REPORT

Hazard Potential Classification 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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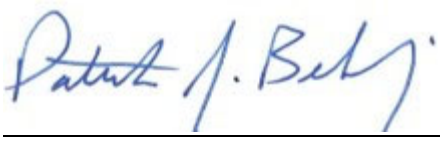
PROFESSIONAL CERTIFICATION

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 Hazard Potential Classification Assessment was conducted in accordance with the requirements of 40 C.F.R. § 257.73(a)(2) and 30 T.A.C. § 352.731.



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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(a)(2) specifies that periodic Hazard Potential Classification Assessments (HPCAs) be performed by a qualified professional engineer for each existing CCR surface impoundment and 30 T.A.C. 352.731 adopts this requirement by reference. In accordance with § 257.73(f)(1) of the CCR Rule, the initial HPCA for the FGD Ponds was completed and placed in the OGSES operating record in October 2016 (Golder, 2016). As specified in §257.73 (f)(3), the HPCAs must be updated every five years from the completion date of the initial plan. Golder Associates Inc., member of WSP (Golder), was retained by Oak Grove to prepare this updated HPCA for the FGD Ponds.

1.1 CCR Surface Impoundment Hazard Potential Classification Assessment Requirements

Section 257.73(a)(2) specifies that periodic hazard potential classification assessments be performed for each existing CCR surface impoundment. The hazard potential classification assessments must document the hazard potential classification of each CCR impoundment as either:

- A high hazard potential CCR surface impoundment,
- A significant hazard potential CCR surface impoundment, or
- A low hazard potential CCR surface impoundment.

The assessments must document the basis for each hazard potential classification and must be certified by a qualified professional engineer confirming that the hazard potential classifications were conducted in accordance with the requirements of § 257.73(a)(2).

1.2 OGSES Surface Impoundments Subject to Hazard Potential Classification Assessments

Section 257.53 defines CCRs as "fly ash, bottom ash, boiler slag, and flue gas desulfurization materials from burning coal for the purpose of generating electricity by electric utilities and independent power producers". The hazard potential classification assessment requirements of the CCR Rule apply to surface impoundments that dispose or otherwise engage in solid waste management of CCRs.

The FGD Ponds have been identified as CCR Units subject to the hazard potential classification assessment requirements at the OGSES.

1.3 Description of FGD Ponds

The FGD Ponds are located approximately 2,500 feet northwest of the OGSES power generation units (Figure 2) 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 part of the power plant area. 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 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). The retrofitted liner system will consist of a minimum 2-foot thick compacted clay liner or geosynthetic clay liner (GCL), overlain be a 60-mil HDPE geomembrane liner. The floor of the pond will be covered by a 1.5-foot thick layer of protective soil and the upper portion of the pond side slopes will be covered with concrete revetment mat.

FGD-B covers an area of approximately 11.2 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 15.2 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).

Based on available construction data, the FGD Ponds were constructed to provide the following estimated storage capacities:

- FGD-A: 190 acre-feet,
- FGD-B: 125 acre-feet, and
- FGD-C: 248 acre-feet.

1.4 USACE Size Classification for FGD Ponds

The US Army Corps of Engineers (USACE) classifies the relative size of dams based on the height of the dam and the storage capacity of the impounded area behind the dam as follows (USACE, 1979):

USACE Dam Size Classification		
Size Category	**Impoundment Capacity (acre-ft)**	**Impoundment Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

Based on the dike heights and operating capacities of the FGD Ponds, these ponds are categorized as small impoundments based on the USACE dam size classification criteria.

1.5 Previous Hazard Potential Classification Assessments for FGD Ponds

The following Hazard Potential Classification Assessments were previously performed for the FGD Ponds:

- **Initial Hazard Potential Classification Assessment, 2016**. As required under § 257.73(a)(2), the initial Hazard Potential Classification Assessment for the FGD Ponds was completed and placed in the OGSES operating record in October 2016 (Golder, 2016). The FGD Ponds were classified as **LOW** hazard potential CCR surface impoundments, since a failure or mis-operation of the impoundments results in no probable loss of human life, low economic and/or environmental losses, and no significant disruption of lifeline systems.
- **EPA Hazard Potential Classification Assessment, 2014**. In 2009, the EPA initiated a program to assess the stability and functionality of coal ash impoundments at coal-fired electric generating plants across the United States. The assessment of the stability and functionality of the OGSES FGD Ponds was performed by O'Brien and Gere (OBG) on behalf of EPA (OBG, 2014). The FGD Ponds were classified as **LOW** hazard potential CCR surface impoundments in the 2014 OBG assessment.

