

2016 Landfill Inspection Report

Northeastern Units 3&4 Ash Landfill
Oologah, Oklahoma
NHIW Landfill Permit No. 3566010

November 2016
Project No. 35167178



**PUBLIC SERVICE
COMPANY OF
OKLAHOMASM**

A unit of American Electric Power

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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

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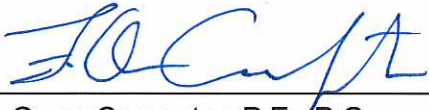
PROFESSIONAL ENGINEER'S CERTIFICATION

The following Sections contain information, studies, findings, data, and observations compiled by Terracon Consultants, Inc. (Terracon) for Public Service Company of Oklahoma (PSO) Northeastern Power Station Units 3 & 4. This report documents findings for the Northeastern Ash Landfill, an existing non-hazardous industrial solid waste (NHIW) landfill located in Rogers County, Oklahoma. Public Service Company of Oklahoma is a unit of American Electric Power.

This document is intended to comply with *CCR Rule Section 257.84 Inspection requirements for CCR landfills*. The information that comprises this Annual Inspection Report was prepared under the direction of F. Owen Carpenter, a licensed professional engineer in the State of Oklahoma.

As required by *Oklahoma Title 59 O.S. Supp. 2010- Section 475*, Terracon Consultants, Inc. is authorized by the Oklahoma State Board of Professional Engineers and Land Surveyors to provide engineering services in the State of Oklahoma. In testimony thereof, **Certificate Number 4531** was issued under seal of the Board on March 24, 2004. The current certification expiration date is June 30, 2017.

"I certify that, to the best of my knowledge, the information contained herein is accurate and verifiable."



F. Owen Carpenter, P.E., P.G.
Oklahoma Professional Engineer No. 23514

November 10, 2016

Date



Expires 31-OCT-17

1.0 INTRODUCTION

Public Service Company of Oklahoma (PSO) owns and operates the Northeastern Ash Landfill, an existing non-hazardous industrial solid waste (NHIW) disposal facility located near Oologah, Oklahoma. The landfill currently operates under ODEQ Permit No. 3566010 and is permitted to dispose of coal combustion residuals. The PSO Northeastern Power Station is located at the junction of U.S. Highway 169 and Oklahoma Highway 88 approximately 1 mile south of Oologah, Rogers County, Oklahoma. A site location map showing the general location of the landfill is presented in **FIGURE 1** in **APPENDIX A**.

Mr. Owen Carpenter, P.E., and Mr. Quin Baber, P.G. performed the 2016 annual inspection of the ash landfill at the Northeastern Power Station. This report is a summary of the inspection and an assessment of the general condition of the facility.

Prior to conducting the inspection, all available information regarding the status and condition of the CCR unit, such as the operating record and 7-day inspection forms, was reviewed. The date ranges of the 7-day inspections reviewed were 10/21/2015 through 12/30/2015 and 1/4/2016 through 6/29/2016. None of the 7-day inspections indicated a deficiency, however the inspection form from 6/9/2016 indicated that the leachate pumps and collection system were undergoing routine maintenance. Therefore, the pumps were not online and could not be verified as under satisfactory condition at that time.

The 2016 annual inspection was conducted on September 28, 2016 during the morning hours. Weather conditions were sunny during the inspection with temperature ranging from approximately 54 degrees to 70 degrees Fahrenheit. Precedent rainfall totaled approximately 0.7 inches during the seven days leading up to the inspection date (Tulsa Int. Airport Station).

FIGURE 2 in **APPENDIX A** provides a plan view Google Earth aerial photographic image of the subject landfill and areas observed during the annual inspection. Photographic log approximate location and viewing directions are depicted on the figure using directional arrows. The existing landfilled wastes were placed within a mined/quarried area adjacent to the Verdigris River near the southern boundary of the Northeastern Plant property ownership. Portions of the upper limestone rock appear to have been removed, primarily within the western portion of the landfill. A dike structure defining the south edge of the disposal facility was built as a part of initial plant construction. This dike would be built to an elevation of 610 feet MSL having a crest width of 10 to 12 feet and 3:1 side slopes. The dike acted as a barrier between the disposal area and the Verdigris River. An additional construction event raised the dike to the current crest elevations of greater than 630 feet MSL, with a crest width of about 25 feet. Side-slopes of the dike, running down to the river basin, have an overall slope on the order of 30 degrees from horizontal and consist of red-brown clay with limestone gravel mixed with varying amounts of ash material and larger rock. Limestone with some thin shale beds, followed by shale, underlies the constructed

dike. The facility previously installed a slurry wall and grout curtain on the southeast side of the landfill within the constructed dike.

