Arizona Public Service
Cholla Power Plant

Bottom Ash Monofill

Location Restrictions Demonstration Report

Prepared for :
Arizona Public Service

AECOM Job No. 60587726
October 8, 2018

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Certification Statement

Certification Statement for Location Restrictions:

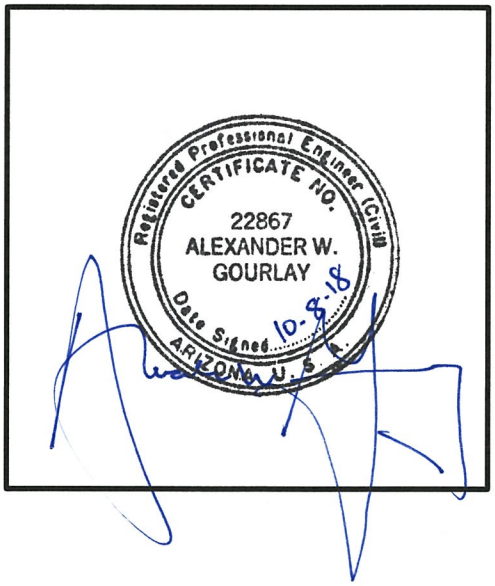
- **40 CFR § 257.64 – Unstable Areas**

CCR Unit: Arizona Public Service Company; Cholla Power Plant; Bottom Ash Monofill

I, Alexander Gourlay, being a Registered Professional Engineer in good standing in the State of Arizona, 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 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 meets the requirements of 40 CFR § 257.64(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 restriction demonstration of the Bottom Ash Monofill at the Cholla Power Plant (Cholla, the Plant) near Joseph City, in Navajo County, Arizona. Figure 1-1 shows the location of the Bottom Ash Monofill at Cholla. This Demonstration Report documents location-specific conditions relevant to the Bottom Ash Monofill.

1.1 Report Purpose and Description

The purpose of this report is to document the location restriction demonstration for the Bottom Ash Monofill. The Bottom Ash Monofill is an existing CCR landfill owned and 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 surface CCR landfills must obtain a certification from a qualified professional engineer stating that the demonstration for the CCR unit meets the requirements relative to 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). Section 257.64 defines location restriction criteria for existing CCR landfills and requires the owner or operator of the CCR unit to demonstrate that the unit meets minimum requirements for location away from unstable areas.

Existing CCR landfills, such as the Bottom Ash Monofill, are required to demonstrate compliance with the location restrictions by October 17, 2018. An owner or operator unable to demonstrate compliance is prohibited from placing CCR in the CCR unit under 40 CFR § 257.64(c)(4).

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 – Location Relative to Unstable Areas	§ 257.64 Unstable areas
• Section 3 – Conclusions	
• Section 4 – Limitations	
• Section 5 – References	
• Appendix A – Karst and Land Subsidence Maps	

1.4 Facility Description

The Cholla Power Plant is an electric generating station located near Joseph City, in Navajo County, Arizona. The station consists of four coal-fired units. Units 1, 2 (decommissioned), and 3 are owned by APS and Unit 4 is

owned by PacifiCorp. CCR generated at the Plant is either recycled for beneficial use or disposed at two major surface impoundments: the Fly Ash Pond located approximately 1.5 miles east of the Plant and the Bottom Ash Pond located about 1 mile north of the Plant. The Bottom Ash Monofill was constructed to dispose of bottom ash excavated from the Bottom Ash Pond. Lesser amounts of CCR, from the vehicle wash station, vacuum trucks, and Plant area runoff, are collected at the Sedimentation Pond. Figure 1-1 shows the location of the Bottom Ash Monofill in relation to the Plant.

The Bottom Ash Monofill is a coal combustion waste landfill that was constructed beginning in the late 1990s. In 2009, the Arizona Department of Environmental Quality (ADEQ) executed an amendment to Cholla Plant Aquifer Protection Permit No. P-100568 for the currently-permitted 43-acre footprint and maximum storage elevation of 5,261 feet above mean sea level, with final slopes of 4H:1V (horizontal:vertical). In 2015, the Bottom Ash Monofill was expanded to the north and east to its maximum APP-permitted footprint to add capacity for continuing operations at the Plant (APS 2018a).

