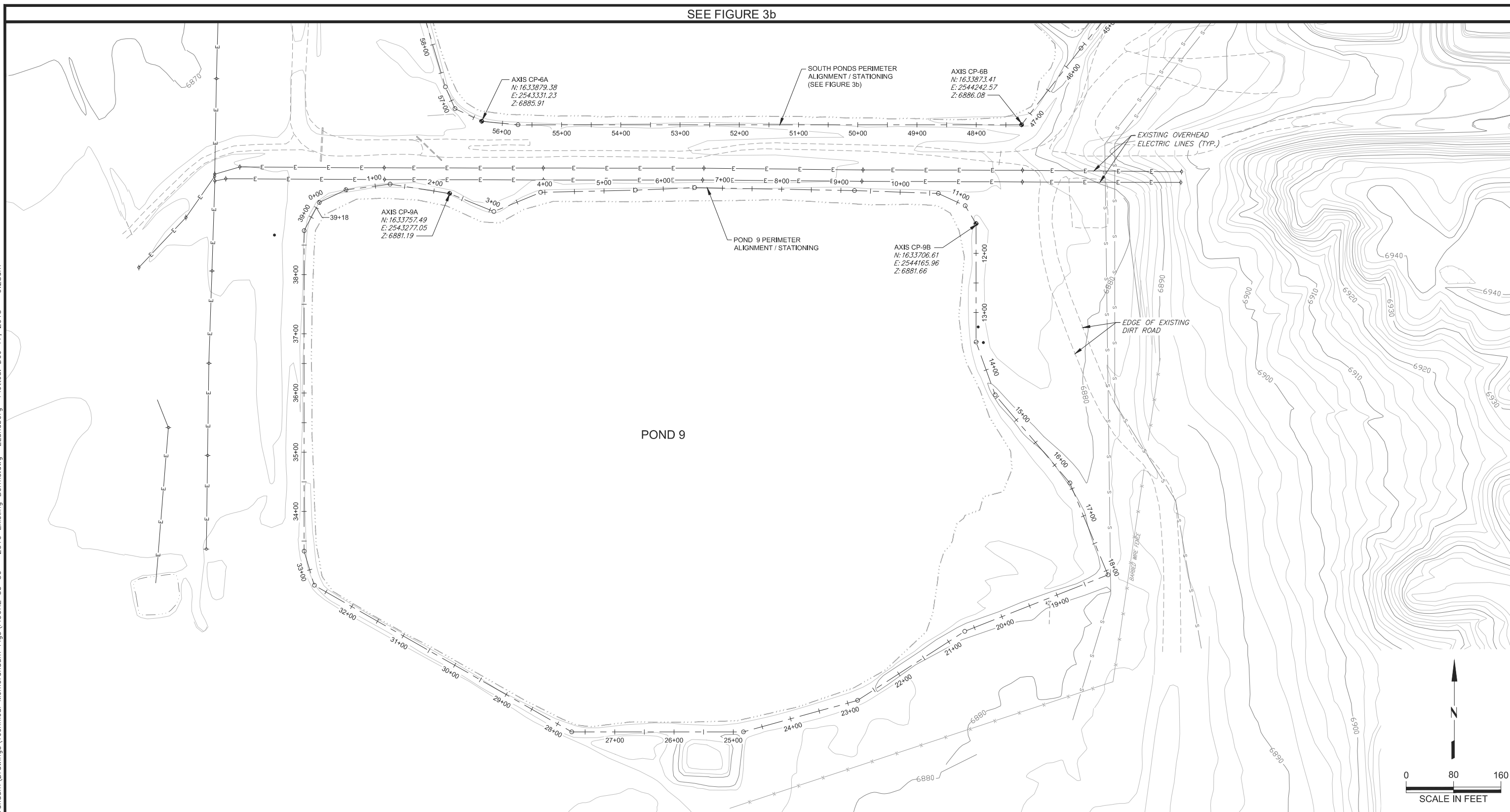
PRE-2014 TOPOGRAPHY
SOUTH PONDS

DRAWING NO.: 3b

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 3b-3c - 2010 Existing Berms.dwg ELundborg Plotted: Dec 17, 2015 - 9:29am

