Arizona Public Service Four Corners Power Plant

Lined Decant Water Pond

Location Restrictions Demonstration Report

Prepared for :
Arizona Public Service

AECOM Job No. 60587725
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Certification Statement for Location Restrictions:

- **40 CFR § 257.60 – Placement above the uppermost aquifer**
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- **40 CFR § 257.64 – Unstable Areas**

CCR Unit: Arizona Public Service Company; Four Corners Power Plant; Lined Decant Water Pond

I, Alexander Gourlay, being a Registered Professional Engineer in good standing in the State of New Mexico, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR unit, that the demonstration regarding the location of the CCR unit less than 1.52 meters (5 feet) above the upper limit of the uppermost aquifer, the demonstration regarding the location of the CCR unit in the wetlands, the demonstration regarding the location of the CCR unit within 60 meters (200 feet) of the outermost damage zone of a fault that has had a displacement in Holocene time, the demonstration regarding the location of the CCR unit in a seismic impact zone, and the demonstration that the location of the CCR unit is not in an unstable area, as included in the Location Restrictions Demonstration Report dated October 8, 2018 meet the requirements of 40 CFR § 257.60(a), § 257.61(a), § 257.62(a), § 257.63(a), and § 257.64(a).

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October 8, 2018

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1 Introduction

Arizona Public Service Company (APS) contracted AECOM to assist in the location restrictions demonstrations of the existing coal combustion residual (CCR) surface impoundments at the Four Corners Power Plant (FCPP, the Plant) within the Navajo Nation, near Fruitland, New Mexico. Figure 1-1 shows the location of the CCR Impoundments at the FCPP. This Demonstration Report documents location-specific conditions relevant to the Lined Decant Water Pond (LDWP).

1.1 Report Purpose and Description

The purpose of this report is to document the location restrictions demonstration for the LDWP. The LDWP is an existing CCR surface impoundment operated by APS. In 2015, the United States Environmental Protection Agency (EPA) finalized a rule (Rule) regulating CCRs under subtitle D of the Resource Conservation and Recovery Act (RCRA). As part of this Rule, owners and operators of existing CCR surface impoundments must obtain a certification from a qualified professional engineer stating that the demonstrations for the CCR unit meet the requirements relative to the uppermost aquifer, wetlands, fault areas, seismic impact zones, and unstable areas.

1.2 EPA Regulatory Requirements

On April 17, 2015 the United States Environmental Protection Agency issued 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule (the Rule). Sections 257.60 through 257.64 define location restriction criteria for existing CCR surface impoundments and require the owner or operator of the CCR unit to demonstrate that the unit meets minimum requirements for:

a) Placement above the uppermost aquifer (§ 257.60);
b) Location outside wetlands (§ 257.61);
c) Location more than 60 meters (200 feet) from the outermost damage zone of a fault that has had displacement in Holocene time (§ 257.62);
d) Location outside seismic impact zones (§ 257.63);
e) Location away from unstable areas (§ 257.64).

Existing CCR surface impoundments, such as the LDWP, are required to demonstrate compliance with the location restrictions no later than October 17, 2018. An owner or operator unable to demonstrate compliance is prohibited from placing CCR in the CCR unit under either 40 CFR § 257.60(c)(4), § 257.61(c)(4), § 257.62(c)(4), § 257.63(c)(4), or § 257.64(c)(4), as applicable.

1.3 Report Organization

This Demonstration Report is organized into the following sections:

Report Section	Applicable CFR 40 Part 257 Citation
• Section 1 – Introduction	
• Section 2 – Placement Above the Uppermost Aquifer	§ 257.60 Placement above the uppermost aquifer
• Section 3 – Location Relative to Wetlands	§ 257.61 Wetlands
• Section 4 – Location Relative to Fault Areas	§ 257.62 Fault areas

- Section 5 – Location Relative to Seismic Impact Zones § 257.63 Seismic impact zones
- Section 6 – Location Relative to Unstable Areas § 257.64 Unstable areas
- Section 7 – Conclusions
- Section 8 – Limitations
- Section 9 – References
- Appendix A – Original Construction Plans
- Appendix B – Wetlands Map
- Appendix C – Unified Hazard Tool Summary

1.4 Facility Description

The FCPP is an electric generating station located within the Navajo Nation, near Fruitland, New Mexico. The FCPP is operated by APS and owned by a consortium of utility companies. The FCPP consists of two coal-fired electrical generating units, Units 4 and 5. Units 1, 2, and 3 ceased generation in 2013 and were then decommissioned. The two generating units are cooled by water from Morgan Lake, a man-made reservoir located immediately north of the Plant. Five existing CCR units are located at the FCPP: the Combined Waste Treatment Pond (CWTP) located immediately east of the Plant, the Lined Ash Impoundment (LAI) located approximately 1 mile west of the Plant, the Lined Decant Water Pond (LDWP) located approximately 1.5 miles west of the Plant and adjacent to the LAI, the Upper Retention Sump located immediately southeast of the Plant, and the Dry Fly Ash Disposal Area (DFADA), a landfill located approximately 2 miles southwest of the Plant and south of the LAI. Figure 1-1 shows the locations of these units.

The LDWP was constructed in 2003 over old Ash Pond 3 and consists of a reservoir basin formed by a perimeter embankment. The LDWP has a total surface area of approximately 45 acres. The reservoir is lined with two geomembrane layers separated by a leak detection/collection layer that drains to an evacuation sump at the southwest corner of the pond. The reservoir is formed on all sides by a perimeter embankment. The perimeter embankment is an extension of, and incorporates, the pre-existing perimeter embankments of Ash Pond 3 on the south and west sides. On the east side, the perimeter embankment ties directly into the completed west embankment of the LAI. On the north side, the perimeter embankment ties directly into the completed north toe buttress area of the west embankment of the LAI.

The primary purpose of the LDWP is to receive and store water that decants from the LAI. The LDWP also receives direct precipitation and pump back of intercepted subsurface flows from the Pond 3 Pumphouse. The LDWP acts as a temporary storage reservoir for the collected water before it is pumped back to the plant for reuse.

2 Placement Above the Uppermost Aquifer

40 CFR § 257.60 requires that existing CCR surface impoundments must be constructed with a base that is located no less than 1.52 meters (5 feet) above the upper limit of the uppermost aquifer, unless the owner or operator demonstrates that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevation (including the seasonal high water table).

Uppermost aquifer is defined by the Rule to mean the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

2.1 Methodology

This Location Restrictions Demonstration Report includes an assessment of the separation between the base of the LDWP and the uppermost aquifer based on available data. The following information was reviewed to assess the vertical location of the LDWP relative to the uppermost aquifer:

- Preconstruction topographic conditions shown on construction plans (included in Appendix A)
- APS as-built drawings for the LDWP (APS 2004b)
- CCR Monitoring Well Network Report and Certification (AECOM 2017)
- Annual Groundwater Monitoring and Corrective Action Report for 2017 (Amec Foster Wheeler 2018)

2.2 Discussion and Conclusion

2.2.1 Base Elevation of the CCR Unit

The LDWP is a lined impoundment constructed west of the LAI on top of Ash Pond 3. The base of the LDWP is defined by two 60-mil HDPE geomembrane liners installed on the top surface of old Ash Pond 3 as part of the LDWP construction (APS 2004b). The base of the LDWP slopes from approximate EL 5206 feet (NGVD29, EL 5209 feet NAVD88) in the northeast corner to a low point at approximate EL 5202 feet (NGVD29, EL 5205 feet (NAVD88) in the southwest corner of the impoundment.

2.2.2 Groundwater Elevations

Monitoring wells MW-7, MW-8, MW-40R, MW-61, MW-75, and MW-76 were installed to monitor groundwater in the native soils (Lewis shale) underlying the ash disposal area in the vicinity of the LDWP (Figure 2-1). Monitoring wells MW-54 and MW-60 do not meet criteria for inclusion in the CCR groundwater monitoring program, but provide useful groundwater elevation data and are shown on Figure 2-1; The wells are labeled as "supplementary" wells, consistent with terminology used in the Annual Groundwater Monitoring and Corrective Action Report for 2017 (Amec Foster Wheeler 2018).

Table 1 presents well data and the water level elevations in the wells monitored in the vicinity of the LDWP (AECOM 2017, AECOM 2018, and Amec Foster Wheeler 2018). Table 2 presents data from the open standpipe piezometer in the northeast corner of the LDWP.

Table 1 – Well Data and Groundwater Elevations (ft)[1]

	Well Name							
	MW-7	MW-8	MW-40R	MW-54	MW-60	MW-61	MW-75	MW-76
Location Relative to the LDWP	South	Southwest	Northwest	East	Northwest	West	West	West
Surface Elevation (ft)	5148.29	5120.85	5134.83	5218.38	5141.50	5126.59	5124.80	5114.30
Bottom of Screen (ft)	5113.62	5072.81	5110.53	5127.38	5117.16	5092.39	5085.78	5087.50
Screened In	Alluvium, Weathered Shale	Weathered, Unweathered Shale	Weathered Shale	Weathered Shale	Weathered Shale	Weathered Shale	Alluvium, Weathered Shale	Alluvium

Measurement Date	MW-7	MW-8	MW-40R	MW-54[3]	MW-60	MW-61	MW-75	MW-76
11/3-11/9, 11/14/2015	5121.97	5076.00	Dry	NM[4]	5129.69	5104.49	NI[2]	NI[2]
4/25/2016	5122.28	5077.80	5111.73	NM[4]	5128.65	5104.55	NI[2]	NI[2]
6/20/2016	NM[4]	NM[4]	NM[4]	5148.80	NM[4]	NM[4]	NI[2]	NI[2]
9/12/2016	5123.71	5075.45	5112.53	NM[5]	5130.08	5103.64	NI[2]	NI[2]
9/16/2016	NM[4]	NM[4]	NM[4]	5148.37	NM[4]	NM[4]	NI[2]	NI[2]
10/19-10/20/2016	5122.96	5074.49	5112.71	NM[4]	5129.82	5103.25	NI[2]	NI[2]
1/31-2/1/2017	5126.24	5075.62	5113.09	NM[4]	5130.07	5103.09	NI[2]	NI[2]
5/1/2017	5128.49	5075.97	5112.96	NM[4]	5129.67	5105.83	5102.32	Dry
9/9/2017	5129.35	5075.17	5112.25	NM[4]	5129.34	5102.38	5101.78	5088.47
10/11/2017	5129.60	5075.07	5113.29	NM[4]	5129.63	5102.40	5101.85	Dry
8/9/2018	NM[4]	NM[4]	NM[4]	5147.25	NM[4]	NM[4]	NM[4]	NM[4]

Highest Recorded Groundwater Elevation (ft)	5129.60	5077.80	5113.29	5148.80	5130.08	5105.83	5102.32	5088.47

1) Elevations are presented in NAVD88.
2) NI = Not installed. Monitoring wells MW-75 and MW-76 were installed in March 2017.
3) Groundwater elevation data for monitoring well MW-54 was provided by APS (internal communication, APS 2018b).
4) NM = The groundwater elevation was not measured on the date shown.

