



Groundwater Monitoring System Certification

WEC Temporary Ash Disposal Area

Whelan Energy Center
Public Power Generation Agency/
Hastings Utilities

Hastings, Nebraska
February 9, 2018



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Certification

I do hereby certify, to the best of my knowledge, information and belief:

- that the information contained in this certification is prepared in accordance with accepted practice of engineering;
- that the information contained herein is accurate as of the date of my signature below;
- that I have reviewed the groundwater monitoring system in this certification report for evaluating the groundwater for the CCR management area Whelan Energy Center Temporary Ash Disposal Area, near Hastings, Nebraska and that the groundwater system meet the requirements described in 40 CFR 257.91.

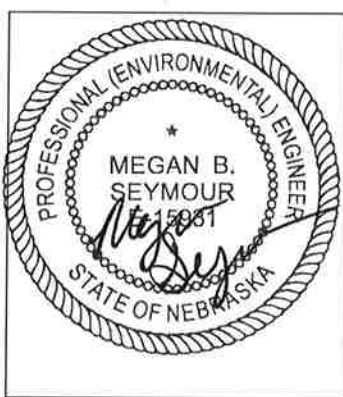
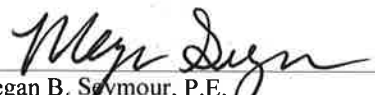
	 Megan B. Seymour, P.E. Nebraska License No. E-15931 My license renewal date is December 31, 2018. <u>02/09/2018</u> Date
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1 Introduction

On April 17, 2015 the U.S. Environmental Protection Agency (EPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA). The CCR rule is formally promulgated in the U.S. Code of Federal Regulations (CFR), Title 40, Parts 257 and 261. The rule – effective on October 19, 2015 – applies to electric utilities and independent power producers that fall within NAICS code 221112, and the facility produces or stores CCR materials in surface impoundments or landfills. This regulation applies to the Whelan Energy Center (WEC) owned and operated by Hastings Utilities.

The WEC Temporary Ash Disposal Area is currently permitted under the current Nebraska Department of Environmental Quality (NDEQ) Title 132 regulations for fossil fuel combustion ash disposal areas (NDEQ Permit No. NE0204129, Facility ID 58048). The Title 132 regulation and NDEQ require semi-annual sampling of groundwater monitoring wells with semi-annual reports. A Groundwater Sampling and Analysis Plan (Groundwater SAP) dated October 2016 describing the groundwater monitoring system for the WEC Temporary Ash Disposal Area was submitted to NDEQ in the most recent Title 132 permit renewal.

Pursuant to the 40 CFR Subpart D-Standards for the Disposal of CCRs, Section §257.91 requires a groundwater monitoring system that consists of sufficient number of wells at appropriate locations and depths, based on site-specific technical information, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of both background groundwater, and groundwater passing the boundary of the CCR unit.
- Monitor potential contamination pathways.

Based on the following information available for the Site, it is believed that the groundwater monitoring system at the WEC Temporary Ash Disposal Area site meets those requirements. This report includes the following sections in support of the certification.

- Section 1.0 Introduction
- Section 2.0 Facility Background
- Section 3.0 Site Hydrogeology Summary
- Section 4.0 Groundwater Monitoring System

2 Facility Background

The Whelan Energy Center is located in Adams County, Nebraska, approximately two miles east of Hastings, Nebraska. WEC Temporary Ash Disposal Area serves the two fossil fuel combustion units of the Whelan Energy Center. The WEC Temporary Ash Disposal Area is an existing CCR surface impoundment of approximately 23.2 acres that has historically received CCR for disposal/storage and is permitted with the State of Nebraska (NDEQ ID #58048, Program ID – IWM NE0204129). WEC Temporary Ash Disposal Area continues to receive CCR for disposal/storage.

3 Site Hydrogeology Summary

The groundwater monitoring system is based on the Hydrogeologic Characterization (HDR, 2011; Title 132 Permit – Appendix K) and Supplemental Hydrogeologic Characterization (HDR 2011; Title 132 Permit – Appendix L) and the Groundwater Modeling Study completed in October 2010 (HDR, 2010). The following information is a summary of the Site information obtained from the reports referenced above.

