ADMINISTRATION
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Chouteau, OK 74337
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Grand River Dam Authority

January 30, 2023

Ms. Hillary Young, P.E.
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality (ODEQ)
707 North Robinson
P.O. Box 1677
Oklahoma City, Oklahoma 73101-1677

RE: Annual Groundwater Monitoring and Corrective Action Report 2022 & Assessment of Corrective Measures Grand River Dam Authority (GRDA) Grand River Energy Center

Dear Ms. Young:

As required by the State of Oklahoma regulations governing the disposal of coal combustion residuals (CCRs) from electric utilities (OAC 252:517), please find attached the Annual Groundwater Monitoring and Corrective Action Report for calendar year 2022. This report has been prepared for the CCR Landfill located at the Grand River Energy Center (GREC) in Chouteau, Oklahoma. As required by OAC 252:517, a copy of this document will also be posted on the GRDA CCR Webpage and a copy maintained in the facility operating records.

Additionally, GRDA is pleased to submit its evaluation of the assessment of corrective measures in accordance with the requirements of OAC 252:517-9-7. GRDA would like to note that the correspondence sent on August 25, 2022, from ODEQ was not received by appropriate GRDA staff. GRDA regrets that this miscommunication occurred and has taken steps to ensure that this will not be repeated. GRDA takes its responsibility to follow all applicable laws and regulations seriously and values the working relationship with ODEQ.

GRDA respectfully requests a meeting with ODEQ in the coming weeks to discuss both the regulatory and remedial path forward on this project.

If you have any questions on this matter, or if you require any additional information, please do not hesitate to call.

Sincerely,

Michael L. Bednar

Michael L. Bednar
Manager of Environmental Compliance

2022 Annual Groundwater Monitoring and Assessment of Corrective Measures

Grand River Dam Authority Landfill

Grand River Energy Center

Mayes County, Oklahoma

Solid Waste Permit No. 3549012

Submitted to:

Grand River Dam Authority

Mayes County, Oklahoma

Submitted by:

Enercon Services, Inc.

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Oklahoma City, Oklahoma 73129

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January 31, 2023

ENERCON Project No. GRDA-00021

ENERCON

Table of Contents

List of Tables

List of Figures

Attachments

1.0 INTRODUCTION

This 2022 Annual Groundwater Monitoring and Corrective Measures Assessment addresses the Grand River Dam Authority (GRDA) Landfill at the Grand River Energy Center (GREC), operated by the GRDA. This report was developed in accordance with the Oklahoma Administrative Code (OAC) Title 252, Chapter 517: Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Rule (Rule), effective September 15, 2018.

Consistent with applicable sections of OAC 252:517-9, this report documents the status of the groundwater monitoring and corrective action program, summarizes key actions completed during the previous year (2022), evaluates groundwater data collected during the previous year, describes problems encountered and resolutions, and discusses corrective actions for the upcoming year (2023).

This Annual Report is being submitted to the Oklahoma Department of Environmental Quality (ODEQ) to satisfy the requirement under OAC 252:517-9-1(e) that the owner or operator of a CCR unit prepare an annual groundwater monitoring and corrective action report. This report will be placed in the GRDA Landfill operating record and on GRDA's publicly accessible CCR Website (https://www.grda.com/ccr-rule-compliance-data-and-information/).

2.0 BACKGROUND

The GREC is an electric power generating facility located approximately 3 miles east of the City of Chouteau, in Mayes County, Oklahoma. The GREC houses two coal-fired boilers (Unit No. 1 and Unit No. 2) and one combined cycle natural gas turbine (Unit No. 3). Unit #1 was retired in December 2020. Unit #2 and Unit #3 are currently operational. The GRDA Landfill is permitted by the ODEQ as a Non-Hazardous Industrial Waste (NHIW) Landfill that is allowed to accept fly ash, bottom ash, and spent powdered activated carbon used to control flue gas emissions generated at the GREC. The GRDA Landfill is situated south of the operational area within the GREC complex (**Figure 1**). The total landfill permit area consists of approximately 116 acres, of which only 47 acres have been utilized for CCR disposal. The landfill is underlain by alluvium deposits that consist of unconsolidated clay, silt, sand and gravel layers. The alluvium overlays sandstone/limestone bedrock.

Sampling and analysis of groundwater at the GRDA Landfill is an on-going activity that has been conducted for at least 27 years. Detection monitoring events conducted in 2018 identified and verified statistically significant increases in concentrations (SSIs) in certain wells. In accordance with OAC 252:517-9-6, an Assessment Monitoring Plan was developed and first submitted to the ODEQ on March 29, 2019. The Revised Assessment Monitoring Plan was approved by the ODEQ on January 28, 2020.

The GRDA transitioned into assessment monitoring for the second 2019 semi-annual sampling event and statistical analyses were performed on the entire data set comprising Appendix A and B constituents. In November 2021, the molybdenum, an Appendix B Constituent, demonstrated an SSI and also exceeded the GWPS in MW93-2. Arsenic, mercury, and lithium concentrations were also greater than their respective maximum contaminant level (MCL) or groundwater protection standard (GWPS) in wells MW93-2, MW03-2, and MW93-3, respectively but did not demonstrate SSIs.

Pursuant to the Oklahoma Administrative Code (OAC) Section 252:517-9-6, if Appendix B constituents are detected at an SSI and are above an MCL or GWPS, the owner must notify ODEQ of the exceedances and submit a plan for site characterization in order to develop appropriate corrective action. Additionally, there were indications that data from landfill monitor wells may not accurately represent background or downgradient groundwater conditions.

An application to modify the groundwater monitoring system including the installation of three new monitoring wells was submitted to ODEQ on April 2, 2021. In a letter dated August 19, 2021, ODEQ denied the request to modify the groundwater monitoring system. According to the ODEQ, upon the notification of an SSI, either a site characterization study/delineation of release or a demonstration of a non-landfill source is required. GRDA submitted a Proposed Site Characterization Study Plan and schedule including a soil boring investigation, additional monitor well installations, groundwater sampling and analyses activities, and aquifer testing for the Grand River Energy Center Coal Combustion Residuals Landfill on December 8, 2021.

This report summarizes the actions completed in 2022, 2022 groundwater monitoring activities, statistical analyses, and proposes a Corrective Measures Assessment Plan.

3.0 STATUS OF GROUNDWATER MONITORING AND CORRECTIVE ACTION PROGRAM

GRDA transitioned into assessment monitoring in 2019. Because groundwater concentrations of Appendix B constituents either demonstrated SSIs or were observed to be greater than MCLs or GWPSs in 2021, GRDA conducted a Site Characterization Study in 2022 to evaluate appropriate corrective measures.

4.0 KEY ACTIONS COMPLETED IN 2022

The following summarizes the communications and key actions completed in 2022:

- In a letter dated January 28, 2022, the Oklahoma Department of Environmental Quality (ODEQ) approved the December 8, 2021, proposed Plan and Schedule for the assessment of corrective measures for the GRDA landfill in accordance with Oklahoma Administrative Code (OAC) 252:517-9-7(a).

- As required within the January 28, 2022, letter from the ODEQ (described above), the proposed soil boring locations were provided to the ODEQ for review on February 16, 2022.
- Fifteen (15) soil borings and eight new monitoring wells (MW22-01 through MW22-08) were installed in March 2022 to collect additional lithologic and groundwater data to evaluate if the existing monitoring wells were constructed in the alluvium or to evaluate if well construction was compromised.
- Slug tests were conducted in April 2022 on each newly installed monitor well (MW22-01 to MW22-08) and the existing background and compliance wells (MW93-1, MW93-2, MW93-3, MW03-1, and MW03-2) to evaluate hydraulic conductivity of the surrounding formation and to assess groundwater flow velocity in the vicinity and downgradient of the landfill.
- Groundwater levels were collected in the new monitor wells MW22-01 – MW22-08 and in the existing landfill background and compliance wells, MW93-1, MW93-3, MW03-1, and MW03-02 after each well was developed and surveyed. Groundwater levels were converted to elevation using surveyed top of casing elevations.
- Both the existing wells (MW93-1, MW93-2, MW93-3, MW03-1, and MW03-2) and the new wells (MW22-01 through MW22-08) were sampled in April 2022 and October 2022. The new wells were also sampled in May, June, July, August, and September to develop eight rounds of sampling data for statistical analysis.
- A Site Progress Report was completed on June 27, 2022 to present the early results of the Site Characterization Study. A response letter from ODEQ was received on August 25, 2022.
- The results of the Site Characterization plan were presented in a letter report on November 29, 2022. A response letter from ODEQ was received on January 10, 2023 indicating that further Assessment of Corrective Measures is required.
- Statistical analyses were completed on the older monitor wells using the April and October 2022 data. A statistical analysis was completed on the new monitor wells using the eight rounds of data collected between April 2022 and October 2022.

5.0 GROUNDWATER SAMPLING ACTIVITIES

In accordance with the Revised Assessment Monitoring Plan (approved January 28, 2020) and the approved Site Characterization Study Plan and Schedule for the assessment of corrective measures for the GRDA landfill, assessment groundwater monitoring events were conducted at the GRDA landfill on April 7-8, 2022 and October 3-4, 2022. For each event, groundwater samples were collected from the five existing background and compliance wells (MW93-1, MW93-2, MW93-3, MW03-1, and MW03-2) and the eight newly installed monitor wells (MW22-01 through MW22-08).

The groundwater monitoring wells were uncapped and allowed to equilibrate for approximately 20 minutes. Static water levels and total monitoring well depths were then measured and recorded to the nearest one-hundredth of a foot using an electronic water level meter. The static water level survey data is presented in **Table 1.**

The monitoring wells were then purged and sampled using a peristaltic pump and new dedicated tubing for each monitoring well. Pump tubing was lowered to the approximate midpoint of the monitoring well screen. Purging and sampling procedures followed the United States Environmental Protection Agency (EPA) Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (2017). Groundwater samples were collected into laboratory supplied sample containers and immediately packed on ice in an insulated container. Groundwater samples for metals analysis were collected unfiltered and unpreserved and were analyzed for total recoverable metals. Groundwater did not recharge sufficiently during purging to collect samples from monitor well MW03-1 in October 2022.