SEE FIGURE 3b



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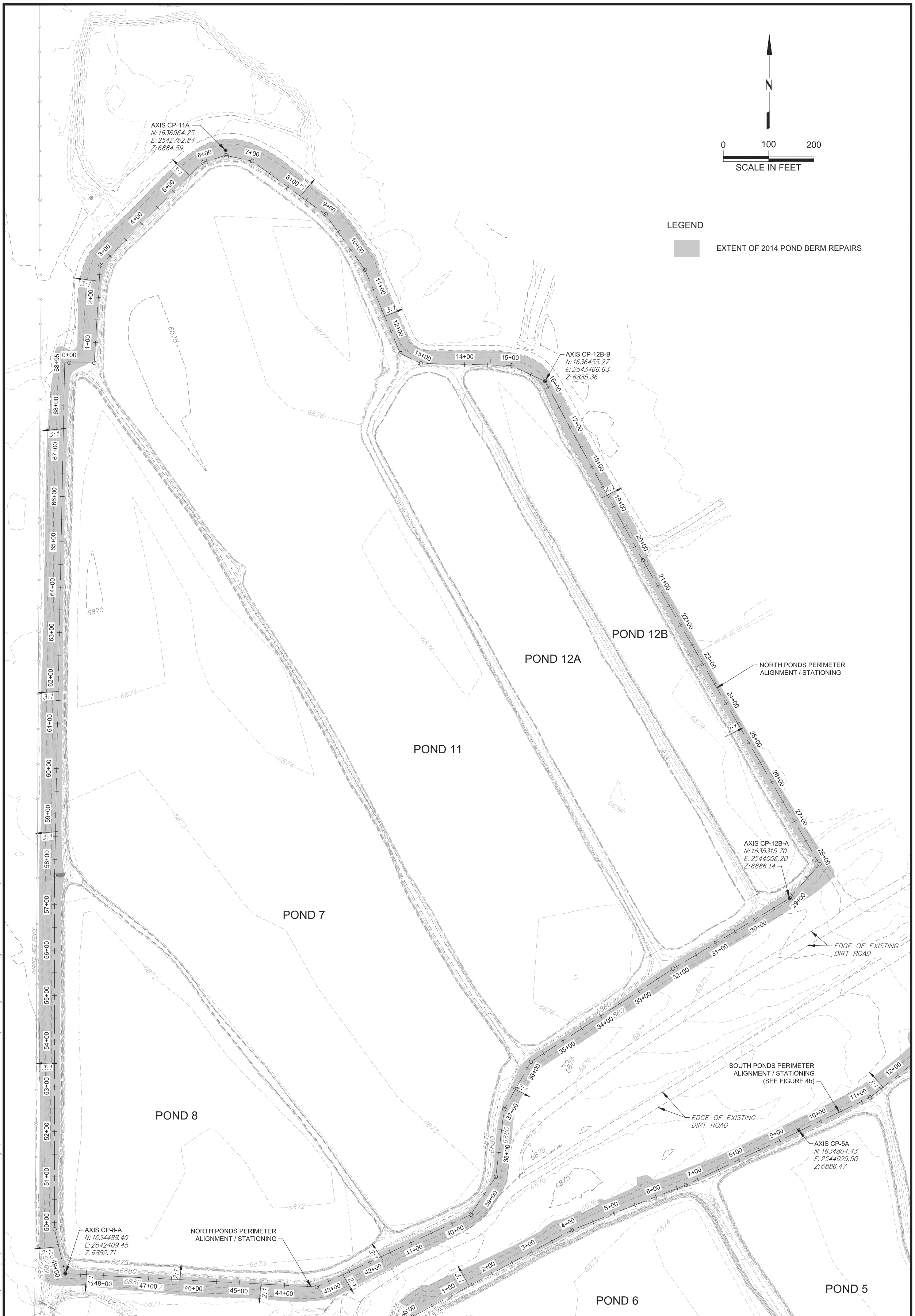
PRE-2014 TOPOGRAPHY
POND 9

DRAWING NO.: 3c



SEE FIGURE 4b

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2014 POND UPGRADES AND REPAIRS
NORTH PONDS

DRAWING NO.: 4a

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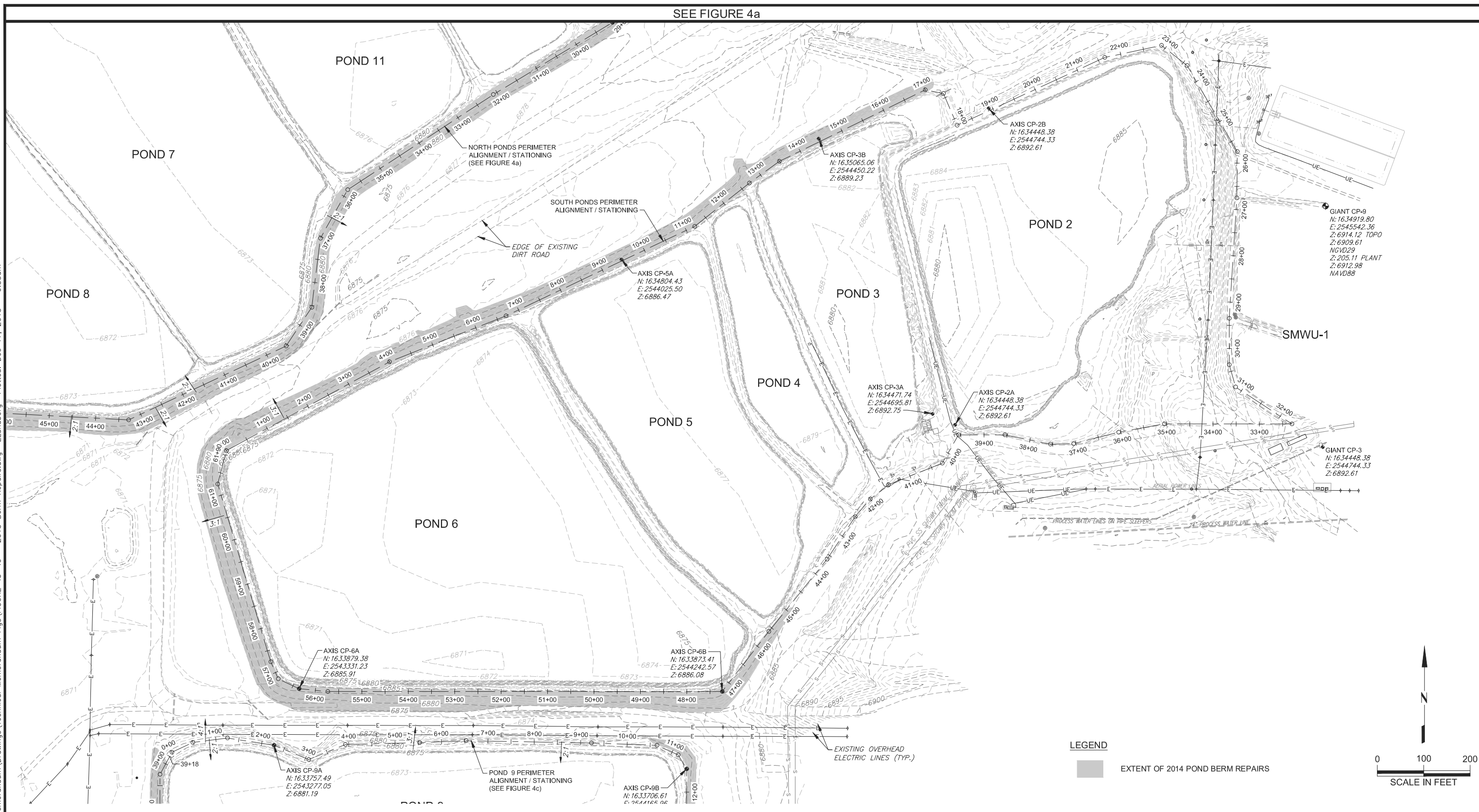
X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4a – 2013 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 – 9:31am

