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October 11, 2021

Illinois Power Generating Company
134 Cips Lane
Coffeen, Illinois 62017

Subject: USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference
2021 USEPA CCR Rule Periodic Certification Report
GMF Recycle Pond, Coffeen Power Plant, Coffeen, Illinois

At the request of Illinois Power Generating Company (IPGC), Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 10 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference

Report Section	USEPA CCR Rule		Illinois Part 845 Rule	
3	§257.73 (a)(2)	Hazard Potential Classification	845.440	Hazard Potential Classification Assessment[3]
4	§257.73 (c)(1)	History of Construction	845.220(a)	Design and Construction Plans (Construction History)
5	§257.73 (d)(1)	Structural Stability Assessment	845.450 (a) and (c)	Structural Stability Assessment
6	§257.73 (e)(1)	Safety Factor Assessment	845.460 (a-b)	Safety Factor Assessment
7	§257.82 (a)(1-3)	Adequacy of Inflow Design Control System Plan	845.510(a), (c)(1), (c)(3)	Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan
	§257.82 (b)	Discharge from CCR Unit	845.510(b)	Discharge from CCR Surface Impoundment

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

CLOSING

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

Lucas P. Carr, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

2021 USEPA CCR RULE CERTIFICATION REPORT
§257.73(a)(2), (c), (d), (e) and §257.82
GMF RECYCLE POND
Coffeen Power Plant
Coffeen, Illinois

Submitted to

Illinois Power Generating Company

134 Cips Lane
Coffeen, Illinois 62017

Submitted by

Geosyntec consultants

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EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the GMF Recycle Pond (GMF RP)[1] at the Coffeen Power Plant (CPP), also known as the Coffeen Power Station (COF), has been prepared in accordance with Rule 40, Code of Federal Regulations (CFR) §257. herein referred to as the "CCR Rule" [1]. The CCR Rule requires that initial certifications for existing CCR surface impoundment, completed in 2016 and subsequently posted on the Illinois Power Generating Company (IPGC) CCR Website ([2], [3], [4], [5], [6]) be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 ([2], [7], [3], [4], [5], [6]) were independently reviewed by Geosyntec. Additionally, field observations, interviews with plant staff, updated engineering analyses, and evaluations were performed to compare conditions in 2021 at the GMF RP relative to the 2016 and 2017 initial certifications. These tasks determined that updates are not required for the Initial Hazard Potential Classification. However, due to changes at the site and technical review comments, updated were required and were performed for the:

- History of Construction Report,
- Initial Structural Stability Assessment,
- Initial Safety Factor Assessment, and
- Initial Inflow Design Flood Control System Plan.

Table 1 provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[1] The GMF RP is also referred to as ID Number W4350150004-04, GMF Recycle Pond, by the Illinois Environmental Protection Agency (IEPA); CCR Unit ID 104 by IPGC; and IL50578 within the National Inventory of Dams (NID) maintained by the Illinois Department of Natural Resources. Within this document it is referred to as the GMF RP.

Table 1 – Periodic Certification Summary

	CCR Rule Reference	Requirement Summary	2016 Initial Certification		2021 Periodic Certification	
			Requirement Met?	Comments	Requirement Met?	Comments
Hazard Potential Classification						
3	§257.73(a)(2)	Document hazard potential classification	Yes	Impoundment was determined to have a Significant hazard potential classification [2].	Yes	No changes were identified that may affect this requirement.
History of Construction						
4	§257.73(c)(1)	Compile a history of construction	Yes	A History of Construction report was prepared for the GMF RP, Ash Pond 1, Ash Pond 2, and the GMF Gypsum Stack Pond [3].	Yes	A letter listing updates to the History of Construction report is provided in **Attachment C**.
Structural Stability Assessment						
5	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations were found to be stable. Abutments were not present [4].	Yes	Foundations and abutments were found to be stable after performing updated slope stability analyses.
	§257.73(d)(1)(ii)	Adequate slope protection	Yes	Slope protection was adequate [4].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iii)	Sufficiency of dike compaction	Yes	Dike compaction was sufficient for expected ranges in loading conditions [4].	Yes	Dike compaction was found to be sufficient after performing updated slope stability analyses.
	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	Yes	Vegetation was present on exterior slopes and was maintained. Interior slopes had alternate protection (geomembrane liner) [4].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and management	Yes	Spillways were adequately designed and constructed to adequately manage flow during the probable maximum flood [4].	Yes	Spillways were found to be adequately designed and constructed and are expected to adequately manger flow during the 1,000-year design flood, as long as the starting water surface elevation is maintained at El. 622.1 ft or below.
	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	Yes	Hydraulic structures are non-erodible, booted, and surrounded by compacted fill [4].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body.	Not Applicable	Inundation of exterior slopes were not expected. This requirement was not applicable [4].	Not Applicable	No changes were identified that may affect this requirement.
Safety Factor Assessment						
6	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 1.55 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 2.40 and higher.
	§257.73(e)(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	Safety factors were calculated to be 1.51 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 2.39 and higher.
	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 1.80 and higher [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.05 and higher.
	§257.73(e)(1)(iv)	For dike construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20	Not Applicable	Dike soils were not susceptible to liquefaction. This requirement was not applicable [5].	Not Applicable	No changes were identified that may affect this requirement.
Inflow Design Flood Control System Plan						
7	§257.82(a)(1), (2), (3)	Adequacy of inflow design control system plan.	Yes	Flood control system adequately managed inflow and peak discharge during the PMP, 24-hr Inflow Design Flood [6].	Yes	The flood control system was found to adequately manage inflow and peak discharge during the 1,000-year, 24-hour Inflow Design Flood, after performing updated hydrologic and hydraulic analyses, as long as the starting water surface elevation is maintained at El. 622.1 ft or below.
	§257.82(b)	Discharge from CCR Unit	Yes	Discharges into Waters of the United States were not expected to occur during normal and 1, 000-year, 24-hr, Inflow Design Flood conditions [6].	Yes	Discharge into Waters of the United States were not expected to occur during both normal and 1,000-year, 24-hour Inflow Design Flood conditions, after performing updated hydrologic and hydraulic analyses, as long as the starting water surface elevation is maintained at El. 622.1 ft or below.

SECTION 1

INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Illinois Power Generating Company (IPGC) to document the re-certification of the GMF Recycle Pond at the Coffeen Power Plant (CPP), also known as the Coffeen Power Station (COF), located at 134 Cips Lane in Coffeen, Illinois, 62017. The location of CPP is provided in **Figure 1**, and a site plan showing the location of the GMF RP, among other closed and active CCR units and non-CCR surface impoundments, is provided in **Figure 2**.