Groundwater samples (except for pH) were then submitted to Pace Analytical of Mt. Juliet, Tennessee for analysis. Groundwater pH was measured in the field within the 15-minute hold time and under ENERCON's Oklahoma Department of Environmental Quality (ODEQ) field laboratory accreditation. Quality Assurance/Quality Control (QA/QC) samples consisted of one duplicate per event.

Groundwater samples were analyzed for the following constituents:

- Appendix A: boron, calcium, chloride, fluoride, pH, sulfate, total dissolved solids (TDS), specific conductivity, total alkalinity, and sodium; and
- Appendix B: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, radium 226 and 228 combined.

A summary of groundwater analytical data for the April 2022 and October 2022 assessment monitoring events for wells MW93-1. MW93-2, MW93-3, MW03-1, and MW03-2 are included as **Tables 2 and 3.** Analytical data collected during the Site Characterization Study for the new wells, MW22-01 – MW22-08, are summarized in **Table 4**. Laboratory analytical reports are included in **Attachment A**.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) REVIEW

Field equipment calibration and sampling records were reviewed to evaluate adherence to the purging and sampling procedures. Review of the field notes indicated field instruments were properly calibrated and wells were properly purged prior to sample collection. The chain of custody forms associated with the laboratory reports were reviewed for information regarding sample dates, sample identification, sample media, and date of submittal to the analytical laboratory. Review of the laboratory analytical report confirmed that the samples were received in good condition at the appropriate temperature, in the proper containers, with the appropriate preservatives, with custody seals intact, and within method-specified holding times. For the laboratory analytical report, the laboratory inserted arbitrary duplicate sample dates required by the laboratory data management system. The sample dates recorded in the laboratory analytical summary table reflect the actual duplicate (Dup) sample collection dates. Based on this review, samples were collected and delivered to the analytical laboratory according to environmental sampling protocols.

The duplicate samples collected from MW93-2 were collected and analyzed for Appendix A constituents. The relative percent difference (RPD) between the analytical results from samples MW93-2 and their respective duplicate samples were calculated. The RPDs ranged from 1 to 4.3 percent, within the typical groundwater RPD review criteria of 25 percent, indicating acceptable field and laboratory precision.

Where applicable, the method detection limit (MDL) and reported detection limit (RDL) values for the groundwater samples were corrected for the dilution factor used in the analysis. The Method and Batch Quality Control analyses were within established criteria for the laboratory methods, except where qualifiers (e.g., J-flags) are presented, thus the analytical results are characterized as accurate and precise.

7.0 EVALUATION OF 2022 GROUNDWATER MONITORING DATA

Groundwater levels were collected in the new monitor wells MW22-01 through MW22-08 and in the existing landfill background and compliance wells, MW93-1, MW93-3, MW03-1, and MW03-02. Groundwater levels were converted to elevation using surveyed top of casing elevations. The soil boring investigation indicated that MW93-2 is screened within a perched water layer within the landfill; therefore, water levels from MW93-2 were not included in the groundwater flow analysis.

Groundwater elevations in each well indicate that a groundwater divide is present near the landfill with groundwater flowing radially towards the west, south, and east. Potentiometric surface maps from the April 2022 and October 2022 sampling events are presented as **Figures 2 and 3**. Groundwater elevations for each sampling event are presented in Table 1.

Groundwater velocity at GRDA can be calculated using the following:

$$V = \frac{K * I}{n}$$

Where:

V = Groundwater seepage velocity (cm/s)

K = Hydraulic Conductivity (cm/s)

I= Hydraulic Gradient (cm/cm)

n = Effective Porosity

Average and maximum seepage velocities were calculated using the average and maximum K values derived from the slug tests. The hydraulic gradient was calculated using the difference in water levels from upgradient monitor well MW93-1 and downgradient monitor well MW22-06 using a distance of 2,122 feet. Effective porosity was derived using the average specific yield calculated using slug test data. **Table 5** summarizes groundwater seepage velocity inputs and calculations.

The calculated groundwater seepage velocity at the Site ranges from an average of 34 feet per year up to a maximum of 145.2 feet per year.

8.0 STATISTICAL ANALYSIS OF ASSESSMENT MONITORING DATA AND DATA FROM NEW MONITOR WELLS

Statistical evaluation of the laboratory analytical results was performed in accordance with OAC 252:517-9-4(g)(3) and the Revised Assessment Monitoring Plan (approved January 28, 2020) utilizing Chemostat Statistical Analysis Software (Version 6.4.0). Statistical analyses were conducted using the Shapiro-Francia Test of Normality, Levene's equal variance test, and ANOVA (Analysis of Variance) to establish assumptions of normality and equal variance of the historical concentration data sets for each constituent. Analyses of the constituent data sets indicated that assumptions of normality and equal variance were not appropriate for all constituents, and non-parametric prediction intervals were used for inter-well and intra-well comparisons.

For the Semi-Annual and Annual Groundwater Assessment Monitoring data, inter-well analyses were conducted to compare constituent concentrations in down-gradient compliance wells (MW93-2, MW93-3, MW03-1, and MW03-2) to the concentrations observed in an up-gradient background well (MW93-1). Statistical analyses were also completed using the population of data collected from the new monitor wells (MW22-01 through MW22-08) during the Site Characterization Study. Inter-well analyses were conducted to compare constituent concentrations in downgradient compliance wells (MW22-02 through MW22-08) to the concentrations observed in an up-gradient background well (MW22-01). Inter-well tests assume that concentrations observed in the background well are not impacted by site activities and represent natural groundwater conditions. Background concentrations are established by pooling a statistically significant number of historical data points from the background well to establish a maximum background concentration for each constituent analyzed. A SSI occurs if recent detected concentrations exceed the established background concentration. An intra-well exceedance occurs when a pool of recent data demonstrates a statistically significant increasing trend when compared to a pool of historical baseline data from the same well.

Groundwater concentrations are also compared to the site-specific GWPS. The GWPS for each constituent were developed using respective MCLs, or in the case of Cobalt (Co), lead (Pb), lithium (Li), and molybdenum (Mo), the GWPS are developed using limits set forth in the United States Environmental Protection Agency's (USEPA) Coal Ash Rule (83 FR 364.35, Effective August 29, 2018). If a constituent did not have an MCL, a limit designated by the USEPA Coal Ash Rule, or if the background concentration was greater than the MCL; then the statistical background concentration was used as the GWPS.

Established background concentrations, GWPS/MCLs, and results of the statistical analysis are included in **Tables 6, 7, and 8.** A copy of the statistical output is included in **Attachment B**.

8.1 Statistical Analysis of the April 2022 Assessment Monitoring Data using MW93-1, MW93-2, MW93-3, MW03-1, and MW03-2

Statistical analysis of the April 2022 Semi-Annual Assessment Groundwater Monitoring data indicated the following:

- Inter-well exceedances (relative to background) were observed for all Appendix A constituents except calcium. Inter-well exceedances for Appendix B constituents were observed for arsenic, barium, fluoride, lithium, mercury, molybdenum, and combined radium.
- No SSIs (both an inter-well and intra-well exceedance) were observed for Appendix A constituents.
- Lithium concentrations exceeded background in MW 93-2, MW93-3, and MW03-2 and demonstrated SSIs in MW93-2 and MW03-2. Lithium concentrations in MW93-3 are greater than the GWPS/MCL but did not demonstrate a SSI in concentration.
- Mercury concentrations were greater than background in MW93-3 and MW03-2, and a SSI of mercury was observed in MW93-3. Mercury concentrations in MW03-2 were greater than the GWPS/MCL but did not demonstrate a SSI.
- Concentrations of arsenic exceeded the GWPS/MCL in MW93-2 but did not demonstrate a SSI.
- Concentrations of molybdenum exceeded the GWPS/MCL in MW93-2 but did not demonstrate a SSI.

8.2 Statistical Analysis of the October 2022 Assessment Monitoring Data using MW93-1, MW93-2, MW93-3, MW03-1, and MW03-2

Statistical analysis of the October 2022 Annual Assessment Groundwater Monitoring data indicated the following:

- Inter-well exceedances (relative to background) for several Appendix A and Appendix B constituents were observed in the compliance wells. Exceedances for every Appendix A constituent was observed except for calcium. Exceedances for Appendix B constituents include arsenic, barium, fluoride, lithium, mercury, molybdenum, and combined radium.
- SSIs of sodium and sulfate (Appendix A) were observed in MW93-2 and specific conductivity (Appendix A) in MW93-2 and MW93-3. GWPS/MCL are not established for Appendix A constituents.
- The mercury concentration in MW93-3 demonstrated an SSI but did not exceed the GWPS/MCL.
- The molybdenum concentration in MW93-2 demonstrated an SSI and also exceeded the GWPS/MCL.
- Concentrations of arsenic exceeded the GWPS/MCL in MW93-2 but did not demonstrate a SSI.
- Concentrations of lithium exceeded the GWPS/MCL in MW93-3 but did not demonstrate a SSI.

8.3 Statistical Analysis of the October 2022 Site Characterization Study Data using New Monitoring Wells MW22-01 through MW22-08

Statistical analysis of the October 2022 data was using new monitor wells MW22-01 through MW22-08 indicated the following:

- Inter-well exceedances (relative to background) for every Appendix A constituent were observed except for pH and alkalinity. SSIs of boron and calcium (Appendix A) were observed in MW22-02, and SSIs for sodium (Appendix A) were observed in MW22-05, MW22-07, and MW22-08. GWPS are not established for Appendix A constituents. Inter-well exceedances for Appendix B constituents include arsenic, barium, fluoride, lithium, molybdenum, combined radium, and selenium.
- Mercury concentrations in well MW22-01 slightly exceeded the GWPS/MCL during one sampling event in early May. Concentrations did not exceed the GWPS/MCL in MW22-01 during subsequent monitoring events, and no SSIs were observed for mercury in any monitoring well.
- Concentrations of arsenic exceeded the GWPS/MCL during one sampling event in August in MW22-03. Arsenic concentrations did not exceed the GWPS/MCL in subsequent monitoring events, and no SSIs were observed for arsenic in any monitoring well.
- Radium concentrations exceeded the GWPS/MCL in MW22-03 during a May monitoring event, but were not observed in subsequent monitoring events. No SSIs were observed for radium in any monitoring well.