2.0 CCR HAZARD CLASSIFICATION ASSESSMENT METHODOLOGY

As defined in § 257.53, hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. Hazardous potential classifications for CCR surface impoundments include high hazard potential CCR surface impoundment, significant hazard potential CCR surface impoundment, and low hazard potential CCR surface impoundment, which are defined in the CCR Rule as follows:

- High Hazard Potential CCR Surface Impoundment. A diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- Significant Hazard Potential CCR Surface Impoundment. A diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. FEMA considers lifeline facilities to include transportation facilities (highways, airports, ports, trains), electric power, water and sewer, communications (telephone, TV, radio, electronic) and gas and liquid fuel pipelines (FEMA, 1995).
- Low Hazard Potential CCR Surface Impoundment. A diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

The hazard classification assessment for the FGD Ponds was performed using the methodology presented in Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams developed by the Federal Emergency Management Agency (FEMA, 2004). The FEMA guidelines classify dams into similar hazard potential categories to those defined in the CCR Rule (low hazard potential, significant hazard potential and high hazard potential) and the FEMA guidelines are listed in the Preamble to the CCR Rule as one of the technical resources considered by EPA during development of the CCR Rule.

The FEMA hazard potential evaluation is based on assessing the probable loss of human life and the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure or mis-operation of a dam or its appurtenances. The location/size of the dam and impoundment area is evaluated against development, occupancy and land use conditions in areas downstream of the dam/impoundment that would be affected by a failure of the dam and release of the impounded water. The FEMA evaluation recognizes that the failure of any dam or water-retaining structure, no matter how small, represents a potential danger to downstream life and property and there is always the possibility of someone being in the path of the resulting discharge. However, the FEMA evaluation recognizes that considering every conceivable circumstance that might remotely place a person in the area potentially inundated as a result of the dam failure should not be the basis for determining the hazard classification level of the dam/impoundment. The FEMA evaluation considers "probable loss of life" to exist where persons are permanently located in the area potentially inundated as a result of the dam failure.

The hazard classification of the FGD Ponds was assessed by identifying the development, occupancy and land use characteristics of potentially affected areas downstream of the impoundments. The assessment included a review of available aerial photographs, USGS topographic maps, interviews with Oak Grove personnel familiar with the area, and similar resources. Classification of the FGD Ponds in accordance with the FEMA hazard potential criteria is based on the assessment of probable loss of human life and the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure of the embankments surrounding the ponds.

3.0 UPDATED HAZARD POTENTIAL CLASSIFICATION ASSESSMENT FOR FGD PONDS

The hazard potential classification of the FGD Ponds was assessed by identifying the development, occupancy and land use characteristics of areas downstream of the impoundments, assessing the probable loss of human life and/or the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure of the embankments surrounding the impoundments, and using the results of the assessment to classify the impoundments based on the FEMA hazard potential criteria described in Section 2.0 of this report.

3.1 Areas Downstream of FGD Ponds

The OGSES is located approximately ten miles north of Franklin, Texas and borders the south side of the Twin Oak Reservoir (Twin Oak). Twin Oak is a man-made reservoir that was constructed in 1982 to provide cooling water for the OGSES. Oak Grove owns the water rights to the lake and operates and maintains Twin Oak Dam. The emergency spillway of the dam is approximately 407 ft. above mean sea level (MSL) with a normal lake (conservation pool) elevation of 401 ft. MSL. At the conservation pool elevation, Twin Oak covers an area of approximately 2,330 acres, and contains a total volume of approximately 30,319 acre-ft of water (TWDB, 2021).

The FGD Ponds are located on the western edge of the OGSES and border Twin Oak Reservoir (see Figure 2). In the immediate vicinity of the FGD Ponds, Twin Oak Reservoir is subdivided into the following hydraulically connected areas separated by berms that extend 5 to 10 feet above the normal pool elevation:

- Upper Secondary Discharge Pond (Normal Pool Elevation of 410 ft. MSL, Area of approximately 80 acres), and
- Secondary Discharge Canal (Normal Pool Elevation of 410 ft. MSL, Area of approximately 270 acres).

