January 24, 2022

Industrial and Hazardous Waste Permits Section, MC-130
Coal Combustion Residuals Program
Waste Permits Division
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, Texas 78711-3087

**RE: Monticello Steam Electric Station - SWR 30081 – New CCR Application**

On behalf of Golden Eagle Development, LLC (CN605736982), Gemini Engineering, LLC (Gemini) is submitting a CCR Application to the Texas Commission on Environmental Quality for the Big Brown Steam Electric Station (BBSES) facility.

Please contact me at (512) 566-6878 or at a.kaiser@geministl.com if you have any questions or comments.

Sincerely,

Adam J. Kaiser

Adam Kaiser, PE
Senior Project Engineer
**Gemini Engineering LLC**

CC:
Jesse Froh – Golden Eagle Development
Charlie Klumb – Golden Eagle Development

Texas Commission on Environmental Quality

# Waste Permits Division Correspondence Cover Sheet

Date: 1/24/2022
Facility Name: Monticello Steam Electric Station
Permit or Registration No.: 30081

Nature of Correspondence:
☒ Initial/New
☐ Response/Revision to TCEQ Tracking No.: ______ (from subject line of TCEQ letter regarding initial submission)

Affix this cover sheet to the front of your submission to the Waste Permits Division. Check appropriate box for type of correspondence. Contact WPD at (512) 239-2335 if you have questions regarding this form.

**Table 1 - Municipal Solid Waste Correspondence**

| Applications | Reports and Notifications |
|---|---|
| ☐ New Notice of Intent | ☐ Alternative Daily Cover Report |
| ☐ Notice of Intent Revision | ☐ Closure Report |
| ☐ New Permit (including Subchapter T) | ☐ Compost Report |
| ☐ New Registration (including Subchapter T) | ☐ Groundwater Alternate Source Demonstration |
| ☐ Major Amendment | ☐ Groundwater Corrective Action |
| ☐ Minor Amendment | ☐ Groundwater Monitoring Report |
| ☐ Limited Scope Major Amendment | ☐ Groundwater Background Evaluation |
| ☐ Notice Modification | ☐ Landfill Gas Corrective Action |
| ☐ Non-Notice Modification | ☐ Landfill Gas Monitoring |
| ☐ Transfer/Name Change Modification | ☐ Liner Evaluation Report |
| ☐ Temporary Authorization | ☐ Soil Boring Plan |
| ☐ Voluntary Revocation | ☐ Special Waste Request |
| ☐ Subchapter T Disturbance Non-Enclosed Structure | ☐ Other: |
| ☐ Other: | |

**Table 2 - Industrial & Hazardous Waste Correspondence**

| Applications | Reports and Responses |
|---|---|
| ☒ New | ☐ Annual/Biennial Site Activity Report |
| ☐ Renewal | ☐ CPT Plan/Result |
| ☐ Post-Closure Order | ☐ Closure Certification/Report |
| ☐ Major Amendment | ☐ Construction Certification/Report |
| ☐ Minor Amendment | ☐ CPT Plan/Result |
| ☒ CCR Registration | ☐ Extension Request |
| ☐ CCR Registration Major Amendment | ☐ Groundwater Monitoring Report |
| ☐ CCR Registration Minor Amendment | ☐ Interim Status Change |
| ☐ Class 3 Modification | ☐ Interim Status Closure Plan |
| ☐ Class 2 Modification | ☐ Soil Core Monitoring Report |
| ☐ Class 1 ED Modification | ☐ Treatability Study |
| ☐ Class 1 Modification | ☐ Trial Burn Plan/Result |
| ☐ Endorsement | ☐ Unsaturated Zone Monitoring Report |
| ☐ Temporary Authorization | ☐ Waste Minimization Report |
| ☐ Voluntary Revocation | ☐ Other: |
| ☐ 335.6 Notification | |
| ☐ Other: | |

## Texas Commission on Environmental Quality

**Registration Application for Coal Combustion Residuals (CCR) Waste Management**

# I. General Information

## 1. Reason for Submittal

Type of Registration Application

☒ New ☐ Major Amendment ☐ Minor Amendment

☐ Notice of Deficiency (NOD) Response ☐ Transfer ☐ Name Change

☐ Other

## 2. Application Fees

☒ $150 Application Fee

Payment Method

☐ Check ☐ Online through ePay portal <www3.tceq.texas.gov/epay/>

If paid online, enter ePay Trace Number:

## 3. Facility Information

*Facility information must match regulated entity information on the Core Data Form.*

Applicant: ☐ Owner ☐ Operator ☒ Owner/Operator

Facility TCEQ Solid Waste Registration No: 30081

Facility EPA ID: TXD054378948

Regulated Entity Reference No. (if issued): RN 102285921

Facility Name: Monticello Steam Electric Station

Facility (Area Code) Telephone Number: 314-624-1604

Facility physical street address (city, state, zip code, county): 8 mi SE of Mt. Pleasant, FM 127, Mt. Pleasant, TX 75456, Titus

Facility mailing address (city, state, zip code, county): 2275 Cassens Drive, Suite 118, Fenton, MO 63026

Latitude (Degrees, Minutes Seconds): North Latitude 33° 5' 30.0444"

Longitude (Degrees, Minutes Seconds): West Longitude 95°2' 19.5324"

## 4. Publicly Accessible Website

Provide the URL address of a publicly accessible website where the owner or operator of a CCR unit will post information.
http:// ccrmonticello.com

## 5. Facility Landowner(s) Information

Facility landowner(s) name: Golden Eagle Development LLC

Facility landowner mailing address: 2275 Cassens Drive, Suite 118, Fenton, MO 63026

City: State: Zip Code:

(Area Code) Telephone Number: 314-624-1604

Email Address (optional):
cklumb@commercialliabilitypartners.com

## 6. CCR Waste Management Unit(s) - See Attachment #1

■ Landfill Unit(s) ■ Surface Impoundment(s)

For each existing landfill, new landfill and lateral expansion, existing surface impoundment, and new surface impoundment and lateral expansion(s) provide information on type of waste, the registered unit(s) in which they are managed, and sampling and analytical methods.

Submit the following tables: See Attachment #1

Table I.6. – CCR Waste Management Units;

Table I.6.A. – Waste Management Information;

Table I.6.B. – Waste Managed in Registered Units; and

Table I.6.C. – Sampling and Analytical Methods.

## 7. Description of Proposed Activities or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or registration conditions, if the application is for an amendment. See Attachment #2

## 8. Primary Contact Information

Contact Name: Title: Charles Klumb, Project Manager

Contact mailing address:
City: County: State: Zip Code: 2275 Cassens Drive, Suite 118
Fenton, MO 63026
(Area Code) Telephone Number: 314-624-1604

Email Address (optional):

## 9. Notice Publishing

Party responsible for publishing notice:

☐ Applicant ☒ Consultant ☐ Agent in Service

Contact Name: Title: Adam Kaiser, Senior Project Engineer

Contact mailing address: Gemini Engineering
City: County: State: Zip Code: 2275 Cassens Drive, Suite 118
Fenton, MO 63026
(Area Code) Telephone Number: 512-566-6878

## 10. Alternative Language Notice

Is an alternative language notice required for this application? For determination, refer to Alternative Language Checklist on the Public Notice Verification Form (TCEQ-20244-Waste-NORI).

☒ Yes ☐ No

## 11. Public Place Location of Application

Name of the Public Place: Freestone County Courthouse Annex
Physical Address: County Clerk's Office
City: County: State: Zip Code: 103 E. Main Street, Suit 1
Fairfield, Texas 75840
(Area code) Telephone Number: 903-389-2656

## 12. Ownership Status of the Facility

☒ Corporation ☐ Limited Partnership

☐ Sole Proprietorship ☐ General Partnership ☐ Other (specify):

Does the Site Owner (Permittee/Registrant) own all the CCR units and all the facility property?

☒ Yes ☐ No

## 13. Property / Legal Description Information

Provide a legal description and supporting documents of the property where the management of CCR waste will occur; including a survey plat and a boundary metes and bounds description (30 TAC §352.231(g)). See Attachment #3

Submit the following documents:

a. Property Legal Description
b. Property Metes and Bounds Description
c. Metes and Bounds Drawings
d. On-Site Easements Drawings

## 14. Operator Information - Same as Owner

Identify the entity who will conduct facility operations, if the owner and operator are not the same.

Operator Name: Same as Owner

Operator mailing address:

City: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

## 15. Confidential Documents

Does the application contain confidential documents?

☐ Yes ■ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

## 16. Permits and Construction Approvals

| Permit or Approval | Received | Pending | Not Applicable |
|---|---|---|---|
| Hazardous Waste Management Program under the Texas Solid Waste Disposal Act | ☐ | ☐ | ☒ |
| Underground Injection Control Program under the Texas Injection Well Act | ☐ | ☐ | ☒ |
| National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26 | ☒ | ☐ | ☐ |
| Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA).<br>Nonattainment Program under the FCAA | ☐ | ☐ | ☒ |
| National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA | ☐ | ☐ | ☒ |
| Other (describe) | ☐ | ☐ | ☐ |
| Other (describe) | ☐ | ☐ | ☐ |
| Other (describe) | ☐ | ☐ | ☐ |

## 17. Legal Authority

The owner and operator of the facility shall submit verification of their legal status with the application. This shall be a one-page certificate of incorporation issued by the secretary of state. The owner or operator shall list all persons having over a 20% ownership in the facility.

See Attachment #4

## 18. TCEQ Core Data Form

The TCEQ requires that a Core Data Form (TCEQ-10400) be submitted on all incoming applications, unless a Regulated Entity and Customer Reference Number has been issued by the TCEQ and no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or visit the TCEQ Website.

See Attachment #5

## 19. Other Governmental Entities Information

**Coastal Management Program**

Is the facility within the Coastal Management Program boundary?

☐ Yes ■ No

**Local Government Jurisdiction (If Applicable)**
Within City Limits of:
Within Extraterritorial Jurisdiction of:

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ■ No If "Yes", provide a copy of the ordinance or order as an attachment.

## 20. Attachments

Does the application include the following? See Attachment #6

| | | |
|---|---|---|
| General Maps | X Yes | ☐ No |
| General Topographic Map | X Yes | ☐ No |
| Facility Layout Map | X Yes | ☐ No |
| Surrounding Features Map | ■ Yes | ☐ No |
| Process Flow Diagram | ☐ Yes | ■ No |
| Land Ownership Map | X Yes | ☐ No |
| Land Ownership List | X Yes | ☐ No |
| Pre-printed Mailing Labels | X Yes | ☐ No |

Maps and drawings shall be legible and easily readable by eye without magnification. Scales and paper size shall be chosen based on the type of map submitted, the land area covered, and the amount of detail to be shown. See instructions for details regarding maps and drawings to be submitted in application.

## 21. Verification of Compliance

Does the owner and operator verify that the design, construction, and operation of CCR landfill(s) and surface impoundment(s) meets the requirements of 30 TAC §352.231(f) (30 TAC §352.2; 40 CFR §257.52, and 40 CFR §§257.3-1 – 257.3-3).

■ Yes ☐ No

## II. Location Restrictions and Geology

See Instructions and Technical Guidance

### 22. Location Restrictions - Not Applicable

Submit certifications and technical reports demonstrating compliance of CCR unit(s) with applicable location restrictions (30 TAC 352, Subchapter E) and comply with 30 TAC §352.231(d) and 30 TAC §352.4 for submission of engineering and geoscientific information.

A. **Placement above the uppermost aquifer** (30 TAC §352.601) (40 CFR §257.60). For those CCR units whose base is less than five feet above the upper limit of the uppermost aquifer, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.60(a) – (c).

B. **Wetlands** (30 TAC §352.611) (40 CFR §257.61). For CCR units located in wetlands, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.61(a) – (c).

C. **Fault areas** (30 TAC §352.621) (40 CFR §257.62). For CCR units located within 200 feet of the outermost damage zone of a fault, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.62(a) – (c).

D. **Seismic impact zones** (30 TAC §352.631) (40 CFR §257.63). For CCR units located in a seismic impact zone, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.63(a) – (c).

E. **Unstable areas** (30 TAC §352.641) (40 CFR §257.64). For CCR units located in unstable areas, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.64(a) – (d).

The BAPs are being removed and not storing material; therefore, the location restrictions are not applicable.

### 23. Geology Summary Report - See Attachment #7

Submit a summary of the geologic conditions at the facility, including the relation of the geologic condition to each CCR unit. The summary must include enough information and data and include sources and references for the information. Include all groundwater monitoring data required by 40 CFR Part 257, Subpart D, (30 TAC §352.241, §352.601, §352.621, §352.631, and §352.641) and submitted in accordance of 30 TAC §352.4.

**Note:** Previously prepared documents may be submitted but must be supplemented or updated as necessary to provide the requested information (30 TAC §352.241(b)).

## III. Fugitive Dust Control Plan

### 24. Fugitive Dust Control Plan - See Attachment #8

**A. Submit a copy of the CCR Fugitive Dust Control Plan** (30 TAC §352.801) (40 CFR §257.80(b)), or the most recently amended plan. The initial plan or subsequent amended plan must be certified by a qualified Texas licensed professional engineer (Texas P.E.) that the plan meets the requirements of 30 TAC Chapter 352.

**B. Submit the most recent Annual CCR Fugitive Dust Control Report** (30 TAC §352.801) (40 CFR §257.80(c)) and include the report information. See Attachment #8

# IV. Landfill Criteria

See Instructions and Technical Guidance – No. 30 Coal Combustion Residuals Landfill

## 25. Landfill(s) for CCR Waste - Section Not Applicable

Provide the following information below if there is a landfill; if there is more than one landfill, separate information is required for each landfill.

**A. Landfill Characteristics**

Describe the design, installation, construction, and operation of the landfill and submit a completed Table IV.A. – Landfill Characteristics.

**B. Liner Design**

1. For existing landfills, provide attachments describing how the facility will comply with 30 TAC 352, Subchapter F (Design Criteria).
2. For new landfills or lateral expansions of existing landfills, submit pages describing how the facility will comply with 30 TAC §352.261 and 30 TAC §352.701.
3. Complete Table IV.B. - Landfill Liner System and specify the type of liner used for the landfill.
4. Provide attachments describing the design, installation, and operation of the liner and leak detection system. The description must demonstrate that the liner and leak detection system will prevent discharge to the land, groundwater, and surface water. Submit a quality assurance project plan (QAPP) to ensure that each analysis is performed appropriately.

**C. Leachate Collection and Removal**

Submit design information and description of leachate collection and removal system in accordance with 30 TAC §352.701.

Complete Table IV.C. - Landfill Leachate Collection System

**D. Design of Liner and Leachate Collection and Removal System.**

For a new landfill or lateral expansion of a CCR landfill, provide a qualified Texas P.E. certification and technical report that the design of the liner and the leachate collection and removal system meets the requirements of 30 TAC §352.711.

**E. Run-on and Run-off Controls**

At time of application, attach pages describing how the facility will comply with the run-on and run-off system plan for an existing, new, or lateral expansion of a CCR landfill information. Provide a qualified Texas P.E. certification and technical report that the run-on and run-off control system plans meet the requirements of 30 TAC §352.811.

**F. Inspection for Landfills**

At time of application, attach pages describing how the facility will comply 30 TAC §352.841 and complete Table IV.D. – Inspection Schedule for Landfills. For existing CCR landfills, provide the most recent inspection report. All CCR landfills and any lateral expansions of a CCR landfill must be inspected for any structural weakness, malfunction, deterioration conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit, or any other conditions which may cause harm to human health and environment at a frequency specified in 40 CFR §257.84(a) and (b).

# V. Surface Impoundment Criteria

See Instructions and Technical Guidance – No. 31 Coal Combustion Residuals Surface Impoundment

## 26. Surface Impoundment(s) for CCR Waste See Attachment #9

Provide the following information below if there is a surface impoundment; if there is more than one surface impoundment, separate information is required for each surface impoundment.

### A. General Surface Impoundment(s) Characteristics

Provide information about the characteristics of the surface impoundment(s): incised, surface area (acres), storage volume (acres-feet), and depth (feet).

For all surface impoundment(s), include the following information:

1. Complete Table V.A. - Surface Impoundments Characteristics. List the surface impoundment(s) to be registered as a CCR unit(s), the wastes managed in each unit, and the rated capacity or size of each unit. See Attachments #9
2. Describe the surface impoundment(s) and provide a plan view drawing with cross-sections, if available.
3. Specify the minimum freeboard to be maintained and the basis of the design to prevent overtopping resulting from normal or abnormal operation; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error. Show that adequate freeboard will be available to prevent overtopping from a 100-year, 24-hour storm.
4. Waste Flow
   Describe the means that will be used to immediately shut off the flow of waste to the impoundment in the event of liner failure or to prevent overtopping.
5. Dike Construction ☐ Yes ■ No

   If Yes, submit the dike certification (located at the end of the application).

   The structural integrity of the dike system must be certified by a qualified Texas P.E. before the registration is issued. If the impoundment is not being used, the dike system must be certified before it can be put into use. The certification must be sealed by a qualified Texas P.E., along with the engineering firm's name and registration number (30 TAC §352.4). Not Applicable

A report shall accompany the dike certification which summarizes the activities, calculations, and laboratory and field analyses performed in support of the dike certification. Describe the design basis used in construction of the dikes. A QAPP should be included in the report to ensure that each analysis is performed appropriately and include: Not Applicable

(1) Slope Stability Analysis

(2) Hydrostatic and Hydrodynamic Analysis

(3) Storm Loading

(4) Rapid Drawdown

Earthen dikes should have a protective cover to minimize wind and water erosion and to preserve the structural integrity of the dike. Describe the protective cover used and describe its installation and maintenance procedures.

**B. Liner Design**

For surface impoundment(s), provide information about how the facility will comply with 30 TAC §352.711 for existing CCR surface impoundments. For new and lateral expansion of CCR surface impoundments provide information on how the facility will comply with 30 TAC §352.261, and 30 TAC §352.721, see Instructions and Technical Guidance No. 31 Coal Combustion Residuals Surface Impoundment. The qualified Texas P.E. must certify that the design of the liner complies with the requirements of 30 TAC Chapter 352 and 40 CFR Part 257, Subpart D, where required.

Is the CCR surface impoundment unlined? ☐ Yes ■ No

If "Yes", the CCR unit is subject to the closure requirements under 30 TAC Chapter 352 and 40 CFR §257.101(a) to retrofit or close. A notification must be prepared stating that an assessment of corrective measures has been initiated.

1. Complete Table V.B. - Surface Impoundment Liner System for each surface impoundment to be registered. See Attachments #9
2. Describe the design, installation and operation of liner and leak detection components. The description must demonstrate that the liner and leak detection system will prevent discharge to the land and surface water. Submit a QAPP report to ensure that each analysis is performed appropriately.
3. For new or laterally expansions of existing surface impoundments, provide a subsurface soil investigation report that must include:
    a. A description of all borings drilled, at the unit location, to test soils and characterize groundwater;
    b. A unit map drawn to scale showing the surveyed locations and elevations of the borings, including location of permanent identification markers ((30 TAC §352.731) and (40 CFR §257.73(a)(1));
    c. Cross-sections prepared from the borings depicting the generalized strata at the unit;
    d. Boring logs, including a description of materials encountered, and any discontinuities such as fractures, fissures, slickensides, lenses or seams;
    e. A description of the geotechnical data and the geotechnical properties of the subsurface soil materials, including the suitability of the soils and strata for the intended uses; and

f. A demonstration that all geotechnical tests were performed in accordance with industry practices and recognized procedures.

**C. Hazard Potential Classification**

Provide the current hazard potential classification assessment and associated documentation, as required by 30 TAC §352.731 or §352.741 and 40 CFR §257.73(a)(2) or §257.74(a)(2). The qualified Texas P.E. must certify that the initial hazard potential classification and any subsequent periodic classification was conducted in accordance with the requirements of 30 TAC Chapter 352, where required. Not Applicable

Hazard Potential Classification:

**D. Emergency Action Plan for High or Significantly High Hazard Potential**

Provide the current Emergency Action Plan that has been certified by a qualified Texas P.E. and includes the following requirements from 30 TAC 352, Subchapter F and 40 CFR §257.73(a)(3)(i)(A) - (E) or 40 CFR §257.74 (a)(3)(i)(A) - (E). The qualified Texas P.E. must certify that the written Emergency Action Plan and any subsequent amendment of the plan complies with the requirements of 30 TAC 352, Subchapter F, where required.

Complete Table V.J. - Inspection of Surface Impoundments Not Applicable

**E. Inflow Design Flood Control System Plan**

Describe how the surface impoundment(s) system will manage stormwater run-on away from the surface impoundment(s) (30 TAC §352.821 and 40 CFR §257.82(a) and (c)). Stormwater run-on must be diverted away from a surface impoundment, based on the hazard potential. Where dikes are used to divert run-on, they must be protected from erosion. Include all analyses used to calculate run-on volumes. Provide the inflow design flood control system plan. Provide qualified Texas P.E. certification that the initial and periodic inflow design flood control system plans meet the requirements of 30 TAC §352.821, where required. Not Applicable

**F. History of Construction for Existing CCR Surface Impoundment(s), or the Design and Construction Plans for New and Lateral Expansions**

Provide information on the history of construction for each existing CCR surface impoundment (30 TAC §352.731 and 40 CFR §257.73(c)) or the design and construction plans for new and lateral expansions of each CCR surface impoundment (30 TAC §352.741) and (40 CFR §257.74(c)). See Attachments #9

**G. Structural Stability Assessment**

Provide the most recent structural stability assessment of the surface impoundments. Include the combined capacity of all surface impoundment spillways with calculations; the peak discharge the unit must meet for all combined spillways; probable maximum flood-high hazard, 1,000-yr-significant high hazard, 100-yr-low hazard; identify if there were any structural stability deficiencies in last assessment; identify how these deficiencies were managed and corrected; and qualified Texas P.E. certification. The structural stability assessment must include all information required in 30 TAC §352.731 for existing surface impoundments or 30 TAC §352.741 for new or laterally expanding surface impoundments. Not Applicable

**H. Safety Factor Assessment**

The current safety factor assessment must be submitted with the application. It must include documentation that demonstrates whether the calculated factors of safety for each CCR surface impoundment achieve the minimum safety factors specified in 30 TAC 352, Subchapter F and 40 CFR §257.73(e)(1)(i) - (iv) and 40 CFR §257.74(e)(1)(i) - (iv) for the critical cross-section of the embankment. The critical cross-section is the cross-section anticipated to be the most susceptible to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations and certified by a qualified Texas P.E. Not Applicable

# VI. Groundwater Monitoring and Corrective Action (30 TAC 352, Subchapter H)

See Instructions and Technical Guidance – No. 32 Coal Combustion Residuals Groundwater Monitoring and Corrective Action

## 27. Groundwater Monitoring System See Attachment #10

**A.** Complete Table VI.A. - Unit Groundwater Detection Monitoring System. See Attachment #10

**B.** Provide a map showing location of wells, groundwater elevations, and groundwater flow direction.

**C.** Provide attachments describing how the facility will comply with the requirements in 30 TAC §352.911 and provide a certification by a qualified Texas P.E or qualified Texas P.G. that the groundwater monitoring system design and construction meet the requirements of 30 TAC Chapter 352. See Attachment #11

**D.** Provide a figure showing the geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities. See Attachment #7

**E.** For a multiunit groundwater monitoring system, demonstrate that the groundwater monitoring system will be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system for each CCR unit by providing at minimum the following information:

1. Number, spacing, and orientation of each CCR unit;
2. Hydrogeologic setting; and
3. Site history.

**F.** Has there been any sampling concentrations of one or more constituents listed in Appendix IV detected at statistically significant levels above the groundwater protection standard (GWPS)? ☐ Yes ☒ No

**G.** Provide information on how monitoring wells have been constructed and cased in a manner that maintains the integrity of the monitoring well borehole and to prevent contamination of samples and the groundwater. See Attachment #11

## 28. Groundwater Monitoring Sampling and Analysis Program See Attachment #11

Provide a sampling and analysis plan that includes procedures and techniques; sampling and analytical methods that are appropriate for groundwater sampling; and that address the requirements of 30 TAC §352.931 and 40 CFR §257.93. Provide a P.E or P.G. certification that describes the statistical method selected to evaluate the groundwater monitoring data and certifies that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. Refer to TG-32 for information and guidance.
See Attachment #10

## 29. CCR Unit(s) in a Detection Monitoring Program

Does the facility have CCR unit(s) in a Detection Monitoring Program?

☒ Yes ☐ No See Attachment #12

If "Yes", Submit the following information:

**A.** Submit Table VI.C. – Facility CCR Units Under Detection Monitoring.

**B.** Provide a Background Evaluation Report.

**C.** Provide a report with the results of semiannual monitoring events.

1. Has a statistically significant increase (SSI) been detected for one or more of the constituents listed in Appendix III at any monitoring well?

   ☐ Yes ☒ No

2. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☒ No

3. Date assessment monitoring program will start: Started in 2018

4. Do you plan to provide an alternative source demonstration (ASD)?

   ☐ Yes ☒ No

## 30. CCR Unit(s) in an Assessment Monitoring Program - Not Applicable

Does the facility have CCR unit(s) in an Assessment Monitoring Program?

☐ Yes ☒ No
If "Yes", Submit information related for units.

**A.** Complete Table VI.D. – CCR Units Under Assessment Monitoring.

**B.** Provide, for each well in assessment monitoring status, the recorded concentrations lab sheets and results in a tabulated form.

**C.** Have the concentrations of all constituents listed in Appendices III and IV been at or below background values, using the statistical procedures in 30 TAC §352.931 and 40 CFR §257.93(g), for two consecutive sampling events for the CCR unit(s)? ☐ Yes ☒ No

If answer to above is yes, detection monitoring may resume. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit and obtain written approval from the executive director.

**D.** Are there any concentrations of any constituent in Appendices III and IV above background values? ☒ Yes ☐ No

1. Has a notification to the executive director been sent within 14 days?

   ■ Yes ☐ No

**E.** Date assessment of corrective measures will be initiated (must be within **90 days** of finding a statistically significant level above the GWPS) for the CCR unit(s):

**F.** Will you provide an ASD (see TG-32 for an acceptable submittal)? ☐ Yes ■ No Completed in 2018

**G.** Date assessment of corrective measures will be initiated if ASD is not accepted?

**H.** Complete Table VI.D-2. - Groundwater Detection Monitoring Parameters

**Note**: Refer to TG-32 regarding establishing a GWPS for each constituent in Appendix IV detected in the groundwater and attach as table.

**I.** Have you completed the assessment of corrective measures? ■ Yes ☐ No
If "Yes", date assessment of corrective measures was completed:
If "No", date assessment of corrective measures will be completed:
Expected date of submittal of amendment (see note below):
Provide completed assessment of corrected measures materials.

**Note**: Within **30 days** of completing the assessment of corrective measures, and before remedy implementation, the owner or operator shall submit an application for amendment to the registration. In some circumstances, the assessment of corrective measures and selected remedy may be approved as part of the initial application for the CCR unit registration.

**J.** Have you selected a remedy? ■ Yes ☐ No

Provide public meeting documentation under 30 TAC §352.961 and a report under 30 TAC §352.971 and 40 CFR §257.97.

# VII. Closure and Post-Closure Care

## See Instructions and Technical Guidance

Submit a full closure plan and post-closure plan and all information describing how the owner or operator will comply with 30 TAC 352, Subchapter J and 40 CFR §§257.100 - 257.104. The owner of property on which an existing disposal facility is located, following the closure of a unit, must also submit documentation that a notation has been placed in the deed to the facility that will in perpetuity notify any potential purchasers of the property that the land has been used to manage CCR wastes and its use is restricted (30 TAC §352.1221 and 40 CFR §257.102(i)). For CCR units, closed after October 19, 2015, that were closed before submission of the application, the applicant should submit documentation to show that notices required under 30 TAC 352, Subchapter K and 40 CFR §257.105 or §257.106 have been filed.

## 31. Closure Plan

This section applies to the owners and operators of all CCR units required to be registered. The applicant must close the facility in a manner that minimizes need for further maintenance and controls, or eliminates, to the extent necessary to protect human health and the environment, the post-closure release of CCR waste, chemical constituents of concern, leachate, contaminated rainfall, or waste decomposition products to the groundwater, surface waters, or to the atmosphere. See Attachment #13

The type of unit to be closed can determine the level of detail sufficient for a closure plan. CCR units which have been certified closed after October 19, 2015, must provide documentation to demonstrate compliance with state and federal regulations.

For each unit to be registered, complete Table VII.A.1. - Unit Closure and list the CCR Unit components to be decontaminated, possible methods of decontamination, and possible methods of disposal of wastes and waste residues generated during unit closure. All ancillary components must be decontaminated, and the generated waste disposed of appropriately.

Information about CCR units closed or to be closed under alternative closure requirements must be provided in Table VII.A.2. - CCR Units Under Alternative Closure Notification.

Guidance on design of a closure cap and final cover for non-hazardous industrial solid wastes landfills is provided in EPA publication 530-SW-85-014, TCEQ Technical Guidance No. 3 and TCEQ publication, RG-534, "Guidance for Liner Construction and Testing for a Municipal Solid Waste Landfill".

## 32. Post-Closure Care Plan -

Provide a post-closure care plan that complies with the requirements of 30 TAC §352.1241. Post-closure care of each CCR unit must continue for at least 30 years after the date of completing closure of the unit and must consist of monitoring and reporting of the groundwater monitoring systems, in addition to the maintenance and monitoring of CCR unit. Continuation of certain security requirements may be necessary after the date of closure. Post-closure use of property on or in which waste remains after closure must never be allowed to disrupt the integrity of the containment system. In addition, submit the following information:

- The name, address, and phone number of the person or office to contact about the CCR unit during the post-closure period; and
- A discussion of the future use of the land associated with each unit.

Landfills and surface impoundments which have been certified closed after October 19, 2015, must be included in post-closure care plans, unless they have been determined to have been closed by waste removal equivalent to the closure standards in 30 TAC §352.1221 and 40 CFR §257.102 or 30 TAC §352.1231 and 40 CFR §257.103. If such a demonstration has been made pursuant to 40 CFR §257.102 or §257.103, but an equivalency determination has not been made, please submit a copy of the demonstration documentation. If an equivalency determination has been made, applicant should submit a copy of this determination.

See Attachment #14

# VIII. Financial Assurance

## 33. Post-Closure Care Cost Estimate

Financial assurance for post-closure care (30 TAC §352.1101) applies to owners or operators of all CCR units, except CCR units from which the owner or operator intends to remove wastes and perform clean closure. Provide a written cost estimate in current dollars of the total cost of the 30-year (or longer, if applicable under 30 TAC §352.1101(d)) post-closure care period to perform post-closure care requirements as prescribed in 30 TAC §352.1241. The cost estimate must be based on the costs of hiring a third party to conduct post-closure care maintenance. Not applicable - the units are expected to be clean closed in 2022.

Complete Table VIII.A.1 – Post-Closure Cost Summary for Existing Registered Units

Complete Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

## 34. Financial Assurance Mechanism -

The financial assurance for post-closure care is required in accordance with 30 TAC §352.1101. The applicant shall demonstrate the financial assurance within 90 days after approval of the registration with a financial mechanism acceptable to TCEQ in compliance with 30 TAC §352.1101(c) and 30 TAC §37, Subchapters A through D, except as indicated in 30 TAC §352.1111, in an amount no less than the amount specified in the approved Post-Closure Care Cost Summary. Provide a description of the proposed financial assurance mechanism.

Complete Table VIII.B. - Post-Closure Period, for the authorized post-closure period, to meet the requirements of 30 TAC §352.1241(a) through (c).

Not applicable - the units are expected to be clean closed in 2022.

**Signature Page**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

**Applicant** Signature: Ron Froh Date: 1/21/22

Name and Official Title (type or print): Ron Froh, President & CEO

**Owner or Operator** Signature: Ron Froh Date: 1/21/22

Name and Official Title (type or print): Ron Froh, President & CEO

To be completed by the owner or operator if the application is signed by an authorized representative for the operator

I, ______________________ hereby designate ________________________
(operator) (authorized representative)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a CCR waste management registration. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any registration which might be issued based upon this application.

________________________________________
Printed or Typed Name of Applicant or Principal Executive Officer

________________________________________
Signature

(Note: Application Must Bear Signature & Seal of Notary Public)

**Subscribed and sworn** to before me by the said President & CEO Ron Froh on this 21 day of January, 2022

My commission expires on the 21 day of October, 2022

(Seal) Notary Public in and for St. Louis County, ~~Texas~~ Missouri

TAYLOR LAMMERT
Notary Public - Notary Seal
St Louis County - State of Missouri
Commission Number 20861225
My Commission Expires Oct 21, 2024

**Registration Application for Coal Combustion Residuals Waste Management**

(See instructions for P.E/P.G. seal requirements.)

| Attachments and Tables | Attachment No. |
|---|---|
| General Information | |
| Attachments | |
| Technical Report and Certification | |
| Location Restrictions Certifications | |
| Placement above the uppermost aquifer | |
| Wetlands | |
| Fault Areas | |
| Seismic impact zones | |
| Unstable areas | |
| Geology Summary | |
| CCR Fugitive Dust Control Plan | |
| Annual CCR Fugitive Dust Control Report | |
| Landfill Design and Operating Criteria | |
| Landfill Characteristics | |
| Liner Design | |
| Leachate Collection and Removal | |
| Run-on and Run-off Controls | |
| Inspection for Landfills | |
| Surface Impoundment Design and Operating Criteria | |
| General Surface Impoundment Characteristics | |
| Liner Design | |
| Hazard Potential Classification | |
| Emergency Action Plan | |
| Inflow Design Flood Control System Plan | |
| Construction History/Design Plans | |
| Structural Stability Assessment | |
| Safety Factor Assessment | |
| Groundwater Monitoring and Corrective Action | |
| Groundwater Monitoring System | |
| Groundwater Monitoring Sampling and Analysis Program | |
| Detection Monitoring Program | |
| Assessment Monitoring Program | |
| Assessment of Corrective Measures | |
| Remedy Report | |
| Closure and Post-Closure Care | |
| Closure Plan | |
| Post-Closure Care | |
| Financial Assurance | |

**Tables**

| Tables | Submitted | Not Applicable |
|---|---|---|
| **Table I.6. - CCR Waste Management Units** Attachment 1 | ☒ | ☐ |
| **Table I.6.A. - Waste Management Information** | ☒ | ☐ |
| **Table I.6.B. - Wastes Managed in Registered Units** | ☒ | ☐ |
| **Table I.6.C. - Sampling and Analytical Methods** NA | ☐ | ☒ |
| **Table IV.A. - Landfill Characteristics** | ☐ | ☒ |
| **Table IV.B. - Landfill Liner System** | ☐ | ☒ |
| **Table IV.C. - Landfill Leachate Collection System** NA | ☐ | ☒ |
| **Table IV.D. - Inspection Schedule of Landfills** | ☐ | ☒ |
| **Table V.A. - Surface Impoundments Characteristics** | ☒ | ☐ |
| **Table V.B. - Surface Impoundment Liner System** | ☐ | ☐ |
| **Table V.J. - Inspection of Surface Impoundments** | ☐ | ☒ |
| **Table VI.A. - Unit Groundwater Detection Monitoring System** | ☒ | ☐ |
| **Table VI.C. - CCR Units Under Detection Monitoring** | ☒ | ☐ |
| **Table VI.D. - CCR Units Under Assessment Monitoring** Attachment 18 | ☐ | ☒ |
| **Table VI.D-2. - Groundwater Detection Monitoring Parameters** | ☒ | ☐ |
| **Table VII.A.1. - Unit Closure** | ☒ | ☐ |
| **Table VII.A.2. - CCR Units Under Alternative Closure Notification** | ☐ | ☒ NA |
| **Table VIII.A.1. - Post-Closure Cost Summary for Existing Registered Units** | ☐ | ☒ |
| **Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units** | ☐ | ☒ NA |
| **Table VIII.B. - Post-Closure Period** ? | ☒ | ☐ |
| **Engineering Certification(s) - Dike Construction** NA | ☐ | ☒ |

**Additional Attachments as Applicable - Select all those apply and add as necessary**

- ■ TCEQ Core Data Form(s)
- ■ Signatory Authority Delegation
- ■ Fee Payment Receipt
- ☐ Confidential Documents
- ■ Certificate of Fact (Certificate of Incorporation)
- ☐ Assumed Name Certificate

**Attachment #1 for Item #6 - Tables**

### Table I.6. – CCR Waste Management Units

| CCR Unit No.[1] | Unit Name | N.O.R. No.[1] | Unit Description[3] | Capacity | Unit Status[2] |
|---|---|---|---|---|---|
| 1 | NE Ash Water Retention Pond | 011 | Surface Impoundment | 0 | closed |
| 2 | West Ash Settling Pond | 012 | Surface Impoundment | 0 | closed |
| 3 | SW Ash Settling Pond | 022 | Surface Impoundment | 0 | closed |
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1 Registered Unit No. and N.O.R. No. cannot be reassigned to new units or used more than once.
2 Unit Status options: Active, Closed, Inactive (built but not managing waste), Proposed (not yet built), Never Built, Transferred, Post-Closure.
3 If a unit has been transferred, the applicant should indicate which facility/permit it has been transferred to in the Unit Description column.

**Table I.6.A. – Waste Management Information**

| Waste No.[1] | Waste Type(s) | Source | Volume (tons/year) |
|---|---|---|---|
| 1 | Table I.6.B. | Waste has been removed | 0 |
| 2 | Table I.6.B. | Waste has been removed | 0 |
| 3 | Table I.6.B. | Waste has been removed | 0 |
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1 Assign waste number sequentially. Do not remove waste number wastes which are no longer generated.

**Table I.6.B - Former Waste Managed in Units - Bottom Ash Ponds**

| Waste No | Waste | TCEQ Waste Form Codes and Classification Codes | |
|---|---|---|---|
| 1, 2, 3 | Bottom ash. | 30003043 | Inactive |
| 1, 2, 3 | Hydroblast Water - Nonhazardous water generated from pressure cleaning of miscellaneous facility equipment, structures, etc. | 38001142 | Inactive |
| 1, 2, 3 | Demineralizer regerant waste. Liquid waste from regeneration of ion exchange resin used in raw water treatment. | 38151191 | Inactive |

**Table I.6.C – Sampling and Analytical Methods**

| Waste No.[1] | Sampling Location | Sampling Method | Frequency | Parameter | Test Method | Desired Accuracy Level |
|---|---|---|---|---|---|---|
| 1 & 2 | NA | NA | NA | NA | NA | NA |
| 3 | NA | NA | NA | NA | NA | NA |
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1 from Table I.6.A., first column

**Attachment #2 for Item #7 - Description of Proposed Activities or Changes to Existing Facility**

The site contains three BAPs subject to CCR closure requirements, Northeast Ash Water Retention Pond (WMU 11), West Ash Settling Pond (WMU 12), and Southwest Ash Settling Pond (WMU 22) that comprise of approximately 19-acres (Figure 2). The adjacent Stormwater Collection Pond (WMU 9) is not subject to CCR regulations. The BAPs were built in 1974; however, they were relined in 1990 with 3-foot clay liners. The BAPs received recovered overflow from bottom ash dewatering bins and other MOSES process wastewater sources. The ponds also acted as a surge basin for various water streams in the ash-water system. Recovered sluice water, process waters and storm water runoff from the MOSES ash-water system were pumped to each pond through a series of above grade pipes on the east end. The BAPs also served as settling basins to remove residual bottom ash and fines from recovered sluice water associated with the dewatering bins. Water was pumped from the SW Pond, as needed, and returned for reuse in the bottom ash system. When sufficient ash had accumulated in either the NE or West Ponds, the recovered sluice water was diverted to the other pond. Ash was then removed from the first pond and transported via train car to the G Ash Area. Based on the design of the BAPs, minimal accumulation of solids occurred within the SW Pond.

**BOTTOM ASH PONDS CLOSURE - CLOSURE BY REMOVAL OF CCR**

The BAPS will be closed through the removal of CCR, and the closure will be performed pursuant to 40 CFR 257.102(c). The dewatering of the BAPs started in January 2021. In 2021 and into 2022, the bottom ash has been removed from the SW and West Ponds. The ash removal of the NE pond has started in January 2022 and is expected to be complete in the spring of 2022.

The bottom ash material from the ponds has been hauled to the B-Area Landfill (WMU 002) for beneficial structure fill. The embankments and bottom clay liner will also be removed following the bottom ash and used as B-Area fill. Pipelines that are above grade will be removed from the around the impoundments. Underground pipelines entering the impoundments will be excavated and removed or closed in place as necessary for future grading.

Upon closure completion, certification from a qualified Texas professional engineer will be provided verifying that closure has been completed in accordance with the closure plan. Following closure certification, the area will be graded to the southwest toward Lake Monticello via an existing surface water culvert that is currently permitted stormwater Outfall 001. Interior surface grading will provide a 3 to 5 percent slope for drainage relief from the footprint of the former impoundments to ensure (to the maximum extent feasible) that post-closure run-off is conveyed off the former impoundment area. The Stormwater Collection Pond will be closed per Texas Risk Reduction Rule (TRRP) 30 TAC 350.

**Attachment #3 for Item #13 - Property / Legal Description Information**

## Property Owner Affidavit (30 TAC 330.59(d))

I/We, Ron Froh, as President & CEO,
(Printed Signatory Name) (Signatory Capacity)
As authorized signatory for Golden Eagle Development, LLC,
(Printed Name of Property Owner of Record)
acknowledgment that the State of Texas may hold the property owner of record either jointly or severally responsible for the operation, maintenance, and closure and post-closure care of the facility. For facilities where waste will remain after closure, acknowledgment that the owner has a responsibility to file with the county deed records an affidavit to the public advising that the land will be used for a solid waste facility prior to the time that the facility actually begins operating as a municipal solid waste landfill facility, and to file a final recording upon completion of disposal operations and closure of the landfill units in accordance with §330.19 of this title (relating to Deed Recordation). The property owner acknowledges that the facility owner or operator and the State of Texas shall have access to the property during the active life and post-closure care period, if required, after closure for the purpose of inspection and maintenance.