Table 2 presents data for piezometers installed around the LDWP and screened in fly ash and native soil.

Table 2 – Open Standpipe Piezometer Groundwater Elevations (ft)[1]

	Piezometer Name							
	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25
Location Relative to the LDWP	South	Southwest	West	West	West	Northeast	Northeast	Northeast
Collar Elevation (ft)	~5216	~5216	~5216	~5216	~5216	5216.98	~5216	~5216
Bottom of Screen (ft)	~5151	~5130	~5128.5	~5133	~5151	~5155	~5184	~5190
Screened In	Fly Ash and Native Soil		Bottom Ash and Native Soil		Fly Ash and Native Soil	Fly Ash and Native Soil	Fly Ash	Fly Ash and Bottom Ash

Measurement Date	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25
1/28/2015	Dry	Dry	Dry	Dry	Dry	5157.56	Dry	Dry
4/28/2015	Dry	Dry	Dry	Dry	Dry	5157.22	Dry	Dry
7/6/2015	Dry	Dry	Dry	Dry	Dry	5157.43	Dry	Dry

Measurement Date	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25
1/15/2016	Dry	Dry	Dry	Dry	Dry	5157.34	Dry	Dry
4/18/2016	Dry	Dry	Dry	Dry	Dry	5157.18	Dry	Dry
7/13/2016	Dry	Dry	Dry	Dry	Dry	5157.16	Dry	Dry
10/10/2016	Dry	Dry	Dry	Dry	Dry	5157.18	Dry	Dry
1/18/2017	Dry	Dry	Dry	Dry	Dry	5157.19	Dry	Dry
4/17/2017	Dry	Dry	Dry	Dry	Dry	5157.16	Dry	Dry
7/17/2017	Dry	Dry	Dry	Dry	Dry	5157.03	Dry	Dry
10/16/2017	Dry	Dry	Dry	Dry	Dry	5157.07	Dry	Dry
Highest Recorded Groundwater Elevation (ft)	Dry	Dry	Dry	Dry	Dry	5157.56	Dry	Dry

1) Elevations are presented in NGVD29 (NAVD88 ≈ NGVD29 + 3 feet).

2.2.3 Draining of Old Ash Pond 3

APS undertook several measures to ensure and verify that phreatic surface within ash contained in old Ash Pond 3 had lowered significantly prior to initial construction of the LDWP. These measures were:

1. Gravity drain-down – Old Ash Pond 3 was allowed to dry and drain, without addition of CCR or process water, from the mid-1980s until 2003.

2. Tamarisk – Tamarisk were allowed to grow on the top surface of old Ash Pond 3 after cessation of discharge in the 1980s. The tamarisk has a long tap root that tends to seek and draw up saline groundwater. The tamarisk were removed prior to construction of the LDWP in 2003.

3. Geotechnical investigation – Soil borings and cone penetration test soundings were advanced into old Ash Ponds 3 and 4 to verify their suitability as the foundation of the future LAI and LDWP in 2002.

2.2.4 Geotechnical Investigation of Old Ash Ponds 3 and 4

The primary purpose of the 2002 geotechnical investigation was to verify the suitability of the foundation for proposed construction of the west embankment of the LAI, which would overlie the eastern portion of old Ash Pond 3. One objective of the investigation was to identify the depth of the phreatic surface, if any, within the impounded ash of old Ash Pond 3. The investigation consisted of a soil boring program and a separate cone penetration test (CPT) program:

2002 Soil Borings in Ash Ponds 3 and 4 – APS as-builts for the 2003 construction of the LDWP (APS 2004b) document boring logs for six hollow-stem auger soil borings drilled on either side of, and within, the divider dike between old Ash Ponds 3 and 4. The as-builts depicting the plan location of the borings and the boring logs are presented in Figures A-1 and A-2 (Appendix A).

- Borings B-2 and B-4 – Drilled in old Ash Pond 3. Showed ash deposits to a depth of 36 feet in B-2 and 41 feet in B-4. Measured perched groundwater (impounded in Ash Pond 3) from 18 to 36 feet deep in B-2 and no groundwater in B-4.

- Borings B-3 and B-5 – Drilled through the divider dike. Showed a minor thickness of ash. Measured groundwater in the native weathered shale at 46 feet deep in B-3 and no groundwater in B-5.

- Borings B-1 and B-6 – Drilled in old Ash Pond 4, under the future impoundment of the LAI. Showed ash deposits to a depth of 36 feet in B-1 and 14 feet in B-6. 4. Measured perched groundwater (impounded in Ash Pond 4) from 31.5 to 37 feet depth in B-1 and no groundwater in B-6.

The results of the soil boring program show that the phreatic surface within old Ash Pond 3, as evidenced by borings B-2 and B-4, was significantly deeper than 5 feet below the top of ash surface on which the LDWP geomembrane liners were later installed.

2002 Cone Penetration Test (CPT) Program in Ash Ponds 3 and 4 – APS contracted ConeTec, Inc. to perform a series of CPT soundings with pore pressure measurements on either side of, and within, the divider dike between old Ash Ponds 3 and 4 in 2002. The as-builts depicting the plan locations of the CPT soundings are presented on Figure A-1. The results of 15 CPT soundings confirm that the upper 10 feet did not appear to contain a stabilized phreatic surface.

2.2.5 Construction of the LDWP

Construction of the LDWP required extensive operation of heavy construction equipment across the top surface of Ash Pond 3 for construction of perimeter embankments, site grading, and distribution of rolls of geomembrane. The equipment operated successfully, without hindrance from soft ground conditions. APS interprets the successful operation of heavy equipment as confirming the consistent absence of shallow saturation in old Ash Pond 3 at the time of LDWP construction.

2.2.6 Separation from the Uppermost Aquifer

Soil borings B-2 and B-4 show that the phreatic surface within old Ash Pond 3 was significantly deeper than 5 feet below the top of ash surface at the time the LDWP geomembrane liners were installed. The CPT soundings confirm the lack of an extensive, established phreatic surface in the upper 10 or more feet of ash in old Ash Pond 3. Successful operation of heavy equipment for construction of the LDWP confirms the absence of significant moisture in the upper 5 feet of ash below the geomembrane liner at the time of construction of the LDWP. The LDWP geomembrane liners were intended and installed to prevent discharge from the LDWP to the subgrade. Although the edge of liner system has occasionally been damaged by equipment operation, and then repaired, there is no indication that the geomembrane liners have allowed sufficient leakage to re-saturate old Ash Pond 3 and to cause mounding of the phreatic surface within 5 feet of the base of the LDWP.

There is a well and three piezometers located upgradient (to the east) of the LDWP: Well MW-54 and Piezometers P-23, P-24, and P-25. Each of these instruments is dry or shows a highest recorded groundwater elevation significantly lower than the elevation of the LDWP base liner (Table 3).

There are six wells and five piezometers located downgradient (to the south and west) of the LDWP: Wells MW-7, MW-8, MW-40R, MW-61, MW-75, and MW-76; Piezometers P-18, P-19, P-20, P-21, and P-22. Each of these instruments show a maximum recorded groundwater elevation significantly lower than the elevation of the adjacent LDWP base liner (Table 3).

Table 3 – Maximum Recorded Groundwater Elevations and Adjacent LDWP Base Elevation

Well/Piezometer	Maximum Recorded Groundwater Elevation (ft)[1]	Adjacent LDWP Base Elevation (ft)[1,3]
MW-7	5129.60	5205.0
MW-8	5077.80	5205.0
MW-40R	5113.29	5206.0
MW-54	5148.80	5207.0
MW-61	5105.83	5205.5
MW-75	5102.32	5205.0
MW-76	5088.47	5205.0
P-18	Dry[2]	5205.0
P-19	Dry[2]	5205.0

Well/Piezometer	Maximum Recorded Groundwater Elevation (ft)[1]	Adjacent LDWP Base Elevation (ft)[1,3]
P-20	Dry[2]	5205.0
P-21	Dry[2]	5206.0
P-22	Dry[2]	5206.0
P-23	5160.56	5210.0
P-24	Dry[2]	5210.0
P-25	Dry[2]	5210.0

1) Elevations are presented in NAVD88.
2) No groundwater has been recorded in the piezometer.
3) The LDWP base elevation (in NGVD29) is from APS drawing FC-C-17-ADS-150793, Sheet 2 (Appendix A). NAVD88 ≈ NGVD29 + 3 feet.

The groundwater instruments that surround the LDWP indicate groundwater is either not present or greater than 5 feet below the adjacent base elevation of the LDWP.

Conclusion: The base of the LDWP is located greater than 1.52 meters (5 feet) above the groundwater level in the uppermost aquifer.

3 Location Relative to Wetlands

40 CFR § 257.61 requires that existing surface impoundments not be located in wetlands. Wetlands are defined in 40 CFR § 232.2 as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.”

3.1 Methodology

A wetland delineation was performed in April 2012 and jurisdictional determinations of the wetlands identified have been reviewed and accepted by the U.S. Army Corps of Engineers and the Environmental Protection Agency (United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement 2015). A map of wetlands identified at the FCPP in this study is presented in Appendix B.

3.2 Discussion and Conclusion

No wetlands were identified in the footprint of the LDWP. One 0.07-acre wetland is located approximately 600 feet from the LDWP. The wetland drains into a concrete-lined detention pond upstream of the Pond 3 Pumphouse.

Conclusion: The LDWP is not located in wetlands.

4 Location Relative to Faults

40 CFR § 257.62 requires that existing surface impoundments not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time (beginning 11,700 years before present (BP)) unless the owner or operator demonstrates the an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

4.1 Methodology

AECOM reviewed the Quaternary Faults and Folds database maintained by the United States Geological Survey (USGS) as part of the Holocene fault search (USGS 2018). The Holocene epoch is the most recent subdivision of the Quaternary period and therefore any faults that have had displacement in the Holocene would also be included in the Quaternary period database. The Quaternary Faults and Folds database is the source for the faults used in the National Seismic Hazard Maps and contains information on faults and associated folds that are believed to be sources of M > 6 earthquakes during the Quaternary Period. AECOM searched the USGS Quaternary Fault and Fold Database for Category A and Category B faults in San Juan County, New Mexico. Fault categories are defined in Table 4. Fault categories A and B relate to the Rule; fault categories C and D describe less defined or non-tectonic features.