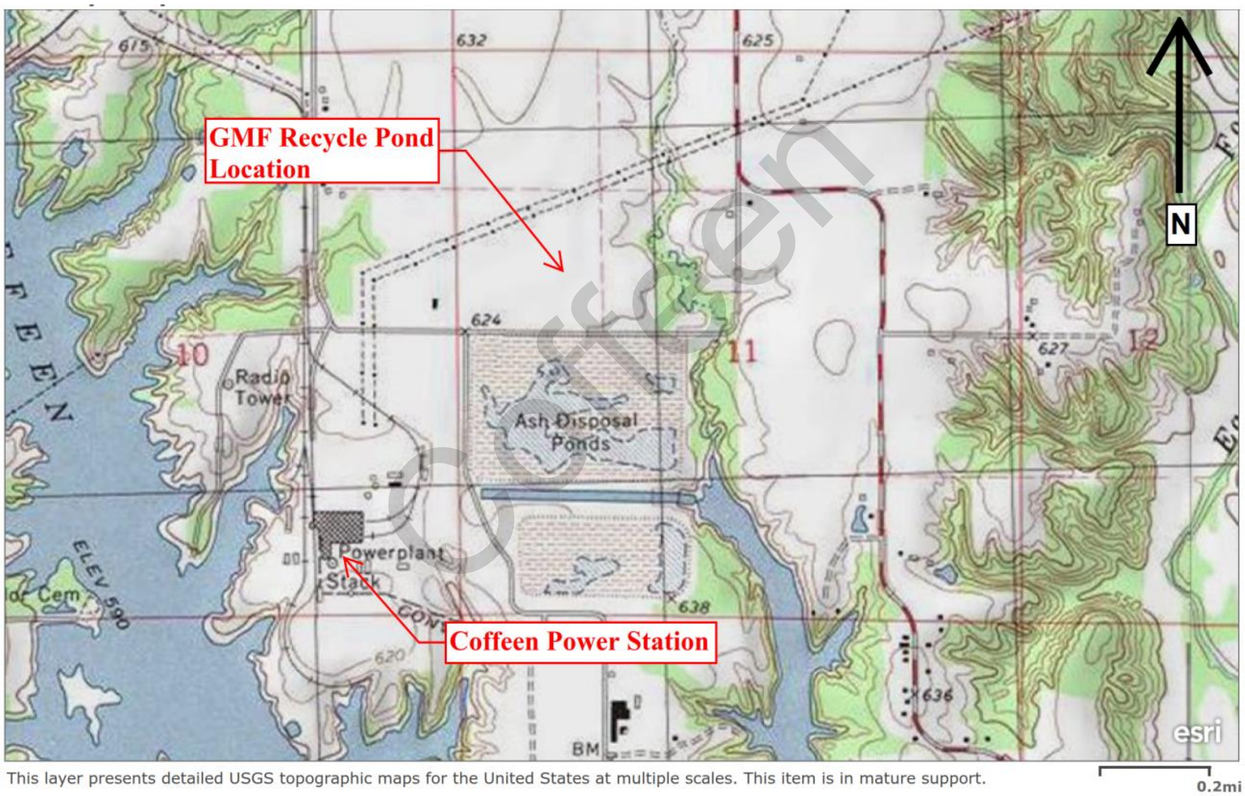

Figure 1 – Site Location Map (from esri.com, 2021)

Figure 2 – Site Plan (adapted from AECOM, 2016)

1.1 GMF RP Description

CPP was retired in 2019. Prior to retirement, three active CCR surface impoundments – the GMF RP, the GMF Gypsum Stack Pond (GMF GSP), and AP1 – and one CCR landfill – were used for managing CCRs generated at CPP. This certification report only pertains to the GMF RP. The GMF RP has a Significant hazard potential, based on the initial hazard potential classification assessment performed by Stantec in 2017 in accordance with §257.73(a)(2) ([2], [7]).

The GMF RP formerly served as the primary polishing pond for process water associated with gypsum produced by the wet scrubber system at CPP [8]. The GMF RP received clear water outflow from the GMF GSP via a lined channel (transfer channel) that connected the two ponds. Water was pumped out from the GMF RP via the pump house and transmitted back to the CPP for recycling. The GMF RP was operated in a closed-loop (e.g., zero discharge) fashion. Approximately 43,000 cubic yards (CY) of gypsum was sluiced directly into the GMF RP prior to construction completion for the GMF GSP circa 2009, although the GMF RP has not since been used for the primary disposal of gypsum [9]. This gypsum has remained within the GMF RP.

The GMF RP has a 60-mil high-density polyethylene (HDPE) single liner system that extends up to elevation 629.0 ft and is present beneath the entire footprint of the pond. The geomembrane liner is exposed at the pond bottom and side slopes [10].

As formerly operated, the maximum operating pool elevation of the GMF RP was elevation (El). 624.0 ft, based on the invert elevation of the emergency spillway system [10], which was intended only to discharge under emergency high-water conditions. The water elevation in the GMF RP was 617.6 ft in the periodic survey conducted in December of 2020 [11], after retirement of the CPP, the cessation of regular inflow and outflow pumping, and the construction of a berm in the transfer channel leading from the GMF GSP to the GMF RP [12]. Normal outflow from the GMF RP was formerly controlled by a decant structure and pump house located at the southeast corner of the embankment, in addition to an emergency spillway consisting of three drop inlets and three, 48-in. diameter HDPE pipes leading to a riprap-lined stilling basin [10]. Valves were installed and closed on the intake pipes leading to the pump house after closure of CPP. As currently operated, the GMF RP and GMF GSP only receive inflow from direct precipitation, and do not outflow, although outflow could occur from the GMF RP emergency spillways if the level were to rise above El. 624 ft. Water levels vary seasonably based on precipitation and evaporation.

The GMF RP is approximately 18.3 acres in size and was formed with a continuous embankment, a ring dike, which has a total length of approximately 3,600 ft. The perimeter dike has a crest width of approximately 30 ft and 5H:1V orientations on both the interior and exterior side slopes. The embankment crest elevation is El. 629 ft [11] and the maximum height above exterior grades is approximately 16 ft [13].

Initial certifications for the GMF RP for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec, AECOM, and Hanson in 2016 and 2017 and subsequently posted to IPGC's CCR Website ([2], [3], [4], [5], [6]). Additional documentation for the initial certifications included detailed operating record reports containing calculations and other information prepared for the hazard potential classification by Stantec [7] and for the structural stability assessment, safety factor assessment, and inflow design flood control system plan by Hanson [13]. These operating record reports were not posted to IPGC's CCR Website.

1.2 Report Objectives

These following objectives are associated with this report:

- Compare site conditions from 2015/2016 to site conditions in 2020/2021, and evaluate if updates are required to the:
    - §257.73(a)(2) Hazard Potential Classification [2];
    - §257.73(c) History of Construction [3];
    - §257.73(d) Structural Stability Assessment [4];
    - §257.73(e) Safety Factor Assessment [5], and/or
    - §257.82 Inflow Design Flood Control System Plan [6].
- Independently review the Hazard Potential Classification ([2], [7]), Structural Stability Assessment ([4], [13]), Safety Factor Assessment ([5], [13]), and Inflow Design Flood Control System Plan ([6], [13]) to determine if updates may be required based on technical considerations.
    - The History of Construction report [3] was not independently reviewed for technical considerations as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the CCR units at CPP, and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2)-(3), §257.73(c)-(e), or §257.82.
- Confirm that the GMF RP meets all of the requirements associated with §257.73(a)(2)-(3), (c), (d), (e), and §257.82, or, if the GMF RP does not meet all requirements, provide recommendations for compliance with these sections of the CCR Rule [1].