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4b-4c – 2013 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 – 9:33am

SEE FIGURE 4a



SEE FIGURE 4c

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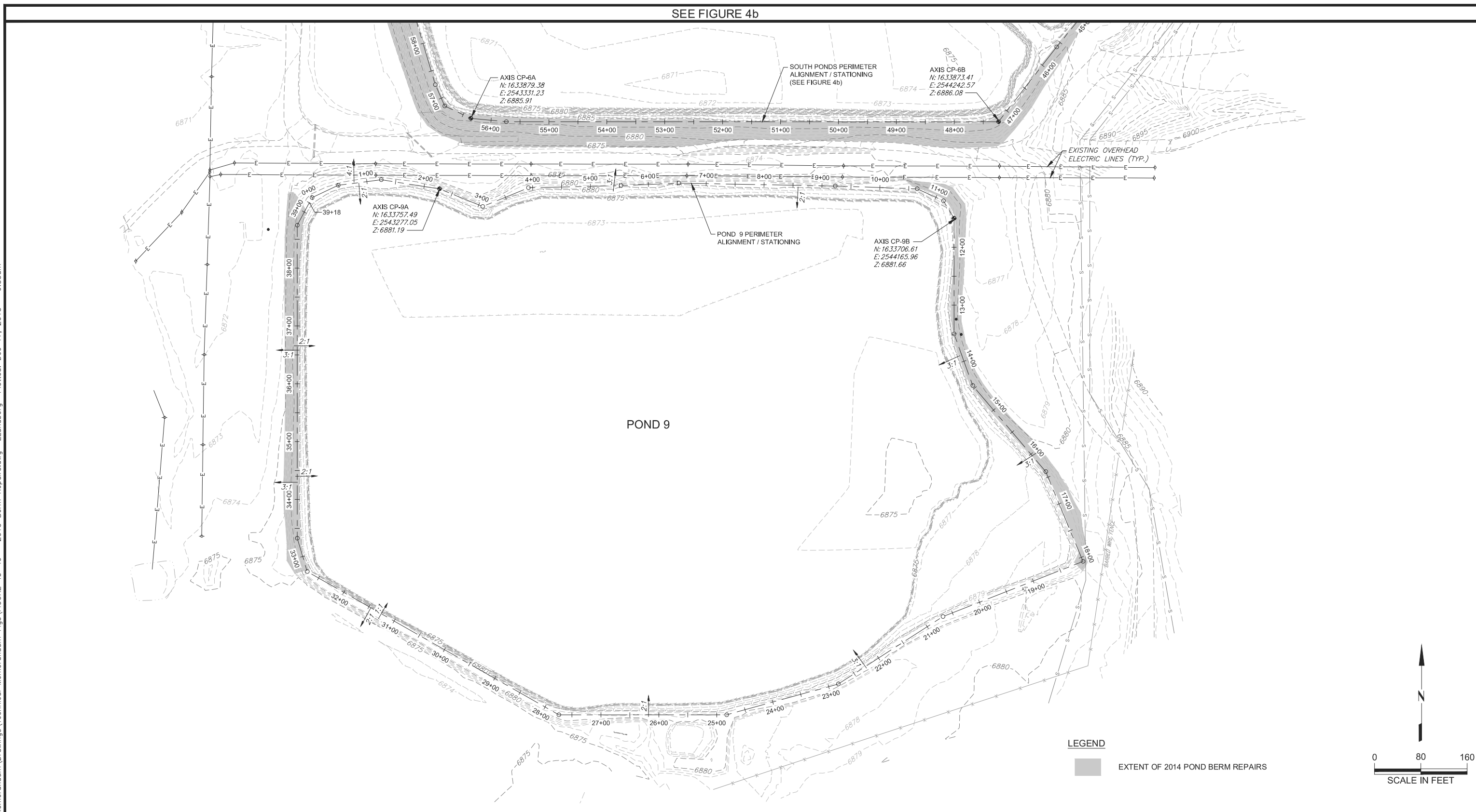
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2014 POND UPGRADES & REPAIRS
SOUTH PONDS

DRAWING NO.: 4b

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4b-4c - 2013 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 - 9:33am

