GOLDER

REPORT

Run-on and Run-off Control System Plan
5 Year Update

Oak Grove Steam Electric Station
Ash Landfill 1
Robertson County, Texas

Submitted to:

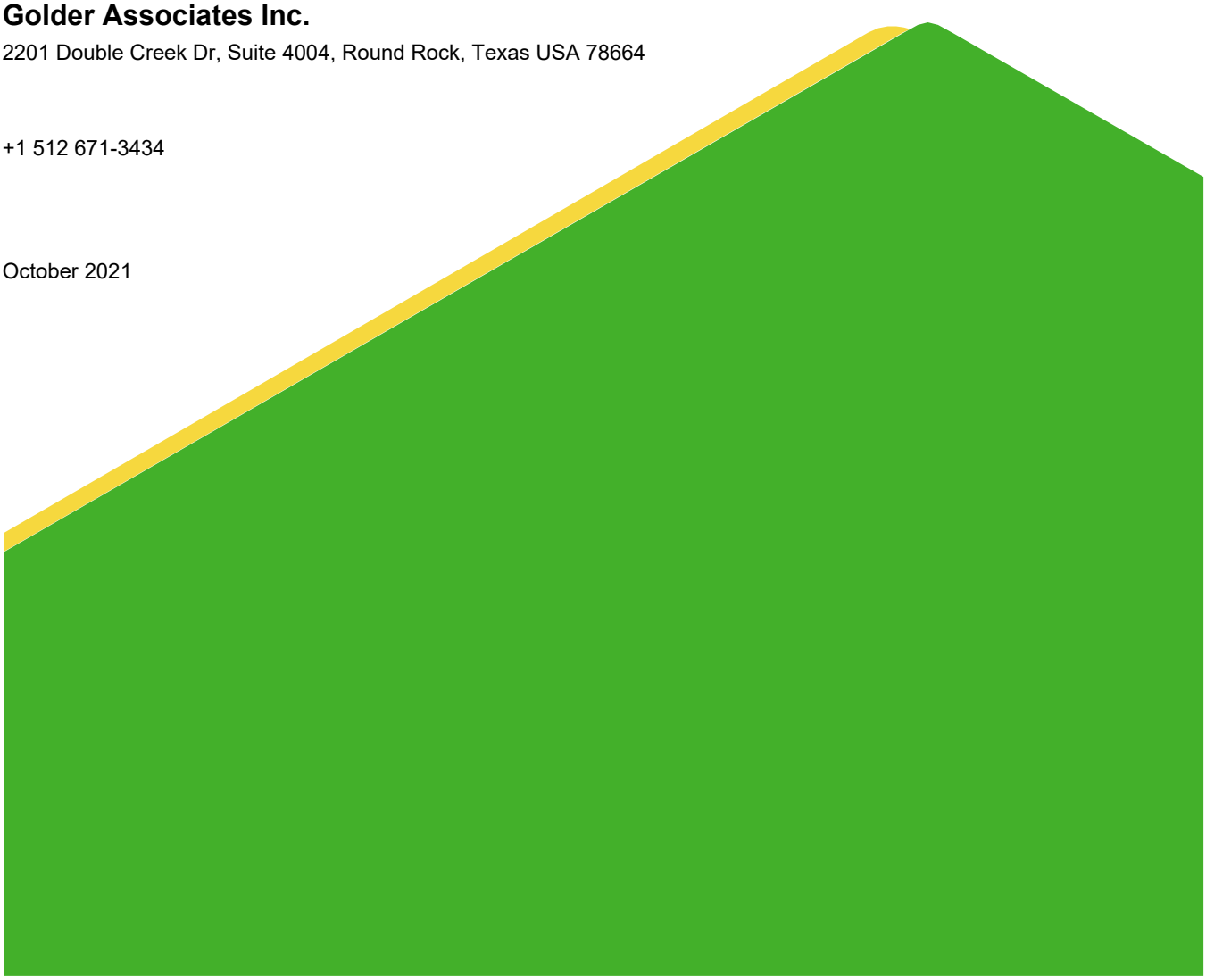
Oak Grove Management Company LLC
6555 Sierra Drive
Irving, TX 75039

Submitted by:

Golder Associates Inc.
2201 Double Creek Dr, Suite 4004, Round Rock, Texas USA 78664

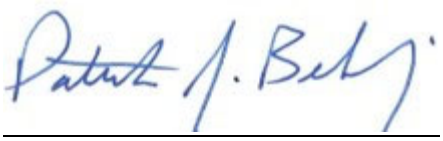
+1 512 671-3434

October 2021



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 Run-on and Run-off Control System Plan has been prepared in accordance with the requirements of 40 C.F.R. § 257.81 and 30 T.A.C. § 352.811.



Patrick J. Behling, P.E.
Principal Engineer
Golder Associates Inc.
Firm Registration No. F-2578

Table of Contents

FIGURES

APPENDICES

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 (Figure 1). The power plant and related support areas are located along the south side of Twin Oak Reservoir (Figure 2). 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 (ALF1).

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. ALF1 at the OGSES has been identified as an Existing CCR Landfill regulated under the CCR Rule.

Section 257.81(c) requires that a Run-On/Run-Off Control System Plan (RRCSP) be developed for all CCR Landfills and 30 T.A.C. 352.811 adopts this requirement by reference. In accordance with § 257.81(c)(3), the initial RRCSP for ALF1 was completed and placed in the OGSES operating record in October 2016 (Golder, 2016). As specified in §257.81(c)(4), the RRCSP must be updated every five years from the completion date of the initial plan. Golder Associates Inc., member of WSP, was retained by Oak Grove to prepare this updated RRCSP for ALF1.

1.1 CCR Landfill Run-on and Run-off Control System Plan Requirements

Section 257.81(c) specifies that a written run-on and run-off control system plan be prepared for each existing CCR landfill that describes the systems that have been designed and constructed to control run-on to and run-off from the landfill consistent with the requirements of the CCR Rule and recognized and generally accepted good engineering practices. The RRCSP must include, at a minimum, design, construction, operation, and maintenance information for the following:

- A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and
- A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR unit must be managed in accordance with the requirements of 40 C.F.R. 257.3–3 (prohibition against pollution of waters of the United States).

The RRCSP must be supported by appropriate engineering calculations and must be certified by a qualified professional engineer. The RRCSP must document how the run-on and run-off control system has been designed and constructed to comply with the requirements of § 257.81.

1.2 Description of Ash Landfill 1

ALF 1 is the primary disposal facility for CCR generated at the OGSES and is located approximately 1200 feet southwest of the OGSES (see Figure 3). ALF1 consists of four landfill cells (Cells 1 through 4), each constructed with a 3-foot thick compacted clay liner (hydraulic conductivity ≤ 1×10^{-7} cm/sec). ALF1 has been in operation since 2008.

