REPORT

Structural Stability Assessment 5-Year Update

Oak Grove Steam Electric Station

FGD Ponds

Robertson County, Texas

Submitted to:

Oak Grove Management Company LLC

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Submitted by:

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PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Golder Associates Inc. 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 Structural Stability Assessment Update has been prepared in accordance with the requirements of 40 C.F.R. § 257.73(d) and 30 T.A.C. § 353.731.

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FIGURES

1.0 INTRODUCTION

Oak Grove Management Company LLC (Oak Grove) owns and operates the Oak Grove Steam Electric Station (OGSES) located approximately ten miles north of Franklin in Robertson County, Texas. The power plant and related support areas are located along the south side of Twin Oak Reservoir (Figure 1). The OGSES consists of two lignite-fired units with a combined operating capacity of approximately 1,796 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of OGSES unit operation. The CCRs are transported off-site for beneficial use by third-parties or are disposed at the OGSES Ash Landfill 1.

The U.S. Environmental Protection Agency promulgated 40 C.F.R. Part 257, Subpart D (the CCR Rule) and the Texas Commission on Environmental Quality (TCEQ) promulgated 30 T.A.C. Chapter 352 (which largely adopts the federal CCR Rule by reference) to establish technical requirements for new and existing CCR landfills and surface impoundments. On June 28, 2021, USEPA approved the majority of TCEQ's CCR program, which will now operate in lieu of the federal regulations. FGD-A, FGD-B, and FGD-C (collectively the "FGD Ponds") at the OGSES have been identified as Existing CCR Surface Impoundments regulated under the CCR Rule.

Section 257.73(d) specifies that periodic structural stability assessments must be conducted for each CCR surface impoundment and 30 T.A.C. 352.731 adopts this requirement by reference. In accordance with § 257.73(g), the initial Structural Stability Assessments for the FGD Ponds was completed and placed in the facility operating record in November 2016 (Golder, 2016). As specified in § 257.73(f)(3), the Structural Stability Assessment must be updated every five years from the completion date of the initial plan. Golder Associates Inc., member of WSP (Golder), was retained by Luminant to prepare this updated Structural Stability Assessment for the FGD Ponds.

1.1 Description of FGD Ponds

The FGD Ponds are located approximately 2,500 feet northwest of the OGSES power generation units (Figure 1) and are constructed above grade and surrounded by engineered earthen dikes that extend up to approximately 25 feet above surrounding grade.

The FGD Ponds receive wastewater from the FGD wet scrubber system blowdown, low volume wastewater, bottom ash contact water, and storm water runoff from approximately 41 acres of the power plant. All fluids are pumped into the FGD Ponds and there are no uncontrolled or gravity inflows into the ponds, with the exception of a gravity overflow from FGD-A to FGD-B. Process wastewater can be transferred between the FGD Ponds and is used as makeup water to the FGD scrubber system and related purposes. The are no spillways or other uncontrolled gravity flow releases from the ponds. Solids that accumulate in the FGD ponds are periodically removed and transported to OGSES Ash Landfill 1.

FGD-A covers an area of approximately 9.5 acres and was constructed in 2008. FGD-A is currently lined with a 3-foot thick compacted clay liner; however, FGD-A ceased receipt of waste by April 11, 2021, and Oak Grove has initiated the retrofit of FGD-A with a composite liner system meeting the requirements of § 257.71(a)(1)(ii).

FGD-B covers an area of approximately 12 acres and was constructed in 2011. FGD-B is constructed with a composite liner consisting of a minimum 2-foot thick compacted clay liner, overlain be a 60-mil HDPE geomembrane liner, overlain by a 1-foot thick layer of protective soil. The composite liner system in FGD-B complies with the requirements of §257.71(a)(1)(ii).

FGD-C is approximately 25 acres and was constructed in 2016. FGD-C is constructed with a composite liner consisting of a minimum 2-foot thick compacted clay liner, overlain by a 60-mil HDPE geomembrane liner, overlain by a 2-foot thick soil/ash protective layer. The composite liner system in FGD-C complies with the requirements of §257.71(a)(1)(ii).