SEE FIGURE 4b



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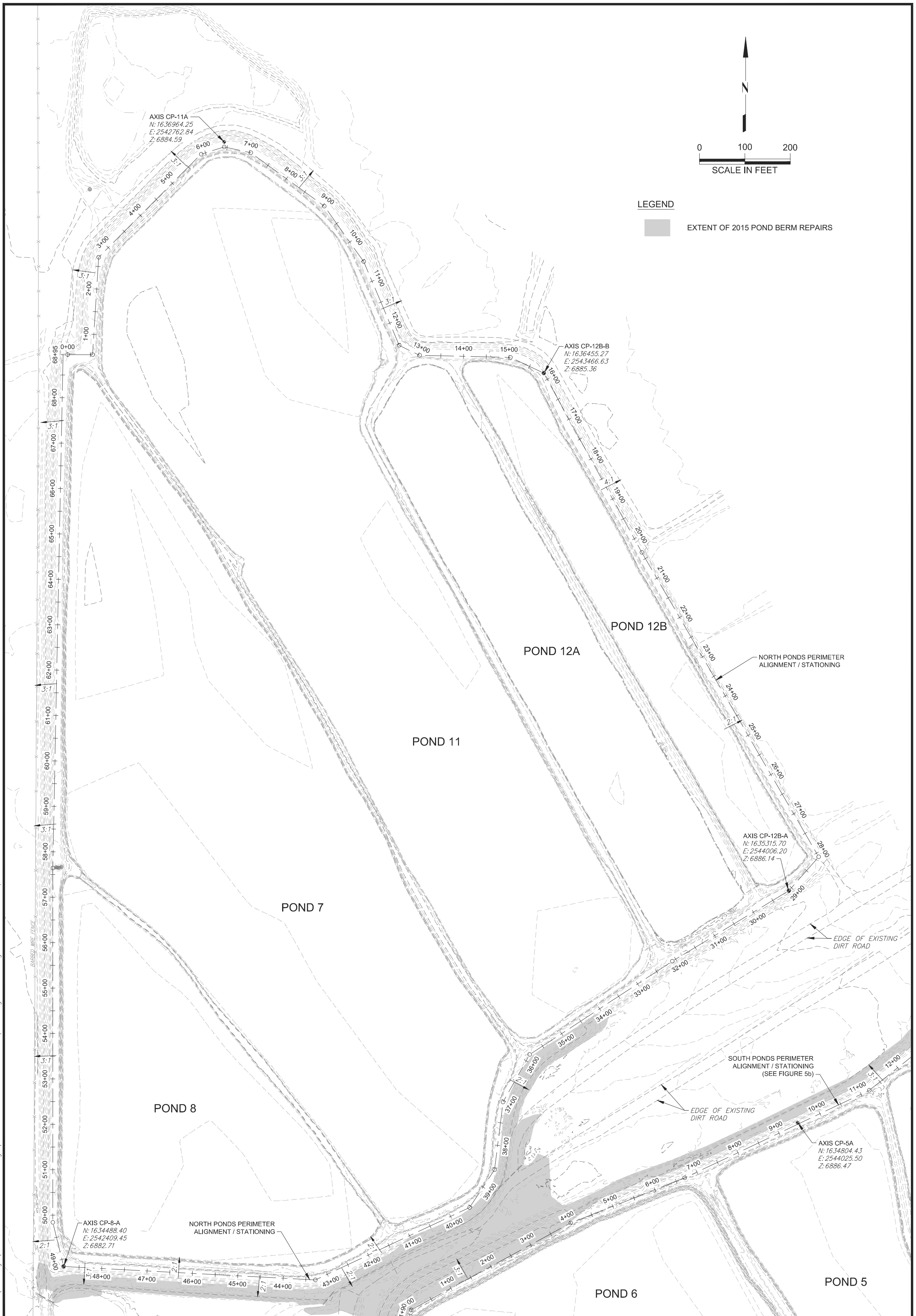
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2014 POND UPGRADES & REPAIRS
POND 9

DRAWING NO.:
4c



SEE FIGURE 5b

AXIS GROUP Inc.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
NORTH PONDS

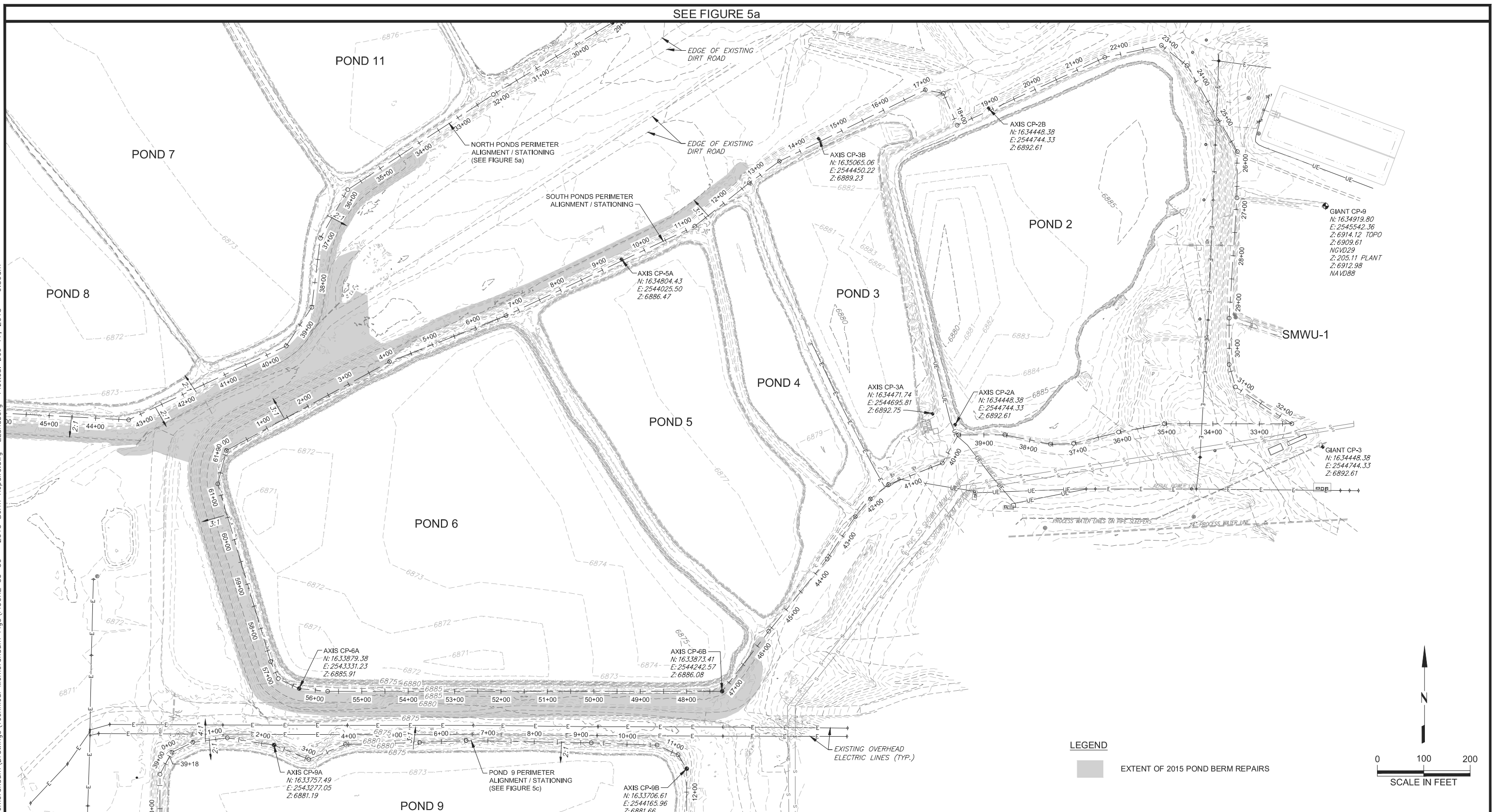
DRAWING NO.: 5a

PROJ. NO.: 15-112	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

X:\15-112 — WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5a — 2015 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 — 9:36am