Ron Froh [signature]
Property Owner

1/21/22
Date

LacySurveying.com
Phone ( 903 ) 859 – 9942
P.O. Box 736 · Arp, TX 75750
TBPLS Firm #100299-00

December 17, 2019
Field Notes for Luminant Mining Company LLC
**Area 421**
**387.6 Acres**
Joseph Muchin Survey A-356
R. Lewis Survey A-138
Titus County, Texas

## GENERAL DESCRIPTION

All that certain tract, lot or parcel of land, a part of the Joseph Muchin Survey A-356 and part of the R. Lewis Survey A-138, Titus County, Texas, Texas and also being a part of those certain tracts of land listed below, all of which are recorded in the Deed Records of Titus County, Texas and being more completely described as follows, to wit;

1. P.I. 1 (part) – John B. Stephens, et ux, Elizabeth to Henry E. Jones, Trustee, January 4, 1971, Volume 364, Page 490, called 1858.42 acres

2. P.I. 24 (part) A.P. Fitzgerald, et ux, Gladys to Henry E. Jones, Trustee, May 28, 1971, Volume 369, Page 233, called 56.97 acres

3. P.I. 25 (part) Edward Florey to L.D. Cross, Trustee, September 13, 1972, Volume 428, Page 600, called 194.21 acres

4. Tract 544 (part) Bascom Perkins, et al, to Henry E. Jones, Trustee, May 12, 1975, Volume 398, Page 124, called 18.07 acres (Tract 2)

## METES AND BOUNDS DESCRIPTION

Beginning at a 1/2 inch iron rod with a cap stamped "LACY SURVEYING PROPERTY CORNER" (LSPC) {Texas North Central Coordinate value N: 530,105.03, E: 2,752,846.61} which bears South 51 degrees 55 minutes and 57 seconds East, a distance of 6082.23 feet, from a concrete right-of-way marker, at a 2 inch iron pipe fence corner, found in the Southeast right-of-way (R.O.W.) line of F.M. Road No. 127 and at the Northwest corner of the Goree Hardge called 39.994 acre tract (Volume 464 – Page 771);

Thence across said tract as follows:

South 62 degrees 05 minutes and 42 seconds East, for a distance of 894.79 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner at the P.C. of a curve to the right;

Southeasterly with said curve to the right, which has a central angle of 32 degrees 36 minutes and 05 seconds, a radius of 1770.19 feet, and a chord bearing of South 45 degrees 47 minutes and 39 seconds East, for a chord distance of 993.71 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner at the P.T. of said curve;

South 29 degrees 29 minutes and 37 seconds East, for a distance of 1301.40 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 47 degrees 39 minutes and 25 seconds East, for a distance of 47.44 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 30 degrees 33 minutes and 14 seconds East, for a distance of 286.49 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 12 degrees 54 minutes and 44 seconds East, for a distance of 77.22 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 37 degrees 22 minutes and 39 seconds East, for a distance of 180.85 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 29 degrees 44 minutes and 59 seconds East, for a distance of 837.87 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 34 degrees 17 minutes and 54 seconds East, for a distance of 155.94 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 33 degrees 25 minutes and 14 seconds East, for a distance of 369.83 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 49 degrees 43 minutes and 03 seconds West, for a distance of 282.45 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 46 degrees 01 minutes and 43 seconds West, for a distance of 276.03 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 30 degrees 50 minutes and 27 seconds East, for a distance of 151.63 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 64 degrees 33 minutes and 39 seconds East, for a distance of 518.10 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 21 degrees 24 minutes and 22 seconds East, for a distance of 837.45 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 25 degrees 00 minutes and 46 seconds East, for a distance of 156.58 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 21 degrees 04 minutes and 58 seconds East, for a distance of 896.28 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 24 degrees 46 minutes and 25 seconds East, for a distance of 187.32 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 66 degrees 58 minutes and 56 seconds West, for a distance of 28.96 feet, to a PK nail with a washer stamped "RPLS 4021" set for corner on the 337.5 feet contour line around Lake Bob Sandlin;

Thence across said 1858.42 acres and along said 337.5 feet contour as follows:

North 19 degrees 04 minutes and 40 seconds West, for a distance of 24.68 feet, to a point for corner;

North 64 degrees 32 minutes and 15 seconds West, for a distance of 113.75 feet, to a point for corner;

North 25 degrees 34 minutes and 49 seconds West, for a distance of 35.66 feet, to a point for corner;

North 54 degrees 36 minutes and 35 seconds West, for a distance of 35.95 feet, to a point for corner;

North 62 degrees 11 minutes and 43 seconds West, for a distance of 96.19 feet, to a point for corner;

North 77 degrees 00 minutes and 23 seconds West, for a distance of 41.40 feet, to a point for corner;

South 75 degrees 53 minutes and 28 seconds West, for a distance of 49.94 feet, to a point for corner;

North 83 degrees 10 minutes and 14 seconds West, for a distance of 61.12 feet, to a point for corner;

North 74 degrees 50 minutes and 02 seconds West, for a distance of 76.48 feet, to a point for corner;

North 14 degrees 05 minutes and 37 seconds West, for a distance of 45.99 feet, to a point for corner;

North 46 degrees 58 minutes and 14 seconds West, for a distance of 22.37 feet, to a point for corner;

North 84 degrees 45 minutes and 56 seconds West, for a distance of 14.30 feet, to a point for corner;

North 57 degrees 17 minutes and 30 seconds West, for a distance of 26.09 feet, to a point for corner;

North 36 degrees 00 minutes and 43 seconds West, for a distance of 58.38 feet, to a point for corner;

South 57 degrees 45 minutes and 37 seconds West, for a distance of 35.78 feet, to a point for corner;

North 72 degrees 27 minutes and 12 seconds West, for a distance of 100.97 feet, to a point for corner;

North 50 degrees 37 minutes and 46 seconds West, for a distance of 59.32 feet, to a point for corner;

South 52 degrees 21 minutes and 44 seconds West, for a distance of 9.35 feet, to a point for corner;

South 45 degrees 25 minutes and 12 seconds East, for a distance of 101.37 feet, to a point for corner;

South 56 degrees 49 minutes and 27 seconds East, for a distance of 56.82 feet, to a point for corner;

South 75 degrees 13 minutes and 43 seconds East, for a distance of 47.13 feet, to a point for corner;

South 51 degrees 20 minutes and 53 seconds East, for a distance of 13.89 feet, to a point for corner;

South 13 degrees 32 minutes and 53 seconds West, for a distance of 23.39 feet, to a point for corner;

South 41 degrees 20 minutes and 34 seconds West, for a distance of 30.71 feet, to a point for corner;

South 89 degrees 19 minutes and 27 seconds East, for a distance of 42.68 feet, to a point for corner;

South 27 degrees 05 minutes and 50 seconds East, for a distance of 81.57 feet, to a point for corner;

North 63 degrees 33 minutes and 11 seconds West, for a distance of 53.27 feet, to a point for corner;

North 59 degrees 54 minutes and 00 seconds West, for a distance of 80.08 feet, to a point for corner;

South 34 degrees 24 minutes and 47 seconds East, for a distance of 31.90 feet, to a point for corner;

South 11 degrees 00 minutes and 42 seconds West, for a distance of 10.43 feet, to a point for corner;

South 22 degrees 22 minutes and 34 seconds East, for a distance of 108.93 feet, to a point for corner;

South 37 degrees 49 minutes and 11 seconds East, for a distance of 273.30 feet, to a point for corner;

South 35 degrees 24 minutes and 31 seconds East, for a distance of 195.77 feet, to a point for corner;

South 60 degrees 10 minutes and 01 seconds East, for a distance of 68.35 feet, to a point for corner;

and South 29 degrees 58 minutes and 04 seconds East, for a distance of 49.31 feet, to a point for corner on the South line of said 1858.42 acres and the North line of the Titus County Fresh Water Supply District called 641.09 acre tract (Volume 418 – Page 334, Parcel 1A);

Thence along the South line of said 1858.42 acres, along the North line of said 641.09 acres and along said 337.5 feet contour line as follows:

South 26 degrees 31 minutes and 21 seconds West, for a distance of 106.46 feet, to a point for corner;

South 36 degrees 59 minutes and 13 seconds West, for a distance of 71.44 feet, to a point for corner;

South 44 degrees 44 minutes and 17 seconds West, for a distance of 104.66 feet, to a point for corner;

South 68 degrees 29 minutes and 00 seconds West, for a distance of 50.05 feet, to a point for corner;

North 86 degrees 15 minutes and 08 seconds West, for a distance of 55.96 feet, to a point for corner;

North 60 degrees 50 minutes and 58 seconds West, for a distance of 112.96 feet, to a point for corner;

South 69 degrees 22 minutes and 33 seconds West, for a distance of 45.75 feet, to a point for corner;

South 47 degrees 54 minutes and 30 seconds West, for a distance of 82.22 feet, to a point for corner;

South 76 degrees 51 minutes and 31 seconds West, for a distance of 29.79 feet, to a point for corner;

South 40 degrees 23 minutes and 58 seconds East, for a distance of 25.03 feet, to a point for corner;

South 42 degrees 42 minutes and 02 seconds East, for a distance of 42.28 feet, to a point for corner;

South 12 degrees 29 minutes and 57 seconds East, for a distance of 95.52 feet, to a point for corner;

South 50 degrees 17 minutes and 14 seconds West, for a distance of 59.15 feet, to a point for corner;

South 20 degrees 38 minutes and 47 seconds East, for a distance of 21.40 feet, to a point for corner;

South 82 degrees 19 minutes and 40 seconds East, for a distance of 42.11 feet, to a point for corner;

South 01 degrees 46 minutes and 16 seconds East, for a distance of 52.91 feet, to a point for corner;

South 63 degrees 47 minutes and 00 seconds West, for a distance of 72.51 feet, to a point for corner;

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TBPLS Firm #100299-00

South 82 degrees 19 minutes and 37 seconds West, for a distance of 83.85 feet, to a point for corner;

North 75 degrees 02 minutes and 48 seconds West, for a distance of 101.23 feet, to a point for corner;

North 87 degrees 14 minutes and 29 seconds West, for a distance of 133.93 feet, to a point for corner;

South 62 degrees 14 minutes and 44 seconds West, for a distance of 52.31 feet, to a point for corner;

North 86 degrees 02 minutes and 32 seconds West, for a distance of 27.57 feet, to a point for corner;

South 50 degrees 12 minutes and 07 seconds West, for a distance of 49.96 feet, to a point for corner;

South 77 degrees 01 minutes and 19 seconds West, for a distance of 64.59 feet, to a point for corner;

North 67 degrees 14 minutes and 25 seconds West, for a distance of 64.48 feet, to a point for corner;

North 49 degrees 17 minutes and 07 seconds West, for a distance of 49.66 feet, to a point for corner;

North 28 degrees 26 minutes and 01 seconds West, for a distance of 50.33 feet, to a point for corner;

North 56 degrees 12 minutes and 15 seconds West, for a distance of 59.85 feet, to a point for corner;

North 26 degrees 42 minutes and 09 seconds West, for a distance of 24.53 feet, to a point for corner;

North 52 degrees 22 minutes and 12 seconds West, for a distance of 40.94 feet, to a point for corner;

North 63 degrees 51 minutes and 33 seconds West, for a distance of 63.41 feet, to a point for corner;

North 15 degrees 05 minutes and 07 seconds West, for a distance of 24.25 feet, to a point for corner;

North 40 degrees 26 minutes and 00 seconds West, for a distance of 49.13 feet, to a point for corner;

North 70 degrees 24 minutes and 16 seconds West, for a distance of 17.34 feet, to a point for corner;

North 39 degrees 09 minutes and 47 seconds West, for a distance of 130.26 feet, to a point for corner;

South 41 degrees 08 minutes and 56 seconds West, for a distance of 35.94 feet, to a point for corner;

South 30 degrees 00 minutes and 41 seconds West, for a distance of 147.15 feet, to a point for corner;

South 55 degrees 30 minutes and 21 seconds West, for a distance of 56.15 feet, to a point for corner;

South 51 degrees 54 minutes and 56 seconds West, for a distance of 141.36 feet, to a point for corner;

South 69 degrees 28 minutes and 09 seconds West, for a distance of 92.60 feet, to a point for corner;

North 53 degrees 11 minutes and 04 seconds West, for a distance of 59.90 feet, to a point for corner;

North 18 degrees 18 minutes and 24 seconds West, for a distance of 132.08 feet, to a point for corner;

North 44 degrees 18 minutes and 49 seconds East, for a distance of 30.90 feet, to a point for corner;

North 04 degrees 12 minutes and 30 seconds East, for a distance of 83.51 feet, to a point for corner;

North 14 degrees 54 minutes and 28 seconds West, for a distance of 27.99 feet, to a point for corner;

North 32 degrees 47 minutes and 35 seconds West, for a distance of 30.92 feet, to a point for corner;

South 73 degrees 21 minutes and 11 seconds West, for a distance of 58.65 feet, to a point for corner;

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North 77 degrees 06 minutes and 40 seconds West, for a distance of 48.42 feet, to a point for corner;

South 31 degrees 38 minutes and 57 seconds West, for a distance of 55.73 feet, to a point for corner;

South 70 degrees 07 minutes and 15 seconds West, for a distance of 52.74 feet, to a point for corner;

South 44 degrees 58 minutes and 11 seconds West, for a distance of 187.08 feet, to a point for corner;

South 31 degrees 38 minutes and 33 seconds West, for a distance of 72.74 feet, to a point for corner;

South 43 degrees 33 minutes and 16 seconds West, for a distance of 86.71 feet, to a point for corner;

South 57 degrees 37 minutes and 48 seconds West, for a distance of 33.86 feet, to a point for corner;

South 30 degrees 10 minutes and 58 seconds West, for a distance of 29.68 feet, to a point for corner;

North 83 degrees 19 minutes and 42 seconds West, for a distance of 258.84 feet, to a point for corner;

South 76 degrees 32 minutes and 49 seconds West, for a distance of 40.69 feet, to a point for corner;

North 82 degrees 01 minutes and 07 seconds West, for a distance of 29.28 feet, to a point for corner;

South 41 degrees 46 minutes and 32 seconds West, for a distance of 26.78 feet, to a point for corner;

South 73 degrees 25 minutes and 19 seconds West, for a distance of 53.85 feet, to a point for corner;

South 87 degrees 28 minutes and 01 seconds West, for a distance of 183.02 feet, to a point for corner;

and North 82 degrees 52 minutes and 17 seconds West, for a distance of 25.29 feet, to a point for corner in a chain link fence line, from which a post at the end of said fence bears South 21 degrees 41 minutes and 14 seconds West, a distance of 14.50 feet;

Thence across said 1858.42 acres and along said chain link fence as follows:

North 21 degrees 41 minutes and 14 seconds East, for a distance of 203.13 feet, to a chain link fence post found for corner;

North 27 degrees 54 minutes and 04 seconds East, for a distance of 127.63 feet, to a chain link fence post found for corner;

North 82 degrees 17 minutes and 53 seconds East, for a distance of 27.71 feet, to a chain link fence post found for corner;

North 08 degrees 14 minutes and 36 seconds West, for a distance of 24.42 feet, to a chain link fence post found for corner;

South 83 degrees 38 minutes and 46 seconds West, for a distance of 27.79 feet, to a chain link fence post found for corner;

North 10 degrees 27 minutes and 12 seconds West, for a distance of 111.34 feet, to a chain link fence post found for corner;

North 41 degrees 02 minutes and 44 seconds East, for a distance of 187.59 feet, to a chain link fence post found for corner;

North 81 degrees 53 minutes and 53 seconds East, for a distance of 16.99 feet, to a chain link fence post found for corner;

and North 10 degrees 37 minutes and 07 seconds East, for a distance of 267.56 feet, to a chain link fence post found for corner;

Thence South 88 degrees 52 minutes and 06 seconds East, continuing across said tract, for a distance of 20.45 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner, 25.0 feet from and at a right angle to the 340.0 feet contour around Lake Monticello;

Thence continuing across said tract, 25.0 feet from and parallel to the 340.0 feet contour line of Lake Monticello as follows:

North 12 degrees 49 minutes and 02 seconds East, for a distance of 49.17 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 32 degrees 45 minutes and 56 seconds East, for a distance of 150.10 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 20 degrees 18 minutes and 05 seconds East, for a distance of 52.96 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 20 degrees 18 minutes and 05 seconds East, for a distance of 140.33 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 03 degrees 20 minutes and 54 seconds West, for a distance of 98.64 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 08 degrees 43 minutes and 01 seconds West, for a distance of 69.53 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 33 degrees 52 minutes and 44 seconds West, for a distance of 105.16 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 30 degrees 04 minutes and 13 seconds West, for a distance of 130.75 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 26 degrees 27 minutes and 26 seconds West, for a distance of 79.86 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 26 degrees 27 minutes and 26 seconds West, for a distance of 116.31 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 13 degrees 19 minutes and 37 seconds West, for a distance of 100.05 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 37 degrees 20 minutes and 35 seconds West, for a distance of 122.91 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 27 degrees 25 minutes and 30 seconds West, for a distance of 63.38 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 41 degrees 36 minutes and 14 seconds West, for a distance of 27.46 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 01 degrees 50 minutes and 53 seconds West, for a distance of 9.48 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 25 degrees 10 minutes and 34 seconds West, for a distance of 24.57 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 81 degrees 13 minutes and 56 seconds West, for a distance of 11.67 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 60 degrees 15 minutes and 09 seconds West, for a distance of 13.07 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 30 degrees 46 minutes and 36 seconds West, for a distance of 57.58 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 63 degrees 41 minutes and 07 seconds West, for a distance of 209.83 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 49 degrees 33 minutes and 03 seconds West, for a distance of 215.26 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 30 degrees 50 minutes and 36 seconds West, for a distance of 174.08 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 36 degrees 35 minutes and 03 seconds West, for a distance of 152.58 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 29 degrees 44 minutes and 26 seconds West, for a distance of 129.81 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 06 degrees 52 minutes and 17 seconds West, for a distance of 49.32 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 73 degrees 57 minutes and 40 seconds West, for a distance of 64.96 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 37 degrees 55 minutes and 04 seconds East, for a distance of 31.45 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

North 52 degrees 16 minutes and 54 seconds East, for a distance of 41.42 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 17 degrees 41 minutes and 54 seconds East, for a distance of 63.93 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 54 degrees 21 minutes and 05 seconds East, for a distance of 121.53 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 49 degrees 19 minutes and 47 seconds East, for a distance of 179.28 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 23 degrees 41 minutes and 20 seconds East, for a distance of 26.10 feet, to a point for corner on concrete;

and North 56 degrees 52 minutes and 51 seconds East, for a distance of 85.01 feet, to in "X" scribed into a concrete headwall for corner;

Thence continuing across said tract as follows:

North 60 degrees 45 minutes and 19 seconds East, for a distance of 62.77 feet, to a PK nail with a washer stamped "RPLS 4021" set for corner;

and North 29 degrees 14 minutes and 41 seconds West, for a distance of 192.71 feet, to a 60D nail with a washer stamped "RPLS 4021" set for corner 25.0 feet from and at a right angle to said 340.0 contour line;

Thence continuing across said tract, 25.0 feet from and parallel to said 340.0 contour line as follows:

North 39 degrees 31 minutes and 19 seconds West, for a distance of 56.27 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 71 degrees 38 minutes and 33 seconds West, for a distance of 45.84 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 72 degrees 09 minutes and 59 seconds West, for a distance of 112.24 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

and North 11 degrees 01 minutes and 12 seconds East, for a distance of 14.41 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

Thence continuing across said tract

North 19 degrees 21 minutes and 37 seconds West, for a distance of 39.00 feet, to the South corner of a concrete wall;

North 15 degrees 25 minutes and 12 seconds East, for a distance of 56.88 feet, to an "X" scribed in concrete;

and North 70 degrees 05 minutes and 05 seconds West, for a distance of 207.07 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner, 25.0 feet from and at a right angle to said 340.0 contour line;

Thence continuing across said tract, 25.0 feet from and parallel to said 340.0 contour line as follows:

South 82 degrees 33 minutes and 03 seconds West, for a distance of 62.04 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 36 degrees 29 minutes and 51 seconds West, for a distance of 56.92 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 09 degrees 55 minutes and 26 seconds West, for a distance of 97.89 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 86 degrees 38 minutes and 28 seconds West, for a distance of 32.57 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 51 degrees 33 minutes and 34 seconds West, for a distance of 253.76 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 64 degrees 09 minutes and 20 seconds West, for a distance of 122.81 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 05 degrees 20 minutes and 40 seconds West, for a distance of 38.40 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 34 degrees 10 minutes and 59 seconds West, for a distance of 103.20 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 46 degrees 48 minutes and 51 seconds West, for a distance of 182.37 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 52 degrees 57 minutes and 47 seconds West, for a distance of 139.53 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 43 degrees 14 minutes and 13 seconds West, for a distance of 88.45 feet, to a point for corner on a rock;

North 50 degrees 04 minutes and 26 seconds West, for a distance of 190.38 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 51 degrees 29 minutes and 43 seconds West, for a distance of 172.33 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 39 degrees 10 minutes and 49 seconds West, for a distance of 185.31 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 56 degrees 48 minutes and 22 seconds West, for a distance of 162.51 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

and North 50 degrees 22 minutes and 48 seconds West, for a distance of 92.29 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

Thence continuing across said tract as follows:

North 09 degrees 31 minutes and 45 seconds East, for a distance of 101.12 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 80 degrees 45 minutes and 02 seconds East, for a distance of 153.76 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 66 degrees 03 minutes and 58 seconds East, for a distance of 161.36 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 19 degrees 05 minutes and 51 seconds East, for a distance of 197.22 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 76 degrees 43 minutes and 04 seconds East, for a distance of 716.94 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 49 degrees 36 minutes and 46 seconds East, for a distance of 114.30 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 07 degrees 34 minutes and 15 seconds East, for a distance of 166.24 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 65 degrees 56 minutes and 10 seconds West, for a distance of 180.97 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 81 degrees 52 minutes and 40 seconds West, for a distance of 336.29 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 26 degrees 13 minutes and 38 seconds West, for a distance of 321.94 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 24 degrees 37 minutes and 44 seconds West, for a distance of 62.22 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 37 degrees 30 minutes and 30 seconds West, for a distance of 180.98 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 42 degrees 04 minutes and 58 seconds West, for a distance of 234.57 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 47 degrees 56 minutes and 01 seconds West, for a distance of 172.61 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 87 degrees 27 minutes and 21 seconds East, for a distance of 246.85 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 33 degrees 55 minutes and 17 seconds East, for a distance of 778.94 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 28 degrees 27 minutes and 09 seconds West, for a distance of 346.61 feet, to a chain link fence corner post found for corner;

North 01 degrees 02 minutes and 39 seconds West, for a distance of 233.02 feet, to a chain link fence corner post found for corner;

South 87 degrees 25 minutes and 57 seconds East, for a distance of 65.62 feet, to a chain link fence post found for corner;

South 70 degrees 17 minutes and 36 seconds East, for a distance of 171.53 feet, to a chain link fence corner post found for corner;

North 58 degrees 44 minutes and 50 seconds East, for a distance of 254.93 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 30 degrees 24 minutes and 13 seconds East, for a distance of 202.30 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 24 degrees 40 minutes and 17 seconds East, for a distance of 188.99 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 17 degrees 13 minutes and 49 seconds East, for a distance of 183.80 feet, to a PK nail with a washer stamped “RPLS 4021” set for corner;

South 09 degrees 17 minutes and 48 seconds East, for a distance of 199.51 feet, to a PK nail with a washer stamped “RPLS 4021” set for corner;

South 01 degrees 31 minutes and 20 seconds East, for a distance of 188.03 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

South 00 degrees 33 minutes and 54 seconds West, for a distance of 457.13 feet, to a 60D nail with a washer stamped “RPLS 4021” set for corner;

North 84 degrees 49 minutes and 23 seconds East, for a distance of 23.15 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

South 05 degrees 08 minutes and 04 seconds East, for a distance of 269.38 feet, to a 60D nail with a washer stamped "RPLS 4021" set for corner;

North 84 degrees 51 minutes and 56 seconds East, for a distance of 56.60 feet, to an "X" set in concrete for corner;

North 05 degrees 13 minutes and 38 seconds West, for a distance of 570.98 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 84 degrees 49 minutes and 23 seconds East, for a distance of 44.34 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 04 degrees 24 minutes and 37 seconds West, for a distance of 537.30 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 62 degrees 22 minutes and 55 seconds East, for a distance of 64.43 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

North 27 degrees 37 minutes and 05 seconds West, for a distance of 543.06 feet, to a 1/2 inch iron rod with a cap stamped (LSPC) set for corner;

and North 36 degrees 16 minutes and 57 seconds West, for a distance of 153.86 feet, to the place of beginning and containing **387.6 acres.**

Plat Prepared of Even Date.

Grid Bearings based on Texas State Plane Coordinates, North Central Zone 4202, NAD 1927
Elevations based on NGVD 29.

Distances and acreage recited in surface feet. To convert to grid, multiply by the combined scale factor of 0.999854.

Convergence angle at the beginning point is 1°20'27"

I, **DANIEL LEE COOPER**, Registered Professional Land Surveyor No. 6148, do hereby certify that the above field notes were prepared from an actual survey made on the ground under my direction and supervision on December 13, 2019

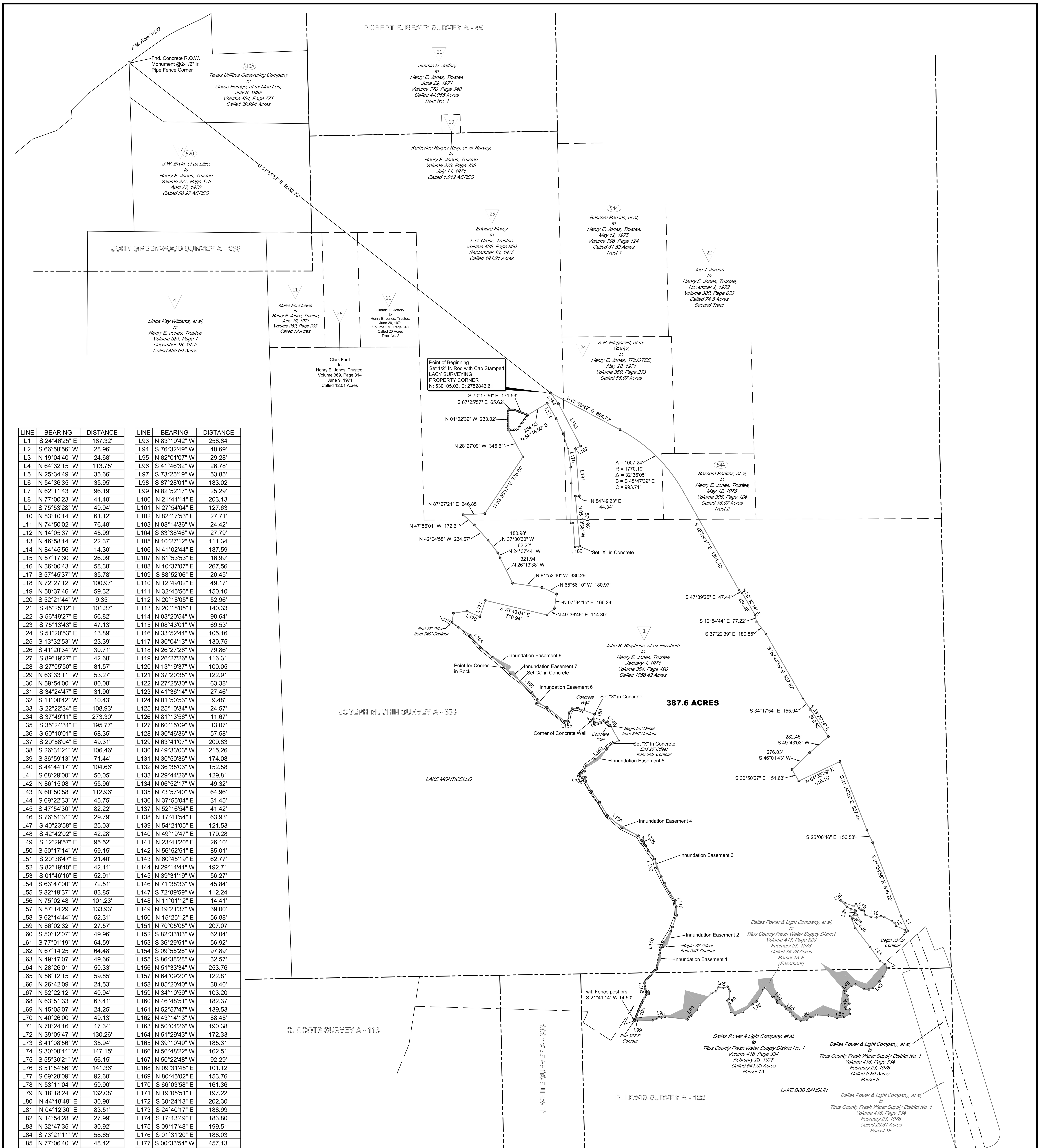
GIVEN UNDER MY HAND AND SEAL, this the 17th day of December, 2019.

Daniel Lee Cooper

Digitally signed by Daniel Lee Cooper
DN: cn=Daniel Lee Cooper, o=Lacy Surveying Inc., ou, email=dcooper@lacylandsurveying.com, c=US
Date: 2019.12.17 10:34:35 -06'00'

Daniel Lee Cooper R.P.L.S. No. 6148

STATE OF TEXAS
REGISTERED
DANIEL LEE COOPER
6148
PROFESSIONAL
LAND SURVEYOR




| LINE | BEARING | DISTANCE |
|---|---|---|
| L1 | S 24°46'25" E | 187.32' |
| L2 | S 66°58'56" W | 28.96' |
| L3 | N 19°04'40" W | 24.68' |
| L4 | N 64°32'15" W | 113.75' |
| L5 | N 25°34'49" W | 35.66' |
| L6 | N 54°36'35" W | 35.95' |
| L7 | N 62°11'43" W | 96.19' |
| L8 | N 77°00'23" W | 41.40' |
| L9 | S 75°53'28" W | 49.94' |
| L10 | N 83°10'14" W | 61.12' |
| L11 | N 74°50'02" W | 76.48' |
| L12 | N 14°05'37" W | 45.99' |
| L13 | N 46°58'14" W | 22.37' |
| L14 | N 84°45'56" W | 14.30' |
| L15 | N 57°17'30" W | 26.09' |
| L16 | N 36°00'43" W | 58.38' |
| L17 | S 57°45'37" W | 35.78' |
| L18 | N 72°27'12" W | 100.97' |
| L19 | N 50°37'46" W | 59.32' |
| L20 | S 52°21'44" W | 9.35' |
| L21 | S 45°25'12" E | 101.37' |
| L22 | S 56°49'27" E | 56.82' |
| L23 | S 75°13'43" E | 47.13' |
| L24 | S 51°20'53" E | 13.89' |
| L25 | S 13°32'53" W | 23.39' |
| L26 | S 41°20'34" W | 30.71' |
| L27 | S 89°19'27" E | 42.68' |
| L28 | S 27°05'50" E | 81.57' |
| L29 | N 63°33'11" W | 53.27' |
| L30 | N 59°54'00" W | 80.08' |
| L31 | S 34°24'47" E | 31.90' |
| L32 | S 11°00'42" W | 10.43' |
| L33 | S 22°22'34" E | 108.93' |
| L34 | S 37°49'11" E | 273.30' |
| L35 | S 35°24'31" E | 195.77' |
| L36 | S 60°10'01" E | 68.35' |
| L37 | S 29°58'04" E | 49.31' |
| L38 | S 26°31'21" W | 106.46' |
| L39 | S 36°59'13" W | 71.44' |
| L40 | S 44°44'17" W | 104.66' |
| L41 | S 68°29'00" W | 50.05' |
| L42 | N 86°15'08" W | 55.96' |
| L43 | N 60°50'58" W | 112.96' |
| L44 | S 69°22'33" W | 45.75' |
| L45 | S 47°54'30" W | 82.22' |
| L46 | S 76°51'31" W | 29.79' |
| L47 | S 40°23'58" E | 25.03' |
| L48 | S 42°42'02" E | 42.28' |
| L49 | S 12°29'57" E | 95.52' |
| L50 | S 50°17'14" W | 59.15' |
| L51 | S 20°38'47" E | 21.40' |
| L52 | S 82°19'40" E | 42.11' |
| L53 | S 01°46'16" E | 52.91' |
| L54 | S 63°47'00" W | 72.51' |
| L55 | S 82°19'37" W | 83.85' |
| L56 | N 75°02'48" W | 101.23' |
| L57 | N 87°14'29" W | 133.93' |
| L58 | S 62°14'44" W | 52.31' |
| L59 | N 86°02'32" W | 27.57' |
| L60 | S 50°12'07" W | 49.96' |
| L61 | S 77°01'19" W | 64.59' |
| L62 | N 67°14'25" W | 64.48' |
| L63 | N 49°17'07" W | 49.66' |
| L64 | N 28°26'01" W | 50.33' |
| L65 | N 56°12'15" W | 59.85' |
| L66 | N 26°42'09" W | 24.53' |
| L67 | N 52°22'12" W | 40.94' |
| L68 | N 63°51'33" W | 63.41' |
| L69 | N 15°05'07" W | 24.25' |
| L70 | N 40°26'00" W | 49.13' |
| L71 | N 70°24'16" W | 17.34' |
| L72 | N 39°09'47" W | 130.26' |
| L73 | S 41°08'56" W | 35.94' |
| L74 | S 30°00'41" W | 147.15' |
| L75 | S 55°30'21" W | 56.15' |
| L76 | S 51°54'56" W | 141.36' |
| L77 | S 69°28'09" W | 92.60' |
| L78 | N 53°11'04" W | 59.90' |
| L79 | N 18°18'24" W | 132.08' |
| L80 | N 44°18'49" E | 30.90' |
| L81 | N 04°12'30" E | 83.51' |
| L82 | N 14°54'28" W | 27.99' |
| L83 | N 32°47'35" W | 30.92' |
| L84 | S 73°21'11" W | 58.65' |
| L85 | N 77°06'40" W | 48.42' |
| L86 | S 31°38'57" W | 55.73' |
| L87 | S 70°07'15" W | 52.74' |
| L88 | S 44°58'11" W | 187.08' |
| L89 | S 31°38'33" W | 72.74' |
| L90 | S 43°33'16" W | 86.71' |
| L91 | S 57°37'48" W | 33.86' |
| L92 | S 30°10'58" W | 29.69' |

| LINE | BEARING | DISTANCE |
|---|---|---|
| L93 | N 83°19'42" W | 258.84' |
| L94 | S 76°32'49" W | 40.69' |
| L95 | N 82°01'07" W | 29.28' |
| L96 | S 41°46'32" W | 26.78' |
| L97 | S 73°25'19" W | 53.85' |
| L98 | S 87°28'01" W | 183.02' |
| L99 | N 82°52'17" W | 25.29' |
| L100 | N 21°41'14" E | 203.13' |
| L101 | N 27°54'04" E | 127.63' |
| L102 | N 82°17'53" E | 27.71' |
| L103 | N 08°14'36" W | 24.42' |
| L104 | S 83°38'46" W | 27.79' |
| L105 | N 10°27'12" W | 111.34' |
| L106 | N 41°02'44" E | 187.59' |
| L107 | N 81°53'53" E | 16.99' |
| L108 | N 10°37'07" E | 267.56' |
| L109 | S 88°52'06" E | 20.45' |
| L110 | N 12°49'02" E | 49.17' |
| L111 | N 32°45'56" E | 150.10' |
| L112 | N 20°18'05" E | 52.96' |
| L113 | N 20°18'05" E | 140.33' |
| L114 | N 03°20'54" W | 98.64' |
| L115 | N 08°43'01" W | 69.53' |
| L116 | N 33°52'44" W | 105.16' |
| L117 | N 30°04'13" W | 130.75' |
| L118 | N 26°27'26" W | 79.86' |
| L119 | N 26°27'26" W | 116.31' |
| L120 | N 13°19'37" W | 100.05' |
| L121 | N 37°20'35" W | 122.91' |
| L122 | N 27°25'30" W | 63.38' |
| L123 | N 41°36'14" W | 27.46' |
| L124 | N 01°50'53" W | 9.48' |
| L125 | N 25°10'34" W | 24.57' |
| L126 | N 81°13'56" W | 11.67' |
| L127 | N 60°15'09" W | 13.07' |
| L128 | N 30°46'36" W | 57.58' |
| L129 | N 63°41'07" W | 209.83' |
| L130 | N 49°33'03" W | 215.26' |
| L131 | N 30°50'36" W | 174.08' |
| L132 | N 36°35'03" W | 152.58' |
| L133 | N 29°44'26" W | 129.81' |
| L134 | N 06°52'17" W | 49.32' |
| L135 | N 73°57'40" W | 64.96' |
| L136 | N 37°55'04" E | 31.45' |
| L137 | N 52°16'54" E | 41.42' |
| L138 | N 17°41'54" E | 63.93' |
| L139 | N 54°21'05" E | 121.53' |
| L140 | N 49°19'47" E | 179.28' |
| L141 | N 23°41'20" E | 26.10' |
| L142 | N 56°52'51" E | 85.01' |
| L143 | N 60°45'19" E | 62.77' |
| L144 | N 29°14'41" W | 192.71' |
| L145 | N 39°31'19" W | 56.27' |
| L146 | N 71°38'33" W | 45.84' |
| L147 | S 72°09'59" W | 112.24' |
| L148 | N 11°01'12" E | 14.41' |
| L149 | N 19°21'37" W | 39.00' |
| L150 | N 15°25'12" E | 56.88' |
| L151 | N 70°05'05" W | 207.07' |
| L152 | S 82°33'03" W | 62.04' |
| L153 | S 36°29'51" W | 56.92' |
| L154 | S 09°55'26" W | 97.89' |
| L155 | S 86°38'28" W | 32.57' |
| L156 | N 51°33'34" W | 253.76' |
| L157 | N 64°09'20" W | 122.81' |
| L158 | N 05°20'40" W | 38.40' |
| L159 | N 34°10'59" W | 103.20' |
| L160 | N 46°48'51" W | 182.37' |
| L161 | N 52°57'47" W | 139.53' |
| L162 | N 43°14'13" W | 88.45' |
| L163 | N 50°04'26" W | 190.38' |
| L164 | N 51°29'43" W | 172.33' |
| L165 | N 39°10'49" W | 185.31' |
| L166 | N 56°48'22" W | 162.51' |
| L167 | N 50°22'48" W | 92.29' |
| L168 | N 09°31'45" E | 101.12' |
| L169 | N 80°45'02" E | 153.76' |
| L170 | S 66°03'58" E | 161.36' |
| L171 | N 19°05'51" E | 197.22' |
| L172 | S 30°24'13" E | 202.30' |
| L173 | S 24°40'17" E | 188.99' |
| L174 | S 17°13'49" E | 183.80' |
| L175 | S 09°17'48" E | 199.51' |
| L176 | S 01°31'20" E | 188.03' |
| L177 | S 00°33'54" W | 457.13' |
| L178 | N 84°49'23" E | 23.15' |
| L179 | S 05°08'04" E | 269.38' |
| L180 | N 84°51'56" E | 56.60' |
| L181 | N 04°24'37" W | 537.30' |
| L182 | N 62°22'55" E | 64.43' |
| L183 | N 27°37'05" W | 543.06' |
| L184 | N 36°16'57" W | 153.86' |

0' 100' 200' 300' 400' 500' 750' 1000'

LEGEND

- Set 1/2" Ir. Rod with cap stamped "Lacy Surveying Property Corner"
- Point for Corner
- Set 60D Nail with washer stamped "RPLS 4021"
- Set P.K. Nail with Washer Stamped "RPLS 4021"
- Found Right-of-Way Monument
- Chain Link Fence Post
- Wire Fence
- Pipe Fence
- Chain Link Fence
- Aerial Power Line
- Pipeline
- Electric Transmission Line
- Abstract Line

NOTES

- Grid Coordinates and Bearings based on Texas State Plane Coordinates, North Central Zone 4202, NAD 27. Convergence angle at the beginning point = 1°20'27"
- Distances shown in surface feet. Combined Scale factor = 0.999854.
- This survey was prepared without the benefit of a Title Commitment.
- Deed references shown hereon refer to the Deed, Land or Official Public Records of Titus County, Texas and may not reflect current ownership.
- Field Notes prepared of even date.
- Improvements not shown at request of client.

# PLAT OF SURVEY SHOWING PART OF THE JOSEPH MUCHIN SURVEY A - 356 PART OF THE R. LEWIS SURVEY A - 138 TITUS COUNTY, TX

I, DANIEL LEE COOPER, REGISTERED PROFESSIONAL LAND SURVEYOR NO 6148, do hereby certify that this plat was prepared from an on the ground survey performed under my direction and supervision on December 13, 2019.

GIVEN UNDER MY HAND AND SEAL, this the 17th day of December, 2019.

Daniel Lee Cooper
Digitally signed by Daniel Lee Cooper
DN: cn=Daniel Lee Cooper, o=Lacy Surveying Inc., ou, email=dcooper@lacylandsurveying.com, c=US
Date: 2019.12.17 10:24:30 -06'00'

REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6148

STATE OF TEXAS REGISTERED DANIEL LEE COOPER 6148 PROFESSIONAL LAND SURVEYOR

ADDRESS:

JOB # : 2019168 387.6 Acres

CLIENT : Luminant

SCALE: 1" = 500.00'


LACY SURVEYING EST. 1984
P.O. BOX 736
ARP, TEXAS 75750
PHONE & FAX (903) 859 - 9942
LacySurveying.com
Texas Board of Professional Land Surveying Firm #100299-00

**Attachment #5 for Items #18 – Core Data Form**

TCEQ Use Only

# TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

## SECTION I: General Information

**1. Reason for Submission** *(If other is checked please describe in space provided.)*

☐ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.)*

☒ Renewal *(Core Data Form should be submitted with the renewal form)* ☐ Other

| 2. Customer Reference Number *(if issued)* | Follow this link to search for CN or RN numbers in Central Registry** | 3. Regulated Entity Reference Number *(if issued)* |
|---|---|---|
| CN 605736982 | | RN 102285921 |

## SECTION II: Customer Information

| 4. General Customer Information | 5. Effective Date for Customer Information Updates (mm/dd/yyyy) | 1/19/2022 |
|---|---|---|

☐ New Customer ☒ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

***The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).***

| 6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)* | *If new Customer, enter previous Customer below:* |
|---|---|
| Golden Eagle Development, LLC | |

| 7. TX SOS/CPA Filing Number | 8. TX State Tax ID (11 digits) | 9. Federal Tax ID (9 digits) | 10. DUNS Number (if applicable) |
|---|---|---|---|
| 0803485511 | 32072726568 | 84-3242461 | |

**11. Type of Customer:** ☒ Corporation ☐ Individual Partnership: ☐ General ☐ Limited
Government: ☐ City ☐ County ☐ Federal ☐ State ☐ Other ☐ Sole Proprietorship ☐ Other:

**12. Number of Employees**
☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

**13. Independently Owned and Operated?**
☐ Yes ☐ No

**14. Customer Role** (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other:

| 15. Mailing Address: | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2275 Cassens Drive, Suite 118 | | | | | | |
| | | | | | | | |
| City | Fenton | State | MO | ZIP | 63026 | ZIP + 4 | |

| 16. Country Mailing Information *(if outside USA)* | 17. E-Mail Address *(if applicable)* |
|---|---|
| | |

| 18. Telephone Number | 19. Extension or Code | 20. Fax Number *(if applicable)* |
|---|---|---|
| ( 314 ) 624-1604 | | (   )   - |

## SECTION III: Regulated Entity Information

**21. General Regulated Entity Information** *(If 'New Regulated Entity" is selected below this form should be accompanied by a permit application)*

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☒ Update to Regulated Entity Information

***The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).***

**22. Regulated Entity Name** *(Enter name of the site where the regulated action is taking place.)*

Monticello Steam Electric Station

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **23. Street Address of the Regulated Entity:** *(No PO Boxes)* | | | | | | | |
| | FM 127 | | | | | | |
| | **City** | Mt Pleasant | **State** | TX | **ZIP** | 75456 | **ZIP + 4** |
| **24. County** | Freestone | | | | | | |

**Enter Physical Location Description if no street address is provided.**

| | |
|---|---|
| **25. Description to Physical Location:** | 8 Mi SE of Mt. Pleasant on FM 127 |

| **26. Nearest City** | **State** | **Nearest ZIP Code** |
|---|---|---|
| Mt Pleasant | TX | 75456 |

| **27. Latitude (N) In Decimal:** | 33.091679 | | **28. Longitude (W) In Decimal:** | -95.038492 | |
|---|---|---|---|---|---|
| Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |
| 33 | 5 | 30.0444 | 95 | 2 | 5712 |

| **29. Primary SIC Code** (4 digits) | **30. Secondary SIC Code** (4 digits) | **31. Primary NAICS Code** (5 or 6 digits) | **32. Secondary NAICS Code** (5 or 6 digits) |
|---|---|---|---|
| 1795 | | 221112 | |

**33. What is the Primary Business of this entity?** *(Do not repeat the SIC or NAICS description.)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **34. Mailing Address:** | 2275 Cassens Drive, Suite 118 | | | | | | |
| | | | | | | | |
| | **City** | Fenton | **State** | MO | **ZIP** | 63026 | **ZIP + 4** |
| **35. E-Mail Address:** | | | | | | | |

| **36. Telephone Number** | **37. Extension or Code** | **38. Fax Number *(if applicable)*** |
|---|---|---|
| ( 314 ) 624-1604 | | ( ) - |

**39. TCEQ Programs and ID Numbers** Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

| | | | | |
|---|---|---|---|---|
| ☐ Dam Safety | ☐ Districts | ☐ Edwards Aquifer | ☐ Emissions Inventory Air | ☒ Industrial Hazardous Waste |
| | | | | TXD05438948<br>SWR 30081 |
| ☐ Municipal Solid Waste | ☐ New Source Review Air | ☐ OSSF | ☐ Petroleum Storage Tank | ☐ PWS |
| | | | | |
| ☐ Sludge | ☐ Storm Water | ☐ Title V Air | ☐ Tires | ☐ Used Oil |
| | | | | |
| ☐ Voluntary Cleanup | ☒ Waste Water | ☐ Wastewater Agriculture | ☐ Water Rights | ☐ Other: |
| | WQ000152000<br>TX05EO86 | | | |

## SECTION IV: Preparer Information

| **40. Name:** | Adam Kaiser | | **41. Title:** | Project Engineer |
|---|---|---|---|---|
| **42. Telephone Number** | **43. Ext./Code** | **44. Fax Number** | **45. E-Mail Address** | |
| ( 512 ) 566-6878 | | ( ) - | A.Kaiser@GeminiSTL.com | |

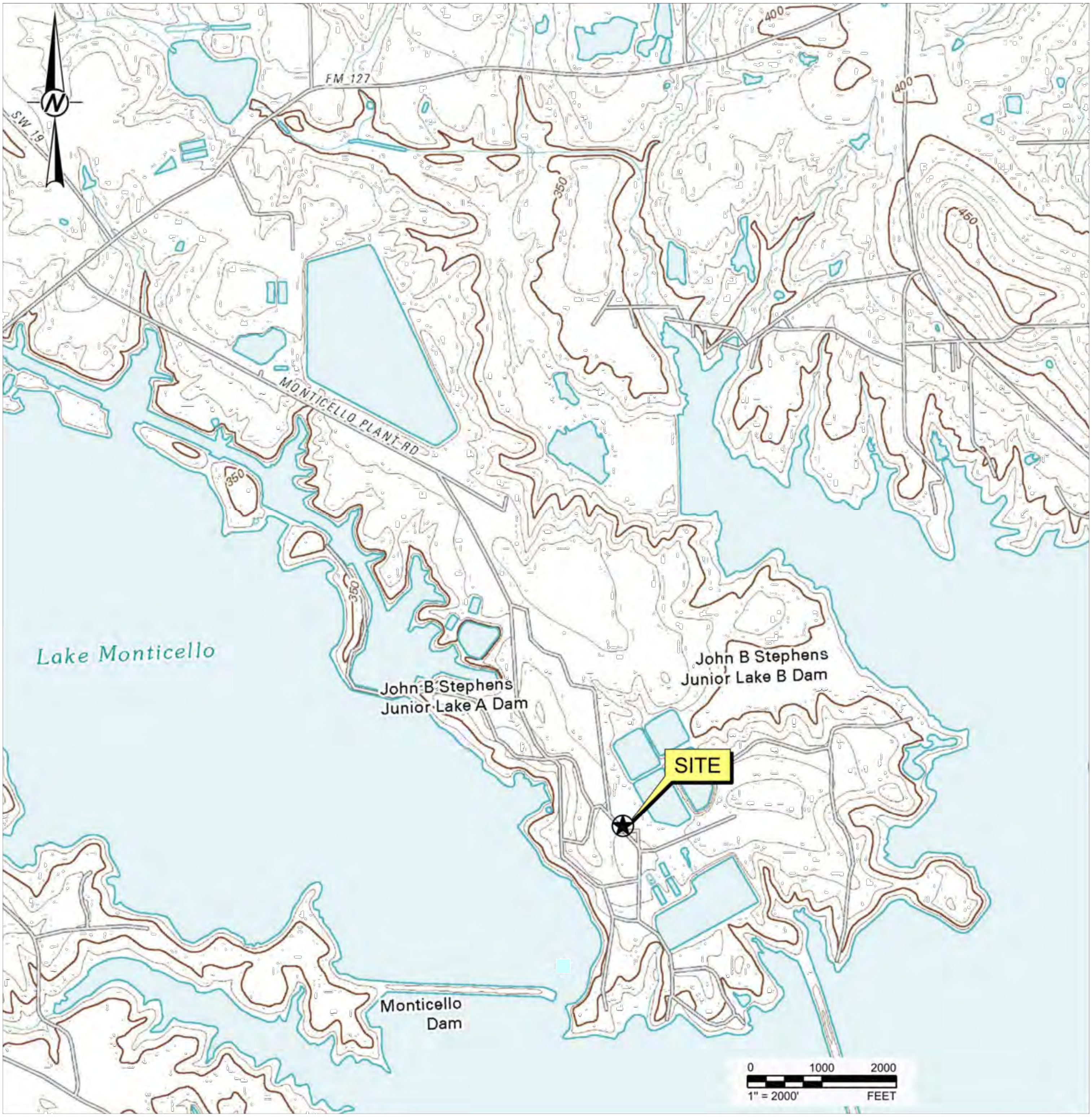
## SECTION V: Authorized Signature

**46.** By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

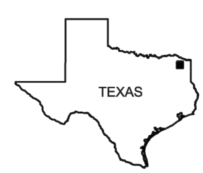
| | | | |
|---|---|---|---|
| **Company:** | Golden Eagle Development, LLC | **Job Title:** | President & CEO |

| **Name** *(In Print)*: | Ron Froh | **Phone:** | ( 314 ) 227- **8313** |
|---|---|---|---|
| **Signature:** | Ron Froh | **Date:** | 1/21/22 |

**Attachment #6 for Items #20 – Figures and Attachments**




**REFERENCE(S)**
BASE MAP TAKEN FROM WWW.TNRIS.GOV, MONTICELLO, TX 7.5 MIN. USGS QUADRANGLE DATED 2010.




QUADRANGLE LOCATIONS

C:\Users\worcc\OneDrive\Documents\DWG\ATON\Projects\Monticello\dwg\fig1_SiteLocMap.dwg

ATON

Figure 1
Site Location Map
Former MOSES Site

| | |
|---|---|
| Chkd: | AK |
| Drawn: | EFC |
| Page: | |
| Date: | 9/30/2020 |
| Scale: | As Shown |


Source: Google Earth Date: 2020

| Figure 2 | NOT TO SCALE **N↑** |
|---|---|
| ATON | **Site Name:** **Monticello Steam Engine Electric Station Mount Pleasant, Texas**<br>**Project:** **SWR 30081** |


LEGEND

DOWNGRADIENT CCR MONITORING WELL

UPGRADIENT CCR MONITORING WELL

C:\Users\worcc\OneDrive\Documents\DWG\ATON\Projects\Monticello\dwg\Site_Plan.dwg

ATON

Detailed Site Plan
Site: Golden Eagle Development

| | |
|---|---|
| Chkd: | AK |
| Drawn: | EFC |
| Page: | 1 of 1 |
| Date: | 9/25/2020 |
| Scale: | As Shown |

# Titus CAD Web Map


1/21/2022, 5:27:06 PM

Abstracts

Parcels

1:9,028

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Maxar

Titus County Appraisal District, BIS Consulting - www.bisconsulting.com

Disclaimer: This product is for informational purposes only and has not been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of boundaries.