2.0 GENERAL INFORMATION

Structure or Unit: Northeastern Ash Landfill, including separation dike along Verdigris River

Owner: Public Service Company of Oklahoma

Type of Dike: Earthen Fill

Date of Construction: Initial Construction 1979

OWRB Hazard Classification: Low

LOCATION

County: Rogers County

General Location: One mile south of Oologah, OK

Stream and Basin: Verdigris River

SIZE

Dike Crest Elevation: 630 (approximate)

Height: 28 feet average above bedrock

In-place Waste: 1.64 million cubic yards (approximate)

3.0 SUMMARY OF VISUAL OBSERVATIONS

The summary of the visual observations presented herein uses terms to describe the general appearance or condition of an observed item, activity or structure. Their meaning is understood as follows:

CONDITION OF LANDFILL OR DIKE COMPONENT

Good: A condition or activity that is generally better or slightly better than what is minimally expected or anticipated from a design or maintenance point of view.

Fair or Acceptable: A condition or activity that generally meets what is minimally expected or anticipated from a design or maintenance point of view.

Poor: A condition or activity that is generally below what is minimally expected or anticipated from a design or maintenance point of view.

SEVERITY OF DEFICIENCY

Deficiency: A “deficiency” is some evidence that a dam or other retaining structure has developed a problem that could impact the structural integrity of the dam or retaining structure. There are four general categories of deficiencies. These four categories are described below:

1. Uncontrolled Seepage is seepage that is not behaving as the design engineer has intended. An example of uncontrolled seepage is seepage that comes through or around the embankment and is not picked up and safely carried off by a drain. Seepage that is collected by a drain can still be uncontrolled if it is not safely collected and transported, such as seepage that is not clear. Seepage that is unable to be measured and/or observed is considered uncontrolled seepage. [Wet or soft areas are not considered as uncontrolled seepage, but can lead to this type of deficiency. These areas should be monitored frequently.]
2. Displacement of the Embankment is large scale movement of part of the dam. Common signs of displacement are cracks, scarps, bulges, depressions, sinkholes and slides.
3. Blockage of Control Features is the restriction of flow at spillways, decant or pipe spillways, or drains.
4. Erosion is the gradual movement of surface material by water, wind or ice. Erosion is considered a deficiency when it is more than a minor routine maintenance item.

Minor: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is normal or desired, but which is not currently causing concern from a structural safety or stability point of view.

Significant: A reference to an observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance program has neglected to improve the condition. Usually these conditions have been identified in previous inspections, but have not been corrected.

Excessive: A reference to an observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is above or worse than what is normal or desired, and which may have affected the ability of the observer to properly evaluate the structure or particular area being observed or which may be a concern from a structural safety or stability point of view.

INSPECTION OBSERVATIONS –

See FIGURE 2: Landfill Inspection Location Plan

The annual inspection included observation for the presence of: Instability signatures, including areas of erosion, sloughing, scarps, saturated areas, changes in vegetation, misalignment, obvious settlement, sinkholes, cracking, etc.; insufficient vegetation; stormwater management features including ditches, swales, benches, etc.; CCR containment features; leachate management system, including precipitate buildup, damaged pipes, etc.; and, landfill liner system, leachate collection system, berms, etc.. For this 2016 annual inspection, the entire area was observed to discern any changes that may have affected the stability or operation of the CCR unit between the initial inspection and the current inspection. The initial inspection included photo-documentation of nearly the entire length of the separation dike along the Verdigris River. The current photo-documentation is focused on any changes that were observed, including the finished landfill intermediate liner area conditions. All areas were observed, unless documented below. No potential or actual structural weaknesses were observed and no changes were noted that could potentially affect the stability and operation of the landfill since the previous inspection.