3.1 Geology

The near surface unconsolidated geology at the WEC site consists of:

- 55 to 80 feet of brown clay and lean clay (loess) at the surface
- Underlain by 30 to 40 feet of fine to medium grained sand and silty clay
- Underlain by fine to coarse alluvial sand and gravel (with minor clay lenses) of Pliocene/Pleistocene age starting at approximately 90 feet below ground surface (bgs) to a total depth of approximately 240 feet bgs.

3.2 Uppermost Aquifer

Depth to groundwater in the vicinity of the WEC Temporary Ash Disposal Area has historically been 105 to 115 feet bgs. More recent depths to groundwater have been approximately 110 to 125 feet bgs. The uppermost aquifer under the WEC Temporary Ash Disposal Area is the unconsolidated Pliocene/Pleistocene alluvial aquifer. This aquifer is considered to be unconfined in the area near the WEC. This aquifer consists of a generally coarsening downward sequence of clay, silt, sand and gravel with a total saturated thickness of approximately 120 to 135 feet (HDR, 2011). In general, this alluvial aquifer consists of highly transmissive sand and gravel interspersed with discontinuous clay layers. Underlying the Pliocene/Pleistocene alluvial aquifer is Cretaceous-age relatively impermeable bedrock that forms the base of the aquifer (HDR, 2010).

3.3 Hydraulic Gradient

The regional hydraulic gradient near Hastings is approximately south 70 degrees east at approximately 0.002 feet per foot (ft/ft) (HDR, 2011). Hydraulic gradient at the WEC Temporary Ash Disposal Area, as determined in 2001 by water levels collected from monitoring well MW-1 (installed in 1999) and the four additional monitoring wells (MW-2, 3, 4 and 5) installed in 2001, was to the southeast at an average gradient of 0.003 (ft/ft), which is similar to the regional groundwater direction. Subsequent monitoring had indicated a groundwater flow direction towards the east and northeast (towards WEC production wells). The changes in groundwater gradient could be due to drought conditions and the effects of local high-capacity production wells.

Hydraulic gradient and flow direction beneath the WEC Temporary Ash Disposal Area does not appear consistent throughout the observed monitoring history (2001 – 2015):

- 2001 to 2005: Groundwater flow direction is to the east northeast towards WEC Production Well C, with a gradient across the site of approximately 0.003 ft/ft.
- 2005 to Late-2007: Water levels at MW-5 dropped two feet, while water levels at the other monitoring wells rose three to five feet resulting in a shift in groundwater direction to the northwest. Regional modeling conducted for the Hastings vicinity does not support groundwater flowing northwest. Gradient across the site was approximately 0.003 ft/ft.
- Late-2007 to 2015: Groundwater flow direction returns to the north/northeast towards WEC Well C, however gradient increased to approximately 0.004 to 0.005 ft/ft.

3.4 Hydraulic Conductivity

Aquifer tests performed near the City of Hastings indicated the hydraulic conductivity of sand and gravel in the uppermost aquifer ranges from 0.067 to 0.081 cm/sec (HDR, 2010). Slug tests performed at the WEC monitoring wells indicated a range of 0.009 to 0.053 cm/sec (HDR, 2011). The lower hydraulic conductivities seen at the monitoring wells may reflect their completion higher up in the Pliocene/Pleistocene alluvial aquifer.

3.5 Groundwater Flow Velocity

Horizontal flow velocity was calculated for the groundwater beneath the WEC Temporary Ash Disposal Area based on hydraulic conductivity determined from slug tests at the monitoring wells and assuming an effective porosity of 26 to 38 percent for sand and gravel. Results indicated a horizontal flow velocity between 0.2 and 1.7 feet per day (HDR, 2011). This compares favorably with the average rate of groundwater movement in Adams County estimated to range from 0.5 to 2 feet per day (HDR, 2010).

3.6 Water Level Decline

Water levels collected at the WEC monitoring wells since 2001 show a decline of as much as five feet in groundwater level beneath the site. This decline since 2001 is reflected regionally in groundwater level data at other wells in the Hastings area (USGS, 2015). It should be noted that in one well located six miles to the west with a long-term record, groundwater level declined approximately 18 feet between predevelopment (1940) and 1981. Water levels then recovered 9 feet between 1981 and 2001, before declining 7 feet between 2001 and 2015.