**MOSES**

| Figure ID | Owner | Address | GIS Parcel ID |
|---|---|---|---|
| 1 | Goldden Eagle Development LLC | | 339943, 340572, 339981 |

**Bottom Ash Pond Adjacent Landowners**

| | | | |
|---|---|---|---|
| 2 | LUMINANT GENERATION COMPANY LLC | PO BOX 219071, DALLAS TX 75221 9071 | 6110 |

LUMINANT GENERATION COMPANY LLC
PO BOX 219071
DALLAS TX 75221-9071

LUMINANT GENERATION COMPANY LLC
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DALLAS TX 75221-9071

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LUMINANT GENERATION COMPANY LLC
PO BOX 219071
DALLAS TX 75221-9071

**Deficiency #9 – Revised Attachment #7 for Items #23 – Geological Summary**

# TECHNICAL MEMORANDUM

**DATE** October 10, 2018 **Project No.** 18107517

**TO** Jeff Jones
Luminant Generation Company LLC

**FROM** Patrick J. Behling, P.E.

**LUMINANT GENERATION COMPANY LLC**
**CCR RULE LOCATION RESTRICTION DEMONSTRATION**
**MONTICELLO STEAM ELECTRIC STATION – TITUS COUNTY, TEXAS**
**ASH PONDS**



Luminant Generation Company LLC (Luminant) formerly operated the Monticello Steam Electric Station (MOSES) located approximately 6 miles southwest of Mt. Pleasant, Titus County, Texas. The MOSES consisted of three coal/lignite-fired units with a combined operating capacity of approximately 1,880 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, boiler slag, and scrubber gypsum were generated as part of MOSES unit operation. The MOSES suspended operations in early 2018.

The U.S. Environmental Protection Agency's (EPA's) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (CCR Rule) has established technical requirements for CCR landfills and surface impoundments (See 80 Fed. Reg. 21,302 (Apr. 17, 2015); 83 Fed. Reg. 36,435 (July 30, 2018)). The following surface impoundments at the MOSES have been identified as Existing CCR Surface Impoundments regulated under the CCR Rule:

- Southwest Ash Settling Pond (SASP);
- West Ash Settling Pond (WASP); and
- Northeast Ash Water Retention Pond (NAWRP).

The WASP, NAWRP and the SASP (collectively referred to as the "Ash Ponds") are located approximately 1,200 feet southeast of the MOSES power plant (Figure 1). The Ash Ponds are located immediately adjacent to each other and share interior earthen embankments. Due to their proximity to each other, the WASP, NAWRP, and SASP are considered one CCR surface impoundment (identified as the "Ash Ponds) under the CCR Rule.

Golder Associates Inc. (Golder) was retained by Luminant to evaluate the Ash Ponds against the five (5) applicable location restriction criteria for existing CCR surface impoundments described in Sections 257.60 through 257.64 of the CCR Rule. This memorandum sets forth Luminant's location restriction demonstrations and corresponding certifications required by the CCR Rule.

## LOCATION RESTRICTION DEMONSTRATION – SUMMARY OF FINDINGS/CONCLUSIONS

This location restriction demonstration concludes that the Ash Ponds satisfy four of the five CCR Rule location restriction criteria for existing CCR surface impoundments (wetlands, fault areas, seismic impact zone and unstable areas):

- The Ash Ponds were determined to not be located in wetlands as per §257.61.
- Based on the available published geologic data and information reviewed, the nearest known fault to the Ash Ponds is located approximately 17 miles north of the MOSES. Therefore, the Ash Ponds satisfy the location restriction criteria presented in §257.62.
- The Ash Ponds were determined to not be located in a Seismic Impact Zone as per §257.63.
- The Ash Ponds were determined to not be located in an Unstable Area as per §257.64.

The Ash Ponds do not comply with the uppermost aquifer separation criterion defined in §257.61. The elevation of the base of the pond liner in the Ash Ponds is below the upper limit of the uppermost aquifer due to normal fluctuations in groundwater elevations.

A professional engineering certification that covers all five location restriction evaluations is included on page 10 of this demonstration.

## MEMORANDUM ORGANIZATION

The memorandum is organized as follows:

# SECTION 1.0 Location Restriction Criteria & CCR Unit Description

## LOCATION RESTRICTION CRITERIA

Existing CCR Surface Impoundments must comply with the following five location restrictions described in Sections 257.60 through 257.64 of the CCR Rule:

- §257.60 – Placement above the Uppermost Aquifer
- §257.61 – Wetlands
- §257.62 – Fault Areas
- §257.63 – Seismic Impact Zone
- §257.64 – Unstable Areas

The CCR Rule requires that the CCR Surface Impoundment owner or operator certify that the CCR Unit meets the specified location restriction requirements by October 17, 2018 for continued operation of the CCR Unit.

## CCR UNIT DESCRIPTION

The WASP and NAWRP received a slurry of bottom ash/boiler slag and water and the SASP was connected to the WASP with two weirs and was used for overflow from the other two ponds. The Ash Ponds are considered an existing CCR Surface Impoundment under the CCR Rule. The Ash Ponds were originally constructed in 1974 as a two-basin system. In 1990, the ponds were segregated and relined with a 3-foot thick clay liner, and the NAWRP interior slopes and the east side interior slopes of the WASP were lined with concrete revetment mats. All remaining interior slopes of the ponds were lined with riprap. The SASP, WASP, and NAWRP are approximately 1000 feet long by 460 feet wide, 570 feet long by 460 feet wide, and 470 feet long by 470 feet wide respectively. The Ash Ponds are constructed partially above and partially below grade and are surrounded by engineered earthen embankments that extend approximately 15 to 20 feet above grade.

# Section 2.0 Placement Above Uppermost Aquifer

Section 257.60(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.*

Section 257.53 of the CCR Rule defines uppermost aquifer as follows:

- Aquifer: a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

- Uppermost aquifer: the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

Golder evaluated the distance between the base of the Ash Ponds and the uppermost aquifer by comparing the documented elevation of the base of the pond liner and historical maximum groundwater elevations as measured from monitoring wells in the vicinity of the ponds. The upper limit of the uppermost aquifer in the vicinity of the Ash Ponds was measured to be approximately Elev. 365 to 367 feet MSL and the base of the pond liner is located at approximately Elev. 358 ft MSL. Based on these measurements, the upper limit of the uppermost ground-water bearing unit can exceed the base of the liner in the ponds due to normal fluctuations in groundwater elevations. As a result, the Ash Ponds do not satisfy the minimum separation location restriction criterion requirements of §257.60(a).

# Section 3.0 Wetlands

Section 257.61(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.*

40 CFR 232.2 defines wetlands as follows:

- Wetlands: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The Ash Ponds were originally constructed in the 1974 and are located in a developed industrial area that is part of the MOSES power plant. To determine if the Ash Ponds are located in wetlands, the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) website was reviewed by Golder. Although the Ash Ponds themselves are represented on the NWI maps as “permanently flooded freshwater basins that were excavated by humans”, wastewater discharges from the MOSES are regulated under Texas Pollution Discharge Elimination System (TPDES) permit WQ0002697000 and the Ash Ponds are part of the MOSES wastewater management system. As a result, the Ash Ponds were designed and constructed to meet Clean Water Act requirements and are therefore not considered federally jurisdictional wetlands in accordance with 33 CFR § 328.3(b)(1).

Based on the NWI maps and the construction characteristics of the Ash Ponds, the Ash Ponds are not “located in wetlands” as per §257.61(a), and the Ash Ponds satisfy the wetlands location restriction criterion.

# Section 4.0 Fault Areas

Section 257.62(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.*

Section 257.53 of the CCR Rule defines Holocene as the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch (11,700 years before present) to present.

Golder evaluated the potential for existence of CCR Rule-defined faults in proximity to the Ash Ponds based on geologic maps and documents published by the United States Geological Survey (USGS). The nearest known mapped faults to the Ash Ponds are located approximately 17 miles north of the MOSES, which greatly exceeds the 200-foot distance prescribed in the CCR Rule. As a result, the Ash Ponds comply with the requirements of §257.62(a).

## Section 5.0 Seismic Impact Zone

Section 257.63(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

Section 257.53 of the CCR Rule defines these terms as follows:

- Seismic impact zone: an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 50 years.
- Lithified earth material: all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.
- Maximum horizontal acceleration in lithified earth material: the maximum expected horizontal acceleration at the ground surface as depicted on a seismic hazard map, with a 98% or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.
- Structural components: liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.

Golder evaluated the location of the Ash Ponds relative to seismic impact zones using maps and documents published by the United States Geological Survey (USGS). The Ash Ponds are located in an area with peak ground accelerations between 0.04g and 0.06g, which is well below the maximum acceleration of 0.10g specified in the CCR Rule to be considered a Seismic Impact Zone. As a result, the Ash Ponds are not located in a Seismic Impact Zone as defined in the CCR Rule and therefore comply with § 257.63(a).

## Section 6.0 Unstable Areas

Section 257.64(a) of the CCR Rule states:

a) *An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.*

Section 257.53 of the CCR Rule defines unstable area as follows:

- Unstable area: a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.
- Poor Foundation Conditions: those areas where features exist which indicate that a natural or human-induced event may result in inadequate foundation support for the structural components of an existing or new CCR unit.
- Areas Susceptible to Mass Movement: those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where, because of natural or human-induced events, the movement of earthen material at, beneath, or adjacent to the CCR unit results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, and rock fall.
- Karst terrain: an area where karst topography, with its characteristic erosional surface and subterranean features, is developed as a result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terrain include, but are not limited to, dolines, collapse shafts (sinkholes), sinking streams, caves, seeps, large springs, and blind valleys.



Under § 257.64(b), the following factors must be considered when determining whether an area is unstable:

- on-site or local soil conditions that may result in significant differential settling;
- on-site or local geologic or geomorphic features; and
- on-site or local human-made features or events (both surface and subsurface).

Golder completed a CCR Rule Structural Stability Assessment Report for the Ash Ponds in 2012 and updated the assessment in 2016. The Structural Stability Assessment Report concluded that the soils underlying the Ash Ponds were stable. As a result, the Ash Ponds are not located in an unstable area as defined in the CCR Rule.

## Section 7.0 Limitations

In preparing this evaluation, Golder has reviewed historic, design and investigative information and other data furnished by Luminant. Golder has relied on this information in completing the location restriction evaluations for the Ash Ponds.

The conclusions presented in this memorandum assume that subsurface site conditions in the vicinity of the Ash Ponds reasonably match those conditions associated with site borings, laboratory testing results, etc. The reported conclusions are also based on our understanding of current site operations, maintenance and CCR management practices at the MOSES at the current time as provided by Luminant.

# Section 8.0 Professional Certification

I, Patrick J. Behling, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this CCR Rule Location Restrictions Demonstration has been prepared in accordance with the accepted practice of engineering. I certify that the CCR Unit described in this report and as explained further in the CCR Rule Location Restriction Evaluation – Monticello Steam Electric Station Ash Ponds, Golder Associates Inc. October 10, 2018, meets the requirements of 40 CFR Sections 257.61 through 257.64. The CCR units do not satisfy the minimum separation location restriction criterion requirements of §257.60(a).

Patrick J. Behling, P.E.
Principal Engineer
Texas PE No. 79872
Golder Associates Inc.
Texas Engineering Firm No. 2578

STATE OF TEXAS
PATRICK J. BEHLING
79872
LICENSED
PROFESSIONAL ENGINEER
10/10/18

# Figures


**LEGEND**

CCR MONITORING WELL LOCATION

**REFERENCE(S)**

IMAGERY FROM GOOGLE EARTH DATED 12/02/2015.

CLIENT

LUMINANT GENERATION COMPANY LLC

PROJECT

MONTICELLO STEAM ELECTRIC STATION
ASH PONDS
CCR RULE LOCATION RESTRICTION DEMONSTRATION

TITLE

**SITE PLAN**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2018-10-05 |
| DESIGNED | BZH |
| PREPARED | BZH |
| REVIEWED | PJB |
| APPROVED | PJB |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 18107517 | 0 | 1 |

# COAL COMBUSTION RESIDUAL RULE
# GROUNDWATER MONITORING SYSTEM CERTIFICATION

## MONTICELLO STEAM ELECTRIC STATION
## ASH PONDS
## MOUNT PLEASANT, TEXAS



**OCTOBER 16, 2017**

***Prepared For:***

Luminant Generation Company, LLC
6555 Sierra Drive
Irving, TX 75039

***Prepared By:***

Pastor, Behling & Wheeler, LLC
2201 Double Creek Drive, Suite 4004
Round Rock, Texas 78664
Texas Engineering Firm No. 4760

October 16, 2017

## PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the groundwater monitoring system installed at the referenced facility has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

STATE OF TEXAS
PATRICK J. BEHLING
79872
LICENSED
PROFESSIONAL ENGINEER
10/16/17

Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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## 1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) operates the Monticello Steam Electric Station (MOSES) located approximately six miles southwest of Mount Pleasant, Titus County, Texas (Figure 1). The three power generation units at the MOSES burn lignite and Powder River Basin coal. Coal Combustion Residuals (CCRs) including fly ash, bottom ash, and scrubber sludge are generated as part of MOSES unit operations. The CCRs are currently stored, treated, and disposed of in surface impoundments on-site, or at other Luminant facilities. Three surface impoundments are located within the MOSES operations, the West Ash Settling Pond, the Southwest Ash Settling Pond, and Northeast Ash Water Retention Pond (Ash Ponds). These ponds are collectively referred to as the Ash Ponds and are evaluated as one CCR unit. The Ash Ponds meet the definition of a CCR surface impoundment and are subject to groundwater monitoring system requirements of the CCR Rule.



The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.

The CCR Rule establishes national minimum criteria for existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions to landfills/impoundments. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to evaluate and certify that the groundwater monitoring system at the Site has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

### 1.1 Description of the Ash Pond Area

Bottom ash is sluiced to the NE and West Ash Ponds, and the SW Ash Pond is used for overflow from the other two ponds. In addition to the sluiced ash, overflow from the dewatering bins is also sent to these ponds. Based on drawings provided by Luminant, these ponds have compacted clay liners consisting of three feet of clay soil, and are considered existing lined surface impoundments under the CCR Rule. The clay soil is covered by a four-inch concrete revetment.

## 1.2 CCR Unit Groundwater Monitoring System Requirements

Section 257.91 of the CCR Rule indicates that existing CCR landfills and surface impoundments be provided with a groundwater monitoring system that consists of sufficient wells, installed at appropriate location and depths, to yield groundwater samples from the uppermost aquifer that meet the following criteria:

- Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit; and
- Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary to ensure detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

The specific configuration of the groundwater monitoring system must be determined based on site-specific technical information that must include aquifer thickness, groundwater flow rate, groundwater flow direction (including seasonal and temporal fluctuation in groundwater flow), saturated and unsaturated geologic units and fill materials that overly the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the upmost aquifer, including, but not limited to, thickness, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.



At a minimum, the monitoring system must consist of at least one upgradient and three downgradient monitoring wells, and any additional monitoring wells necessary to accurately represent the quality of the background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit. Multi-unit groundwater monitoring systems are allowed but must be equally as capable of detecting monitored constituents at the waste boundary of a CCR unit as individual groundwater monitoring wells.

Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater. There must be documentation in the operating record of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified engineer must have access to and must review this documentation as part of the groundwater monitoring system certification.

# 2.0 GROUNDWATER MONITORING SYSTEM EVALUATION

## 2.1 Ash Pond Groundwater Monitoring System

The CCR groundwater monitoring well system at the Ash Ponds consists of seven monitoring wells (W-29, W-30, W-31, W-32, W-33, W-34, and W-35) that are each screened in the uppermost aquifer at the Site. The locations of the CCR monitoring wells are shown on Figure 2. Well construction information and survey data for the CCR wells are summarized in Table 1, CCR monitoring well logs are presented in Appendix A, and photographs of the CCR wells are presented in Appendix B.

## 2.2 Local Geology and Hydrogeology

The Ash Ponds are located in the outcrop area of the Eocene-aged Wilcox Group (Barnes, 1966). PBW reviewed soil boring logs, monitoring well completion documentation, and historical reports to describe the geologic and hydrogeologic conditions in the Ash Pond area. Geologic cross sections were constructed using these data. The locations of the cross sections are shown on Figure 3 and the cross sections are shown on Figures 4 and 5.



The geology of the Ash Pond area consists of an upper clay and silt unit that extends from ground surface to about 5 to 25 feet below ground surface (bgs). The upper clay and silt unit is underlain by an approximately 20-foot to 40-foot thick unit of silty sand, which is underlain by a lower clay unit that ranged in thickness from less than 5 feet to about 15 feet. The uppermost aquifer at the Site occurs under unconfined to semi-confined conditions within the intermediate silty sand unit.

## 2.3 Groundwater Potentiometric Surface Elevations

Eight background groundwater monitoring events were performed using the Ash Pond CCR monitoring well system from October 2015 to December 2016. Static water levels measured during the background monitoring period indicated water elevations ranging from 354.80 feet above mean sea level (amsl) to 367.20 feet amsl, and depths to water ranging from 11.33 feet bgs to 25.74 feet bgs (Table 2). Groundwater potentiometric surface maps based on gauging data collected during the background monitoring period are presented in Appendix C.

Groundwater elevations were generally highest on the east side of the Ash Ponds, with an inferred groundwater flow direction to the west toward Lake Monticello. Based on the inferred direction of groundwater flow, the location of each CCR monitoring well relative to the Ash Ponds is as follows:

| Upgradient Wells | Downgradient Wells |
|---|---|
| W-31 | W-29 |
| W-32 | W-30 |
| W-33 | W-34 |
| | W-35 |

## 2.4 Uppermost Aquifer Hydraulic Conductivity Testing

PBW performed slug tests at monitoring wells W-32, W-33, and W-35 on October 5, 2015 to evaluate hydraulic properties of the uppermost aquifer at the site. Slug test data and time-head change plots used to calculate hydraulic conductivities and transmissivities of the uppermost aquifer are provided in Appendix D. A summary of these hydraulic properties is presented in Table 3. The average hydraulic conductivities for the wells ranged from 6.58 x $10^{-4}$ cm/sec (well W-35) to 8.42 x $10^{-3}$ cm/sec (well W-33), with a geometric mean for the test wells of 2.51 x $10^{-3}$cm/sec.



## 2.5 Conclusions

The CCR groundwater monitoring well system at the Ash Ponds complies with Section 257.91 of the CCR Rule. This conclusion is supported by the following as described in detail in previous sections of this report:

- Seven monitoring wells are included in the CCR groundwater monitoring system – three upgradient monitoring wells and four downgradient monitoring wells.

- Each monitoring well is screened in the uppermost aquifer at the site. Samples collected from upgradient monitoring wells will be representative of the quality of background groundwater that has not been affected by leakage from the CCR units. Samples collected from downgradient wells will ensure detection of groundwater contamination in the uppermost aquifer from the CCR units.

- The monitoring wells are constructed with appropriate well casing to maintain the integrity of the monitoring well borehole and with slotted well screens to enable collection of groundwater samples. In addition, the annular space above the well screen is appropriately sealed to prevent contamination of groundwater samples from surface sources.

- Appropriate documentation exists concerning the design, installation, and development of the monitoring wells.

## 3.0 REFERENCES

Barnes, Virgil E., 1966. Geologic Atlas of Texas, Texarkana Sheet. Texas Bureau of Economic Geology.

**Tables**

**TABLE 1**

**WELL CONSTRUCTION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | Date Installed | Northing | Easting | Screen Interval (feet bgs) | Top of Pad Elev. (feet amsl) | TOC Elev. (feet amsl) | Casing Diameter (inches) |
|---|---|---|---|---|---|---|---|
| W-29 | 8/26/2015 | 527058 | 2754498 | 27-37 | 374.94 | 377.59 | 2 |
| W-30 | 8/26/2015 | 527358 | 2755059 | 32-42 | 373.53 | 376.95 | 2 |
| W-31 | 8/25/2015 | 526969 | 2755498 | 33-43 | 372.99 | 376.33 | 2 |
| W-32 | 8/25/2015 | 526491 | 2755763 | 23-33 | 375.41 | 378.96 | 2 |
| W-33 | 8/25/2015 | 525819 | 2755454 | 20-30 | 383.69 | 387.16 | 2 |
| W-34 | 8/27/2015 | 525962 | 2754790 | 17-27 | 375.84 | 379.16 | 2 |
| W-35 | 8/27/2015 | 526365 | 2754542 | 25-35 | 377.86 | 381.15 | 2 |

Notes:

1. Abbreviations: bgs - below ground surface; amsl - above mean sea level; TOC - top of casing.

**TABLE 2**
**GROUNDWATER ELEVATION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | TOC Elevation (ft amsl) | Date | Depth to Water (ft btoc) | Water Elevation (ft amsl) |
|---|---|---|---|---|
| W-29 | 377.59 | 10/15/15 | 20.97 | 356.62 |
| | | 12/07/15 | 18.46 | 359.13 |
| | | 02/22/16 | 20.34 | 357.25 |
| | | 04/04/16 | 20.13 | 357.46 |
| | | 06/06/16 | 20.01 | 357.58 |
| | | 08/08/16 | 20.72 | 356.87 |
| | | 10/12/16 | 20.51 | 357.08 |
| | | 12/29/16 | 20.93 | 356.66 |
| W-30 | 376.95 | 10/15/15 | 19.49 | 357.46 |
| | | 12/07/15 | 14.91 | 362.04 |
| | | 02/22/16 | 17.19 | 359.76 |
| | | 04/04/16 | 16.04 | 360.91 |
| | | 06/06/16 | 14.77 | 362.18 |
| | | 08/08/16 | 14.98 | 361.97 |
| | | 10/12/16 | 17.62 | 359.33 |
| | | 12/29/16 | 16.14 | 360.81 |
| W-31 | 376.33 | 10/15/15 | 14.97 | 361.36 |
| | | 12/07/15 | 13.12 | 363.21 |
| | | 02/22/16 | 12.97 | 363.36 |
| | | 04/04/16 | 12.74 | 363.59 |
| | | 06/06/16 | 11.33 | 365.00 |
| | | 08/08/16 | 13.56 | 362.77 |
| | | 10/12/16 | 13.12 | 363.21 |
| | | 12/29/16 | 12.98 | 363.35 |
| W-32 | 378.96 | 10/15/15 | 15.46 | 363.50 |
| | | 12/07/15 | 13.99 | 364.97 |
| | | 02/22/16 | 13.49 | 365.47 |
| | | 04/04/16 | 13.26 | 365.70 |
| | | 06/06/16 | 11.76 | 367.20 |
| | | 08/08/16 | 14.31 | 364.65 |
| | | 10/12/16 | 13.72 | 365.24 |
| | | 12/29/16 | 13.77 | 365.19 |
| W-33 | 387.16 | 10/15/15 | 25.74 | 361.42 |
| | | 12/07/15 | 23.54 | 363.62 |
| | | 02/22/16 | 23.77 | 363.39 |
| | | 04/04/16 | 23.01 | 364.15 |
| | | 06/06/16 | 21.94 | 365.22 |
| | | 08/08/16 | 23.78 | 363.38 |
| | | 10/12/16 | 23.61 | 363.55 |
| | | 12/29/16 | 24.25 | 362.91 |
| W-34 | 379.16 | 10/15/15 | 24.36 | 354.80 |
| | | 12/07/15 | 23.03 | 356.13 |
| | | 02/22/16 | 22.51 | 356.65 |
| | | 04/04/16 | 22.68 | 356.48 |
| | | 06/06/16 | 24.09 | 355.07 |
| | | 08/08/16 | 22.22 | 356.94 |
| | | 10/12/16 | 22.58 | 356.58 |
| | | 12/29/16 | 23.04 | 356.12 |

**TABLE 2**
**GROUNDWATER ELEVATION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | TOC Elevation (ft amsl) | Date | Depth to Water (ft btoc) | Water Elevation (ft amsl) |
|---|---|---|---|---|
| W-35 | 381.15 | 10/15/15 | 24.11 | 357.04 |
| | | 12/07/15 | 22.33 | 358.82 |
| | | 02/22/16 | 23.17 | 357.98 |
| | | 04/04/16 | 22.93 | 358.22 |
| | | 06/06/16 | 22.16 | 358.99 |
| | | 08/08/16 | 23.47 | 357.68 |
| | | 10/12/16 | 23.31 | 357.84 |
| | | 12/29/16 | 23.65 | 357.50 |

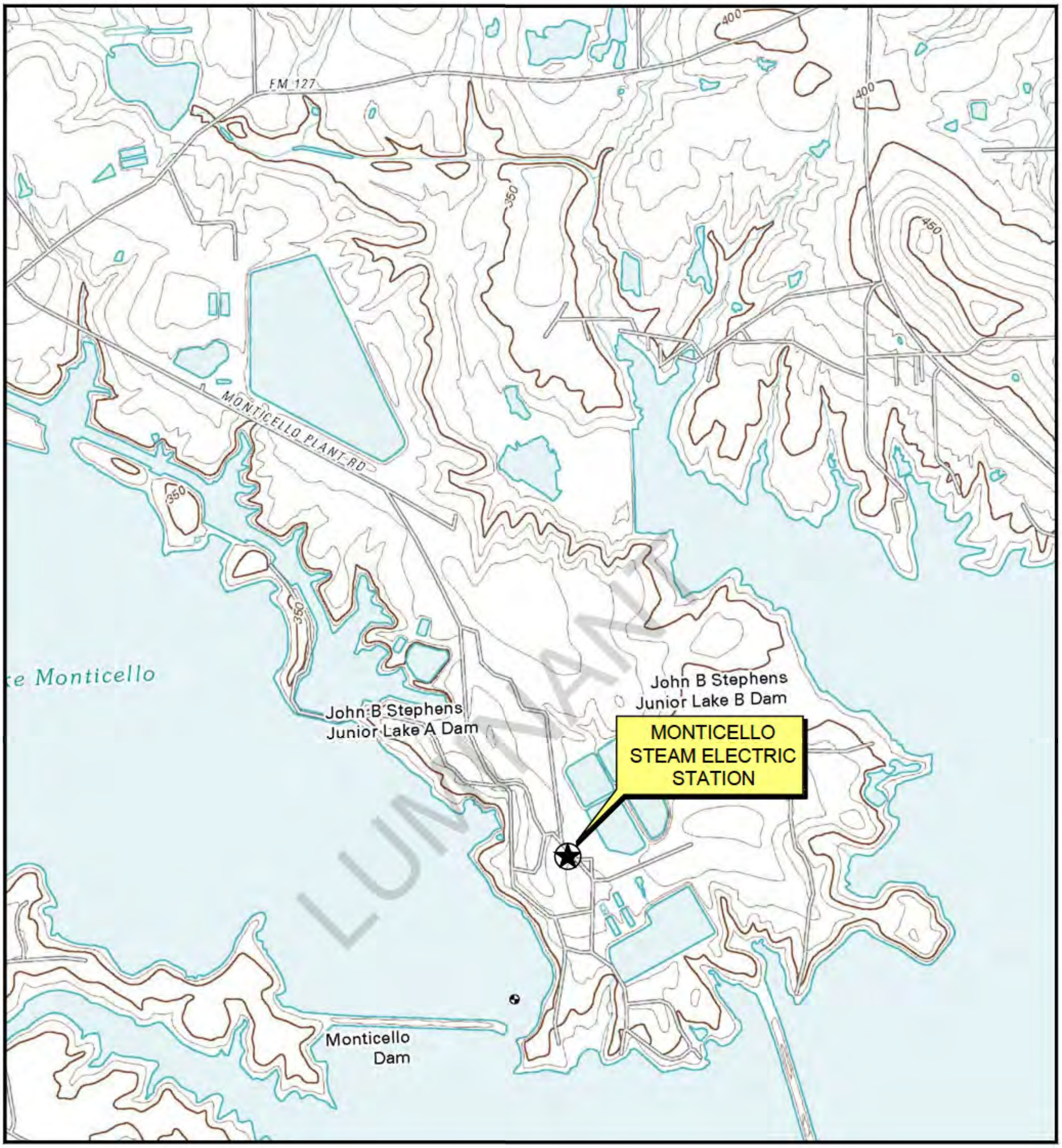
Notes:
1. Abbreviations: TOC - top of casing; ft - feet; amsl - above mean sea level.

**SUMMARY OF AQUIFER TEST RESULTS**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | Test Type | Aquifer Type | Analysis Method | Saturated Thickness (feet) | Results | |
|---|---|---|---|---|---|---|
| | | | | | T ($cm^2$/sec) | K (cm/sec) |
| | | | | | | |
| W-32 | Slug-In | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 1.95E+00 | 3.56E-03 |
| W-32 | Slug-Out | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 1.20E+00 | 2.19E-03 |
| | | | | **MEAN** | **1.58E+00** | **2.87E-03** |
| W-33 | Slug-Out[1] | Unconfined | Bouwer-Rice | 8 | **1.97E+00** | **8.42E-03** |
| | | | | | | |
| W-35 | Slug-In | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 4.08E-01 | 7.43E-04 |
| W-35 | Slug-Out | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 3.14E-01 | 5.72E-04 |
| | | | | **MEAN** | **3.61E-01** | **6.58E-04** |
| | | | | **MEAN FOR ALL TESTS** | **1.04E+00** | **2.51E-03** |

Notes:
[1] - A slug-in test was not performed because the static water level was below top of screen.

**Figures**





QUADRANGLE LOCATIONS

N

Scale in Feet

0 1000 2000

SOURCE:
Base map from www.tnris.gov, Monticello, TX 7.5 min. USGS Quadrangle dated 2010.

**MONTICELLO STEAM ELECTRIC STATION**
MONTICELLO, TEXAS

Figure 1

**ASH PONDS**
**SITE LOCATION MAP**

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: SEPT., 2015 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS


## EXPLANATION

CCR Monitoring Well Location

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 2

# ASH PONDS DETAILED SITE PLAN

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS


## EXPLANATION

- CCR Monitoring Well Location
- Soil Boring Location
- A___A' Geologic Cross Section Location Lines

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 3

# ASH PONDS CROSS SECTION LOCATION MAP

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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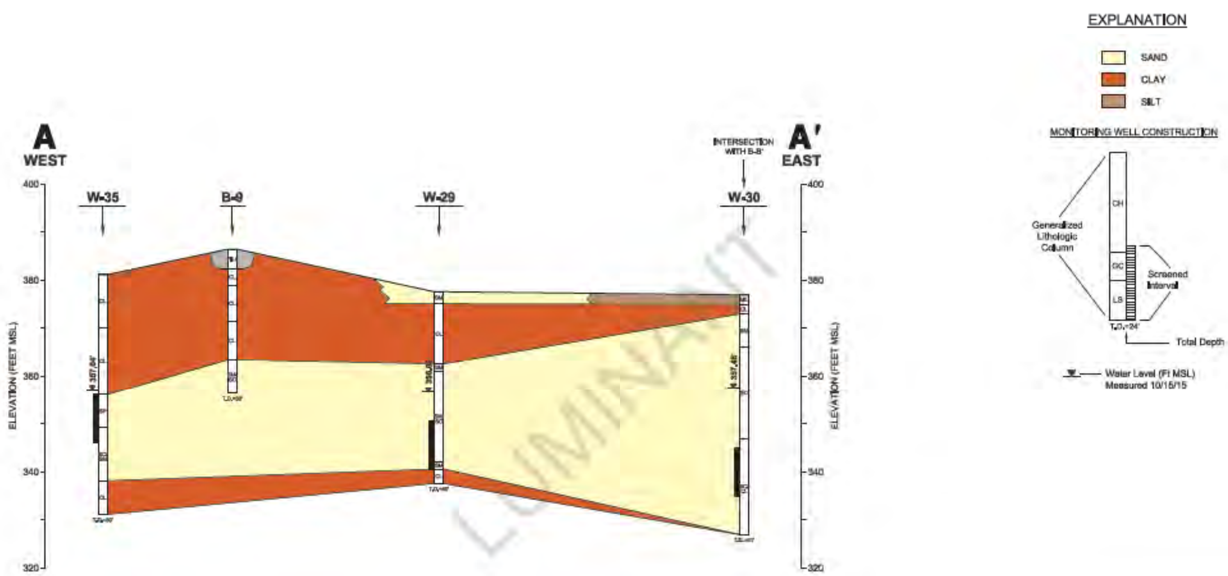


SCALE IN FEET

VERTICAL 20

HORIZONTAL 200

10x Vertical Exaggeration

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 4

**ASH PONDS**
**GEOLOGIC CROSS SECTION A-A'**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: OCT., 2017 | CHECKED: PJB | |

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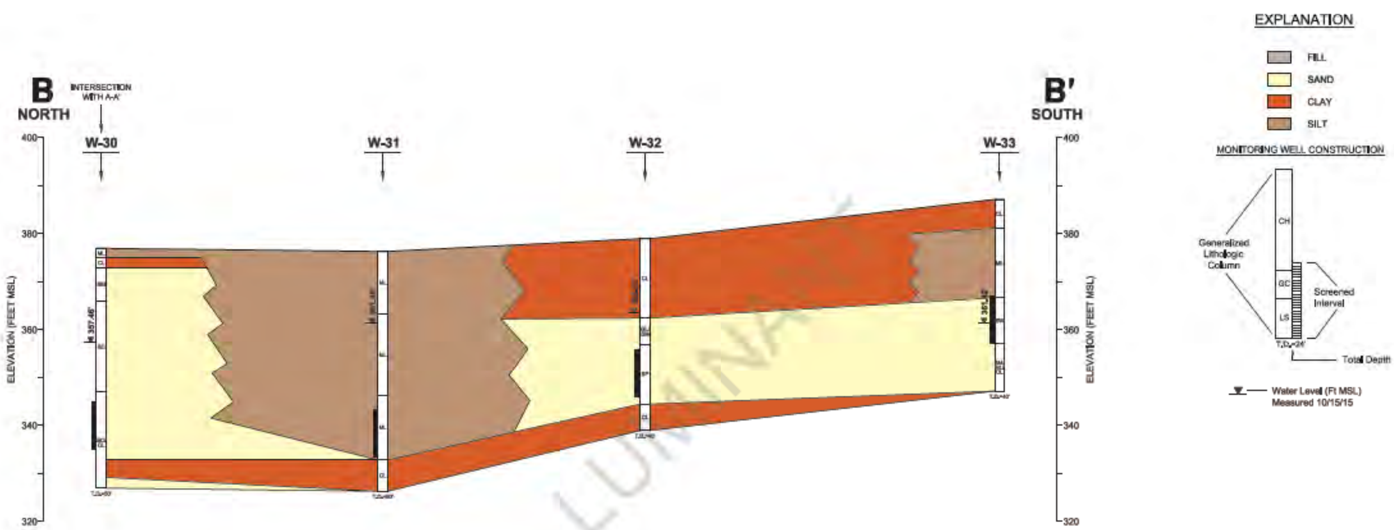
CONSULTING ENGINEERS AND SCIENTISTS





**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 5

**ASH PONDS**
**GEOLOGIC CROSS SECTION B-B'**

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: OCT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS

**Appendix A**

**CCR Monitoring Well Logs**

# Luminant

# Log of Boring: W-29

| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
|---|---|---|---|---|
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 377.59 |
| | Logged By: | Sara Taube | Northing: | 527057.69 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2754497.97 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 | | SM | (0 - 2.5) FILL, silty sand, dark gray, fine grained, moist, soft |
| 5 | 3.5/10.0 | CL | (2.5 - 15) Silty CLAY, reddish brown with orange streaks, local gray sand lenses, gradually becoming sandy silty clay, more grays, gradational basal contact, moist, hard, low plasticity |
| 10 | | | |
| 15 | 8.5/10.0 | SM | (15 - 16.5) Silty SAND, gray, poorly sorted, sharp basal contact, slightly moist, soft |
| 20 | | | |
| 25 | 8.5/10.0 | SM/SC | (16.5 - 35.5) Silty clayey SAND, gray-light reddish brown with orange mottling, 2"-4" layers of light gray silty sand interspersed, 6" gray sand at 21.5-22', slightly moist, firm, low plasticity |
| 30 | | | |
| 35 | 10.0/10.0 | SM | (35.5 - 37) Silty SAND, light gray- reddish brown, very fine grained, poorly sorted, sharp basal contact, wet, soft |
| | | CL | (37 - 40) CLAY, light gray- purple, some orange mottling, moist, hard, low to medium plasticity |
| 40 | | | |



**PBW**

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Round Rock, TX 78664
Tel (512) 671-3434 Fax (512) 671-3446

Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 27) Casing, 2" Sch 40 FJT PVC
(27 - 37) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-23') Grout
(23'-25') Bentonite chips
(25'-37') 20/40 sand
(37'-40') Bentonite chips

# Luminant

# Log of Boring: W-30

| | | | | |
|---|---|---|---|---|
| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 376.95 |
| | Logged By: | Sara Taube | Northing: | 527358.15 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755059.04 |

| Depth (ft) | Well Materials | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|---|
| 0 | | | ML | (0 - 2) FILL, clayey silt, light gray-brown, roots, carbonate nodules, some orange clayey lenses, becomes sandy with depth, light gray sand lens at 2', dry, hard |
| | | | CL | (2 - 4) Silty sandy CLAY, orange-light gray mottling, sharp basal contact, dry, hard, low plasticity |
| 5 | | 7.5/10.0 | SM | (4 - 11) Silty SAND, very fine grained, light gray with some red-orange clay lesnes beginning at 9', dry, soft |
| 10 | | | | |
| 15 | | 7.0/10.0 | | |
| 20 | | | SC | (11 - 30) Clayey SAND with silt, light gray with orange and yellow mottling, sandier with depth and less cohesive, minimal clay below 18', very sandy to 22', becomes clayey and gray again (reddish brown sand), thin light gray sand layers interbedded, very fine grained, some purple clay mottling around 27.5', dry to slightly moist, soft to firm |
| 25 | | 9.5/10.0 | | |
| 30 | | | | |
| 35 | | 9.5/10.0 | | |
| 40 | | | SC/CL | (30 - 50) Interbedded clayey SAND and silty CLAY, light gray with purple or orange mottling in clay, sand typically uniform gray, mostly gray and sandy before 36', below 40' areas of gray and purple mottling in clayier layers, gray with red-orange mottling in sandier layers (40'-42', 47.5'-50'), generally clayier with depth from 42' to 47.5', moist, soft to firm, none to low plasicity |
| 45 | | 10.0/10.0 | | |
| 50 | | | | |



**PBW**

**Pastor, Behling & Wheeler, LLC**
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Tel (512) 671-3434 Fax (512) 671-3446

Notes:
1. This log should not be used separately from the report to which it is attached.

**Well Materials**
(0 - 32) Casing, 2" Sch 40 FJT PVC
(32 - 42) Screen, 2" Sch 40 FJT PVC, 0.010" slot

**Annular Materials**
(0-28') Grout
(28'-30') Bentonite chips
(30'-42') 20/40 sand

# Luminant

# Log of Boring: W-31

| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/25/2015 | Drilling Method: | Sonic |
|---|---|---|---|---|
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 376.33 |
| | Logged By: | Sara Taube | Northing: | 526968.69 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755497.73 |

| Depth (ft) | Well Materials | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|---|
| 0–13 | | 7.9/10.0 (0–10) | ML | (0 - 13) FILL, clayey silt, brown-orange, carbonate nodules to 4', clayier with gray and orange mottling 4'-6.5, sandier with depth, some rock fragments 0-4', sharp basal contact, fill potentially ends at 4', dry, soft to firm, none to low plasticity |
| 13–30 | | 6.0/10.0 (10–20); 9.5/10.0 (20–30) | ML | (13 - 30) Clayey SILT, brown-gray with orange-red mottling, local gray sand lenses, interbedded silty sand and clayey silt: sandier brown-dark brown with red mottling (20'-23.5'), clayier brown with orange and gray mottling (23.5'- 27'), gray and sandy (27'-30'), dry, firm to hard, low to medium plasticity |
| 30–43.5 | | 10.0/10.0 (30–40) | ML | (30 - 43.5) Sandy, clayey SILT, gray with orange mottling, fine grained sand, gray with orange mottling- appears bioturbated with interspersed very fine to fine grained sand lenses (2"-4") (33'-40'), sandier with depth and less orange mottling, moist |
| 43.5–50 | | 10.0/10.0 (40–50) | CL | (43.5 - 50) Silty CLAY, with thin interbedded silty sands, gray with purple and orange mottling, sand is very fine grained, poorly sorrted, light gray, moist, hard, low plasticity |



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Notes:
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Well Materials
(0 - 33) Casing, 2" Sch 40 FJT PVC
(33 - 43) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-29') Grout
(29'-31') Bentonite chips
(31'-43) 20/40 sand

# Luminant

# Log of Boring: W-32

| | | | | |
|---|---|---|---|---|
| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 378.96 |
| | Logged By: | Sara Taube | Northing: | 526491.03 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755762.58 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 – 16.5 | 8.0/10.0 (0–10); 9.0/10.0 (10–20) | CL | (0 - 16.5) Silty CLAY, gray with red-orange mottling, interbedded silty sand intervals (gray and red) up to 4" thick, clay becomes more gray with depth, sand is very fine grained, slightly moist, hard, medium plasticity |
| 16.5 – 22 | | SM/CL | (16.5 - 22) Interbedded silty CLAY and silty SAND, clay is light gray with some orange mottling, low plasticity, sand is very fine grained, poorly sorted, light red-brown, soft and wet, sand intervals are approximately 4.5" thick |
| 22 – 34.5 | 6.5/10.0 (20–30); 9.5/10.0 (30–40) | SP | (22 - 34.5) SAND with some silt present, light red-brown, very fine to fine grained, 2"-3" lenses of light gray silty sand, increasing gray lenses with depth, moist to wet, soft |
| 34.5 – 40 | | CL | (34.5 - 40) Silty CLAY, gray with orange and purple mottling, occasional gray sand lenses, reddish purple (36.5'-37'), no orange below 36', moist, hard, low to medium plasticity |



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Notes:
1. This log should not be used separately from the report to which it is attached.