The landfill is constructed above-grade and is surrounded by earthen perimeter berms that extend 10 to 20 feet or more above ground surface. The perimeter berms are also provided with a 3-foot thick compacted clay liner on the interior face of the berms. CCR placement extends above the top of the perimeter berms and the sides of the CCR placed above the berms are graded to slopes of approximately 3H:1V.

The current status of ALF1 Cells 1 through 4 is as follows:

- Cell 1 has received CCR and is inactive. A final cover consisting of a 3-ft thick clay soil (hydraulic conductivity ≤ 1×10^{-7} cm/sec) overlain with 1.5-ft thick vegetative cover was placed over Cell 1 in 2015.
- Cell 2 has received CCR and is inactive. A final cover consisting of a 40-mil linear low-density polyethylene (LLDPE) geomembrane overlain with a geosynthetic drainage layer and 18 inches of soil was placed over Cell 2 in 2019.
- Cells 3 and 4 are active and are used for CCR disposal and temporary storage prior to sale. The southeastern portion of Cell 4 is used to manage contact water.

1.3 Previous RRCSP for Ash Landfill 1

The Initial RRCSP for ALF1 was completed and placed in the OGSES operating record in October 2016 (Golder, 2016). Key Findings from the Initial RRCSP can be summarized as follows:

- In accordance with § 257.81(a)(1), ALF1 has been constructed to limit contact between storm water run-off from areas outside the landfill and CCR placed in the landfill. The landfill is surrounded by exterior earthen dikes that extend 10 feet or more above the surrounding grade and storm water generated from areas outside the landfill is diverted away from the landfill by the dikes and associated drainage ditches, swales, and other surface features.
- In accordance with § 257.81(a)(2), ALF1 has been constructed to contain precipitation that falls directly on the active portions of the landfill. The majority of the landfill is surrounded by earthen dikes that extend 10 feet or more above the surrounding grade, so precipitation that falls within the active areas of the landfill is contained and managed within run-off collection areas.

2.0 UPDATED RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

The Updated RRCSP for ALF1 is described in this section. In accordance with § 257.81(c), the RRCSP addresses run-on and run-off control for the active portions of the landfill. Run-on and runoff control systems for closed sections of ALF1 are described in the Closure Plan for the landfill.

2.1 Design Storm Event

In accordance with §§ 257.81(a)(1) and 257.81(a)(2), the run-on and run-off control systems for ALF1 must be designed to prevent run-on into the landfill and control run-off from the landfill during the peak discharge from a 25-year, 24-hour storm. The 25-year, 24-hour storm for ALF1 was estimated to be 7.68 inches based on the Point Precipitation Frequency Estimate Table from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for Franklin, TX (NOAA, 2021, see Appendix A).

2.2 Run-on Control System

The CCR Rule defines run-on as “any rainwater, leachate, or other liquid that drains overland onto any part of a CCR landfill or lateral expansion of a CCR landfill.” The run-on control system for ALF1 is shown on Figure 4 and is described below.

2.2.1 Design and Construction

ALF1 has been constructed to limit contact between storm water run-off from areas outside the landfill and CCR placed in the landfill. A significant portion of the landfill is surrounded by exterior earthen dikes that extend 10 feet or more above the surrounding grade. Storm water run-off generated from areas outside the landfill is diverted away from the landfill by the dikes and associated drainage ditches, swales and other surface features. Storm water run-off from capped areas is also diverted away from active areas of the landfill using berms, ditches, swales and other surface features. In accordance with § 257.81(a)(1), the height of the exterior landfill dikes and relative to the surrounding topography indicate that run-off from a 25-year 24-hour storm will be diverted around the landfill and not flow onto any part of the landfill actively receiving CCR.

The landfill dikes and storm water drainage features are also designed and constructed to minimize soil erosion. The exterior of the existing dikes, drainage features and other permanent earthen structures are permanently vegetated to control erosion. Additional erosion protection (channel linings, rip rap, etc.) are used for maintenance of interim controls as well as at locations with higher storm water flow velocities and increased erosion potential.

2.2.2 Operation and Maintenance

Storm water drainage features along the exterior of ALF1 will be operated and maintained to ensure that proper storm water run-on control is maintained throughout the life of the landfill. Storm water run-on operation and maintenance activities implemented at the landfill include:

- The landfill is inspected on a weekly basis by a qualified person in accordance § 257.83(a) and annually by a professional engineer in accordance with § 257.83 (b). The weekly and annual inspections address the exterior dikes around the landfill and storm water run-on control features along the dikes and include:
  - Verification that storm water generated from areas outside the CCR placement areas is diverted around the landfill by the dikes and associated drainage ditches, swales and other drainage features.
  - Verification that the drainage ditches, swales and other drainage features do not contain significant accumulated sediments or other flow obstructions.

  - Identification of areas of dike or drainage feature erosion/scouring that require repair.

- Accumulated sediment/debris are removed, as required, from the drainage features to maintain adequate storm water drainage. Areas of erosion/scour are repaired through backfilling, grading/reshaping, seeding and related activities. Drainage features may be redesigned/reconfigured if erosion/scouring are observed repeatedly in certain areas.

- Inspection and maintenance activities are documented in inspection and maintenance records.

2.3 Run-off Control System

Section 257.53 defines run-off as "any rainwater, leachate, or other liquid that drains overland from any part of a CCR landfill or lateral expansion of a CCR landfill." For the purposes of this RRCSP, the term "run-off" has been further classified into run-off from active landfill areas and run-off from capped landfill areas. The run-off control system for the ALF1 is shown on Figure 5 and is described below.

2.3.1 Design and Construction

ALF1 has been constructed to contain precipitation that falls on the active portions of the landfill. The majority of the landfill is surrounded by earthen dikes that extend 10 feet or more above the surrounding grade, so precipitation that falls within the active areas of the landfill is contained and managed within run-off collection areas. Cells 1 and 2 are capped and non-contact stormwater run-off from these capped areas is diverted away from the landfill by the drainage ditches, swales and other surface features along the perimeter of the landfill.

Cells 3 and 4 are currently active and all precipitation that comes into contact with exposed CCR is contained and managed within the run-off collection area along the southeast side of Cell 4 (see Figure 5 for the Run-off Control Plan).

Run-off Volume Calculation Procedures

In accordance with § 257.81(a)(2), ALF1 has been designed and constructed to contain the estimated volume of run-off from active landfill areas generated from a 25-year, 24-hour storm.

Run-off volumes from active Cells 3 and 4 were estimated using the Curve Number (CN) method as described in the USDA publication TR-55 - Urban Hydrology for Small Water Sheds (USDA-NRCS, 1986). A key component of the TR-55 procedure is identifying the appropriate CN used in the evaluations. Published CNs vary depending on material type, degree of saturation and other variables, ranging from 98 for impervious surfaces (concrete/asphalt pavement, etc.) to 50 or less for vegetated, well drained soils (USDA-NRCS, 1986). The following CNs were assumed for this evaluation (PBW, 2016):

- Exposed ash/FGS solids: CN = 94

One hundred percent (CN = 100) of the direct precipitation on the run-off collection area itself was assumed to be collected in the run-off collection area.