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5b-5c – 2015 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 – 9:39am

SEE FIGURE 5a



SEE FIGURE 5c

NO.	BY	DATE:	REVISION

AXIS GROUP
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SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

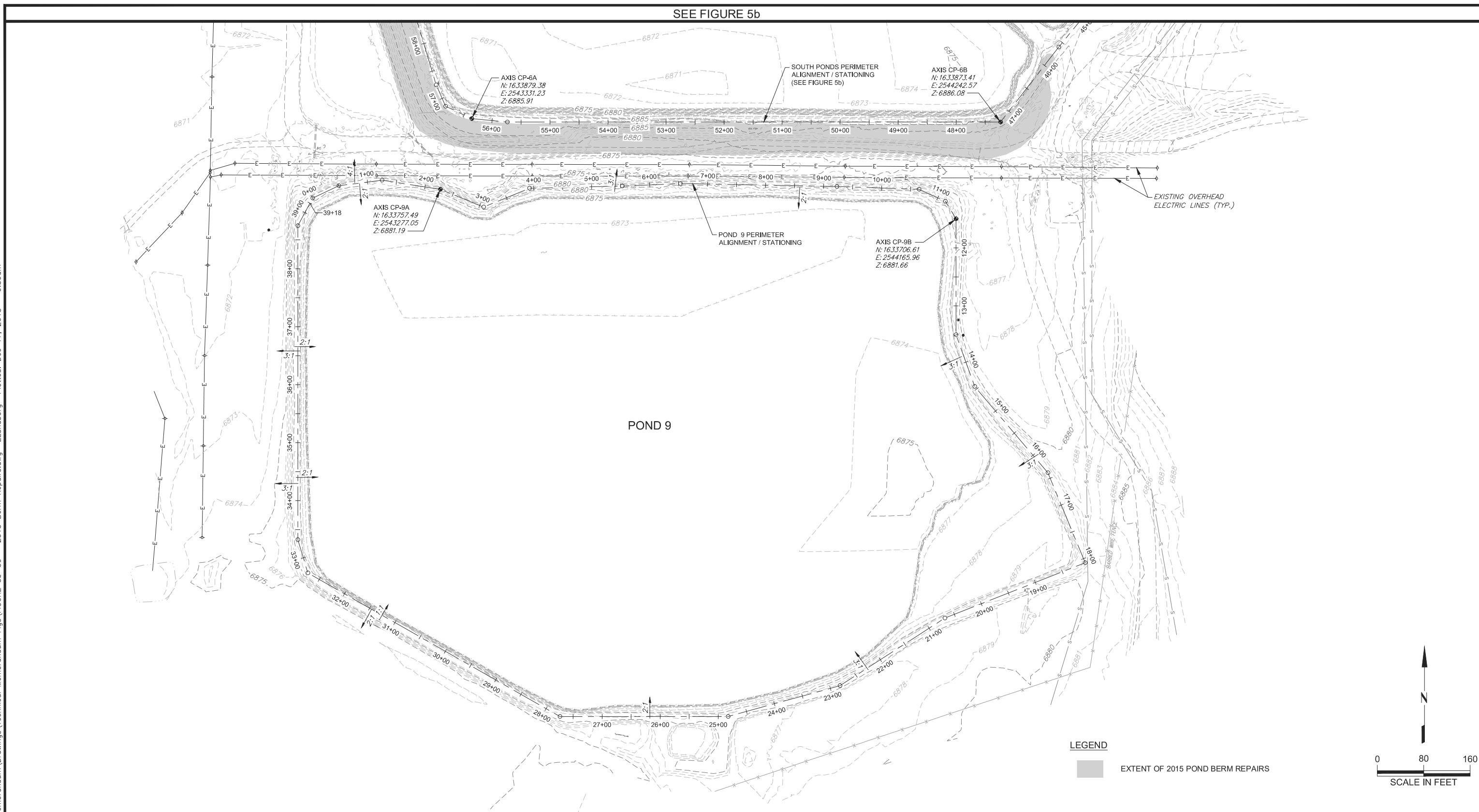
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
SOUTH PONDS