The landfill currently has an estimated 1.64 million cubic yards of waste in place as of the date of the inspection. This in place waste approximation was estimated using topographic data and by the volumetric estimate of waste placed in the landfill since construction. It is recommended that the capacity remaining in the landfill to final waste grades be confirmed using topographic survey data from the next available landfill area survey. The landfill and associated land features were observed, beginning at the north end of Basin C and along the river-side dike over its full length then advancing counterclockwise around the landfill perimeter. Referenced photos are included in **APPENDIX B**.

Landfill Footprint Area

1. Since the initial 2015 annual inspection, minor changes in the geometry of the landfill have occurred. While no changes were made to the configuration of the landfill and cells layout and the perimeter dike system, additional materials including protective cover and wastes have been added. Every area of the existing landfill that was under construction during 2015, including the waste disposal area, the constructed and lined leachate impoundment, and stormwater collection area (Basin C), has been completed. The construction area was re-vegetated or will remain covered with protective geosynthetic materials or protective cover until filling operations begin in a given area.

2. It was noted in the 2015 initial report that there was an area of wetting at the toe of slope of the landfill perimeter berm across from the coal car unloading building. Current deep vegetation growth prevented observation of seepage in the area (Photo 46).

Perimeter Dike - Southwest perimeter of landfill and along the Verdigris River

1. The landfill perimeter dike begins to reach a height of greater than five feet in the vicinity of groundwater monitoring well MW-5 (near Photo 12), and then wraps around the southernmost corner of the landfill after which it runs the full length of the landfill and Basin C along the Verdigris River (to beyond Photo 1). See also **FIGURE 2**. Typical upper slope angles along the dike appeared to be approximately 4:1 and the lower slope appeared to be about 1:1 toward the river. A flatter slope was noted and appeared to be about a 2:1 slope in the vicinity of Photo 39. Occasional, local wetting at the interface between the dike fill and the underlying rock outcrop “shelves” has been noted historically. A slurry wall and grout-curtain system has been installed through the dike along the Verdigris River side of the dike. Up-gradient and down-gradient piezometers have been installed to measure the effectiveness of the slurry wall/grout curtain system and to monitor water levels. At the time of the inspection, the Verdigris River was running high due to discharge from the Oologah Lake Dam. Therefore, it was not possible to traverse the entire bottom slope length of the dike along the relatively flat stream bank area that is typically available during periods of low flow. The dike conditions were typically observed down the slope from the top, except along Basin C where conditions allowed for observation.
2. The outside slope of the dike was in stable condition, with no notable signs of instability. No saturated conditions were observed within the dike fill area above the rock outcrops of the native formation “shelves” upon which it typically rests. No saturated conditions were observed at the fill/shelf interface. Saturated areas or seepage areas emanating from the lower in-place rock shelves in the Verdigris River stream area were not documented for the purposes of this inspection.
3. The outer bank (downslope from the perimeter road at the top of the dike) was heavily wooded with trees and brush and leaf-fall. (Photo 39) Observation of small-scale pre-movement cracking, sloughing and/or saturated conditions may be obscured by the heavy ground cover. However, none were observed.

Stormwater Management System

1. The landfill intermediate liner design includes a perimeter berm that prevents run-on of stormwater into the fill area during operations and conveys stormwater outside the perimeter berm to the stormwater collection basin – Basin C. (Photo 37)
2. Stormwater conveyances have been fully constructed. At this time no blockages of stormwater flow, erosion, or deterioration are noted.
3. Occasional minor occurrences of pooling water within the GM lined perimeter ditch were noted. Trampolining of GM was noted within the perimeter ditch (Photo 10). However,

these occurrences do not inhibit general run-off of stormwater into basin C. Occasional puncture damage (likely deer hoof – Photo 18) or non-penetrating blemishes to the GM liner in the outer stormwater ditch running along the river side were noted. These are outside the constructed CCR containment area located inside the perimeter berm.

CCR Containment Features

1. No damage to the GM liner, berms, LCS piping, etc. was noted during the inspection within the permitted area of the landfill. No appreciable precipitate/scale buildup or damage was noted for visible portions of the leachate collection system. The pipes were cleaned out after placement of the protective cover and will be cleaned out after placement of the first lift of waste, and once a year thereafter in accordance with the facility operating plan.