**Well Materials**
(0 - 23) Casing, 2" Sch 40 FJT PVC
(23 - 33) Screen, 2" Sch 40 FJT PVC, 0.010" slot

**Annular Materials**
(0-19') Grout
(19'-21') Bentonite chips
(21'-33') 20/40 sand
(33'-40') Bentonite chips

# Luminant

# Log of Boring: W-33

| | | | | |
|---|---|---|---|---|
| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/25/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 387.16 |
| | Logged By: | Will Vienne | Northing: | 525819 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755454.17 |

| Depth (ft) | Well Materials | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|---|
| 0–6 | | 5.7/10.0 | CL | (0 - 6) FILL, silty clay at 0-1.4', low plasticity, dark gray with grass/roots near surface; silty sand with thin clayey sand beds below 1.4', gray-brown to light brown, trace orange mottling, dry, soft to slightly firm, sharp basal contact |
| 6–20.5 | | 8.0/10.0 | ML | (6 - 20.5) Sandy, clayey SILT, red with orange mottling, becoming more orange below 11', abundant orange and gray laminae; sand is very fine grained, poorly sorted, unconsolidated to slightly consolidated, abundant organic very dark gray clay at 20-20.5', moist, gradational contact |
| 20.5–30 | | 8.2/10.0 | SW | (20.5 - 30) SAND, light yellow-brown and gray with reddish mottling, fining upward, very fine grained and poorly sorted at 20.5'-25' (very fine to fine grained and moderately sorted below 25', unconsolidated, fine grained black accessory minerals below 25'), petrified wood fragments at 30', wet |
| 30–40 | | 8.8/10.0 | SM/ML/CL | (30 - 40) Interbedded silty SAND, sandy SILT, and silty CLAY; silty clay at 32'-32.7, 36'-36.5', and 35.4'-36.4'; light gray with abundant orange and light brown mottling, low plasticity, wet, slightly firm |


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Notes:
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Well Materials
(0 - 20) Casing, 2" Sch 40 FJT PVC
(20 - 30) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-16') Grout
(16'-18') Bentonite chips
(18'-30) 20/40 sand
(30'-36') Bentonite chips

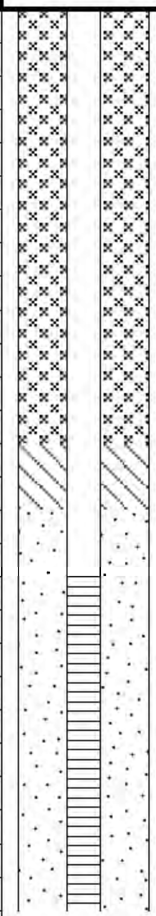
# Luminant

# Log of Boring: W-34

Monticello Steam Electric Station
Mount Pleasant, TX

PBW Project No. 5164C

| | | | |
|---|---|---|---|
| Completion Date: | 8/27/2015 | Drilling Method: | Sonic |
| Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 379.16 |
| Logged By: | Sara Taube | Northing: | 525962.02 |
| Sampling Method: | 4"x10' Core barrel | Easting: | 2754789.66 |



| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 - 10 | 5.2/10.0 | SC/SM | (0 - 10) FILL; clayey, silty sand; light to dark gray with reddish brown, roots to 4', carbonate nodules to 1', orange clay layer 1'-1.5', dry to moist, soft to slightly firm |
| 10 - 16.5 | 6.0/10.0 | CL | (10 - 16.5) Silty CLAY, light gray with orange mottling, small light gray sand lenses, gradational basal contact, slightly moist, firm to hard, low plasticity |
| 16.5 - 21.5 | | SP | (16.5 - 21.5) SAND, light gray, some fines, thin interbeds of sandy clay (reddish brown), slightly moist, soft |
| 21.5 - 25 | 8.0/10.0 | SC/SM | (21.5 - 25) Silty, clayey SAND, light reddish brown, fine-coarse black gravel at 25' and maroon/red staining, moist to wet, soft |
| 25 - 40 | 8.5/10.0 | CL | (25 - 40) Silty, sandy CLAY, light gray with orange and purple mottling, thin red-brown sandy layers interbedded, 4" sandy layer at 27', mostly purple below 34', moist, hard, low plasticity |



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Notes:
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Well Materials
(0 - 17) Casing, 2" Sch 40 FJT PVC
(17 - 27) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-13') Grout
(13'-15') Bentonite chips
(15'-27) 20/40 sand

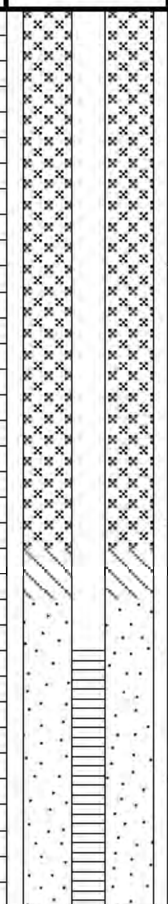
# Luminant

# Log of Boring: W-35

Monticello Steam Electric Station
Mount Pleasant, TX

PBW Project No. 5164C

| | | | |
|---|---|---|---|
| Completion Date: | 8/27/2015 | Drilling Method: | Sonic |
| Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 381.15 |
| Logged By: | Sara Taube | Northing: | 526364.73 |
| Sampling Method: | 4"x10' Core barrel | Easting: | 2754541.91 |



| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 - 11 | 4.1/10.0 | CL | (0 - 11) FILL, silty clay, light gray-red, platey, friable, dry; becomes silt at 1.5', light brown, very soft; silty sand (2'-2.5'), brown, moist; clayey silty sand (2.5'-11'), dark brown, moist, sharp basal contact |
| 11 - 25 | 4.9/10.0 | CL | (11 - 25) Silty, sandy CLAY, light gray with red and orange mottling, more clay with depth to 20', sandier to 25', sharp basal contact, slightly moist, firm, low plasticity |
| 25 - 32 | 6.8/10.0 | SP | (25 - 32) SAND, some fines, very fine to fine grained, light brown-reddish brown-light gray, moist to wet, soft |
| 32 - 43 | 8.3/10.0 | SC/SM | (32 - 43) Silty, clayey SAND, light gray-light brown with reddish brown, sandier areas are light gray, clayier areas are reddish brown-light brown (32'-35'), light gray (35'-37'), red-brown (37'-43'), fine-medium black subangular gravel (40'-43'), all gradual changes, moist to wet, soft to firm |
| 43 - 50 | 7.5/10.0 | CL | (43 - 50) Silty CLAY, light gray with purple and orange mottling, some very fine sand, intermittent 2" light gray sandy layers, moist, hard, low plasticity |

Recovery intervals: 0-10 ft 4.1/10.0; 10-20 ft 4.9/10.0; 20-30 ft 6.8/10.0; 30-40 ft 8.3/10.0; 40-50 ft 7.5/10.0



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Notes:
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Well Materials
(0 - 25) Casing, 2" Sch 40 FJT PVC
(25 - 35) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-21') Grout
(21'-23') Bentonite chips
(23'-35) 20/40 sand

# Appendix B

## Photographs of CCR Groundwater Monitoring Wells

**Appendix B – Photographs of CCR Groundwater Monitoring Wells**
**Monticello Steam Electric Station Ash Ponds**

**Photograph 1: W-29**

**Photograph 2: W-30**

## Appendix B – Photographs of CCR Groundwater Monitoring Wells
## Monticello Steam Electric Station Ash Ponds


**Photograph 3: W-31**

**Photograph 4: W-32**

**Appendix B – Photographs of CCR Groundwater Monitoring Wells**
**Monticello Steam Electric Station Ash Ponds**

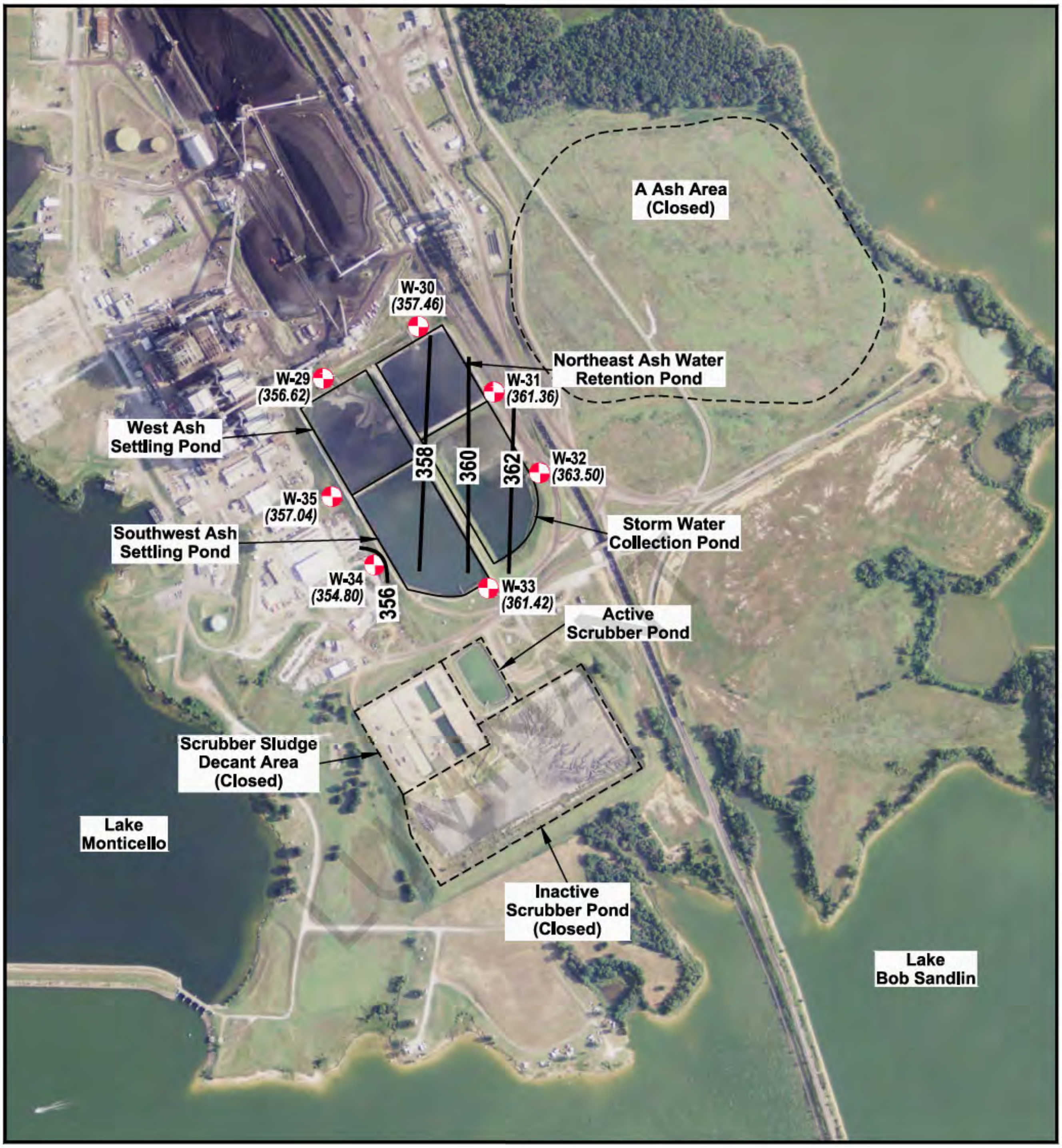
**Photograph 5: W-33**

**Photograph 6: W-34**

**Photograph 7: W-35**

**Appendix C**

**Groundwater Potentiometric Surface Maps**




## EXPLANATION

CCR Monitoring Well Location

*(357.26)* Groundwater Potentiometric Surface (ft. AMSL)

— 358 — Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

**MONTICELLO STEAM ELECTRIC STATION**

MT. PLEASANT, TEXAS

Figure 2

**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - OCT. 15, 2015**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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CONSULTING ENGINEERS AND SCIENTISTS


## EXPLANATION

CCR Monitoring Well Location

*(357.26)* Groundwater Potentiometric Surface (ft. AMSL)

— 358 — Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 3

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC SURFACE MAP - DEC. 7, 2015**

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 4

**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - FEB. 22, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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**EXPLANATION**

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 5

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC SURFACE MAP - APRIL 4, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

CCR Monitoring Well Location

*(357.26)* Groundwater Potentiometric Surface (ft. AMSL)

— 358 — Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 6

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC SURFACE MAP - JUNE 6, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- 358 Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 7

**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - AUGUST 8, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

CCR Monitoring Well Location

*(357.26)* Groundwater Potentiometric Surface (ft. AMSL)

— 358 — Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**

MT. PLEASANT, TEXAS

Figure 8

**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - OCTOBER 12, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 9

**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - DECEMBER 29, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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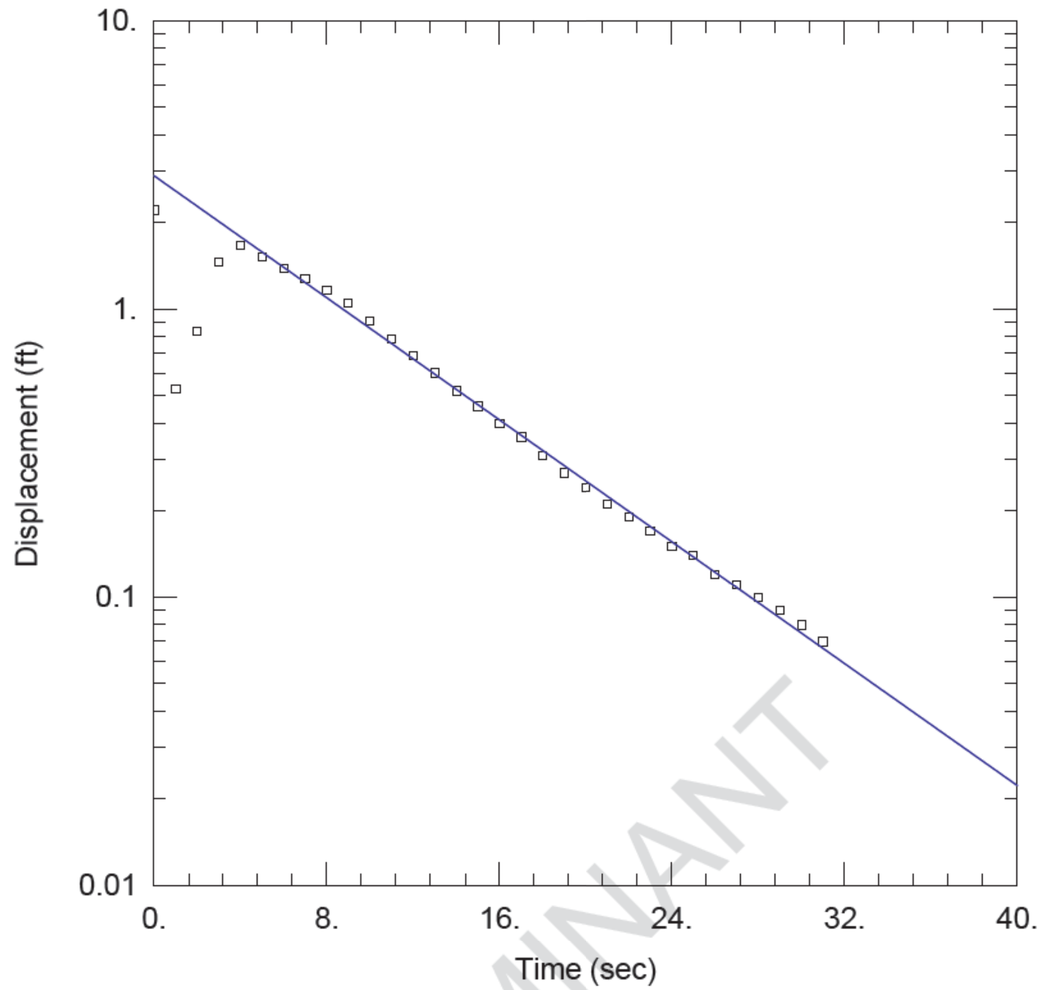
# Appendix D

## Aquifer Test Data





W-32 SLUG IN

Data Set: J:\...\W-32 Slug In.aqt
Date: 09/26/17 Time: 11:41:55

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-32)

Initial Displacement: 2.2 ft Static Water Column Height: 21.56 ft
Total Well Penetration Depth: 16.5 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.003557 cm/sec y0 = 2.898 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-32 Slug In
Date: 09/26/17
Time: 11:42:21

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-32

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 21.56 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 16.5 ft

No. of Observations: 31

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.53 | 17. | 0.36 |
| 2. | 0.84 | 18. | 0.31 |
| 3. | 1.46 | 19. | 0.27 |
| 4. | 1.66 | 20. | 0.24 |
| 5. | 1.51 | 21. | 0.21 |
| 6. | 1.38 | 22. | 0.19 |
| 7. | 1.27 | 23. | 0.17 |
| 8. | 1.16 | 24. | 0.15 |
| 9. | 1.05 | 25. | 0.14 |
| 10. | 0.91 | 26. | 0.12 |
| 11. | 0.79 | 27. | 0.11 |
| 12. | 0.69 | 28. | 0.1 |
| 13. | 0.6 | 29. | 0.09 |
| 14. | 0.52 | 30. | 0.08 |
| 15. | 0.46 | 31. | 0.07 |
| 16. | 0.4 | | |

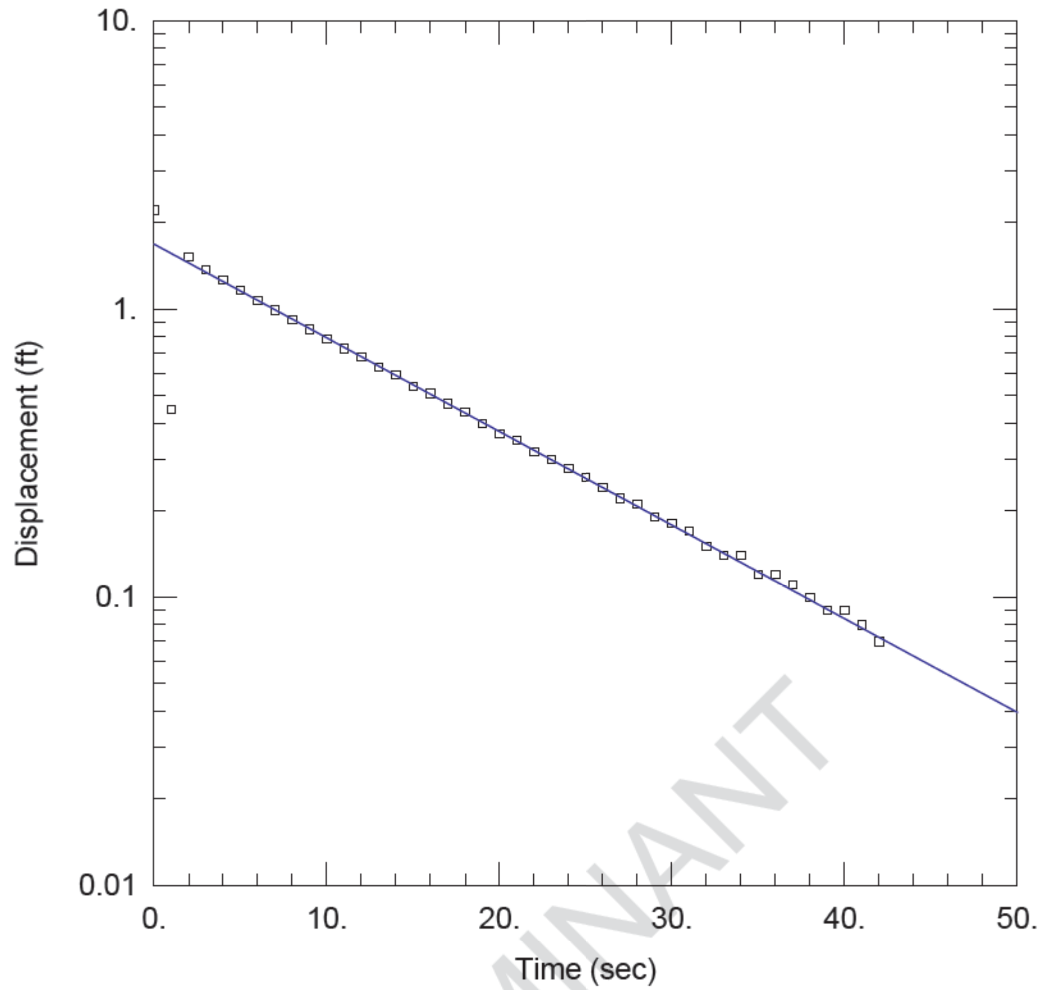
## SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.782

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate |
|---|---|






## W-32 SLUG OUT

Data Set: J:\...\W-32 Slug Out.aqt
Date: 09/26/17 Time: 11:42:50

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

## AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (W-32)

Initial Displacement: 2.2 ft Static Water Column Height: 21.56 ft
Total Well Penetration Depth: 16.5 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

## SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.002185 cm/sec y0 = 1.679 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-32 Slug Out
Date: 09/26/17
Time: 11:43:03

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-32

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 21.56 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 16.5 ft

No. of Observations: 42

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.45 | 22. | 0.32 |
| 2. | 1.51 | 23. | 0.3 |
| 3. | 1.37 | 24. | 0.28 |
| 4. | 1.26 | 25. | 0.26 |
| 5. | 1.16 | 26. | 0.24 |
| 6. | 1.07 | 27. | 0.22 |
| 7. | 0.99 | 28. | 0.21 |
| 8. | 0.92 | 29. | 0.19 |
| 9. | 0.85 | 30. | 0.18 |
| 10. | 0.79 | 31. | 0.17 |
| 11. | 0.73 | 32. | 0.15 |
| 12. | 0.68 | 33. | 0.14 |
| 13. | 0.63 | 34. | 0.14 |
| 14. | 0.59 | 35. | 0.12 |
| 15. | 0.54 | 36. | 0.12 |
| 16. | 0.51 | 37. | 0.11 |
| 17. | 0.47 | 38. | 0.1 |
| 18. | 0.44 | 39. | 0.09 |
| 19. | 0.4 | 40. | 0.09 |
| 20. | 0.37 | 41. | 0.08 |
| 21. | 0.35 | 42. | 0.07 |

## SOLUTION

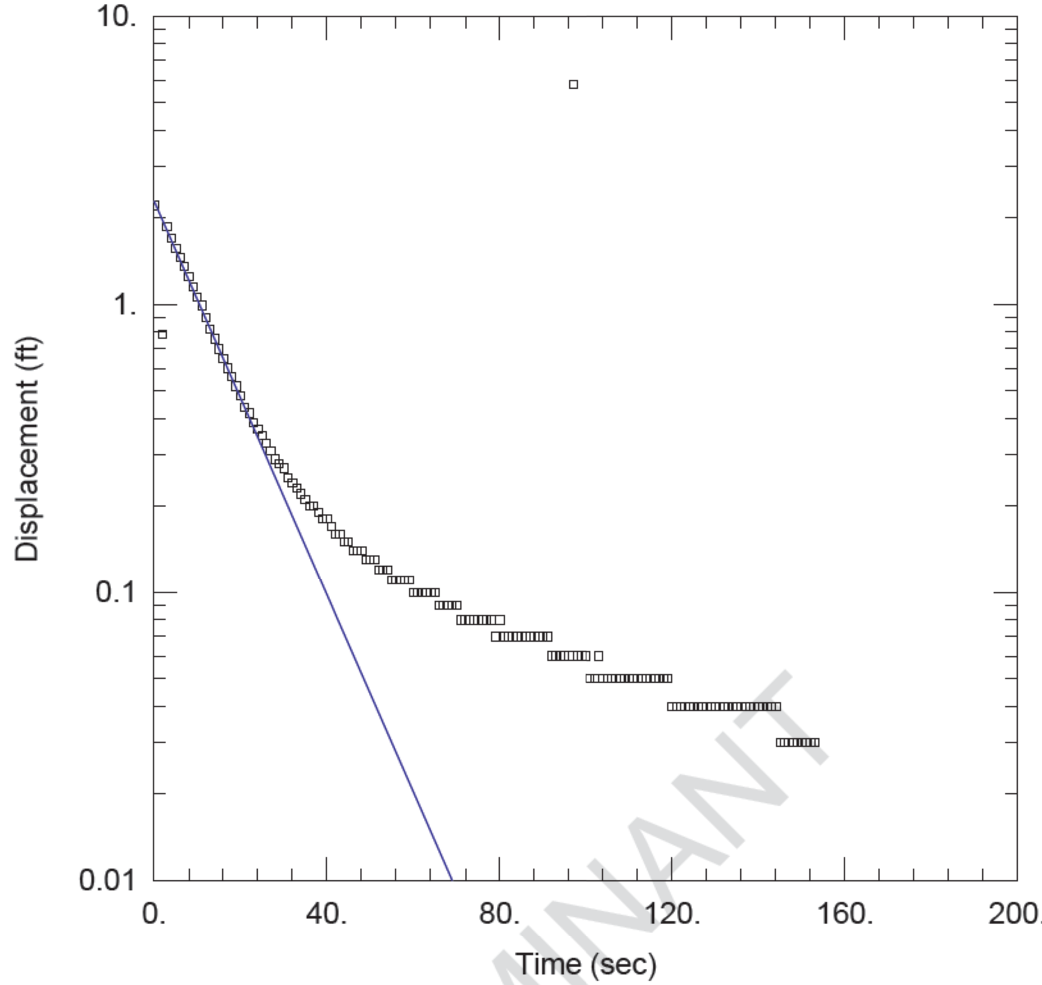
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.782

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.002185 | cm/sec |
| y0 | 1.679 | ft |

T = K*b = 1.199 $cm^2$/sec






## W-33 SLUG OUT

Data Set: J:\...\W-33 Slug Out.aqt
Date: 09/26/17 Time: 11:43:34

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

## AQUIFER DATA

Saturated Thickness: 7.69 ft
Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (W-33)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 7.69 ft
Screen Length: 10. ft
Well Radius: 0.27 ft
Gravel Pack Porosity: 0.2

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.008423 cm/sec
y0 = 2.281 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-33 Slug Out
Date: 09/26/17
Time: 11:44:01

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 7.69 ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-33

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 7.69 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1417 ft
Gravel Pack Porosity: 0.2

No. of Observations: 154

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 0. | 0. | 77. | 0.08 |
| 1. | -0.08 | 78. | 0.08 |
| 2. | 0.79 | 79. | 0.07 |
| 3. | 1.86 | 80. | 0.08 |
| 4. | 1.7 | 81. | 0.07 |
| 5. | 1.56 | 82. | 0.07 |
| 6. | 1.45 | 83. | 0.07 |
| 7. | 1.35 | 84. | 0.07 |
| 8. | 1.25 | 85. | 0.07 |
| 9. | 1.15 | 86. | 0.07 |
| 10. | 1.06 | 87. | 0.07 |
| 11. | 0.99 | 88. | 0.07 |
| 12. | 0.9 | 89. | 0.07 |
| 13. | 0.82 | 90. | 0.07 |
| 14. | 0.76 | 91. | 0.07 |
| 15. | 0.7 | 92. | 0.06 |
| 16. | 0.65 | 93. | 0.06 |
| 17. | 0.6 | 94. | 0.06 |
| 18. | 0.56 | 95. | 0.06 |
| 19. | 0.52 | 96. | 0.06 |
| 20. | 0.48 | 97. | 5.8 |
| 21. | 0.44 | 98. | 0.06 |
| 22. | 0.42 | 99. | 0.06 |
| 23. | 0.39 | 100. | 0.06 |
| 24. | 0.37 | 101. | 0.05 |
| 25. | 0.35 | 102. | 0.05 |
| 26. | 0.33 | 103. | 0.06 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 27. | 0.31 | 104. | 0.05 |
| 28. | 0.29 | 105. | 0.05 |
| 29. | 0.28 | 106. | 0.05 |
| 30. | 0.27 | 107. | 0.05 |
| 31. | 0.25 | 108. | 0.05 |
| 32. | 0.24 | 109. | 0.05 |
| 33. | 0.23 | 110. | 0.05 |
| 34. | 0.22 | 111. | 0.05 |
| 35. | 0.21 | 112. | 0.05 |
| 36. | 0.2 | 113. | 0.05 |
| 37. | 0.2 | 114. | 0.05 |
| 38. | 0.19 | 115. | 0.05 |
| 39. | 0.18 | 116. | 0.05 |
| 40. | 0.18 | 117. | 0.05 |
| 41. | 0.17 | 118. | 0.05 |
| 42. | 0.16 | 119. | 0.05 |
| 43. | 0.16 | 120. | 0.04 |
| 44. | 0.15 | 121. | 0.04 |
| 45. | 0.15 | 122. | 0.04 |
| 46. | 0.14 | 123. | 0.04 |
| 47. | 0.14 | 124. | 0.04 |
| 48. | 0.14 | 125. | 0.04 |
| 49. | 0.13 | 126. | 0.04 |
| 50. | 0.13 | 127. | 0.04 |
| 51. | 0.13 | 128. | 0.04 |
| 52. | 0.12 | 129. | 0.04 |
| 53. | 0.12 | 130. | 0.04 |
| 54. | 0.12 | 131. | 0.04 |
| 55. | 0.11 | 132. | 0.04 |
| 56. | 0.11 | 133. | 0.04 |
| 57. | 0.11 | 134. | 0.04 |
| 58. | 0.11 | 135. | 0.04 |
| 59. | 0.11 | 136. | 0.04 |
| 60. | 0.1 | 137. | 0.04 |
| 61. | 0.1 | 138. | 0.04 |
| 62. | 0.1 | 139. | 0.04 |
| 63. | 0.1 | 140. | 0.04 |
| 64. | 0.1 | 141. | 0.04 |
| 65. | 0.1 | 142. | 0.04 |
| 66. | 0.09 | 143. | 0.04 |
| 67. | 0.09 | 144. | 0.04 |
| 68. | 0.09 | 145. | 0.03 |
| 69. | 0.09 | 146. | 0.03 |
| 70. | 0.09 | 147. | 0.03 |
| 71. | 0.08 | 148. | 0.03 |
| 72. | 0.08 | 149. | 0.03 |
| 73. | 0.08 | 150. | 0.03 |
| 74. | 0.08 | 151. | 0.03 |
| 75. | 0.08 | 152. | 0.03 |
| 76. | 0.08 | 153. | 0.03 |



## SOLUTION

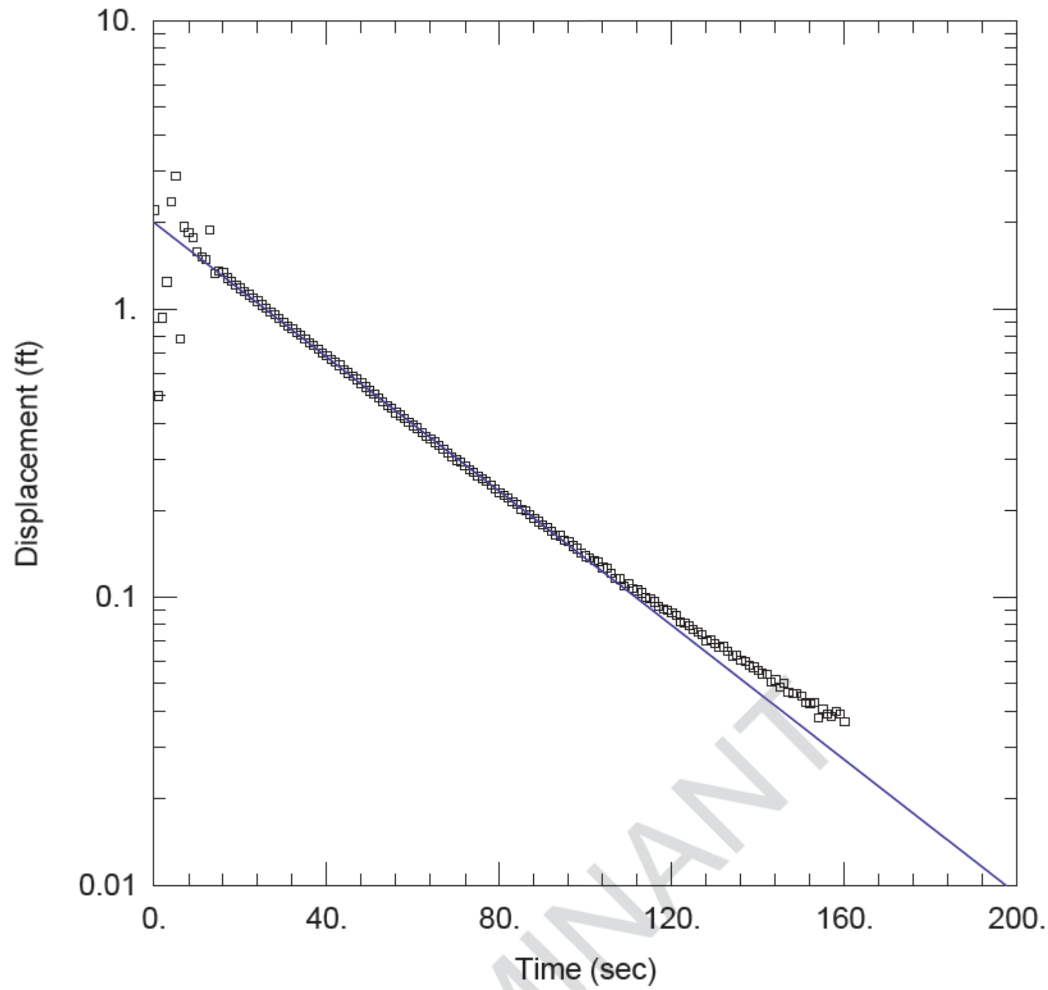
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.748

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.008423 | cm/sec |
| y0 | 2.281 | ft |

T = K*b = 1.974 $cm^2$/sec






W-35 SLUG IN

Data Set: J:\...\W-35 Slug In.aqt
Date: 09/26/17 Time: 11:49:25

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-35
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-35)

Initial Displacement: 2.2 ft Static Water Column Height: 22.38 ft
Total Well Penetration Depth: 14.38 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0007432 cm/sec y0 = 1.994 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-35 Slug In
Date: 09/26/17
Time: 11:44:39

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-35

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-35

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 22.38 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.38 ft

No. of Observations: 160

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.4999 | 81. | 0.2254 |
| 2. | 0.9332 | 82. | 0.2206 |
| 3. | 1.24 | 83. | 0.2146 |
| 4. | 2.357 | 84. | 0.2097 |
| 5. | 2.894 | 85. | 0.2017 |
| 6. | 0.7846 | 86. | 0.1997 |
| 7. | 1.928 | 87. | 0.193 |
| 8. | 1.835 | 88. | 0.188 |
| 9. | 1.765 | 89. | 0.183 |
| 10. | 1.573 | 90. | 0.179 |
| 11. | 1.52 | 91. | 0.1746 |
| 12. | 1.483 | 92. | 0.1701 |
| 13. | 1.885 | 93. | 0.1645 |
| 14. | 1.329 | 94. | 0.1635 |
| 15. | 1.35 | 95. | 0.1578 |
| 16. | 1.336 | 96. | 0.156 |
| 17. | 1.279 | 97. | 0.1506 |
| 18. | 1.247 | 98. | 0.1478 |
| 19. | 1.212 | 99. | 0.1429 |
| 20. | 1.18 | 100. | 0.1389 |
| 21. | 1.152 | 101. | 0.1369 |
| 22. | 1.122 | 102. | 0.1345 |
| 23. | 1.092 | 103. | 0.1322 |
| 24. | 1.063 | 104. | 0.1267 |
| 25. | 1.033 | 105. | 0.1262 |
| 26. | 1.006 | 106. | 0.121 |
| 27. | 0.9786 | 107. | 0.1158 |
| 28. | 0.9549 | 108. | 0.1156 |
| 29. | 0.9264 | 109. | 0.1096 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 30. | 0.897 | 110. | 0.1114 |
| 31. | 0.875 | 111. | 0.1069 |
| 32. | 0.8531 | 112. | 0.1053 |
| 33. | 0.8306 | 113. | 0.1032 |
| 34. | 0.8094 | 114. | 0.0999 |
| 35. | 0.7878 | 115. | 0.0988 |
| 36. | 0.7659 | 116. | 0.0961 |
| 37. | 0.7462 | 117. | 0.093 |
| 38. | 0.727 | 118. | 0.0907 |
| 39. | 0.7061 | 119. | 0.0897 |
| 40. | 0.6873 | 120. | 0.088 |
| 41. | 0.6698 | 121. | 0.086 |
| 42. | 0.653 | 122. | 0.0822 |
| 43. | 0.6381 | 123. | 0.081 |
| 44. | 0.6172 | 124. | 0.0798 |
| 45. | 0.6008 | 125. | 0.077 |
| 46. | 0.5857 | 126. | 0.0757 |
| 47. | 0.5699 | 127. | 0.0743 |
| 48. | 0.5532 | 128. | 0.0706 |
| 49. | 0.5358 | 129. | 0.0708 |
| 50. | 0.52 | 130. | 0.0691 |
| 51. | 0.5055 | 131. | 0.0669 |
| 52. | 0.4898 | 132. | 0.0671 |
| 53. | 0.4776 | 133. | 0.0649 |
| 54. | 0.4631 | 134. | 0.0625 |
| 55. | 0.4523 | 135. | 0.0627 |
| 56. | 0.4373 | 136. | 0.0605 |
| 57. | 0.4283 | 137. | 0.0598 |
| 58. | 0.4179 | 138. | 0.0581 |
| 59. | 0.4033 | 139. | 0.057 |
| 60. | 0.3943 | 140. | 0.0558 |
| 61. | 0.3861 | 141. | 0.0542 |
| 62. | 0.373 | 142. | 0.0539 |
| 63. | 0.3623 | 143. | 0.0508 |
| 64. | 0.3534 | 144. | 0.0515 |
| 65. | 0.3457 | 145. | 0.0488 |
| 66. | 0.3365 | 146. | 0.0503 |
| 67. | 0.327 | 147. | 0.0466 |
| 68. | 0.3173 | 148. | 0.0464 |
| 69. | 0.308 | 149. | 0.0464 |
| 70. | 0.2992 | 150. | 0.0453 |
| 71. | 0.2939 | 151. | 0.0432 |
| 72. | 0.2862 | 152. | 0.0425 |
| 73. | 0.2772 | 153. | 0.043 |
| 74. | 0.2721 | 154. | 0.038 |
| 75. | 0.2641 | 155. | 0.0409 |
| 76. | 0.2573 | 156. | 0.0393 |
| 77. | 0.2521 | 157. | 0.0385 |
| 78. | 0.2448 | 158. | 0.04 |
| 79. | 0.2376 | 159. | 0.0393 |
| 80. | 0.2309 | 160. | 0.0368 |



## SOLUTION

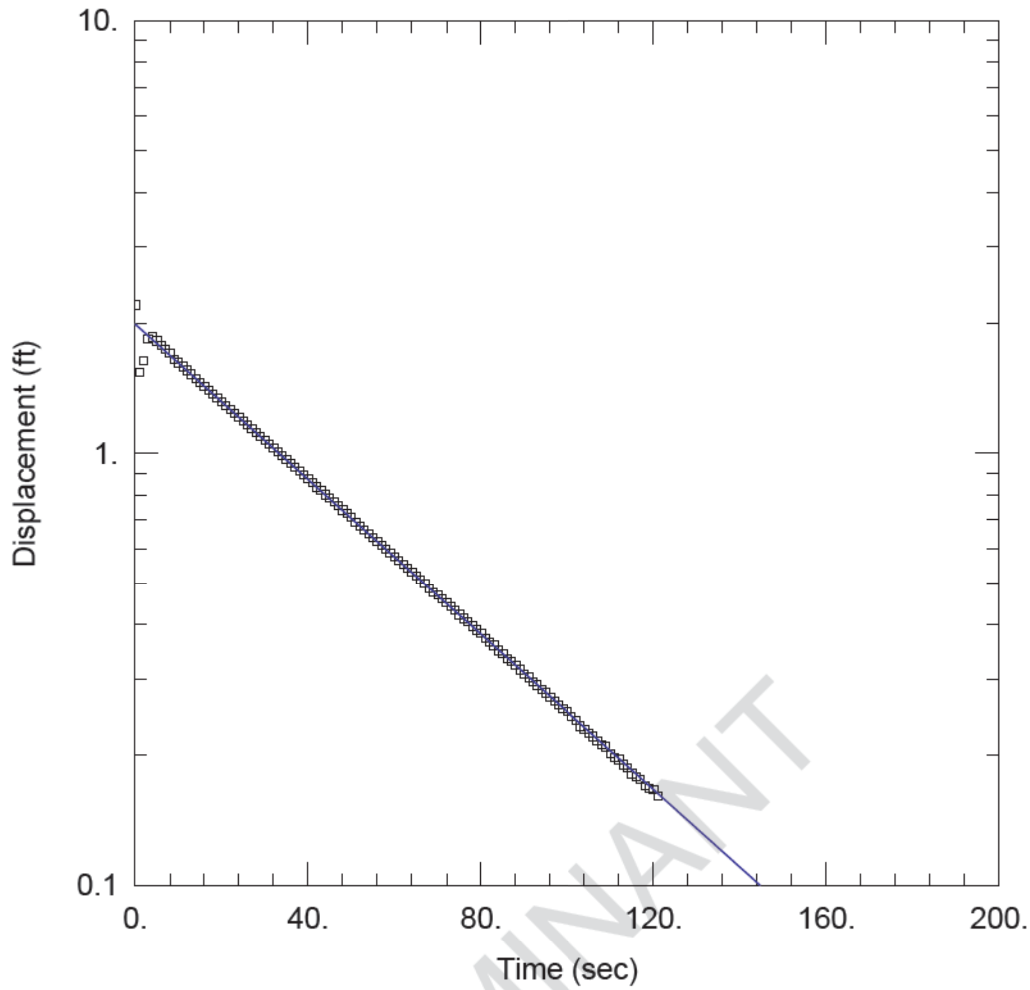
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.638

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.0007432 | cm/sec |
| y0 | 1.994 | ft |

T = K*b = 0.4077 $cm^2$/sec






W-35 SLUG OUT

Data Set: J:\...\W-35 Slug Out.aqt
Date: 09/26/17 Time: 11:52:25

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-35
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-35)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 14.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.38 ft
Screen Length: 10. ft
Well Radius: 0.27 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0005724 cm/sec
y0 = 1.988 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-35 Slug Out
Date: 09/26/17
Time: 11:52:48

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-35

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-35

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 22.38 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.38 ft

No. of Observations: 121

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 1.537 | 62. | 0.5529 |
| 2. | 1.634 | 63. | 0.5407 |
| 3. | 1.841 | 64. | 0.532 |
| 4. | 1.857 | 65. | 0.52 |
| 5. | 1.817 | 66. | 0.5091 |
| 6. | 1.774 | 67. | 0.4981 |
| 7. | 1.742 | 68. | 0.4862 |
| 8. | 1.702 | 69. | 0.4765 |
| 9. | 1.651 | 70. | 0.4697 |
| 10. | 1.62 | 71. | 0.46 |
| 11. | 1.587 | 72. | 0.4496 |
| 12. | 1.553 | 73. | 0.4411 |
| 13. | 1.522 | 74. | 0.4319 |
| 14. | 1.489 | 75. | 0.4221 |
| 15. | 1.46 | 76. | 0.4134 |
| 16. | 1.43 | 77. | 0.4061 |
| 17. | 1.401 | 78. | 0.3974 |
| 18. | 1.371 | 79. | 0.3891 |
| 19. | 1.343 | 80. | 0.3817 |
| 20. | 1.315 | 81. | 0.3723 |
| 21. | 1.288 | 82. | 0.3649 |
| 22. | 1.263 | 83. | 0.3583 |
| 23. | 1.236 | 84. | 0.3491 |
| 24. | 1.211 | 85. | 0.3423 |
| 25. | 1.187 | 86. | 0.3344 |
| 26. | 1.162 | 87. | 0.3288 |
| 27. | 1.137 | 88. | 0.322 |
| 28. | 1.115 | 89. | 0.3148 |
| 29. | 1.093 | 90. | 0.3082 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 30. | 1.069 | 91. | 0.3021 |
| 31. | 1.049 | 92. | 0.2949 |
| 32. | 1.026 | 93. | 0.2903 |
| 33. | 1.007 | 94. | 0.2828 |
| 34. | 0.986 | 95. | 0.2785 |
| 35. | 0.9649 | 96. | 0.2714 |
| 36. | 0.9476 | 97. | 0.2667 |
| 37. | 0.9265 | 98. | 0.2607 |
| 38. | 0.9085 | 99. | 0.2557 |
| 39. | 0.8898 | 100. | 0.2517 |
| 40. | 0.8713 | 101. | 0.2456 |
| 41. | 0.855 | 102. | 0.2409 |
| 42. | 0.8357 | 103. | 0.2334 |
| 43. | 0.8197 | 104. | 0.2296 |
| 44. | 0.802 | 105. | 0.2248 |
| 45. | 0.7868 | 106. | 0.2209 |
| 46. | 0.7708 | 107. | 0.216 |
| 47. | 0.7575 | 108. | 0.2114 |
| 48. | 0.7383 | 109. | 0.209 |
| 49. | 0.7258 | 110. | 0.2009 |
| 50. | 0.7101 | 111. | 0.197 |
| 51. | 0.6927 | 112. | 0.1952 |
| 52. | 0.679 | 113. | 0.1899 |
| 53. | 0.666 | 114. | 0.1865 |
| 54. | 0.6525 | 115. | 0.1811 |
| 55. | 0.6385 | 116. | 0.1782 |
| 56. | 0.6244 | 117. | 0.1753 |
| 57. | 0.6134 | 118. | 0.17 |
| 58. | 0.6001 | 119. | 0.1677 |
| 59. | 0.5871 | 120. | 0.1661 |
| 60. | 0.5765 | 121. | 0.1606 |
| 61. | 0.5634 | | |



## SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.638

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.0005724 | cm/sec |
| y0 | 1.988 | ft |

T = K*b = 0.3141 cm²/sec

**Deficiency #9 – Revised Attachment #7 for Items #23 – Geological Summary**

# TECHNICAL MEMORANDUM

**DATE** October 10, 2018 **Project No.** 18107517

**TO** Jeff Jones
Luminant Generation Company LLC

**FROM** Patrick J. Behling, P.E.

**LUMINANT GENERATION COMPANY LLC**
**CCR RULE LOCATION RESTRICTION DEMONSTRATION**
**MONTICELLO STEAM ELECTRIC STATION – TITUS COUNTY, TEXAS**
**ASH PONDS**

Luminant Generation Company LLC (Luminant) formerly operated the Monticello Steam Electric Station (MOSES) located approximately 6 miles southwest of Mt. Pleasant, Titus County, Texas. The MOSES consisted of three coal/lignite-fired units with a combined operating capacity of approximately 1,880 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, boiler slag, and scrubber gypsum were generated as part of MOSES unit operation. The MOSES suspended operations in early 2018.