The FGD Ponds are located adjacent to the Upper Secondary Discharge Pond. A berm separates the Upper Secondary Discharge Pond from the Secondary Discharge Canal, which are hydraulically connected by culverts through the berm. A second berm separates the Secondary Discharge Canal from the main body of Twin Oak Reservoir with the Tertiary Discharge Canal allowing flow to the main reservoir at a controlled rate. A potential release from the FGD Ponds would flow into Upper Secondary Discharge Pond, then into the Secondary Discharge Canal, then into the main body of the reservoir.

The shoreline of Twin Oak is mostly undeveloped and there are no permanent residences along the lake shoreline. Oak Grove owns all property immediately adjacent to the lake.

No gas or petroleum pipelines traverse Twin Oak Reservoir (RRC, 2021). Other than Oak Grove service roads that transverse the tops of the berms that run along the downstream edges of the Upper Secondary Discharge Pond and the Secondary Discharge Canal, no public roadways and no railroads cross the reservoir.

3.2 Hazard Potential Classification Assessment

A failure of the dikes surrounding the FGD Ponds would release CCR solids/fluids that would flow north toward Upper Secondary Discharge Pond, then potentially into the Secondary Discharge Canal, then potentially into Twin Oak Reservoir. As described in Section 1.3 of this report, the operating volume of the largest of the FGD Ponds (FGD-C) is approximately 248 acre-ft. In the unlikely event that the entire volume of FGD-C is released through catastrophic failure of the dikes, the solids/fluids would first flow into and be equalized by the Upper Secondary Discharge Pond, then flow into and be equalized by the Secondary Discharge Canal. Even if the total volume of FGD-C were to pass from the Secondary Discharge Canal to the main body of Twin Oak, the total volume of

FGD-C (248 acre-ft) represents less than one percent of the conservation pool volume of Twin Oak (30,319 acre-ft). Assuming a lake surface area of 2,330 acres at the conservation pool elevation of 401 feet, the total volume of FGD-C would raise the lake level by approximately 0.11 feet or slightly more than one inch. The resulting water surface elevation (401.11 feet) is well below the emergency spillway elevation at Twin Oak Dam (407 feet), indicating that the total volume of FGD-C would be retained and equalized within Twin Oak.

Using the FEMA hazard potential criteria described in Section 2.0 of this report, the projected effects of catastrophic failure or mis-operation of the impoundments results in a hazard potential classification of **LOW** for the FGD Ponds. This classification is supported by the following:

- No Probable Loss of Human Life. FEMA considers "probable loss of life" to exist where persons are permanently located in the area potentially inundated as a result of dam failure. The shoreline of Twin Oak Reservoir is mostly undeveloped and there are no permanent residences along the lake shoreline. In addition, the total volume of the largest FGD Pond (FGD-C) would be retained and equalized in Upper Secondary Discharge Pond, the Secondary Discharge Canal and/or the main body of Twin Oak. If the total volume of FGD-C were to pass into the main body of Twin Oak, the reservoir level would be raised by approximately 0.11 feet, which is well below the emergency spillway elevation of Twin Oak Dam. As a result, a release from the FGD Ponds would result in no probable loss of human life.

- Low Economic and/or Environmental Losses. FEMA considers low economic and or environmental losses to occur when losses resulting from a dam failure are principally limited to the dam owner's property. Since Oak Grove owns the water rights to Twin Oak Reservoir and the land surrounding the lake, any losses would primarily be limited to the Oak Grove property.

- No Significant Disruption of Lifelines. There are no gas/petroleum pipelines, public highways or railroads that traverse Twin Oak Reservoir. Therefore, no lifelines would be affected by a release from the FGD Ponds.

4.0 FINDINGS OF UPDATED HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

Golder was retained by Oak Grove to perform the 5-Year update to the Hazard Potential Classification Assessment for the FGD Ponds in accordance with the requirements of § 257.73(a)(2). The HPCA was performed using the methodology presented in Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams developed by the Federal Emergency Management Agency.

Based on the FEMA hazard potential criteria, the FGD Ponds are classified as **LOW** hazard potential CCR surface impoundments, since a failure or misoperation of the ponds results in no probable loss of human life, low economic and/or environmental losses, and no significant disruption of lifeline systems.

In accordance with § 257.73(f), this updated hazard potential classification assessment must be placed in the operating record for the OGSES no later than October 12, 2021. Subsequent periodic hazard potential classification assessments must be completed every five years.

5.0 REFERENCES

Golder Associates, Inc. (Golder), 2016. Initial Hazard Potential Classification Assessment, CCR Surface Impoundments – Oak Grove Steam Electric Station, Robertson County, Texas, October.

Federal Emergency Management Agency (FEMA), 2004. Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams.

