Arizona Public Service
Four Corners Power Plant

Combined Waste Treatment Pond

Location Restrictions Demonstration Report

Prepared for:
Arizona Public Service

AECOM Job No. 60587725
October 8, 2018

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Certification Statement

Certification Statement for Location Restrictions:

- **40 CFR § 257.60 – Placement above the uppermost aquifer**
- **40 CFR § 257.61 – Wetlands**
- **40 CFR § 257.62 – Fault areas**
- **40 CFR § 257.63 – Seismic impact zones**
- **40 CFR § 257.64 – Unstable Areas**

CCR Unit: Arizona Public Service Company; Four Corners Power Plant; Combined Waste Treatment Pond

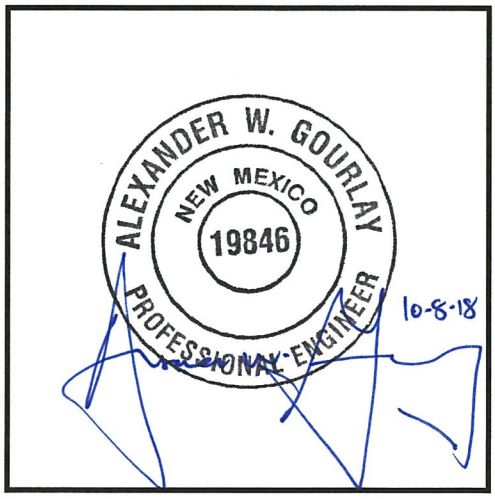
I, Alexander Gourlay, being a Registered Professional Engineer in good standing in the State of New Mexico, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR unit, that the demonstration regarding the location of the CCR unit 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 § 257.61(a), § 257.62(a), § 257.63(a), and § 257.64(a). 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 does not meet the requirements of 40 CFR § 257.60(a),

Alexander W. Gourlay, P.E.

Printed Name

October 8, 2018

Date



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 Combined Waste Treatment Pond (CWTP).

1.1 Report Purpose and Description

The purpose of this report is to document the location restrictions demonstration for the CWTP. The CWTP 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 CWTP, 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 – Cross-Section and Bathymetry
- Appendix B – National Wetlands Inventory 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 CWTP was constructed in 1978 to provide a retention and settling capacity that would reduce suspended solids in the effluent discharged to the cooling water return canal. The CWTP was formed by constructing an embankment along the cooling water return canal to form the impoundment basin. The CWTP receives bottom ash transport water from the bottom ash recovery and transport processes at Units 4 and 5 (U45) in addition to smaller amounts of low-volume waste water from the Plant. Ash and other sediment within the transport water settle out in decant basins located along the western side of the CWTP. The water in the decant basins overflows into the CWTP. The decant basins are periodically dredged to remove the settled solids.

The CWTP has a total surface area of approximately 13.4 acres. The impoundment is bounded on the west and south sides by native ground and fill. The impoundment is enclosed by an embankment on the north and east sides that separates the CWTP from the cooling water return canal.

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 CWTP and the uppermost aquifer based on available data. The following information was reviewed to assess the vertical location of the CWTP relative to the uppermost aquifer:

- As-built typical section (APS Drawing G-67227)
- Bathymetric survey of the CWTP impoundment (Sakura Engineering & Surveying 2016)
- 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

A bathymetric survey performed on September 7, 2016 recorded the elevation of remaining solids within the CWTP. The actual base elevation of the CCR unit would be equal to or deeper than the elevation of the remaining solids. The elevation of the remaining solids within base of the CCR unit averaged approximately EL 5322 feet (NAVD88) (Sakura Engineering & Surveying 2016). The deepest location was observed as EL 5307.2 feet (NAVD88).

2.2.2 Groundwater Elevations

Monitoring wells MW-62, MW-63, MW-64, and MW-65 were installed at the CWTP embankment in September 2015 to monitor groundwater quality and elevation (Figure 2-1). Table 1 presents well data and the water level elevations in the wells monitored for the CWTP (AECOM 2017, Amec Foster Wheeler 2018).