4 Groundwater Monitoring System

Based on the groundwater flow to the east, southeasterly and northeasterly direction, observed by historical onsite groundwater level measurements, the groundwater monitoring system network for the WEC Temporary Ash Disposal Area is described in Table 1. The monitoring well locations are shown in the attached Figure 1. This groundwater monitoring system meets the minimum number of monitoring wells required by 40 CFR 247.91(c) (i.e. one upgradient and three downgradient). As sampling and analytical data are obtained, revisions to the monitoring system may be warranted. This certification will be updated as needed if revisions are appropriate.

The replacement well MW-5B, existing well MW-6, and the new upgradient well (MW-9) will be utilized initially to establish the background groundwater quality for the WEC Temporary Ash Disposal Area, as required by the CCR rule, for the Appendix III and IV constituents.

Monitoring well MW-2B is a deeper well to monitor for vertical downward migration of potential contaminants due to the influence of continuously pumping Well C. MW-2B is one of six downgradient wells.

Monitoring well MW-1 currently (as measured in 2017) has less than 14 feet of its 30-foot screen submerged in the upper aquifer and is a downgradient monitoring well. MW-2 has not had sufficient water levels for sampling since 2014 and is not included in the monitoring well system. Monitoring well MW-4B is a replacement well for MW-4, which has not had sufficient water levels for sampling since 2014. Monitoring well MW-3R was a replacement well for MW-3, which was abandoned in 2001. MW-3R, MW-4B, MW-7, and MW-8 are downgradient wells.

Groundwater monitoring wells MW-1 and MW-6 are constructed of 2-inch-diameter, schedule 40 PVC, flush threaded riser pipe, and machine slotted 10-slot (0.010 inch) screen. Groundwater monitoring wells MW-3R, MW-2B, MW-4B, MW-5B, MW-7, MW-8, and MW-9 are constructed with 4-inch diameter casing. The monitoring wells are screened in the uppermost aquifer. All wells have a 10-foot screen with the exception of MW-1, which has a 30-foot screen. The surface completion for each well consists of a steel protective casing, concrete apron, and protective bollards/posts.

Table 1. WEC Temporary Ash Disposal Area Groundwater Monitoring Well System ^(d,e)

Monitoring Well	Date Installed	Boring Depth ^(a) (feet bgs)	Well Depth (feet bgs)	Screened Interval (ft bgs)	Location w/ respect to Active CCR Unit	Approx. Top of Well Casing Elevation (ft AMSL)
Groundwater Monitoring System						
MW-5B ^(b)	10/11/2016	122.0	121.0	111.0 – 121.0	Background/ Upgradient	1899.16
MW-6	10/5/2004	110.5	110.0	100.0 – 110.0	Background/ Upgradient	1896.72
MW-9	10/10/2016	118.5	117.0	107.0 – 117.0	Background/ Upgradient	1896.54
MW-1	7/28/1999	135.0	134.0	104.0 – 134.0	Downgradient	1902.93
MW-2B (deep well)	10/18/2016	162.0	160.0	150.0 – 160.0	Downgradient	1902.96
MW-3R	1/29/2011	126.7	111.9	101.9 – 111.9	Downgradient	1900.45
MW-4B ^(c)	10/26/2016	121.0	119.0	109.0 – 119.0	Downgradient/ Cross-gradient	1897.02
MW-7	10/07/2016	127.2	127.0	117.0 – 127.0	Downgradient	1901.23
MW-8	10/20/2016	131.0	127.0	117.0 – 127.0	Downgradient/ Cross-gradient	1903.37

Notes:

^a Gravel pack (16-30 Silica Sand) was utilized to fill annulus between the bottom of the bore hole to approximately 2 feet above the top of screen.

^b MW-5B is a replacement well for MW-5 which has not had sufficient water to sample since 2014. MW-5 has not been abandoned; however it is not included in the monitoring well system.