The surface areas of Cells 3 and 4 were measured using AutoCAD Civil 3D and were used to calculate run-off volumes (see Appendix B). The estimated surface areas of the Cells were as follows:

- Cell 3: Approximately 30 acres
- Cell 4: Approximately 26 acres

Run-off Evaluation

Run-off volume estimates for ALF1 are shown in Appendix C. Estimated volumes of run-off were compared to run-off collection area containment capacities to confirm that adequate run-off containment is provided for the 25-year, 24-hour storm (7.68 inches).

The total volume of run-off generated from Cells 3 and 4 was estimated to be 1,499,233 cf.

Run-off Containment Capacity

The current topography of Cell 3 and Cell 4 was used to estimate the run-off containment capacity in the Cell 4 collection area and adjacent areas using AutoCAD Civil 3D (See Appendix D). The run-off containment capacity for the run-off collection area in Cell 4 and adjacent areas was calculated to be 58,128 cubic yards (1,569,456 cf) assuming a minimum of 1-foot freeboard remains along the perimeter dikes.

Since the volume of run-off to the Cell 4 collection area and adjacent areas is less than the containment capacity, the Cell 4 collection area and adjacent areas can contain the run-off from a 25-yr, 24-hr storm.

2.3.2 Operation and Maintenance

The run-off containment features of ALF1 will be operated and maintained to ensure that proper run-off control is maintained throughout the life of the landfill. Run-off control operation and maintenance activities implemented at the landfill include:

- Run-off from active landfill areas is stored in the run-off collection areas for the shortest time practicable. Run-off accumulated in the collection areas is applied to active areas of the landfill to control dust and/or is allowed to evaporate.
- The landfill is inspected on a weekly basis by a qualified person in accordance § 257.83(a) and annually by a professional engineer in accordance with § 257.83 (b). The weekly and annual inspections address the interior and exterior dikes at the landfill and include:
  - Verification that run-off from active areas is being contained in the collection area and a minimum of 2 feet of freeboard is maintained in the collection area.
  - Inspection and maintenance activities are documented in inspection and maintenance records.

2.4 Updates to Run-on and Run-off Control System Plan

In accordance with § 257.81(c)(3), this Updated RRCSP must be placed in the in the OGSES operating record no later than October 12, 2021. Subsequent RRCSPs must be completed every five years.

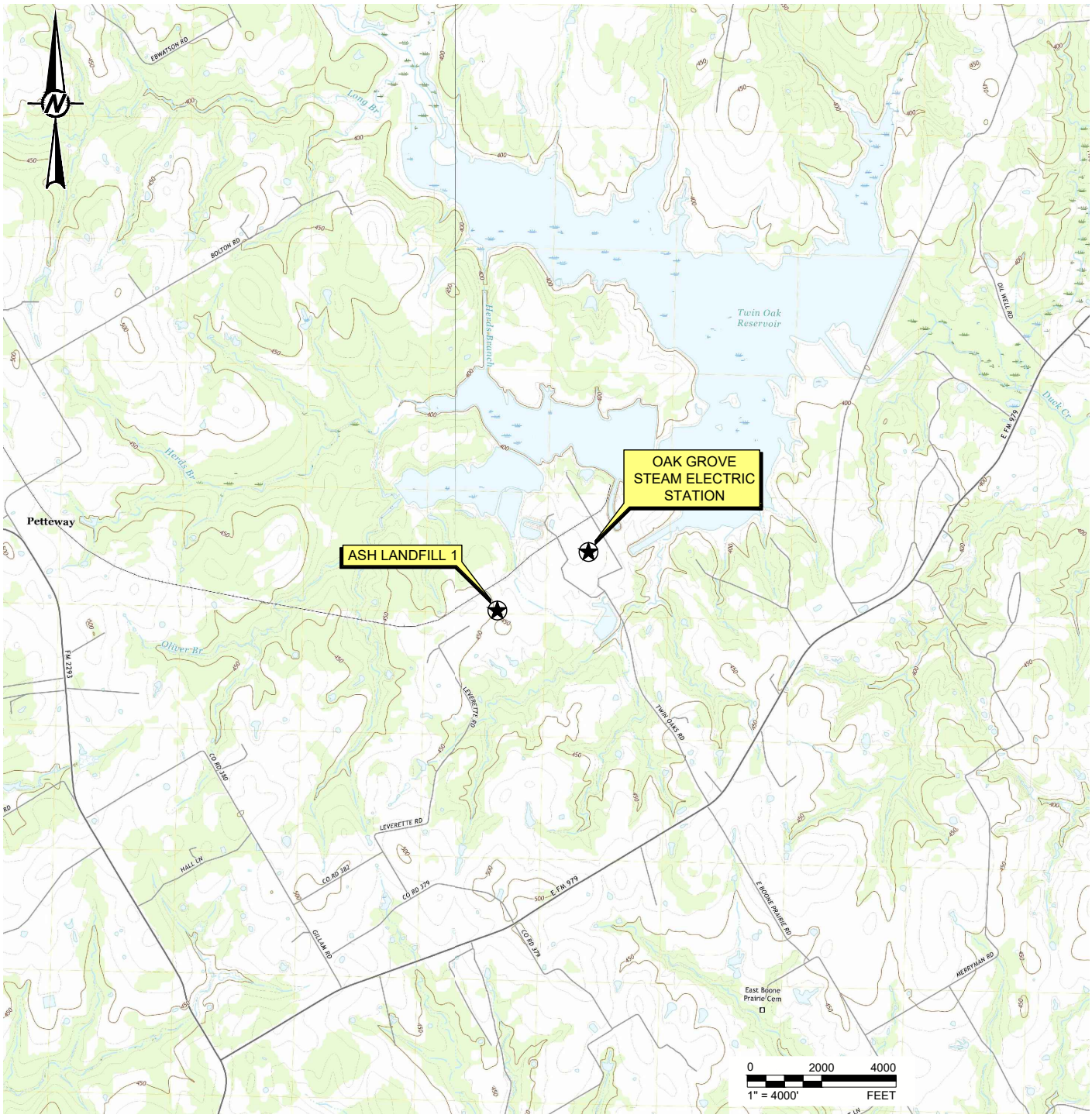
3.0 REFERENCES

Golder Associates, Inc. (Golder), 2016. Run-on and Run-off Control System Plan – Ash Landfill 1, Oak Grove Steam Electric Station, October.