SECTION 2

COMPARISION OF INITIAL AND PERIODIC SITE CONDITIONS

2.1 Overview

This section describes the comparison of conditions at the GMF RP between the start of the initial CCR certification program in 2015 and subsequent collection of periodic certification site data in 2020 and 2021.

2.2 Review of Annual Inspection Reports

Annual onsite inspections of the GMF RP were performed between 2016 and 2020 ([14], [15], [16], [17], [18]) and were certified by a licensed professional engineer in accordance with §257.83(b). Each inspection report stated the following information, relative to the previous inspection:

- A statement that no changes in geometry of the impounding structure were observed since the previous inspection;
- A statement that no geotechnical instrumentation was present;
- Approximate volumes of impounded water and CCR at the time of inspection;
- A statement that no appearances of actual or potential structural weakness or other disruptive conditions were observed; and
- A statement that no other changes which may have affected the stability or operation of the impounding structure were observed.

In summary, the reports did not indicate any significant changes to the GMF RP between 2015 and 2020. No signs of instability, structural weakness, or changes which may have affected the operation or stability of the GMF RP were noted in the inspection reports.

2.3 Review of Instrumentation Data

Eleven groundwater monitoring wells (G270, G271, G272, G273, G274, G275, G276, G277, G278, G279, and G280) are present around the GMF RP. Groundwater level readings were collected generally on a quarterly basis and provided from February 17, 2016 to January 27, 2021. Geosyntec reviewed the groundwater level data to evaluate if significant fluctuations, particularly increases in phreatic levels, may have occurred after development of the initial structural stability and factor of safety certifications ([4], [5], [13]) Available water level readings are plotted in **Attachment A,** and **Figure 3** provides approximate locations of the monitoring wells.

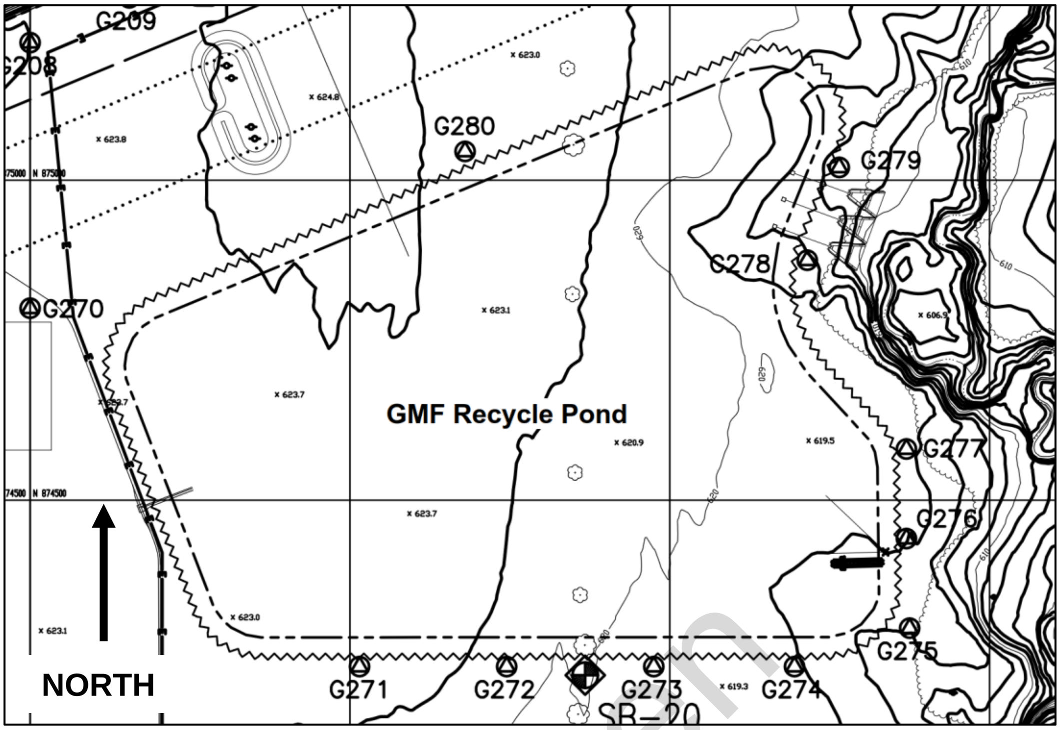

Figure 3 – GMF RP Monitoring Well Locations
(Not to Scale, adapted from Hanson, 2021)

In summary, groundwater levels in the monitoring well network were observed to be up to 20 ft different between individual wells. Seasonal fluctuations were relatively consistent between the wells, typically increasing or decreasing by 5 to 7 ft. These water levels are approximately 10 ft lower than water levels utilized in the slope stability analyses prepared to support the initial structural stability and safety factor assessments ([4], [5], [13]), therefore the water levels in the initial slope stability analyses are conservative relative to current conditions.

2.4 Comparison of Initial to Periodic Surveys

The initial survey of the GMF RP, conducted at the site by Hanson Professional Services Inc. (Hanson) in 2016 [19] and included a bathymetric but not a topographic survey. This survey was compared to the periodic topographic and bathymetric survey of the GMF RP, conducted by IngenAE, LLC (IngenAE) in 2020 [11], using AutoCAD Civil3D 2021 software.

The comparison quantified changes in the volume of CCR placed within the GMF RP and considered volumetric changes above and below the starting water surface elevation (SWSE) used for the 2016 §257.82 inflow design flood control plan hydraulic analysis ([6], [13]). This comparison is presented in a side-by-side comparison of the surveys in **Drawing 1** and a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 2**.

Table 2 – Initial to Periodic Survey Comparison

Periodic Surveyed Pool Elevation (ft)	617.5
Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)	624.0
Total Change in CCR Volume (CY)	+1,200
Change in CCR Volume Above SWSE (CY)	0
Change in CCR Volume Below SWSE (CY)	+1,200

The comparison indicated that approximately 1,200 CY of CCR may have been placed in the GMF RP between 2015 and 2020, with all of the CCR placed below the SWSE. However, reportedly no CCR was placed in the GMF RP between collection of the initial and periodic surveys, so it may be possible that the estimate change in CCR volume is due to minor differences in the initial and periodic bathymetric surveys. The indicated changes in CCR volumes are below the SWSE and are therefore unlikely to affect area-capacity curve of the GMF RP.

2.5 Comparison of Initial to Periodic Aerial Photography

Initial aerial photographs of the GMF RP collected by Weaver Consultants, Inc. (Weaver) in 2015 [20] were compared to periodic aerial photographs collected by IngenAE in 2020 [11] to visually evaluate if potential site changes (i.e., changes to the embankment, outlet structures, limits of CCR, other appurtenances) may have occurred between. A comparison of these aerial photographs is provided in **Drawing 3**. No significant changes were identified as part of this comparison.