Table 4 – Fault Categories

Category	Definition
A	Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed by mapping or inferred from liquefaction or other deformational features.
B	Geologic evidence demonstrates the existence of Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.
C	Geologic evidence is insufficient to demonstrate (1) the existence of tectonic faulting, or (2) Quaternary slip or deformation associated with the feature.
D	Geologic evidence demonstrates that the feature is not a tectonic fault or feature; this category includes features such as joints, landslides, erosional or fluvial scarps, or other landforms resembling scarps but of demonstrable non-tectonic origin.

4.2 Discussion and Conclusion

The USGS Quaternary Faults and Folds Database of the United States does not contain any Class A or Class B faults in San Juan County.

Conclusion: No faults with Holocene displacement are present within 200 feet of the LDWP.

5 Location Relative to Seismic Impact Zones

40 CFR § 257.63 requires existing surface impoundments not be located in seismic impact zones unless the owner or operator demonstrates that all structural components, including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. *Seismic impact zone* is defined by the Rule as an area having a 2 percent or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years.

5.1 Methodology

The USGS maintains the Unified Hazard Tool website to provide access to the source and attenuation models for locations within the United States. AECOM utilized version 4.0.x of the 2014 Unified Hazard Tool to calculate the peak horizontal ground acceleration (PGA) with a 2 percent probability of exceedance in 50 years (USGS 2018a) for the LDWP location. The Unified Hazard Tool result is presented in Appendix C.

5.2 Discussion and Conclusion

The PGA with a 2 percent probability of exceedance in 50 years for the LDWP is 0.0745g. This value is less than the Rule-required maximum value of 0.10 g in 50 years.

Conclusion: The LDWP is not located in a seismic impact zone.

6 Location Relative to Unstable Areas

40 CFR § 257.64 requires that existing surface impoundments not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. The following factors must be considered when determining whether the area is unstable:

1) On-site or local soil conditions that may result in significant differential settling;
2) On-site or local geologic or geomorphologic features; and
3) On-site or local human-made features or events (both surface and subsurface).

Structural components include any component used in the construction and operation of the CCR landfill or CCR surface impoundment that is necessary to ensure the integrity of the unit and to ensure that the contents will not be released to the environment, including liners, leachate collection system, embankments, spillways, outlets, final covers, inflow design flood control systems.

Unstable area means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.

6.1 Methodology

The location of the LDWP relative to unstable areas was assessed by reviewing design and construction documentation, historic geological and geotechnical investigations, and engineering analyses (safety factor calculations). Information was reviewed to assess: 1) whether poor foundation conditions may exist which could result in inadequate foundation support for structural components of the LDWP; and 2) whether areas susceptible to mass movement (such as subsidence, landslides, avalanches, debris slides and flows, block sliding, or rock falls) capable of impairing the integrity of the structural components of the LDWP are present.

6.2 Discussion and Conclusion

6.2.1 Geologic Setting

The FCPP is located on the western flank of the San Juan Basin, in the Colorado Plateau physiographic province in northwestern New Mexico. The San Juan Basin is a structural basin approximately 100 miles from north to south and 90 miles from east to west underlain by laterally extensive, gently dipping to flat-lying sedimentary rocks of Late Cretaceous age. The northwestern boundary of the San Juan Basin is defined by the Hogback Monocline. The Hogback Monocline is a structural monocline where the generally horizontal to gently dipping Cretaceous sedimentary rock units in the area are uplifted into a one-sided fold which dips steeply (approximately 38 degrees) to the east. The resulting bedrock ridge approximately 3 miles west of the Plant is composed of younger rock units on the eastern flank and progressively older units exposed in the central and western portions of the Hogback.

Karst terrain is not known to be present beneath the FCPP or LDWP footprint based on the predominance of shale and sandstone in the area.

6.2.2 Foundation Conditions

The LDWP embankments were constructed primarily with compacted bottom ash and are founded on native silt, clay, and weathered shale. The native soils and shale within the embankment footprint appear to be competent materials based on materials recovered during monitoring well installations and exploratory borings drilled to bedrock during previous geotechnical investigations (URS 2012, AECOM 2017) around both the LDWP and the ash disposal area.

Prior to construction, Ash Pond 3 had been inactive since the late 1980s and APS transplanted a local population of tamarisk trees on top of the inactive pond as a means of passive dewatering near the surface while APS directed waste streams to Ash Pond 6.

The LDWP embankment is founded on approximately 40 to 50 feet of hydraulically-placed (existing) fly ash along the northern and eastern sides and weathered shale bedrock along the southern and western sides where the new LDWP embankment was incorporated into the pre-existing embankment of Ash Pond 3. The north and east embankments of the LDWP were constructed with similar methods used for the west and south embankments, with the exception of the foundation preparation. Although APS believes the LDWP foundation was stable prior to construction, geogrid and compacted bottom ash were placed under the portions of the embankment that were constructed on top of Ash Pond 3 to reduce the likelihood that construction would result in embankment instability. The reinforcement was constructed to mitigate excessive settlement of the embankment over the soft foundation of previously impounded fly ash. To minimize the opportunity for leaks from the LDWP, the unit was constructed with a double liner and leak collection/pumpback system.

Regulatory Review: The LDWP is regulated by the New Mexico Office of State Engineer (NMOSE), Dam Safety Bureau. NMOSE references the LDWP as File No. D-635. APS engaged NMOSE for regulatory approval before, during, and after LDWP construction.

Foundation Improvement: The foundation of the LDWP has been investigated, improved, and protected through a series of measures implemented during and after construction. These measures include:

1. Old Ash Pond 3 was allowed to dry and drain by gravity, without addition of CCR or process water, between the mid-1980s and 2003.

2. Subgrade preparation for embankments constructed on impounded ash within old Ash Pond 3 included three feet of reinforced bottom ash and clay. The reinforcement consists of two layers of geogrid installed with the first layer at least one foot above the existing surface and the second layer installed one foot above the first layer.

3. Installation of a 15-foot wide compacted clay zone (“liner”) on the upstream face of the LDWP embankment and installation of two layers of geosynthetic liner with geonet on the upstream face of the LDWP to prevent impounded fluids from infiltrating into the old Ash Pond 3 subgrade.

4. Multiple geotechnical investigations in old Ash Pond 3 and near the LDWP embankment since 2003 consisting of a total of 8 hollow-stem auger borings (with open standpipe piezometers) and 5 cone penetration test (CPT) soundings after construction. The 2016 AECOM Structural Integrity Assessment (AECOM 2016) and 2012 URS Design Report (URS 2012) for the LAI provide additional details pertaining to these investigations.

5. Regular monitoring of embankment performance, throughout staged construction and continuing to the present time, using geotechnical instrumentation consisting of standpipe and vibrating wire piezometers, buried settlement monuments, and surface survey monuments.

6. Multiple geotechnical analyses of slope stability, seepage evaluation, drainage and consolidation, settlement, liquefaction (static and cyclic), and deformation under both static and earthquake loading. Additional details are included in the LDWP Structural Integrity Assessment (AECOM 2016) and the 2012 URS Design Report (URS 2012).

Conditions Associated with Unstable Areas: The Rule identifies three conditions that must be considered when determining whether the area is unstable:

1. On-site or local soil conditions that may result in significant differential settling;

   The presence of old Ash Pond 3 under the LDWP is consistent with a soil condition that could conceivably allow differential settling. However, the good engineering practices (see "Foundation Improvement") and minimal actual recorded differential deformations (APS 2018a) provide reasonable assurance that significant differential settling has not occurred during operation of the LDWP and that the integrity of the structural components of the LDWP are intact and will not be disrupted by differential settling.

2. On-site or local geologic or geomorphologic features:

   There are no identified geologic or geomorphologic features that could cause the area of the LDWP to become unstable. In accordance with the NMOSE permit, the LDWP freeboard is maintained at a sufficiently low level to accommodate the probable maximum flood (PMF) from direct precipitation to the LDWP and the LAI (which drains into the LDWP).

3. On-site or local human-made features or events (both surface and subsurface):

   The LDWP perimeter embankment, constructed on old Ash Pond 3, is a human-made feature that could conceivably cause the area of the LDWP to become unstable. However, the good engineering practices (see "Foundation Improvement") and monitored minimal actual deformations provide reasonable assurance that the integrity of the structural components of the LDWP are intact and will not be disrupted by distress or failure of the perimeter embankment. The physical condition of the perimeter embankment of the LDWP is inspected and recorded weekly by trained Plant operations personnel and at least annually by a trained qualified professional engineer.

   The LDWP is filled by gravity flow from the LAI and pumped flow from the Pond 3 Pumphouse. Over-filling of the impoundment is a human-caused event that could cause the LDWP to become unstable. However, the LDWP is operated and maintained with a specified minimum freeboard to accommodate and store all runoff from the probable maximum flood (PMF). The impounded fluid level of the LDWP is inspected and recorded weekly by trained Plant operations personnel and at least annually by a trained qualified professional engineer.

6.2.3 Areas Susceptible to Mass Movement

Topographic and geologic conditions in the area do not indicate the potential for landslides, avalanches, debris slides, debris flows, block sliding, rock falls, or other mass movements which could impact the structural components of the LDWP.

Conclusion: The LDWP is not located in an unstable area.

7 Conclusions

Based on the findings and results of the location restrictions demonstrations, AECOM provides the following conclusions for the LDWP:

- The base of the LDWP is located greater than 1.52 meters (5 feet) above the groundwater level in the uppermost aquifer.
- The LDWP is not located in wetlands.
- No faults with Holocene displacement are present within 200 feet of the LDWP.
- The LDWP is not located in a seismic impact zone.
- The LDWP is not located in an unstable area.

8 Limitations

This report is for the sole use of APS on this project only and is not to be used for other projects. In the event that conclusions based upon the data obtained in this report are made by others, such conclusions are the responsibility of others. The Certification of Professional Opinion is limited to the information available to AECOM at the time this report was written. This report was written in accordance with current practice and the standard of care. Standard of care is defined as the ordinary diligence exercised by fellow practitioners in this area performing the same services under similar circumstances during the same period. Professional judgments presented herein are primarily based on information from previous reports that were assumed to be accurate partly based on knowledge of the site and partly based on our general experience with similar evaluations performed for similar structures. No warranty or guarantee, either express or implied, is applicable to this work.

The use of the words “certification” and/or “certify” in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not be interpreted or construed as a guarantee, warranty, or legal opinion.

9 References

AECOM, 2016. “Final Summary Report Structural Integrity Assessment, Lined Decant Water Pond, Four Corners Power Plant, Fruitland, New Mexico.” August.

AECOM, 2017. “CCR Monitoring Well Network Report and Certification, Four Corners Power Plant, Fruitland, New Mexico.” September 18.

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United States Department of the Interior Office of Surface Mining Reclamation and Enforcement, 2015. “Final Environmental Impact Statement (EIS) for the Four Corners Power Plant and Navajo Mine Energy Project.” May 1.