- Lithium concentrations in well MW22-07 slightly exceeded the GWPS during one sampling event in May. No lithium exceedances were observed in MW22-07 during subsequent monitoring events.
- Concentrations of molybdenum were greater than the GWPS/MCL but concentrations did not demonstrate a SSI.
- Concentrations of selenium were greater than the GWPS/MCL but concentrations did not demonstrate a SSI.
- Lithium concentrations in MW22-03 exceeded the GWPS/MCL during every sampling event with the exception of October. Lithium concentrations in MW22-03 did not demonstrate a SSI.
- The lithium concentration in MW22-08 was greater than the GWPS/MCL for all eight sampling events and demonstrated an SSI.
- Cobalt concentrations in the background well, MW22-01, slightly exceeded the GWPS/MCL in one monitoring event in April indicating that naturally occurring background concentrations may be greater than the GWPS/MCL.

9.0 PROBLEMS ENCOUNTERED AND RESOLUTIONS

Pursuant to the Oklahoma Administrative Code (OAC) Section 252:517-9-6, if Appendix B constituents are detected at an SSI and are above an MCL or GWPS, the owner must notify ODEQ of the exceedances and submit a plan for site characterization in order to develop appropriate corrective action. In a letter dated January 28, 2022, the Oklahoma Department of Environmental Quality (ODEQ) acknowledged the receipt of the December 8, 2021, proposed Plan and Schedule for the Site Characterization Study for the GRDA landfill in accordance with Oklahoma Administrative Code (OAC) 252:517-9-7(a). The approved Plan included a soil boring investigation, additional monitor well installations, groundwater sampling and analyses activities, and aquifer testing to determine whether the five historical landfill monitor wells had been compromised and to evaluate if there has been a release from the landfill. Site Characterization Study was conducted from March until October 2022. Groundwater assessment monitoring was conducted in April 2022 and October 2022 over the duration of the Site Characterization plan.

The results of the Site Characterization Study and 2022 Assessment Groundwater Monitoring indicate the following:

- The ash encountered below 21 feet bgs in soil boring PSB-09 confirms monitor well MW93-2 is completed in the landfill. Results of the slug tests indicate that MW93-2 is screened within a perched water unit with K values more than an order of magnitude higher than other site monitor wells. Based on the results of the soil boring investigation and the slug tests, MW93-2 appears to be screened in the landfill and should not be included in the final groundwater monitoring network for the landfill.

- Groundwater was previously thought to flow primarily towards the southeast. Groundwater elevation data collected from the eight new monitor wells indicate that groundwater flow is likely more radial in nature. The highest groundwater elevations were observed in MW93-1 and MW22-01. There appears to be a groundwater divide located in the vicinity of the landfill or slightly north of the landfill with groundwater flow towards the west, south and east.
- Arsenic and mercury concentrations in some of the older monitor wells have historically been greater than their GWPS/MCLs. Arsenic and mercury in the new monitor wells were either not detected or were detected sporadically at concentrations greater than their GWPS/MCLs, but were not detected in subsequent monitoring events. These groundwater monitoring results indicate that the arsenic and mercury detections in MW93-2, MW93-3, and MW03-2 are due to poor well construction and are not attributable to a release from the landfill.
- Lithium, molybdenum, and selenium were detected routinely at concentrations greater than the GWPS/MCL and concentrations of lithium demonstrated an SSI. The exceedances and SSI were observed in monitor wells located adjacent to or in close proximity to the landfill. No confirmed exceedances were observed in wells located further downgradient of the landfill.

Additionally, ENERCON compiled cross sections using available boring logs and survey information. Cross sections presented in Figures 4 through 8 indicate the following:

- MW93-2 is screened within suspected landfill material, and groundwater observed within the well is likely from a perched layer within the landfill. Historical maps also indicate that seeps have been observed on the southern toe of the landfill and in the vicinity of the MW93-2, further indication of a perched water layer. Groundwater levels observed within the well are also generally consistent with water levels observed in the nearby wastewater pond to the south of the well indicating that groundwater samples collected from MW93-02 are not representative of water quality in the alluvial aquifer.
- Wells MW93-1, MW93-2, and MW03-1 are generally shallow wells with screened intervals at or less than 15 feet bgs. When compared to the depths of the newer wells, it appears that these wells are also not likely completed at the top of bedrock.
- The older wells are between 20 and 30 years old. The subsurface construction and integrity of the older wells is unknown.

In addition, observations from recent groundwater sampling events indicate:

- Groundwater levels were just above the bottom of the MW03-1, and groundwater recovery was not sufficient to collect a groundwater sample.

- The well pad around MW93-1 is no longer flush with ground surface, and there are indications that surface water may be infiltrating around the well casing.

Based on this, Enercon proposes the closure of the older monitoring wells MW93-1, MW93-2, MW-93-3, MW03-1 and MW03-2.

The next Semi-Annual and Annual groundwater monitoring events are planned for April and October 2023.

With Agency approval, the Assessment Groundwater Monitoring and statistical analysis will be conducted using the newly installed monitoring wells MW22-01 through MW22-08. MW22-01 will be used as the background well, and wells MW22-02 through MW22-08 will be used as compliance points. If necessary, replacement wells for MW93-1, MW03-1, and MW03-2 can be installed as part of the next steps in 2023.

10.0 ASSESSMENT OF CORRECTIVE MEASURES

The results of the 2022 Assessment Monitoring and the results of the Site Characterization Study indicate that groundwater may be impacted by a potential release of lithium, molybdenum, and selenium from the landfill. The impacts appear to be limited to wells adjacent to or in close proximity to the landfill.

Pursuant to the Oklahoma Administrative Code (OAC) Section 252:517-9-7(c), upon detection of a release from the landfill (SSI and GWPS/MCL exceedance) further assessment of corrective measures is required. The assessment of corrective measures must:

- Evaluate the performance, reliability, potential impact and exposure risk of the remedy;
- Determine the time to begin and complete the remedy, and
- Ensure that institutional requirements including any permitting or health requirements are met.

Based on these criteria and in order to evaluate appropriate remedies to address potential releases from the landfill, ENERCON proposes to complete groundwater modeling consisting of the construction of a site-specific, numerical groundwater and constituent fate and transport model to simulate the migration of landfill constituents of concern in the alluvial aquifer. The groundwater model will be used to identify a remedy or a combination of remedies that will appropriately address the landfill release, be protective of potential receptors, and fulfill regulatory requirements.

Groundwater modeling efforts will be completed using Groundwater Modeling Software (GMS) and will consist of the construction of a three-dimensional saturated groundwater flow model using the widely applied MODFLOW code and constituent transport simulations using MT3DMS. The constituent transport portion of the modeling effort will be completed using a partition coefficient

(K_d) approach. Particle tracking simulations will be completed using MODPATH. The model structure will be a reasonable representation of hydrogeologic conditions based on observed conditions, interpreted site-specific data, available local and regional data, and other accepted published information.

The groundwater flow will be calibrated to site conditions using data from new monitor wells MW22-01 through MW22-08 and to surface water using nearby USGS gauging stations. The calibrated flow model will be used to simulate the future migration of constituents of concern in groundwater. Simulated output will be used to evaluate of the performance, reliability, potential impact and exposure risk of the potential corrective remedies.

Potential groundwater remedies that will be modeled include but are not limited to:

- The containment of impacted groundwater using groundwater extraction,
- Interceptor trenches to intercept impacted groundwater,
- Passive reactive barriers to treat impacted groundwater in situ,
- Natural attenuation of landfill constituents with enhanced monitoring utilizing background, compliance, and sentinel monitoring points, and
- Source control to prevent the infiltration of water through the landfill.

Constituent transport simulations will be completed to ten, twenty and thirty year increments (or other appropriate time increments, if necessary) to evaluate remedy effectiveness, and output will be in the form of simulated iso-concentration maps mapped to the GWPS/MCL. All inputs, references, output, remedy selection, and rationale will be compiled into a report. Upon approval of the report, GRDA will begin the groundwater model.

11.0 REFERENCES

EPA, 2017. Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revision 4. September 19, 2017.

A&M Engineering and Environmental Services, 2018. Groundwater Sampling and Analysis Program for Grand River Dam Authority Landfill. Grand River Energy Center. Mayes County, Oklahoma. Solid Waste Permit No. 3549012. October 16, 2017. Updated January 3, 2018.

A&M Engineering and Environmental Services, 2019. Assessment Monitoring Plan for the Grand River Dam Authority Grand River Energy Center Landfill. Chouteau, Mayes County, Oklahoma. Permit No. 3549012. March 2019. Revised August 2019 and December 2019. Approved January 28, 2020.

A&M Engineering and Environmental Services, 2020. Annual Groundwater Monitoring and Corrective Action Report (Calendar Year 2019). Grand River Dam Authority Landfill. Grand River Energy Center. Mayes County, Oklahoma. Solid Waste Permit No. 3549012. January 31, 2020.

ODEQ, 2020. Letter to GRDA Re: 2019 Annual Groundwater Monitoring and Corrective Action Report (Report), Grand River Dam Authority Landfill. Mayes County, Permit Number 3549012. Dated March 6, 2020.

GRDA, 2021. 2021 Annual Groundwater Monitoring and Corrective Action Report for Calendar Year 2021. Grand River Dam Authority. Grand River Dam Authority. Grand River Energy Center, Chouteau, Oklahoma. Dated January 2022.

ENERCON, 2022. Site Characterization Study Report, Grand River Dam Authority Landfill. Mayes County, Permit Number 3549012. Dated November 29, 2022.