1.2 Previous Slope Stability Evaluations

The Initial Structural Assessment for the FGD Ponds was completed and placed in the OGSES operating record in October 2016 (Golder, 2016). No structural stability deficiencies were identified in the surface impoundments during the initial assessment.

In addition, Golder performed previous evaluations on the FGD-A, and FGD-B ponds as part of the below reports submitted to Luminant:

- FGD-B Slope Stability Investigation Report (Revised), Luminant Oak Grove SES, Robertson County, Texas, dated June 2010
- FGD-A Slope Stability Evaluation Report, Luminant Oak Grove SES, Robertson County, Texas, dated March 2011
- Addendum to Slope Stability Investigation Reports Luminant Oak Grove SES, Robertson County, Texas, March 2014

These studies found the pond slopes to be adequately stable.

Construction of FGD-C Pond was completed in 2016. During the design of FGD-C Pond, Golder evaluated the stability of the embankments.

2.0 SUBSURFACE CONDITIONS

2.1 Regional Geology

The OGSES site is located in the Sandy Hills physiographic province of Texas. Ground elevations range from 400 to 425 feet MSL (mean sea level), and the topography is characterized by low rolling hills and shallow stream valleys (Espey, Huston & Associates, 1987). The regional terrain consists of a thick series of unconsolidated sediments consisting of sand, silt, clay, and lignite. The major geologic units are the tertiary age ‘bedrock’ strata and the quaternary age fluviatile deposits. Eroded bedrock is overlain by alluvium and terraces along the valleys of larger streams. The approximate thickness of alluvium in the area of the site varies from 0 to 50 ft. The alluvium typically consists of sand, silt, silty clay and sandy clay and is not easily differentiated from the underlying bedrock strata in many instances.

2.2 Site Geology

2.2.1 Subsurface Investigations and Laboratory Testing

Information from previous subsurface investigations was used to characterize the subsurface site conditions. Golder conducted a subsurface investigation for the FGD-A Pond in July 2008, prior to construction of the clay liner within the pond. Golder completed nine borings within the pond footprint with boring depths ranging from 16 to 28 feet below ground surface (bgs) (Golder, 2008). Golder also conducted a subsurface investigation for the FGD-B Pond in March 2010 (Golder, 2010). In December 2014, Golder completed another subsurface investigation including ten geotechnical boreholes and installation of 3 groundwater monitoring wells, to facilitate design and construction of the FGD-C Pond. Appendix A of the initial Structural Stability Assessment (Golder2016) includes the boring location maps and select, representative boring logs.

For each investigation, laboratory testing was performed on selected samples, in accordance with commonly accepted methods and practices. Undisturbed and disturbed soil samples were tested to determine water content, Atterberg limits, grain size distribution, and shear strength. Water content determination was performed in accordance with ASTM D2216; Atterberg limits were determined in accordance with ASTM D4318; and grain size distribution was performed in accordance with ASTM D422. Shear strength testing consisted of unconsolidated-undrained (UU) and consolidated-undrained (CU) triaxial compression tests in general accordance with ASTM D2850 and D4767, respectively. Laboratory data are presented in Appendix B of the initial Structural Stability Assessment (Golder, 2016).

The findings from the above subsurface investigations were reviewed for their applicability to this study and are summarized in the following sections.

2.2.2 Subsurface Site Conditions

2.2.2.1 FGD-A Pond

The soils encountered under the FGD-A Pond consist of lean clays, sandy clays, silty clays, sands, silty sands, clayey sands, and sandy silts. The near surface soils under the pond generally consist of fine- grained soils extending to depths ranging from approximately 6 feet to more than 19 feet below the pond bottom. Coarse-grained soils (i.e., sands) were generally encountered at depths greater than 6 feet below the pond bottom. Sands were encountered at shallower depths in the northwest portion of the pond than in the southeast portion of the pond.

Historical monitoring well measurements near the FGD-A Pond indicate that the groundwater level is between approximately 406 and 411 ft-msl.