2 Location Relative to Unstable Areas

40 CFR § 257.64 requires that existing CCR landfills must 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 an 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.

2.1 Methodology

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

Published geologic references documenting the Holbrook Basin salt karst subsidence features and Interferometric Synthetic Aperture Radar (InSAR) data collected by the Arizona Department of Water Resources (ADWR) Satellite Based Land Subsidence Monitoring Program to monitor the spatial extent, deformation rates, and time-series history of land subsidence features identified in the state were reviewed to assess the potential for karstic terrain in the vicinity of the Bottom Ash Monofill.

2.2 Discussion and Conclusion

2.2.1 Geologic Setting

The Cholla Power Plant is located within the Navajo section of the Colorado Plateau Physiographic Province. The Colorado Plateau is characterized by wide areas of nearly flat-lying sedimentary rocks, separated by abrupt monoclinal folds formed when sedimentary rocks overly deep basement faults. The northwest-southeast trending Holbrook anticline occurs approximately 20 miles south of the Plant. The Navajo section is a somewhat poorly defined structural depression consisting of broad plateaus and wide valleys (Hendricks 1985). The Plant is located approximately ½ mile north of the Little Colorado River. Exposed bedrock units in the vicinity of the plant include the Permian-age Coconino Sandstone, the Triassic-age Moenkopi and Chinle Formations, and the Quaternary alluvial deposits of the Little Colorado River. Surficial geology at the Plant site consists of up to 200

feet of heterogeneous interbedded sand, silt, and clay layers of the Little Colorado River alluvium (Montgomery & Associates 2011).

The landfill is surrounded on its north, east, southeast, and west sides by natural topography consisting of rock outcrops of mudstones, siltstones, and sandstones. The southwest side is adjacent to the Bottom Ash Pond.

2.2.2 Foundation Conditions

The Bottom Ash Monofill is founded on native alluvium overburden associated with Tanner Wash, which overlies the Moenkopi formation. Based on borings drilled adjacent to the Bottom Ash Monofill in the northeast section of the Bottom Ash Pond footprint during the Ebasco (1975) geotechnical investigation, the soils in the area consist of approximately 2 to 7 feet of clay, silt, sand, and gravel overlying interbedded claystone, siltstone, and sandstone (the Holbrook Member of the Moenkopi Formation).

2.2.3 Areas Susceptible to Mass Movement

Design and construction documentation indicate that the Bottom Ash Monofill was not constructed on materials that would be susceptible to excessive settlement. Topographic and geologic conditions do not indicate the potential for landslides, avalanches, debris slides and flows, block sliding, rock falls, or other mass movements which could impact the structural components of the Bottom Ash Monofill.

2.2.4 Karst Areas

Collapse features (sinkholes, fissures, depressions, expanded bedrock joints and joint sets, compression ridges and buckles) associated with dissolution of evaporate deposits within the Permian-aged Supai Formation have been documented within the Holbrook Basin (see map in Appendix A). These features, collectively referred to as “salt karst,” are concentrated along a roughly 60 mile long, northwest-southeast trending dissolution front near the southwestern margin of the Holbrook Basin, approximately 20 miles from the Cholla Power Plant.

The Cholla Power Plant site is within the Holbrook Basin where ADWR monitors several land subsidence features. ADWR monitors the extent and rate of land subsidence annually using InSAR data. Land subsidence maps published by ADWR for the Holbrook Basin are included in Appendix A. Three features in the Holbrook Basin are located approximately 11 miles from the Plant site and are associated with evaporite karst dissolution. A fourth land subsidence feature has been identified south of Joseph City, approximately 2 miles southwest of the Plant site. No land subsidence features have been identified at the Plant site.

2.2.5 Subsidence

Extraction of a groundwater resource can cause lowering of the regional groundwater table, consolidation of alluvial deposits, and lowering of the ground surface. In extreme circumstances, in combination with variations in the bedrock surface, earth fissures can form and express at the ground surface around the boundary of the subsidence area. The ADWR land subsidence maps (Appendix A) indicate the presence of a 1-mile wide localized subsidence area approximately 2 miles west of the Plant, 3 miles southwest of the Bottom Ash Pond and Bottom Ash Monofill, and 3.5 miles west of the Fly Ash Pond.