United States Geological Survey (USGS), 2018a. *Unified Hazard Tool – Conterminous U.S. 2014 (v4.0.x)*. https://earthquake.usgs.gov/hazards/interactive/. Accessed July 31, 2018.

United States Geological Survey (USGS), 2018b. *Quaternary Fault and Fold Database of the United States*. https://earthquake.usgs.gov/hazards/qfaults/. Accessed August 2, 2018.

Figures

AECOM

Figure 1-1

SITE VICINITY MAP

FOUR CORNERS POWER PLANT
LDWP LOCATION RESTRICTIONS
ARIZONA PUBLIC SERVICE
Project No.: 60587725

Last saved by: LEE.WRIGHT(2018-09-19) Last Plotted: 2018-09-19
Filename: P:\PROJECTS\ARIZONA_PUBLIC_SERVICE\60587725_FC_LOC_RES\900_CAD_GIS\910_CAD\25-SKETCHES\60587725-SKE-20-0000-C-FIGURE1.1LDWP.DWG
Project Management Initials: Designer: LMW Checked:____ Approved:____ ANSI B 11" x 17"

AECOM

Figure 2-1

WELL LOCATION MAP

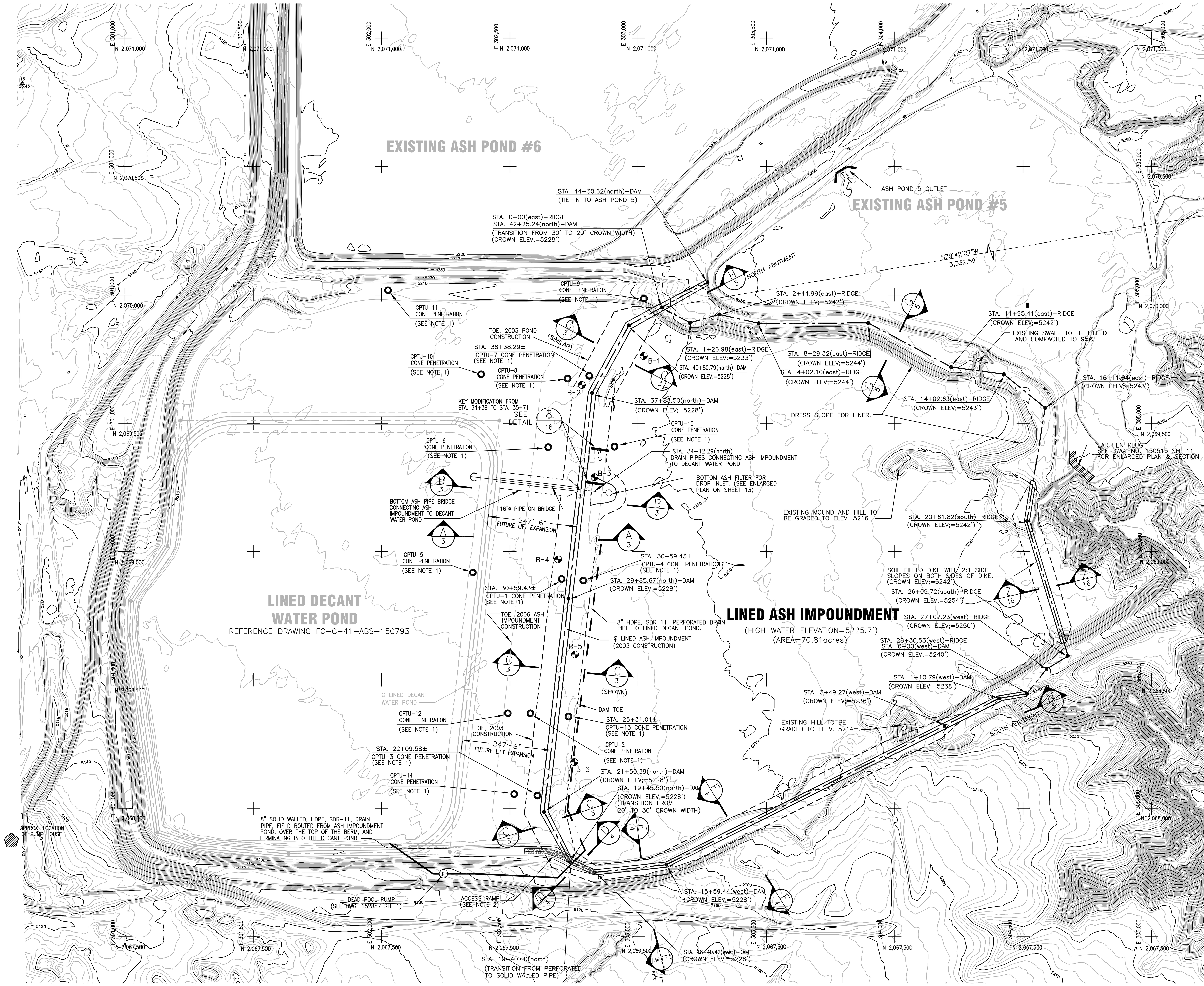
FOUR CORNERS POWER PLANT
LDWP LOCATION RESTRICTIONS
ARIZONA PUBLIC SERVICE
Project No.: 60587725

Last saved by: LEE.WRIGHT(2018-09-14) Last Plotted: 2018-09-14
Filename: P:\PROJECTS\ARIZONA_PUBLIC_SERVICE\60587725_FC_LOC_RES\900_CAD_GIS\910_CAD\25-SKETCHES\60587725-SKE-20-0000-C-FIGURE2.1LDWP.DWG
Project Management Initials: Designer: LMW Checked: Approved: ANSI B 11" x 17"

Appendix A. Original Construction Plans

NOTES:
1. FOR CONE PENETRATION TESTING RESULTS, SEE REPORT PREPARED BY "CONETEC INC." DATED OCT. 14, 2002.
2. CONSTRUCT A 20' WIDE CLAY ACCESS RAMP FROM CROWN OF EMBANKMENT (ELEV. 5228) DOWN TO EXISTING GRADE (ELEV. 5212). SLOPE TO BE 10:1 AND A TOTAL LENGTH OF 160'±. EXCAVATE OUT BOTTOM ASH CONSTRUCTION ACCESS RAMP DOWN TO THE PRE-CONSTRUCTION EMBANKMENT, (APPROXIMATE ELEVATION OF 5212'). REMOVE TOP 6 INCHES OF THE EXISTING CLAY CREST OF THE SOUTH EMBANKMENT, SCARIFY THE SURFACE, MOISTURE CONDITIONED TO OPTIMUM MOISTURE CONTENT (-1% TO +2%) AND COMPACT PER THE SPECIFICATIONS. BACK FILL WITH CLAY AND COMPACT TO 95% AS DETERMINED BY ASTM D698. SIDE SLOPES TO BE 1½:1 FROM THE RAMP CROWN TO EXISTING GROUND. (SEE ENLARGED PLAN ON SHEET 12)
3. FOR FLY ASH SLURRY DELIVERY PIPING SEE SHEET 15.

DATUM CONTROL
HV-53
(ACTUAL LOCATION OFF DRAWING)



STATION NO.	NORTHING	EASTING
STA. 0+00 (ridge) STA. 42+25.24 (dam)	N2,069,951.02	E303,092.78
STA. 1+26+98	N2,069,891.18	E303,203.19
STA. 2+44.99	N2,069,924.03	E303,316.54
STA. 4+02.10	N2,069,889.06	E303,469.71
STA. 8+29.32	N2,069,890.43	E303,896.41
STA. 11+95.41	N2,069,718.82	E304,219.79
STA. 14+02.63	N2,069,690.93	E304,424.85
STA. 16+11.04	N2,069,559.63	E304,587.14
STA. 20+61.82	N2,069,119.08	E304,515.16
STA. 26+09.72	N2,068,594.41	E304,673.94
STA. 27+07.23	N2,068,542.55	E304,591.50
STA. 28+30.55 (ridge) STA. 0+00 (dam)	N2,068,446.45	E304,514.73

STATION POINTS - RIDGE

(TIED TO STATE COORDINATES)

STATION NO.	NORTHING	EASTING
STA. 0+00 (dam) STA. 28+30.55 (ridge)	N2,068,446.45	E304,514.73
STA. 1+10.79	N2,068,428.07	E304,406.53
STA. 3+49.27	N2,068,320.86	E304,193.50
STA. 15+59.44	N2,067,780.86	E303,110.49
STA. 18+40.42	N2,067,750.49	E302,831.16
STA. 19+40.00	N2,067,788.32	E302,745.87
STA. 19+45.50	N2,067,793.10	E302,735.10
STA. 21+50.39	N2,067,983.85	E302,660.31
STA. 29+85.67	N2,068,813.66	E302,755.69
STA. 34+12.29	N2,069,236.05	E302,804.44
STA. 37+85.50	N2,069,608.26	E302,847.01
STA.40+80.79	N2,069,867.69	E302,988.04
STA. 42+25.24 (dam) STA. 0+00 (ridge)	N2,069,951.02	E303,092.78
STA. 44+30.62	N2,070,048.93	E303,271.25

STATION POINTS - DAM

(TIED TO STATE COORDINATES)

Figure A-1

REFERENCE:
FLOWN BY "AERIAL MAPPING COMPANY, INC." ON JULY 19, 2001
3141 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

LEGEND
- B-1 SOIL BORING LOCATIONS (SEE BORING LOGS ON SHEET #7)
- CPTU TEST LOCATION (SEE NOTE #1)
- TYPICAL CROSS SECTIONS (SEE SHEETS 3-5)

NORTH

SITE PLAN
SCALE: 1"=200'
CONTOUR INTERVAL=2'
0 50 100 150 200 400 600 800

DRAINAGE AREA DRAWING, SEE E-150515 SHEET #9

DATUM INFORMATION
CONTROL POINTS:
HV-53
SOUTHERN CALIFORNIA EDISON (SCE) BRASS CAP

NORTHING	EASTING	ELEVATION
N2,070,519.859	E306,365.846	5328.150'

NEW MEXICO STATE PLANE
TRANSVERSE MERCATOR-WEST ZONE
N.A.D. 1927

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
3	5-14-04	AS-BUILT	PRATT	PSS	BRC		JDM	04-6379
2	6-5-03	Add ramp/note 2 & earth plug	PRATT		BRC		JDM	04-6379
1	1-14-03	REVISE PER STATES' FIRST REVIEW	PRATT		BRC		JDM	04-6379

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT
SITE PLAN

APS

SCALE NOTED DATE 6-28-02

DWN PRATT
CHD
EXD BRC
RVWD
APPROVED JOHN D. MITCHELL ENGINEERING SUPERVISOR
W A 04-6379

UNIT	DISC	TYPE	SYS	NUMBER	SHEET	REV
FC	C	17	ADS	150515	2	3

DRAWING: L:\Projects\4c\6379 New ash pond\civil\FINAL ASH PONDS\FC-C-17-ADS-150515-2.dwg