4.0 CONCLUSIONS

Based on our visual inspection, it is concluded that the perimeter dike impounding the ash landfill was generally in good condition at the time of inspection. There were no observed signs of distress that would indicate actual or potential structural weakness of the unit. The dike did not show signs of existing conditions that are disrupting or have the potential to disrupt the operation and safety of the unit. The stormwater conveyances that have been constructed are in good condition with no blockages or deterioration other than the puncture noted above. The CCR containment features that have been constructed are in good condition with no damage noted to elements of the system.

5.0 RECOMMENDATIONS

Remedial Activities

- It is recommended that the geomembrane (GM) liner in the outer stormwater ditch running northeast along the river side should be repaired in areas where puncture damage, presumably from an animal hoof has occurred. While the GM lined ditch is not technically within the constructed CCR waste disposal unit, the GM liner is expected to provide an infiltration barrier to surface water that may percolate into the subsurface in the landfill area.

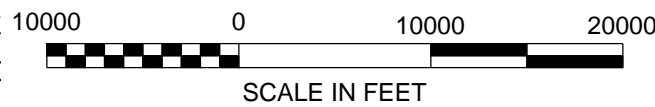
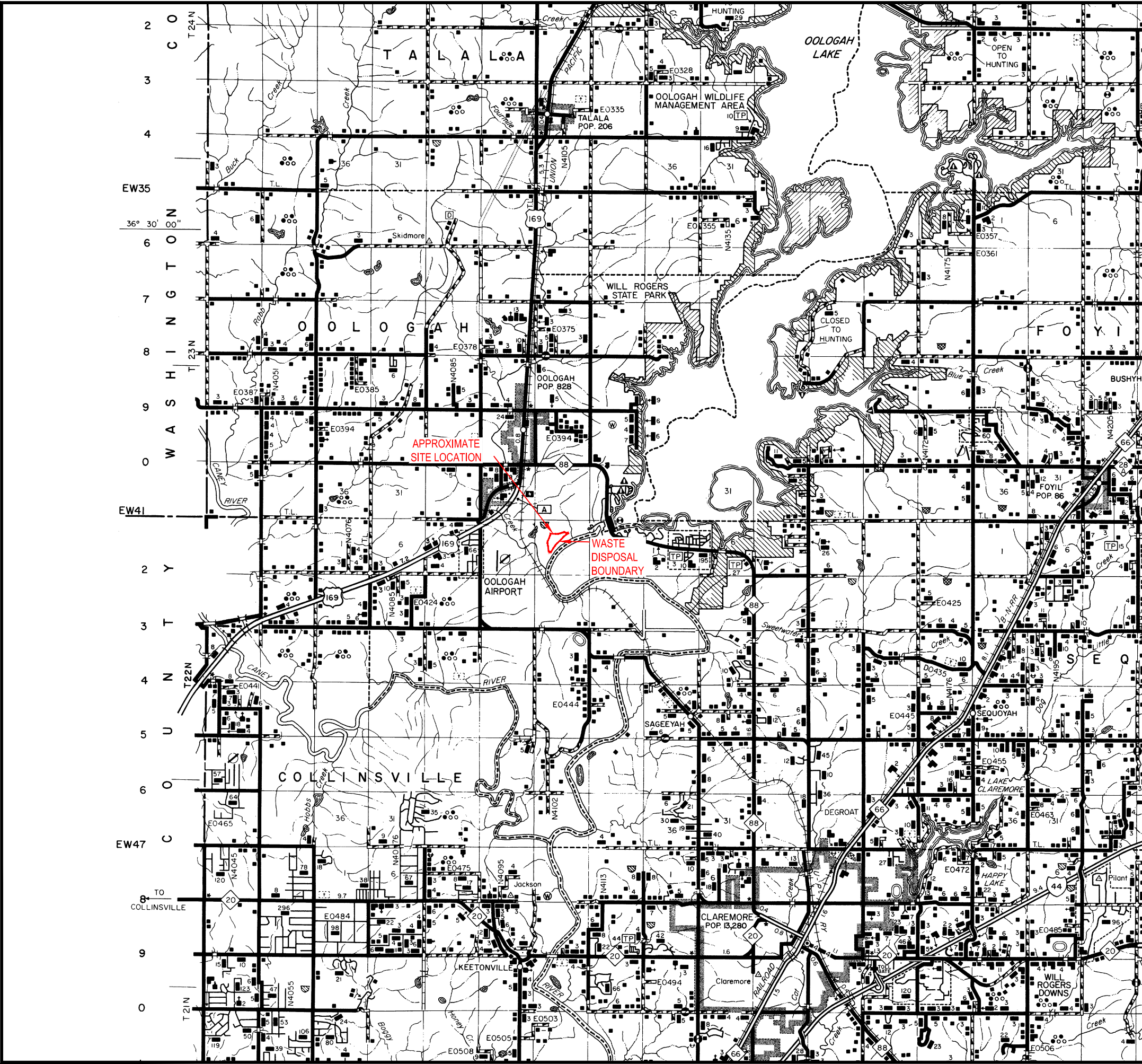
General Maintenance and Monitoring Activities