The InSAR data suggest subsidence rates in the range of 0 to 1 centimeters per year (cm/yr) for the most recent six-year interval (2012-2018). APS operates a wellfield south and east of the Plant, east of the subsidence area indicated on the ADWR land subsidence maps (Appendix A). APS staff report that: 1) APS groundwater extraction from its wellfield has decreased by approximately one-third since the retirement of Unit 2 in 2014 and 2) the Coconino aquifer is highly productive and groundwater levels within the wellfield have been rising since the retirement of Unit 2 in 2014 (APS Internal Communication 2018b).

The ADWR land subsidence maps suggest a cumulative subsidence of 3.9 to 5.9 inches between 2012 and 2018. The ground underlying the Bottom Ash Monofill is not considered to be susceptible to the formation of earth fissures based on the distance of the CCR unit from the area of identified subsidence and the relatively small indicated total settlement.

Conclusion: The Bottom Ash Monofill is not located in an unstable area.

3 Conclusions

Based on the findings and results of the location restriction demonstration, AECOM provides the following conclusion for the Bottom Ash Monofill.

- The Bottom Ash Monofill is not located in an unstable area.

4 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.

5 References

Arizona Public Service Company (APS), 2018a. “Cholla Power Plant Fly Ash Dam, Bottom Ash Dam, Sedimentation Pond and Bottom Ash Monofill – Annual CCR Impoundment and Landfill Inspection Report 2017.” January.

Arizona Public Service Company (APS), 2018b. “Internal Communication.” September 21.

Montgomery & Associates, 2011. “Arizona Public Service Cholla Power Plant Point of Compliance Evaluation.” Prepared for Arizona Public Service Company. January 26.

Hendricks, David M., 1985. “Arizona Soils.” A Centennial Publication of the College of Agriculture, University of Arizona. Tucson, Arizona.

Figure

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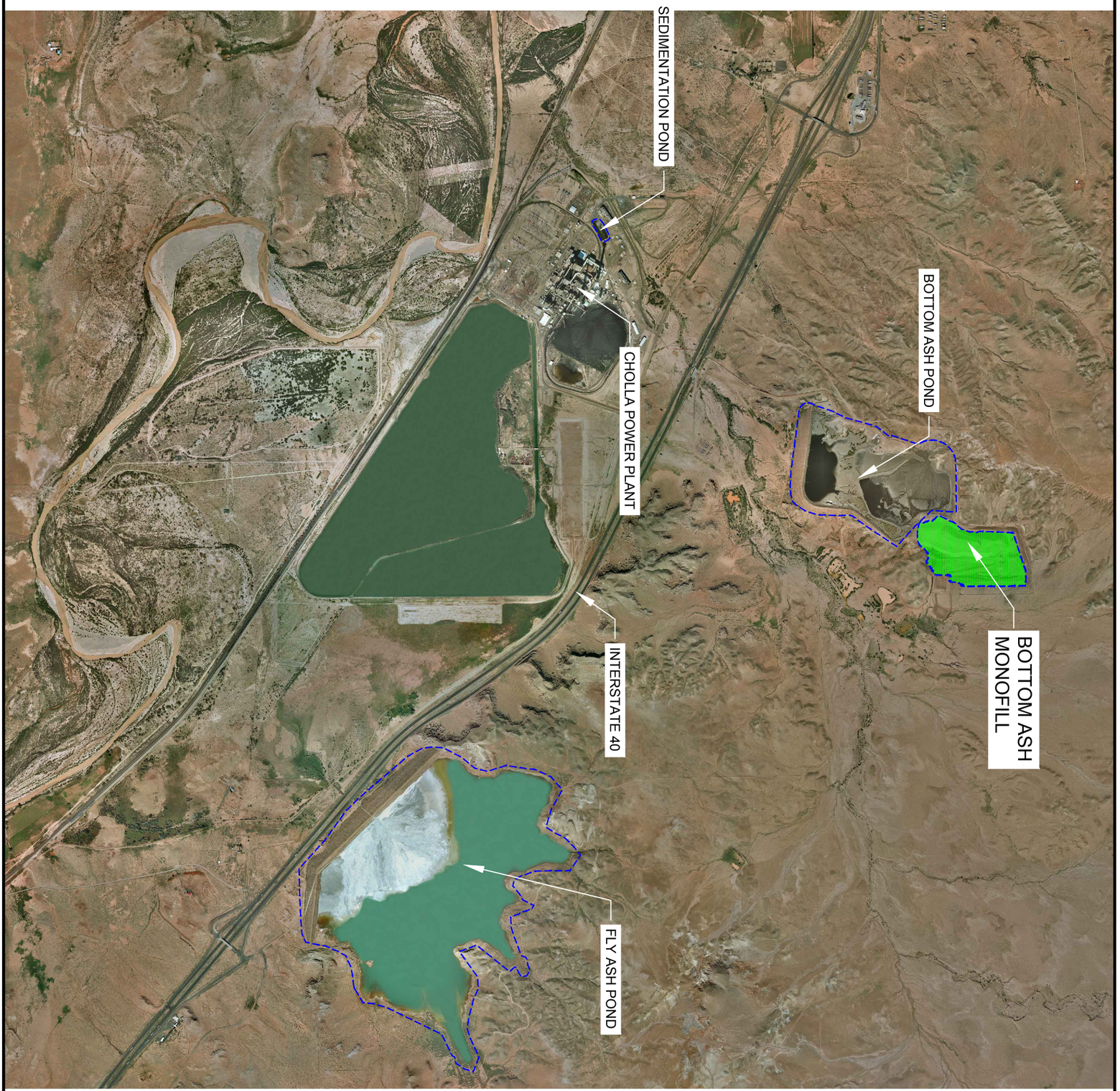