The U.S. Environmental Protection Agency's (EPA's) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (CCR Rule) has established technical requirements for CCR landfills and surface impoundments (See 80 Fed. Reg. 21,302 (Apr. 17, 2015); 83 Fed. Reg. 36,435 (July 30, 2018)). The following surface impoundments at the MOSES have been identified as Existing CCR Surface Impoundments regulated under the CCR Rule:

- Southwest Ash Settling Pond (SASP);
- West Ash Settling Pond (WASP); and
- Northeast Ash Water Retention Pond (NAWRP).



The WASP, NAWRP and the SASP (collectively referred to as the "Ash Ponds") are located approximately 1,200 feet southeast of the MOSES power plant (Figure 1). The Ash Ponds are located immediately adjacent to each other and share interior earthen embankments. Due to their proximity to each other, the WASP, NAWRP, and SASP are considered one CCR surface impoundment (identified as the "Ash Ponds) under the CCR Rule.

Golder Associates Inc. (Golder) was retained by Luminant to evaluate the Ash Ponds against the five (5) applicable location restriction criteria for existing CCR surface impoundments described in Sections 257.60 through 257.64 of the CCR Rule. This memorandum sets forth Luminant's location restriction demonstrations and corresponding certifications required by the CCR Rule.

## LOCATION RESTRICTION DEMONSTRATION – SUMMARY OF FINDINGS/CONCLUSIONS

This location restriction demonstration concludes that the Ash Ponds satisfy four of the five CCR Rule location restriction criteria for existing CCR surface impoundments (wetlands, fault areas, seismic impact zone and unstable areas):

- The Ash Ponds were determined to not be located in wetlands as per §257.61.
- Based on the available published geologic data and information reviewed, the nearest known fault to the Ash Ponds is located approximately 17 miles north of the MOSES. Therefore, the Ash Ponds satisfy the location restriction criteria presented in §257.62.
- The Ash Ponds were determined to not be located in a Seismic Impact Zone as per §257.63.
- The Ash Ponds were determined to not be located in an Unstable Area as per §257.64.

The Ash Ponds do not comply with the uppermost aquifer separation criterion defined in §257.61. The elevation of the base of the pond liner in the Ash Ponds is below the upper limit of the uppermost aquifer due to normal fluctuations in groundwater elevations.

A professional engineering certification that covers all five location restriction evaluations is included on page 10 of this demonstration.



## MEMORANDUM ORGANIZATION

The memorandum is organized as follows:

SECTION 1.0 - Location Restriction Criteria & CCR Unit Description

SECTION 2.0 - Placement Above Uppermost Aquifer

SECTION 3.0 - Wetlands

SECTION 4.0 - Fault Areas

SECTION 5.0 - Seismic Impact Zone

SECTION 6.0 - Unstable Areas

SECTION 7.0 - Limitations

SECTION 8.0 - Professional Certification

FIGURE 1 – Site Plan – Ash Ponds

# SECTION 1.0 Location Restriction Criteria & CCR Unit Description

## LOCATION RESTRICTION CRITERIA

Existing CCR Surface Impoundments must comply with the following five location restrictions described in Sections 257.60 through 257.64 of the CCR Rule:

- §257.60 – Placement above the Uppermost Aquifer
- §257.61 – Wetlands
- §257.62 – Fault Areas
- §257.63 – Seismic Impact Zone
- §257.64 – Unstable Areas

The CCR Rule requires that the CCR Surface Impoundment owner or operator certify that the CCR Unit meets the specified location restriction requirements by October 17, 2018 for continued operation of the CCR Unit.

## CCR UNIT DESCRIPTION

The WASP and NAWRP received a slurry of bottom ash/boiler slag and water and the SASP was connected to the WASP with two weirs and was used for overflow from the other two ponds. The Ash Ponds are considered an existing CCR Surface Impoundment under the CCR Rule. The Ash Ponds were originally constructed in 1974 as a two-basin system. In 1990, the ponds were segregated and relined with a 3-foot thick clay liner, and the NAWRP interior slopes and the east side interior slopes of the WASP were lined with concrete revetment mats. All remaining interior slopes of the ponds were lined with riprap. The SASP, WASP, and NAWRP are approximately 1000 feet long by 460 feet wide, 570 feet long by 460 feet wide, and 470 feet long by 470 feet wide respectively. The Ash Ponds are constructed partially above and partially below grade and are surrounded by engineered earthen embankments that extend approximately 15 to 20 feet above grade.

## Section 2.0 Placement Above Uppermost Aquifer

Section 257.60(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.*

Section 257.53 of the CCR Rule defines uppermost aquifer as follows:

- Aquifer: a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

- Uppermost aquifer: the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

Golder evaluated the distance between the base of the Ash Ponds and the uppermost aquifer by comparing the documented elevation of the base of the pond liner and historical maximum groundwater elevations as measured from monitoring wells in the vicinity of the ponds. The upper limit of the uppermost aquifer in the vicinity of the Ash Ponds was measured to be approximately Elev. 365 to 367 feet MSL and the base of the pond liner is located at approximately Elev. 358 ft MSL. Based on these measurements, the upper limit of the uppermost ground-water bearing unit can exceed the base of the liner in the ponds due to normal fluctuations in groundwater elevations. As a result, the Ash Ponds do not satisfy the minimum separation location restriction criterion requirements of §257.60(a).

# Section 3.0 Wetlands

Section 257.61(a) of the CCR Rule states:

*a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.*

40 CFR 232.2 defines wetlands as follows:

- Wetlands: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The Ash Ponds were originally constructed in the 1974 and are located in a developed industrial area that is part of the MOSES power plant. To determine if the Ash Ponds are located in wetlands, the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) website was reviewed by Golder. Although the Ash Ponds themselves are represented on the NWI maps as "permanently flooded freshwater basins that were excavated by humans", wastewater discharges from the MOSES are regulated under Texas Pollution Discharge Elimination System (TPDES) permit WQ0002697000 and the Ash Ponds are part of the MOSES wastewater management system. As a result, the Ash Ponds were designed and constructed to meet Clean Water Act requirements and are therefore not considered federally jurisdictional wetlands in accordance with 33 CFR § 328.3(b)(1).

Based on the NWI maps and the construction characteristics of the Ash Ponds, the Ash Ponds are not "located in wetlands" as per §257.61(a), and the Ash Ponds satisfy the wetlands location restriction criterion.

# Section 4.0 Fault Areas

Section 257.62(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.*

Section 257.53 of the CCR Rule defines Holocene as the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch (11,700 years before present) to present.

Golder evaluated the potential for existence of CCR Rule-defined faults in proximity to the Ash Ponds based on geologic maps and documents published by the United States Geological Survey (USGS). The nearest known mapped faults to the Ash Ponds are located approximately 17 miles north of the MOSES, which greatly exceeds the 200-foot distance prescribed in the CCR Rule. As a result, the Ash Ponds comply with the requirements of §257.62(a).

## Section 5.0 Seismic Impact Zone

Section 257.63(a) of the CCR Rule states:

a) *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

Section 257.53 of the CCR Rule defines these terms as follows:

- Seismic impact zone: an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 50 years.
- Lithified earth material: all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.
- Maximum horizontal acceleration in lithified earth material: the maximum expected horizontal acceleration at the ground surface as depicted on a seismic hazard map, with a 98% or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.
- Structural components: liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.

Golder evaluated the location of the Ash Ponds relative to seismic impact zones using maps and documents published by the United States Geological Survey (USGS). The Ash Ponds are located in an area with peak ground accelerations between 0.04g and 0.06g, which is well below the maximum acceleration of 0.10g specified in the CCR Rule to be considered a Seismic Impact Zone. As a result, the Ash Ponds are not located in a Seismic Impact Zone as defined in the CCR Rule and therefore comply with § 257.63(a).

## Section 6.0 Unstable Areas

Section 257.64(a) of the CCR Rule states:

a) *An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.*

Section 257.53 of the CCR Rule defines unstable area as follows:

- Unstable area: a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.
- Poor Foundation Conditions: those areas where features exist which indicate that a natural or human-induced event may result in inadequate foundation support for the structural components of an existing or new CCR unit.
- Areas Susceptible to Mass Movement: those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where, because of natural or human-induced events, the movement of earthen material at, beneath, or adjacent to the CCR unit results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, and rock fall.
- Karst terrain: an area where karst topography, with its characteristic erosional surface and subterranean features, is developed as a result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terrain include, but are not limited to, dolines, collapse shafts (sinkholes), sinking streams, caves, seeps, large springs, and blind valleys.

Under § 257.64(b), the following factors must be considered when determining whether an area is unstable:

- on-site or local soil conditions that may result in significant differential settling;
- on-site or local geologic or geomorphic features; and
- on-site or local human-made features or events (both surface and subsurface).

Golder completed a CCR Rule Structural Stability Assessment Report for the Ash Ponds in 2012 and updated the assessment in 2016. The Structural Stability Assessment Report concluded that the soils underlying the Ash Ponds were stable. As a result, the Ash Ponds are not located in an unstable area as defined in the CCR Rule.

## Section 7.0 Limitations

In preparing this evaluation, Golder has reviewed historic, design and investigative information and other data furnished by Luminant. Golder has relied on this information in completing the location restriction evaluations for the Ash Ponds.

The conclusions presented in this memorandum assume that subsurface site conditions in the vicinity of the Ash Ponds reasonably match those conditions associated with site borings, laboratory testing results, etc. The reported conclusions are also based on our understanding of current site operations, maintenance and CCR management practices at the MOSES at the current time as provided by Luminant.

# Section 8.0 Professional Certification

I, Patrick J. Behling, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this CCR Rule Location Restrictions Demonstration has been prepared in accordance with the accepted practice of engineering. I certify that the CCR Unit described in this report and as explained further in the CCR Rule Location Restriction Evaluation – Monticello Steam Electric Station Ash Ponds, Golder Associates Inc. October 10, 2018, meets the requirements of 40 CFR Sections 257.61 through 257.64. The CCR units do not satisfy the minimum separation location restriction criterion requirements of §257.60(a).

Patrick J. Behling, P.E.
Principal Engineer
Texas PE No. 79872
Golder Associates Inc.
Texas Engineering Firm No. 2578

# Figures


**LEGEND**

CCR MONITORING WELL LOCATION

**REFERENCE(S)**

IMAGERY FROM GOOGLE EARTH DATED 12/02/2015.

CLIENT
LUMINANT GENERATION COMPANY LLC

PROJECT
MONTICELLO STEAM ELECTRIC STATION
ASH PONDS
CCR RULE LOCATION RESTRICTION DEMONSTRATION

TITLE
**SITE PLAN**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2018-10-05 |
| DESIGNED | BZH |
| PREPARED | BZH |
| REVIEWED | PJB |
| APPROVED | PJB |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 18107517 | 0 | 1 |

**COAL COMBUSTION RESIDUAL RULE**
**GROUNDWATER MONITORING SYSTEM CERTIFICATION**

**MONTICELLO STEAM ELECTRIC STATION**
**ASH PONDS**
**MOUNT PLEASANT, TEXAS**

**OCTOBER 16, 2017**



***Prepared For:***

Luminant Generation Company, LLC
6555 Sierra Drive
Irving, TX 75039

***Prepared By:***

Pastor, Behling & Wheeler, LLC
2201 Double Creek Drive, Suite 4004
Round Rock, Texas 78664
Texas Engineering Firm No. 4760

October 16, 2017

## PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the groundwater monitoring system installed at the referenced facility has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

STATE OF TEXAS
PATRICK J. BEHLING
79872
LICENSED
PROFESSIONAL ENGINEER

Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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# 1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) operates the Monticello Steam Electric Station (MOSES) located approximately six miles southwest of Mount Pleasant, Titus County, Texas (Figure 1). The three power generation units at the MOSES burn lignite and Powder River Basin coal. Coal Combustion Residuals (CCRs) including fly ash, bottom ash, and scrubber sludge are generated as part of MOSES unit operations. The CCRs are currently stored, treated, and disposed of in surface impoundments on-site, or at other Luminant facilities. Three surface impoundments are located within the MOSES operations, the West Ash Settling Pond, the Southwest Ash Settling Pond, and Northeast Ash Water Retention Pond (Ash Ponds). These ponds are collectively referred to as the Ash Ponds and are evaluated as one CCR unit. The Ash Ponds meet the definition of a CCR surface impoundment and are subject to groundwater monitoring system requirements of the CCR Rule.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.



The CCR Rule establishes national minimum criteria for existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions to landfills/impoundments. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to evaluate and certify that the groundwater monitoring system at the Site has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

## 1.1 Description of the Ash Pond Area

Bottom ash is sluiced to the NE and West Ash Ponds, and the SW Ash Pond is used for overflow from the other two ponds. In addition to the sluiced ash, overflow from the dewatering bins is also sent to these ponds. Based on drawings provided by Luminant, these ponds have compacted clay liners consisting of three feet of clay soil, and are considered existing lined surface impoundments under the CCR Rule. The clay soil is covered by a four-inch concrete revetment.

## 1.2 CCR Unit Groundwater Monitoring System Requirements

Section 257.91 of the CCR Rule indicates that existing CCR landfills and surface impoundments be provided with a groundwater monitoring system that consists of sufficient wells, installed at appropriate location and depths, to yield groundwater samples from the uppermost aquifer that meet the following criteria:

- Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit; and
- Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary to ensure detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

The specific configuration of the groundwater monitoring system must be determined based on site-specific technical information that must include aquifer thickness, groundwater flow rate, groundwater flow direction (including seasonal and temporal fluctuation in groundwater flow), saturated and unsaturated geologic units and fill materials that overly the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the upmost aquifer, including, but not limited to, thickness, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.



At a minimum, the monitoring system must consist of at least one upgradient and three downgradient monitoring wells, and any additional monitoring wells necessary to accurately represent the quality of the background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit. Multi-unit groundwater monitoring systems are allowed but must be equally as capable of detecting monitored constituents at the waste boundary of a CCR unit as individual groundwater monitoring wells.

Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater. There must be documentation in the operating record of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified engineer must have access to and must review this documentation as part of the groundwater monitoring system certification.

# 2.0 GROUNDWATER MONITORING SYSTEM EVALUATION

## 2.1 Ash Pond Groundwater Monitoring System

The CCR groundwater monitoring well system at the Ash Ponds consists of seven monitoring wells (W-29, W-30, W-31, W-32, W-33, W-34, and W-35) that are each screened in the uppermost aquifer at the Site. The locations of the CCR monitoring wells are shown on Figure 2. Well construction information and survey data for the CCR wells are summarized in Table 1, CCR monitoring well logs are presented in Appendix A, and photographs of the CCR wells are presented in Appendix B.

## 2.2 Local Geology and Hydrogeology

The Ash Ponds are located in the outcrop area of the Eocene-aged Wilcox Group (Barnes, 1966). PBW reviewed soil boring logs, monitoring well completion documentation, and historical reports to describe the geologic and hydrogeologic conditions in the Ash Pond area. Geologic cross sections were constructed using these data. The locations of the cross sections are shown on Figure 3 and the cross sections are shown on Figures 4 and 5.



The geology of the Ash Pond area consists of an upper clay and silt unit that extends from ground surface to about 5 to 25 feet below ground surface (bgs). The upper clay and silt unit is underlain by an approximately 20-foot to 40-foot thick unit of silty sand, which is underlain by a lower clay unit that ranged in thickness from less than 5 feet to about 15 feet. The uppermost aquifer at the Site occurs under unconfined to semi-confined conditions within the intermediate silty sand unit.

## 2.3 Groundwater Potentiometric Surface Elevations

Eight background groundwater monitoring events were performed using the Ash Pond CCR monitoring well system from October 2015 to December 2016. Static water levels measured during the background monitoring period indicated water elevations ranging from 354.80 feet above mean sea level (amsl) to 367.20 feet amsl, and depths to water ranging from 11.33 feet bgs to 25.74 feet bgs (Table 2). Groundwater potentiometric surface maps based on gauging data collected during the background monitoring period are presented in Appendix C.

Groundwater elevations were generally highest on the east side of the Ash Ponds, with an inferred groundwater flow direction to the west toward Lake Monticello. Based on the inferred direction of groundwater flow, the location of each CCR monitoring well relative to the Ash Ponds is as follows:

| Upgradient Wells | Downgradient Wells |
|---|---|
| W-31 | W-29 |
| W-32 | W-30 |
| W-33 | W-34 |
| | W-35 |

## 2.4 Uppermost Aquifer Hydraulic Conductivity Testing

PBW performed slug tests at monitoring wells W-32, W-33, and W-35 on October 5, 2015 to evaluate hydraulic properties of the uppermost aquifer at the site. Slug test data and time-head change plots used to calculate hydraulic conductivities and transmissivities of the uppermost aquifer are provided in Appendix D. A summary of these hydraulic properties is presented in Table 3. The average hydraulic conductivities for the wells ranged from 6.58 x $10^{-4}$ cm/sec (well W-35) to 8.42 x $10^{-3}$ cm/sec (well W-33), with a geometric mean for the test wells of 2.51 x $10^{-3}$cm/sec.



## 2.5 Conclusions

The CCR groundwater monitoring well system at the Ash Ponds complies with Section 257.91 of the CCR Rule. This conclusion is supported by the following as described in detail in previous sections of this report:

- Seven monitoring wells are included in the CCR groundwater monitoring system – three upgradient monitoring wells and four downgradient monitoring wells.
- Each monitoring well is screened in the uppermost aquifer at the site. Samples collected from upgradient monitoring wells will be representative of the quality of background groundwater that has not been affected by leakage from the CCR units. Samples collected from downgradient wells will ensure detection of groundwater contamination in the uppermost aquifer from the CCR units.
- The monitoring wells are constructed with appropriate well casing to maintain the integrity of the monitoring well borehole and with slotted well screens to enable collection of groundwater samples. In addition, the annular space above the well screen is appropriately sealed to prevent contamination of groundwater samples from surface sources.
- Appropriate documentation exists concerning the design, installation, and development of the monitoring wells.

## 3.0 REFERENCES

Barnes, Virgil E., 1966. Geologic Atlas of Texas, Texarkana Sheet. Texas Bureau of Economic Geology.

**Tables**

**TABLE 1**

**WELL CONSTRUCTION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | Date Installed | Northing | Easting | Screen Interval (feet bgs) | Top of Pad Elev. (feet amsl) | TOC Elev. (feet amsl) | Casing Diameter (inches) |
|---|---|---|---|---|---|---|---|
| W-29 | 8/26/2015 | 527058 | 2754498 | 27-37 | 374.94 | 377.59 | 2 |
| W-30 | 8/26/2015 | 527358 | 2755059 | 32-42 | 373.53 | 376.95 | 2 |
| W-31 | 8/25/2015 | 526969 | 2755498 | 33-43 | 372.99 | 376.33 | 2 |
| W-32 | 8/25/2015 | 526491 | 2755763 | 23-33 | 375.41 | 378.96 | 2 |
| W-33 | 8/25/2015 | 525819 | 2755454 | 20-30 | 383.69 | 387.16 | 2 |
| W-34 | 8/27/2015 | 525962 | 2754790 | 17-27 | 375.84 | 379.16 | 2 |
| W-35 | 8/27/2015 | 526365 | 2754542 | 25-35 | 377.86 | 381.15 | 2 |

Notes:

1. Abbreviations: bgs - below ground surface; amsl - above mean sea level; TOC - top of casing.

**TABLE 2**
**GROUNDWATER ELEVATION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | TOC Elevation (ft amsl) | Date | Depth to Water (ft btoc) | Water Elevation (ft amsl) |
|---|---|---|---|---|
| W-29 | 377.59 | 10/15/15 | 20.97 | 356.62 |
| | | 12/07/15 | 18.46 | 359.13 |
| | | 02/22/16 | 20.34 | 357.25 |
| | | 04/04/16 | 20.13 | 357.46 |
| | | 06/06/16 | 20.01 | 357.58 |
| | | 08/08/16 | 20.72 | 356.87 |
| | | 10/12/16 | 20.51 | 357.08 |
| | | 12/29/16 | 20.93 | 356.66 |
| W-30 | 376.95 | 10/15/15 | 19.49 | 357.46 |
| | | 12/07/15 | 14.91 | 362.04 |
| | | 02/22/16 | 17.19 | 359.76 |
| | | 04/04/16 | 16.04 | 360.91 |
| | | 06/06/16 | 14.77 | 362.18 |
| | | 08/08/16 | 14.98 | 361.97 |
| | | 10/12/16 | 17.62 | 359.33 |
| | | 12/29/16 | 16.14 | 360.81 |
| W-31 | 376.33 | 10/15/15 | 14.97 | 361.36 |
| | | 12/07/15 | 13.12 | 363.21 |
| | | 02/22/16 | 12.97 | 363.36 |
| | | 04/04/16 | 12.74 | 363.59 |
| | | 06/06/16 | 11.33 | 365.00 |
| | | 08/08/16 | 13.56 | 362.77 |
| | | 10/12/16 | 13.12 | 363.21 |
| | | 12/29/16 | 12.98 | 363.35 |
| W-32 | 378.96 | 10/15/15 | 15.46 | 363.50 |
| | | 12/07/15 | 13.99 | 364.97 |
| | | 02/22/16 | 13.49 | 365.47 |
| | | 04/04/16 | 13.26 | 365.70 |
| | | 06/06/16 | 11.76 | 367.20 |
| | | 08/08/16 | 14.31 | 364.65 |
| | | 10/12/16 | 13.72 | 365.24 |
| | | 12/29/16 | 13.77 | 365.19 |
| W-33 | 387.16 | 10/15/15 | 25.74 | 361.42 |
| | | 12/07/15 | 23.54 | 363.62 |
| | | 02/22/16 | 23.77 | 363.39 |
| | | 04/04/16 | 23.01 | 364.15 |
| | | 06/06/16 | 21.94 | 365.22 |
| | | 08/08/16 | 23.78 | 363.38 |
| | | 10/12/16 | 23.61 | 363.55 |
| | | 12/29/16 | 24.25 | 362.91 |
| W-34 | 379.16 | 10/15/15 | 24.36 | 354.80 |
| | | 12/07/15 | 23.03 | 356.13 |
| | | 02/22/16 | 22.51 | 356.65 |
| | | 04/04/16 | 22.68 | 356.48 |
| | | 06/06/16 | 24.09 | 355.07 |
| | | 08/08/16 | 22.22 | 356.94 |
| | | 10/12/16 | 22.58 | 356.58 |
| | | 12/29/16 | 23.04 | 356.12 |

**TABLE 2**
**GROUNDWATER ELEVATION SUMMARY**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | TOC Elevation (ft amsl) | Date | Depth to Water (ft btoc) | Water Elevation (ft amsl) |
|---|---|---|---|---|
| W-35 | 381.15 | 10/15/15 | 24.11 | 357.04 |
| | | 12/07/15 | 22.33 | 358.82 |
| | | 02/22/16 | 23.17 | 357.98 |
| | | 04/04/16 | 22.93 | 358.22 |
| | | 06/06/16 | 22.16 | 358.99 |
| | | 08/08/16 | 23.47 | 357.68 |
| | | 10/12/16 | 23.31 | 357.84 |
| | | 12/29/16 | 23.65 | 357.50 |

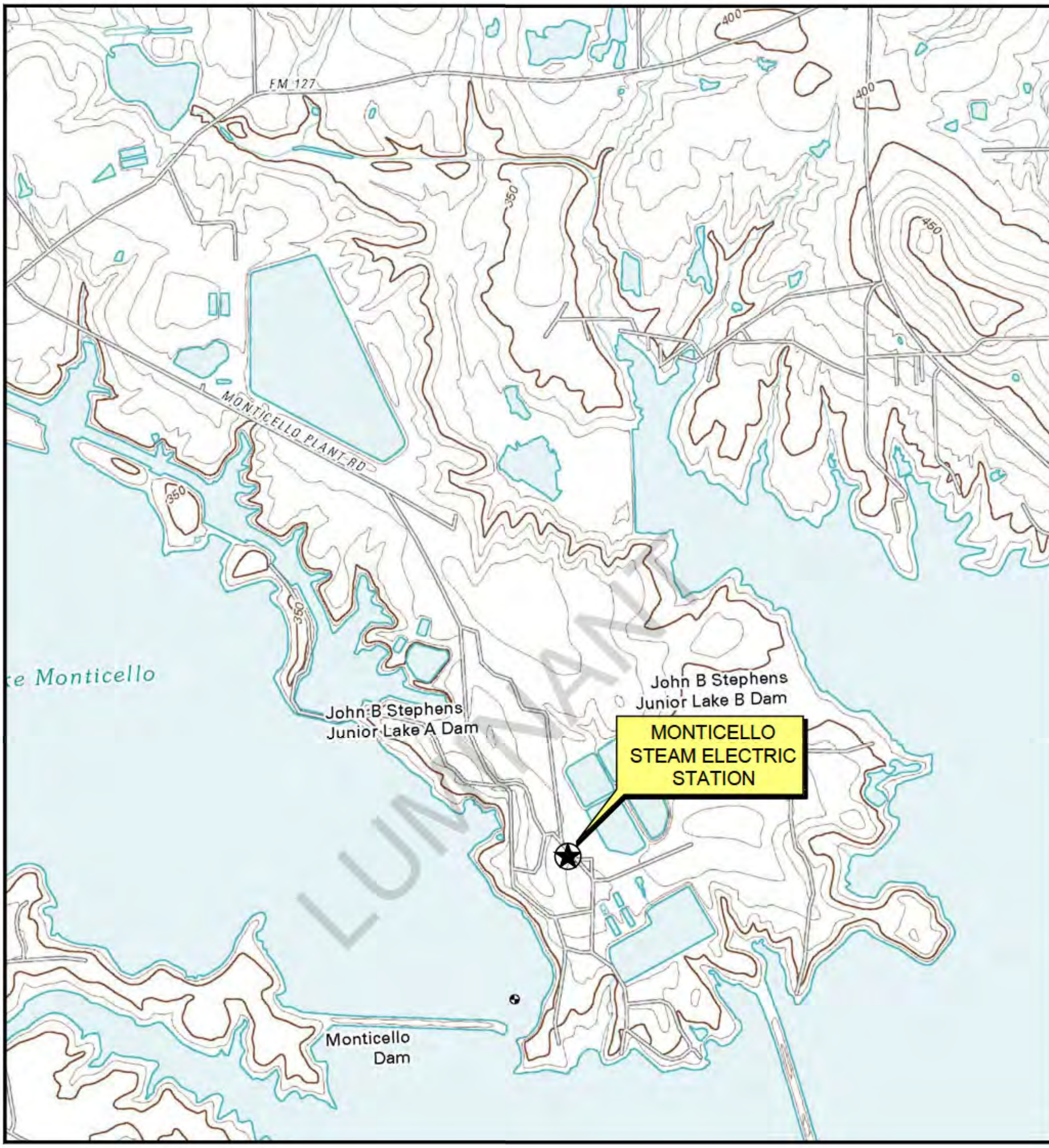
Notes:
1. Abbreviations: TOC - top of casing; ft - feet; amsl - above mean sea level.

**SUMMARY OF AQUIFER TEST RESULTS**
**MONTICELLO STEAM ELECTRIC STATION ASH PONDS**

| Well ID | Test Type | Aquifer Type | Analysis Method | Saturated Thickness (feet) | Results T ($cm^2$/sec) | Results K (cm/sec) |
|---|---|---|---|---|---|---|
| | | | | | | |
| W-32 | Slug-In | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 1.95E+00 | 3.56E-03 |
| W-32 | Slug-Out | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 1.20E+00 | 2.19E-03 |
| | | | | **MEAN** | **1.58E+00** | **2.87E-03** |
| W-33 | Slug-Out[1] | Unconfined | Bouwer-Rice | 8 | **1.97E+00** | **8.42E-03** |
| | | | | | | |
| W-35 | Slug-In | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 4.08E-01 | 7.43E-04 |
| W-35 | Slug-Out | Unconfined to Semi-Confined | Bouwer-Rice | 18 | 3.14E-01 | 5.72E-04 |
| | | | | **MEAN** | **3.61E-01** | **6.58E-04** |
| | | | | **MEAN FOR ALL TESTS** | **1.04E+00** | **2.51E-03** |

Notes:
[1] - A slug-in test was not performed because the static water level was below top of screen.

**Figures**





QUADRANGLE LOCATIONS

N

Scale in Feet
0 1000 2000

SOURCE:
Base map from www.tnris.gov, Monticello, TX 7.5 min. USGS Quadrangle dated 2010.

**MONTICELLO STEAM ELECTRIC STATION**
MONTICELLO, TEXAS

Figure 1
## ASH PONDS
## SITE LOCATION MAP

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: SEPT., 2015 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**
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## EXPLANATION

CCR Monitoring Well Location

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 2

# ASH PONDS DETAILED SITE PLAN

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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**EXPLANATION**

- CCR Monitoring Well Location
- Soil Boring Location
- A___A' Geologic Cross Section Location Lines

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 3

## ASH PONDS CROSS SECTION LOCATION MAP

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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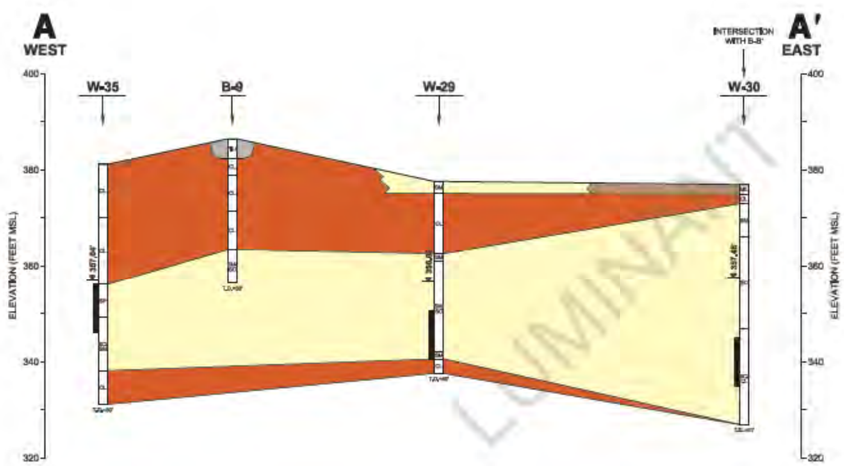




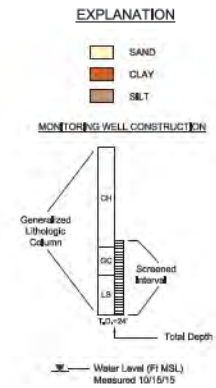



| MONTICELLO STEAM ELECTRIC STATION<br>MT. PLEASANT, TEXAS | | |
|---|---|---|
| Figure 4<br>**ASH PONDS<br>GEOLOGIC CROSS SECTION A-A'** | | |
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: OCT., 2017 | CHECKED: PJB | |
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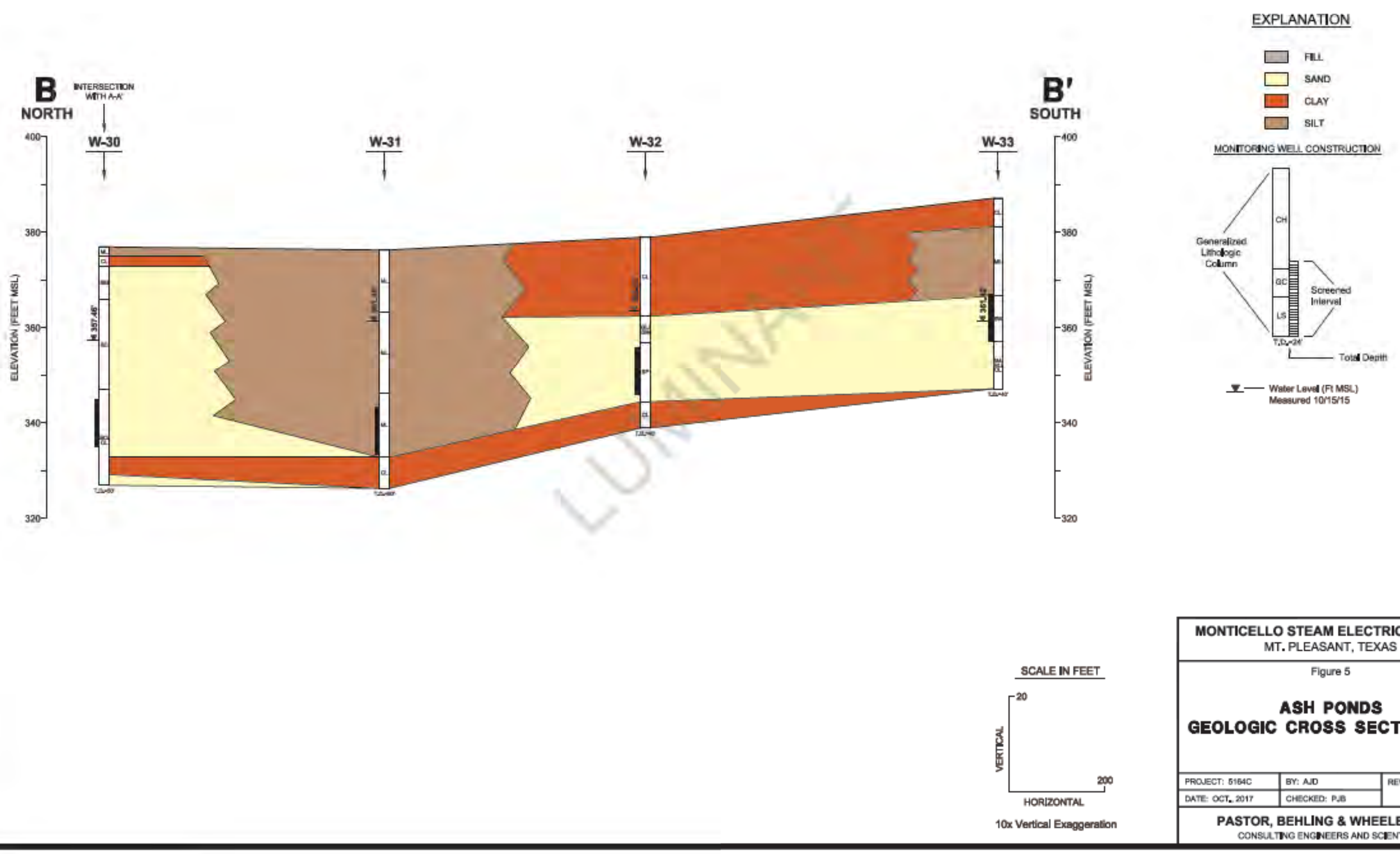


**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 5

**ASH PONDS**
**GEOLOGIC CROSS SECTION B-B'**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: OCT. 2017 | CHECKED: PJB | |

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**Appendix A**

**CCR Monitoring Well Logs**

# Luminant

# Log of Boring: W-29

| Monticello Steam Electric Station<br>Mount Pleasant, TX<br><br>PBW Project No. 5164C | | | | |
|---|---|---|---|---|
| | Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 377.59 |
| | Logged By: | Sara Taube | Northing: | 527057.69 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2754497.97 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 – 2.5 | | SM | (0 - 2.5) FILL, silty sand, dark gray, fine grained, moist, soft |
| 2.5 – 15 | 3.5/10.0 (0–10); 8.5/10.0 (10–20) | CL | (2.5 - 15) Silty CLAY, reddish brown with orange streaks, local gray sand lenses, gradually becoming sandy silty clay, more grays, gradational basal contact, moist, hard, low plasticity |
| 15 – 16.5 | | SM | (15 - 16.5) Silty SAND, gray, poorly sorted, sharp basal contact, slightly moist, soft |
| 16.5 – 35.5 | 8.5/10.0 (20–30); 10.0/10.0 (30–40) | SM/SC | (16.5 - 35.5) Silty clayey SAND, gray-light reddish brown with orange mottling, 2"-4" layers of light gray silty sand interspersed, 6" gray sand at 21.5-22', slightly moist, firm, low plasticity |
| 35.5 – 37 | | SM | (35.5 - 37) Silty SAND, light gray- reddish brown, very fine grained, poorly sorted, sharp basal contact, wet, soft |
| 37 – 40 | | CL | (37 - 40) CLAY, light gray- purple, some orange mottling, moist, hard, low to medium plasticity |

**PBW**

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Notes:
1. This log should not be used separately from the report to which it is attached.

**Well Materials**
(0 - 27) Casing, 2" Sch 40 FJT PVC
(27 - 37) Screen, 2" Sch 40 FJT PVC, 0.010" slot

**Annular Materials**
(0-23') Grout
(23'-25') Bentonite chips
(25'-37') 20/40 sand
(37'-40') Bentonite chips

# Luminant

# Log of Boring: W-30

Monticello Steam Electric Station
Mount Pleasant, TX

PBW Project No. 5164C

| | | | |
|---|---|---|---|
| Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
| Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 376.95 |
| Logged By: | Sara Taube | Northing: | 527358.15 |
| Sampling Method: | 4"x10' Core barrel | Easting: | 2755059.04 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 - 2 | 7.5/10.0 | ML | (0 - 2) FILL, clayey silt, light gray-brown, roots, carbonate nodules, some orange clayey lenses, becomes sandy with depth, light gray sand lens at 2', dry, hard |
| 2 - 4 | | CL | (2 - 4) Silty sandy CLAY, orange-light gray mottling, sharp basal contact, dry, hard, low plasticity |
| 4 - 11 | | SM | (4 - 11) Silty SAND, very fine grained, light gray with some red-orange clay lesnes beginning at 9', dry, soft |
| 11 - 30 | 7.0/10.0; 9.5/10.0 | SC | (11 - 30) Clayey SAND with silt, light gray with orange and yellow mottling, sandier with depth and less cohesive, minimal clay below 18', very sandy to 22', becomes clayey and gray again (reddish brown sand), thin light gray sand layers interbedded, very fine grained, some purple clay mottling around 27.5', dry to slightly moist, soft to firm |
| 30 - 50 | 9.5/10.0; 10.0/10.0 | SC/CL | (30 - 50) Interbedded clayey SAND and silty CLAY, light gray with purple or orange mottling in clay, sand typically uniform gray, mostly gray and sandy before 36', below 40' areas of gray and purple mottling in clayier layers, gray with red-orange mottling in sandier layers (40'-42', 47.5'-50'), generally clayier with depth from 42' to 47.5', moist, soft to firm, none to low plasticity |



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Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 32) Casing, 2" Sch 40 FJT PVC
(32 - 42) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-28') Grout
(28'-30') Bentonite chips
(30'-42') 20/40 sand

# Luminant

# Log of Boring: W-31

| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/25/2015 | Drilling Method: | Sonic |
|---|---|---|---|---|
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 376.33 |
| | Logged By: | Sara Taube | Northing: | 526968.69 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755497.73 |

| Depth (ft) | Well Materials | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|---|
| 0–10 | | 7.9/10.0 | ML | (0 - 13) FILL, clayey silt, brown-orange, carbonate nodules to 4', clayier with gray and orange mottling 4'-6.5, sandier with depth, some rock fragments 0-4', sharp basal contact, fill potentially ends at 4', dry, soft to firm, none to low plasticity |
| 10–20 | | 6.0/10.0 | ML | (13 - 30) Clayey SILT, brown-gray with orange-red mottling, local gray sand lenses, interbedded silty sand and clayey silt: sandier brown-dark brown with red mottling (20'-23.5'), clayier brown with orange and gray mottling (23.5'- 27'), gray and sandy (27'-30'), dry, firm to hard, low to medium plasticity |
| 20–30 | | 9.5/10.0 | ML | |
| 30–40 | | 10.0/10.0 | ML | (30 - 43.5) Sandy, clayey SILT, gray with orange mottling, fine grained sand, gray with orange mottling- appears bioturbated with interspersed very fine to fine grained sand lenses (2"-4") (33'-40'), sandier with depth and less orange mottling, moist |
| 40–50 | | 10.0/10.0 | CL | (43.5 - 50) Silty CLAY, with thin interbedded silty sands, gray with purple and orange mottling, sand is very fine grained, poorly sorrted, light gray, moist, hard, low plasticity |



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Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 33) Casing, 2" Sch 40 FJT PVC
(33 - 43) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-29') Grout
(29'-31') Bentonite chips
(31'-43) 20/40 sand

# Luminant

# Log of Boring: W-32

| | | | | |
|---|---|---|---|---|
| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/26/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 378.96 |
| PBW Project No. 5164C | Logged By: | Sara Taube | Northing: | 526491.03 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755762.58 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 - 16.5 | 8.0/10.0 (0-10); 9.0/10.0 (10-20) | CL | (0 - 16.5) Silty CLAY, gray with red-orange mottling, interbedded silty sand intervals (gray and red) up to 4" thick, clay becomes more gray with depth, sand is very fine grained, slightly moist, hard, medium plasticity |
| 16.5 - 22 | | SM/CL | (16.5 - 22) Interbedded silty CLAY and silty SAND, clay is light gray with some orange mottling, low plasticity, sand is very fine grained, poorly sorted, light red-brown, soft and wet, sand intervals are approximately 4.5" thick |
| 22 - 34.5 | 6.5/10.0 (20-30) | SP | (22 - 34.5) SAND with some silt present, light red-brown, very fine to fine grained, 2"-3" lenses of light gray silty sand, increasing gray lenses with depth, moist to wet, soft |
| 34.5 - 40 | 9.5/10.0 (30-40) | CL | (34.5 - 40) Silty CLAY, gray with orange and purple mottling, occasional gray sand lenses, reddish purple (36.5'-37'), no orange below 36', moist, hard, low to medium plasticity |



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Notes:
1. This log should not be used separately from the report to which it is attached.