2.6 Comparison of Initial to Periodic Site Visits

An initial site visit to the GMF RP was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [21]. A periodic site visit was conducted by Geosyntec on May 28, 2021, with Mr. Lucas P. Carr, P.E. conducting the site visit. The periodic site visit was intended to evaluate potential changes at the site since 2015 (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), and to perform visual observations of the GMF RP to evaluate if the structural stability requirements (§257.73(d)) were still met. The site visit included driving the perimeter of the GMF RP, periodically stopping to exist the vehicle and visually observe conditions, recording field notes, and collecting photographs. The site visit is documented in a photographic log provided in **Appendix B**. No significant changes were identified as part of this comparison.

2.7 Interview with Power Plant Staff

An interview with Mr. John Romang of CPP was conducted by Mr. Lucas P. Carr, P.E. of Geosyntec on May 28, 2021. Mr. Romang, at the time of the interview, had been employed at CPP for approximately 20 years as the environmental and chemistry manager or supervisor and was responsible for general oversight and compliance for the GMF RP since development of the initial certifications ([2], [7], [3], [4], [5], [6], [13]). A summary of the interview is provided below.

- Were any construction projects completed for the GMF RP between 2015 and 2021, and, if so, are design drawings and/or details available?
    - A berm was constructed in the transfer channel leading from the GMF GSP to the GMF RP.
    - Shutoff valves were installed and closed on the intake pipes leading to the outfall pump house, as part of power plant closure.
- Were there any changes to the purpose of the GMF RP between 2015 and 2017?
    - CPP was retired and plant inflows or outflows no longer occur into or out of the GMF RP.
    - Outflow from dewatering wells in Ash Pond No. 2 (AP2) were formerly discharged into the GMF RP. This discharge was ceased upon closure of AP2 in 2020.
- Were there any changes to the to the instrumentation program and/or physical instruments for the GMF RP between 2015 and 2021?
    - No instruments are present at the GMF RP.
- Were there any changes to spillways and/or diversion features for the GMF RP completed between 2015 and 2021?
    - No changes occurred.
- Have any area-capacity curves been developed for the GMF RP since 2015?
    - No known curves have been developed.
- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the GMF RP between 2015 and 2021?
    - No.
- Were there any instances of dike and/or structural instability for the GMF RP between 2015 and 2021?
    - No known instances occurred.

SECTION 3

HAZARD POTENTIAL CLASSIFICATION - §257.73(A)(2)

3.1 Overview of Initial HPC

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ([2], [7]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Performing two breach analysis using HEC-HMS software, using pool levels estimated within the GMF RP during the Probable Maximum Precipitation (PMP) rainfall event, for a single breach occurring at the eastern side of the GMF RP, where the embankment is at its maximum height.
- Evaluating potential effects of flooding in multiple areas, including breach flood wave velocities, flood depths, and/or pool increases, or the following locations:
    - County Road 450 N,
    - The eastern cove of Coffeen Lake,
    - Coffeen Lake Dam, and
    - Coffeen Lake itself.
- While a breach map is not included within the Initial HPC, it included within the §257.73(a)(3) Initial Emergency Action Plan (Initial EmAP) [22].

The breach analysis concluded that a breach of the GMF RP would impact intermittently used County Road 450N, but that a loss of life was not probable due to the only transient occupation of the roadway. County Road 450N is paved but is a dead-end road leading to a supplemental entry to CPP, as of 2016. After closure of the CPP, Country Road 450N became the primary entry to CPP, however use of the road is still considered transient due to CPP having a reduced onsite staff, typically consisting of two personnel, although contractors or other visitors may also visit the site on an intermittent basis. The Initial HPC concluded that the breach would be unlikely to result in a probable loss of human life, although the breach could cause CCR to be released into the Coffeen Lake, thereby causing environmental damage. The Initial HPC therefore recommended a “Significant” hazard potential classification for the GMF RP [2].

3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ([2], [7]), in terms of technical approach, input parameters, and assessment of results. The review included the following tasks:

- Reviewing the breach assessment inputs for appropriateness,
- Reviewing the selected HPC for appropriateness based on the results of the breach analysis, including flow velocities and depths;
- Reviewing the HPC vs. applicable requirements of the CCR Rule [1].

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

3.3 Summary of Site Changes Affecting the Initial HPC

Geosyntec performed a visual assessment to evaluate if any new structures, infrastructure, frequently occupied facilities/areas, or waterways were present within mapped breach areas for the GMF RP, as identified in the Initial Emergency Action Plan [22], in addition to evaluating if downstream site topography in the probable breach area may have changed. The visual assessment considered a comparison of the 2015 to 2020 aerial imagery (**Drawing 3**) and photographs collected by Geosyntec in May of 2021 (**Attachment B**).

Geosyntec did not identify any changes at the site that may affect the HPC. No new structures, infrastructure, frequently occupied facilities/areas, or waterways were present in the probable breach area indicated in the Initial EmAP [22]. Additionally, no significant changes to the topography in the probable breach were identified.

3.4 Periodic HPC

Geosyntec recommends retaining the "Significant" hazard potential classification for the GMF RP, per §257.73(a)(2), based on the lack of site changes potentially affecting the Initial HPC occurring since the Initial HPC was developed, as described in **Section 3.3** and the lack of significant technical review comments, as described in **Section 3.2**. Updates to the Initial HPC reports ([2], [7]) are not recommended at this time.

SECTION 4

HISTORY OF CONSTRUCTION REPORT - §257.73(C)

4.1 Overview of Initial HoC

The Initial History of Construction report (Initial HoC) was prepared by AECOM in 2016 [3], following the requirements of §257.73(c), and included information on all CCR surface impoundments at CPP, including the GMF RP, the GMF GSP, AP1, and AP2. The Initial HoC included the following information for the GMF RP:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the dike materials,
- Approximate dates and stages of construction,
- Available design and engineering drawings,
- A summary of instrumentation,
- A statement that area-capacity curves for the GMF RP were not readily available,
- Information on spillway structures,
- Construction specifications,
- Inspection and surveillance plans,
- Information on operational and maintenance procedures, and
- A statement that no known instability has occurred at the GMF RP.

4.2 Summary of Site Changes Affecting the Initial HoC

Several significant changes were identified at the site that occurred after development of the Initial HoC [3] report and are described below:

- A state identification number (ID) of W1350150004-04 was assigned to the GMF RP by the Illinois Environmental Protection Agency (IEPA).
- Electricity generation at the CPP ceased in 2019. The purpose of the GMF RP changed as it no actively longer receives process water from the CPP and GMF RP and water is no longer pumped from the GMF RP back to the CPP.
- Valves were installed on the intake pipes for the outfall structure and the valves were closed due to the cessation of power generation at CPP.
- Dewatering discharge from AP2 into the GMF RP was ceased due to closure of AP2.
- Revised area-capacity curves and spillway design calculations for the GMF RP were prepared as part of the updated periodic Inflow Design Flood Control System Plan, as described in **Section 7**.

A letter documenting changes to the HoC report is provided in **Attachment C**.

SECTION 5

STRUCTURAL STABILITY ASSESSMENT - §257.73(D)

5.1 Overview of Initial SSA

The Initial Structural Stability Assessment (Initial SSA) was prepared by Hanson in 2016 ([4], [13]), following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of dike foundations, dike abutments, slope protection, dike compaction, and slope vegetation;
- Spillway stability including capacity, structural stability and integrity; and
- An evaluation to determine if downstream water bodies that could induce a sudden drawdown condition to the exterior slopes could be present.