FEMA, 1995. Plan for Developing and Adopting Seismic Design Guidelines and Standards for Lifelines, September.

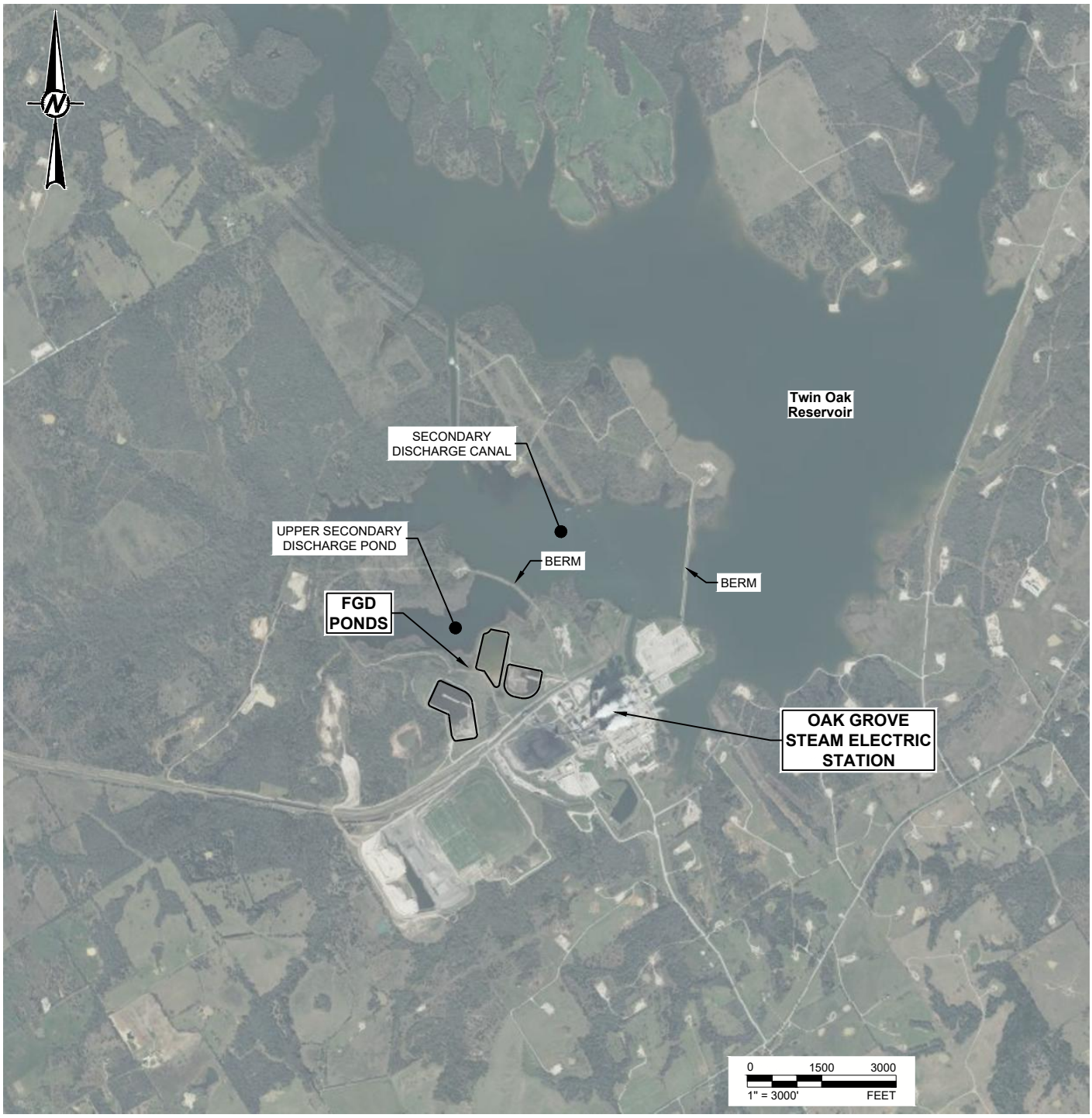
O'Brien & Gere (OBG), 2014. Dam Safety Assessment of CCW Impoundments – Luminant Oak Grove Steam Electric Station, June 3.

Texas Railroad Commission (RRC), 2021. Public GIS Viewer – Oil and Gas Well and Pipeline Data. On-line database.

Texas Water Development Board (TWDB), 2021, Twin Oak Reservoir Information. On-line report.