**Well Materials**
(0 - 23) Casing, 2" Sch 40 FJT PVC
(23 - 33) Screen, 2" Sch 40 FJT PVC, 0.010" slot

**Annular Materials**
(0-19') Grout
(19'-21') Bentonite chips
(21'-33') 20/40 sand
(33'-40') Bentonite chips

# Luminant

# Log of Boring: W-33

| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/25/2015 | Drilling Method: | Sonic |
|---|---|---|---|---|
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 387.16 |
| PBW Project No. 5164C | Logged By: | Will Vienne | Northing: | 525819 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2755454.17 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 – 6 | 5.7/10.0 | CL | (0 - 6) FILL, silty clay at 0-1.4', low plasticity, dark gray with grass/roots near surface; silty sand with thin clayey sand beds below 1.4', gray-brown to light brown, trace orange mottling, dry, soft to slightly firm, sharp basal contact |
| 6 – 20.5 | 8.0/10.0 | ML | (6 - 20.5) Sandy, clayey SILT, red with orange mottling, becoming more orange below 11', abundant orange and gray laminae; sand is very fine grained, poorly sorted, unconsolidated to slightly consolidated, abundant organic very dark gray clay at 20-20.5', moist, gradational contact |
| 20.5 – 30 | 8.2/10.0 | SW | (20.5 - 30) SAND, light yellow-brown and gray with reddish mottling, fining upward, very fine grained and poorly sorted at 20.5'-25' (very fine to fine grained and moderately sorted below 25', unconsolidated, fine grained black accessory minerals below 25'), petrified wood fragments at 30', wet |
| 30 – 40 | 8.8/10.0 | SM/ML/CL | (30 - 40) Interbedded silty SAND, sandy SILT, and silty CLAY; silty clay at 32'-32.7, 36'-36.5', and 35.4'-36.4'; light gray with abundant orange and light brown mottling, low plasticity, wet, slightly firm |



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Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 20) Casing, 2" Sch 40 FJT PVC
(20 - 30) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-16') Grout
(16'-18') Bentonite chips
(18'-30) 20/40 sand
(30'-36') Bentonite chips

# Luminant

# Log of Boring: W-34

| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/27/2015 | Drilling Method: | Sonic |
|---|---|---|---|---|
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 40 |
| PBW Project No. 5164C | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 379.16 |
| | Logged By: | Sara Taube | Northing: | 525962.02 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2754789.66 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 – 10 | 5.2/10.0 | SC/SM | (0 - 10) FILL; clayey, silty sand; light to dark gray with reddish brown, roots to 4', carbonate nodules to 1', orange clay layer 1'-1.5', dry to moist, soft to slightly firm |
| 10 – 16.5 | 6.0/10.0 | CL | (10 - 16.5) Silty CLAY, light gray with orange mottling, small light gray sand lenses, gradational basal contact, slightly moist, firm to hard, low plasticity |
| 16.5 – 21.5 | | SP | (16.5 - 21.5) SAND, light gray, some fines, thin interbeds of sandy clay (reddish brown), slightly moist, soft |
| 21.5 – 25 | 8.0/10.0 | SC/SM | (21.5 - 25) Silty, clayey SAND, light reddish brown, fine-coarse black gravel at 25' and maroon/red staining, moist to wet, soft |
| 25 – 40 | 8.5/10.0 | CL | (25 - 40) Silty, sandy CLAY, light gray with orange and purple mottling, thin red-brown sandy layers interbedded, 4" sandy layer at 27', mostly purple below 34', moist, hard, low plasticity |



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Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 17) Casing, 2" Sch 40 FJT PVC
(17 - 27) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-13') Grout
(13'-15') Bentonite chips
(15'-27) 20/40 sand

# Luminant

# Log of Boring: W-35

| | | | | | |
|---|---|---|---|---|---|
| Monticello Steam Electric Station<br>Mount Pleasant, TX | Completion Date: | 8/27/2015 | Drilling Method: | Sonic |
| | Drilling Company: | Walker-Hill Environmental | Borehole Diameter (in.): | 6.5 |
| | Driller: | Dwayne Whitehead | Total Depth (ft): | 50 |
| | Driller's License: | 5814M | TOC Elevation (ft. AMSL): | 381.15 |
| PBW Project No. 5164C | Logged By: | Sara Taube | Northing: | 526364.73 |
| | Sampling Method: | 4"x10' Core barrel | Easting: | 2754541.91 |

| Depth (ft) | Recovery (ft/ft) | USCS | Lithologic Description |
|---|---|---|---|
| 0 – 11 | 4.1/10.0 | CL | (0 - 11) FILL, silty clay, light gray-red, platey, friable, dry; becomes silt at 1.5', light brown, very soft; silty sand (2'-2.5'), brown, moist; clayey silty sand (2.5'-11'), dark brown, moist, sharp basal contact |
| 11 – 25 | 4.9/10.0; 6.8/10.0 | CL | (11 - 25) Silty, sandy CLAY, light gray with red and orange mottling, more clay with depth to 20', sandier to 25', sharp basal contact, slightly moist, firm, low plasticity |
| 25 – 32 | 6.8/10.0 | SP | (25 - 32) SAND, some fines, very fine to fine grained, light brown-reddish brown-light gray, moist to wet, soft |
| 32 – 43 | 8.3/10.0 | SC/SM | (32 - 43) Silty, clayey SAND, light gray-light brown with reddish brown, sandier areas are light gray, clayier areas are reddish brown-light brown (32'-35'), light gray (35'-37'), red-brown (37'-43'), fine-medium black subangular gravel (40'-43'), all gradual changes, moist to wet, soft to firm |
| 43 – 50 | 7.5/10.0 | CL | (43 - 50) Silty CLAY, light gray with purple and orange mottling, some very fine sand, intermittent 2" light gray sandy layers, moist, hard, low plasticity |

Recovery intervals: 0–10 ft 4.1/10.0; 10–20 ft 4.9/10.0; 20–30 ft 6.8/10.0; 30–40 ft 8.3/10.0; 40–50 ft 7.5/10.0



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Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0 - 25) Casing, 2" Sch 40 FJT PVC
(25 - 35) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0-21') Grout
(21'-23') Bentonite chips
(23'-35) 20/40 sand

**Appendix B**

**Photographs of CCR Groundwater Monitoring Wells**

**Appendix B – Photographs of CCR Groundwater Monitoring Wells**
**Monticello Steam Electric Station Ash Ponds**

**Photograph 1: W-29**

**Photograph 2: W-30**

## Appendix B – Photographs of CCR Groundwater Monitoring Wells
## Monticello Steam Electric Station Ash Ponds


**Photograph 3: W-31**

**Photograph 4: W-32**

**Appendix B – Photographs of CCR Groundwater Monitoring Wells**
**Monticello Steam Electric Station Ash Ponds**

**Photograph 5: W-33**

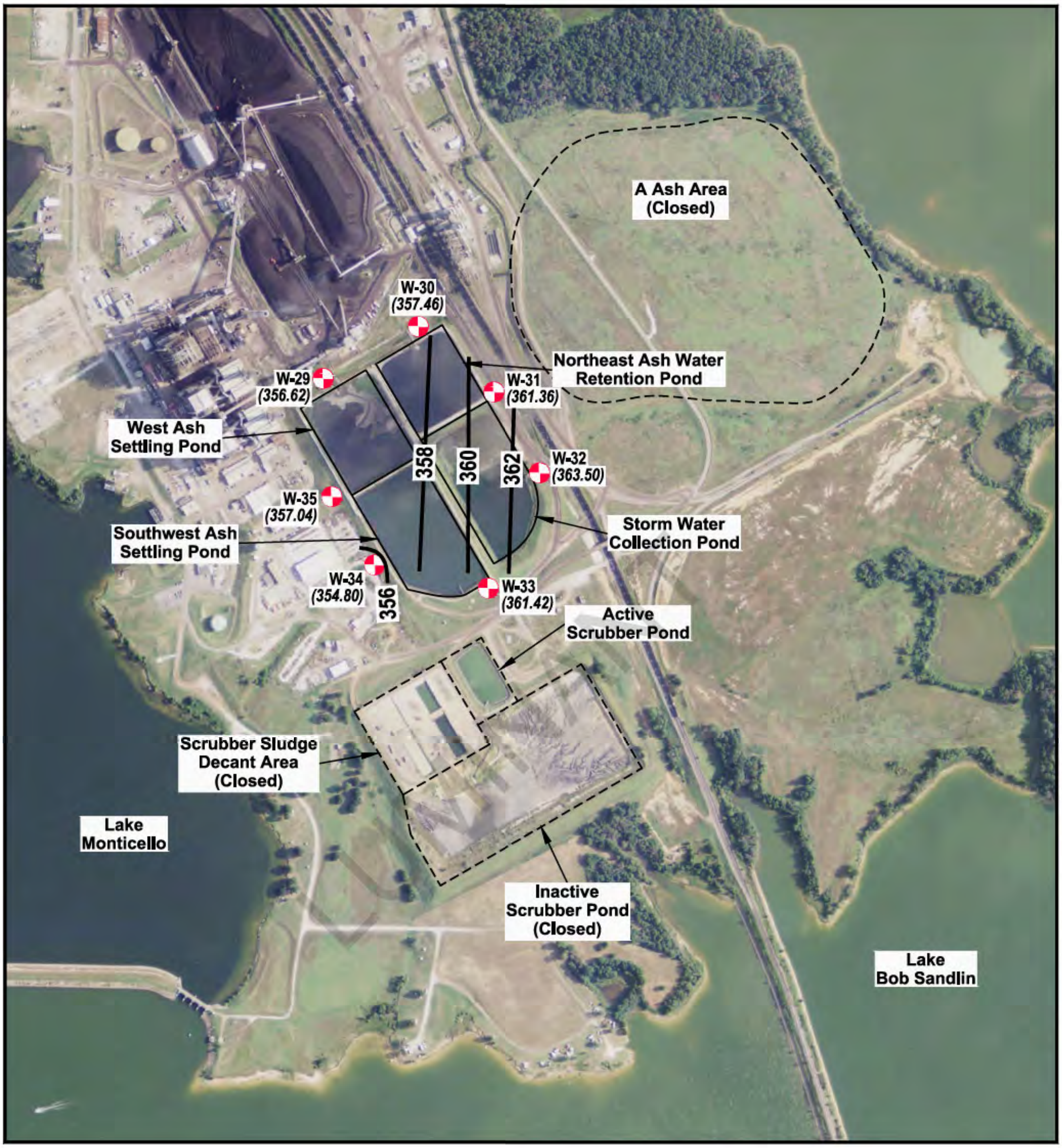
**Photograph 6: W-34**

**Appendix B – Photographs of CCR Groundwater Monitoring Wells**
**Monticello Steam Electric Station Ash Ponds**

**Photograph 7: W-35**

# Appendix C

# Groundwater Potentiometric Surface Maps




## EXPLANATION

CCR Monitoring Well Location

*(357.26)* Groundwater Potentiometric Surface (ft. AMSL)

— 358 — Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

**MONTICELLO STEAM ELECTRIC STATION**

MT. PLEASANT, TEXAS

Figure 2

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC SURFACE MAP - OCT. 15, 2015**

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: SEPT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

| MONTICELLO STEAM ELECTRIC STATION<br>MT. PLEASANT, TEXAS | | |
|---|---|---|
| Figure 3<br>**ASH PONDS<br>GROUNDWATER POTENTIOMETRIC SURFACE MAP - DEC. 7, 2015** | | |
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |
| **PASTOR, BEHLING & WHEELER, LLC**<br>CONSULTING ENGINEERS AND SCIENTISTS | | |


## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from www.tnris.gov, Monticello, aerial photographs, 2012.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 4

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC**
**SURFACE MAP - FEB. 22, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

CCR Monitoring Well Location

(357.26) Groundwater Potentiometric Surface (ft. AMSL)

358 Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

| MONTICELLO STEAM ELECTRIC STATION<br>MT. PLEASANT, TEXAS | | |
|---|---|---|
| Figure 5<br>**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - APRIL 4, 2016** | | |
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |
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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

# MONTICELLO STEAM ELECTRIC STATION

MT. PLEASANT, TEXAS

Figure 6

## ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - JUNE 6, 2016

| PROJECT: 5164C | BY: AJD | REVISIONS |
|---|---|---|
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**
MT. PLEASANT, TEXAS

Figure 7

**ASH PONDS**
**GROUNDWATER POTENTIOMETRIC SURFACE MAP - AUGUST 8, 2016**

| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

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## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

| MONTICELLO STEAM ELECTRIC STATION<br>MT. PLEASANT, TEXAS | | |
|---|---|---|
| Figure 8<br>**ASH PONDS GROUNDWATER POTENTIOMETRIC SURFACE MAP - OCTOBER 12, 2016** | | |
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |
| **PASTOR, BEHLING & WHEELER, LLC**<br>CONSULTING ENGINEERS AND SCIENTISTS | | |


## EXPLANATION

- CCR Monitoring Well Location
- *(357.26)* Groundwater Potentiometric Surface (ft. AMSL)
- **358** Groundwater Potentiometric Surface Contour (C.I. = 2 ft.)

N

Scale in Feet

0 450 900

SOURCE:
Imagery from Google Earth dated 12/2/2015.

**MONTICELLO STEAM ELECTRIC STATION**

MT. PLEASANT, TEXAS

Figure 9

**ASH PONDS
GROUNDWATER POTENTIOMETRIC
SURFACE MAP - DECEMBER 29, 2016**

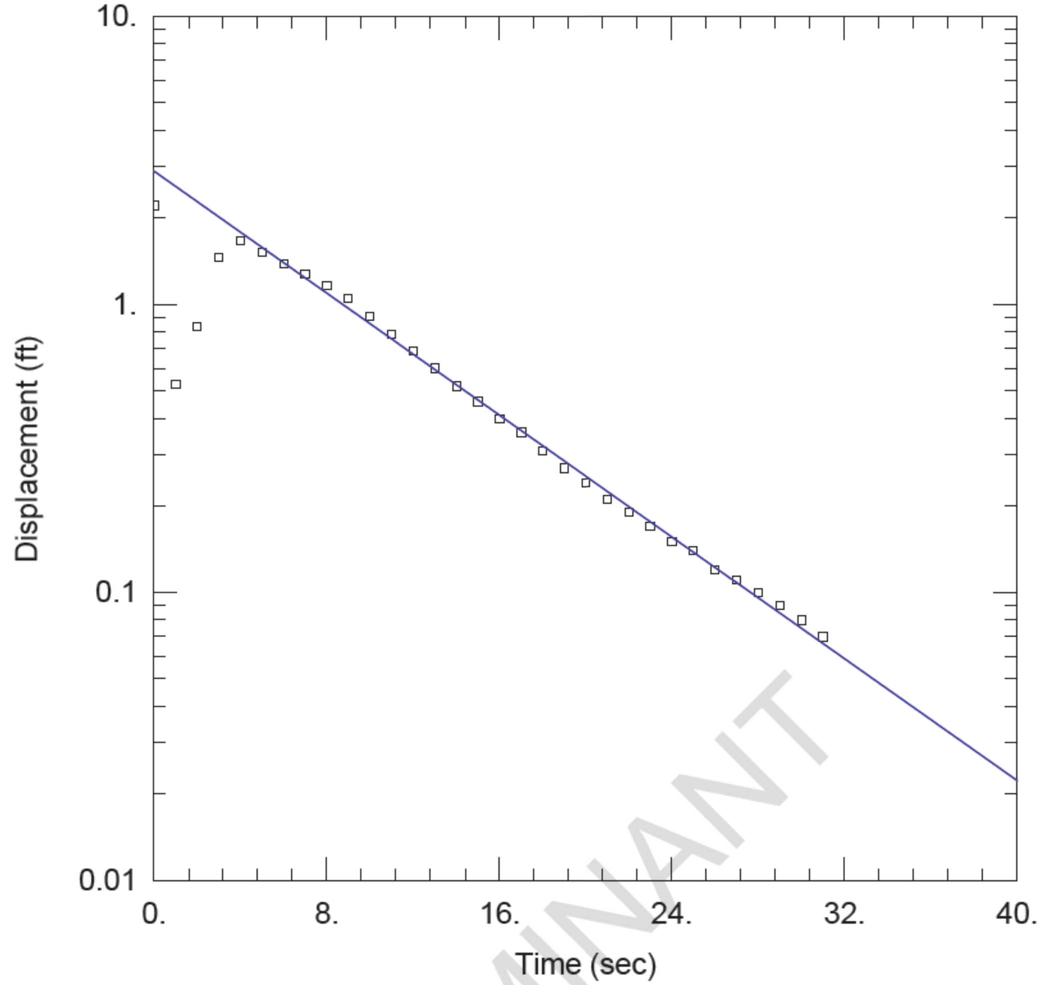
| | | |
|---|---|---|
| PROJECT: 5164C | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**

CONSULTING ENGINEERS AND SCIENTISTS

# Appendix D

# Aquifer Test Data






W-32 SLUG IN

Data Set: J:\...\W-32 Slug In.aqt
Date: 09/26/17 Time: 11:41:55

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-32)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 16.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.56 ft
Screen Length: 10. ft
Well Radius: 0.27 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.003557 cm/sec y0 = 2.898 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-32 Slug In
Date: 09/26/17
Time: 11:42:21

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-32

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 21.56 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 16.5 ft

No. of Observations: 31

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.53 | 17. | 0.36 |
| 2. | 0.84 | 18. | 0.31 |
| 3. | 1.46 | 19. | 0.27 |
| 4. | 1.66 | 20. | 0.24 |
| 5. | 1.51 | 21. | 0.21 |
| 6. | 1.38 | 22. | 0.19 |
| 7. | 1.27 | 23. | 0.17 |
| 8. | 1.16 | 24. | 0.15 |
| 9. | 1.05 | 25. | 0.14 |
| 10. | 0.91 | 26. | 0.12 |
| 11. | 0.79 | 27. | 0.11 |
| 12. | 0.69 | 28. | 0.1 |
| 13. | 0.6 | 29. | 0.09 |
| 14. | 0.52 | 30. | 0.08 |
| 15. | 0.46 | 31. | 0.07 |
| 16. | 0.4 | | |



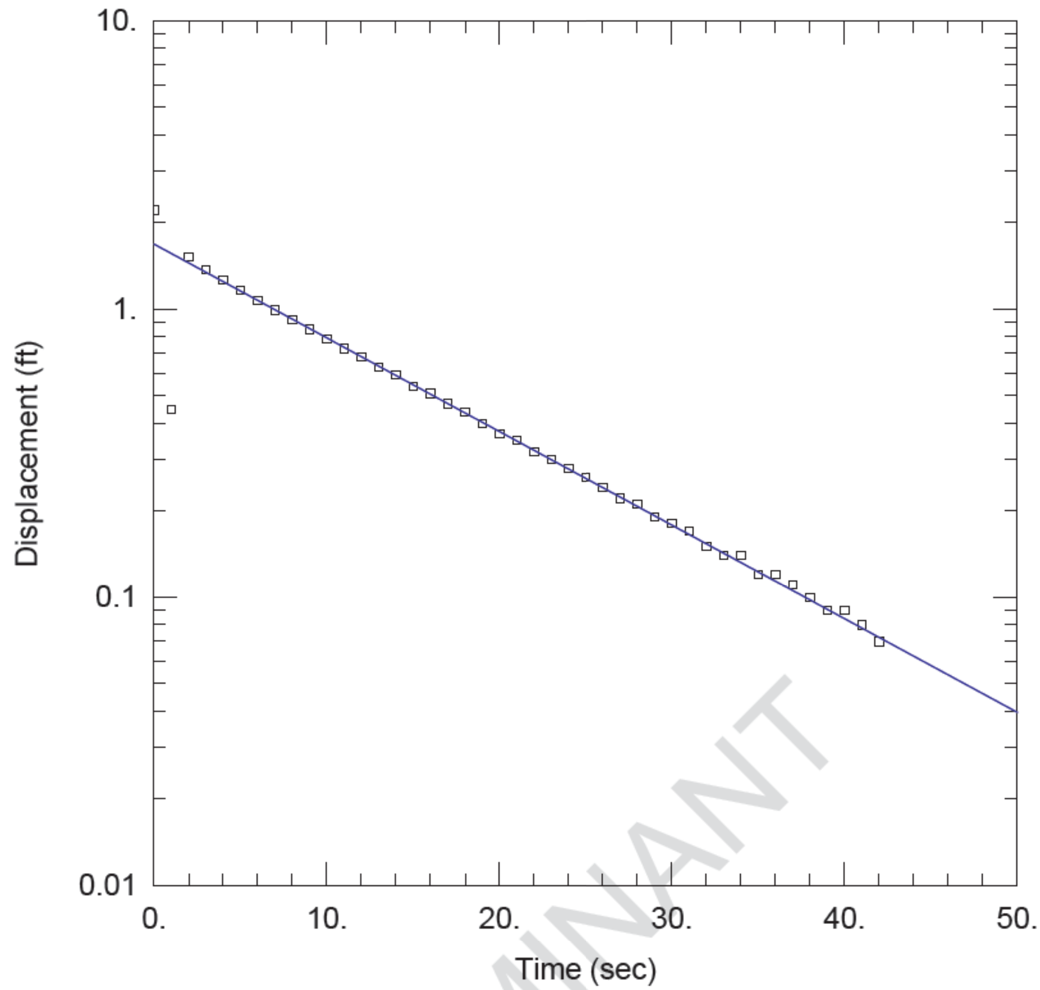
## SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.782

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate |
|---|---|






W-32 SLUG OUT

Data Set: J:\...\W-32 Slug Out.aqt
Date: 09/26/17 Time: 11:42:50

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-32)

Initial Displacement: 2.2 ft Static Water Column Height: 21.56 ft
Total Well Penetration Depth: 16.5 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.002185 cm/sec y0 = 1.679 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-32 Slug Out
Date: 09/26/17
Time: 11:43:03

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-32

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 21.56 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 16.5 ft

No. of Observations: 42



Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.45 | 22. | 0.32 |
| 2. | 1.51 | 23. | 0.3 |
| 3. | 1.37 | 24. | 0.28 |
| 4. | 1.26 | 25. | 0.26 |
| 5. | 1.16 | 26. | 0.24 |
| 6. | 1.07 | 27. | 0.22 |
| 7. | 0.99 | 28. | 0.21 |
| 8. | 0.92 | 29. | 0.19 |
| 9. | 0.85 | 30. | 0.18 |
| 10. | 0.79 | 31. | 0.17 |
| 11. | 0.73 | 32. | 0.15 |
| 12. | 0.68 | 33. | 0.14 |
| 13. | 0.63 | 34. | 0.14 |
| 14. | 0.59 | 35. | 0.12 |
| 15. | 0.54 | 36. | 0.12 |
| 16. | 0.51 | 37. | 0.11 |
| 17. | 0.47 | 38. | 0.1 |
| 18. | 0.44 | 39. | 0.09 |
| 19. | 0.4 | 40. | 0.09 |
| 20. | 0.37 | 41. | 0.08 |
| 21. | 0.35 | 42. | 0.07 |

## SOLUTION

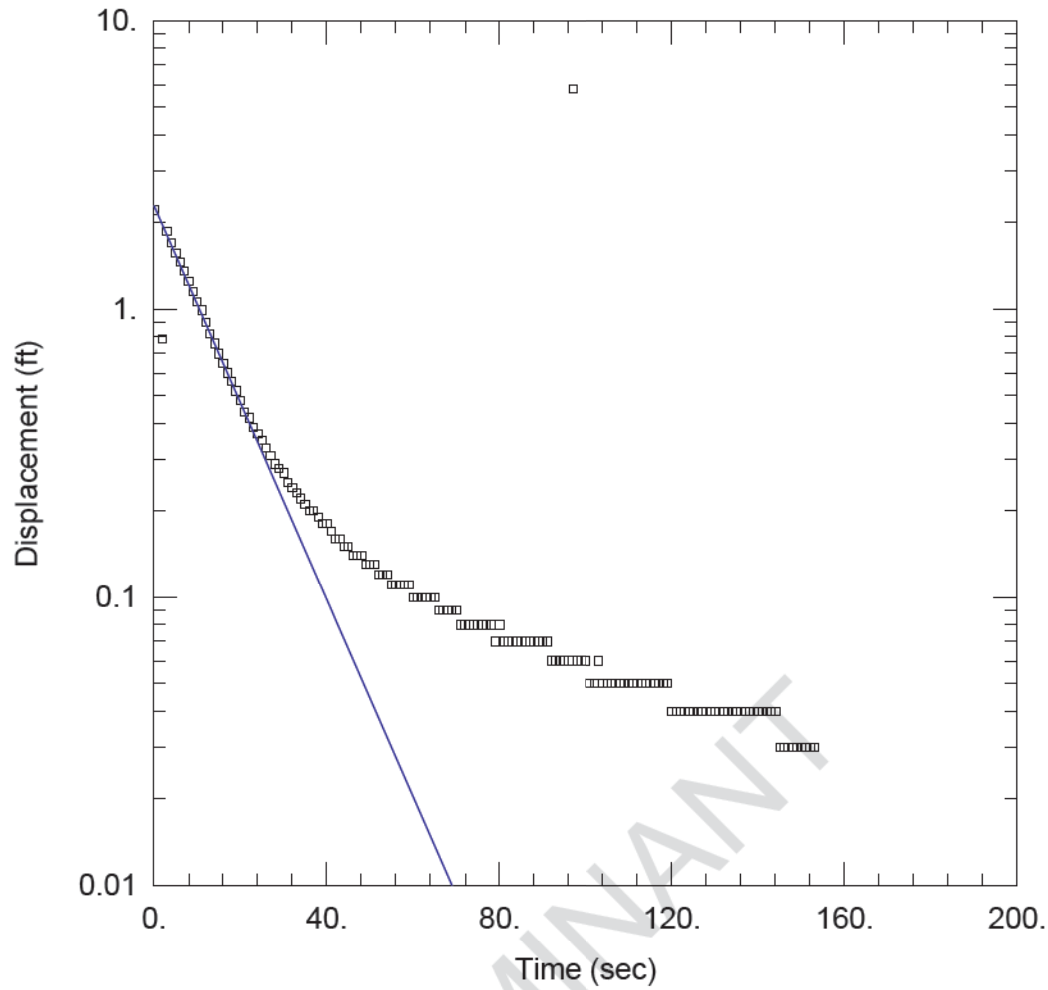
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.782

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.002185 | cm/sec |
| y0 | 1.679 | ft |

$T = K*b = 1.199\ cm^2/sec$





W-33 SLUG OUT

Data Set: J:\...\W-33 Slug Out.aqt
Date: 09/26/17 Time: 11:43:34

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-32
Test Date: 10/6/15

AQUIFER DATA

Saturated Thickness: 7.69 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (W-33)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 7.69 ft
Screen Length: 10. ft
Well Radius: 0.27 ft
Gravel Pack Porosity: 0.2

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.008423 cm/sec y0 = 2.281 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-33 Slug Out
Date: 09/26/17
Time: 11:44:01

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-32

## AQUIFER DATA

Saturated Thickness: 7.69 ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-33

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 7.69 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1417 ft
Gravel Pack Porosity: 0.2

No. of Observations: 154

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 0. | 0. | 77. | 0.08 |
| 1. | -0.08 | 78. | 0.08 |
| 2. | 0.79 | 79. | 0.07 |
| 3. | 1.86 | 80. | 0.08 |
| 4. | 1.7 | 81. | 0.07 |
| 5. | 1.56 | 82. | 0.07 |
| 6. | 1.45 | 83. | 0.07 |
| 7. | 1.35 | 84. | 0.07 |
| 8. | 1.25 | 85. | 0.07 |
| 9. | 1.15 | 86. | 0.07 |
| 10. | 1.06 | 87. | 0.07 |
| 11. | 0.99 | 88. | 0.07 |
| 12. | 0.9 | 89. | 0.07 |
| 13. | 0.82 | 90. | 0.07 |
| 14. | 0.76 | 91. | 0.07 |
| 15. | 0.7 | 92. | 0.06 |
| 16. | 0.65 | 93. | 0.06 |
| 17. | 0.6 | 94. | 0.06 |
| 18. | 0.56 | 95. | 0.06 |
| 19. | 0.52 | 96. | 0.06 |
| 20. | 0.48 | 97. | 5.8 |
| 21. | 0.44 | 98. | 0.06 |
| 22. | 0.42 | 99. | 0.06 |
| 23. | 0.39 | 100. | 0.06 |
| 24. | 0.37 | 101. | 0.05 |
| 25. | 0.35 | 102. | 0.05 |
| 26. | 0.33 | 103. | 0.06 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 27. | 0.31 | 104. | 0.05 |
| 28. | 0.29 | 105. | 0.05 |
| 29. | 0.28 | 106. | 0.05 |
| 30. | 0.27 | 107. | 0.05 |
| 31. | 0.25 | 108. | 0.05 |
| 32. | 0.24 | 109. | 0.05 |
| 33. | 0.23 | 110. | 0.05 |
| 34. | 0.22 | 111. | 0.05 |
| 35. | 0.21 | 112. | 0.05 |
| 36. | 0.2 | 113. | 0.05 |
| 37. | 0.2 | 114. | 0.05 |
| 38. | 0.19 | 115. | 0.05 |
| 39. | 0.18 | 116. | 0.05 |
| 40. | 0.18 | 117. | 0.05 |
| 41. | 0.17 | 118. | 0.05 |
| 42. | 0.16 | 119. | 0.05 |
| 43. | 0.16 | 120. | 0.04 |
| 44. | 0.15 | 121. | 0.04 |
| 45. | 0.15 | 122. | 0.04 |
| 46. | 0.14 | 123. | 0.04 |
| 47. | 0.14 | 124. | 0.04 |
| 48. | 0.14 | 125. | 0.04 |
| 49. | 0.13 | 126. | 0.04 |
| 50. | 0.13 | 127. | 0.04 |
| 51. | 0.13 | 128. | 0.04 |
| 52. | 0.12 | 129. | 0.04 |
| 53. | 0.12 | 130. | 0.04 |
| 54. | 0.12 | 131. | 0.04 |
| 55. | 0.11 | 132. | 0.04 |
| 56. | 0.11 | 133. | 0.04 |
| 57. | 0.11 | 134. | 0.04 |
| 58. | 0.11 | 135. | 0.04 |
| 59. | 0.11 | 136. | 0.04 |
| 60. | 0.1 | 137. | 0.04 |
| 61. | 0.1 | 138. | 0.04 |
| 62. | 0.1 | 139. | 0.04 |
| 63. | 0.1 | 140. | 0.04 |
| 64. | 0.1 | 141. | 0.04 |
| 65. | 0.1 | 142. | 0.04 |
| 66. | 0.09 | 143. | 0.04 |
| 67. | 0.09 | 144. | 0.04 |
| 68. | 0.09 | 145. | 0.03 |
| 69. | 0.09 | 146. | 0.03 |
| 70. | 0.09 | 147. | 0.03 |
| 71. | 0.08 | 148. | 0.03 |
| 72. | 0.08 | 149. | 0.03 |
| 73. | 0.08 | 150. | 0.03 |
| 74. | 0.08 | 151. | 0.03 |
| 75. | 0.08 | 152. | 0.03 |
| 76. | 0.08 | 153. | 0.03 |



## SOLUTION

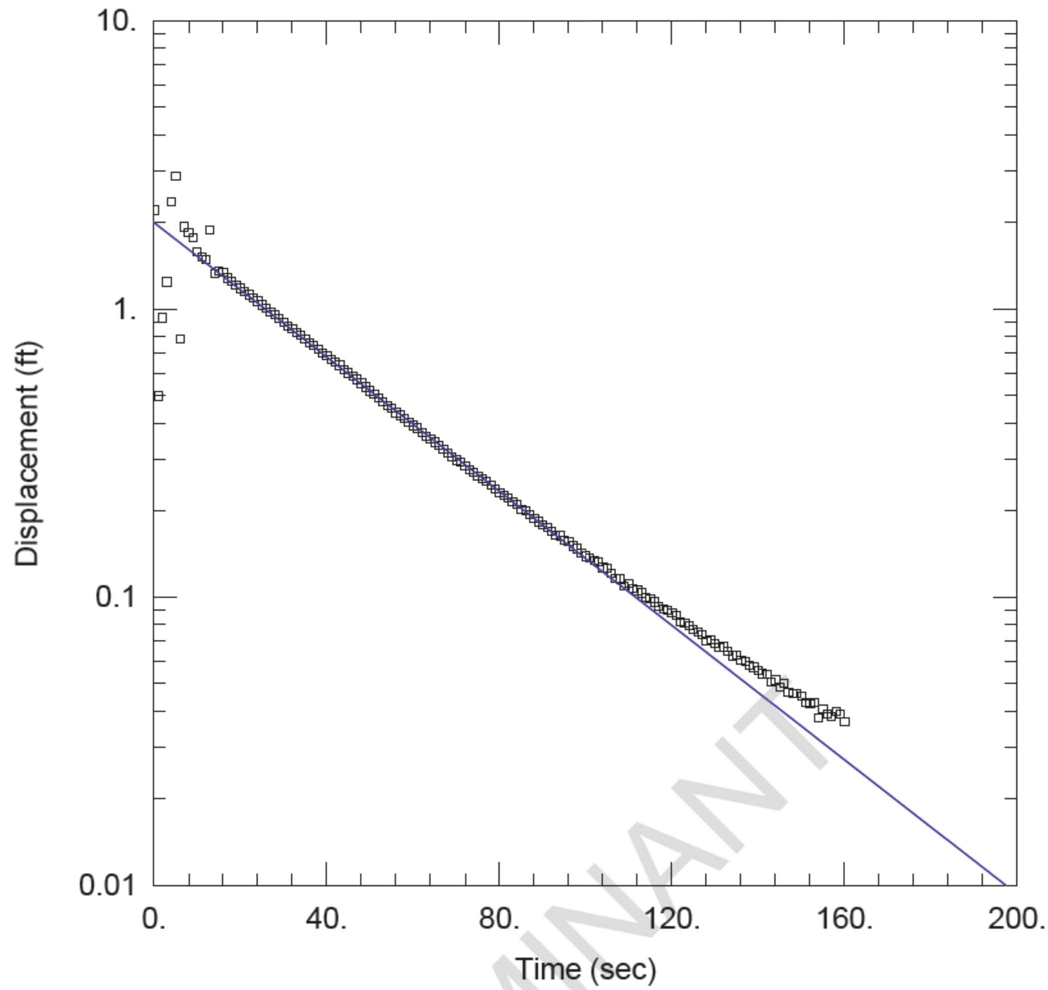
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.748

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.008423 | cm/sec |
| y0 | 2.281 | ft |

T = K*b = 1.974 $cm^2/sec$





## W-35 SLUG IN

Data Set: J:\...\W-35 Slug In.aqt
Date: 09/26/17 Time: 11:49:25

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-35
Test Date: 10/6/15

## AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (W-35)

Initial Displacement: 2.2 ft Static Water Column Height: 22.38 ft
Total Well Penetration Depth: 14.38 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

## SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0007432 cm/sec y0 = 1.994 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-35 Slug In
Date: 09/26/17
Time: 11:44:39

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-35

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-35

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 22.38 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.38 ft

No. of Observations: 160

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 0.4999 | 81. | 0.2254 |
| 2. | 0.9332 | 82. | 0.2206 |
| 3. | 1.24 | 83. | 0.2146 |
| 4. | 2.357 | 84. | 0.2097 |
| 5. | 2.894 | 85. | 0.2017 |
| 6. | 0.7846 | 86. | 0.1997 |
| 7. | 1.928 | 87. | 0.193 |
| 8. | 1.835 | 88. | 0.188 |
| 9. | 1.765 | 89. | 0.183 |
| 10. | 1.573 | 90. | 0.179 |
| 11. | 1.52 | 91. | 0.1746 |
| 12. | 1.483 | 92. | 0.1701 |
| 13. | 1.885 | 93. | 0.1645 |
| 14. | 1.329 | 94. | 0.1635 |
| 15. | 1.35 | 95. | 0.1578 |
| 16. | 1.336 | 96. | 0.156 |
| 17. | 1.279 | 97. | 0.1506 |
| 18. | 1.247 | 98. | 0.1478 |
| 19. | 1.212 | 99. | 0.1429 |
| 20. | 1.18 | 100. | 0.1389 |
| 21. | 1.152 | 101. | 0.1369 |
| 22. | 1.122 | 102. | 0.1345 |
| 23. | 1.092 | 103. | 0.1322 |
| 24. | 1.063 | 104. | 0.1267 |
| 25. | 1.033 | 105. | 0.1262 |
| 26. | 1.006 | 106. | 0.121 |
| 27. | 0.9786 | 107. | 0.1158 |
| 28. | 0.9549 | 108. | 0.1156 |
| 29. | 0.9264 | 109. | 0.1096 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 30. | 0.897 | 110. | 0.1114 |
| 31. | 0.875 | 111. | 0.1069 |
| 32. | 0.8531 | 112. | 0.1053 |
| 33. | 0.8306 | 113. | 0.1032 |
| 34. | 0.8094 | 114. | 0.0999 |
| 35. | 0.7878 | 115. | 0.0988 |
| 36. | 0.7659 | 116. | 0.0961 |
| 37. | 0.7462 | 117. | 0.093 |
| 38. | 0.727 | 118. | 0.0907 |
| 39. | 0.7061 | 119. | 0.0897 |
| 40. | 0.6873 | 120. | 0.088 |
| 41. | 0.6698 | 121. | 0.086 |
| 42. | 0.653 | 122. | 0.0822 |
| 43. | 0.6381 | 123. | 0.081 |
| 44. | 0.6172 | 124. | 0.0798 |
| 45. | 0.6008 | 125. | 0.077 |
| 46. | 0.5857 | 126. | 0.0757 |
| 47. | 0.5699 | 127. | 0.0743 |
| 48. | 0.5532 | 128. | 0.0706 |
| 49. | 0.5358 | 129. | 0.0708 |
| 50. | 0.52 | 130. | 0.0691 |
| 51. | 0.5055 | 131. | 0.0669 |
| 52. | 0.4898 | 132. | 0.0671 |
| 53. | 0.4776 | 133. | 0.0649 |
| 54. | 0.4631 | 134. | 0.0625 |
| 55. | 0.4523 | 135. | 0.0627 |
| 56. | 0.4373 | 136. | 0.0605 |
| 57. | 0.4283 | 137. | 0.0598 |
| 58. | 0.4179 | 138. | 0.0581 |
| 59. | 0.4033 | 139. | 0.057 |
| 60. | 0.3943 | 140. | 0.0558 |
| 61. | 0.3861 | 141. | 0.0542 |
| 62. | 0.373 | 142. | 0.0539 |
| 63. | 0.3623 | 143. | 0.0508 |
| 64. | 0.3534 | 144. | 0.0515 |
| 65. | 0.3457 | 145. | 0.0488 |
| 66. | 0.3365 | 146. | 0.0503 |
| 67. | 0.327 | 147. | 0.0466 |
| 68. | 0.3173 | 148. | 0.0464 |
| 69. | 0.308 | 149. | 0.0464 |
| 70. | 0.2992 | 150. | 0.0453 |
| 71. | 0.2939 | 151. | 0.0432 |
| 72. | 0.2862 | 152. | 0.0425 |
| 73. | 0.2772 | 153. | 0.043 |
| 74. | 0.2721 | 154. | 0.038 |
| 75. | 0.2641 | 155. | 0.0409 |
| 76. | 0.2573 | 156. | 0.0393 |
| 77. | 0.2521 | 157. | 0.0385 |
| 78. | 0.2448 | 158. | 0.04 |
| 79. | 0.2376 | 159. | 0.0393 |
| 80. | 0.2309 | 160. | 0.0368 |



## SOLUTION

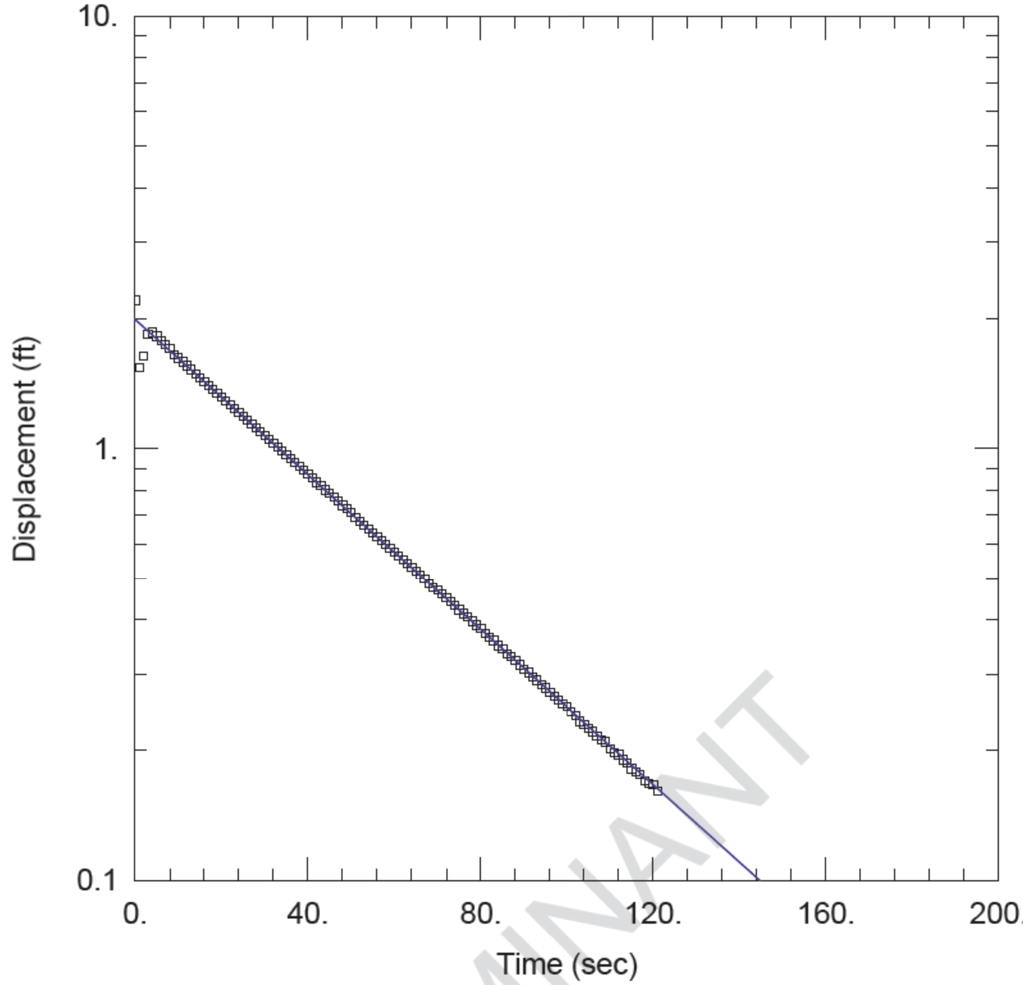
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.638

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.0007432 | cm/sec |
| y0 | 1.994 | ft |

T = K*b = 0.4077 cm²/sec






## W-35 SLUG OUT

Data Set: J:\...\W-35 Slug Out.aqt
Date: 09/26/17 Time: 11:52:25

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Well: W-35
Test Date: 10/6/15

## AQUIFER DATA

Saturated Thickness: 18. ft Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (W-35)

Initial Displacement: 2.2 ft Static Water Column Height: 22.38 ft
Total Well Penetration Depth: 14.38 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.27 ft

## SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0005724 cm/sec y0 = 1.988 ft

Data Set: J:\5164 - Luminant CCR GW Monitoring\5164-C_Monticello\Slug Tests\Monticello Slug Tests\Aqtesolv Fi
Title: W-35 Slug Out
Date: 09/26/17
Time: 11:52:48

## PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164
Location: MOSES
Test Date: 10/6/15
Test Well: W-35

## AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

## SLUG TEST WELL DATA

Test Well: W-35

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 22.38 ft
Casing Radius: 0.083 ft
Well Radius: 0.27 ft
Well Skin Radius: 0.27 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.38 ft

No. of Observations: 121

Observation Data

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 1. | 1.537 | 62. | 0.5529 |
| 2. | 1.634 | 63. | 0.5407 |
| 3. | 1.841 | 64. | 0.532 |
| 4. | 1.857 | 65. | 0.52 |
| 5. | 1.817 | 66. | 0.5091 |
| 6. | 1.774 | 67. | 0.4981 |
| 7. | 1.742 | 68. | 0.4862 |
| 8. | 1.702 | 69. | 0.4765 |
| 9. | 1.651 | 70. | 0.4697 |
| 10. | 1.62 | 71. | 0.46 |
| 11. | 1.587 | 72. | 0.4496 |
| 12. | 1.553 | 73. | 0.4411 |
| 13. | 1.522 | 74. | 0.4319 |
| 14. | 1.489 | 75. | 0.4221 |
| 15. | 1.46 | 76. | 0.4134 |
| 16. | 1.43 | 77. | 0.4061 |
| 17. | 1.401 | 78. | 0.3974 |
| 18. | 1.371 | 79. | 0.3891 |
| 19. | 1.343 | 80. | 0.3817 |
| 20. | 1.315 | 81. | 0.3723 |
| 21. | 1.288 | 82. | 0.3649 |
| 22. | 1.263 | 83. | 0.3583 |
| 23. | 1.236 | 84. | 0.3491 |
| 24. | 1.211 | 85. | 0.3423 |
| 25. | 1.187 | 86. | 0.3344 |
| 26. | 1.162 | 87. | 0.3288 |
| 27. | 1.137 | 88. | 0.322 |
| 28. | 1.115 | 89. | 0.3148 |
| 29. | 1.093 | 90. | 0.3082 |

| Time (sec) | Displacement (ft) | Time (sec) | Displacement (ft) |
|---|---|---|---|
| 30. | 1.069 | 91. | 0.3021 |
| 31. | 1.049 | 92. | 0.2949 |
| 32. | 1.026 | 93. | 0.2903 |
| 33. | 1.007 | 94. | 0.2828 |
| 34. | 0.986 | 95. | 0.2785 |
| 35. | 0.9649 | 96. | 0.2714 |
| 36. | 0.9476 | 97. | 0.2667 |
| 37. | 0.9265 | 98. | 0.2607 |
| 38. | 0.9085 | 99. | 0.2557 |
| 39. | 0.8898 | 100. | 0.2517 |
| 40. | 0.8713 | 101. | 0.2456 |
| 41. | 0.855 | 102. | 0.2409 |
| 42. | 0.8357 | 103. | 0.2334 |
| 43. | 0.8197 | 104. | 0.2296 |
| 44. | 0.802 | 105. | 0.2248 |
| 45. | 0.7868 | 106. | 0.2209 |
| 46. | 0.7708 | 107. | 0.216 |
| 47. | 0.7575 | 108. | 0.2114 |
| 48. | 0.7383 | 109. | 0.209 |
| 49. | 0.7258 | 110. | 0.2009 |
| 50. | 0.7101 | 111. | 0.197 |
| 51. | 0.6927 | 112. | 0.1952 |
| 52. | 0.679 | 113. | 0.1899 |
| 53. | 0.666 | 114. | 0.1865 |
| 54. | 0.6525 | 115. | 0.1811 |
| 55. | 0.6385 | 116. | 0.1782 |
| 56. | 0.6244 | 117. | 0.1753 |
| 57. | 0.6134 | 118. | 0.17 |
| 58. | 0.6001 | 119. | 0.1677 |
| 59. | 0.5871 | 120. | 0.1661 |
| 60. | 0.5765 | 121. | 0.1606 |
| 61. | 0.5634 | | |



## SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.638

## VISUAL ESTIMATION RESULTS

### Estimated Parameters

| Parameter | Estimate | |
|---|---|---|
| K | 0.0005724 | cm/sec |
| y0 | 1.988 | ft |

T = K*b = 0.3141 cm²/sec

**Attachment #9 for Items #26 – Surface Impoundment Characteristics**

Registration No.: XXXXX
Registrant: Falcon Development

## Table V.A. – Surface Impoundment Characteristics

| Registered Unit No. | Surface Impoundment Name | N.O.R. No. | Waste Nos.[1] | Rated Capacity | Dimensions[2] | Distance from lowest liner to groundwater | Action Leakage Rate (if required) | Unit will manage CCR Waste and non-CCR Waste (state all that apply) |
|---|---|---|---|---|---|---|---|---|
| 1 | NE Ash Water Retention Pond | 011 | 1 | 28.0 MG | 480'x480'x25' | >6' | NA | No waste |
| 2 | West Ash Settling Pond | 012 | 2 | 36.4 MG | 600'x480'x25' | >6' | NA | No waste |
| 3 | SW Ash Settling Pond | 022 | 3 | 40.6 MG | 750'x480'x25' | >6' | NA | No waste |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width and depth, also include the surface acreage for the unit.