National Oceanic and Atmospheric Administration (NOAA), 2021. Atlas 14 – Point Precipitation Frequency Estimates Website, Franklin, Texas. September.

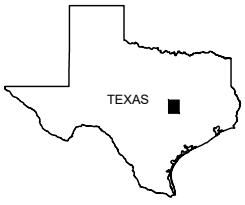
United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), 1986. Urban Hydrology for Small Watersheds - TR-55, June.

FIGURES



REFERENCE(S)

BASE MAP TAKEN FROM USGS.GOV, BALD PRAIRIE AND PETTEWAY, TX 7.5 MIN. USGS QUADRANGLES DATED 2019.



QUADRANGLE LOCATION

CLIENT

OAK GROVE MANAGEMENT COMPANY LLC

PROJECT

OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
21465177		0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 1 in

LEGEND

- - - - - - - - REGISTERED LANDFILL BOUNDARY

REFERENCE(S)

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
SITE VICINITY MAP

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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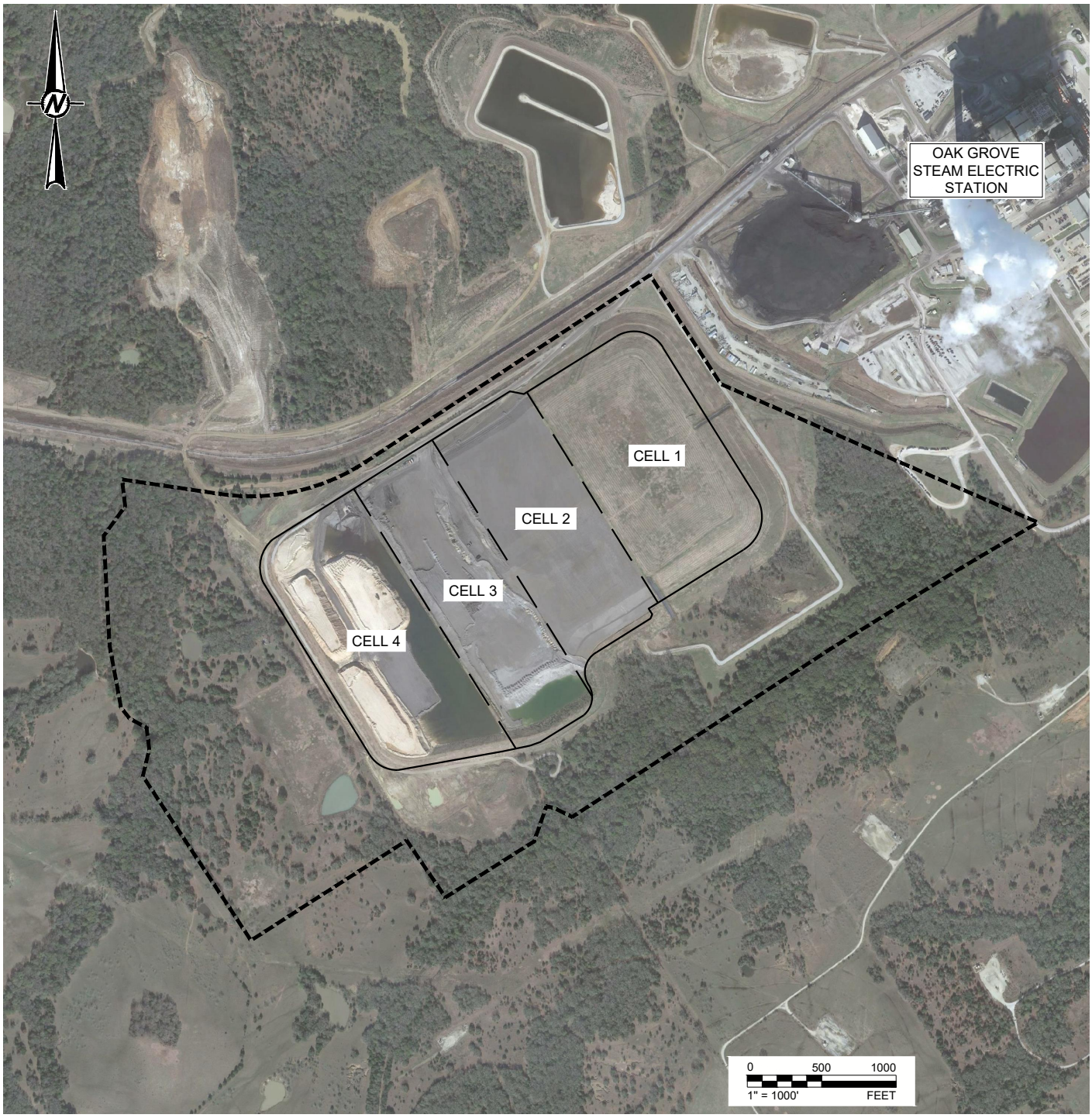

LEGEND

- - - - - - - - REGISTERED LANDFILL BOUNDARY

REFERENCE(S)