2.2.2.2 FGD-B Pond

The soils encountered in the borings generally consisted of very stiff to hard clays and compact to very dense sands. The surficial soils were generally classified as very stiff to hard sandy (lean and fat) clay and ranged in thickness from 8 to 27 ft. The surficial clay stratum was underlain by layers of compact to very dense sand, clayey sand, silty sand, and/or very stiff to hard silty clay or clay.

Historical monitoring well measurements near FGD-B Pond indicate that the groundwater level is between approximately 405 and 411 ft-msl.

2.2.2.3 FGD-C Pond

Based on the results of the geotechnical investigations at this facility, soils in the footprint of the FGD-C Pond in general comprise the following:

- Laminated clays, silty clays and sandy clays having low horizontal and vertical hydraulic conductivity;
- Thinly bedded clays, clayey silts, and silty sands characterized by low to moderate horizontal permeability and low net vertical permeability; and
- Bedded sands, silty sands, clayey sands, and silts of moderate to relatively high horizontal and moderate vertical permeability.

Based on monitoring well measurements near FGD-C, the groundwater level ranges from approximately 410 ft-msl to 413 ft-msl.

3.0 SITE RECONNAISSANCE

Following a review of the structural stability assessment and past inspection reports, Golder performed a site reconnaissance on October 7, 2021 to observe conditions at the crest, downstream slopes, and areas beyond the FGD Ponds. With the exception of portions of the FGD-A Pond where the CCR has been removed in preparation for retrofitting, it was not feasible to observe the conditions of the upstream slopes below the water level.

During the site visit no items of concern were noted.

4.0 UPDATED STRUCTURAL STABILITY ASSESSMENT - §257.73(d)(1)(i)-(vii)

The CCR rules require conducting periodic structural stability assessments by a qualified professional engineer to document whether the design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater that can be impounded therein.

4.1 Foundations and Abutments - §257.73(d)(1)(i)

As noted above, the foundation soils consist of native soils and fill. The foundation soils and abutments are stable.

4.2 Slope Protection - §257.73(d)(1)(ii)

The downstream slopes of the embankments in each FGD pond are protected from erosion and deterioration by the establishment of a vegetative cover. The vegetative cover is inspected weekly for erosion, signs of seepage, animal burrows, sloughing, and plants that could negatively impact the embankment.

4.3 Dikes (Embankment) - §257.73(d)(1)(iii)

Each of the embankments was constructed of compacted site soils. No construction testing of the original embankment fill in FGD-A and FGD-B Ponds are available.

As described in Section 4.6 (Hydraulic Structures), the retrofitting will include removal and replacement of crossover pipeline through the northern embankment of the FGD-A Pond and installation of a suction pipeline and drain line through the southeastern corner of the FGD-B Pond embankment. This will require removal and replacement of fill along embankments. The technical specifications for embankment fill require placement in loose horizontal lifts not exceeding 10 inches and compaction to 95% of the maximum dry density and within -1% to +3% of the optimum water content as determined by the standard Proctor test (ASTM D698).

In 2011, the base and embankment elevations of FGD-B Pond were raised, and the pond was lined with a composite geomembrane/clay liner system. The subgrade was raised 5 feet using structural fill to increase the separation depth from the groundwater. Approximately 150,000 cy of structural fill was placed in 6-inch lifts and compacted to 95% of the maximum standard Proctor dry density.

The FGD-C Pond embankment was constructed of compacted site soils, placed in 6-inch lifts compacted to 95% of the standard Proctor maximum dry density and within -1% to +3% of the standard Proctor optimum water content. FGD-C Pond is lined with a composite liner consisting of a 2-ft thick clay liner, a 60-mil HDPE geomembrane and a 2-ft thick soil/ash protective cover. The clay liner was placed in 6-inch thick lifts compacted to achieve a hydraulic conductivity of less than 1×10^{-7} cm/s.

Based on a review of past inspection reports and on recent observations, each of the embankments are sufficient to withstand the range of loading conditions they are subjected to.

4.4 Vegetated Slopes - §257.73(d)(1)(iv)

The exterior slopes of the surface impoundments at the OGSES are vegetated to control erosion. Luminant maintains the vegetation in a manner that ensures that the weekly inspections required under the CCR Rule can be conducted; however, the height of the vegetation varies depending on the frequency of maintenance.