BORING B-1

DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0								FILL: BOTTOM ASH (TEMPORARY ROAD)
3						ML		GRAY, DAMP, SANDY SILT. MIXTURE OF FLY ASH AND BOTTOM ASH.
5	6.5'	S	WOH				VANESHEAR AT 7.5 FEET SHELBY TUBE AT 9.5 FEET	
10	9.5' – 11.5'	SH	2.5" REC	71	39			
15	16.5'	S	7				VANESHEAR AT 17.5 FEET	
20	21.5'	S	1				VANESHEAR AT 24.0 FEET	
25	26.5'	S	0				VANESHEAR AT 28.0 FEET SHELBY TUBE AT 30.0 FEET	
30	32.5'	SH	NR					PERCHED WATER ENCOUNTERED AT 31.5 FT. TO 37.0'
35	35' – 36.5'	S	4					
36						CL	WOH-1-3	SILTY CLAY, DARK BROWN, MEDIUM PI
40	41.5'	U	28					
42.5								NATIVE: WEATHERED SHALE, DARK BROWN, DAMP WITH SOME GYPSUM
45	47.5'	U	80/11"	116	16			
50		S	50				REFUSAL	
51.5								BOTTOM OF HOLE AT 51.5 FEET NOTE: PERCHED WATER ENCOUNTERED AT 31.5 FEET

GROUNDWATER DEPTH = 31.5'

SAMPLE TYPE
A=AUGER CUTTINGS; NR=NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-2

DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0								FILL: BOTTOM ASH (TEMPORARY ROAD)
3						ML		GRAY, DAMP, SANDY SILT. BOTTOM ASH
5							VANESHEAR AT 8.0 FEET	FLY ASH
15	13' – 15.5'	SH	75" REC				SHELBY TUBE AT 13.0 FEET VANESHEAR AT 16'-9" FEET	
20								PERCHED WATER ENCOUNTERED AT 18.0 FT. TO 36.0'
25	22' – 24.5'	SH	21" REC	49	64		SHELBY TUBE AT 22.0 FEET VANESHEAR AT 25'-9" FEET	
30, 32	31' – 32.5'	S	NR				DROPPED 5.5 FEET	FLY ASH
35	36.5'	S	3					
36						CL		SILTY CLAY, DARK BROWN, DAMP
40	41.5'	U	101/15					
45, 45.5	46.5'	S	78					NATIVE: WEATHERED SHALE, DARK BROWN, DAMP WITH SOME GYPSUM
46.5								BOTTOM OF HOLE AT 46.5 FEET NOTE: PERCHED WATER ENCOUNTERED AT 18.0 FEET

GROUNDWATER DEPTH = 18.0'

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-3

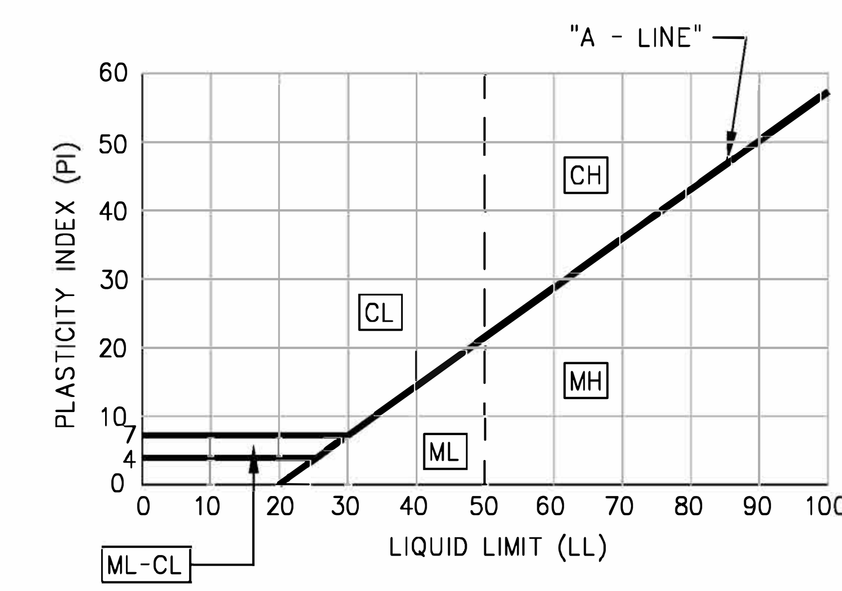
DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0								FILL: BOTTOM ASH (TEMPORARY ROAD)
3						ML		MIXTURE OF FLY & BOTTOM ASH GRAY, DAMP, SANDY SILT.
4, 5						CL		SANDY CLAY, DARK BROWN, DAMP, EMBANKMENT FILL MEDIUM PI
	7' – 8.5'	U	6					
10	12.5' – 14'	U	12	95	28			
15	17.5' – 19'	S	14					
20	22.5' – 24'	U	23	108	19			
25	26.5' – 27.5'	A						
	27.5' – 29'	S	9					
30	32.5' – 34'	U	25					
35	32.5' – 34'	S	14					
40	42.5' – 44'	U	21					
45	47.5'	S	48					NATIVE: WEATHERED SHALE, DARK BROWN, DAMP.
49, 50								BOTTOM OF HOLE @ 49' GROUND WATER @ 46'

GROUNDWATER DEPTH = 46.0'

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS, (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS. GRAVEL-SAND MIXTURE. LITTLE OR NO FINES.
				GP	POORLY GRADED GRAVELS. GRAVEL-SAND MIXTURE. LITTLE OR NO FINES.
		GRAVELS WITH FINES. (APPRECIABLE AMOUNT OF FINES.)		GM	SILTY GRAVELS. GRAVEL-SAND-SILT MIXTURES.
				GC	CLAYEY GRAVELS. GRAVEL-CLAY-SAND MIXTURE.
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELY-SANDS, LITTLE OR NO FINES.
				SP	POORLY GRADED SANDS. GRAVELY-SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES. (APPRECIABLE AMOUNT OF FINES.)		SM	SILTY SANDS. SAND-SILT MIXTURE.
				SC	CLAYEY SANDS. SAND-CLAY MIXTURES.
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY. GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
				OL	ORGANIC SILTS AND ORGANIC SILTY-CLAYS OF LOW PLASTICITY.
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.
				CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS.
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS, ORGANIC SILTS.
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS.

UNIFIED SOIL CLASSIFICATION SYSTEM



PLASTICITY CHART

BORING B-4

DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0							VANESHEAR AT 3.5 FEET	FILL: BOTTOM ASH (TEMPORARY ROAD)
3.5						ML		GRAY, DAMP, SANDY SILT. MIXTURE OF FLY ASH AND BOTTOM ASH
5	7.5'	SH	22" REC	47	30		SHELBY TUBE AT 5.0 FEET VANESHEAR AT 8.0 FEET	
10	12.5'	SH	27" REC				SHELBY TUBE AT 10.0 FEET	
15							VANESHEAR AT 15.0 FEET	
20	18.5' – 21'	SH	26.5" REC	60	53		SHELBY TUBE AT 18.5 FEET VANESHEAR AT 22.0 FEET	
25	27.5'	SH	NR				SHELBY TUBE AT 25.0 FEET	
30							VANESHEAR AT 30.0 FEET	
35	36.5'	S	14					
40	41.5'	S	10					
41						CL		SANDY CLAY, DARK BROWN, DAMP
45	46.5'	U	60					
49								NATIVE: CLAY AND WEATHERED SHALE, DARK BROWN, DAMP WITH TRACE OF GYPSUM
50		U	90/10"					
51.5								BOTTOM OF HOLE AT 51.5 FEET NOTE: NO GROUNDWATER ENCOUNTERED

GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-5

DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0							VANESHEAR AT 3.0 FEET	FILL: BOTTOM ASH (TEMPORARY ROAD) FLY ASH
3						ML		MIXTURE OF FLY & BOTTOM ASH GRAY, DAMP, SANDY SILT.
4, 5	6.5'	U	14			CL		CLAY, DARK BROWN, SLIGHTLY DAMP, EMBANKMENT FILL. MEDIUM PI
10	11.5'	U	9					
15		S	16					
	18.5'	A						
20	21.5'	U	9					
25	26.5'	S	9					
30	31.5'	U	23					
35	36.5'	S	14					
40	41.5'	U	27	106	20			
45	46.5'	S	26					
46								NATIVE: WEATHERED SHALE, DARK BROWN, DAMP WITH SOME GYPSUM
50		S	34					
51.5								BOTTOM OF HOLE AT 51.5 FEET NOTE: NO GROUNDWATER ENCOUNTERED

GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-6

DEPTH IN FEET	SAMPLE	SAMPLE TYPE	BLOWS/FT. 140lb. 30" FREE-FALL DROP HAMMER	DRY DENSITY LBS. PER CUBIC FT.	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	REMARKS	VISUAL CLASSIFICATION
0								FILL: BOTTOM ASH (TEMPORARY ROAD)
3						ML		GRAY, DAMP, SANDY SILT. FLY ASH
5	7.5'	SH	NR				VANESHEAR AT 5.0 FEET VANESHEAR AT 7.5 FEET SHELBY TUBE AT 8.0 FEET VANESHEAR AT 12.0 FEET	
10	13'	SH	NR				SHELBY TUBE AT 13.0 FEET	
14, 15		S	11			CL	SHELBY TUBE AT 15.0 FEET PACKER TEST ON CLAY 15-30 FT	SANDY CLAY, DARK BROWN DAMP MEDIUM PI
18.5, 20	21.5'	U	15	93	27			NATIVE: WEATHERED SHALE, DARK BROWN, DAMP VERY SOFT
25	26.5'	U	16					
30		S	13					
31.5								BOTTOM OF HOLE AT 31.5 FEET NOTE: NO GROUNDWATER ENCOUNTERED

GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

Figure A-2

NOTE
BORING LOCATIONS SHOWN ON DRAWING NO. E-150515 SHEET #2

BYRON R. CONRAD
NEW MEXICO
13248
REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
2	5-14-04	AS-BUILT	PRATT	PSS	BRC		JDM	04-6379
1	1-14-03	WAS SHEET #5	PRATT		BRC		JDM	04-6379

FOUR CORNER COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT
SOIL BORING LOGS