CHOLLA POWER PLANT
BOTTOM ASH MONOFILL LOCATION RESTRICTIONS
ARIZONA PUBLIC SERVICE
Project No.: 60587726

SITE VICINITY MAP

AECOM

Figure 1-1

Appendix A.
Karst and Land Subsidence Maps

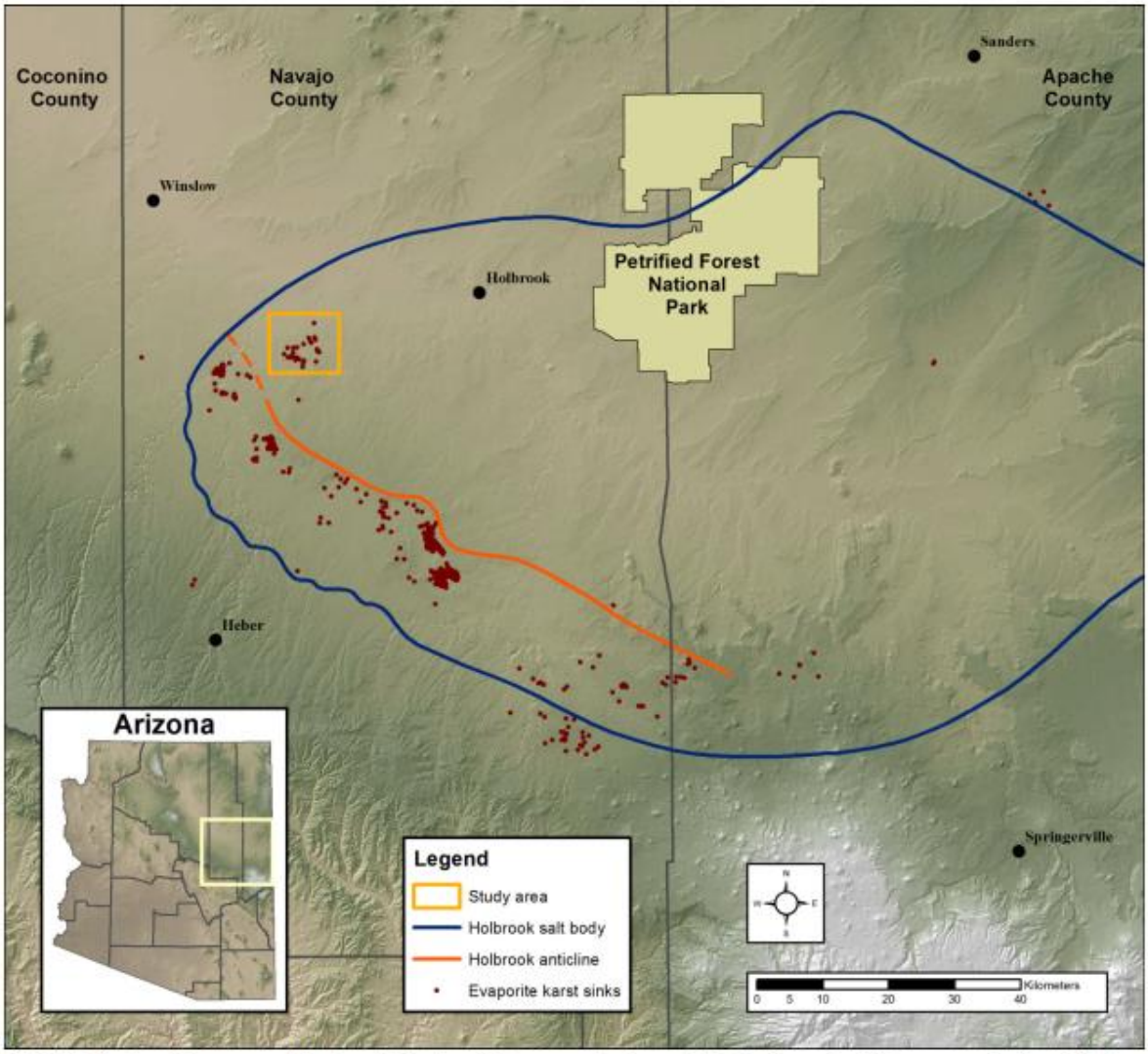
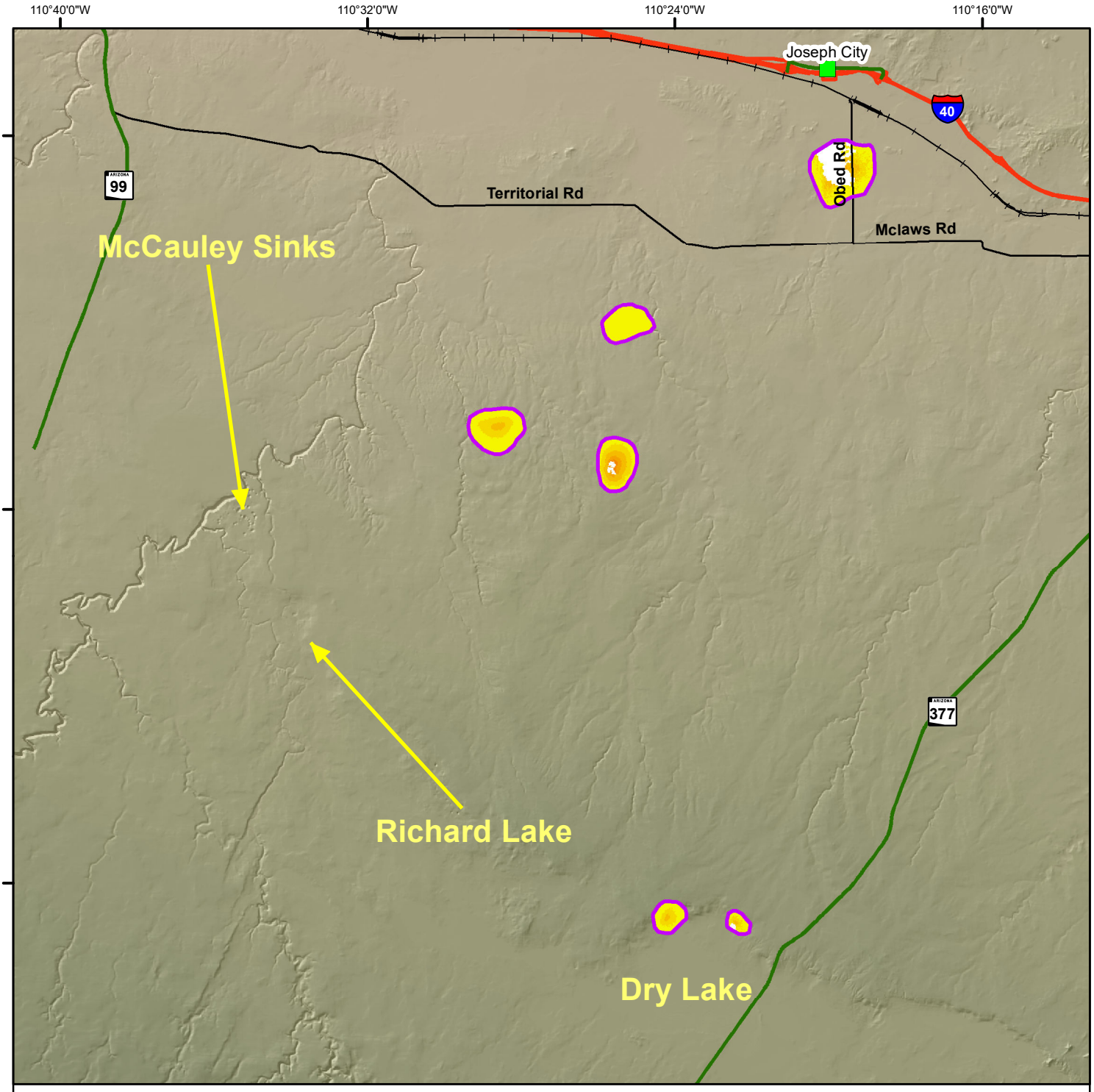