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

	Well Name			
	MW-62	**MW-63**	**MW-64**	**MW-65**
Location Relative to the CWTP	West Edge	North Embankment	East Abutment	South Edge
Surface Elevation (ft)	5339.37	5337.02	5337.66	5337.24
Bottom of Screen (ft)	5319.37	5318.02	5317.66	5319.24
Screened In	Pictured Cliffs Formation			

Measurement Date	**MW-62**	**MW-63**	**MW-64**	**MW-65**
11/3-11/9, 11/14/2015	5330.34	5330.32	5330.86	5331.02
4/25/2016	5330.72	5330.32	5330.91	5331.24
9/12/2016	5330.87	5330.44	5330.90	5331.33
10/19-10/20/2016	5330.24	5330.02	5330.58	5330.88
1/31-2/1/2017	5330.61	5330.41	5330.80	5331.03
5/1/2017	5330.48	5330.24	5330.69	5330.93
9/9/2017	5330.04	5329.73	5330.25	5330.41
10/11/2017	5330.09	5329.51	5330.17	5330.51

Highest Recorded Groundwater Elevation (ft)	5330.87	5330.44	5330.91	5331.33

1) Elevations are presented in NAVD88.

2.2.3 Separation from the Uppermost Aquifer

By inspection, the base of the CCR impoundment is lower than the elevation of groundwater in the adjacent wells. There is no observable separation between the base of the impoundment and the aquifer.

Conclusion: The CWTP does not meet the location restriction requirement relative to the uppermost aquifer and is subject to closure per 40 CFR § 257.101(b)(1).

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

The U.S. Fish and Wildlife Service (USFWS) maintains the National Wetlands Inventory mapper on the Internet (https://www.fws.gov/wetlands/data/Mapper.html). The application integrates digital map data along with other resources information to produce information on the status, extent, characteristics, and functions of wetlands and other resources. The National Wetlands Inventory, last modified on May 1, 2018 was reviewed to assess the location of the CWTP relative to wetlands. The results are presented in Appendix B.

3.2 Discussion and Conclusion

The USFWS National Wetlands Inventory identified Morgan Lake (classified as L1UBHh) and four man-made ponds (classified as PUBFx) adjacent to the CWTP as wetlands; however, the CWTP footprint is not located in wetlands.

Conclusion: The CWTP 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 2. Fault categories A and B relate to the Rule; fault categories C and D describe less defined or non-tectonic features.

Table 2 – 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 CWTP.

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 CWTP 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 CWTP is 0.0749g. This value is less than the Rule-required maximum value of 0.10 g in 50 years.

Conclusion: The CWTP 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 controls 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 CWTP 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 CWTP; 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 CWTP 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 CWTP footprint based on the predominance of shale and sandstone in the area.

6.2.2 Foundation Conditions

The CWTP embankment is founded on bottom ash, the deposition of which predated the construction of the impoundment. Near the midpoint of the embankment, the bottom ash layer underlying the embankment was observed to be approximately 20 feet thick. The bottom ash does not appear to be present near the abutment where the embankment bears directly on rock. Weathered shale and sandstone of the Pictured Cliffs Formation underlie the bottom ash. The underlying weathered shale and sandstone appear competent within the embankment footprint based on exploratory borings drilled to native ground during the 2016 AECOM Geotechnical Investigation (AECOM 2016).

No survey monuments are present along the crest of the CWTP embankment to measure vertical or horizontal movement with time. Comparison of the nominal design crest elevation to the crest elevation measured during a site survey of the embankment conducted as part of the 2016 AECOM Geotechnical Investigation (AECOM 2016) indicates the crest is approximately 1 foot lower than anticipated. This apparent lowering is likely due to removal of material during maintenance (grading) of the crest, deviations from the design during construction, or erosion of the crest. No cracks have been observed during routine embankment inspections and maintenance. Therefore, differential settlement, if present within the embankment, is assessed to be not significant. The presence of the competent bedrock foundation and observations of small to moderate settlement of the embankment are an indication of stability of the foundation and abutments.

6.2.3 Areas Susceptible to Mass Movement

Design and construction documentation indicate that the CWTP embankment was not constructed on materials that would be susceptible to excessive settlement. Safety factors against deep-seated slope failure calculated for the CWTP indicate that the embankment is not susceptible to mass movement. Topographic and geologic conditions 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 CWTP.