The Initial SSA concluded that the GMF RP met all structural stability requirements for §257.73(d)(1)(i)-(vii).

The Initial SSA referenced the results of the Initial Structural Factor Assessment (Initial SFA) ([5], [13]), to demonstrate stability of the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) portions of the SSA criteria. This included stating that slope stability analyses for slip surfaces passing through the foundation met or exceeded the criteria listed in §257.73(e)(1), for the stability of foundations and abutments. For the sufficiency of dike compaction, this included stating that slope stability analyses for slip surfaces passing through the dike also met or exceeded the §257.73(e)(1) criteria.

5.2 Review of Initial SSA

Geosyntec performed a review of the Initial SSA ([4], [13]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii).
- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i) and sufficiency of dike compaction, per §257.73(d)(1)(iii), in terms of supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions.

- Review of the methodology used to demonstrate that a downstream water body that could induce a sudden drawdown condition, per §257.73(d)(1)(vii), is not present.

- Completeness and technical approach used to evaluate the stability of hydraulic structures, per §257.73(d)(1)(vi).

Several review comments and corresponding recommended technical updates were identified during review of the geotechnical analyses supporting the sufficiency of dike compaction and foundation and abutment stability portions of the Initial SSA. Review comments were also identified during review of the hydrologic and hydraulic analyses supporting the adequacy of the spillway management system. Specific review comments and associated with these analyses are discussed in **Sections 6.2** and **7.2**.

5.3 Summary of Site Changes Affecting Initial SSA

Several changes at the site that occurred after development of the Initial SSA were identified. These changes required updates to the Initial SSA and are described below.

- The Initial SSA utilized the results of the Initial Inflow Design Flood Control System Plan (IDF) to demonstrate compliance with the adequacy of spillway design and management (§257.73(d)(1)(v)(A)-(B)). The Initial IDF was subsequently updated to develop a Periodic IDF, based on site changes and review comments, as discussed in **Section 7**.

- The Initial SSA utilized the slope stability analysis results of the Initial Safety Factor Assessment (SFA) as part of the compliance demonstration for the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) as discussed in **Section 5.1.** The Initial SFA slope stability analyses were subsequently updated to develop a Periodic SFA, based on site changes and review comments, as discussed in **Section 6**.

5.4 Periodic SSA

The Periodic SFA (**Section 6**) indicates that the foundations and abutments are stable and dike compaction is sufficient for expected ranges in loading conditions, as slope stability factors of safety were found to meet or exceed the requirements of §257.73(e)(1), including for post-earthquake (i.e., liquefaction) loading conditions considering seismically-induced strength loss in the foundation soils. Therefore, the requirements of §257.73(d)(1)(i) and §257.73(d)(1)(iii) are met for the Periodic SSA.

The Periodic IDF (**Section 7**) indicates that spillways are adequately designed and constructed to adequately manage flow during the 1,000-year design flood, as the spillways can adequately manager flow during peak discharge from the 1,000-year design flood without overtopping of the embankments, as long as the normal operating pool (e.g., SWSE) within the GMF RP is maintained at El. 622.1 and below. Therefore, the requirements of §257.73(d)(1)(v)(A)-(B) are met for the Periodic SSA.

SECTION 6

SAFETY FACTOR ASSESSMENT - §257.73(E)(1)

6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by Hanson in 2016 ([5], [13]), following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program laboratory testing used to support the initial design of the GMF RP;
- An assessment of the potential for liquefaction in the dike and foundation soils;
- The development of one (1) slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W and PCSTABL5 software;
- The analysis of each cross-sections for maximum storage pool, maximum surcharge pool, and seismic loading conditions.
    - Liquefaction loading conditions were not evaluated as liquefaction-susceptible soil layers were not identified in the embankments' soils.

The Initial SFA concluded that the GMF Recycle Pond met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ([5], [13]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
    - Completeness and adequacy of supporting geotechnical investigation and testing data;
    - Completeness and approach of liquefaction triggering assessments; and
    - Input parameters, analysis methodology, selection of critical cross-sections, and loading conditions utilized for slope stability analyses;

- Comparison of geotechnical parameters selected by Hanson with geotechnical investigations performed by and subsequent parameters developed by AECOM in 2015 and 2016 for Ash Pond No. 1 (AP1), Ash Pond No. 2 (AP2), and the GMF GSP at Coffeen ([8], [23]) as these ponds are located adjacent to the GMF RP on the north and the south and subsurface conditions are relatively consistent across the CPP site; and

- Phreatic conditions assumed in the analyses relative to available monitoring well groundwater level data collected from 2016 through 2021, as discussed in **Section 2.3**.

Several comments were identified during review of the Initial SFA. Each comment required updates to the Initial SFA is described below:

- The geotechnical investigation program utilized to develop subsurface stratigraphy at the GMF RP consisted of 6 borings used to support the initial design of the GMF RP. Only one of the borings was located along the perimeter embankment of the GMF RP. Subsurface stratigraphic data from the eleven monitoring wells located around the GMF RP perimeter were not utilized to support the geotechnical investigation. Additionally, laboratory testing and CPT data collected for Ash Pond No. 1, Ash Pond No. 2, and the GMF GSP the CPP site by AECOM in 2015 ([8], [23]) were not considered in the investigation and assessment; the AECOM data included refined shear strength testing.

- Geotechnical analyses used to support the Initial SSA, which were contained within the Initial SFA, concluded that the soils at the site were not susceptible to liquefaction based on fines content and blowcounts. However, the 2015 and 2016 AECOM Initial SFAs for AP1 and the GMF GSP identified the presence of a low-strength soft clay layer at the transition between overburden loess soils and underlying glacial till and identified that this material may be susceptible to cyclic softening. A review of available borings for the GMF RP indicated that this layer is present beneath the GMF RP based on low blowcounts in the transition zone.

- The Initial SFA evaluated sudden drawdown and end-of-construction loading conditions, however the sudden drawdown loading condition is not applicable as the interior slopes are lined and a downstream water body is not present on the exterior slopes. Additionally, the Initial SFA included end-of-construction conditions, which are not currently applicable for the GMF RP as the pond was constructed approximately 12 years ago, as of the date of this report.

- Groundwater levels utilized in the Initial SFA were approximately 10 ft higher than groundwater levels measured from the monitoring wells.

6.3 Summary of Site Changes Affecting Initial SFA

Several changes at the site that occurred after development of the Initial SFA were identified. These changes required updates to the Initial SFA and are described below:

- The normal pool levels within the GMF RP decreased from 623.0 ft to 622.1 ft, due to the construction of a berm in the transfer channel and the cessation of process water pumping (**Section 7**), resulting in 1.9 ft of lower water loading on the embankment dikes for the maximum storage pool and seismic loading conditions (§257.73(e)(1)(i) and (iii)), relative to the Initial SFA.