Figure 1. *Location map of Holbrook Basin, study area extent, and distribution of existing evaporite karst sinks relative to the extent of the Holbrook salt body and anticline.*



Total Land Subsidence in the Holbrook Basin, Navajo County
Based on Radarsat-2 Satellite Interferometric Synthetic Aperture Radar (InSAR) Data
Time Period of Analysis: 5.5 Years 09/22/2012 To 04/24/2018

© MDA 2012 - 2018

Explanation

09/22/2012 To 04/24/2018

Total Land Subsidence

- Decorrelation/No Data
- Greater 40 cm (15.7 in)
- 25 - 40 cm (9.8 - 15.7 in)
- 15 - 25 cm (5.9 - 9.8 in)
- 10 - 15 cm (3.9 - 5.9 in)
- 6 - 10 cm (2.4 - 3.9 in)
- 4 - 6 cm (1.6 - 2.4 in)
- 2 - 4 cm (0.8 - 1.6 in)
- 1 - 2 cm (0.4 - 0.8 in)
- 0 - 1 cm (0 - 0.4 in)

- Subsidence Feature
- Hardrock
- Cities/Towns

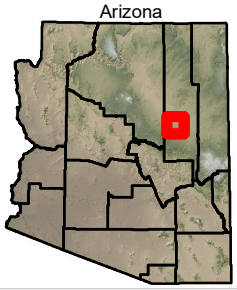
Highways and Interstates

- Interstate
- US
- State
- Roads
- Railway

1:220,000

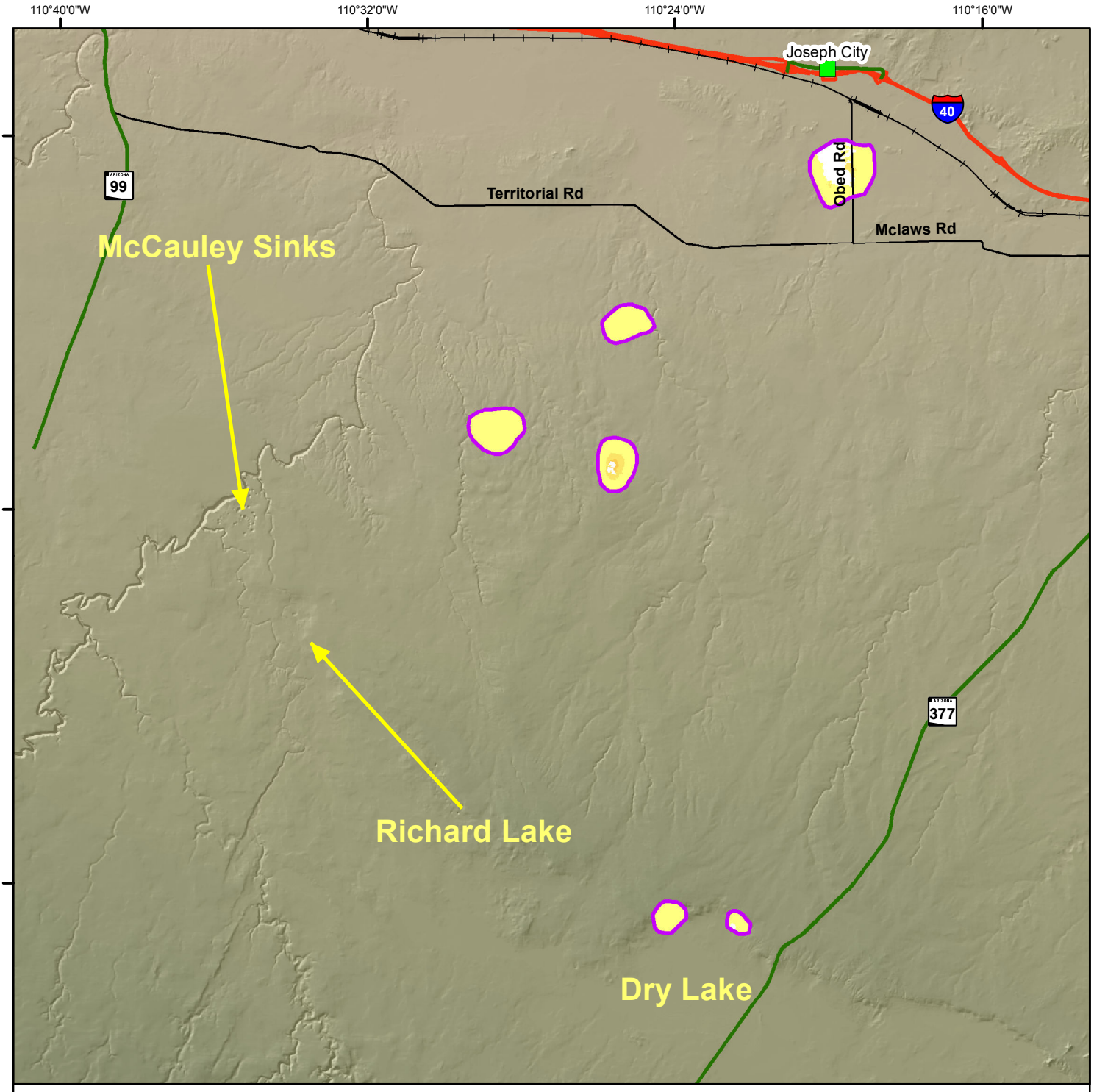
0 1 2 4 6 8 Miles

Arizona



Decorrelation (white areas) are areas where the phase of the received satellite signal changed between satellite passes, causing the data to be unusable. This occurs in areas where the land surface has been disturbed (i.e. bodies of water, snow, agriculture areas, areas of development, etc).