Conclusion: The CWTP 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 CWTP:

- The CWTP does not meet the location restriction requirement relative to the uppermost aquifer and is subject to closure per 40 CFR § 257.101(b)(1).
- The CWTP is not located in wetlands.
- No faults with Holocene displacement are present within 200 feet of the CWTP.
- The CWTP is not located in a seismic impact zone.
- The CWTP 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, Combined Waste Treatment Pond, Four Corners Power Plant, Fruitland, New Mexico.” August, 2016.

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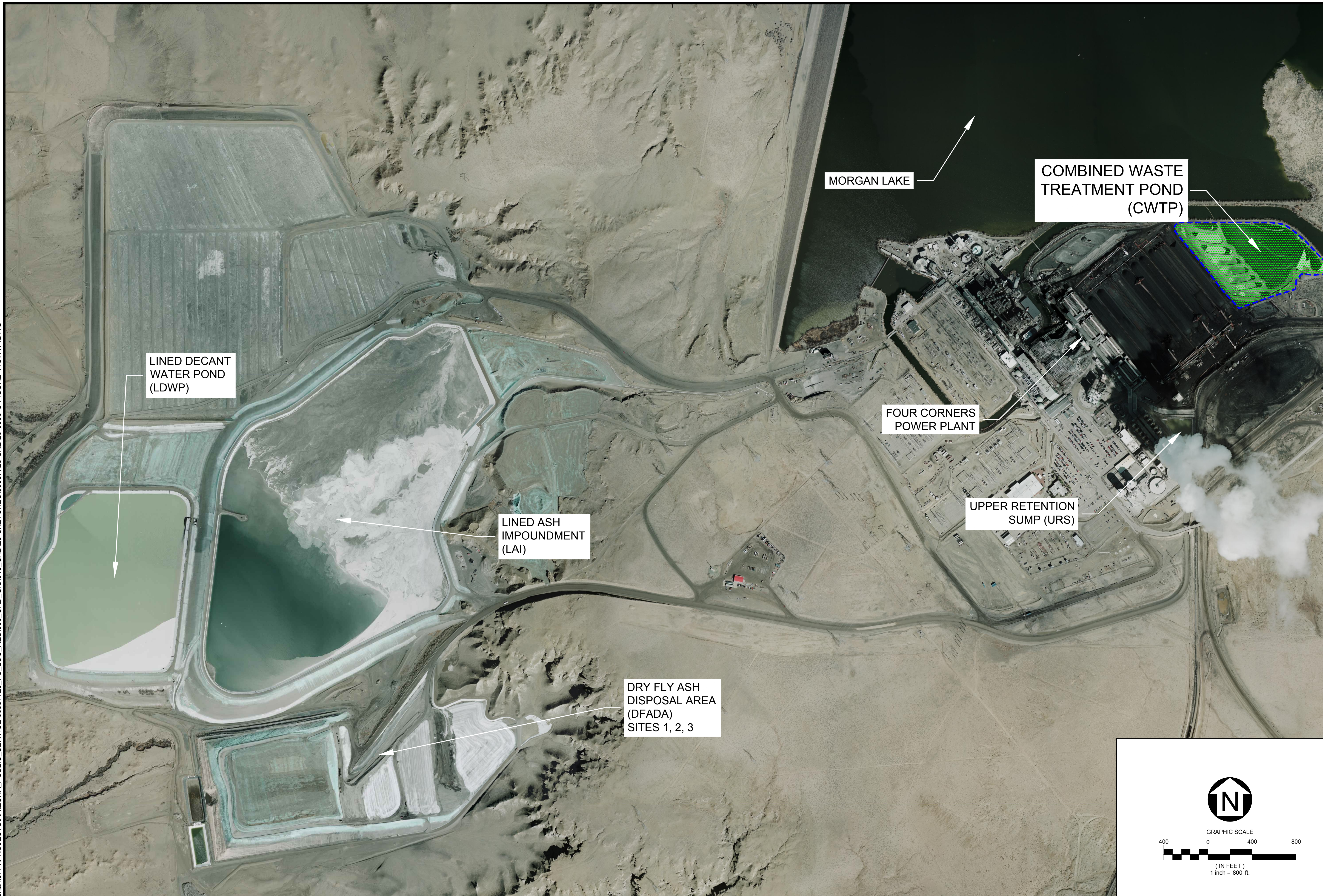
Figures