**Table V.B. – Surface Impoundment Liner System**

| Registered Unit No.* | Surface Impoundment Name | Geomembrane Liner Material | Geomembrane Liner Permeability (cm/sec) | Geomembrane Liner Thickness | Soil Liner Material | Soil Liner Permeability (cm/sec) | Soil Liner Thickness |
|---|---|---|---|---|---|---|---|
| 1 | NE Ash Water Retention Pond | NA | NA | NA | Clay | <1x10-7 | 3' |
| 2 | West Ash Settling Pond | NA | NA | NA | Clay | <1x10-7 | 3' |
| 3 | SW Ash Settling Pond | NA | NA | NA | Clay | <1x10-7 | 3' |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

* This number should match the Registration Unit No. given on Table V.A.

**Attachment #10 for Item #27 - Groundwater System**

## MOSES Detection Monitoring

The MOSES CCR Bottom Ash Ponds are currently in the Detection Monitoring Program. Luminant collected the initial Detection Monitoring Program groundwater samples from the Bottom Ash Ponds CCR monitoring well network in September 2017. Detection groundwater samples have been collected from the CCR groundwater monitoring network on a semi-annual basis in 2018 through 2020, as required by the CCR Rule. All CCR groundwater monitoring wells were sampled for Appendix III constituents during the detection monitoring sampling events.

There were no SSIs of Appendix III parameters in 2017 through 2019; therefore, the CCR units remained in Detection Monitoring in 2020. The analytical data from the 2020 detection monitoring sampling events were evaluated using procedures described in the Statistical Analysis Plan to identify Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations.

Since the BAPs are on a peninsula of a lake and has surface water lakes on three sides, the groundwater gradient is to the NE and SW. The BAPs are the higher elevation on the peninsula.


LEGEND

DOWNGRADIENT CCR MONITORING WELL

UPGRADIENT CCR MONITORING WELL

C:\Users\worcc\OneDrive\Documents\DWG\ATON\Projects\Monticello\dwg\Site_Plan.dwg

| ATON | Detailed Site Plan<br>Site: Golden Eagle Development | Chkd: AK<br>Drawn: EFC<br>Page: 1 of 1<br>Date: 9/25/2020<br>Scale: As Shown |
|---|---|---|

**MOSES BAPs Groundwater Elevations - March 2021**

| | |
|---|---|
| W-29 | 355.59 |
| W-30 | 361.25 |
| W-31 | 364.43 |
| W-32 | 366.76 |
| W-33 | 364.26 |
| W-34 | 357.16 |
| W-35 | 358.55 |

## Table VI.A. - Unit Groundwater Detection Monitoring System

**For each unit/area** which requires groundwater monitoring, specify the number and type of wells which will comprise the groundwater monitoring system for the unit/area. Prepare additional tables as necessary.

**Waste Management Unit/Area Name[1] – Bottom Ash Ponds**

| Well Number(s) | W-29 | W-30 | W-31 | W-32 | W-33 | W-34 |
|---|---|---|---|---|---|---|
| Hydrogeologic Unit Monitored | Shallow Sand | Shallow Sand | Shallow Sand | Shallow Sand | Shallow Sand | Shallow Sand |
| Type (e.g.,. point of compliance, background, observation, etc.) | POC | POC | POC | POC | POC | POC |
| Up or Down Gradient | Up | Up | Down | Down | Down | Down |
| Casing Diameter and Material | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC |
| Screen Diameter and Material | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC |
| Screen Slot Size (in.) | 0.0014 | 0.0014 | 0.0014 | 0.0014 | 0.0014 | 0.0014 |
| Top of Casing Elevation (ft, MSL) | 377.59 | 376.95 | 376.33 | 378.96 | 387.16 | 379.16 |
| Grade or Surface Elevation (ft, MSL) | 374.94 | 373.53 | 372.99 | 375.41 | 383.69 | 375.84 |
| Well Depth (ft) | 37 | 42 | 43 | 33 | 30 | 27 |
| Screen Interval, From(ft) To(ft) | 27-37 | 32-42 | 33-43 | 23-33 | 20-30 | 17-27 |
| Facility Coordinates (e.g., lat/long or company coordinates) | 527058 | 527358 | 526969 | 526491 | 525819 | 525962 |
| | 2754498 | 2755059 | 2755498 | 2755763 | 2755454 | 2754790 |
| | | | | | | |

[1]From Tables in Section V.

**For each unit/area** which requires groundwater monitoring, specify the number and type of wells which will comprise the groundwater monitoring system for the unit/area. Prepare additional tables as necessary.

**Waste Management Unit/Area Name[1]**

| Well Number(s) | W-35 | | | | | |
|---|---|---|---|---|---|---|
| Hydrogeologic Unit Monitored | Shallow Sand | | | | | |
| Type (e.g.,. point of compliance, background, observation, etc.) | POC | | | | | |
| Up or Down Gradient | Down | | | | | |
| Casing Diameter and Material | 2” PVC | | | | | |
| Screen Diameter and Material | 2” PVC | | | | | |
| Screen Slot Size (in.) | 0.0014 | | | | | |
| Top of Casing Elevation (ft, MSL) | 381.15 | | | | | |
| Grade or Surface Elevation (ft, MSL) | 377.86 | | | | | |
| Well Depth (ft, ) | 35 | | | | | |
| Screen Interval, From(ft)<br>To(ft) | 25-35 | | | | | |
| Facility Coordinates (e.g., lat/long or company coordinates) | 526365 | | | | | |
| | 2754542 | | | | | |
| | | | | | | |

[1]From Tables in Section V.

**Attachment #11 for Item #28 - Groundwater Monitoring SAP**

**COAL COMBUSTION RESIDUAL RULE**
**STATISTICAL ANALYSIS PLAN**

**MONTICELLO STEAM ELECTRIC STATION**
**ASH PONDS**
**MOUNT PLEASANT, TEXAS**

**OCTOBER 11, 2017**



***Prepared For:***

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October 11, 2017

## PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision. I hereby certify that the proposed statistical method is appropriate for evaluating groundwater data in accordance with the requirements of Sections 257.93 through 257.95 of the CCR Rule.

Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

STATE OF TEXAS
PATRICK J. BEHLING
79872
LICENSED
PROFESSIONAL ENGINEER

# TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ANOVA | analysis of variance |
| CCR | coal combustion residuals |
| EPA | United States Environmental Protection Agency |
| MCL | maximum contaminant level |
| PPCC | Filliben's probability plot correlation coefficient test |
| RROS | robust regression order statistics |
| SAP | statistical analysis plan |
| SWFPR | site-wide false positive rate |
| UPL | Upper Prediction Limit |

# 1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) issued regulations regarding the disposal of coal combustion residuals (CCR) in certain landfills and impoundments in April 2015. These regulations, found under 40 CFR 257, Subpart D and referred to as the "CCR Rule" require facilities to design a groundwater monitoring program to monitor if landfills or impoundments with CCR materials, called CCR units, are impacting downgradient groundwater quality.

Section 257.90 of the CCR Rule requires that all existing CCR landfills and surface impoundments comply with the following groundwater monitoring requirements no later than October 17, 2017:

- Install a groundwater monitoring system as required under Section 257.91;
- Develop a groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required under Section 257.93;
- Initiate a detection monitoring program to include obtaining a minimum of eight independent samples for each background upgradient and downgradient monitoring well as required under Section 257.94; and
- Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in Appendix III of this part as required under Section 257.94.



Statistical analysis of groundwater monitoring data is required as part of detection monitoring and assessment monitoring under Section 257.93 of the CCR Rule. Section 257.93 of the CCR Rule provides several options for statistically evaluating groundwater data. The owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of Section 257.93 when evaluating constituent concentrations from the groundwater monitoring. EPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (EPA, 2009), also called the "Unified Guidance", presents acceptable statistical approaches for such evaluations and analyses. However, neither the CCR Rule nor the Unified Guidance outlines a step-by-step process to consistently evaluate groundwater monitoring data in order to satisfy the CCR Rule.

The purpose of this statistical analysis plan (SAP) is to develop a standard set of statistical approaches to follow when demonstrating groundwater compliance for each CCR unit in accordance with the CCR Rule and the Unified Guidance. Depending on the CCR unit and the evaluation of groundwater data for the CCR unit, CCR groundwater compliance may be evaluated using either an interwell or an intrawell approach—the interwell approach being a comparison of water quality data upgradient of the CCR unit to water quality data downgradient of the CCR unit, and the intrawell approach being a comparison of water quality data of a well against background values established from that well's own historical water quality data.

This SAP describes and summarizes the statistical approach for establishing and evaluating baseline conditions to use for detection monitoring and assessment monitoring. The plan is designed to detect a release from a CCR facility. The plan conforms with EPA "Unified Guidance Document: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities," March 2009, and the American Society for Testing and Materials (ASTM) Standard D6312-17, Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities.

# 2.0 DATA PREPARATION

Analytical data from wells in the groundwater monitoring network at a CCR unit during each sampling event are first reviewed for usability after final data packages are received from the laboratory. The analytical data are then prepared for statistical analysis. Methods for handling duplicate and non-detect data are implemented during this data preparation phase in order to comply with the performance standards outlined in 40 CFR 257.93. During the data preparation, anomalously low or high constituent concentrations are also considered for usability. The following subsections provide further details.

## 2.1 Handling Duplicate Data

Field duplicates and data rejected after data validation are removed from the data set. Only the primary samples are retained for the statistical evaluation.

## 2.2 Handling Non-Detect Data

A non-detected constituent concentration is defined as any analytical result that either has an instrument response but is below a sample detection limit or that has no instrument response. A non-detected concentration is handled by using one of two approaches, depending on the percentage of detections in the data set:

- If a data set has at least 85% of samples detected, half of the sample detection limit is substituted as a proxy concentration. In these cases, substituting a proxy concentration will not alter the results of statistical tests or summary statistics (EPA, 2009; EPA, 2000).
- If a data set has at least 50% but no more than 85% of the samples detected, the robust regression order statistics (RROS) method is used to estimate summary statistics such as the mean and standard deviation (EPA, 2009).
- If a data set has fewer than 50% of the samples detected, then nonparametric statistical approaches are used to evaluate the data and to prepare summary statistics (EPA, 2009; EPA, 2000).

It should be noted that J-flagged data (estimated concentrations between the sample detection limit and the reporting limit) are defined as detected concentrations.

## 2.3 Handling Anomalous Detections

There may be infrequent cases when an anomalously high or low detection cannot be confirmed after resampling a well. In such cases, the anomalous detection should be considered for removal from the data set and should be replaced by the resampled concentration so that current conditions are not over- or under-estimated. This is particularly important when estimating a baseline or background value to use to compare to future constituent concentrations from the network of groundwater monitoring wells. An anomalous detection may be identified at any point after analytical laboratory results are available, based on professional judgment or based on the outlier evaluation (see Section 3.4 for more details about testing for outliers). If an analytical result is removed, documentation should be provided in the annual report stating which analytical result was removed and justifying its removal.

## 3.0 STATISTICAL ASSUMPTIONS

Before baseline or background values can be established, a number of statistical assumptions are evaluated to determine if concentrations are independent and identically distributed. A sample's constituent concentration is independent when no other sample concentrations influence its measurement, regardless of when or where the sample was collected. Statistical independence is indicated by a set of random data. But randomness is only demonstrated by the presence of mean and variance stationarity and the lack of evidence for effects such as spatial and temporal variation, autocorrelation, and trends (EPA, 2009).

The validity of statistical independence is checked by testing for:

- Spatial stationarity,
- Temporal stationarity,
- Lack of autocorrelation, and
- Lack of statistical data outliers.

For the purpose of this SAP, the statistical software R (The R Foundation, 2017) is assumed to be used to perform the statistical tests used for checking the validity of independent samples. Other applicable programs may be used as necessary.



### 3.1 Spatial Stationarity

Spatial stationarity is defined as the lack of variability across well locations. Spatial variation may be naturally occurring and unaffected by human activity, or may be caused by human activity. The presence of spatial variability does not necessarily mean that contamination is present. If spatial variability is present, regardless whether it's naturally-occurring or not, it may hinder attempts to identify the cause of a statistically significant increase in constituent concentrations between current and baseline or background conditions (EPA, 2009). In some cases, spatial variability may make upgradient-to-downgradient comparisons (also called interwell comparisons) difficult (EPA, 2009).

One way to identify spatial stationarity is to observe whether spatial variability does or does not exist across multiple wells. This is particularly true when a CCR unit has more than one upgradient well and when interwell comparisons are used for detection or assessment monitoring. Constituent concentrations from each upgradient well are taken as a single data set and then upgradient well data sets are compared. Before establishing baseline or background values for the detection monitoring or assessment monitoring programs, two steps are taken to check for spatial stationarity for each constituent and groundwater monitoring well (recommended by the Unified Guidance):

1. Side-by-side box plots are created, and
2. The one-way analysis of variance (ANOVA) or Kruskal-Wallis test is used.

Box plots provide a quick screen for possible spatial variation. The ANOVA and Kruskal-Wallis test are more formal tests for identifying spatial variability. All of the statistical tests are performed and the box plots are generated using the statistical software R (The R Foundation, 2017) or similar software.

In some cases, spatial variability, where substantial differences in average constituent concentrations are present among upgradient wells, can make interwell comparisons difficult (EPA, 2009). Professional judgment should be used to determine whether the set of constituent concentrations from all upgradient wells appropriately represent baseline or background conditions and whether the spatial variability will prevent the detection or assessment monitoring from identifying a potential release at a CCR unit. If the spatial variability were to indicate that analytical data from a set of upgradient wells do not appropriately represent background conditions or if the spatial variability were to hinder the detection or assessment monitoring, then the data set should be adjusted accordingly.



### 3.1.1 Box Plots

A box plot is a graphical representation of the pattern and distribution of concentrations for a single constituent data set. Visually comparing box plots for upgradient well's constituent concentrations, side-by-side, is one way to identify similarities or differences across upgradient well concentrations. If box plots contain similar range of concentrations, then the concentrations for the upgradient wells are similar (spatial stationarity). Likewise, if box plots do not contain similar range of concentrations, then the concentrations for the upgradient wells are different: spatial variability. Section 3.4.1 provides more details about how to create box plots.

### 3.1.2 ANOVA and Kruskal-Wallis Tests

The ANOVA and Kruskal-Wallis tests are similar statistical tests; both tests indicate significant spatial variability by indicating whether a statistically significant difference exists among average, upgradient well concentrations. The ANOVA is a parametric approach for comparing average concentrations across two or more wells. The Kruskal-Wallis test is a non-parametric approach to the ANOVA using the ranks of concentrations, rather than using the actual concentration measurements. Neither test can be performed if the variances across upgradient wells are unequal. A Type I error rate (α), or level of significance, is set to α=0.05 for identifying a statistical significant different among well averages.

Determining which test to perform, either the ANOVA or Kruskal-Wallis tests, depends upon the frequency of detected results, the validity of assuming normality or lognormality for residuals, and the validity of assuming upgradient wells have equal variances. More details about these dependencies are provided in the subsections below (Sections 3.1.2.1-3.1.2.3). Figure 1 outlines the steps taken to define which statistical test (ANOVA or Kruskal-Wallis) should be used. The method used to determine the appropriate statistical test is based on the Unified Guidance recommendations. Tests of normality and equal variances use a 0.01 level of significance, rather than a 0.05 level of significance, because the ANOVA is reasonably robust to small departures of normality and equal variances (EPA, 2009).



No statistical test is performed when there are no detected concentration measurements in any of the upgradient wells.

If there are at least 85% detected concentrations in every upgradient well, then the ANOVA may be considered. For any non-detected concentration, half of the sample detection limit is used as a proxy concentration (see Section 2.2 for more details). The assumptions of normality and equal variances are checked. To test the normality assumption, residuals are tested using two distributional tests, the Shapiro-Wilk test and Filliben's probability plot correlation coefficient (PPCC) test. The Levene's test is used to check for equal variances. Only when evidence exists that both assumptions are valid is the ANOVA using the raw concentration measurements used. If either assumption is not met, then the assumptions of normality and equal variances are checked using the log-transformed data. Only when evidence exists that both assumptions are valid is the ANOVA using the log-transformed concentration measurements used. If either assumption is not met, then an ANOVA cannot be considered.

If there are fewer than 85% detected concentrations or if the ANOVA cannot be considered, then the Kruskal-Wallis may be considered. Non-detected data are treated differently for the Kruskal-Wallis test since the ranks of the data are used rather than the concentration measurements: all data below the maximum sample detection limit are set to the same value, lower than the maximum sample detection limit (Helsel, 2012). Since the Kruskal-Wallis tests uses ranks of the data, the actual value used for data below the maximum sample detection limit is not relevant. The assumption of equal variances is checked using the Fligner's test. If the Fligner's test indicates that the assumption of equal variances is valid, then the Kruskal-Wallis test is used. Otherwise, no test can be performed because variances are heterogeneous among upgradient well concentration measurements.

### 3.2 Temporal Stationarity

Temporal stationarity is the lack of temporal variability. Temporal variability refers to the concept that concentration measurements vary over time. Temporal variability may be present across a group of wells and/or constituents. Temporal variability can also be present at an individual well or for a single constituent. By definition, temporal variability also includes autocorrelation, which is discussed separately in Section 3.3.

Any temporal pattern can invalidate or weaken the results of statistical testing (EPA, 2009). Plotting concentrations over time for a given constituent and for a given well is one way to identify possible trends. The Mann-Kendall trend test is another way to identify possible temporal variation for a given constituent and well. The Mann-Kendall is a nonparametric method to test for an increasing or decreasing linear trend over time. The Mann-Kendall doesn't require any special treatment for non-detects, other than all non-detects should be set to a common value lower than any of the detected concentrations (EPA, 2009 p.8-32). The Mann-Kendall is performed for any set of data with at least one detected concentration.



Before establishing baseline or background values for the detection monitoring or assessment monitoring programs, two steps are taken to check for temporal stationarity for each constituent and groundwater monitoring well:

1. A time plot is created, and
2. The Mann-Kendall trend test is used.

The time plots are generated and the Mann-Kendall trend test is performed using the statistical software R (The R Foundation, 2017) and the EnvStats package (Package 'EnvStats', 2017) or similar software.

Statistically significant increasing or decreasing temporal trends are not expected for any upgradient well since, by definition, an upgradient well should not be impacted by a release at the CCR unit. If, however, there is evidence of a temporal trend, then professional judgment should be used to determine whether constituent concentrations from that upgradient well appropriately represent baseline or background conditions and whether the trend will prevent the detection or assessment monitoring from identifying a potential release at a CCR unit. If the trend were to indicate that an upgradient well does not appropriately represent baseline or background conditions or if the trend were to hinder the detection or assessment monitoring, then the data set should be adjusted accordingly.

To identify a statistically significant temporal trend, a Type I experiment wise error rate ($\alpha$) is set to $\alpha = 0.05$. That means, a single test error rate is defined for each well across the detected Appendix III or Appendix IV constituents. Each well's single test error rate is based on the number of detected constituents, $d$, for a given constituent list. For example, a well with five detected Appendix IV constituents ($d = 5$) has a single test error rate equal to $1 - (1 - \alpha)^{1/d^*} = 1 - (1 - 0.05)^{1/5} = 0.0102$. A statistically significant linear trend is identified when the p-value for the Mann-Kendall test is less than the single test error rate.

### 3.3 Lack of Autocorrelation



Autocorrelation is the statistical dependence between pairs of constituent concentrations across a sequence of time. That is, pairs of consecutive concentrations will exhibit stronger similarity in concentration measurements than expected from pairs collected at random times (p.6-25, EPA, 2009). To identify autocorrelation, the Unified Guidance recommends using the rank von Neumann ratio test for its ease of use and robustness when applied to either normal or non-normal distributions (p.14-17 EPA, 2009). Since this test has not been designed to handle tied values such as non-detect concentrations, this test is only performed for those wells and constituents with at least 50% detected concentrations.

The rank von Neumann ratio test statistic and associated p-value are computed using the statistical software R (The R Foundation, 2017) and the EnvStats package (Package 'EnvStats', 2017) or similar software.

Before baseline or background values are established for the detection monitoring or assessment monitoring programs, the rank von Neumann ratio test is used. Statistically significant autocorrelation is not expected for any well since, by definition, constituent concentration measurements from a well should be collected with far enough time between sampling events that a more recent sample does not include the same volume of groundwater as any previous sample. If, however, there is evidence of autocorrelation, then professional judgment should be used to determine whether constituent concentrations from a well appropriately represent baseline or background conditions and whether the trend will prevent the detection or assessment monitoring from identifying a potential release at a CCR unit. If the trend were to indicate that a well does not appropriately represent baseline or background conditions or if the trend were to hinder the detection or assessment monitoring, then the data set should be adjusted accordingly.

To identify a statistically significant autocorrelation, a Type I experiment wise error rate, $\alpha$, of 0.05 is used for each well across the detected Appendix III or Appendix IV constituents. Each well's single test error rate is based on the number of constituents detected at least 50% of the time, $d^*$, for a given constituent list. For example, a well with five detected Appendix IV constituents ($d^* = 5$), has a single test error rate equal to $1 - (1 - \alpha)^{1/d^*} = 1 - (1 - 0.05)^{1/5} = 0.0102$. A statistically significant autocorrelation is identified when the p-value for the rank von Neumann test is less than the single test error rate.

### 3.4 Lack of Statistical Outliers

Based on the Unified Guidance, outliers are "extreme, unusual-looking measurements". An outlier may be an invalid concentration measurement due to a typographical error, an equipment error, a sampling error, etc. Or an outlier may be a valid concentration measurement that reflects a "...temporary, local 'hot spot' of higher concentration" (EPA, 2009). Furthermore, outliers are "measurements (larger or smaller than other data values) that are not representative of the sample population from which they were drawn" (EPA, 2002).



The Unified Guidance recommends testing for outliers to attempt to determine whether a suspect outlier may have been drawn from the same sample population as the rest of the data. "The basic problem with including statistical outliers in analyzing groundwater data is that they do not come from the same distribution as the other measurements in the sample and so fail the identically distributed presumption of most tests" (EPA, 2009).

The consequences of keeping statistical outliers when developing a baseline or background value may lead to an unreasonably high value that will be unable to identify potential releases at a CCR unit. Professional judgment should be used to determine whether to retain or remove any outlier. The Unified Guidance states that outliers generally should not be removed unless some basis for a likely error or discrepancy can be identified. Possible errors or discrepancies include "...values significantly outside the historical ranges of background data" (EPA, 2009). "The decision to discard an outlier should be based on some scientific or quality assurance basis" (EPA, 2000). "A data point should not be eliminated from the background data set simply because it is the highest value that was observed" (EPA, 2002). EPA recommends "…that all data not known to be in error should be considered valid" (EPA, 1989). Furthermore, "[t]he general rule is that a measurement should never be deleted from a data set solely on the basis of an outlier test" (SWDIV, 1999).

Before baseline or background values are established for the detection monitoring or assessment monitoring programs, two steps are taken to check for suspect outliers for each constituent with at least 50% detected concentrations and at each well or set of upgradient wells:

1. A box plot is created to identify suspect outliers, and
2. The Dixon's test or Rosner's test is used.

Possible, or suspect, outliers are identified using a box plot. The statistical outlier tests, the Dixon's test and Rosner's test, are tests to check whether any suspect outlier is a statistical outlier. The box plots are generated and the Dixon's or Rosner's test is performed using the statistical software R (The R Foundation, 2017) or similar software.



### 3.4.1 Box Plots

Creating a box plot is a visual technique used to identify suspect outliers. Box plots can also demonstrate the pattern and distribution of constituent concentrations for a data set. The size of the vertical box in a box plot indicates where the middle half of the data fall (i.e., the interquartile range, IQR). Concentration measurements that plot further away from the others indicate suspect outliers; for a box plot, these measurements are called mild or extreme outliers (EPA, 2009).

Box plots are constructed to identify two types of suspect outliers: mild and extreme outliers. Suspect outliers are defined in terms of the IQR, represented by the range of the middle half of the data and indicated by the vertical 'box' in a box plot. The IQR is the difference between the upper quartile and the lower quartile of the data. Mild and extreme outliers are identified for small or large sample detected concentration measurements. A high, mild outlier is any detected concentration that exceeds 1.5 times the IQR, but no more than 3 times the IQR, from the upper quartile. A small, mild outlier is any detected concentration that is below 1.5 times the IQR, but no less than 3 times the IQR, from the lower quartile. A high, extreme outlier is any detected concentration greater than 3 times the IQR from the upper quartile. A low, extreme outlier is any detected concentration less than 3 times the IQR from the lower quartile. EPA, 2009 and EPA, 2017 state that mild and extreme outliers should be considered suspect outliers. Computational details for box plots are found in EPA guidance documents (EPA, 2000; EPA, 2009).

### 3.4.2 Statistical Outlier Tests

A statistical outlier test, either the Dixon's test or Rosner's test, is performed for each data set having at least one suspect outlier in order to determine if the suspect outlier is also a statistical outlier. For a data set with no more than 25 samples, the Dixon's test is used. For a data set with at least 20 samples, the Rosner's test is used. Dixon's test can only test if one detected concentration (i.e., the minimum or the maximum) is a statistical outlier. The Rosner's test can test if one or more detected concentrations are statistical outliers (EPA, 2000; EPA, 2002; EPA, 2009). Computational details for these outlier tests are outlined in EPA documents (EPA, 2000; EPA, 2009). Based on results from the statistical outlier tests, mild and extreme outliers are classified as statistical outliers.

Both statistical outlier tests assume that the data set with the suspect outlier(s) removed is normally distributed (or lognormally distributed if the data are transformed to the natural-log scale). Section 4.1.2 below discusses how to test distributional assumptions of normality or lognormality.

Any extreme, suspect outlier that is also identified as a statistical outlier is evaluated for possible errors or data discrepancies before a baseline or background value is established. Suspect outliers, including those also classified as statistical outliers, should be reviewed for having possible analytical or other quality errors. Professional judgment should be used to determine whether constituent concentrations defined as suspect or statistical outliers should be removed so that baseline or background conditions are properly represented so that detection or assessment monitoring can identify a potential release at a CCR unit. If an outlier does not represent baseline or background conditions or if the outlier hinders the detection or assessment monitoring, then the data set should be adjusted accordingly.

## 4.0 STATISTICAL APPROACH FOR DETECTION AND ASSESSMENT MONITORING

Section 257.93 of the CCR rule provides several options for statistically evaluating the groundwater data and the performance standards to follow at CCR facilities. At each CCR unit, upper prediction limits (UPLs) are calculated for each detected constituent. To achieve UPLs with sufficient statistical power, the UPLs are designed to include retesting procedures based on the 1-of-2 approach (one assigned sample and one resample—see Section 4.1.3). Using UPLs is one of the preferred methods for comparing groundwater based on the Unified Guidance (EPA, 2009).

UPLs are computed using baseline or background data. The source of the baseline or background data may differ, depending whether interwell or intrawell comparisons are appropriate. "With interwell tests, background is derived from distinct, initially upgradient background wells" (EPA, 2009). "Future data from each of these compliance wells are then tested against this common background. On the other hand, intrawell background [also called baseline] is derived from and represents historical groundwater conditions in each individual compliance well." (EPA, 2009)

There are several considerations to make when determining whether interwell or intrawell comparisons should be performed. To consider interwell comparisons for a CCR unit, the groundwater monitoring data should meet the statistical assumptions of spatial stationarity, temporal stationarity, lack of autocorrelation, and lack of statistical outliers (see Section 3). Furthermore, the CCR unit should

- have at least one upgradient well,
- have a clearly defined groundwater flow direction without any radial flow, and
- not contain highly variable mine spoil.

If any of these conditions cannot be met or if the statistical assumptions cannot be met, then intrawell comparisons should be considered for a CCR unit. Both Gibbons and EPA's Unified guidance recommend using intrawell analyses when spatial variability exists. Both Gibbons and the Unified Guidance caution that intrawell analyses are appropriate in the absence of contamination. Since a CCR unit may be an existing landfill or impoundment that is now under the CCR rule, there is a possibility that contamination may be present. Professional judgment should be used for such CCR units to determine if contamination is likely present, and to determine which type of comparison is more appropriate.

### 4.1 Calculating UPLs

UPLs are estimated with constituent concentrations that are independent and identically distributed, as described in Section 3. The set of data used to calculate UPLs are based on constituent concentrations from the eight background sampling events and from either:

- upgradient wells for the CCR unit (for interwell comparisons), or
- individual compliance well (for intrawell comparisons).

UPLs must be calculated using a single-test error rate that accounts for the site-wide false positive rate (SWFPR) associated with all of the detection or assessment monitoring comparisons. The SWFPR is set based on the Unified Guidance recommendations and is discussed in more detail in Section 4.1.1.

After assumptions have been checked and outliers have been identified for the appropriate set of data, the data distribution is defined in accordance with EPA guidance (EPA, 2000; EPA, 2002; EPA, 2009; EPA, 2017; SWDIV, 1998). UPLs are then calculated based on the defined data distribution. Distributions are defined using the methodology outlined in Section 4.1.2, and the UPLs are calculated using the methodology described in Section 4.1.3.

The statistical software R (The R Foundation, 2017) or similar software is used to perform all statistical distribution tests and to calculate UPLs.



#### 4.1.1 Defining Single-test error rate

Based on 40 CFR 257.93 (g)(2) and the Unified Guidance, the cumulative SWFPR or Type I experiment wise error rate for yearly monitoring shall be no more than 0.10. That means, a single test error rate must be considerably lower than 0.10. The single test error rate depends on the number of detected constituents and number of compliance wells evaluated in a CCR unit's monitoring program, defined as:
$1 - (1 - \alpha)^{1/cw}$, where:

- $\alpha$=0.10, the SWFPR;
- $c$=the number detected constituents for the monitoring program (the Appendix III constituents for detection monitoring or Appendix IV constituents for assessment monitoring); and
- w=the number of compliance wells at the CCR unit.

Sampling frequency is not included in this single-test error rate because UPL calculations are designed to account for the number of sampling events per year.

### 4.1.2 Defining a Distribution for Background

The type of UPL calculated is based on a data set's defined distribution. Figure 2 outlines the steps to take to define whether a data set follows a normal, gamma, lognormal, or nonparametric distribution. If there are no detections for a data set, no distribution is defined. For a constituent with fewer than 50% detected concentrations, the distribution is defined as nonparametric (EPA, 2000; EPA, 2009).

For each data set with at least 50% detected concentrations and at least 4 samples, the data's distribution is tested using up to three distributional tests, which include the Shapiro-Wilk test, Kolmogorov-Smirnov test, and PPCC test. A test for the gamma distribution is included because EPA, 2017 generally recommends using summary statistics from a gamma distribution before using statistics from a lognormal distribution when both the gamma and lognormal distributional assumptions are valid. All of these distributional tests are recommended by EPA (EPA, 2000; EPA, 2002; EPA, 2009; EPA, 2017). Each distributional test is performed with only the detected data, which reflects how ProUCL performs distributional tests (EPA, 2017).



The method used to define a distribution, using the largest p-value from all of the appropriate tests and comparing it to a 0.05 level of significance, is designed to follow ProUCL's distributional recommendations. It should be noted that for a data set with fewer than five detected samples, the Kolmogorov-Smirnov test and the PPCC test cannot be performed. And, the Kolmogorov-Smirnov test is not used to test for gamma distributions.

If results from any of these three tests indicate the data are normally distributed (when the largest p-value is greater than 0.05), the distribution is defined as normal. If none of the test results indicate normality, the detected data set is tested for the gamma distribution by running the Shapiro-Wilk and PPCC tests. If either test indicates the data set follow a gamma distribution (when the larger p-value is greater than 0.05), the distribution is defined as a gamma distribution. If none of the test results indicate a gamma distribution, the data set is tested for lognormality by running the Shapiro-Wilk, Kolmogorov-Smirnov, and PPCC tests with the log-transformed detected data. If results from any of these tests indicate the data set is lognormally distributed (when the largest p-value is greater than 0.05), the distribution is defined as lognormal. If none of the distributional test results indicate normality, a gamma distribution, or lognormality, the data's distribution is defined as nonparametric.

### 4.1.3 Calculating UPLs

UPLs are calculated using a 1-of-2 retesting strategy to ensure comparisons are statistically powerful and to minimize the SWFPR. A 1-of-2 retesting strategy means that if one or more constituent concentrations in a compliance well are above their respective background concentration, a resample is collected to validate or invalidate the background concentration exceedance. According to the Unified Guidance, "A *1-of-m* retesting plan implies that up to *m* groundwater measurements may have to be collected at each compliance well, including the initial observation and *(m-1)* possible resamples. For the test to be valid, all of these sample measurements need to be statistically independent" (EPA, 2009). Since detection and assessment monitoring frequency will be semi-annual, there will be enough time to collect one independent resample between sampling events if necessary.



The Unified Guidance defines when a well is in-compliance and out-of-compliance: "If the initial groundwater observation is in-bounds [in compliance with the designed standard], the test is complete and no resamples need to be collected. Only when the first concentration exceeds the UPL, does additional sampling come into play" (EPA, 2009). If all *m* samples (the initial sample plus *m-1* resamples) exceed, then the well is considered out-of-compliance. If none of the *(m-1)* resamples exceed after the initial sample exceeded, then the well can still be considered to be in-compliance (EPA, 2009).

The type of UPL computed (e.g., parametric or nonparametric) is based on the detection frequency and the defined data distribution for each data set, as described in Section 4.1.2. For a constituent with no detected concentration measurements in the baseline or background data, the UPL is set to the reporting limit (EPA, 2009). For a constituent with at least 50% detections, the UPL calculation adjusts for non-detected concentration(s) as described in Section 2.2, and the appropriate UPL calculation is used based on results from the distributional tests. If no parametric distribution (normal, lognormal, or gamma) can be defined for a data set, then a nonparametric UPL is estimated. Since J-flagged data are defined as detected, a calculated UPL may be less than the reporting limit; in such cases, the UPL is set to the reporting limit.

### 4.2 Establishing Background Values

Background values used for detection monitoring or assessment monitoring are based on UPLs. For detection monitoring (Appendix III constituents), background values are defined as the higher of the UPL and reporting limit. For assessment monitoring (Appendix IV constituents) background values are defined as the highest of the maximum concentration level (MCL), UPL, and reporting limit. The reporting limit is included so that a constituent having an UPL below the reporting limit does not have an unfair limitation because most or all of the baseline or background constituent concentrations are below the reporting limit. For each CCR unit, tables of statistically-derived background values will be prepared for each Appendix III and Appendix IV constituent. For interwell comparisons, background values will be developed using upgradient well data. For intrawell comparisons, background values will be developed for each monitoring well using historical data from the well.

### 4.3 Updating Background Values

As detection or assessment monitoring continues, it is recommended to update baseline or background data sets periodically with valid monitoring concentrations that are representative of groundwater unimpacted by leakage from the CCR unit. The Unified Guidance recommends reviewing and possibly updating background values when enough new concentrations have been collected to perform statistical comparisons. That means, background values should be reviewed about every two or three years during semi-annual monitoring. Failure to update background will exclude factors such as natural temporal variation, changes in field or laboratory methodologies, and changes in the water table due to meteorological conditions or other influences.

# 5.0 DETECTION MONITORING DATA EVALUATION

Detection monitoring will be performed at each CCR unit's groundwater monitoring system on a semi-annual basis during the active life of the landfill and during the post-closure period. Each CCR monitoring well will be sampled for the following Appendix III constituents as part of the detection monitoring program:

- Boron
- Calcium
- Chloride
- Fluoride
- pH
- Sulfate
- Total Dissolved Solids (TDS)

After every detection monitoring event, the constituent concentrations from each well will be compared to the background values, as described in Section 3 of this plan, to ascertain if a statistically significant increase above background does or does not exist. Possible outcomes from comparing the detection monitoring constituent concentrations in each well to their respective background values are as follows:

- All detection monitoring constituent concentrations in a compliance well are less than or equal to their respective background values; or
- One or more detection monitoring constituent concentrations in a compliance well are above their respective background values.



## 5.1 No Statistically Significant Increase over Background Values

UPLs are based on a 1-of-2 resampling approach, meaning that if zero or one concentration measurements from a series of two independent samples collected from a well do not exceed the appropriate UPL, then a statistically significant increase over baseline or background has not occurred at a CCR unit. This conclusion will be reached if the data indicate either of the following:

- All detection monitoring constituent concentrations in a compliance well are less than or equal to their respective background values; or
- At least one detection monitoring constituent concentration in a well is above the respective background value. If this occurs, the well or wells with constituent concentration(s) above the background value(s) will be resampled and analyzed for the detection monitoring constituent(s) with exceedances. If the resample indicates that the target detection monitoring constituent concentration(s) in the well or wells is less than or equal to their respective background value(s),

then it can be concluded that a statistically significant increase over background for all detection monitoring constituents does not exist, since concentrations in one sample of the two independent samples do not exceed the appropriate background value(s).

If the groundwater monitoring data indicates that a statistically significant increase over background does not exist at the CCR wells, then detection monitoring at all CCR wells will continue on a semi-annual basis.

### 5.2 Statistically Significant Increase over Background Values

If one or more detection monitoring constituent concentrations in any well is above the respective background value in both the original detection monitoring sample and the resample, then a statistically significant increase over background for the target detection monitoring constituents can be concluded. If a statistically significant increase is indicated, within 90 days Luminant will:

- Establish an assessment monitoring program as described in this plan, or
- Demonstrate that a source other than the CCR unit caused the statistically significant increase over the background value for a constituent, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with the detection monitoring program.

## 6.0 ASSESSMENT MONITORING DATA EVALUATION

Assessment monitoring will be performed at a CCR unit's groundwater monitoring system on a semi-annual basis after a statistically significant increase over background values has been confirmed in that well for one or more of the detection monitoring constituents. Within 90 days of triggering the assessment monitoring program, and semi-annually thereafter, each CCR monitoring well requiring assessment monitoring will be sampled for the following Appendix IV parameters as part of the assessment monitoring program:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Fluoride
- Lead
- Lithium
- Mercury
- Molybdenum
- Selenium
- Thallium
- Radium 226 and 228 combined



Within 90 days of obtaining the results from the initial assessment monitoring sampling event, all wells in a CCR unit's groundwater monitoring system will be resampled and analyzed for:

- All Appendix III detection monitoring parameters; and
- The Appendix IV assessment monitoring parameters that were detected as part of the assessment monitoring event.

This monitoring will be performed on at least a semi-annual basis thereafter, unless Luminant can demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for these constituents during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semi-annually, the alternative frequency shall be no less than annual.

Within 90 days of obtaining the results from the initial assessment monitoring sampling event, groundwater protection standards will be established for all Appendix IV assessment monitoring constituents that were detected in the AX Landfill groundwater monitoring system wells as follows:

- For constituents for which an MCL has been established, the highest of the MCL, UPL, and reporting limit for that constituent; or
- For constituents for which an MCL has not been established, the higher of the UPL and reporting limit for that constituent (note: future revisions to the Rule may allow additional flexibility in establishing groundwater protection standards for states with EPA-approved CCR permit programs for Appendix IV constituents that do not have a MCL).

Each assessment monitoring constituent concentration will be compared to the appropriate groundwater protection standard to ascertain if a statistically significant increase above groundwater protection standards does or does not exist. Possible outcomes from comparing the assessment monitoring constituent concentrations to their respective groundwater protection standards are as follows:

- All assessment monitoring constituent concentrations at a well are less than or equal to their respective groundwater protection standard(s); or
- One or more assessment monitoring constituent concentrations at a well are above their respective groundwater protection standard(s).



### 6.1 No Statistically Significant Increase Over Groundwater Protection Standards

UPLs that are used in the groundwater protection standards are based on a 1-of-2 resampling approach, meaning that if zero or one concentration measurements from a series of two independent samples collected from a well do not exceed the appropriate UPL, then a statistically significant increase over the groundwater protection standard has not occurred at a CCR unit. This conclusion will be reached if the data indicate either of the following:

- All assessment monitoring constituent concentrations at a well are less than or equal to their respective groundwater protection standard(s); or
- At least one assessment monitoring constituent concentration at a well is above the respective groundwater protection standard. If this occurs, the well or wells with concentration(s) above the groundwater protection standard(s) will be resampled and analyzed for the assessment monitoring constituent(s) that exceed the groundwater protection standard(s). If the resample indicates that the target assessment monitoring constituent concentration(s) at the well or wells is less than or equal to their respective groundwater protection standard(s), then it can be concluded that a statistically significant increase over groundwater protection standards has not occurred at the CCR unit.

Assessment monitoring will continue on a semi-annual basis and analyzed for:

- All Appendix III detection monitoring parameters; and
- The Appendix IV assessment monitoring parameters that were detected as part of the initial assessment monitoring event.

If, for two consecutive assessment monitoring sampling events, the constituent concentrations for all Appendix III constituents and for those detetcted Appendix IV constituents are shown to be statistically at or below background values and groundwater protection standards, respectively, then assessment monitoring will be terminated and detection monitoring as described in this plan will resume. If the constituent concentrations of any Appendix III constituents are shown to be statistically above background values, but all Appendix IV detection monitoring constituent concentrations are below their respective groundwater protection standards, assessment monitoring will continue.



### 6.2 Statistically Significant Increase Over Groundwater Protection Standards

If assessment monitoring constituent concentrations in both the initial assessment monitoring sample and the resample is above the respective groundwater protection standards, then a statistically significant increase over groundwater protection standards has occurred at a CCR unit. If a statistically significant increase over groundwater protection standards for any Appendix IV assessment monitoring constituent is confirmed, within 90 days of the initial assessment monitoring event, Luminant will either:

- Initiate an assessment of corrective measures for the CCR unit in accordance with CCR Rule Section 257.96; or
- Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is made, the owner or operator must continue assessment monitoring. If a successful demonstration has not been made at the end of the 90 day period, the owner or operator of the CCR unit must initiate an assessment of corrective measures for the CCR unit.

If one or more Appendix IV assessment monitoring constituent concentrations are statistically above the respective groundwater protection standards, and if a source other than the CCR unit cannot be demonstrated to have caused the contamination, a release from the CCR unit is likely and the nature and extent of the release will be further characterized as follows:

- Install additional monitoring wells necessary to define the contaminant plume(s);

- Collect data on the nature and estimated quantity of material released including specific information on the Appendix IV assessment monitoring constituents and the levels at which they are present in the material released;

- Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well for all Appendix III detection monitoring parameters and for those Appendix IV assessment monitoring constituents that have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.

- Sample all CCR unit wells for all Appendix III detection monitoring parameters and for those Appendix IV assessment monitoring constituents that have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.

## 7.0 REPORTING REQUIREMENTS

The results of the CCR groundwater monitoring program performed at each CCR unit will be reported yearly in an Annual Groundwater Monitoring and Corrective Action Report. A separate annual report for each CCR unit will document the status of the groundwater monitoring and corrective action program, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. At a minimum, the Annual Groundwater Monitoring and Corrective Action Report will contain the following information:

- A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
- In addition to all the monitoring data obtained under CCR Rule Sections 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs, as well as the basis for the background values and the statistical methods employed to establish the background values;
- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and
- Other information required to be included in the annual report as specified in CCR Rule Sections 257.90 through 257.98.