The US Court of Appeals for the District of Columbia Circuit remanded and vacated the CCR Rule requirement that vegetation on the exterior portions of dikes on CCR surface impoundments be maintained not to exceed 6 inches in height. EPA proposed to address this requirement in 2018 but it has not finalized any new requirements.

4.5 Spillways - §257.73(d)(1)(v)

There are no spillways on any of the surface impoundments.

4.6 Hydraulic Structures - §257.73(d)(1)(v)

Sludge and waste water enter FGD-A Pond through high density polyethylene (HDPE) pipes near the southern portion of the eastern embankment. Water can be recycled from FGD-A Pond back to the SES through three pipes connecting to a reclaim/recycling pump station located near the northern portion of the eastern embankment. A 12-inch HDPE crossover pipeline located across the pond from the inlet pipes connects the FGD-A Pond to FGD-B Pond. Flow through this pipe is controlled with a valve located near the toe of the western embankment.

As part of the FGD-A Pond retrofitting, the HDPE inlet pipes will be removed, and new pipes will be installed near the crest of the embankment. In addition, the existing 12-inch crossover pipeline will be removed and replaced with an 18-inch diameter HPE crossover pipeline approximately 9 feet lower through the north embankment. The new pipeline will tie in to the existing gate valve.

Currently, there are no pipes that pass through or under the FGD-B embankment.

Sludge and waste water enter FGD-C through HDPE pipes passing above the embankment crest elevation near the southwestern corner of the pond. There are two pipes that pass through the embankment: a 24- inch diameter HDPE recycle/reclaim pipe and a 12-inch diameter drain pipe located near the middle of the eastern pond embankment. Water can be recycled from the FGD-C Pond back to the SES through the 24- inch diameter HDPE recycle/reclaim pipe that ties into the FGD-A Pond Pump station. The water in FGD- C can also be drained by the 12-inch diameter pipe which can be connected to the 24-inch diameter HDPE recycle/reclaim pipe when needed.

No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris were observed that may negatively affect the operation of the surface impoundments.

4.7 Downstream Slopes Adjacent to Water Body - §257.73(d)(1)(vii)

The west side of the FGD-B Pond borders a cove off of the Twin Oak Reservoir. This man-made reservoir is designed for a maximum water surface at EL 410 ft-msl. The toe of the FGD-B west embankment is at an elevation of approximately 420 ft-msl; therefore, the embankment will likely never be inundated and never subjected to rapid drawdown.

4.8 Structural Stability Deficiencies - §257.73(d)(2)

No structural stability deficiencies were identified during this assessment.

5.0 CONCLUSIONS

Based on our review of the information provided by Oak Grove, on information prepared by Golder Associates Inc., and on our on-site observations, no structural stability deficiencies were identified in the surface impoundments during this assessment.

6.0 REFERENCES

Espey, Huston & Associates, Inc., 1987, Hydrogeologic Assessment of Proposed Surface Impoundment Areas, Twin Oak SES, Robertson County, Texas.

Golder Associates Inc. 2008, Data Report - Oak Grove SES, FGD Pond Subsurface Investigation, Robertson County, Texas.