APS

SCALE NONE
DATE 6-28-02

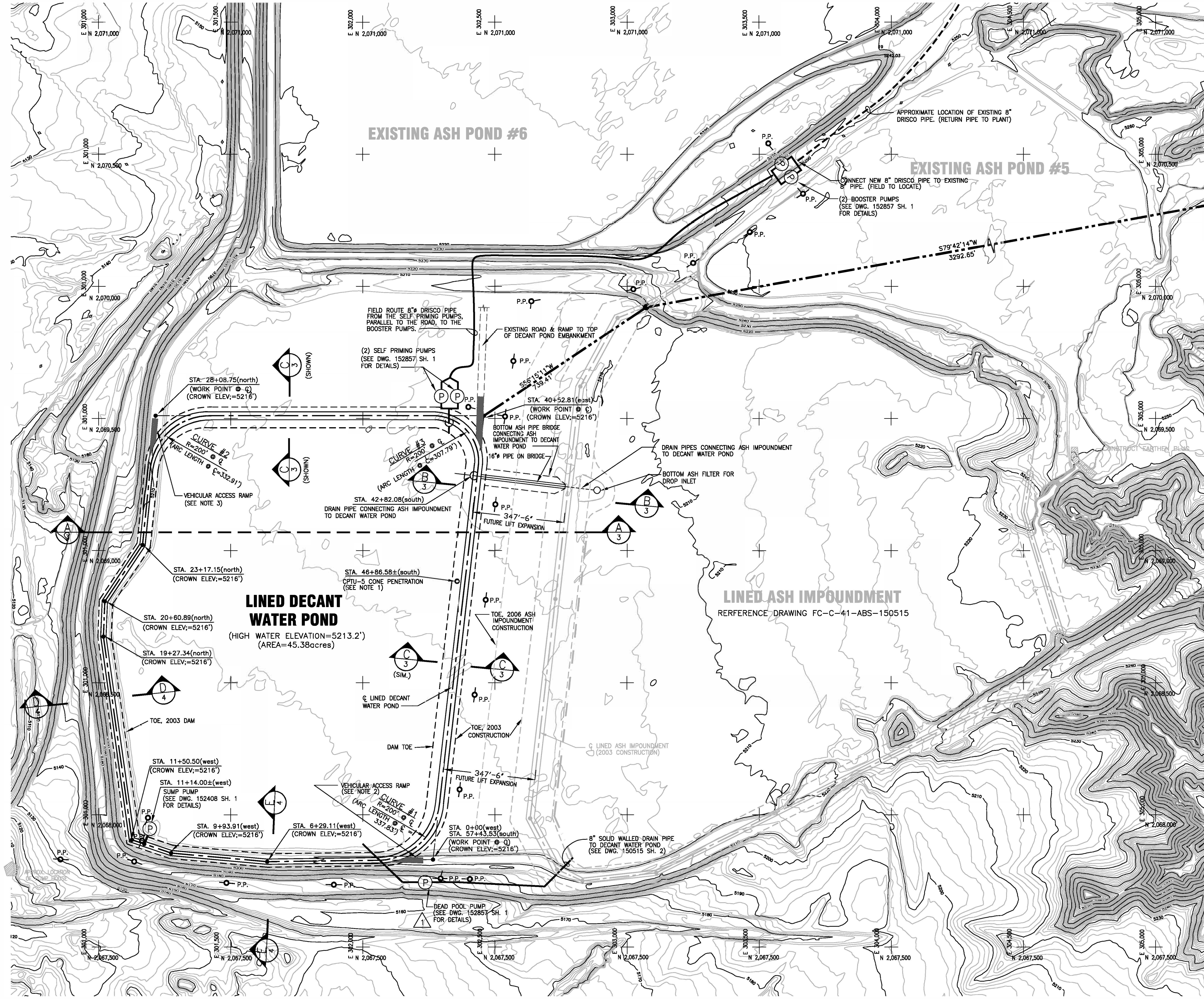
DWN PRATT
CHD
EXD BRC
RVWD

APPROVED
JOHN D. MITCHELL
ENGINEERING SUPERVISOR

W A 04-6379

UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	39	ADS	150515	7

DRAWING: L:\Projects\4c\6379 New ash pond\civil\FINAL ASH PONDS\FC-C-39-ADS-150515-7.dwg



NOTES:

1. FOR CONE PENETRATION TESTING RESULTS, SEE REPORT PREPARED BY "CONETEC INC." DATED OCT. 14, 2002.
2. CONSTRUCT A 20' WIDE CLAY VEHICULAR RAMP FROM CROWN OF THE EMBANKMENT (ELEV. 5216) DOWN TO EXISTING GRADE (ELEV. 5210). SLOPE TO BE 10:1 AND A TOTAL LENGTH OF 60'±.
3. CONSTRUCT A 20' WIDE CLAY VEHICULAR RAMP FROM CROWN OF THE EMBANKMENT (ELEV. 5216) DOWN TO EXISTING GRADE (ELEV. 5208). SLOPE TO BE 10:1 AND A TOTAL LENGTH OF 80'±.
4. INSTALL 1"Φ HOLES IN PRIMARY LINER TO PROVIDE VENTILATION. SPACE HOLES AT 100' CENTERS. (3A SEE DETAIL 152408 SH. 1A)

DATUM CONTROL
HV-53
(ACTUAL LOCATION OFF DRAWING)

STATION NO.	NORTHING	EASTING
STA. 0+00	N2,067,830.82	E302,265.35
STA. 6+29.11	N2,067,823.05	E301,637.64
STA. 9+93.91	N2,067,855.53	E301,274.29
STA. 11+50.50	N2,067,905.57	E301,125.91
STA. 19+27.34	N2,068,674.86	E301,017.82
STA. 20+60.89	N2,068,808.30	E301,023.32
STA. 23+17.15	N2,069,021.28	E301,165.82
STA. 28+08.75	N2,069,510.48	E301,215.63
STA. 40+52.81	N2,069,510.48	E302,458.41
STA. 42+82.08	N2,069,281.85	E302,432.20
STA. 57+43.53	N2,067,830.82	E302,265.35

STATION POINTS
(TIED TO STATE COORDINATES)

PUMP NAME	NORTHING	EASTING
DEAD POOL PUMP	N2,067,745.00±	E302,260.00±
SELF-PRIMING PUMPS	N2,069,586.00±	E302,330.00±
BOOSTER PUMPS	N2,070,435.00±	E303,600.00±

PUMPS' COORDINATE POINTS
(TIED TO STATE COORDINATES)

NOTE:
THESE COORDINATES REPRESENT THE APPROXIMATE LOCATION OF THE PUMPS. THE FIELD IS TO DETERMINE THE EXACT LOCATION.

Figure A-3

REFERENCE:
FLOWN BY "AERIAL MAPPING COMPANY, INC." ON JULY 19, 2001
3141 WEST CLARENDON AVENUE
PHOENIX, ARIZONA 85017

LEGEND
TYPICAL CROSS SECTIONS SEE SHEETS 3 & 4
P PUMP
P.P. NEW POWER POLE

NORTH

SITE PLAN
SCALE: 1"=200'
CONTOUR INTERVAL=2'
0 50 100 150 200 400 600 800

DRAINAGE AREA DRAWING, SEE E-150793 SHEET #6

DATUM INFORMATION
CONTROL POINTS:
HV-53
SOUTHERN CALIFORNIA EDISON (SCE) BRASS CAP

NORTHING	EASTING	ELEVATION
N2,070,519.859	E306,365.846	5328.150'

NEW MEXICO STATE PLANE
TRANSVERSE MERCATOR-WEST ZONE
N.A.D. 1927

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
1	5-14-04	AS-BUILT	PRATT	PSS	BRC		JDM	04-6379

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED DECANT WATER POND
SITE PLAN

APS

SCALE NOTED DATE 1-14-03
DWN PRATT
CHD
EXD BRC
RVWD
APPROVED JOHN D. MITCHELL ENGINEERING SUPERVISOR
W A 04-6379

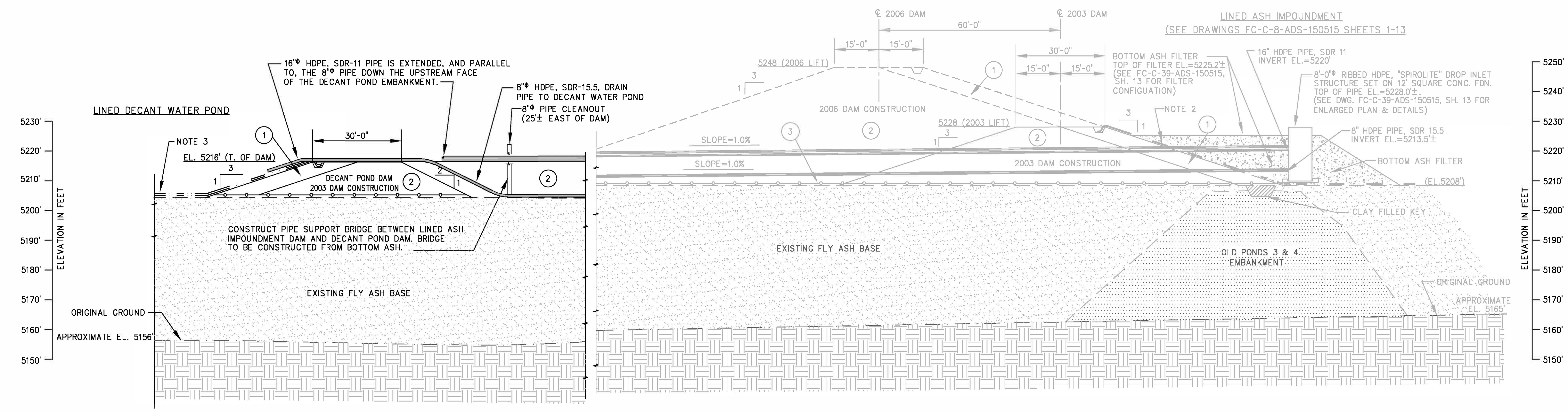
THIS DRAWING IS CONFIDENTIAL AND SHALL NOT BE USED OR REPRODUCED IN ANY PART WITHOUT WRITTEN CONSENT OF PINNACLE WEST CAPITAL CORPORATION.