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

CLIENT

OAK GROVE MANAGEMENT COMPANY LLC

PROJECT

OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE

EXISTING SITE PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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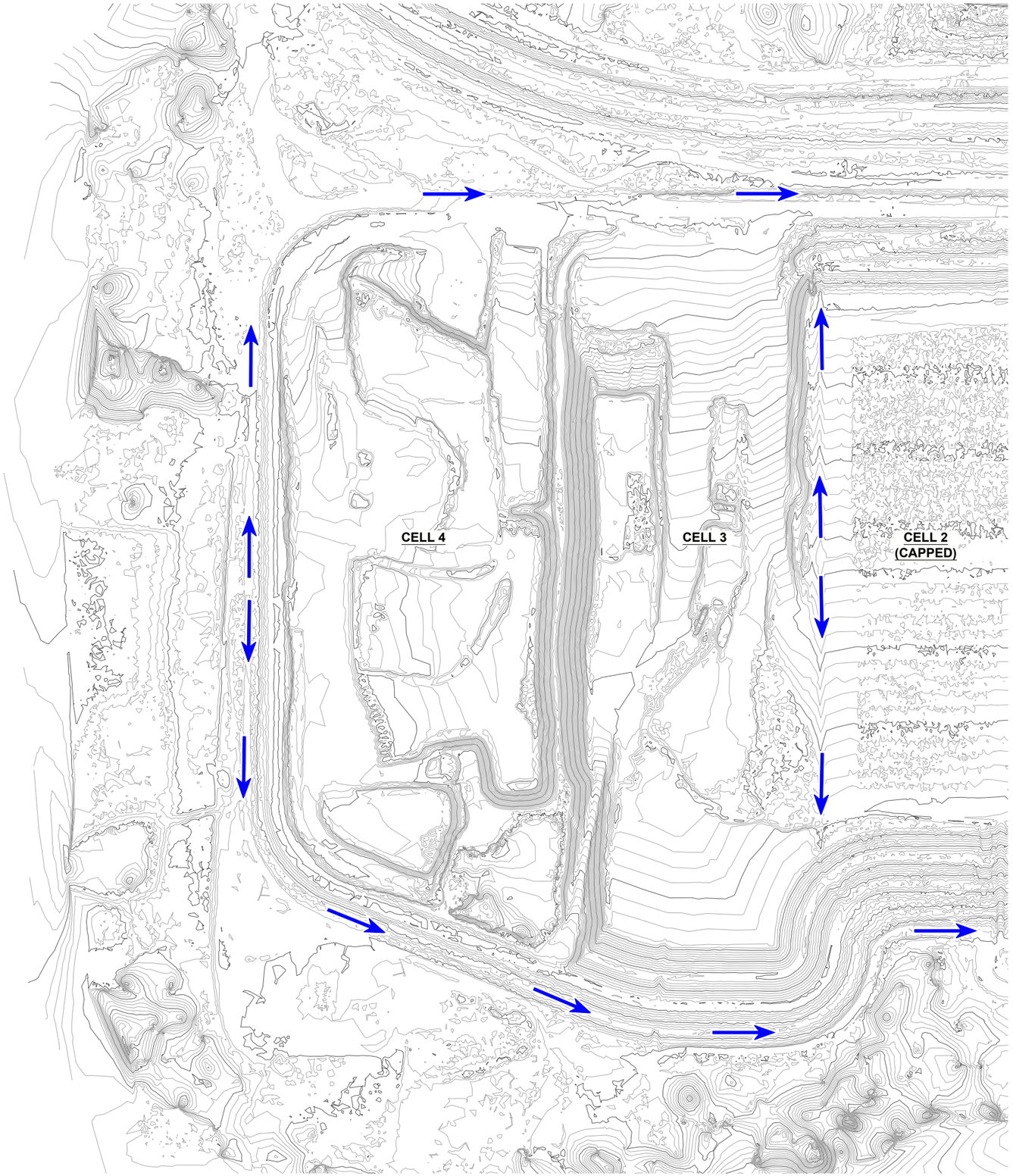

LEGEND

- EXISTING GRADE CONTOUR - 2 FT INTERVAL
- EXISTING GRADE CONTOUR - 10 FT INTERVAL
- STORMWATER RUN-OFF FLOW DIRECTION

0 150 300
1" = 300' FEET

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
RUN-ON CONTROL PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

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

PROJECT NO. 21465177 | CONTROL | REV. 0 | FIGURE 4

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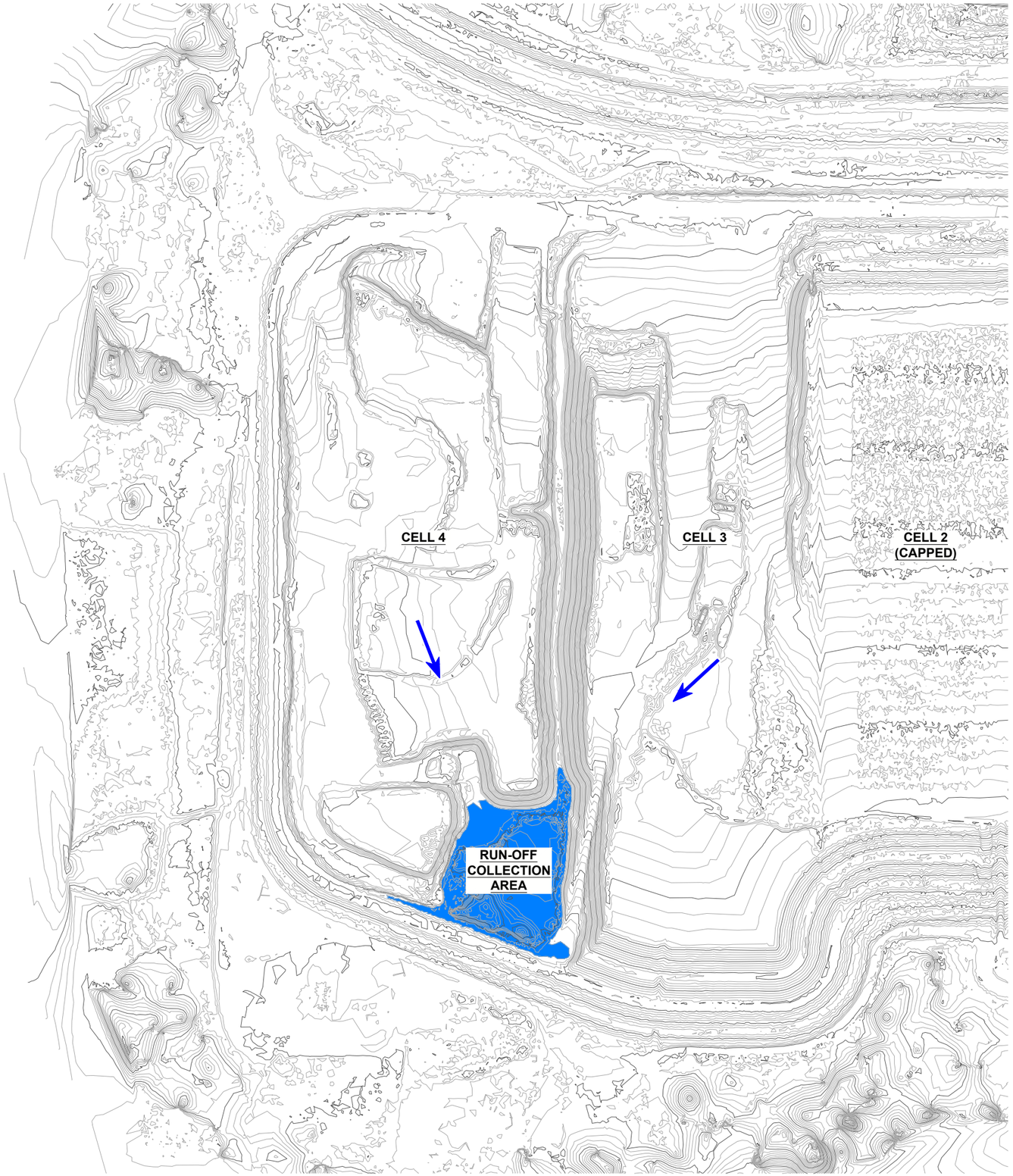

LEGEND

- EXISTING GRADE CONTOUR - 2 FT INTERVAL
- EXISTING GRADE CONTOUR - 10 FT INTERVAL
- RUN-OFF COLLECTION AREA

0 150 300
1" = 300' FEET

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
RUN-OFF CONTROL PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

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

PROJECT NO.	CONTROL	REV.	FIGURE
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APPENDIX A