AECOM

Figure 1-1

SITE VICINITY MAP

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

Last saved by: LEE.WRIGHT(2018-09-14) Last Plotted: 2018-09-14
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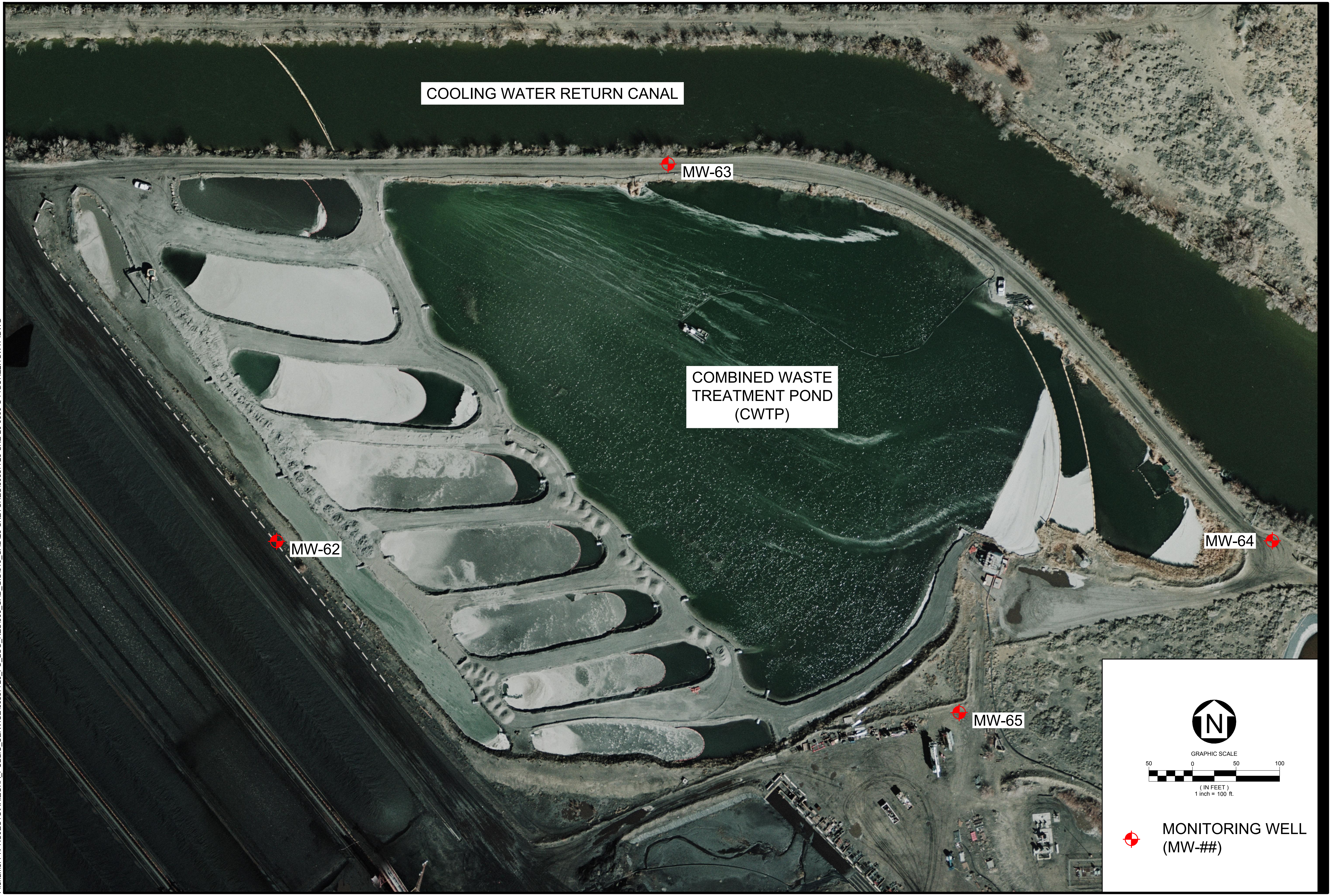
Project Management Initials: Designer: LMW Checked: ____ Approved: ____ ANSI B 11" x 17"