The Groundwater Monitoring and Corrective Action Report for the 2017 monitoring program must be placed in each facility operating record no later than January 31, 2018. Subsequent reports must be placed in the facility operating records no later than January 31 of the year following completion of the groundwater monitoring program from the preceding calendar year. The reports must also be posted to the owner or operator's CCR Rule Compliance Data and Information internet site within 30 days of placing the reports in the operating record.

# 8.0 REFERENCES

ASTM, 2017. Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities - D6312-17.

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The R Foundation, 2017. "R" Software Suite. https://www.r-project.org. February.

FIGURES

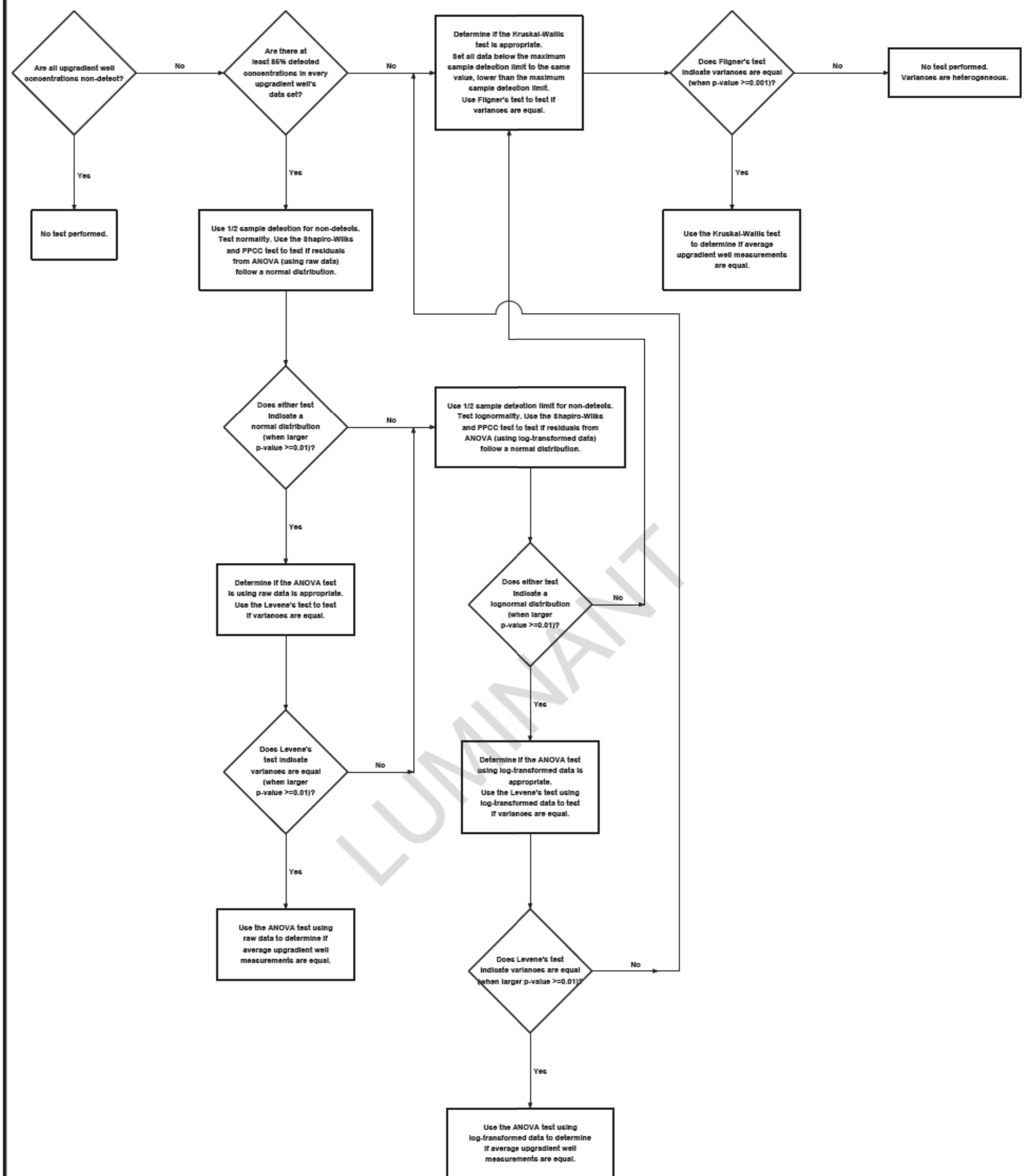




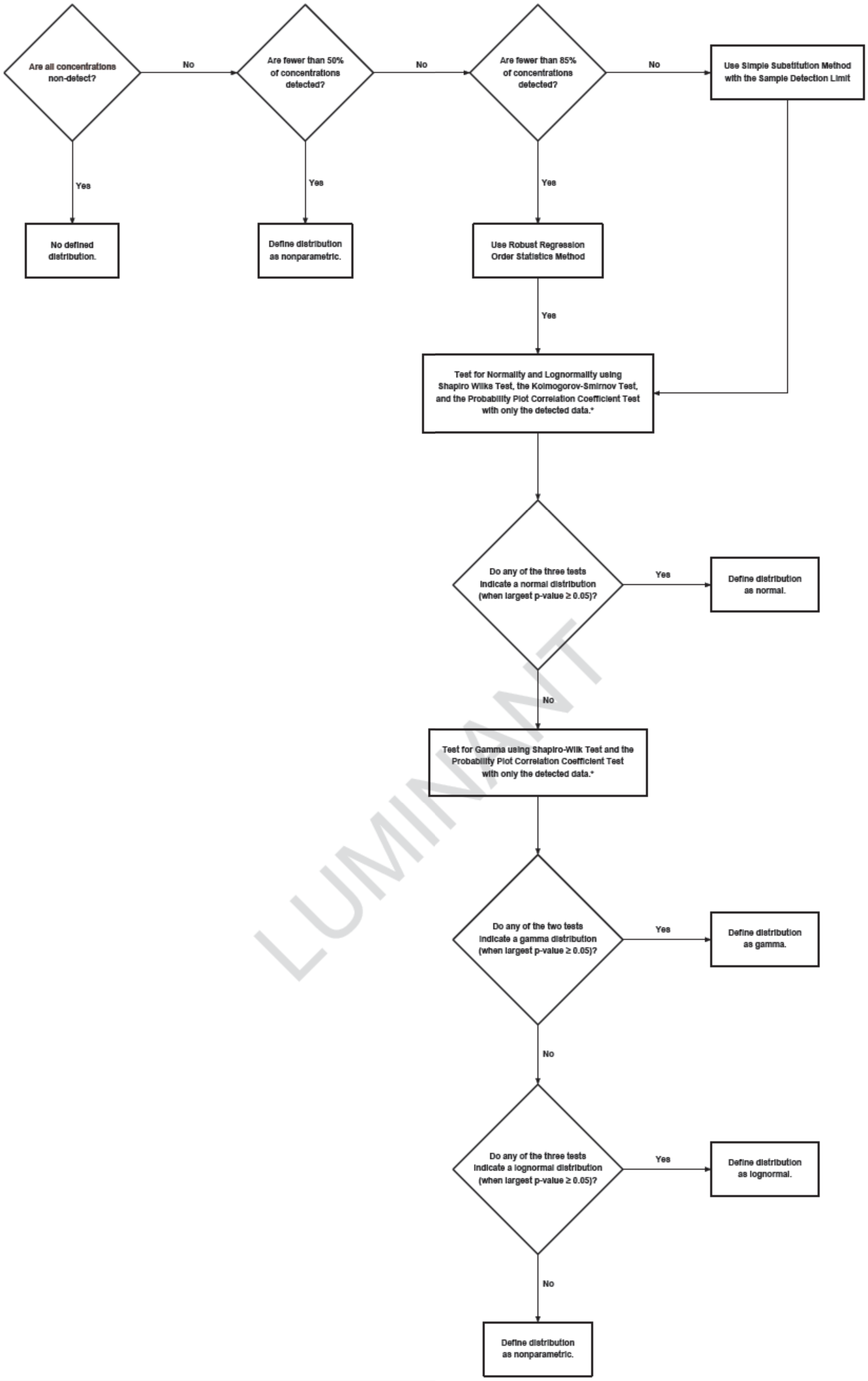

Figure 1

**PROCESS FOR SELECTING ANOVA OR KRUSKAL-WALLIS TEST TO COMPARE UPGRADIENT WELL AVERAGES**

| | | |
|---|---|---|
| PROJECT: 5164E | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**

CONSULTING ENGINEERS AND SCIENTISTS






Note:

* - Distributional tests can not be performed for the following cases:

1. For a data group with fewer than five detected samples, the Kolmogorov-Smirnov Test and the Probability Plot Correlation Coefficient Test can not be performed using only the detected concentrations.
2. For a data group with fewer than four detected samples, the Shapiro-Wilks Test can not be performed using only the detected concentrations.

Figure 2

**PROCESS FOR DEFINING A DISTRIBUTION FOR A DATA SET**

| | | |
|---|---|---|
| PROJECT: 5164E | BY: AJD | REVISIONS |
| DATE: SEPT., 2017 | CHECKED: PJB | |

**PASTOR, BEHLING & WHEELER, LLC**

CONSULTING ENGINEERS AND SCIENTISTS

# Attachment #12 for Item #29 – Detection Monitoring Program

**Table VI.D-2. – Groundwater Detection Monitoring Parameters**

| Parameter | Sampling Frequency | Analytical Method | Practical Quantification Limit (units) | Concentration Limt[1] |
|---|---|---|---|---|
| Boron | Semi-Annual | EPA 6020 | <0.03 mg/L | 8.52 |
| Calcium | Semi-Annual | EPA 6020 | <1.0 mg/L | 311 |
| Chloride | Semi-Annual | EPA 9056A | <1.0 mg/L | 184 |
| Fluoride | Semi-Annual | EPA 9056A | <0.15 mg/L | 2.93 |
| Sulfate | Semi-Annual | EPA 9056A | <25.0 mg/L | 1,190 |
| Total Dissolved Solids | Semi-Annual | EPA 2540 | <10.0 mg/L | 2,150 |
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1 The concentration limit is the basis for determining whether a release has occurred from the CCR unit/area.

**Attachment #13 for Item #21 – Closure Plan**

# CORRESPONDENCE COVER SHEET
# WASTE PERMITS DIVISION
# TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Date: 5/21/2021
Facility Name: Monticello Steam Electic Station
Permit or Registration No.: SWR30081

Nature of Correspondence:
☒ Initial/New
☐ Response/Revision*

*If Response/Revision, please provide previous TCEQ Tracking No.:
(Previous TCEQ Tracking No. can be found in the Subject line of the TCEQ's response letter to your original submittal.)

This cover sheet should accompany all correspondences submitted to the Waste Permits Division and should be affixed to the front of your submittal as a cover page. Please check the appropriate box for the type of correspondence being submitted. For questions regarding this form, please contact the Waste Permits Division at (512) 239-2335.

**Table 1 - Municipal Solid Waste**

| APPLICATIONS | REPORTS and RESPONSES |
|---|---|
| ☐ New Notification | ☐ Closure Report |
| ☐ New Permit (including Subchapter T) | ☐ Groundwater Alternate SRC Demonstration |
| ☐ New Registration (including Subchapter T) | ☐ Groundwater Corrective Action |
| ☐ Major Amendment | ☐ Groundwater Monitoring Report |
| ☐ Minor Amendment | ☐ Groundwater Statistical Evaluation |
| ☐ Limited Scope Major Amendment | ☐ Landfill Gas Corrective Action |
| ☐ Notice Modification | ☐ Landfill Gas Monitoring |
| ☐ Non-Notice Modification | ☐ Liner Evaluation Report |
| ☐ Transfer/Name Change Modification | ☐ Soil Boring Plan |
| ☐ Temporary Authorization | ☐ Special Waste Request |
| ☐ Voluntary Revocation | ☐ Other: |
| ☐ Subchapter T Workplan | |
| ☐ Other: | |

**Table 2 - Industrial & Hazardous Waste**

| APPLICATIONS | REPORTS and RESPONSES |
|---|---|
| ☐ New | ☐ Annual/Biennial Site Activity Report |
| ☐ Renewal | ☐ CfPT Plan/Result |
| ☐ Post-Closure Order | ☐ Closure Certification/Report |
| ☐ Major Amendment | ☐ Construction Certification/Report |
| ☐ Minor Amendment | ☐ CPT Plan/Result |
| ☐ Class 3 Modification | ☐ Extension Request |
| ☐ Class 2 Modification | ☐ Groundwater Monitoring Report |
| ☐ Class 1 ED Modification | ☐ Interim Status Change |
| ☐ Class 1 Modification | ☐ Interim Status Closure Plan |
| ☐ Endorsement | ☐ Soil Core Monitoring Report |
| ☐ Temporary Authorization | ☐ Treatability Study |
| ☐ Voluntary Revocation | ☐ Trial Burn Plan/Result |
| ☐ 335.6 Notification | ☐ Unsaturated Zone Monitoring Report |
| ☐ Other: | ☐ Waste Minimization Report |
| | ☒ Other: Updated Closure Plan |

ATON

November 22, 2021

Mario Perez
Project Manager
TCEQ, Industrial and Hazardous Waste Permits Section
PO Box 13087
Austin, Texas 78753

**RE: Former Monticello Steam Engine Electric Station (SWR 30081) Bottom Ash Ponds Closure Schedule Update**

Dear Mr. Perez:

On behalf of Golden Eagle Development, LLC (CN605736982), ATON, LLC (ATON) is submitting this notice of a schedule update for closure of the bottom ash ponds (BAPs) (Northeast Ash Water Retention Pond (WMU 11), West Ash Settling Pond (WMU 12), and Southwest Ash Settling Pond (WMU 22)) at the former Monticello Steam Electric Station (MOSES). This summer the site received more precipitation than anticipated; therefore, there was a delay in construction activities. Below is the updated closure schedule:

- Mobilization and dewatering - Complete
- Bottom Ash Removal – SW Pond - Complete
- Bottom Ash Removal – West Pond - December 2021
- Bottom Ash Removal – NE Pond – April 2022
- Liner and Embankment Removal - May 2022
- BAP Closure – June 2022
- BAP Area Re-Grading - July 2022

Thank you for your cooperation in this project, please contact me at (512) 566-6878 or adam.kaiser@atonenv.com if you have any questions or comments.

Sincerely,

Adam J. Kaiser, PE
Senior Project Engineer
**ATON LLC**

CC: Golden Eagle Development

2275 Cassens Drive | Suite 118
Fenton, MO 63026
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# UPDATED CCR CLOSURE PLAN
## Bottom Ash Ponds

*Former Monticello Steam Electric Station*
*Titus County, Texas*

Prepared for:
**GOLDEN EAGLE DEVELOPMENT LLC**

Prepared by:

**ATON LLC**
2275 Cassens Drive, Suite 118
Fenton, Missouri 63026


May 2021

On behalf of Golden Eagle Development, LLC (Golden Eagle), ATON, LLC (ATON) has prepared this Updated Coal Combustion Residue (CCR) Closure Plan (30 TAC 352.1221/40 CFR 257.102(b)) for the Bottom Ash Ponds (BAPs) at the Monticello Steam Electric Station (MOSES) (Figure 1). This plan is an update to the updated closure plan submitted in January 2020 by Golden Eagle (ATON, 2020). The 2016 closure plan design proposed to close one of the BAPs by CCR removal and cap the other two ponds. Per the updated plans all three BAPs will be closed by removal. The May 2020 update provides an updated schedule and soil sample collection.

## 1.0 BOTTOM ASH PONDS

The site contains three BAPs subject to CCR closure requirements, Northeast Ash Water Retention Pond (WMU 11), West Ash Settling Pond (WMU 12), and Southwest Ash Settling Pond (WMU 22) that comprise of approximately 19-acres (Figure 2). The adjacent Stormwater Collection Pond (WMU 9) is not subject to CCR regulations. The BAPs were built in 1974; however, they were relined in 1990 with 3-foot clay liners.

The BAPs received recovered overflow from bottom ash dewatering bins and other MOSES process wastewater sources. The ponds also acted as a surge basin for various water streams in the ash-water system. Recovered sluice water, process waters and storm water runoff from the MOSES ash-water system were pumped to each pond through a series of above grade pipes on the east end. The BAPs also served as settling basins to remove residual bottom ash and fines from recovered sluice water associated with the dewatering bins. Water was pumped from the SW Pond, as needed, and returned for reuse in the bottom ash system. When sufficient ash had accumulated in either the NE or West Ponds, the recovered sluice water was diverted to the other pond. Ash was then removed from the first pond and transported via train car to the G Ash Area. Based on the design of the BAPs, minimal accumulation of solids occurred within the SW Pond.

## 2.0 BOTTOM ASH PONDS CLOSURE - CLOSURE BY REMOVAL OF CCR

### 2.1 Closure by Removal

The purpose of this Updated CCR Closure Plan is to describe the steps required to close the BAPs at MOSES consistent with recognized and generally accepted good engineering practices. Closure of the BAPS will be designed to reduce the need for long-term maintenance and control the post-closure release of constituents into environmental pathways. The BAPS will be closed through the removal of CCR, and the closure will be performed pursuant to 40 CFR 257.102(c).

The ash material from the BAPs will been dewatered of free liquids via pumping to the North Operating Pond (WMU 007) starting with the SW Pond. Following removal of free liquids, the bottom ash material from the ponds will be excavated and hauled to the B-Area Landfill (WMU 002) for beneficial structure fill starting with the SW Pond. Water and bottom ash will then be removed from the NE Pond and West Pond, respectively. The embankments and bottom clay liner will also be removed following the bottom ash and used as B-Area fill. Pipelines that are above be removed from the around the impoundments. Underground pipelines entering the impoundments will be excavated and removed or closed in place as necessary for future grading.

Upon closure completion, certification from a qualified Texas professional engineer will be provided verifying that closure has been completed in accordance with the closure plan. Following closure certification, the area will be graded to the southwest toward Lake Monticello via an existing surface water culvert that is currently permitted stormwater Outfall 001. Interior surface grading will provide a 3 to 5 percent slope for drainage relief from the footprint of the former impoundments to ensure (to the maximum extent feasible) that post-closure run-off is conveyed off the former impoundment area. The Stormwater Collection Pond will be closed per Texas Risk Reduction Rule (TRRP) 30 TAC 350.

## 2.2 Closure Schedule

- Mobilization and dewatering SW Pond – completed February 2021
- Bottom Ash Removal – SW Pond – completed April 2021
- Dewatering NE Pond – ongoing since January 2021
- Bottom Ash Removal – NE Pond - June 2021
- Dewatering West Pond – June 2021
- Bottom Ash Removal – West Pond - August 2021
- Liner and Embankment Removal - September 2021
- BAP Closure – September/October 2021
- BAP Area Re-Grading - November 2021

# 3.0 GROUNDWATER MONITORING

Golden Eagle currently conducts groundwater sampling in the BAP area on a semi-annual basis for Detection Monitoring in accordance with 40 CFR 257.94. Pursuant to 40 CFR 257.102(c), groundwater protection standards (GWPS) have not been established. The impoundment will remain in detection monitoring during implementation of the closure activities. If groundwater has been determined to not be impacted, the ongoing detection monitoring program will cease after completion of the closure activities and posting of the Notification of Completion of Closure to the CCR website. The monitoring wells making up the bottom ash ponds groundwater monitoring system will then be properly closed and abandoned per applicable State of Texas requirements.

## 4.0 CERTIFICATION STATEMENT

This closure plan and all attachments were prepared by ATON LLC under my direction and supervision. This closure plans meets the requirements of 30 TAC 352.1221/40 CFR 257.102 and been prepared in a manner consistent with recognized and generally accepted good engineering practices.

Adam J. Kaiser, PE


5/21/2021

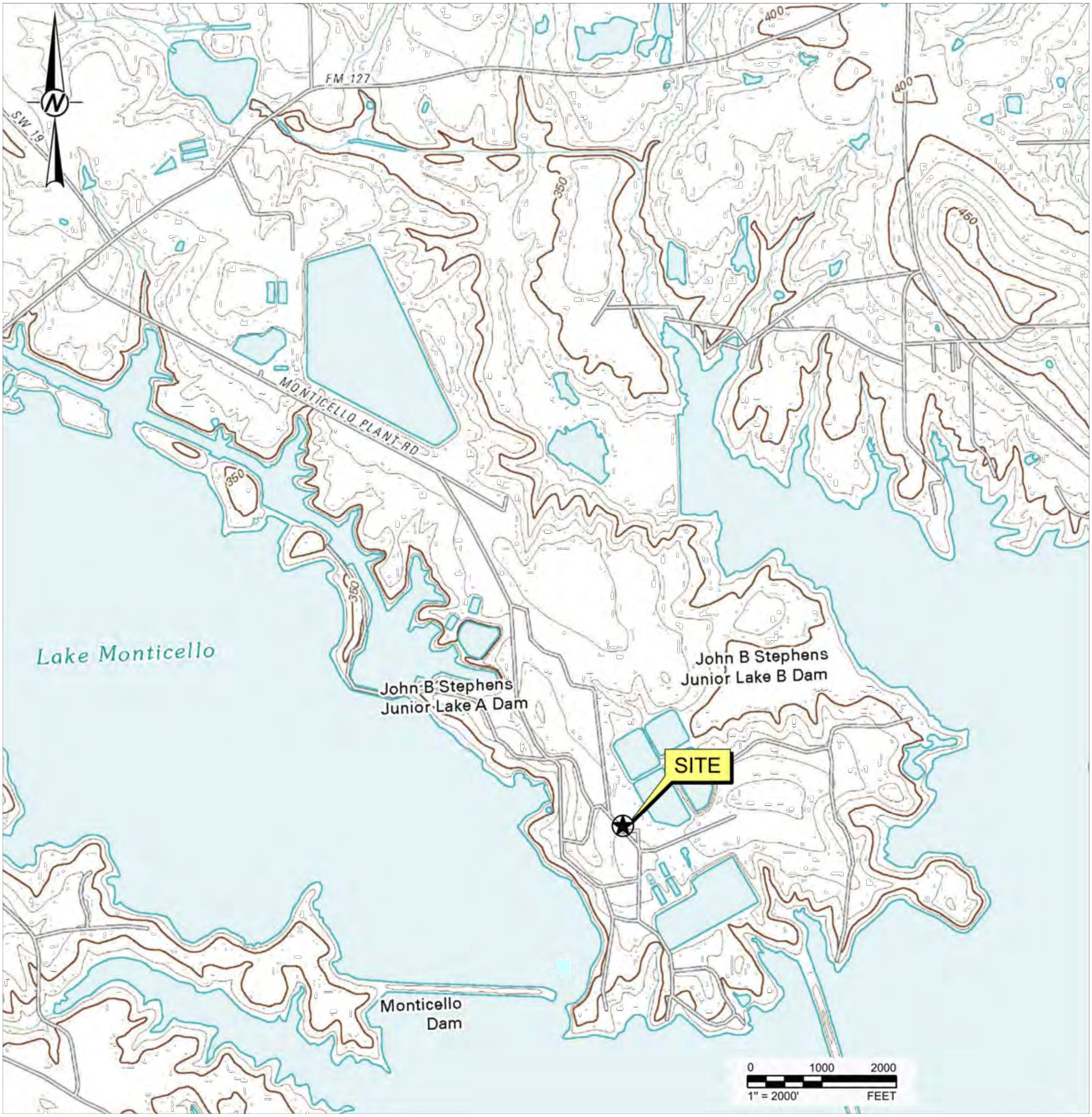
## 5.0 REFERENCES

ATON, 2021. *Updated CCR Closure Plan, Monticello Steam Electric Station.* May

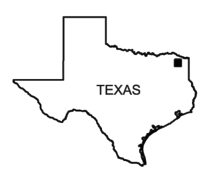
Golder, 2020. *Annual Groundwater Monitoring Report*, *Monticello Steam Electric Station*. July 10.

Pastor, Behling & Wheeler, LLC (PBW), 2016. *CCR Closure Plan, Monticello Steam Electric Station, Bottom Ash Ponds.* October.

Pastor, Behling & Wheeler, LLC (PBW), 2016. *CCR Post-Closure Plan, Monticello Steam Electric Station, Bottom Ash Ponds.* October.




**REFERENCE(S)**
BASE MAP TAKEN FROM WWW.TNRIS.GOV, MONTICELLO, TX 7.5 MIN. USGS QUADRANGLE DATED 2010.




QUADRANGLE LOCATIONS

C:\Users\worcc\OneDrive\Documents\DWG\ATON\Projects\Monticello\dwg\fig1_SiteLocMap.dwg

ATON

Figure 1
Site Location Map
Former MOSES Site

| | |
|---|---|
| Chkd: | AK |
| Drawn: | EFC |
| Page: | |
| Date: | 9/30/2020 |
| Scale: | As Shown |


Source: Google Earth

Date: 2020

Figure 2

NOT TO SCALE

N↑

ATON

**Site Name:** **Monticello Steam Engine Electric Station**

**Mount Pleasant, Texas**

**Project:** **SWR 30081**

**Attachment #14 for Item #32 – Post Closure Care Plan**

# CCR POST-CLOSURE PLAN
# MONTICELLO STEAM ELECTRIC STATION
# BOTTOM ASH PONDS
# TITUS COUNTY, TEXAS

October 2016



Prepared for:

**LUMINANT GENERATION COMPANY, LLC**
1601 Bryan Street (EP-27)
Dallas, Texas 75201

Prepared by:

**PASTOR, BEHLING & WHEELER, LLC**
5416 Plaza Drive
Texarkana, Texas 75503
Texas Engineering Firm No. 4760

PBW Project No. 5196A

**PROFESSIONAL CERTIFICATION**

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that this Post-Closure Plan has been prepared in accordance with the requirements of 40 CFR 257.104 of the CCR Rule.

STATE OF TEXAS
BRIAN D. THOMAS
91192
LICENSED
PROFESSIONAL ENGINEER
10/5/16

10/5/16

Brian Thomas, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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# 1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) owns and operates the Monticello Steam Electric Station (MOSES) located approximately nine miles southwest of Mount Pleasant in Titus County, Texas. The power plant and related support areas occupy approximately 1,000 acres on peninsula located between Lake Monticello and Lake Bob Sandlin (Figure 1). The MOSES consists of three coal/lignite-fired units with a combined operating capacity of approximately 1,880 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MOSES unit operation. The CCRs are transported off-site for beneficial use by third-parties or are placed in mine pits in the Winfield South Mine/G-Ash Area.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.



The CCR Rule establishes national operating criteria for existing CCR surface impoundments and landfills, including development of post-closure plans (PCP) for all CCR impoundments and landfills. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to develop this PCP for the Bottom Ash Ponds at the MOSES.

## 1.1 CCR Impoundment Post-Closure Care Requirements

40 CFR 257.104 of the CCR Rule specifies the post-closure care requirements for existing CCR impoundments that have been closed in accordance with 40 CFR 257.102 of the Rule. Following closure of the impoundment, the owner/operator must conduct post-closure care for the unit, consisting of at least the following:

- Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover; and
- Maintaining the groundwater monitoring system for the unit and monitoring the groundwater in accordance with the requirements of 40 CFR 257.90 through 257.98 of the CCR Rule.

Post-closure care must be conducted for 30 years after the CCR impoundment has been closed. If at the end of the 30-year post-closure care period, groundwater assessment monitoring is being performed at the unit in accordance with 40 CFR 257.95 of the CCR Rule, post-closure care of the unit must continue until the unit has returned to groundwater detection monitoring under 40 CFR 257.95.

Once the post-closure care period has been completed, the owner/operator of the CCR impoundment must prepare a notification verifying that post-closure care has been completed. The notification must include certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the written closure plan for the unit. The notification must be placed in the facility operating record within 60 days of the completion of post-closure care.

40 CFR 257.104(d) of the CCR Rule specifies that a written PCP must be prepared for each existing CCR unit that describes the post-closure care activities for the unit. The PCP must include, at a minimum, the following information:

- A description of the required post-closure monitoring and maintenance activities and the frequency at which these activities will be performed;
- The name, address, telephone number, and email address of the person or office to contact about the facility during the post-closure care period; and
- A description of the planned uses of the closed unit property during the post-closure period. Post-closure use of the property must not disturb the integrity of the final cover, liner, or any other component of the unit containment system, or the function of the monitoring systems.



If the owner/operator of the unit desires to disturb any of the components of the closure during the post-closure care period, a qualified professional engineer must certify that the disturbance of the final cover, liner, or other component of the containment system, including any removal of CCR, will not increase the potential threat to human health or the environment. The certification must be placed in the facility operating record and the Texas Commission on Environmental Quality (TCEQ) must be notified.

The PCP must be certified by a qualified professional engineer and must document how the PCP has been designed and constructed to comply with the requirements of 40 CFR 257.104.

In accordance with 40 CFR 257.104(d)(2) of the CCR Rule, the initial PCP for an existing CCR unit must be completed and placed in the facility operating record no later than October 17, 2016. The PCP must be amended whenever:

- There is a change in the operation of the unit that would substantially affect the written PCP in effect; or
- After post-closure activities have commenced, unanticipated events necessitate a revision of the written PCP.

The PCP must be amended at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing PCP. If the PCP is revised after post-closure activities have commenced for a CCR unit, the PCP must be amended no later than 30 days following the triggering event. The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the PCP meets the requirements of 40 CFR 257.104 of the CCR Rule.

### 1.2 MOSES Units Subject to PCP Requirements

The CCR Rule defines coal combustion residuals such as fly ash, bottom ash, boiler slag, flue gas desulfurization (FGD) materials (gypsum), and related solids generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers. The PCP requirements of the CCR Rule apply to existing and new CCR impoundments that dispose or otherwise engage in solid waste management of CCR.



The surface impoundments at the MOSES that meet the definition of an existing CCR unit are the Northeast Ash Water Retention Pond (NE Pond), West Ash Settling Pond (West Pond) and the Southwest Ash Settling Pond (SW Pond); collectively referred to as the Bottom Ash Ponds (BAPs). Due to their proximity to each other, the BAPs will be considered one CCR surface impoundment for the purposes of this PCP.

This PCP was prepared for the MOSES BAPs. In accordance with 40 CFR 257.104 of the CCR Rule, the PCP must be amended when future impoundments are constructed at the MOSES.

### 1.3 Description of BAPs

The BAPs are located approximately 800 feet southeast of the MOSES power plant (Figure 2). The NE Pond and West Pond share an interior embankment and are each approximately 500 feet wide, covering an area of approximately 5.5 acres and 6.6 acres, respectively. The approximately 8 acre SW Pond shares an embankment with the West Pond (north end of SW Pond).

The BAPs receive recovered overflow from bottom ash dewatering bins and other MOSES process wastewater sources. The ponds also act as a surge basin for various water streams in the ash-water system. Recovered sluice water, process waters and storm water runoff from the MOSES ash-water system are pumped to each pond through a series of above grade pipes on the east end. The BAPs are located partially above and partially below grade and all material that enters the ponds is pumped into the impoundments. There are no gravity discharges to the BAPs.

The BAPs are constructed partially above and partially below grade and are surrounded by earthen embankments that extend approximately 10 to 20 feet above grade depending on surrounding topography. The exterior slopes of the embankments are vegetated with grasses and similar vegetation. The south embankment of the Northeast Pond and east embankment of the SW Pond also act as embankments for the MOSES Storm Water Collection Pond, which is not subject to the CCR rule.

The BAPs were originally constructed in 1974 as a two-basin system and were subsequently segregated and relined with a 3-foot thick clay liner in 1990. As-built engineering drawings indicate that the existing 3-foot compacted clay liner was constructed to a maximum permeability of $1 \times 10^{-7}$ cm/sec (OBG, 2014). The crest elevation of the earthen embankments is approximately 386.5 feet MSL and the design operating fluid/CCR level in the BAPs is approximately 384 feet MSL (approximately 2.5 feet below the crest of the perimeter embankments). Based on an operating elevation of 384 feet MSL, the design operating capacity of the NE Pond, West Pond, and SW Pond are 100, 130, and 145 acre-feet, respectively. The total design operating capacity of the BAPs is approximately 122,200,000 gallons or approximately 375 acre-ft. The BAPs are classified as a low hazard potential impoundment in accordance with the requirements of Section 257.73(a)(2) of the CCR Rule (PBW, 2016).



As described in the CCR Closure Plan prepared for the BAPs, Luminant currently plans to close the NE Pond and West Pond in accordance with Section 257.102(d) of the CCR Rule by leaving CCR in-place and constructing a final cover system over the CCR located within the combined footprint of these two surface impoundments (PBW, 2016A). The SW pond will be closed by removal of CCR. The proposed final grading plan for the final cover system is illustrated in Figure 3. Additional details regarding the final cover system are described in the CCR Closure Plan (PBW, 2016A).

## 2.0 POST-CLOSURE INSPECTION AND MAINTENANCE PLAN

Monitoring and maintenance activities will be performed to maintain the integrity and effectiveness of the final cover system as specified in 40 CFR 257.104(b)(1). During the post-closure monitoring and maintenance period at the BAPs, the final cover of the closed CCR unit will be inspected at the frequency indicated in Table 1 below:

**Table 1 – Post-Closure Care Maintenance**

| Post-Closure Care Maintenance Item | Frequency of Inspections | Types of Deficiency Conditions to be looked for during inspections |
|---|---|---|
| Final Cover Condition | Annually | Inspection for vegetation, erosion, settlement, ponding water, and functionality and the surface water drainage system |
| Vegetation | Annually | Erosion rills and depressions, vegetative stress |
| Drainage structures | Annually | Sediment and debris build up, component damage, blockages, erosion, ponding of water in non-designated areas, excessive vegetative growth |



Each monitoring and maintenance activity will be documented and include the date, components and items monitored, name of the individual performing the monitoring/maintenance, a description of the deficiencies observed (if any), maintenance/repairs performed (if any), and related information.

At a minimum, maintenance will be performed as needed prior to the next scheduled inspection.

## 3.0 GROUNDWATER MONITORING

As specified in 40 CFR 257.104(b)(3), groundwater monitoring activities will continue throughout the post-closure care period in accordance with 40 CFR 257.90 through 40 CFR 257.98. All groundwater monitoring wells that are part of the groundwater monitoring network will be monitored and maintained during the post-closure care period in accordance with the Groundwater Sampling and Analysis Plan, which will be finalized and placed in the Operating Record by October 17, 2017.

If at the end of the 30-year post-closure care period, groundwater assessment monitoring is being performed at the unit in accordance with 40 CFR 257.95, post-closure care of the unit must continue until the unit has returned to groundwater detection monitoring under 40 CFR 257.95.

## 4.0 FACILITY CONTACT INFORMATION

**Table 2: Contact Information**

| | |
|---|---|
| **Name** | Luminant - Environmental Services |
| **Address** | 1601 Bryan St., Dallas, Texas 75201 |
| **Telephone Number** | 214-875-8654 |
| **Email** | CCRPostClosurePlan@Luminant.com |

## 5.0 POST-CLOSURE LAND USE

Post-closure use of the property will not disturb the integrity of the final cover, liner system, or any other component of the containment system, or function of the monitoring system in accordance with §257.104(d)(1)(iii) unless necessary to comply with the maintenance requirements of this subpart or as otherwise provided as allowed under this subpart.

Post-closure land use is anticipated to be undeveloped/unchanged and the area will be deed recorded and deed restricted to prevent disturbance of the closed waste management unit.

## 6.0 NOTIFICATION OF COMPLETION OF POST-CLOSURE CARE PERIOD

No later than 60 days following completion of the post-closure care period, a certification will be prepared by a qualified professional engineer verifying that the post-closure care has been completed in accordance with this Post-Closure Plan.

## 7.0 REFERENCES

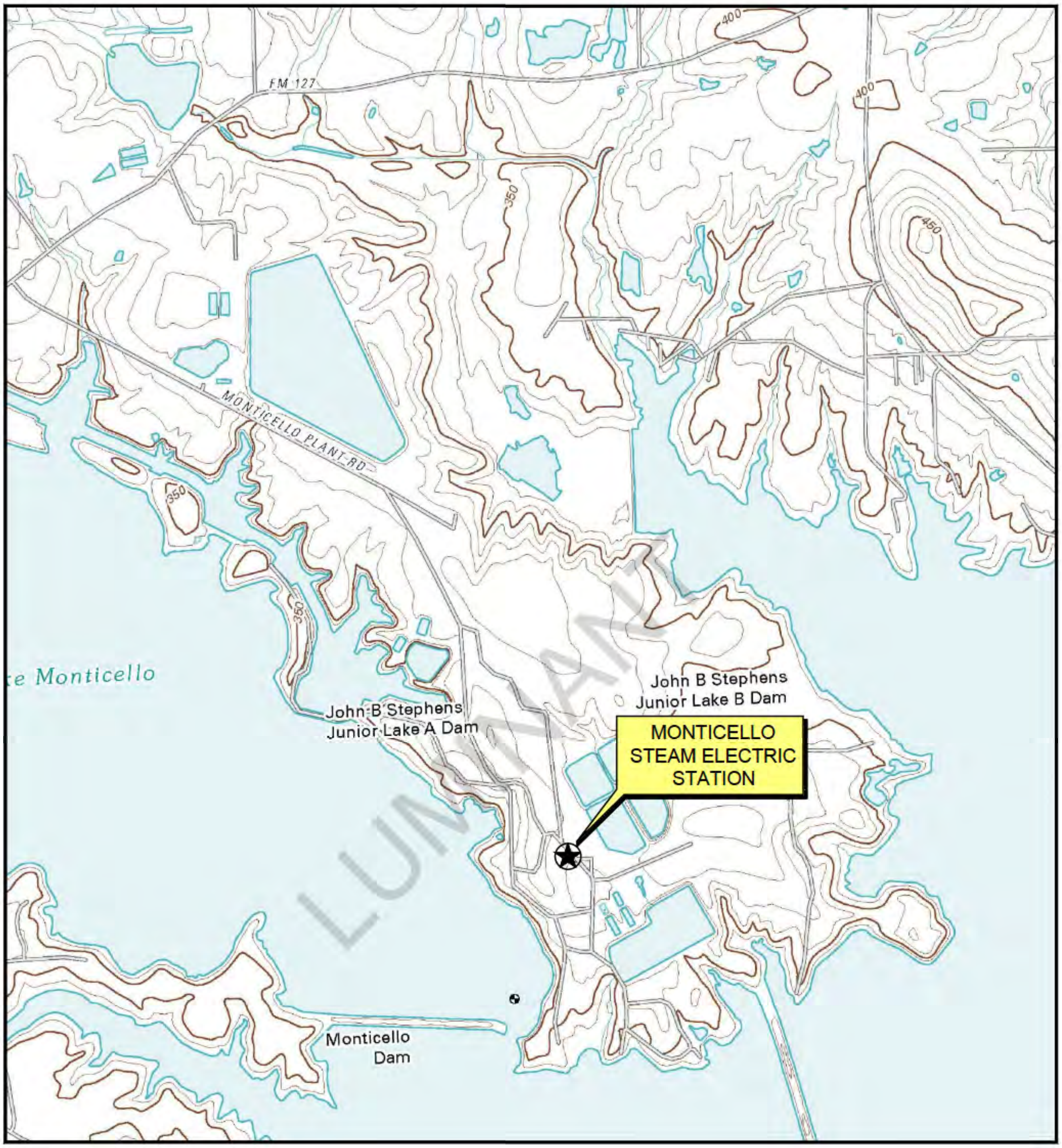
O'Brien & Gere (OBG), 2014. *Dam Safety Assessment of CCW Impoundments, Monticello Steam Electric Station, Mount Pleasant, Texas,* EP-10W000673, June

Pastor, Behling, & Wheeler, LLC (PBW), 2016. Hazard Classification Assessment – Monticello Steam Electric Station Bottom Ash Ponds, Titus County, Texas. October.

Pastor, Behling, & Wheeler, LLC (PBW), 2016A. CCR Closure Plan – Monticello Steam Electric Station Bottom Ash Ponds, Titus County, Texas. October.

United States Geological Survey (U.S.G.S.), 1983, 7.5-*Minute Series Topographic Map, Fair Play, TX Quadrangle.*

**Figures**





QUADRANGLE LOCATIONS

N

Scale in Feet

0 1000 2000

SOURCE:
Base map from www.tnris.gov, Monticello, TX 7.5 min. USGS quadrangle dated 2010.

**LUMINANT GENERATION COMPANY, LLC**
MONTICELLO STEAM ELECTRIC STATION

Figure 1

**SITE LOCATION MAP**

| | | |
|---|---|---|
| PROJECT: 5196B | BY: AJD | REVISIONS |
| DATE: SEPT., 2016 | CHECKED: BDT | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS



N

Scale in Feet

0 1000 2000

SOURCE:
Imagery from Google Earth, aerial photography dated 12-5-15.

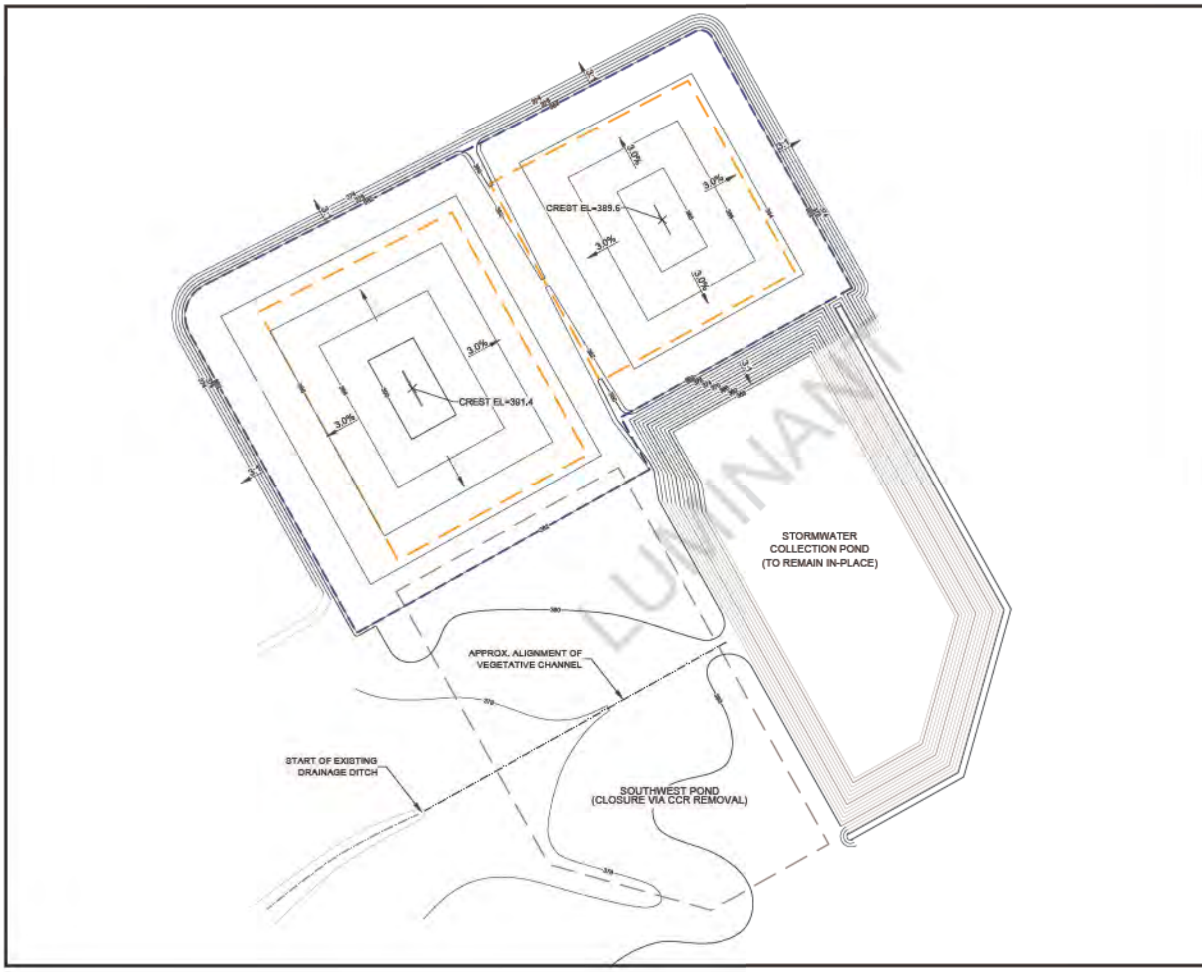
**LUMINANT GENERATION COMPANY, LLC**
MONTICELLO STEAM ELECTRIC STATION

Figure 2

## SITE VICINITY MAP

| | | |
|---|---|---|
| PROJECT: 5196B | BY: AJD | REVISIONS |
| DATE: SEPT., 2016 | CHECKED: BDT | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS




**EXPLANATION**

- Proposed Finished Grade Contour 2 ft Interval
- Proposed Finished Grade Contour 10 ft Interval
- Limits of CAP
- Estimated Limits of CCR (Elev. 375.5)

N

Scale In Feet
0 90 180

**LUMINANT GENERATION COMPANY, LLC**
MONTICELLO STEAM ELECTRIC STATION

Figure 3

**PROPOSED FINAL COVER GRADING PLAN**

| | | |
|---|---|---|
| PROJECT: 5195A | BY: AJD | REVISIONS |
| DATE: SEPT., 2016 | CHECKED: BDT | |

**PASTOR, BEHLING & WHEELER, LLC**
CONSULTING ENGINEERS AND SCIENTISTS