NOAA Atlas 14 Precipitation Data – Franklin, Texas

NOAA Atlas 14, Volume 11, Version 2
Location name: Franklin, Texas, USA*
Latitude: 31.1819°, Longitude: -96.4882°
Elevation: 436.43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.441** (0.334-0.583)	**0.512** (0.390-0.669)	**0.626** (0.476-0.822)	**0.722** (0.542-0.961)	**0.855** (0.622-1.17)	**0.958** (0.678-1.35)	**1.06** (0.734-1.54)	**1.17** (0.789-1.74)	**1.32** (0.859-2.03)	**1.44** (0.911-2.26)
10-min	**0.704** (0.533-0.929)	**0.817** (0.623-1.07)	**1.00** (0.761-1.31)	**1.15** (0.866-1.54)	**1.37** (0.997-1.88)	**1.54** (1.09-2.17)	**1.71** (1.18-2.47)	**1.88** (1.26-2.78)	**2.10** (1.37-3.22)	**2.27** (1.44-3.57)
15-min	**0.882** (0.668-1.17)	**1.02** (0.783-1.34)	**1.26** (0.958-1.65)	**1.45** (1.09-1.93)	**1.71** (1.24-2.35)	**1.91** (1.35-2.69)	**2.11** (1.46-3.06)	**2.33** (1.57-3.46)	**2.62** (1.70-4.02)	**2.85** (1.80-4.48)
30-min	**1.24** (0.941-1.64)	**1.44** (1.10-1.88)	**1.75** (1.34-2.31)	**2.02** (1.51-2.69)	**2.38** (1.73-3.26)	**2.65** (1.87-3.73)	**2.93** (2.02-4.24)	**3.23** (2.17-4.80)	**3.65** (2.37-5.60)	**3.98** (2.52-6.26)
60-min	**1.62** (1.23-2.14)	**1.88** (1.43-2.45)	**2.30** (1.75-3.02)	**2.65** (1.99-3.53)	**3.13** (2.28-4.29)	**3.51** (2.48-4.94)	**3.90** (2.69-5.64)	**4.32** (2.91-6.42)	**4.91** (3.19-7.55)	**5.38** (3.41-8.47)
2-hr	**1.96** (1.50-2.57)	**2.32** (1.77-3.00)	**2.88** (2.21-3.76)	**3.37** (2.54-4.45)	**4.05** (2.96-5.50)	**4.58** (3.26-6.39)	**5.14** (3.56-7.36)	**5.76** (3.89-8.45)	**6.63** (4.32-10.0)	**7.33** (4.65-11.4)
3-hr	**2.16** (1.65-2.82)	**2.58** (1.98-3.31)	**3.24** (2.49-4.20)	**3.82** (2.89-5.02)	**4.63** (3.40-6.27)	**5.28** (3.77-7.33)	**5.98** (4.15-8.50)	**6.74** (4.56-9.81)	**7.81** (5.11-11.8)	**8.69** (5.53-13.4)
6-hr	**2.50** (1.93-3.24)	**3.04** (2.34-3.85)	**3.87** (2.99-4.97)	**4.60** (3.51-6.00)	**5.65** (4.17-7.58)	**6.51** (4.67-8.95)	**7.43** (5.19-10.5)	**8.45** (5.74-12.2)	**9.92** (6.51-14.7)	**11.1** (7.11-16.9)
12-hr	**2.85** (2.21-3.67)	**3.50** (2.69-4.38)	**4.48** (3.47-5.70)	**5.36** (4.11-6.94)	**6.65** (4.94-8.85)	**7.72** (5.58-10.5)	**8.90** (6.25-12.4)	**10.2** (6.98-14.5)	**12.2** (8.01-17.8)	**13.8** (8.83-20.6)
24-hr	**3.25** (2.53-4.14)	**4.00** (3.09-4.96)	**5.13** (4.01-6.49)	**6.16** (4.75-7.92)	**7.68** (5.74-10.1)	**8.95** (6.50-12.1)	**10.4** (7.31-14.2)	**12.0** (8.20-16.8)	**14.3** (9.46-20.7)	**16.3** (10.5-24.0)
2-day	**3.73** (2.93-4.72)	**4.59** (3.58-5.67)	**5.90** (4.64-7.40)	**7.06** (5.48-9.00)	**8.77** (6.58-11.4)	**10.2** (7.40-13.5)	**11.7** (8.28-15.9)	**13.4** (9.26-18.6)	**16.0** (10.6-22.9)	**18.2** (11.7-26.4)
3-day	**4.08** (3.21-5.15)	**5.00** (3.93-6.17)	**6.41** (5.06-8.02)	**7.65** (5.96-9.71)	**9.45** (7.11-12.2)	**10.9** (7.96-14.4)	**12.5** (8.86-16.8)	**14.3** (9.86-19.7)	**16.9** (11.3-24.0)	**19.1** (12.4-27.6)
4-day	**4.37** (3.45-5.49)	**5.32** (4.20-6.56)	**6.80** (5.39-8.48)	**8.09** (6.32-10.2)	**9.94** (7.49-12.8)	**11.4** (8.35-15.0)	**13.0** (9.26-17.5)	**14.8** (10.3-20.3)	**17.5** (11.7-24.6)	**19.7** (12.8-28.3)
7-day	**5.05** (4.01-6.31)	**6.06** (4.83-7.46)	**7.65** (6.10-9.50)	**9.02** (7.08-11.3)	**10.9** (8.27-14.0)	**12.4** (9.13-16.2)	**14.0** (10.0-18.7)	**15.9** (11.0-21.5)	**18.6** (12.4-25.8)	**20.8** (13.5-29.4)
10-day	**5.62** (4.47-6.98)	**6.67** (5.35-8.21)	**8.36** (6.70-10.4)	**9.79** (7.71-12.2)	**11.8** (8.92-15.0)	**13.3** (9.78-17.2)	**14.9** (10.7-19.7)	**16.7** (11.7-22.6)	**19.4** (13.0-26.8)	**21.6** (14.1-30.4)
20-day	**7.35** (5.88-9.06)	**8.54** (6.94-10.5)	**10.5** (8.52-13.0)	**12.2** (9.65-15.1)	**14.4** (10.9-18.1)	**16.0** (11.8-20.5)	**17.6** (12.7-23.0)	**19.4** (13.6-25.8)	**21.9** (14.7-29.8)	**23.9** (15.6-33.0)
30-day	**8.78** (7.06-10.8)	**10.1** (8.25-12.4)	**12.3** (10.0-15.1)	**14.1** (11.2-17.4)	**16.4** (12.6-20.6)	**18.1** (13.5-23.1)	**19.8** (14.3-25.7)	**21.5** (15.1-28.5)	**23.9** (16.1-32.2)	**25.7** (16.8-35.2)
45-day	**10.8** (8.72-13.2)	**12.2** (10.1-15.0)	**14.8** (12.1-18.1)	**16.8** (13.4-20.6)	**19.3** (14.8-24.0)	**21.1** (15.7-26.7)	**22.8** (16.5-29.4)	**24.5** (17.3-32.2)	**26.8** (18.2-35.9)	**28.5** (18.7-38.7)
60-day	**12.6** (10.2-15.3)	**14.2** (11.7-17.4)	**17.0** (13.9-20.7)	**19.1** (15.3-23.4)	**21.8** (16.8-27.0)	**23.7** (17.7-29.8)	**25.4** (18.4-32.6)	**27.2** (19.2-35.4)	**29.4** (20.0-39.1)	**31.1** (20.4-41.9)