Tables

Table 1
2022 Static Water Level Survey Data
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Sample Location	TOC Elevation (ft. AMSL)	4/14/2022		5/13/2022		6/20/2022		7/19/2022		8/18/2022		9/13/2022		10/3/2022	
		Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)	Depth to Water (ft. BTOC)	GW Elevation (ft. AMSL)
MW93-1	620.57	10.44	610.13	10.30	610.27	9.86	610.71	10.32	610.25	NM	NM	NM	NM	10.42	610.15
MW 93-02	608.31	7.91	600.40	7.71	600.60	7.82	600.49	7.92	600.39	NM	NM	NM	NM	8.04	600.27
MW93-03	608.74	14.32	594.42	13.48	595.26	13.67	595.07	14.99	593.75	NM	NM	NM	NM	16.18	592.56
MW03-01	604.97	7.89	597.08	7.50	597.47	8.22	596.75	10.81	594.16	NM	NM	NM	NM	12.32	592.65
MW03-02	607.92	13.8	594.12	13.30	594.62	13.81	594.11	15.37	592.55	NM	NM	NM	NM	16.89	591.03
MW22-01	613.72	15.56	598.16	14.87	598.85	15.93	597.79	18.23	595.49	18.54	595.18	19.02	594.70	19.68	594.04
MW22-02	609.94	13.41	596.53	11.94	598.00	12.16	597.78	13.31	596.63	13.9	596.04	13.88	596.06	14.56	595.38
MW22-03	601.37	6.03	595.34	6.21	595.16	6.29	595.08	6.57	594.80	6.39	594.98	6.29	595.08	6.51	594.86
MW22-04	609.9	14.39	595.51	12.96	596.94	13.3	596.60	15.02	594.88	15.65	594.25	15.58	594.32	16.57	593.33
MW22-05	602.23	7.58	594.65	7.14	595.09	7.72	594.51	9.28	592.95	10.15	592.08	10.29	591.94	10.9	591.33
MW22-06	607.76	21.13	586.63	20.02	587.74	20.69	587.07	22.3	585.46	23.03	584.73	23.09	584.67	23.97	583.79
MW22-07	603.37	18.02	585.35	17.15	586.22	18.24	585.13	19.27	584.10	19.28	584.09	19.3	584.07	19.38	583.99
MW22-08	600.09	7.28	592.81	7.50	592.59	7.8	592.29	8.62	591.47	8.31	591.78	8.34	591.75	8.73	591.36

AMSL - above mean sea level
BTOC - below top of casing
ft - feet

Table 2

Summary of Semi-Annual Groundwater Monitoring Results - April 2022

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Sample Date	Appendix A or B	Analyte	Units	Background	GWPS/MCL	MW93-01	MW93-2	MW93-03	MW03-01	MW03-02
04/08/2022	A	Alkalinity	mg/L	550	NA	406	144	590	40.8	230
04/08/2022	A	Boron	mg/L	0.499	NA	0.321	1.42	0.0765 J	<0.2	<0.2
04/08/2022	A	Calcium	mg/L	670	NA	227	228	80.2	10.8	291
04/08/2022	A	Chloride	mg/L	63	NA	14.3	1460	231	0.942 J	440
04/08/2022	A	Dissolved Solids	mg/L	1130	NA	1130	10000	1300	81	1720
04/08/2022	A	pH	su	7.17	NA	7.07	8.82	6.79	6.2	6.74
04/08/2022	A	Sodium	mg/L	130	NA	84.8	2580	354	9.32	161
04/08/2022	A	Specific Conductance	umhos/cm	1888	NA	1560	13700	2160	2440	115
04/08/2022	A	Sulfate	mg/L	880	NA	452	4920	202	2.92 J	371
04/08/2022	A,B	Fluoride	mg/L	0.25	4.0	0.194	0.375 J	0.19	<0.15	0.0746 J
04/08/2022	B	Antimony	mg/L	Detection	0.01	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500
04/08/2022	B	Arsenic	mg/L	0.0109	0.01	0.000291	**0.0213**	0.000685 J	0.000455 J	<0.001
04/08/2022	B	Barium	mg/L	0.0405	2.0	0.0199	0.141	0.064	0.0301	0.0301
04/08/2022	B	Beryllium	mg/L	Detection	0.004	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
04/08/2022	B	Cadmium	mg/L	Detection	0.005	0.000376	<0.001	<0.001	<0.001	<0.001
04/08/2022	B	Chromium	mg/L	Detection	0.1	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200
04/08/2022	B	Cobalt	mg/L	Detection	0.006**	<0.002	<0.002	<0.002	<0.002	<0.002
04/08/2022	B	Lead	mg/L	Detection	0.15**	<0.002	<0.002	<0.002	<0.002	<0.002
04/08/2022	B	Lithium	mg/L	0.0236	0.04**	0.0236	0.0304	**0.135**	<0.015	0.0346
04/08/2022	B	Mercury	mg/L	0.0002	0.002	<0.0002	<0.0002	0.000945	<0.0002	**0.00285**
04/08/2022	B	Molybdenum	mg/L	0.01	0.01**	<0.005	**1.48**	0.000858 J	<0.005	<0.005
04/08/2022	B	Selenium	pCi/L	2.24	5	<0.002	0.00112 J	<0.002	<0.002	<0.002
04/08/2022	B	Thallium	mg/L	Detection	0.05	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
04/08/2022	B	Combined Radium	mg/L	Detection	0.002	ND	4.77	0.555	1.033	2.337

Constituents that exceed the Maximum Contaminant Level (MCL) are in bold.

Constituents that exceed the Background Concentration derived from MW93-1 are in gray.

NA - Not Applicable

ND - Constituent Not Detected

J: The identification of the analyte is acceptable; the reported value is an estimate. V: The sample concentration is too high to evaluate

Table 3
Summary of Annual Groundwater Monitoring Results - October 2022
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Sample Date	Appendix A or B	Analyte	Units	Background	GWPS/MCL	MW93-01	MW93-2	MW93-2 DUP	MW93-03	MW03-01	MW03-02
10/04/2022	A	Alkalinity	mg/L	550	NA	405	83.8	83.4	**581**	DRY	219
10/04/2022	A	Boron	mg/L	0.499	NA	0.338	**1.92**	1.84	0.0927 J	DRY	<0.2
10/04/2022	A	Calcium	mg/L	670	NA	223	235	217 V	75.2	DRY	257
10/04/2022	A	Chloride	mg/L	63	NA	14.9	**1590**	**1580**	**186**	DRY	**370**
10/04/2022	A	Dissolved Solids	mg/L	1130	NA	1000	**8300**	**8060**	**1230**	DRY	**2060**
10/04/2022	A	pH	su	7.17	NA	6.64	**8.48**	NA	6.55	DRY	6.53
10/04/2022	A	Sodium	mg/L	130	NA	99.5	**3140**	**2860 V**	**381**	DRY	**168**
10/04/2022	A	Specific Conductance	umhos/cm	1888	NA	1500	**13500**	**13600**	**2020**	DRY	**2110**
10/04/2022	A	Sulfate	mg/L	880	NA	446	**5470**	**5690**	217	DRY	363
10/04/2022	A,B	Fluoride	mg/L	0.25	4.0	0.162	<3	<3	**0.278**	DRY	<0.15
10/04/2022	B	Antimony	mg/L	Detection	0.01	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500
10/04/2022	B	Arsenic	mg/L	0.0109	0.01	0.000393	**0.0556**	**0.0535**	0.000641 J	DRY	<0.001
10/04/2022	B	Barium	mg/L	0.0405	2.0	0.0189	**0.132**	0.127	**0.0503**	DRY	0.0281
10/04/2022	B	Beryllium	mg/L	Detection	0.004	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
10/04/2022	B	Cadmium	mg/L	Detection	0.005	0.000631	<0.01	<0.01	<0.001	DRY	<0.001
10/04/2022	B	Chromium	mg/L	Detection	0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
10/04/2022	B	Cobalt	mg/L	Detection	0.006**	<0.002	<0.02	<0.02	0.000143 J	DRY	<0.002
10/04/2022	B	Lead	mg/L	Detection	0.15**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
10/04/2022	B	Lithium	mg/L	0.0236	0.04**	<0.015	0.0151	0.0146 J	**0.137**	DRY	0.00861 J
10/04/2022	B	Mercury	mg/L	0.0002	0.002	<0.0002	<0.0002	<0.0002 J6 O1	**0.00103**	DRY	**0.0014**
10/04/2022	B	Molybdenum	mg/L	0.01	0.01**	0.00108	**1.97**	**1.87**	<0.005	DRY	<0.005
10/04/2022	B	Selenium	pCi/L	2.24	5	<0.002	<0.02	<0.02J3 J6	<0.002	DRY	<0.002
10/04/2022	B	Thallium	mg/L	Detection	0.05	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
10/04/2022	B	Combined Radium	mg/L	Detection	0.002	0.0893	2.049	**3.48**	0.282	DRY	0.75

Constituents that exceed the Maximum Contaminant Level (MCL) are in **bold**.
Constituents that exceed the Background Concentration derived from MW93-1 are in gray.
NA - Not Applicable
ND - Constituent Not Detected
J: The identification of the analyte is acceptable; the reported value is an estimate. V: The sample concentration is too high to evaluate