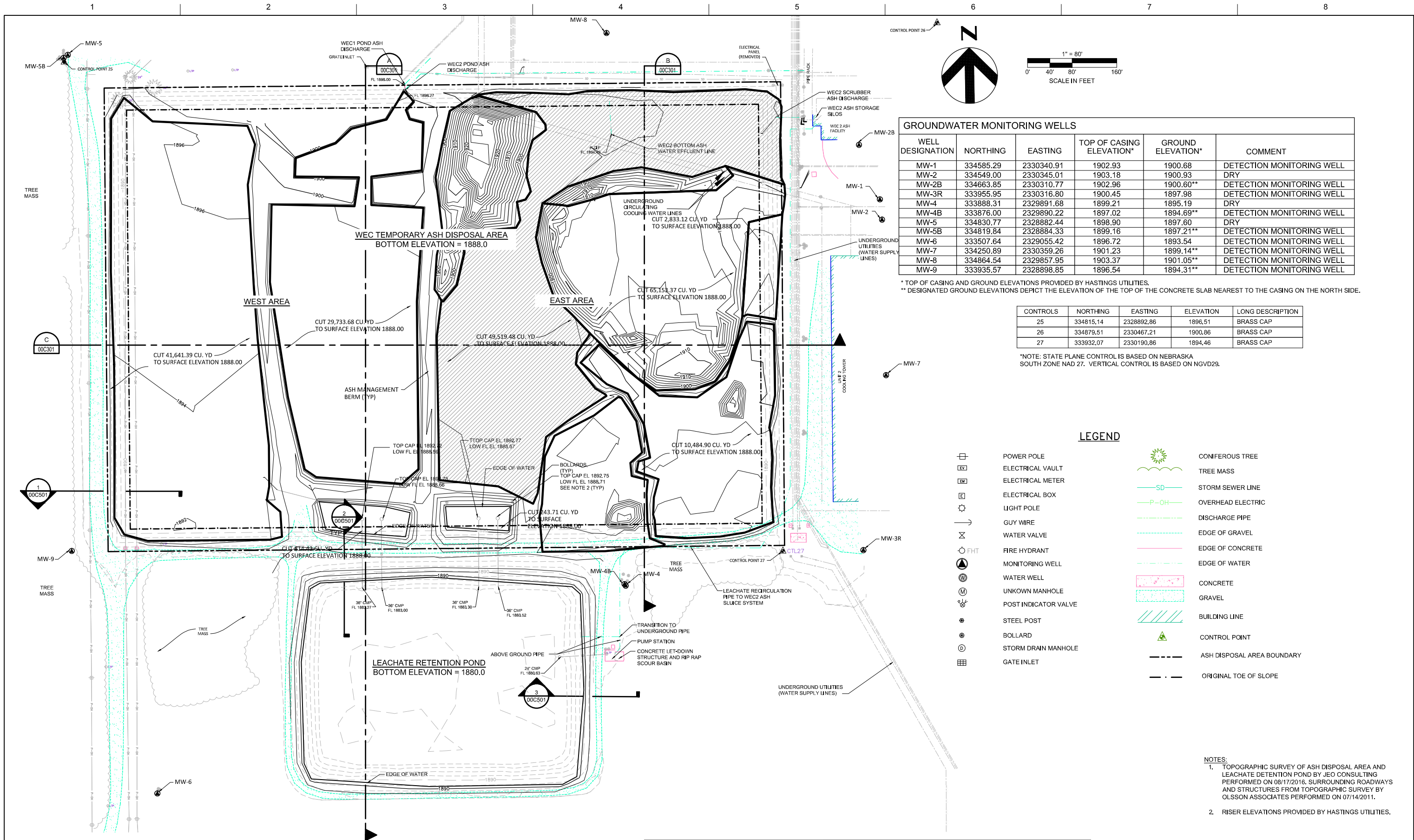
^c MW-4B is a replacement well for MW-4 which has not had sufficient water to sample since 2014. MW-4 has not been abandoned; however it is not included in the monitoring well system.

^d MW-2 has not had sufficient water to sample since 2014. It has not been abandoned; however it is not included in the monitoring well system.

^e MW-3 was abandoned in 2011 and is not included in the monitoring well system.

5 References

- HDR Engineering, Inc., 2010. Hastings Utilities Groundwater Modeling Study, October 2010 – Draft Final. Omaha, Nebraska.
- HDR Engineering, Inc., 2011. Permit Renewal Application – Whelan Energy Center Fossil Fuel Combustion Ash Temporary Ash Disposal Area. Prepared for Public Power Generation Agency and Hastings Utilities, City of Hastings, Nebraska, Revised August 2011. Omaha, Nebraska.
- United States Geological Survey, 2015. National Water Information System: Web Interface for Groundwater Data in Nebraska, Accessed online at <http://waterdata.usgs.gov/ne/nwis/gw> September 10, 2015.