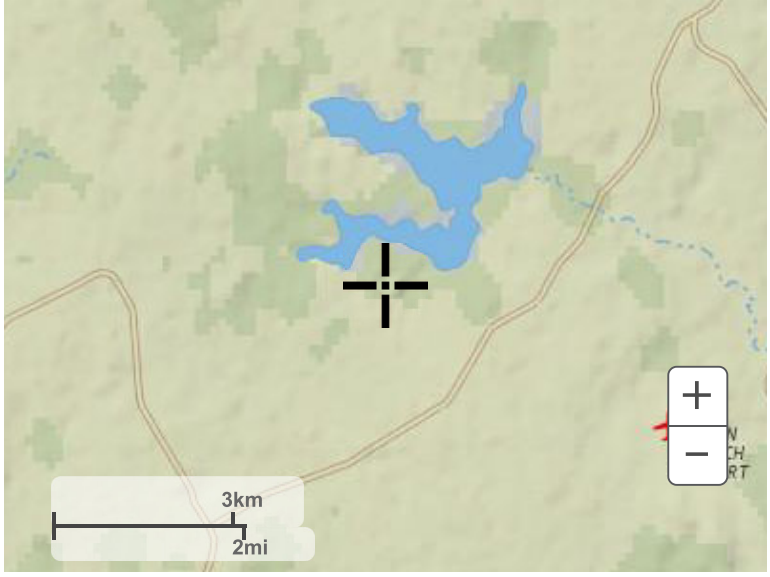
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

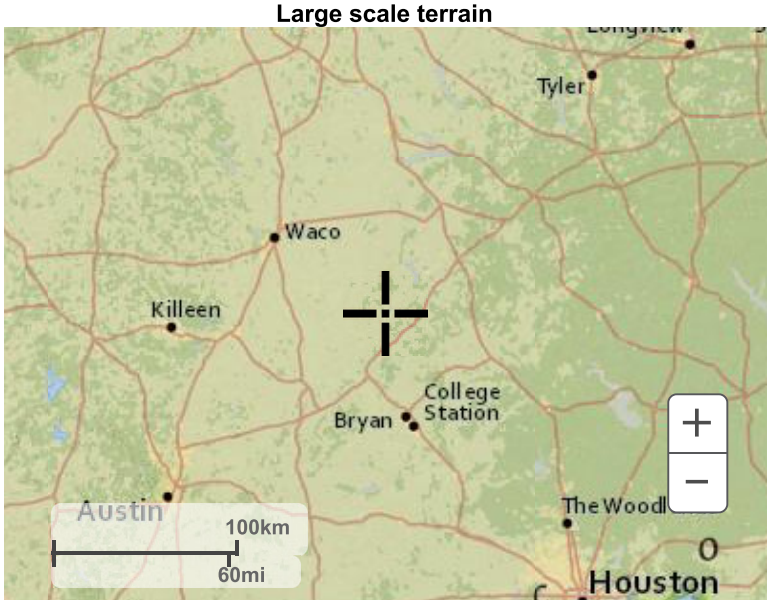
Please refer to NOAA Atlas 14 document for more information.