Table 4
Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022
MW22-01 through MW22-08
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08	
Sample Date					4/7/2022		4/7/2022		4/7/2022		4/7/2022		4/7/2022		4/7/2022		4/7/2022		4/7/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	637		277		216		96.2		212		276		297		437	
Boron	A	mg/L	0.339	NA	0.247		**1.87**		0.109	J	<0.200		<0.200		<0.200		<0.200		0.184	J
Calcium	A	mg/L	323	NA	323		238		122		59.4		269		245		87.6		73.3	
Chloride	A	mg/L	10.2	NA	6.41		**240**		**539**		**32.3**		**1060**		**153**		5.98		**165**	
TDS	A	mg/L	1230	NA	1230		**4530**		1230		322		**2640**		1030		519		1140	
pH	A	SU	7.2	NA	7.2		**7.3**		6.6		6.92		6.75		7.07		6.96		**7.4**	
Sodium	A	mg/L	102	NA	27.1		1070		**303**		27.9		**403**		58.8		81.6		**309**	
Conductivity	A	umhos/cm	1690	NA	1690		**6290**		**2400**		527		**3840**		**1500**		827		**1880**	
Sulfate	A	mg/L	385	NA	353		**2460**		137		86.2		28.1		291		160		273	
Fluoride	A,B	mg/L	0.187	4.0	0.112	J	<1.50		<0.150		0.114	J	0.122	J	0.0837	J	0.166		**0.227**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000639	J	0.000948	J	0.00073	J	0.000632	J	**0.00115**		0.000247	J	0.000522	J	0.000622	J
Barium	B	mg/L	0.0621	2.0	0.0621		0.0435		**0.269**		**0.108**		**0.484**		**0.121**		**0.0944**		**0.104**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	0.000263	J	<0.00100		0.000341	J	<0.00100		0.000395	J	<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.00536		0.000914	J	**0.0062**		0.000256	J	**0.00755**		<0.00200		0.000229	J	0.00183	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		0.0012	J	<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.037		**0.0441**		**0.0597**		0.0171		0.033		0.0284		0.0104	J	**0.077**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	0.000852	J	**0.113**		<0.00500		<0.00500		0.000894	J	<0.00500		<0.00500		0.00224	J
Radium	B	pCi/L	3.838	5	0.65		1.138		0.766		0.802		1.064		1.945		1.644		1.175	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.17**		<0.00200		<0.00200		<0.00200		<0.00200		0.00188	J	<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4

Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022

MW22-01 through MW22-08

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08	
Sample Date					05/09/2022		05/09/2022		05/09/2022		05/09/2022		05/09/2022		05/09/2022		05/09/2022		05/09/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	631		367		216		382		154		274		308		422	
Boron	A	mg/L	0.339	NA	0.339		**2.93**		0.126	J	0.0953	J	<0.200		<0.200		0.0811	J	0.171	J
Calcium	A	mg/L	323	NA	304	V	236		144		73.9		251		216		57		66.9	
Chloride	A	mg/L	10.2	NA	7.86		**244**		**937**		**43.5**		**1090**		**136**		2.41		**172**	
TDS	A	mg/L	1230	NA	1120		**4750**		**2060**	Q	900		**2480**		945		440		1030	
pH	A	SU	7.2	NA	6.99		**7.6**		6.94		**7.26**		6.7		7.19		6.53		**7.55**	
Sodium	A	mg/L	102	NA	31.7	V	**1600**		**495**		**239**		**413**		61.6		90.4		**316**	
Conductivity	A	umhos/cm	1690	NA	**1620**		**7590**		**3570**		1440		**3720**		**1460**		730		**1790**	
Sulfate	A	mg/L	385	NA	355		**3480**		124		308		17.4		263		87		253	
Fluoride	A,B	mg/L	0.187	4.0	0.163		**0.397**	J	<0.150		**0.407**		0.12	J	0.124	J	**0.375**		**0.255**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000949	J	**0.00231**		**0.00292**		0.000787	J	0.000327	J	0.000381	J	0.000517	J	0.000463	J
Barium	B	mg/L	0.0621	2.0	0.0554		**0.0691**		**0.191**		0.0487		**0.456**		**0.0798**		**0.0961**		**0.0993**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		0.000252	J	<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	**0.00738**		0.000686	J	**0.00774**		0.000277	J	0.00433		<0.00200		<0.00200		0.0013	J
Lead	B	mg/L	0.002	0.15**	0.000601	J	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.0177		0.0325		**0.149**		0.018		0.0211		0.019		0.00925	J	**0.0913**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	0.000873	J	**0.372**		<0.00500		0.00196	J	<0.00500		<0.00500		<0.00500		0.00208	J
Radium	B	pCi/L	3.838	5	1.3967		3.002		**7.61**		1.307		1.517		0.752		0.836		0.497	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.469**		<0.00200		0.000769	J	<0.00200		<0.00200		**0.00304**		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000366	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4

Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022

MW22-01 through MW22-08

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08		MW22-08 DUP	
Sample Date					05/31/2022		05/31/2022		05/31/2022		05/31/2022		05/31/2022		05/31/2022		05/31/2022		05/31/2022		05/31/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	555		225		245		175		149		269		299		404		412	
Boron	A	mg/L	0.339	NA	0.213		3.08		0.11	J	0.0578	J	<0.200		<0.200		0.172	J	<0.200		0.0958	J
Calcium	A	mg/L	323	NA	309		297		241	V	78.8		249		232		59.8		65.4		64.4	
Chloride	A	mg/L	10.2	NA	8.14		219		1840		50.6		1160		161		3.25		198		189	
TDS	A	mg/L	1230	NA	1000	J3	3680		3680	Q	613		1800		932		408		984		996	
pH	A	SU	7.2	NA	7.2		7.46		7.2		6.76		6.4		6.52		7.16		7.42		7.42	
Sodium	A	mg/L	102	NA	25.3		1710		856	V	121		380		61.2		78.3		304		294	
Conductivity	A	umhos/cm	1690	NA	1510		8010		6040		1030		3740		1450		692		1780		1820	
Sulfate	A	mg/L	385	NA	385		4120		134		275		18.1		300		77		275		276	
Fluoride	A,B	mg/L	0.187	4.0	0.169		0.678	J	0.0735	J	0.159		0.115	J	0.102	J	0.35		0.296		0.217	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000386	J	0.00233		0.00711		0.000355	J	0.000227	J	0.00028	J	0.000596	J	0.000432	J	0.000402	J
Barium	B	mg/L	0.0621	2.0	0.0431		0.0635		0.274		0.0731		0.461		0.0765		0.106		0.0801		0.0791	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		0.000256	J	<0.00100		<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.00402		0.000493	J	0.00663		<0.00200		0.00349		<0.00200		<0.00200		0.000717	J	0.000695	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.018		0.0285		0.271		0.0139	J	0.0181		0.0158		0.086		<0.0150		<0.0150	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	<0.00500		0.48		0.0014	J	<0.00500		<0.00500		<0.00500		<0.00500		0.00172	J	0.00149	J
Radium	B	pCi/L	3.838	5	1.501		1.785		2.62		1.062		1.661		1.058		0.793		0.627		0.9198	
Selenium	B	mg/L	0.002	0.05	<0.00200		0.0864		<0.00200		<0.00200		<0.00200		<0.00200		0.00249		<0.00200		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000398	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4

Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022

MW22-01 through MW22-08

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Well ID					**MW22-01**		**MW22-02**		**MW22-03**		**MW22-04**		**MW22-04 DUP**		**MW22-05**		**MW22-06**		**MW22-07**		**MW22-08**	
Sample Date					**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**		**06/20/2022**	
Analyte		**Units**	**Background**	**GWPS/MCL**	**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**	
Alkalinity	A	mg/L	637	NA	532		212		245		222		208		196		264		281		397	
Boron	A	mg/L	0.339	NA	0.139	J	**3.08**		0.0975	J	0.0609	J	0.0556	J	<0.200		<0.200		0.136	J	0.163	J
Calcium	A	mg/L	323	NA	306		**339**		**343**		89.4	V	89.5		280		241		68		66.6	
Chloride	A	mg/L	10.2	NA	8.03		**261**		**2440**		**32.3**		**33.8**		**1630**		**158**		3.41		**192**	
TDS	A	mg/L	1230	NA	1010		**6030**		**4520**		648		639		**1800**		904		391		976	
pH	A	SU	7.2	NA	**7.2**		**8.02**		**7.86**		**7.31**		**7.31**		7.19		**7.72**		**7.67**		**8.02**	
Sodium	A	mg/L	102	NA	24.6		**1840**		**1240**		**136**	V	**136**		**443**		65.4		69.5		**323**	
Conductivity	A	umhos/cm	1690	NA	1420		**8320**		**7750**		1030		1020		**3950**		1460		660		**1790**	
Sulfate	A	mg/L	385	NA	357		**4300**		101		263		260		28.9		298		68.5		233	
Fluoride	A,B	mg/L	0.187	4.0	0.17		<1.50		<0.150		**0.189**		0.181		0.123	J	0.115	J	**0.321**		**0.202**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000436	J	**0.00307**		**0.0083**		0.000569	J	0.00044	J	0.000324	J	0.000435	J	0.000611	J	0.000583	J
Barium	B	mg/L	0.0621	2.0	0.0399		**0.0687**		**0.382**		**0.0662**		**0.0661**		**0.515**		**0.079**		**0.119**		**0.0712**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		0.000236	J	<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.00303		0.000575	J	**0.00667**		0.000144	J	<0.00200		0.00298		<0.00200		<0.00200		0.000525	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.0132	J	0.0274		**0.367**		0.0143	J	0.014	J	0.0188		0.0169		<0.0150		**0.0896**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	<0.00500		**0.634**		0.00226	J	0.000927	J	<0.00500		<0.00500		<0.00500		<0.00500		0.00111	J
Radium	B	pCi/L	3.838	5	**3.838**		1.126		**4.45**		0.438		0.985		1.762		0.747		0.835		ND	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.0733**		<0.00200		0.000515	J	<0.00200		<0.00200		<0.00200		0.0016	J	<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000535	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4
Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022
MW22-01 through MW22-08
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08	
Sample Date					07/18/2022		07/18/2022		07/18/2022		07/18/2022		07/18/2022		07/18/2022		07/18/2022		07/18/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	514		360		249		123		236		262		278		393	
Boron	A	mg/L	0.339	NA	0.107	J	**2.94**		0.106	J	0.0434	J	<0.200		<0.200		0.0881	J	0.168	J
Calcium	A	mg/L	323	NA	269		307		306		75.3		247		208		110		59.6	
Chloride	A	mg/L	10.2	NA	9.12		**278**		**2420**		**35.6**		**1200**		**156**		10.1		**202**	
TDS	A	mg/L	1230	NA	956		**4880**		**4190**		500		**2950**		932		638		1020	
pH	A	SU	7.2	NA	6.9		**7.42**		**7.6**		6.71		7.07		**7.32**		**7.34**		**7.7**	
Sodium	A	mg/L	102	NA	24.1		**1310**		**1090**		69		**466**		58.4		88.7		**291**	
Conductivity	A	umhos/cm	1690	NA	1440		**7660**		**7700**		790		**4050**		1440		983		**1760**	
Sulfate	A	mg/L	385	NA	326		**3450**		99.7		211		50.3		282		224		226	
Fluoride	A,B	mg/L	0.187	4.0	0.163		<1.50		0.083	J	0.112	J	0.162		0.11	J	0.178		**0.21**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000347	J	**0.00217**		**0.00952**		0.000399	J	0.000234	J	0.000317	J	0.000502	J	0.000506	J
Barium	B	mg/L	0.0621	2.0	0.0365		0.0562		**0.346**		**0.0742**		**0.45**		**0.0692**		**0.0742**		0.0659	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		0.000323	J	<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.00308		0.000543	J	0.00582		<0.00200		0.00138	J	<0.00200		0.0002	J	0.000454	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.0136	J	0.0282		**0.368**		0.0106	J	0.0181		0.0147	J	0.00896	J	**0.0893**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	<0.00500		**0.424**		0.00222	J	<0.00500		<0.00500		<0.00500		<0.00500		0.00126	J
Radium	B	pCi/L	3.838	5	1.9077		0.494		4.1		1.3		1.688		0.461		0.5542		0.496	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.0275**		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000447	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4
Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022
MW22-01 through MW22-08
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Well ID					**MW22-01**		**MW22-02**		**MW22-03**		**MW22-04**		**MW22-05**		**MW22-06**		**MW22-06 DUP**		**MW22-07**		**MW22-08**	
Sample Date					**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**		**08/18/2022**	
Analyte		**Units**	**Background**	**GWPS/MCL**	**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**	
Alkalinity	A	mg/L	637	NA	552		414		271		115		373		293		288		318		424	
Boron	A	mg/L	0.339	NA	0.093	J	**3.16**		0.177	J	<0.200		<0.200		<0.200		<0.200		0.0798	J	0.167	J
Calcium	A	mg/L	323	NA	264		338		134		72.8		240		210		223		137		59.9	
Chloride	A	mg/L	10.2	NA	9.45		**305**		**858**		**38**		**1140**		**140**		**144**		**13.8**		**209**	
TDS	A	mg/L	1230	NA	978		**6270**	Q	**1560**	Q	491	Q	**2310**	Q	851	Q	940		813		1050	Q
pH	A	SU	7.2	NA	6.5		6.92		6.63		6.26		6.82		6.93		6.93		6.87		**7.27**	
Sodium	A	mg/L	102	NA	24.8		**1540**		**455**		59.2		**529**		58.8		58.6		100		**296**	
Conductivity	A	umhos/cm	1690	NA	1420		**7840**		**3440**		755		**4160**		1350		1380		1130		**1750**	
Sulfate	A	mg/L	385	NA	320		**3780**		199		194		104		261		275		324		225	
Fluoride	A,B	mg/L	0.187	4.0	0.176		**0.232**		<0.150		0.104	J	0.172		0.11	J	0.093	J	0.152		**0.235**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000348	J	**0.00165**		**0.0106**		0.000352	J	0.00022	J	0.000344	J	0.000269	J	0.000314	J	0.000504	J
Barium	B	mg/L	0.0621	2.0	0.0373		0.0444		**0.189**		**0.0719**		**0.388**		**0.0721**		**0.0742**		**0.0719**		**0.0737**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		0.000165	J	<0.00100		<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.0032		0.000412	J	**0.00653**		<0.00200		0.000238	J	<0.00200		<0.00200		<0.00200		0.000499	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.00837	J	0.0237		**0.128**		0.0118	J	0.0153		0.0108	J	0.00802	J	0.00712	J	**0.0962**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	<0.00500		**0.32**		0.00117	J	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		0.00105	J
Radium	B	pCi/L	3.838	5	1.255		2.157		2.34		0.779		2.448		1.971		1.67		0.859		2.455	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.032**		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000392	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4
Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022
MW22-01 through MW22-08
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08	
Sample Date					09/13/2022		09/13/2022		09/13/2022		09/13/2022		09/13/2022		09/13/2022		09/13/2022		09/13/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	514		381		226		97.1		365		269		301		391	
Boron	A	mg/L	0.339	NA	0.106	J	**3.03**		0.174	J	<0.200		<0.200		<0.200		0.0888	J	0.166	J
Calcium	A	mg/L	323	NA	270		**334**		133	V	71.4		230		201		134		59.5	
Chloride	A	mg/L	10.2	NA	8.96		**302**		**826**		**40.2**		**1090**		**141**		**14.1**		**195**	
TDS	A	mg/L	1230	NA	968		**7930**		**1590**		431		**2160**		812		755		1000	
pH	A	SU	7.2	NA	6.64		7.02		6.61		6.38		6.95		7.02		6.95		**7.35**	
Sodium	A	mg/L	102	NA	25.7		**1640**		**473**	V	58.6		**539**		57.8		**102**		**316**	
Conductivity	A	umhos/cm	1690	NA	1450		**8060**		**3360**		700		**4180**		1350		1190		**1780**	
Sulfate	A	mg/L	385	NA	324		**3680**		167		162		103		252		343		205	
Fluoride	A,B	mg/L	0.187	4.0	0.169		<1.50		0.0648	J	0.0839	J	**0.188**		0.0773	J	0.141	J	<0.750	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000382	J	**0.00208**		**0.00662**		0.00068	J	0.000266	J	0.000288	J	0.00036	J	0.000502	J
Barium	B	mg/L	0.0621	2.0	0.0349		0.0381		**0.245**		**0.0745**		**0.357**		**0.0643**		0.056		**0.0708**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.00344		0.000502	J	**0.00657**		0.000221	J	0.000196	J	<0.00200		<0.00200		0.00062	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	0.00773	J	0.023		**0.114**		0.00973	J	0.0138	J	0.00796	J	0.00868	J	**0.097**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	<0.00500		**0.216**		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		0.00109	J
Radium	B	pCi/L	3.838	5	0.432		0.008		1.867		0.693		1.873		1.6071		1.157		ND	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.0641**		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		0.000441	J	<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 4

Summary of Site Characterization Study Groundwater Monitoring Results - April 2022 through October 2022

MW22-01 through MW22-08

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Well ID					MW22-01		MW22-02		MW22-03		MW22-04		MW22-05		MW22-06		MW22-07		MW22-08	
Sample Date					10/03/2022		10/03/2022		10/03/2022		10/03/2022		10/03/2022		10/03/2022		10/03/2022		10/03/2022	
Analyte		Units	Background	GWPS/MCL	Result		Result		Result		Result		Result		Result		Result		Result	
Alkalinity	A	mg/L	637	NA	517		371		200		88.5		377		266		303		393	
Boron	A	mg/L	0.339	NA	0.0962	J	**3.25**		0.209		<0.200		<0.200		<0.200		0.0895	J	0.19	J
Calcium	A	mg/L	323	NA	275		**370**		57.4		65.5		251		208		152		60.7	
Chloride	A	mg/L	10.2	NA	**10.2**		**327**		**132**		**43.1**		**1070**		**135**		**15.2**		**194**	
TDS	A	mg/L	1230	NA	864		**6320**		684		408		**2290**		847		739		1080	
pH	A	SU	7.2	NA	6.4		6.74		6.08		6.14		6.74		6.79		6.68		7.08	
Sodium	A	mg/L	102	NA	29.1		**1780**		**189**		51.9		**605**		62		**121**		**328**	
Conductivity	A	umhos/cm	1690	NA	1320		**8120**		1250		648		**4090**		1310		1230		**1740**	
Sulfate	A	mg/L	385	NA	309		**4220**		232		139		114		239		349		220	
Fluoride	A,B	mg/L	0.187	4.0	**0.187**		<1.50		<0.150		0.0913	J	0.159		<0.150	P1	0.153		**0.239**	
Antimony	B	mg/L	0.005	0.01	<0.00500		<0.0500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500	
Arsenic	B	mg/L	0.0009	0.01	0.000421	J	<0.0100		**0.00399**		0.000606	J	0.00028	J	0.000357	J	0.000341	J	0.000542	J
Barium	B	mg/L	0.0621	2.0	0.0347		0.032	J	**0.109**		**0.0633**		**0.356**		**0.0633**		0.0532		**0.0747**	
Beryllium	B	mg/L	Detection	0.004	<0.00100		<0.0100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Cadmium	B	mg/L	0.001	0.005	0.000216	J	<0.0100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	
Chromium	B	mg/L	Detection	0.1	<0.0200		<0.200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200		<0.0200	
Cobalt	B	mg/L	0.00738	0.006**	0.0038		<0.0200		0.00617		0.000206	J	<0.00200		<0.00200		<0.00200		0.000716	J
Lead	B	mg/L	0.002	0.15**	<0.00200		<0.0200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Lithium	B	mg/L	0.037	0.04**	<0.0150		0.0211		0.0184		0.0111	J	0.0117	J	<0.0150		<0.0150		**0.0971**	
Mercury	B	mg/L	0.0002	0.002	<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200		<0.000200	
Molybdenum	B	mg/L	0.005	0.01**	0.000939	J	**0.186**		<0.00500		<0.00500		<0.00500		<0.00500		<0.00500		0.00111	J
Radium	B	pCi/L	3.838	5	0.2766		0.795		1.711		1.343		0.2454		0.3612		ND		ND	
Selenium	B	mg/L	0.002	0.05	<0.00200		**0.0918**		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200		<0.00200	
Thallium	B	mg/L	0.001	0.002	<0.00100		<0.0100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100		<0.00100	

Table 5

Groundwater Seepage Velocity Calculation

Grand River Dam Authority Landfill

Grand River Energy Center - Mayes County, Oklahoma

Parameter	Value		Units
Hydraulic Conductivity	Maximum	0.0025	cm/s
	Average	0.0006	cm/s
Hydraulic Gradient (I)	Groundwater Elevation MW93-1	610.15	ft
	Groundwater Elevation MW22-06	583.79	ft
	Distance	2122	ft
Effective Porosity	Average	0.221	unitless

Calculated Seepage Velocity	cm/s	ft/year
Maximum	0.00014	145.2
Average	0.00003	34.5