Figure 2-1

WELL LOCATION MAP



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

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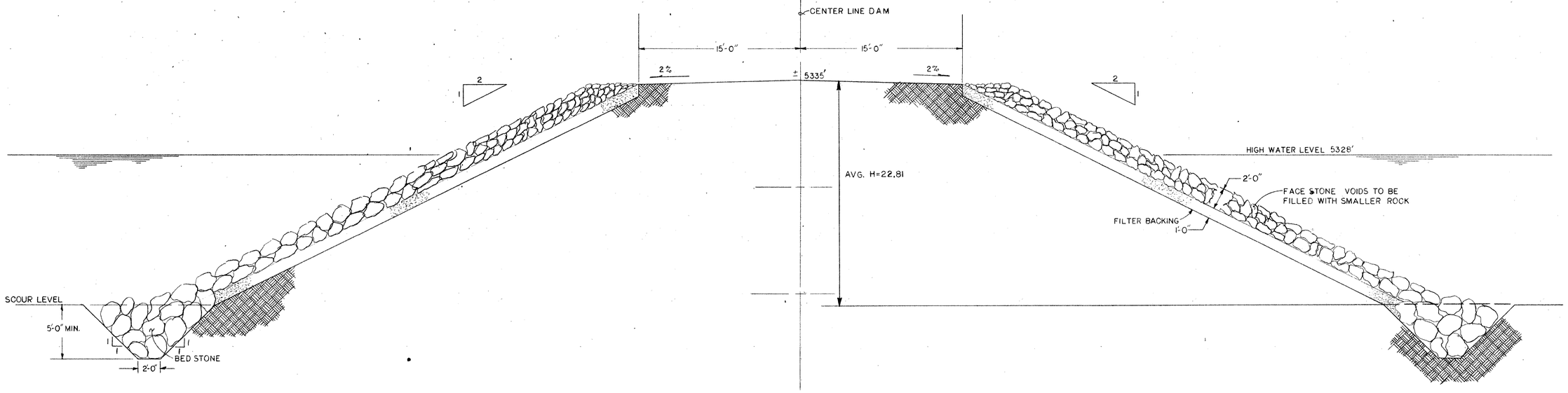
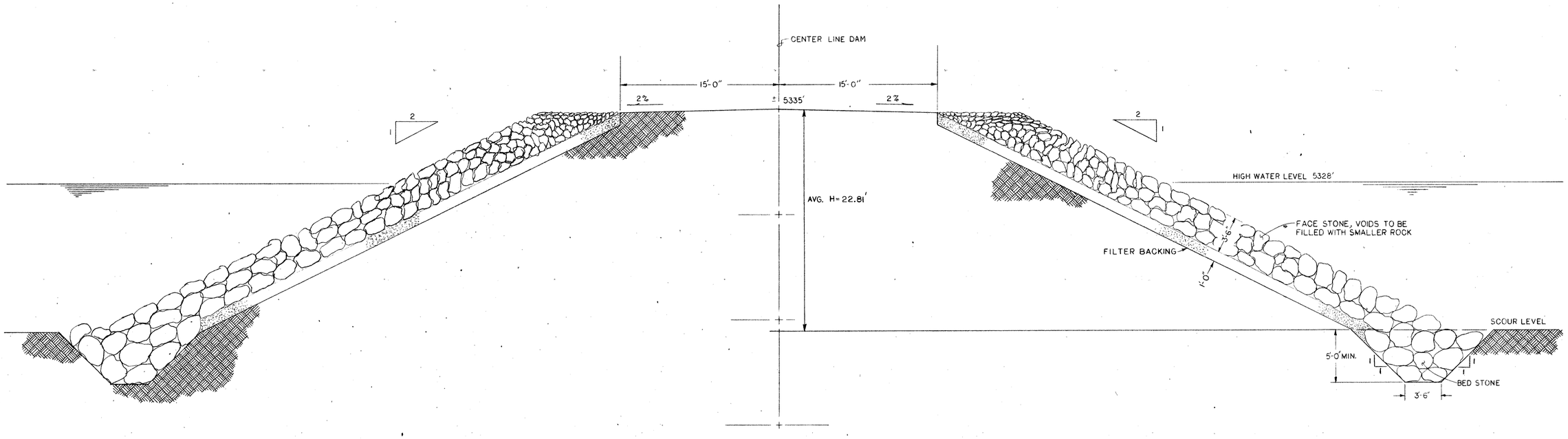
Appendix A.
Cross-Section and Bathymetry