Back to Top

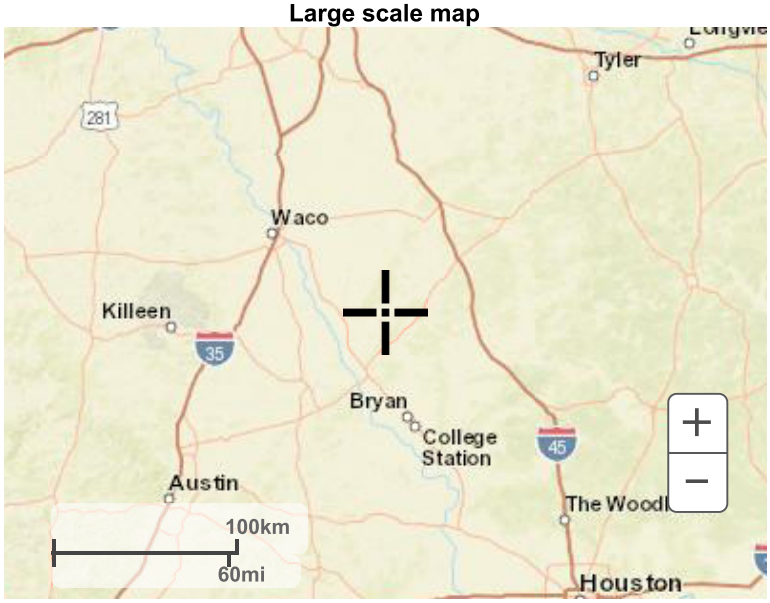
PF graphical



Large scale terrain



Large scale map



Large scale aerial

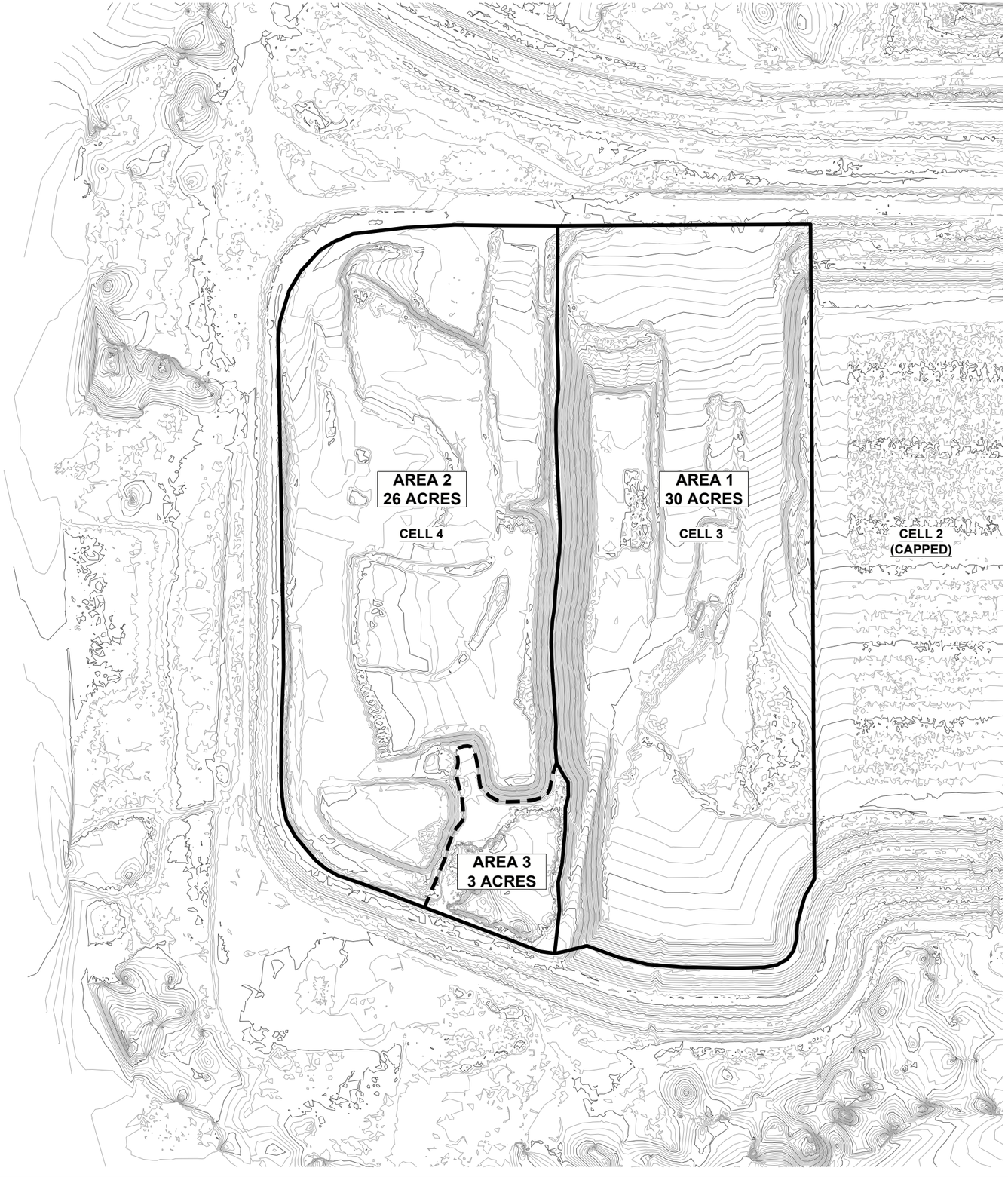
Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B

Surface Areas



LEGEND

EXISTING GRADE CONTOUR - 2 FT INTERVAL

EXISTING GRADE CONTOUR - 10 FT INTERVAL

0 150 300
1" = 300' FEET

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
SURFACE AREAS

CONSULTANT
GOLDER
MEMBER OF WSP

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

PROJECT NO.	CONTROL	REV.	FIGURE
21465177		0	B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in 0

APPENDIX C

Run-off Volume Calculations

APPENDIX C

OAK GROVE MANAGMENT COMPANY LLC
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1 - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - CELL 4 RUN-OFF COLLECTION AREA

Definitions

Run-off from active landfill areas: storm water that comes into contact with waste
Run-off from capped landfill areas: storm water that falls outside of an active waste management area and does not come into contact with waste

Assumptions

1) Contact Run-off from Cells 3 and 4 is collected in the Cell 4 Collection Area
2) Non-contact run-off from capped Cells 1 and 2 is diverted away from Cells 3 and 4
2) Run-off volume based on a 25-year, 24-hr storm
3) Assume exposed fly ash, bottom ash and FGD solids in Cells 3 and 4
4) Storm water runoff volumes are estimated using the Curve Number method as described in USDA's Urban Hydrology for Small Water Sheds (TR-55)

Area that Generates Run-off

From Appendix B:

Cell 3:	30	acres
Cell 3:	1,306,800	sf
Cell 4:	26	acres
Cell 4:	1,132,560	sf

Design Rainfall

25-Yr, 24-Hr Storm (NOAA Atlas 14): 7.68 in

Curve Numbers

Assumptions:
- For exposed ash/FGD solids, use CN = 94

Calculate Weighted Curve Number for Cell 4 Collection Area Watershed

Description	Area (acres)	CN	Area X CN
Cell 3	30	94	2,820
Cell 4	26	94	2,444
	56		5,264

Weighted Curve Number = (Sum of CN X A) /(Total Area)
Weighted Curve Number = 94.0

APPENDIX C

OAK GROVE MANAGMENT COMPANY LLC
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1 - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - CELL 4 RUN-OFF COLLECTION AREA

Calculate Run-Off Volume Using TR-55 Procedures

1) Calculate Potential Retention of Water (S). Assume this represents water adsorbed by ash (non free water)

S = (1000/CNW)-10

where: S = Potential Retention of Water, inches
CN = Curve Number for Site

S = 0.64 inches

2) Calculate Depth of Runoff (Q)

Q = [(P-0.2S)^2]/[P-0.8S)]

where: Q = Depth of run-off generated, inches
S = Potential Retention of Water, inches
P = Design rainfall, inches

Q = 6.96 inches

3) Calculate Volume of Run-off from Watershed

V = Q X A

where: Q = depth of run-off generated, ft
A = Total Area, sf

Q = 6.96 inches
Q = 0.58 feet
Area = 2,439,360 sf

Watershed Run-off Volume: 1,415,598 cf

4) Calculate Volume of Precipitation on Cell 4 Collection Area

V= surface area (sf) X design storm precipitation (ft)

Cell 4 Collection Area Surface Area = 130,680 sf
25-Yr, 24-Hr Storm (NOAA Atlas 14) 7.68 in
25-Yr, 24-Hr Storm (NOAA Atlas 14) 0.64 ft

Volume of Precip on Cell 4 Coll. Area: 83,635 cf

Total Volume to Cell 4 Coll. Area: 1,499,233 cf

APPENDIX D

Run-off Collection Area Capacities

LEGEND

EXISTING GRADE CONTOUR - 2 FT INTERVAL

EXISTING GRADE CONTOUR - 10 FT INTERVAL

0 150 300
1" = 300' FEET

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
VS-POND STORAGE VOLUME	1.000	1.000	271996.987 Sq. Ft.	0.18 Cu. Yd.	58128.27 Cu. Yd.	58128.09 Cu. Yd.<Fill>
Totals			271996.987 Sq. Ft.	0.18 Cu. Yd.	58128.27 Cu. Yd.	58128.09 Cu. Yd.<Fill>

CLIENT
OAK GROVE MANAGEMENT COMPANY LLC

PROJECT
OAK GROVE STEAM ELECTRIC STATION
ASH LANDFILL 1
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
COLLECTION AREA POND STORAGE VOLUME

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-05
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO. 21465177 | CONTROL | REV. 0 | APPENDIX D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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