United States Army Corps of Engineers (USACE), 1979. Recommended Guidelines for Safety Inspections of Dams, ER 1110-2-106, September 26.

FIGURES



CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
FGD PONDS
HAZARD POTENTIAL CLASSIFICATION ASSESSMENT UPDATE

TITLE
SITE LOCATION MAP

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-28
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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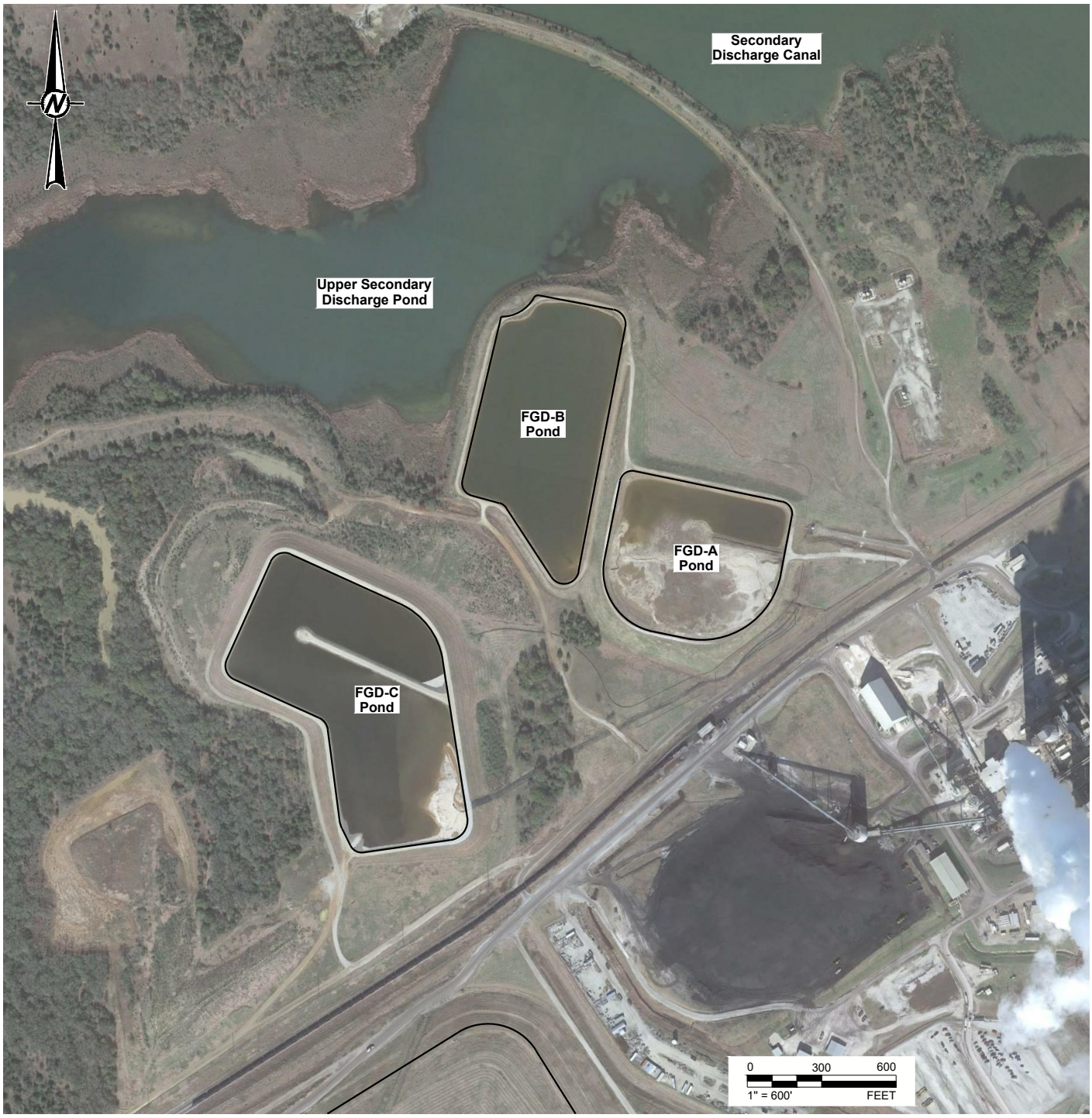

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
FGD PONDS
HAZARD POTENTIAL CLASSIFICATION ASSESSMENT UPDATE

TITLE
SITE PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-28
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
21465177		0	2

REFERENCE(S)
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