"INDEX"



TYPICAL TANGENT SECTION

APPROX. LIMITS: STA. 0+00 TO 9+38.244
℄ 11+95 TO 18+00



TYPICAL CURVED SECTION

APPROX. LIMITS: STA. 9+38.224 TO 11+95.773

MEAN STREAM VELOCITY	PARALLEL FLOW ALONG TANGENT BANK					IMPINGEMENT FLOW AGAINST CURVED BANK				
	CURRENT VELOCITY	MINIMUM STONE	PROTECTION CLASS	PLACEMENT METHOD	SECTION THICKNESS	CURRENT VELOCITY	MINIMUN STONE	PROTECTION CLASS	PLACEMENT METHOD	SECTION THICKNESS
10.5 FPS	7FPS	7 LB	FACING	B	2 FT	14 FPS	430 LB	1/2 TON	A	3.5 FT

NOTE:— ADD 20% SURCHARGE TO BORROW. (DAM EMBANKMENT ONLY)

REF. - G-67227-5 OF 5

NO.	DATE	REVISION	DWN	CHD	EXD	APPD	APPD	W.A.

4 CORNERS POWER PLANT - NPDES
WATER TREATMENT POND DAM
TYPICAL SECTIONS

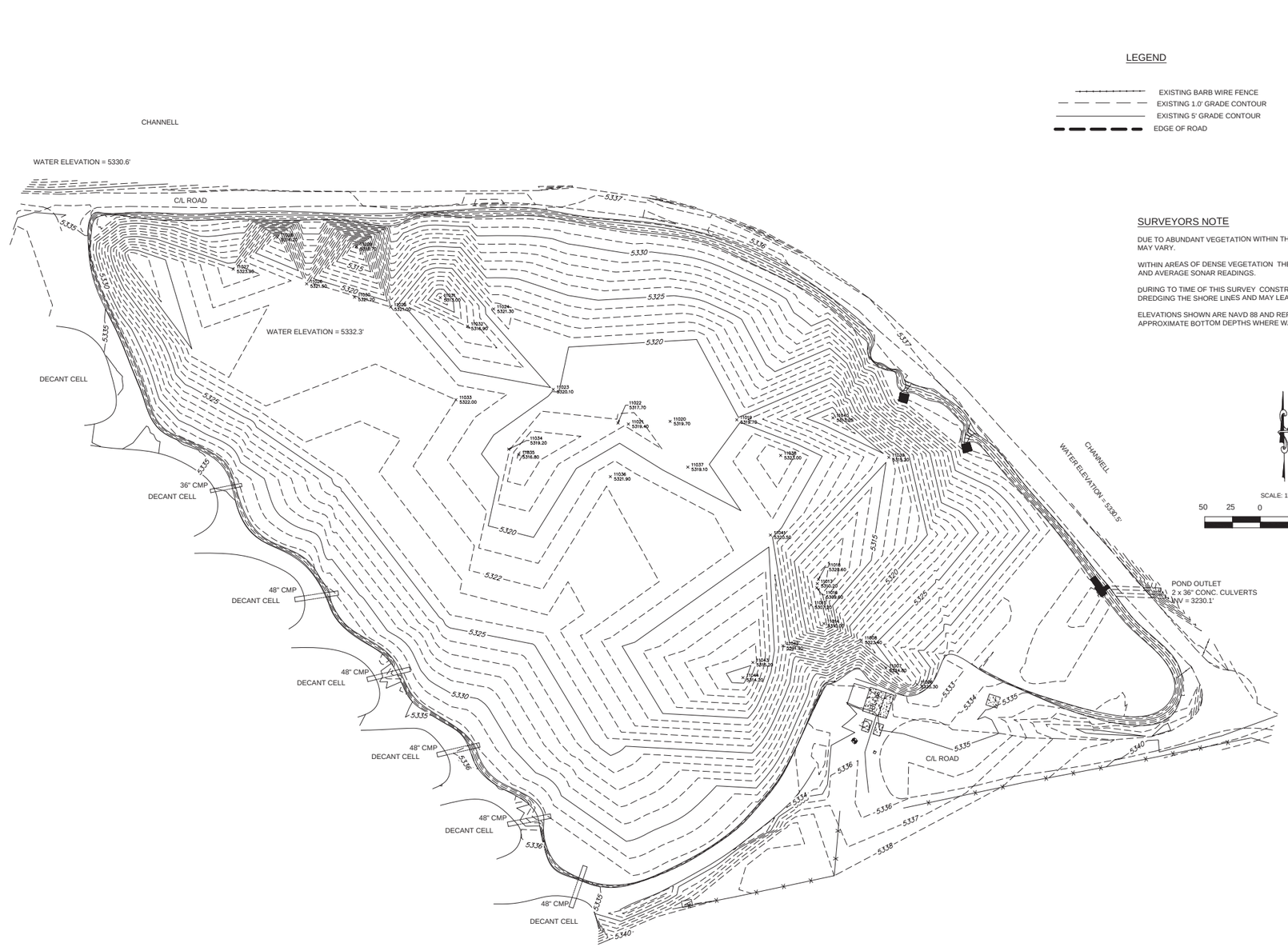
ARIZONA **PUBLIC SERVICE** COMPANY
PHOENIX