- Peak pool levels in the GMF RP during the PMP design flood event decreased from 627.5 ft to 623.9 ft, per the updated Periodic IDF (**Section 7**), resulting in 3.6 ft of lower water loading on the embankment dikes for the maximum surcharge pool loading conditions (§257.73(e)(1)(iv)), relative to the initial SFA.

6.4 Periodic SFA

Following review of the Initial SFA ([5], [13]), Geosyntec developed a new slope stability analysis cross-section (C) at the northeast corner of the GMF RP embankment. This cross-section was selected as the critical cross-section based on the maximum height of the embankment and the location and thickness of the soft clay layer within the foundation soils. The cross-section was developed and analyzed utilizing the following approach and input data:

- Ground surface geometry was obtained from the 2020 survey of the GMF RP [11].

- Subsurface stratigraphy was obtained from the available well boring logs at the vicinity of the cross-section [10] and the Initial SFA for the GMF GSP [8], as the GMF GSP is adjacent to the GMF RP and also considered data collected at AP1 and AP2 [23]. Geosyntec evaluated the boring data and concluded that soil shear strength parameters were similar to those used by Initial SFA for the GMF GSP. Therefore, the soil properties (i.e., strength, unit weight) from the Initial SFA of GMF GSP were utilized for cross-section C.

- Piezometric levels in the foundation soils were assumed to follow the ground surface past the embankment toe, per providing readings from the available monitoring wells (see **Section 2.3**).

- The low-strength soft clay layer at the transition between overburden loess soils and underlying glacial till was assumed to be susceptible to seismically-induced strength losses (i.e., liquefaction and or cyclic softening) and post-liquefaction slope stability model was analyzed to support the Periodic SSA (§257.73(d)(1)(i))) using post-liquefaction shear strength utilized in the Initial SFA for the GMF GSP [8].

- Water levels in the GMF RP for the maximum storage pool, and seismic slope stability analysis loading conditions were considered at El. 622.1 ft, based on the Periodic IDF (**Section 7.4**).

- Water levels in the GMF RP for the maximum surcharge pool slope stability analysis loading conditions were considered at El. 623.9 ft based on the Periodic IDF (**Section 7.4)**.

- The cross-section was analyzed using GeoStudio SLOPE/W 2012 software, with analysis settings including, but not limited to software package and version, slip surface search routines and methods, and pseudostatic seismic coefficients, selected to be consistent with the Initial SFA for the adjacent GMF GSP [8].

Factors of safety from the Periodic SFA are summarized in **Table 3** and confirm that the GMF RP meets the requirements of §257.73(e)(1). The location of critical cross-section C in plan and analysis output data is provided in **Attachment D**.

Table 3 – Factors of Safety from Periodic SFA

	Structural Stability Assessment (§257.73(d)) and Safety Factor Assessment (§257.73(e))				**Structural Stability Assessment (§257.73(d))**
Cross-Section	**Maximum Storage Pool §257.73(e)(1)(i) Minimum Required = 1.50**	**Maximum Surcharge Pool §257.73(e)(1)(ii) Minimum Required = 1.40**	**Seismic §257.73(e)(1)(iii) Minimum Required = 1.00**	**Dike Liquefaction §257.73(e)(1)(iv) Minimum Required = 1.20**	**Foundation Liquefaction §257.73(d)(1)(i) Minimum Required = 1.20**
C	2.40*	2.39*	1.05*	N/A	1.42*

Notes:
N/A – Loading condition is not applicable.
* - Denotes critical cross-section for each loading condition

SECTION 7

INFLOW DESIGN FLOOD CONROL SYSTEM PLAN - §257.82

7.1 Overview of 2016 Inflow Design Flood Control System Plan

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by Hanson in 2016 ([6], [13]), following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis, performed for the Probable Maximum Flood (PMF) design flood event and the 100-year, 12-hour storm event. Specific rainfall depths associated with both flood events were not indicated in the Initial IDF.

- The Initial IDF utilized a HEC-HMS model to evaluate spillway flows and pool level increases during the design flood, with a SWSE of 624.0 ft.

The Initial IDF concluded that AP1 met the requirements of §257.82, as the peak water surface estimated by the HEC-HMS model was El. 627.45 ft, relative to the minimum GMF RP dike crest elevation of 629.0 ft. Therefore, overtopping was not expected.

The Initial IDF also evaluated the potential for discharge from the CCR unit and determined that discharge from the unit was not expected during normal operations, as the GMF RP was operated as a closed-loop system with no discharges during normal conditions.

7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ([6], [13]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification.

- Reviewing the rainfall depth and distribution or appropriateness.

- Performing a high-level review of the inputs to the hydrologic modeling.

- Reviewing hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data.

- Reviewing the overall IDF vs. the applicable requirements of the CCR Rule [1].

Several comments were identified during review of the Initial IDF. The comment is described below:

- The Initial IDF considered the PMF and 100-year flood events, as opposed to the 1,000-year flood event that would typically be utilized for a Significant hazard potential CCR Surface Impoundment, per the CCR Rule.

- The Initial IDF utilized the National Resource Conservation Service (NRCS) Type II rainfall distribution type [24]. Geosyntec recommends utilizing the Huff 3rd Quartile distribution for areas less than 10 square miles [25] for the reasons listed below.

    - Huff 3rd Quartile distribution was identified to be a more appropriate representation of a 1,000-year, 24-hour storm event per the Illinois State Water Survey (ISWS) Circular 173 [25] which developed standardized rainfall distributions from compiled rainfall data at sites throughout Illinois.

    - Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) [26] recommends use of the Huff Quartile distributions in Circular 173 when using frequency events to determine the spillway design flood inflow hydrograph, "*The suggested method to distribute this rainfall is described in the ISWS publication, Circular 173, "Time Distributions of Heavy Rainstorms in Illinois"*.

7.3 Summary of Site Changes Affecting the Initial IDF

Several changes at the site that occurred after development of the Initial IDF were identified. These changes required updates to the Initial IDF and are described below:

- A berm was constructed in the transfer channel between the GMF RP and the upstream GMF GSP [27].

- Approximately 30,000 CY of gypsum were placed above the SWSE in the upstream GMF GSP, thereby altering the stage-storage curve of the upstream pond relative to the Initial IDF [27].

- Due to closure of the CPP, the cessation of process water pumping activities, and the construction of a berm in the transfer channel, the surveyed water surface elevation in in the GMF RP 2020 [11] was lower than the SWSE utilized in the Initial IDF.

7.4 Periodic IDF

Geosyntec revised the Initial IDF to account for the technical review comments and stie changes, as described in **Section 7.2** and **Section 7.3**. The Periodic IDF was prepared using HydroCAD software [28] for consistency with other studies and certifications performed at CPP.

The HydroCAD model for the GMF RP is based on the updated model used for the periodic IDF certification of the GMF GSP [27] . Both models include the GMF RP, the GMF GSP, the transfer channel between the two ponds, and the drainage areas of both ponds.

For the purposes of analyzing the GMF RP, updates to the model included the following:

- The Runoff Method was selected to be "SCS TR-20" [29] for consistency with other models at CPP.

- The Reach Routing Method and the Pond Routing Method for the model were both selected to be "Dynamic Storage Indication" for consistency with other models at CPP and to more accurately account for routing between the connected ponds. Due to the selected routing methods, all tailwater conditions were automated.