UNIT	DISC	TYPE	SYS	NUMBER	SHEET	REV
FC	C	17	ADS	150793	2	1

DRAWING: L:\Projects\4c\6379 New ash pond\clvil\FINAL DECANT POND\FC-C-17-ADS-150793-2.dwg

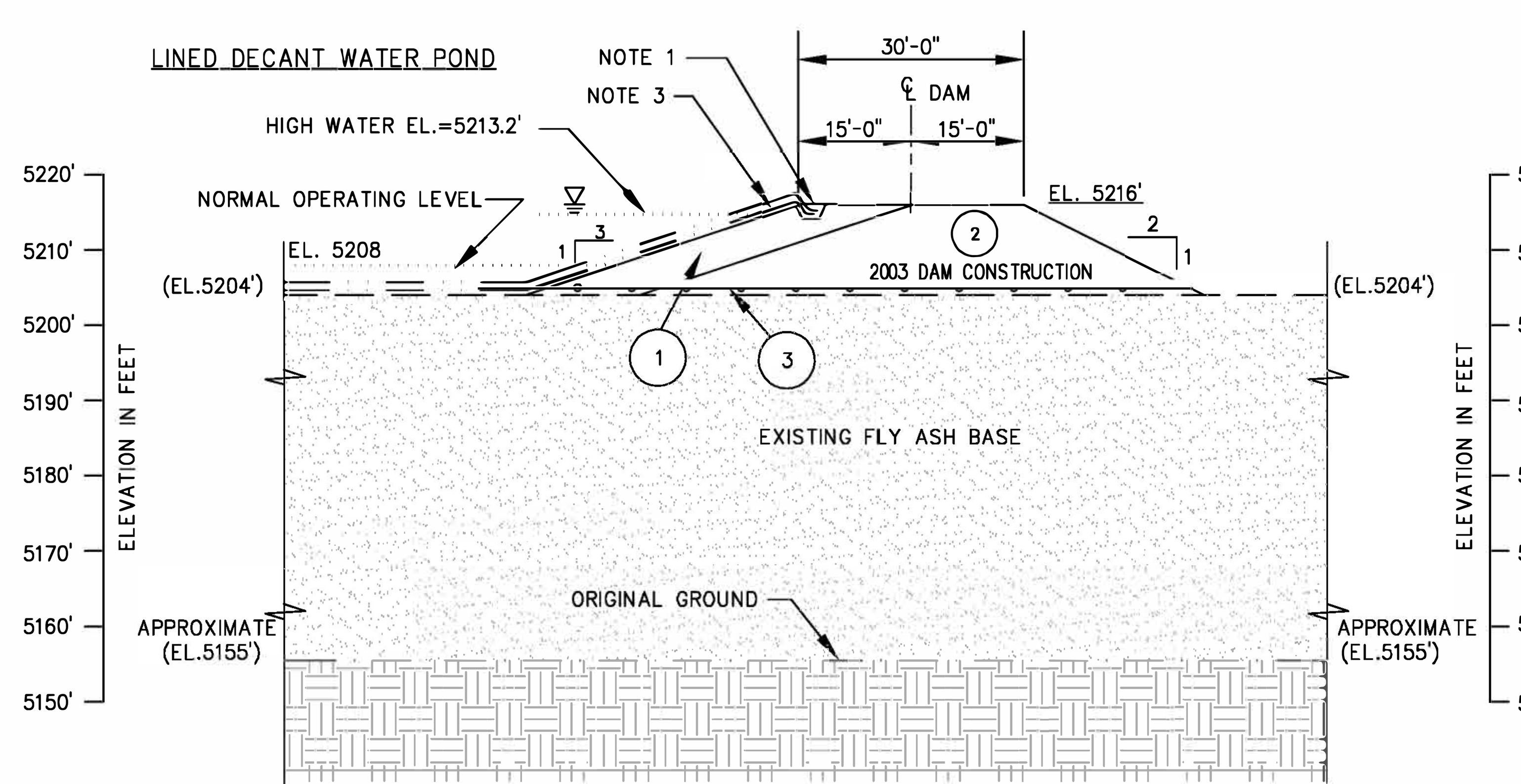
SECTION A/2 A/2 SECTION LOOKING NORTH

1"=30'



SECTION B/2 B/2 PROPOSED OUTLET

1"=20'



SECTION C/2 C/2 CROSS-SECTION (SEE NOTE 4)

1"=20'

NOTES

1. ANCHOR TRENCH FOR GEOSYNTHETIC (FML) LINER. SEE DETAIL 2 / 152408 SH. 1
2. 1-LAYER OF GEOSYNTHETIC (FML) LINER ON THE UPSTREAM FACE OF LINED ASH IMPOUNDMENT.
3. 2-LAYERS OF GEOSYNTHETIC (FML) LINER WITH GEONET ON THE UPSTREAM FACE OF THE LINED DECANT WATER POND. REFERENCE DRAWINGS FC-C-39-ADS-152408, SH. 5 & 6.
4. EXISTING BASE ELEVATIONS VARY. ELEVATIONS AT THE SECTIONS ARE TAKEN AT THE CUTS. IN THE CASE OF MULTIPLE CUTS OF THE SAME SECTION, THE SECTION INDICATED BY "SHOWN" ON THE SITE PLAN, IS THE ONE REPRESENTED ON THIS SHEET.

NEW DAM EMBANKMENT MATERIALS

1. COMPACTED CLAY/SOIL FILL IN ACCORDANCE WITH THE SPECIFICATIONS.
2. COMPACTED BOTTOM ASH
3. SUB GRADE PREPARATION: GEOGRID REINFORCEMENT-BOTTOM ASH OR CLAY AS SPECIFIED. SEE SECTION F/4

LEGEND

- EXISTING DAM EMBANKMENT
- EXISTING BOTTOM ASH & CONTINUOUS SHALE EMBANKMENT
- EXISTING FLY ASH BASE
- EXISTING GROUND SURFACE

Figure A-4

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
2	5-14-04	AS-BUILT	PRATT	PSS	BRC		JDM	04-6379
1	6-5-03	Add det. to note 1	PRATT		BRC		JDM	04-6379

FOUR CORNERS COMMON ASH HANDLING SYSTEM
LINED DECANT WATER POND
SECTIONS

APS

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

SCALE NOTED DATE 1-14-03

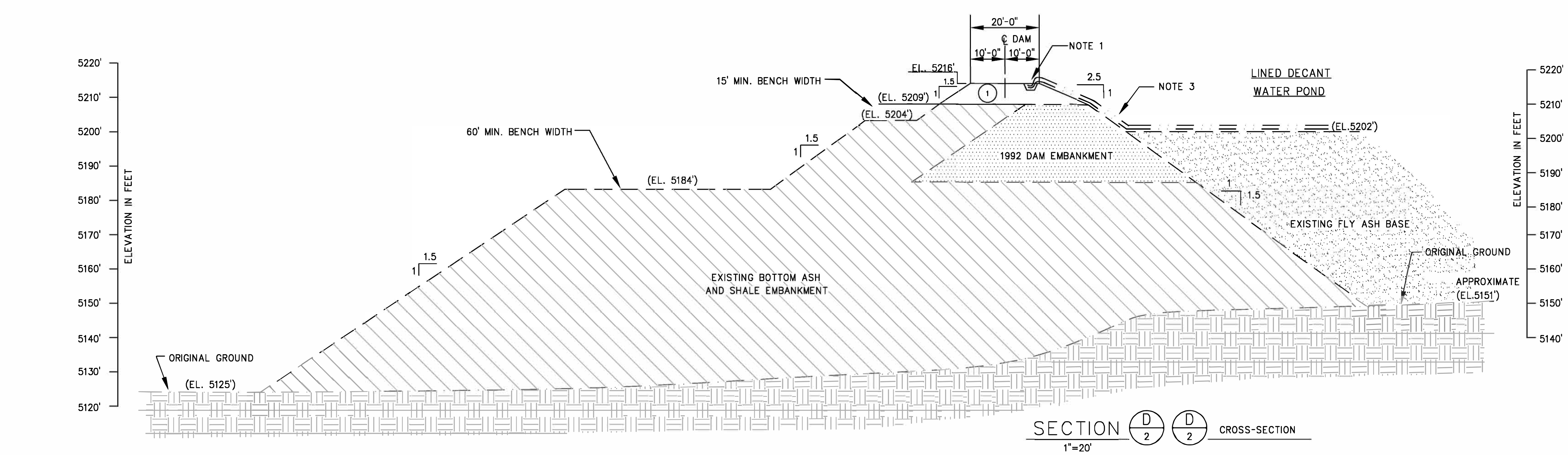
DWN PRATT; CHD; EXD BRC; RVWD

APPROVED JOHN D. MITCHELL ENGINEERING SUPERVISOR

W A 04-6379

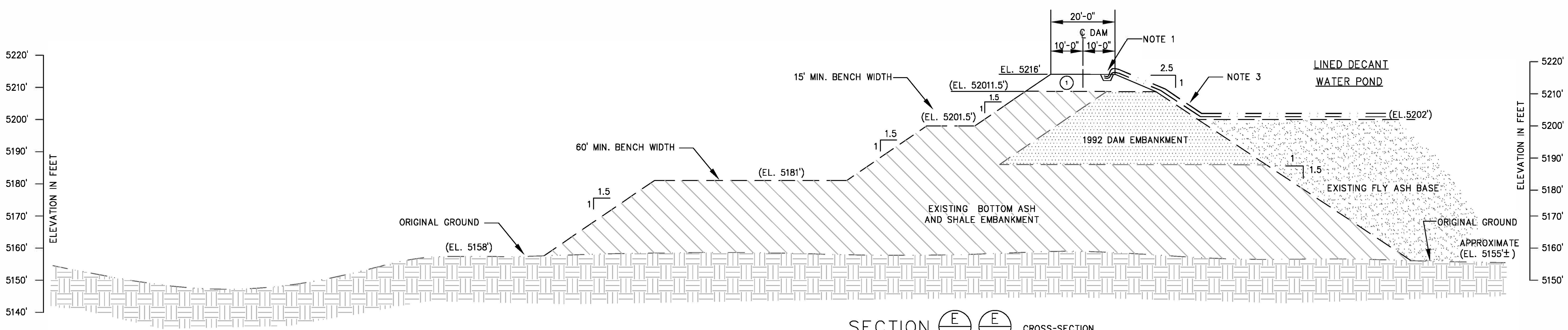
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	39	ADS	150793	3

DRAWING: L:\Projects\4c\6379 New ash pond\civil\FINAL DECANT POND\FC-C-39-ADS-150793-3.dwg