- Continue regulatory inspections, monitoring and maintenance as required by the CCR and ODEQ Solid Waste Management rules.

- Continue to monitor water levels in piezometers still in place in the slurry wall area to determine if excess pore water pressure is building in the outside slope of the perimeter dike.
- Monitor wet areas historically noted in the dike/bedrock interface within the Verdigris River stream area.
- Monitor wet areas at the toe of slope of the landfill perimeter berm in the area of the coal car unloading building.
- It is recommended that mowing be done prior to annual inspection services where possible. Vegetation should be maintained in a manner that allows for unobstructed observation and monitoring of potential seepage areas.

Appendix A

Figures



REV.	DATE	BY	DESCRIPTION

SITE LOCATION MAP

2016 ANNUAL CCR INSPECTION

AMERICAN ELECTRIC POWER

NORTHEASTERN ASH LANDFILL

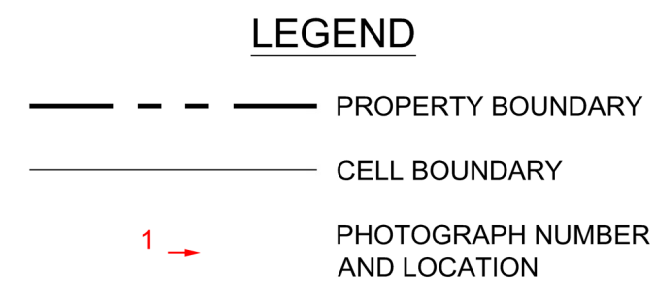
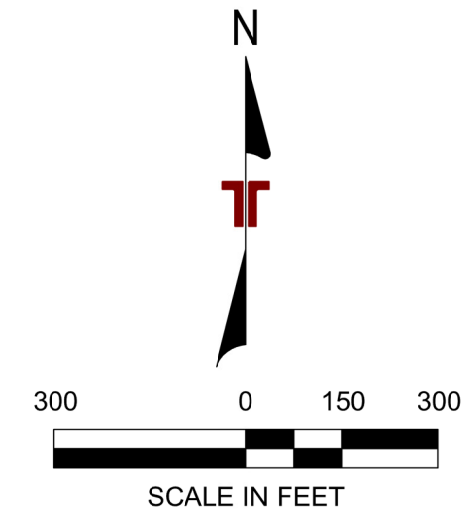
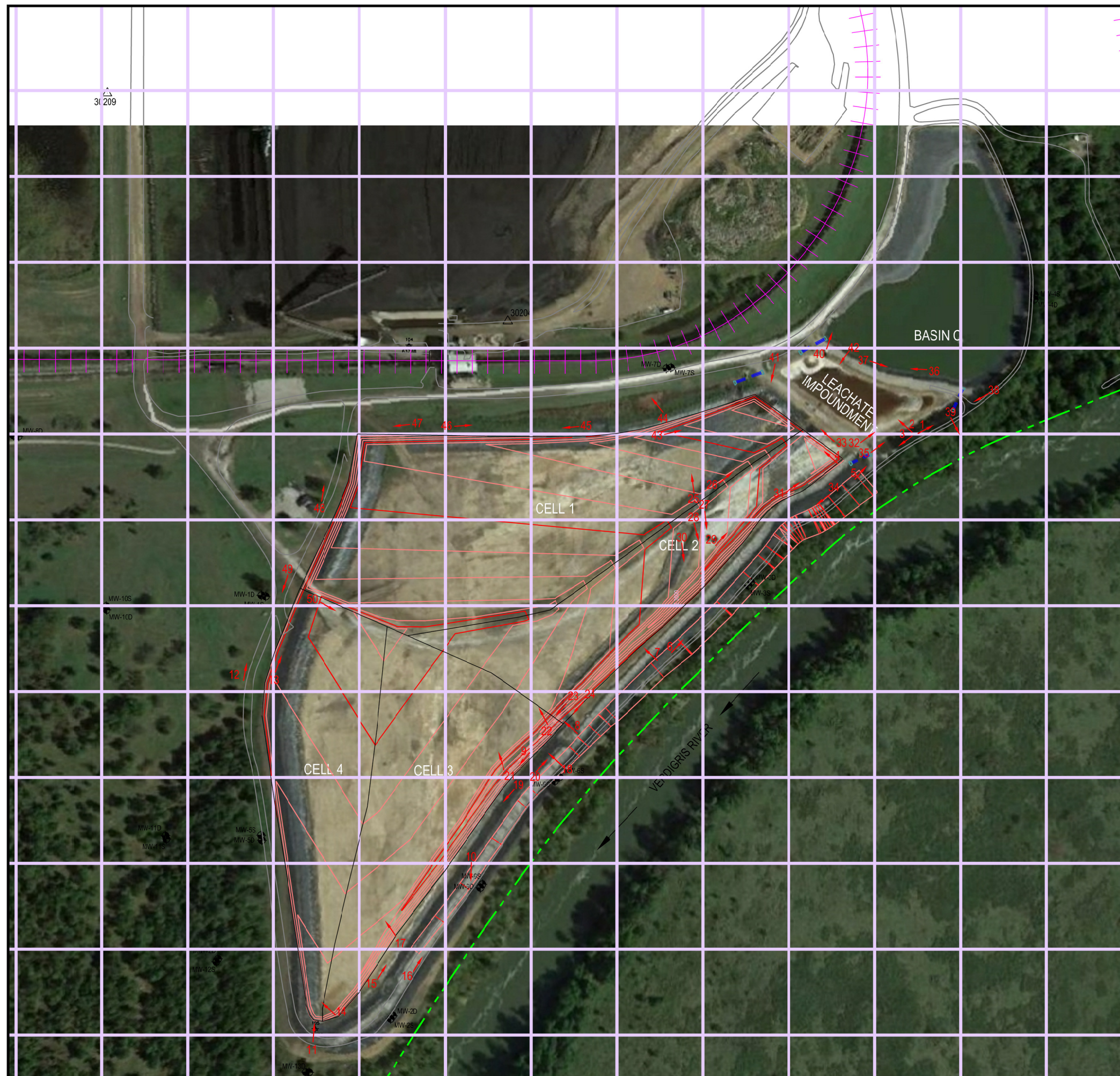
OKLAHOMA



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FIGURE 1	
DESIGNED BY:	FOC
DRAWN BY:	FOC
APPVD. BY:	FOC
SCALE:	1" = 10,000'
DATE:	10/7/2016
JOB NO.	216-003-35157178
ACAD NO.	001
SHEET NO.:	1 OF 2








Appendix B


Inspection Photographs

**NE 34 Ash Landfill 2016 Annual Inspection
Terracon Project Number 35167178
Appendix B Inspection Photographs**

Date of Photography September 28, 2016.

Text			
Photograph ID #	Description	Comments	Photo
1	Looking northeast toward Leachate Impoundment and Basin C	Observe entire landfill boundary and the Basin C boundary, including river-side dike structure	
10	Looking south at perimeter stormwater ditch	Minor pooling of water, along with trampolining of the geomembrane, occurs periodically in the ditch	

12	Looking north along perimeter road adjacent to Cell 4				
18	Puncture in geomembrane in stormwater ditch	Likely deer hoof puncture in flowline of perimeter ditch			
37	Looking northeast at stormwater inflow to Basin C				

39	Looking down-slope toward the Verdigris River				
46	Looking east at perimeter berm around Cell 1	Heavy vegetation prevents observation of wet conditions if present at the toe of the slope		