- The rainfall depth was updated from the probable maximum precipitation (PMP), 24-hour rainfall depth to the 1,000-year, 24-hour rainfall depth, which is consistent with the Significant hazard potential for of the GMF RP. This rainfall depth is 9.13 inches based on NOAA Atlas 14 [30].

- The rainfall distribution type was updated to the "Huff 3rd Quartile" storm type provided by HydroCAD [28].

- The stage-storage curve was updated for both the GMF RP and GMF GSP based on the 2020 site survey [11].

    - Revised stage-volume curves for the GMF RP and GMF GSP were prepared based on measuring the storage volume of the impoundments at every one-foot increment of depth from an elevation at the bottom of the ponds (621.1 ft for GMF GSP; 604.9 ft for GMF RP) to the approximate minimum perimeter dike embankment crest elevation (632 ft for GMF GSP; 629 ft for GMF RP). This analysis identified an overall decrease of 24.9 ac-ft of storage volume at the GMF RP, with a 2.34 ac-ft decrease above the previous SWSE of 624.0 ft from the storage used in the 2016 Initial IDF Certification.

- The SWSE within the GMF GSP was updated from 621.2 ft to 625.2 ft to reflect the 2020 site survey [11]. The discharge structure invert elevation is 619.0 ft; however, the greater elevation of the invert structure and the surveyed WSE was used as the SWSE to provide conservatism in the model if the level increases seasonally due to precipitation inflow.

- The subcatchment area draining to the GMF RP was updated from 17.12 ac to 18.3 ac to reflect the 2020 site survey [11]. The Curve Number (CN) of the subcatchment area was increased from 91 to 98 to reflect that the majority of the drainage area is water.

- The subcatchment area draining to the GMF GSP was updated from 33.8 ac to 36.2 ac to reflect the 2020 site survey [11].

- The time of concentration (ToC) for drainage areas to the GMF GSP and GMF RP was updated from 5 minutes to 6 minutes to reflect direct run-on inflow in accordance with TR-20 [29].

- The GMF GSP and transfer channel geometry were updated to reflect the new berm at the inlet to the transfer channel.
  - The outlet invert from the GMF GSP to the transfer channel between the GMF GSP and the GMF RP was raised from 625 ft to 626 ft per the 2020 site survey [11]. The geometry of the outlet was updated as follows based on the 2020 site survey, as listed in **Table 4**.

Table 4 – GMF GSP Outlet Geometry Attributes in Periodic IDF

Head (ft)	Channel Width (ft)
0	45
2	60
4	75

  - The transfer channel geometry was updated as follows based on the 2020 site survey, as listed in **Table 5**.

Table 5 – Transfer Channel Attributes in Periodic IDF

Parameter	Value
Bottom Width (ft)	32.7
Channel Depth (ft)	6
Left Side Slope	3
Right Side Slope	1.6
Channel Length (ft)	450

- The three outlet structures in the GMF RP were updated from 24 ft broad-crested weirs to horizontal, rectangular orifices with dimensions of 5 ft by 5 ft to reflect the riser structures existing on site. The inlet elevation of the orifices was set to 624 ft per the initial certification reports.

The results of the Periodic IDF are summarized in **Table 6** and confirm that the GMF RP meets the requirements of §257.82(a)-(b), as the peak water surface elevation does not exceed the minimum perimeter dike crest elevations. Additionally, discharge from the GMF RP is not expected to activate the existing spillway system during both normal and IDF conditions, as long as the SWSE is maintained at El. 622.1 ft or below. Updated area-capacity curves and HydroCAD model output are provided in **Attachment E**.

Table 6 – Water Levels from Periodic IDF

Analysis	Starting Water Surface Elevation (ft)	Peak Water Surface Elevation (ft)	Invert Elevation of Emergency Spillway (ft)	Minimum Dike Crest Elevation (ft)
Initial IDF	624.0	627.5	624.0	629.0
Periodic IDF Update	622.1	623.9	624.0	629.0
Initial to Periodic Change[1]	-1.9	-3.6		

Notes:
[1]Postive change indicates increase in the WSE relative to the Initial IDF, negative change indicates decrease in the WSE, relative to the Initial IDF.

SECTION 8

CONCLUSIONS

The GMF RP at CPP was evaluated relative to the USPEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2)),
- History of Construction reporting (§257.73(d)),
- Structural stability assessment (§257.73(d)),
- Safety factor assessment (§257.73(e)), and
- Inflow design flood control system planning (§257.82).

Based on the evaluations presented herein, the referenced requirements are satisfied, as long as the starting water surface elevation in the GMF RP is maintained at El. 622.1 ft or lower.

SECTION 9

CERTIFICATION STATEMENT

CCR Unit: Illinois Power Generating Company, Coffeen Power Plant, GMF RP

I, Lucas P. Carr, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this 2021 USEPA CCR Rule Periodic Certification Report, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the periodic assessment of the hazard potential classification, history of construction report, structural stability, safety factors, and inflow design flood control system planning, dated October 2016, were conducted in accordance with the requirements of 40 CFR §257.73(a)(2), (c), (d), (e), and §257.82.

Lucas P. Carr

10/11/2021

Date

LICENSED PROFESSIONAL ENGINEER
LUCAS PHILIP CARR
062066694
STATE OF ILLINOIS

Exp. 11/30/2021

SECTION 10

REFERENCES

[1] United States Environmental Protection Agency, 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 2015.

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[3] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR §257.73(c), Coffeen Power Station, Coffeen, Illinois," October 2016.

[4] Hanson Professional Services, Inc., "CCR Rule Report: Initial Structural Stability Assessment, GMF Recycle Pond, Coffeen Power Station, Montgomery County, Illinois," October 2016.