GROUNDWATER MONITORING WELLS					
WELL DESIGNATION	NORTHING	EASTING	TOP OF CASING ELEVATION*	GROUND ELEVATION*	COMMENT
MW-1	334585.29	2330340.91	1902.93	1900.68	DETECTION MONITORING WELL
MW-2	334549.00	2330345.01	1903.18	1900.93	DRY
MW-2B	334663.85	2330310.77	1902.96	1900.60**	DETECTION MONITORING WELL
MW-3R	333955.95	2330316.80	1900.45	1897.98	DETECTION MONITORING WELL
MW-4	333888.31	2329891.68	1899.21	1895.19	DRY
MW-4B	333876.00	2329890.22	1897.02	1894.69**	DETECTION MONITORING WELL
MW-5	334830.77	2328882.44	1898.90	1897.60	DRY
MW-5B	334819.84	2328884.33	1899.16	1897.21**	DETECTION MONITORING WELL
MW-6	333507.64	2329055.42	1896.72	1893.54	DETECTION MONITORING WELL
MW-7	334250.89	2330359.26	1901.23	1899.14**	DETECTION MONITORING WELL
MW-8	334864.54	2329857.95	1903.37	1901.05**	DETECTION MONITORING WELL
MW-9	333935.57	2328898.85	1896.54	1894.31**	DETECTION MONITORING WELL

* TOP OF CASING AND GROUND ELEVATIONS PROVIDED BY HASTINGS UTILITIES.
** DESIGNATED GROUND ELEVATIONS DEPICT THE ELEVATION OF THE TOP OF THE CONCRETE SLAB NEAREST TO THE CASING ON THE NORTH SIDE.

CONTROLS	NORTHING	EASTING	ELEVATION	LONG DESCRIPTION
25	334815.14	2328892.86	1896.51	BRASS CAP
26	334879.51	2330467.21	1900.86	BRASS CAP
27	333932.07	2330190.86	1894.46	BRASS CAP

*NOTE: STATE PLANE CONTROL IS BASED ON NEBRASKA SOUTH ZONE NAD 27. VERTICAL CONTROL IS BASED ON NGVD29.

LEGEND

- POWER POLE
- ELECTRICAL VAULT
- ELECTRICAL METER
- ELECTRICAL BOX
- LIGHT POLE
- GUY WIRE
- WATER VALVE
- FIRE HYDRANT
- MONITORING WELL
- WATER WELL
- UNKNOWN MANHOLE
- POST INDICATOR VALVE
- STEEL POST
- BOLLARD
- STORM DRAIN MANHOLE
- GATE INLET

CONFERTIOUS TREETREE MASSSTORM SEWER LINEOVERHEAD ELECTRICDISCHARGE PIPEEDGE OF GRAVELEDGE OF CONCRETEEDGE OF WATERCONCRETEGRAVELBUILDING LINECONTROL POINTASH DISPOSAL AREA BOUNDARYORIGINAL TOE OF SLOPE

- NOTES:
- TOPOGRAPHIC SURVEY OF ASH DISPOSAL AREA AND LEACHATE DETENTION POND BY JEO CONSULTING PERFORMED ON 08/17/2016. SURROUNDING ROADWAYS AND STRUCTURES FROM TOPOGRAPHIC SURVEY BY OLSSON ASSOCIATES PERFORMED ON 07/14/2011.
 - RISER ELEVATIONS PROVIDED BY HASTINGS UTILITIES.



PROJECT MANAGER L. CALUB				
1	11/3/2016	RESPONSE TO NDEQ COMMENTS		
0	10/6/2016	NDEQ TITLE 132 PERMIT RENEWAL		
ISSUE	DATE	DESCRIPTION	PROJECT NUMBER	000000010040278



GERALD T. WHELAN ENERGY CENTER
WEC TEMPORARY ASH DISPOSAL AREA

ASH DISPOSAL AREA PLAN

0	1"	2"	FILENAME	00C102.DWG
			SCALE	-