Coordinate System: NAD 1983 UTM Zone 12N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
Created: 5/15/2018



Land Subsidence Rate in the Holbrook Basin, Navajo County
Based on Radarsat-2 Satellite Interferometric Synthetic Aperture Radar (InSAR) Data
Time Period of Analysis: 5.5 Years 09/22/2012 To 04/24/2018

© MDA 2012 - 2018

Explanation

09/22/2012 To 04/24/2018

Land Subsidence Rate

- Decorrelation/No Data
- Greater 7 cm/yr (2.8 in/yr)
- 5 - 7 cm/yr (2.0 - 2.8 in/yr)
- 3 - 5 cm/yr (1.2 - 2.0 in/yr)
- 2 - 3 cm/yr (0.8 - 1.2 in/yr)
- 1 - 2 cm/yr (0.4 - 0.8 in/yr)
- 0.5 - 1 cm/yr (0.2 - 0.4 in/yr)
- 0 - 0.5 cm/yr (0 - 0.2 in/yr)

- Subsidence Feature
- Hardrock
- Cities/Towns
- Railway

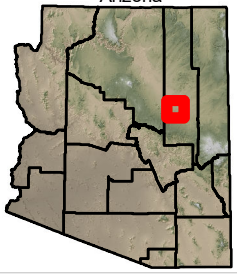
Highways and Interstates

- Interstate
- US
- State
- Roads

1:220,000

0 1 2 4 6 8 Miles

Arizona



Decorrelation (white areas) are areas where the phase of the received satellite signal changed between satellite passes, causing the data to be unusable. This occurs in areas where the land surface has been disturbed (i.e. bodies of water, snow, agriculture areas, areas of development, etc).

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