DRAWING NO.: 5b

SEE FIGURE 5b



LEGEND

EXTENT OF 2015 POND BERM REPAIRS

0 80 160
SCALE IN FEET

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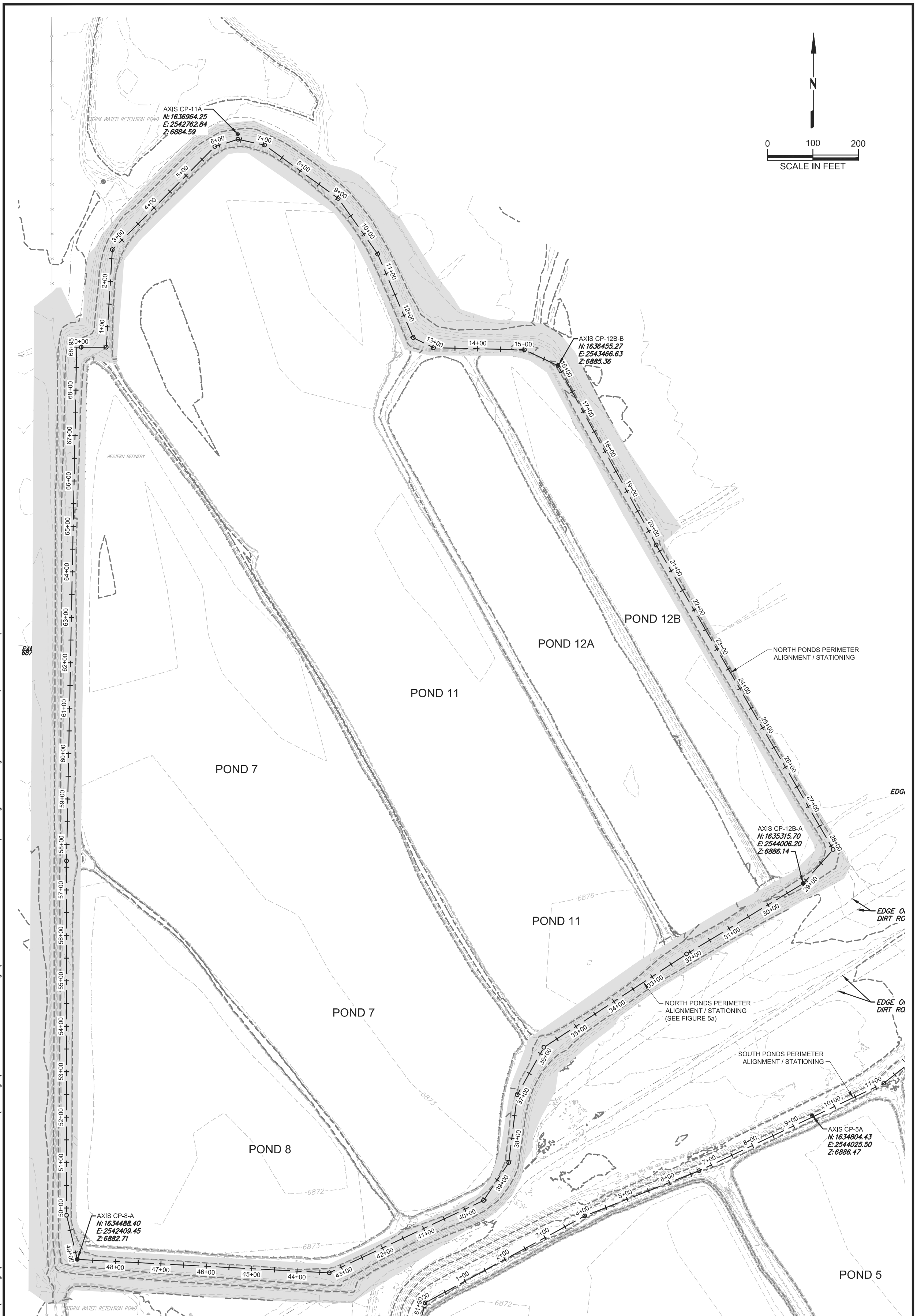
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
POND 9

DRAWING NO.: 5c

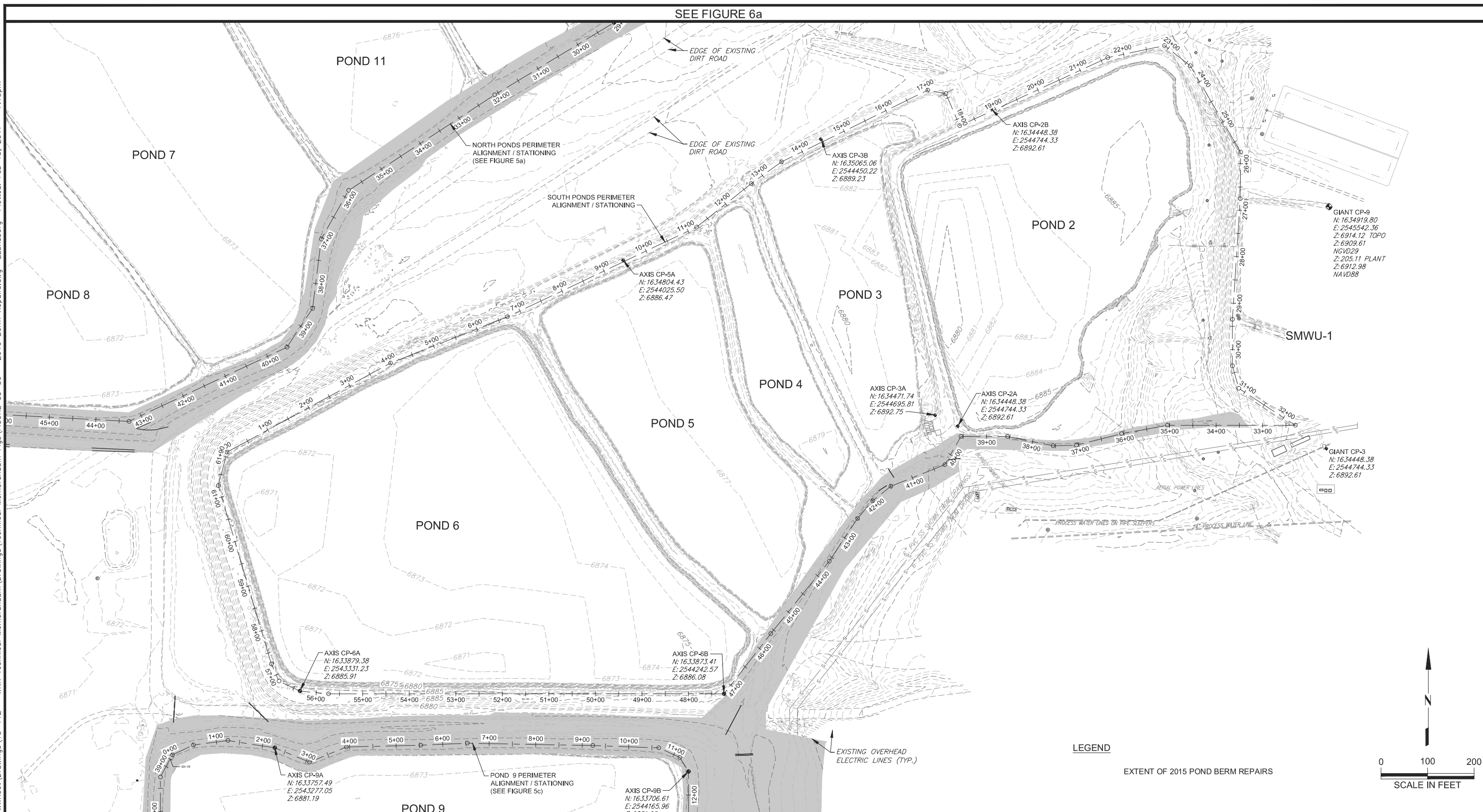


REFERENCE:
BASE INFORMATION TAKEN FROM: WESTERN REFINING SOUTHWEST, INC.
DRAWING NUMBER:

AXIS GROUP Inc. 1101 WEST MINERAL AVENUE, SUITE 102, LITTLETON, COLORADO. 80120, (303) 332-5757	WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO	DRAWING NO.:
PROJ. NO.: 15-112 DATE: 11-06-2015 DRAWN BY: JAY CHECKED BY: JWB	2016 POND UPGRADES & REPAIRS NORTH PONDS	6a

\\dav.syncedtool.com@SSL\DavWWWRoot\Drawings\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5b-5c – 2016 Berm Repairs.dwg ELundborg Plotted: Feb 15, 2017 – 7:18pm

SEE FIGURE 6a



SEE FIGURE 6c

NO.	BY	DATE:	REVISION

AXIS GROUP INC.
1101 WEST MINERAL AVENUE
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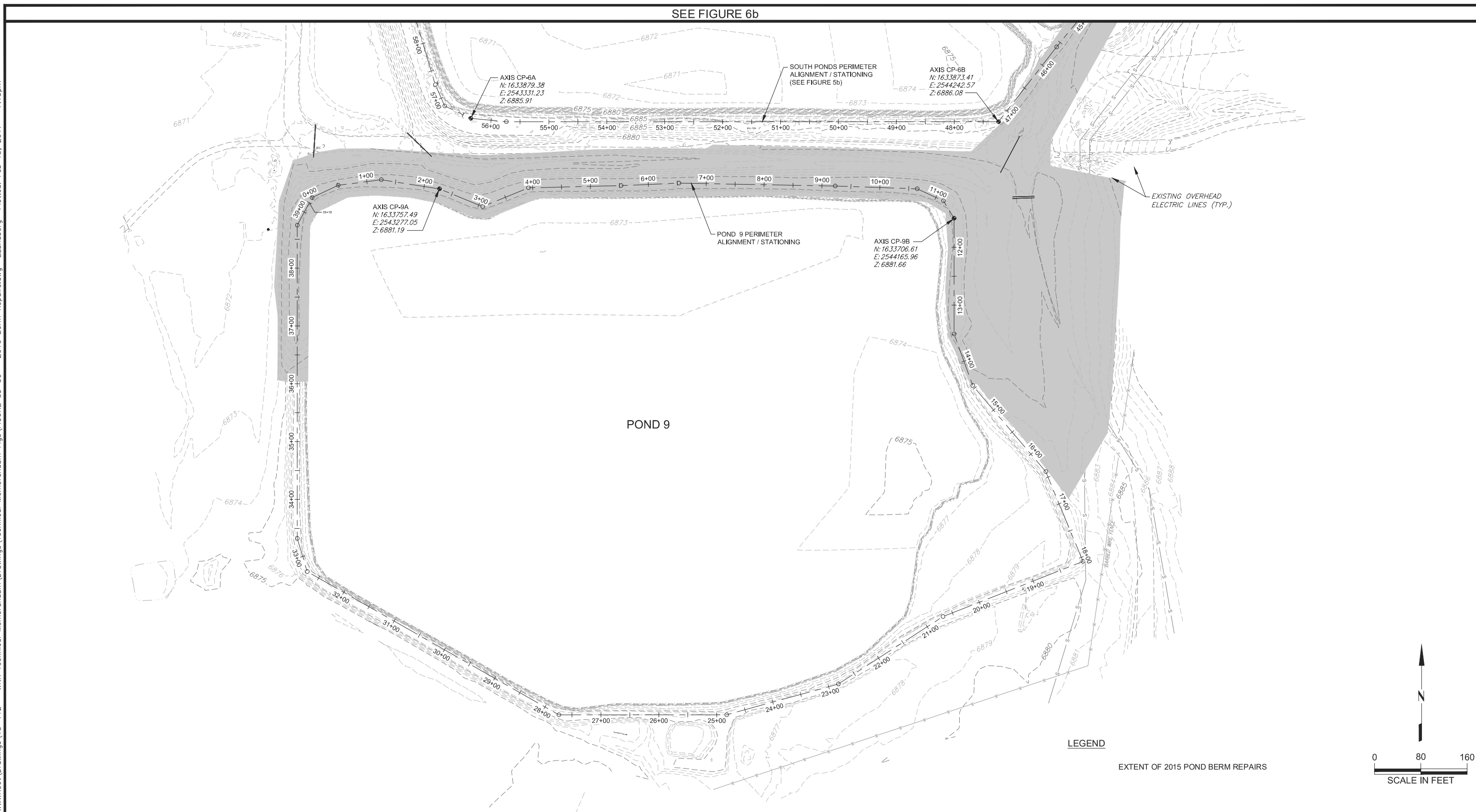
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2016 POND UPGRADES & REPAIRS
SOUTH PONDS