SCALE 1/4"=1'0" DATE 6-8-78

DRAWN RSB | CHECKED | EXAMINED OMP | APPROVED | APPROVED Engineering Manager 7/14/78 | W.A. 95-4-106-92 | DRAWING NO. G- 67227 SHEET 1 of 5

"INDEX"

Figure A-1



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C:\Users\sam.brescia\Desktop\B-Survey\2016-339 APS Pond\Prelim Survey\ACAD\APSWASTEPOND2017.dwg

APS COMBINED WASTE POND
FOUR CORNERS GENERATING STATION

FRUITLAND, NEW MEXICO

OWNER: ARIZONA PUBLIC SERVICE COMPANY

MARK	DATE	DESCRIPTION

SHEET TITLE

EXISTING TOPO.

Project Number	2016-339
Date	September 7, 2016
Drawn By	SDB
Checked By	PFM

Figure A-2

Appendix B.
National Wetlands Inventory Map

U.S. Fish and Wildlife Service
National Wetlands Inventory

CWTP Wetlands

August 1, 2018

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

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

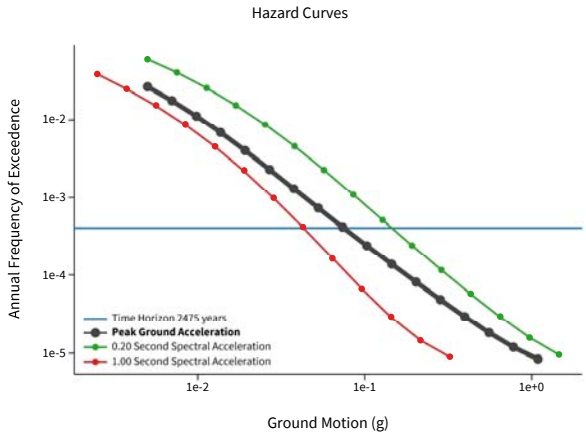
Latitude
Decimal degrees
36.692

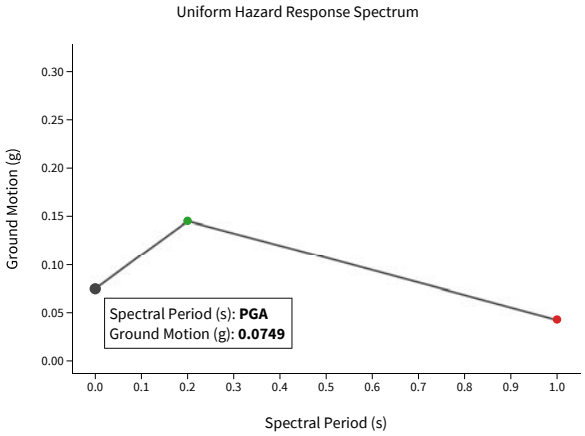
Time Horizon
Return period in years
2475

Longitude
Decimal degrees, negative values for western long…
-108.474

Site Class
760 m/s (B/C boundary)

Hazard Curve





View Raw Data