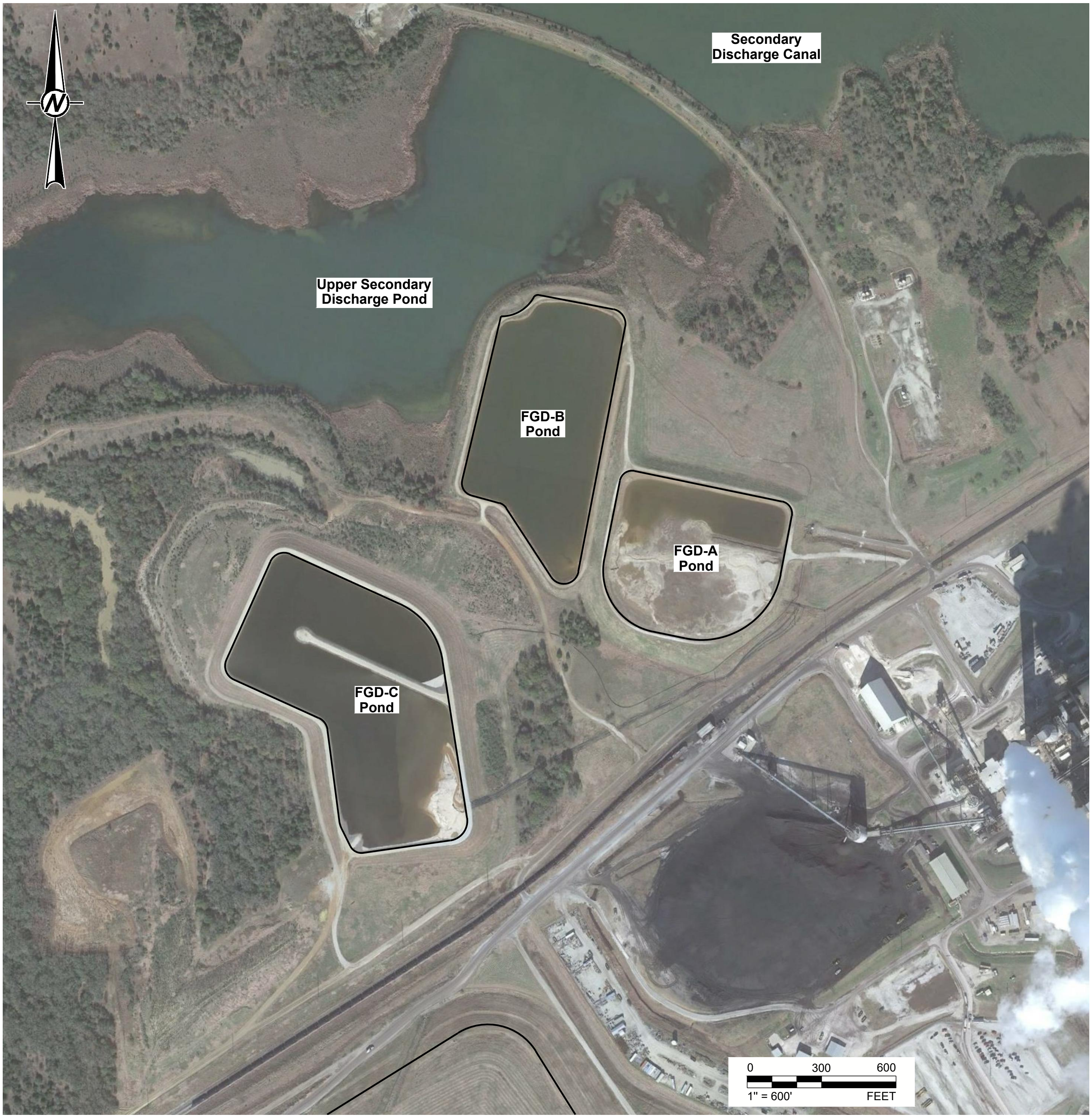
Golder Associates Inc. 2010, FGD-B Slope Stability Investigation Report (Revised), Luminant Oak Grove SES, Robertson County, Texas.

Golder Associates Inc. 2011, FGD-A Slope Stability Evaluation Report, Luminant Oak Grove SES, Robertson County, Texas.

Golder Associates Inc. 2014, Addendum to Slope Stability Investigation Reports, Luminant Oak Grove SES, Robertson County, Texas.

Golder Associates Inc. 2016. Structural Stability Assessment Report, Luminant Oak Grove Steam Electric Station.

Figures



CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
FGD PONDS
STRUCTURAL STABILITY ASSESSMENT UPDATE

TITLE
SITE PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-04
DESIGNED	AJD
PREPARED	AJD
REVIEWED	JBF
APPROVED	JBF

PROJECT NO.	CONTROL	REV.	FIGURE
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REFERENCE(S)
BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

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Path: \\golder.gds\complexdata\office\Texarkana\Projects - Round Rock_2021\21465177 - Luminant OGSES\PRODUCTION\D - 2021 SSA\ | File Name: 1-Site Plan (FGD Ponds).dwg

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