DRAWING NO.: 6b

SEE FIGURE 6b



NO.	BY	DATE:	REVISION

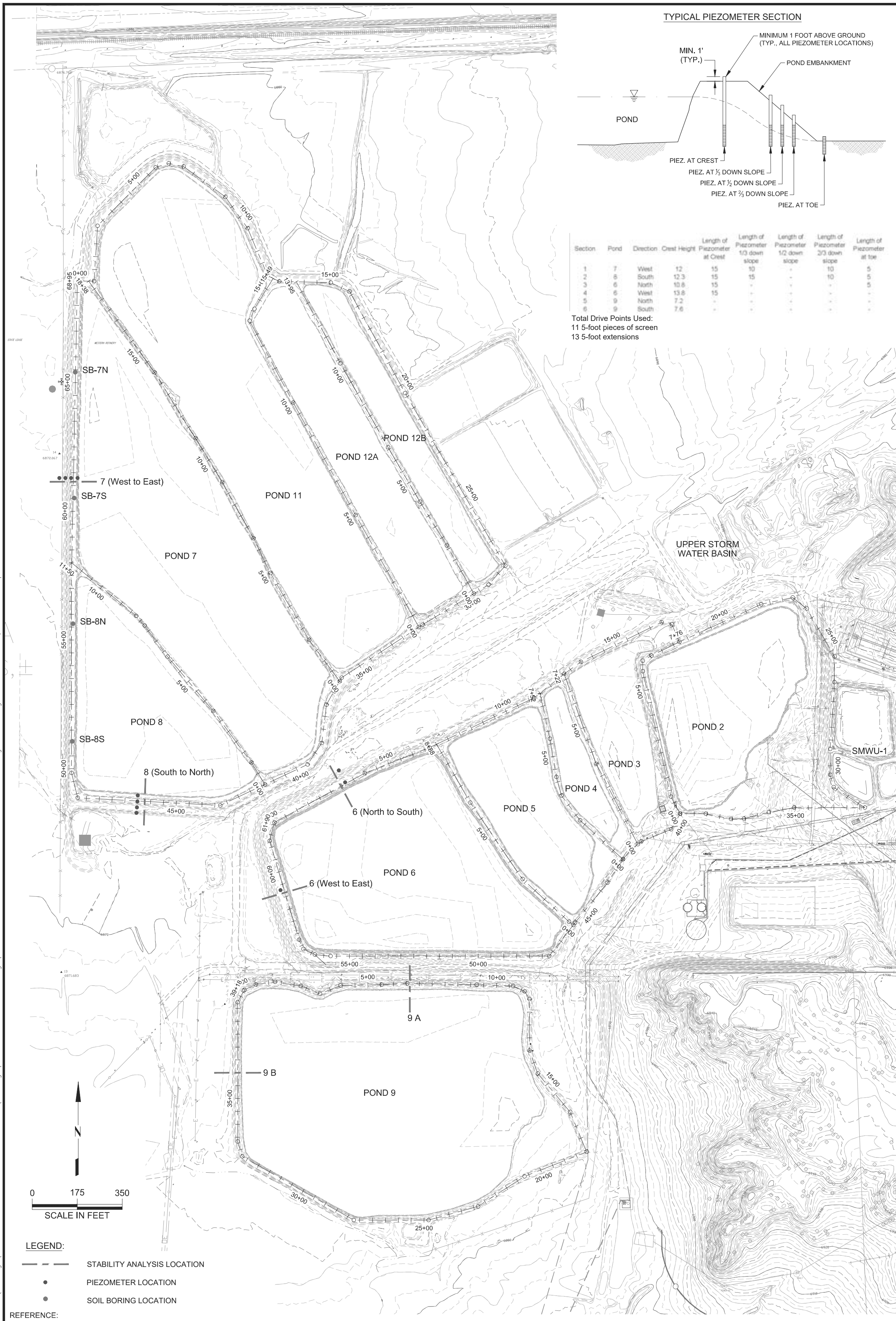
AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112 | DATE: 2-7-2017 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2016 POND UPGRADES & REPAIRS
POND 9

DRAWING NO.: 6c



Section	Pond	Direction	Crest Height	Length of Piezometer at Crest	Length of Piezometer 1/3 down slope	Length of Piezometer 1/2 down slope	Length of Piezometer 2/3 down slope	Length of Piezometer at toe
1	7	West	12	15	10	-	10	5
2	8	South	12.3	15	15	-	10	5
3	6	North	10.8	15	-	-	-	5
4	6	West	13.8	15	-	-	-	-
5	9	North	7.2	-	-	-	-	-
6	9	South	7.6	-	-	-	-	-

Total Drive Points Used:
11 5-foot pieces of screen
13 5-foot extensions

LEGEND:

- STABILITY ANALYSIS LOCATION
- PIEZOMETER LOCATION
- SOIL BORING LOCATION

REFERENCE:
BASE INFORMATION TAKEN FROM: WESTERN REFINING SOUTHWEST, INC.
DRAWING NUMBER:

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LITTLETON, COLORADO. 80120
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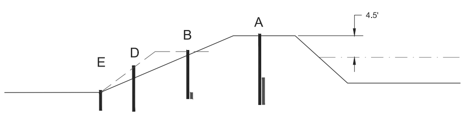
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

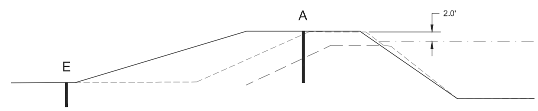
POND 7&8 BORING LOCATIONS
DRIVE POINT PIEZOMETER LOCATIONS
NUMERICAL SLOPE STABILITY SECTION LOCATIONS

DRAWING NO.: 7a

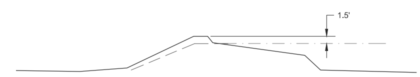
PROJ. NO.: 15-010-04 | DATE: 2-7-2017 | DRAWN BY: JAY | CHECKED BY: JWB



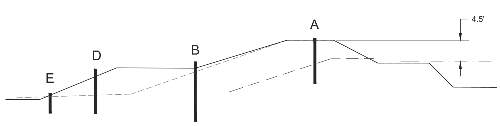
Pond 7 Cross Section (West to East)



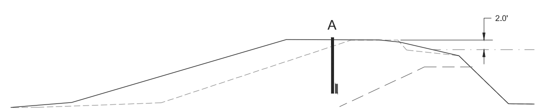
Pond 6 Cross Section (North to South)



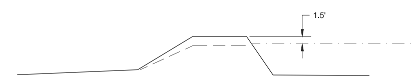
Pond 9 A Cross Section (North to South)



Pond 8 Cross Section (South to North)



Pond 6 Cross Section (West to East)



Pond 9 B Cross Section (East to West)

LEGEND

- 2015 GRADED SURFACE AFTER BERM REPAIRS
- 2014 GRADED SURFACE AFTER REPAIR WORK
- PRE 2014 GRADED SURFACE
- WATER SURFACE
- E — PIEZOMETER, I.D. LABEL AND DETECTED WATER LEVEL

0 10 20
SCALE IN FEET

NO.	BY	DATE:	REVISION

AXIS GROUP INC.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
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PROJ. NO.: 15-112 | DATE: 2-7-2017 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

EVAPORATION POND UPGRADES
POND BERM CROSS SECTIONS

DRAWING NO.: 7b

APPENDICES

APPENDIX A

Photographs