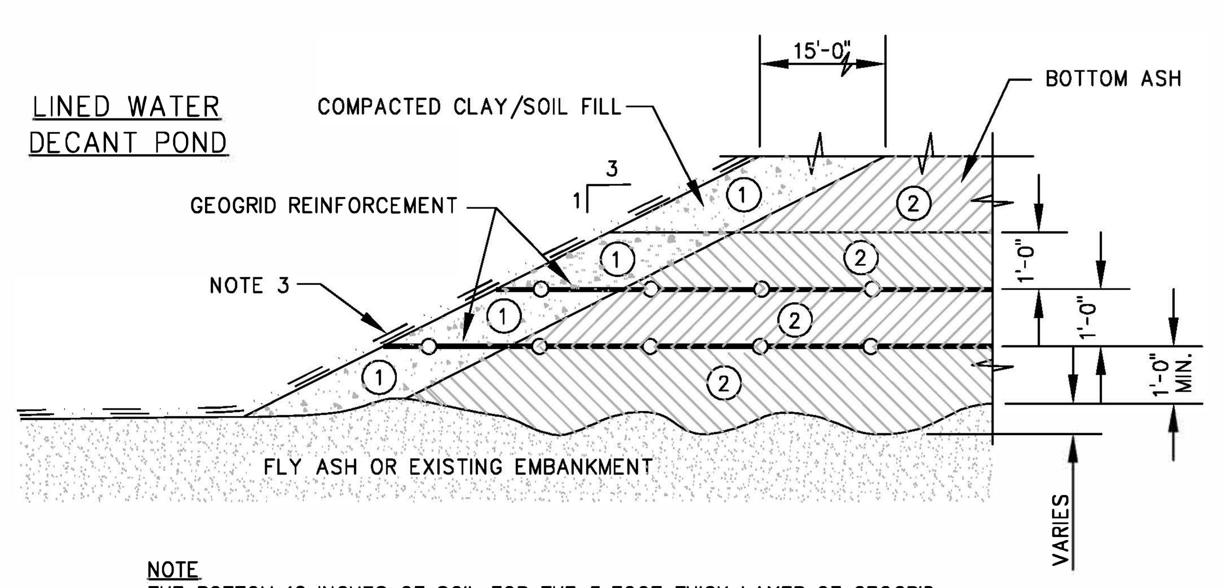
SECTION D/2 D/2 CROSS-SECTION

1"=20'



SECTION E/2 E/2 CROSS-SECTION

1"=20'



NOTE

THE BOTTOM 12 INCHES OF SOIL FOR THE 3 FOOT THICK LAYER OF GEOGRID REINFORCED SOIL/FILL SHALL BE COMPACTED TO THE MAXIMUM ACHIEVABLE DENSITY WITH OUT RUTTING, HEAVING OR OTHERWISE UNSUITABLE CONDITION AND OTHER UNEVEN FEATURES OR TO 95% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D698, SUBSEQUENT TO APPROVAL BY APS ENGINEER. THE REMAINING SOIL/FILL FOR THE GEOGRID REINFORCED SOIL/FILL SHALL BE COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D698. GEOGRID TO BE "TENSAR BX-1200".

SECTION F/- GEOGRID REINFORCEMENT

3/8"=1'-0"

NOTES

1. ANCHOR TRENCH FOR GEOSYNTHETIC (FML) LINER. SEE DETAIL 2/152408 SH. 1
2. 1-LAYER OF GEOSYNTHETIC (FML) LINER ON THE UPSTREAM FACE OF LINED ASH IMPOUNDMENT.
3. 2-LAYERS OF GEOSYNTHETIC (FML) LINER WITH GEONET ON THE UPSTREAM FACE OF THE LINED DECANT WATER POND. REFERENCE DRAWINGS FC-C-39-ADS-152408, SH. 5 & 6.
4. EXISTING BASE ELEVATIONS VARY. ELEVATIONS AT THE SECTIONS ARE TAKEN AT THE CUTS. IN THE CASE OF MULTIPLE CUTS OF THE SAME SECTION, THE SECTION INDICATED BY "SHOWN" ON THE SITE PLAN, IS THE ONE REPRESENTED ON THIS SHEET.

NEW DAM EMBANKMENT MATERIALS

1. COMPACTED CLAY/SOIL FILL IN ACCORDANCE WITH THE SPECIFICATIONS.
2. COMPACTED BOTTOM ASH
3. SUB GRADE PREPARATION: GEOGRID REINFORCEMENT-BOTTOM ASH OR CLAY AS SPECIFIED. SEE SECTION F/-

LEGEND

- EXISTING DAM EMBANKMENT
- EXISTING BOTTOM ASH & CONTINUOUS SHALE EMBANKMENT
- EXISTING FLY ASH BASE
- EXISTING GROUND SURFACE

Figure A-5

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
2	5-14-04	AS-BUILT	PRATT	PSS	BRC		JDM	04-6379
1	6-5-03	Add det. to note 1	PRATT		BRC		JDM	04-6379

FOUR CORNERS COMMON ASH HANDLING SYSTEM LINED DECANT WATER POND SECTIONS

APS

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

SCALE NOTED DATE 1-14-03

DWN PRATT | CHD | EXD BRC | RVWD

APPROVED JOHN D. MITCHELL ENGINEERING SUPERVISOR

W A 04-6379

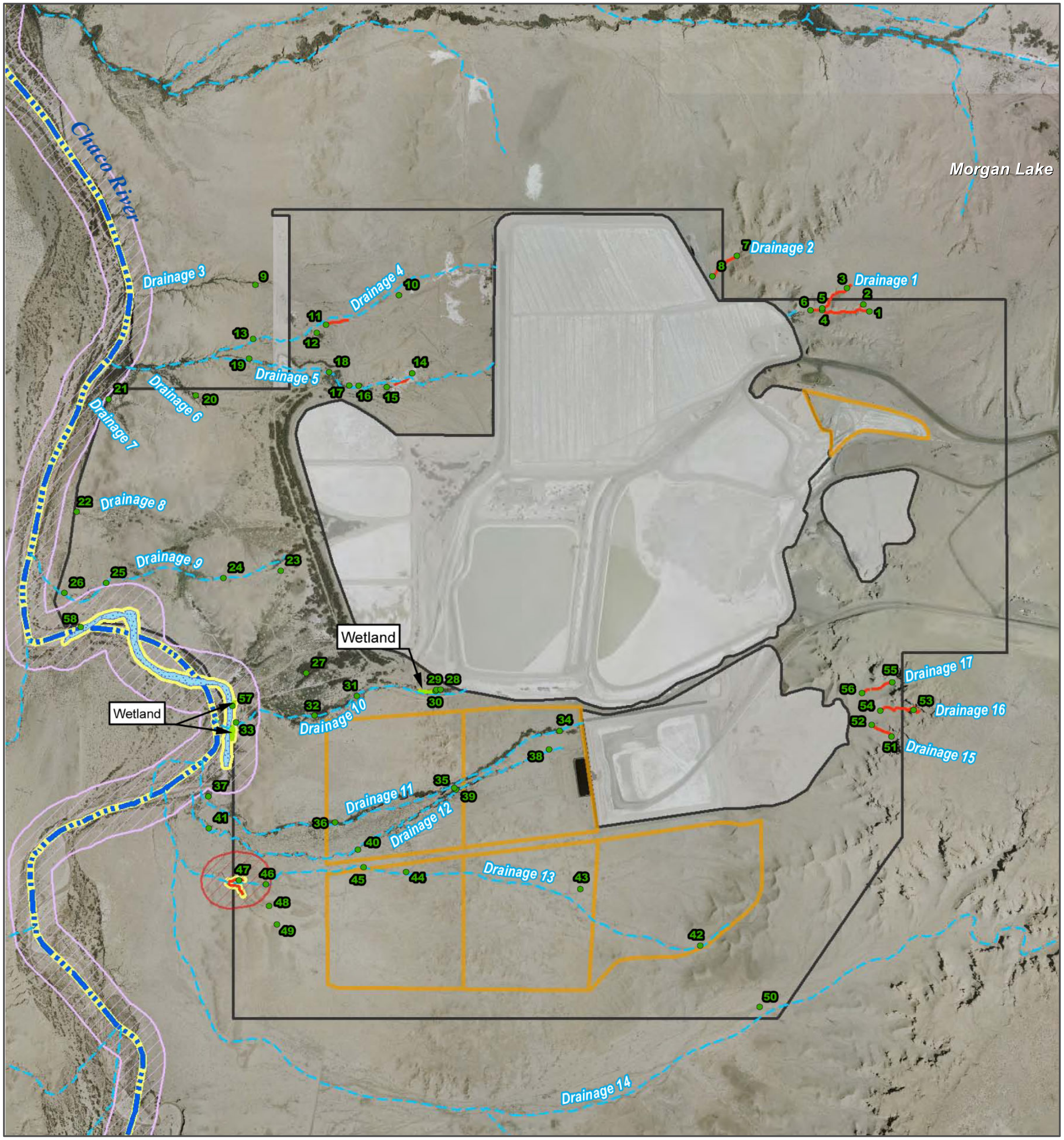
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	08	ADS	150793	4

DRAWING: L:\Projects\4c\6379 New ash pond\civil\FINAL DECANT POND\FC-C-39-ADS-150793-4.dwg

Appendix B.
Wetlands Map

Figure 4.5-7

Jurisdictional Waters of the US
in the Vicinity of the FCPP
Proposed Ash Disposal Facility



GPS Survey Point (#)
Wetland
Chaco River OHWM
Ephemeral
Intermittent
Ordinary High Water Mark Observed*
Jurisdictional (highlighted)
Waters of the U.S. Delineation Boundary
Existing Fly Ash Disposal Facilities
Proposed Fly Ash Facility
Chaco River Avoidance Area
Avoidance Area

*Observed Ordinary High Water Mark without jurisdiction is considered isolated.

Appendix C.
Unified Hazard Tool Summary

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

36.683

Time Horizon

Return period in years

2475

Longitude

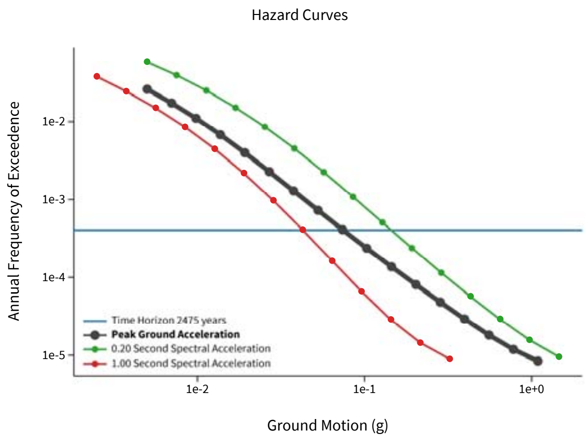
Decimal degrees, negative values for western long…

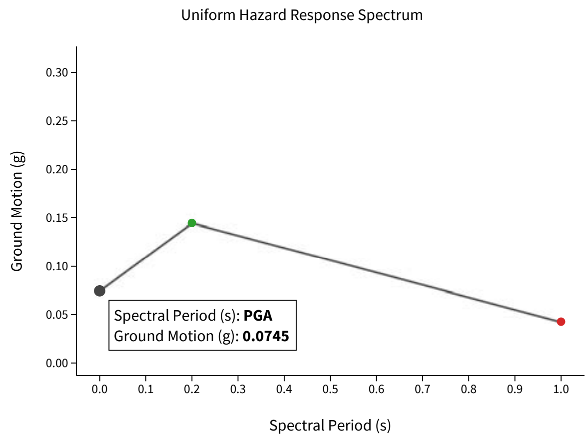
-108.51

Site Class

760 m/s (B/C boundary)

Hazard Curve





View Raw Data