Table 6
Statistical Analysis Summary April 2022 Semi-Annual Event
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Parameter		Units	BG	GWPS	Inter-Well/ Background Exceedance	Intra-Well Exceedance	GWPS Exceedance
Alkalinity	A	mg/L	550	NA	MW93-3	--	--
Boron	A	mg/L	0.499	NA	MW93-2	--	--
Calcium	A	mg/L	670	NA	--	--	--
Chloride	A	mg/L	63	NA	MW93-2 MW93-3 MW03-2	--	--
Total Dissolved Solids	A	mg/L	1130	NA	MW93-2 MW93-3 MW03-2	--	--
pH	A	su	7.17	NA	MW93-2	--	--
Sodium	A	mg/L	130	NA	MW93-2 MW93-3 MW03-2	--	--
Specific Conductance	A	umhos/cm	1888	NA	MW93-2 MW93-3 MW03-1	--	--
Sulfate	A	mg/L	880	NA	MW93-2	--	--
Fluoride	A,B	mg/L	0.25	4.0	MW93-2	--	--
Antimony	B	mg/L	Detection	0.01	--	--	--
Arsenic	B	mg/L	0.0109	0.01	MW93-2	--	MW93-2
Barium	B	mg/L	0.0405	2.0	MW93-2 MW93-3	--	--
Beryllium	B	mg/L	Detection	0.004	--	--	--
Cadmium	B	mg/L	Detection	0.005	--	--	--
Chromium	B	mg/L	Detection	0.1	--	--	--
Cobalt	B	mg/L	Detection	0.006**	--	--	--
Lead	B	mg/L	Detection	0.15**	--	--	--
Lithium	B	mg/L	0.0236	0.04**	MW93-2 MW93-3 MW03-2	MW93-2 MW03-2	MW93-3**
Mercury	B	mg/L	0.0002	0.002	MW93-3 MW03-2	MW93-3	MW03-2
Molybdenum	B	mg/L	0.01	0.01**	MW93-2	--	MW93-2**
Radium 226/228 Combined	B	pCi/L	2.24	5	MW93-2 MW03-2	--	--
Selenium	B	mg/L	Detection	0.05	--	--	--
Thallium	B	mg/L	Detection	0.002	--	--	--

MCL - Maximum Contaminant Level (MCL) according to 40 CFR 141.62 and 141.66.
**Coal Ash Rule 83 FR 364.35 July 30, 2018 health-based GWPS for Co, Pb, Li, Mo, Effective August 29, 2018
NA - Not Applicable
BG - Background Concentration observed in MW93-1
A - Appendix A Constituents for Detection Monitoring
B - Appendix B Constituents for Assessment Monitoring

Table 7
Statistical Analysis Summary October 2022 Annual Event
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Parameter		Units	BG	MCL/GWPS	Inter-Well/ Background Exceedance	Intra-Well Exceedance	MCL/GWPS Exceedance
Alkalinity	A	mg/L	550	NA	MW93-3	--	--
Boron	A	mg/L	0.499	NA	MW93-2	--	--
Calcium	A	mg/L	670	NA	--	--	--
Chloride	A	mg/L	63	NA	MW93-2 MW93-3 MW03-2	--	--
Total Dissolved Solids	A	mg/L	1130	NA	MW93-2 MW93-3 MW03-2	--	--
pH	A	su	7.17	NA	MW93-2	--	--
Sodium	A	mg/L	130	NA	MW93-2 MW93-3 MW03-2	MW93-2	--
Specific Conductance	A	umhos/cm	1888	NA	MW93-2 MW93-3 MW03-1 MW03-2	MW93-2 MW93-3	--
Sulfate	A	mg/L	880	NA	MW93-2	MW93-2	--
Fluoride	A,B	mg/L	0.25	4.0	MW93-3	--	--
Antimony	B	mg/L	Detection	0.01	--	--	--
Arsenic	B	mg/L	0.0109	0.01	MW93-2	--	MW93-2
Barium	B	mg/L	0.0405	2.0	MW93-2 MW93-3	--	--
Beryllium	B	mg/L	Detection	0.004	--	--	--
Cadmium	B	mg/L	Detection	0.005	--	--	--
Chromium	B	mg/L	Detection	0.1	--	--	--
Cobalt	B	mg/L	Detection	0.006**	--	--	--
Lead	B	mg/L	Detection	0.15**	--	--	--
Lithium	B	mg/L	0.0236	0.04**	MW93-3		MW93-3**
Mercury	B	mg/L	0.0002	0.002	MW93-3 MW03-2	MW93-3	--
Molybdenum	B	mg/L	0.01	0.01**	MW93-2	MW93-2	MW93-2**
Radium 226/228 Combined	B	pCi/L	2.24	5	MW93-2	--	--
Selenium	B	mg/L	Detection	0.05	--	--	--
Thallium	B	mg/L	Detection	0.002	--	--	--

MCL - Maximum Contaminant Level (MCL) according to 40 CFR 141.62 and 141.66.
**Coal Ash Rule 83 FR 364.35 July 30, 2018 health-based GWPS for Co, Pb, Li, Mo, Effective August 29, 2018
NA - Not Applicable
BG - Background Concentration observed in MW93-1
A - Appendix A Constituents for Detection Monitoring
B - Appendix B Constituents for Assessment Monitoring

Table 8
Statistical Analysis Summary using Data from New Wells October 2022 Annual Event
Grand River Dam Authority Landfill
Grand River Energy Center - Mayes County, Oklahoma

Parameter		Units	BG	GWPS/MCL	Inter-Well/ Background Exceedance	Intra-Well Exceedance	GWPS/MCL Exceedance
Alkalinity	A	mg/L	637	NA	--	--	--
Boron	A	mg/L	0.339	NA	MW22-02 MW93-2	MW22-02	--
Calcium	A	mg/L	323	NA	MW22-02	MW22-02	--
Chloride	A	mg/L	10.2	NA	MW22-02 MW22-03 MW22-04 MW22-05 MW22-06 MW22-08	--	--
Total Dissolved Solids	A	mg/L	1230	NA	MW22-02 MW22-05	--	--
pH	A	su	6.53, 7.67	NA	--	--	--
Sodium	A	mg/L	102	NA	MW22-02 MW22-03 MW22-04 MW22-05 MW22-07 MW22-08	MW22-05 MW22-07 MW22-08	--
Specific Conductance	A	umhos/cm	1690	NA	MW22-02 MW22-05 MW22-08	--	--
Sulfate	A	mg/L	385	NA	MW22-02	--	--
Fluoride	A,B	mg/L	0.187	4.0	MW22-02 MW22-08	--	--
Antimony	B	mg/L	Detection	0.01	--	--	--
Arsenic	B	mg/L	0.0009	0.01	MW22-03	--	--
Barium	B	mg/L	0.0621	2.0	MW22-03 MW22-04 MW22-05 MW22-06 MW22-08	--	--
Beryllium	B	mg/L	Detection	0.004	--	--	--
Cadmium	B	mg/L	Detection	0.005	--	--	--
Chromium	B	mg/L		0.1	--	--	--
Cobalt	B	mg/L	0.00738	0.006**	--	--	MW22-03
Lead	B	mg/L	Detection	0.15**	--	--	--
Lithium	B	mg/L	0.037	0.04**	MW22-08	MW22-08	MW22-08
Mercury	B	mg/L	Detection	0.002	--	--	--
Molybdenum	B	mg/L	0.005	0.01**	MW22-02	--	MW22-02
Radium 226/228 Combined	B	pCi/L	3.002	5	MW22-03	--	--
Selenium	B	mg/L	0.002	0.05	MW22-02	--	MW22-02
Thallium	B	mg/L	0.001	0.002	--	--	--

MCL - Maximum Contaminant Level (MCL) according to 40 CFR 141.62 and 141.66.
**Coal Ash Rule 83 FR 364.35 July 30, 2018 health-based GWPS for Co, Pb, Li, Mo, Effective August 29, 2018
NA - Not Applicable
BG - Background Concentration observed in MW93-1
A - Appendix A Constituents for Detection Monitoring
B - Appendix B Constituents for Assessment Monitoring

Figures

Grand River Dam Authority **Grand River Energy Center** **Mayes County, Oklahoma**	**Legend:** Monitor Well N	ENERCON **Figure 1** Site Location Map and Monitor Well Locations Project No: GRDA -00021

Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend:

- Monitor Well

N

ENERCON

Figure 2
Groundwater Gradient
April 2022

Project No: GRDA -00021

Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend:

Monitor Well

N

ENERCON

Figure 3
Groundwater Gradient
October 2022

Project No: GRDA -00021

Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

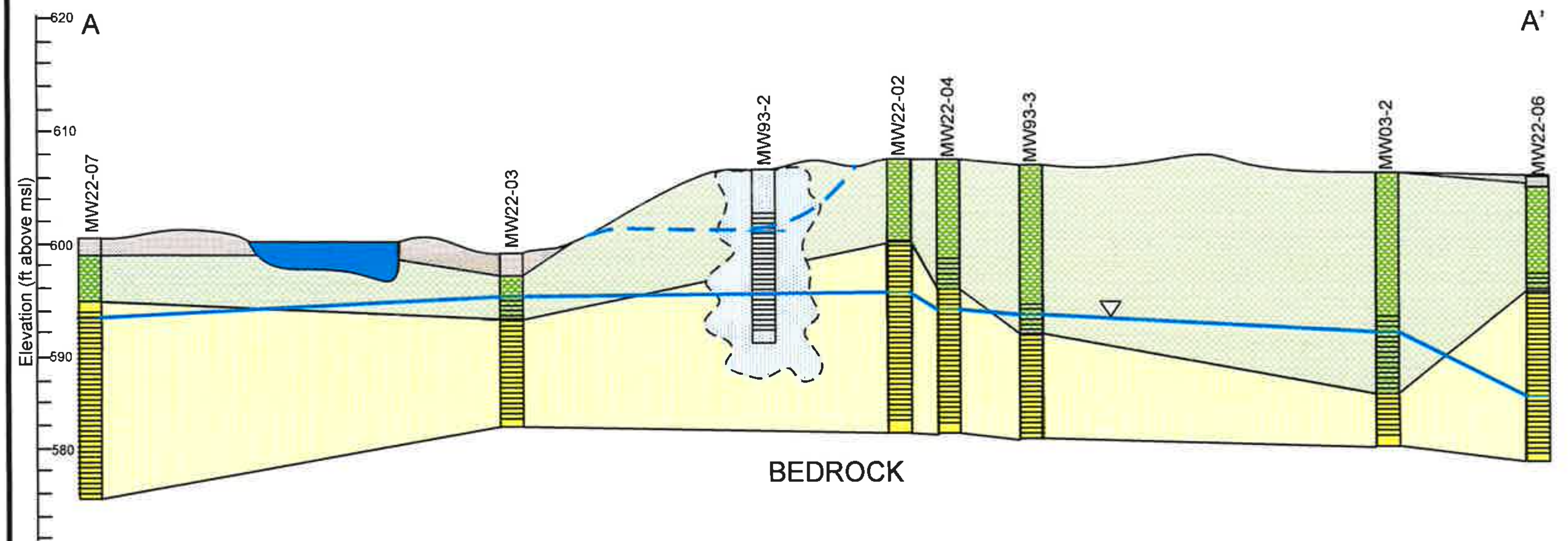
Legend:
Monitor Well

N

ENERCON

Figure 4
Cross Section Lines

Project No: GRDA -00021



Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend

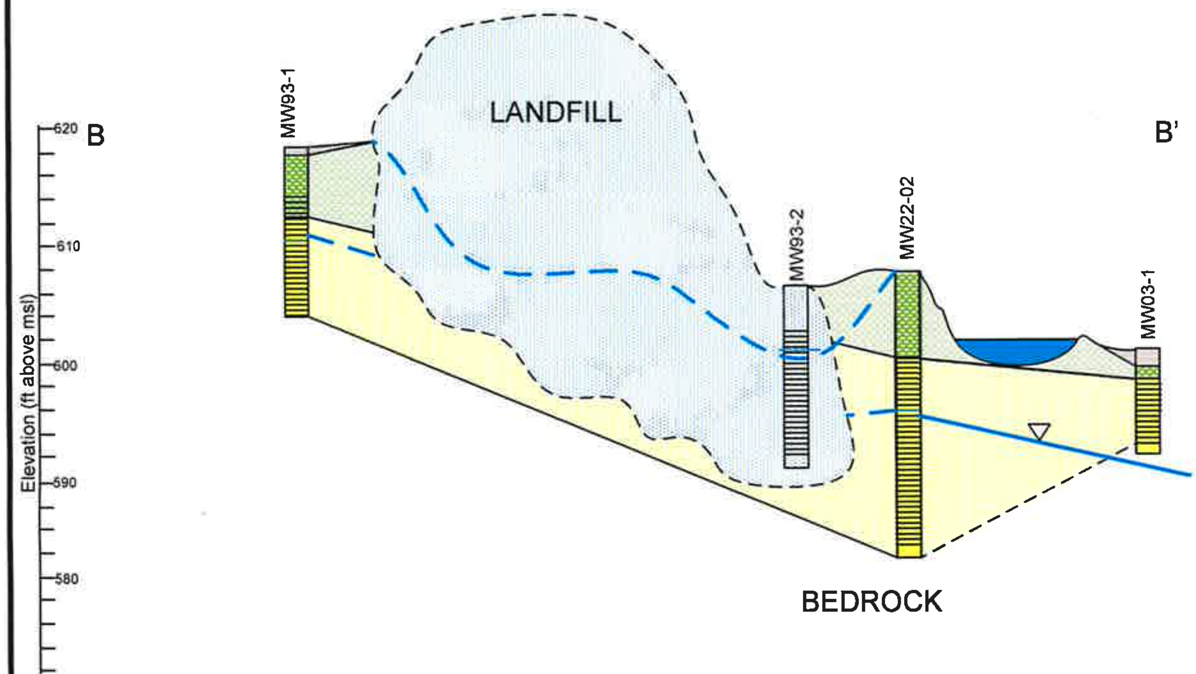
Alluvium – unconsolidated clay, silt, sand, gravel
Gravelley Clay Containing Coal Ash/Landfill Material
Clay
Topsoil or Fill Material
Water Table Boundary
Perched Groundwater

0 ft 400 ft
Scale
Vertical Exaggeration 40X

ENERCON

Figure 5
Cross Section A-A'

Project No: GRDA -00021



Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend

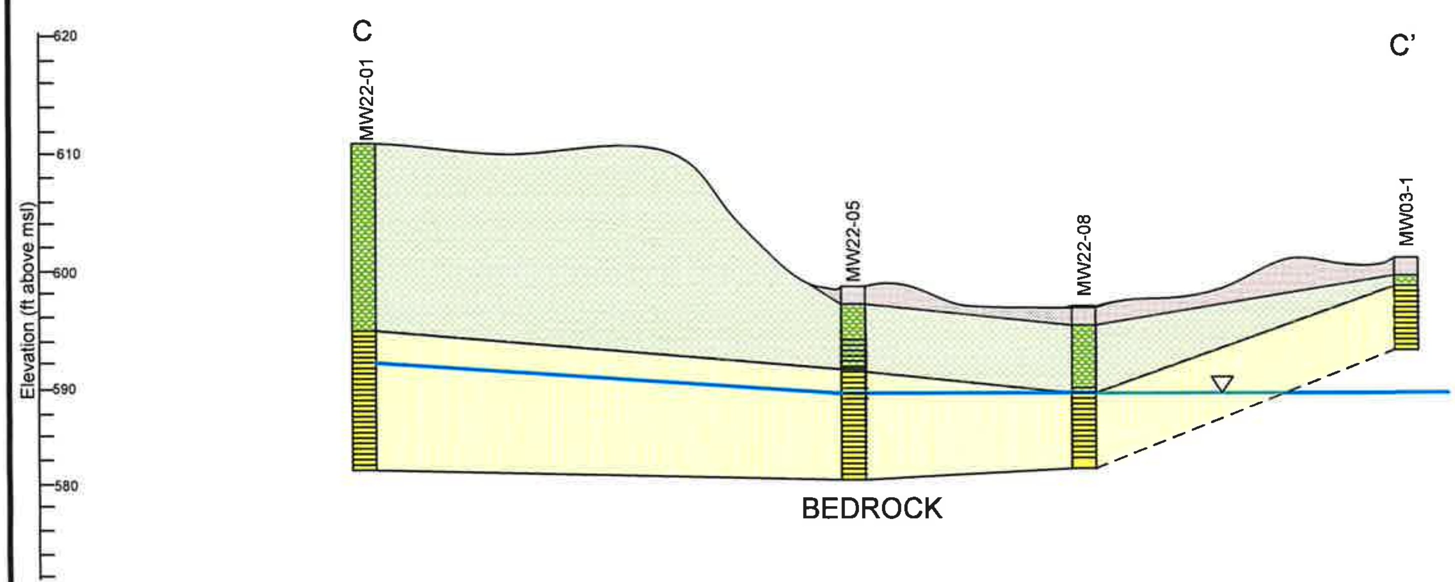
- Alluvium – unconsolidated clay, silt, sand, gravel
- Gravelley Clay Containing Coal Ash/Landfill Material
- Clay
- Topsoil or Fill Material
- Water Table Boundary
- Perched Groundwater

0 ft 400 ft
Scale
Vertical Exaggeration 40X

ENERCON

Figure 6
Cross Section B- B'

Project No: GRDA -00021



Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend

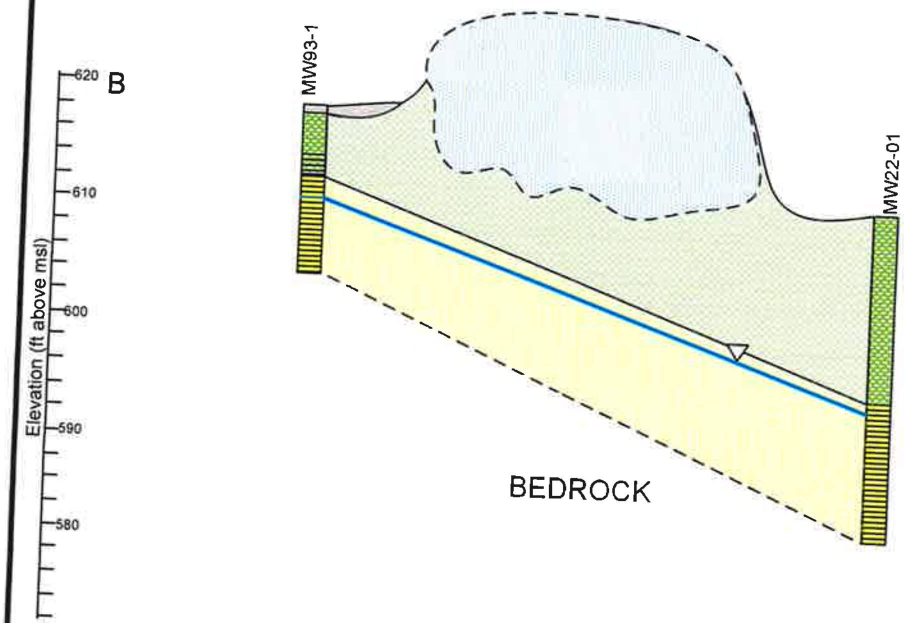
- Alluvium – unconsolidated clay, silt, sand, gravel
- Gravelley Clay Containing Coal Ash/Landfill Material
- Clay
- Topsoil or Fill Material
- Water Table Boundary

0 ft 400 ft
Scale
Vertical Exaggeration 40X

ENERCON

Figure 7
Cross Section C-C'

Project No: GRDA -00021



Grand River Dam Authority
Grand River Energy Center
Mayes County, Oklahoma

Legend

Alluvium – unconsolidated clay, silt, sand, gravel
Gravelley Clay Containing Coal Ash/Landfill Material
Clay
Topsoil or Fill Material
Water Table Boundary
Perched Groundwater

0 ft 400 ft
Scale
Vertical Exaggeration 40X

ENERCON

Figure 8
Cross Section D-D'

Project No: GRDA -00021