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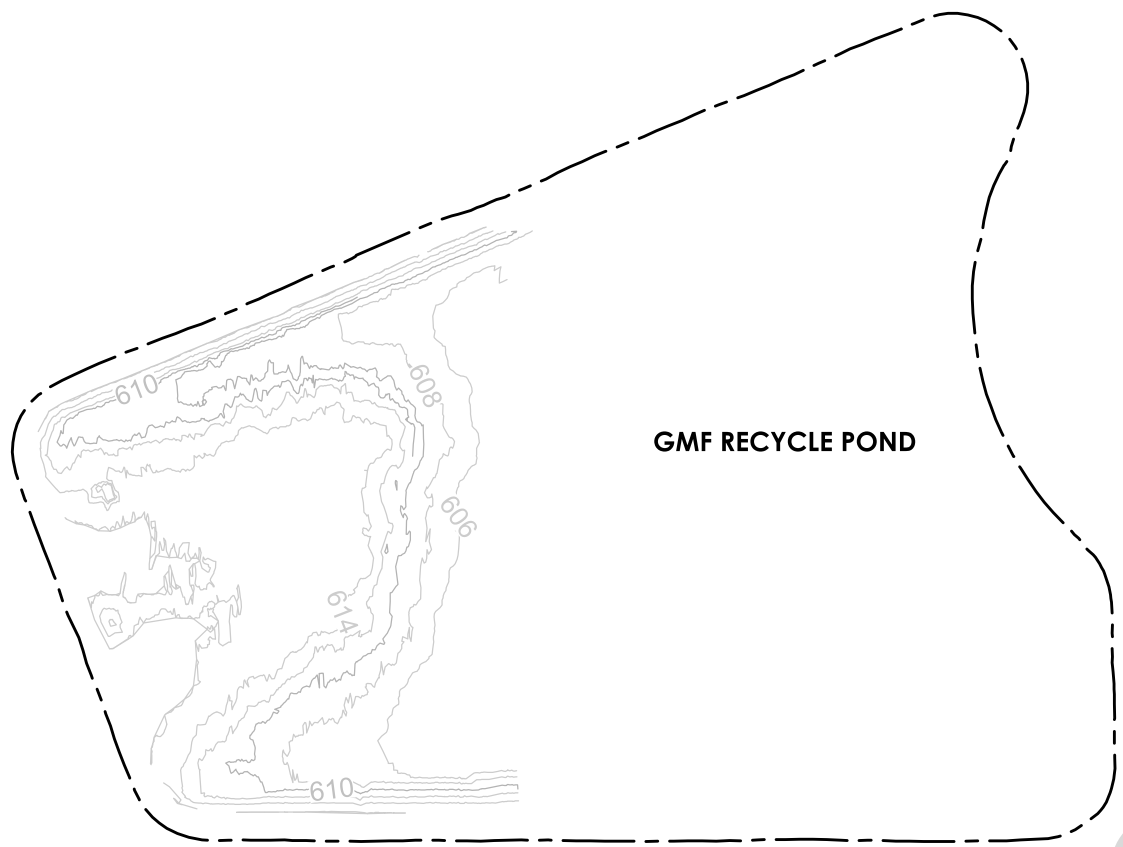
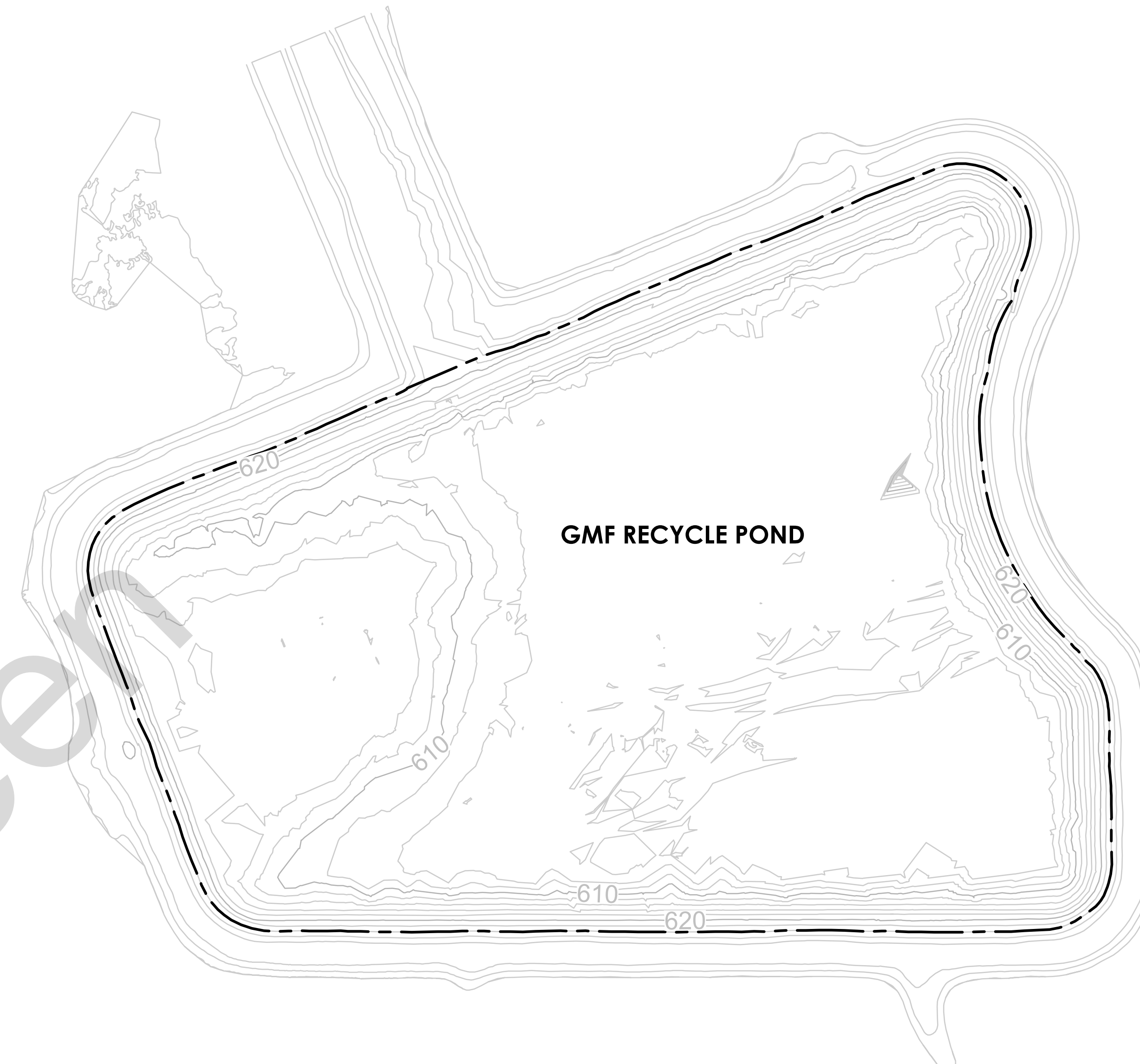
DRAWINGS

N



INITIAL SURVEY
07-18-2016 TOPOGRAPHY



PERIODIC SURVEY
02-26-2021 TOPOGRAPHY

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING TITLED GYPSUM BATHYMETRIC SURVEY, GYPSUM MANAGEMENT FACILITY RECYCLE POND, COFFEEN POWER STATION", PREPARED BY HANSON PROFESSIONAL SERVICES INC., DATED JULY 18, 2016. A CAD FILE WAS NOT PROVIDED FOR THIS SURVEY; CONTOURS WERE APPROXIMATE DIGITIZED AND GEOREFERENCED BY GEOSYNTEC. THE INITIAL SURVEY LIMITS DO NOT ENCOMPASS THE ENTIRE GMF RECYCLE POND AND ONLY ENCOMPASS CCR THAT WAS OBSERVED IN THE GMF POND AT THE TIME OF THE INITIAL SURVEY. GEOSYNTEC HAS ASSUMED THAT NO ADDITIONAL CCR WAS PLACED OUTSIDE OF THE LIMITS OF THE INITIAL SURVEY.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER GENERATING COMPANY, COFFEEN POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.

0 200
SCALE IN FEET

INITIAL TO PERIODIC SURVEY COMPARISON
GMF RECYCLE POND
COFFEEN POWER PLANT
COFFEEN, ILLINOIS

Geosyntec consultants

DRAWING
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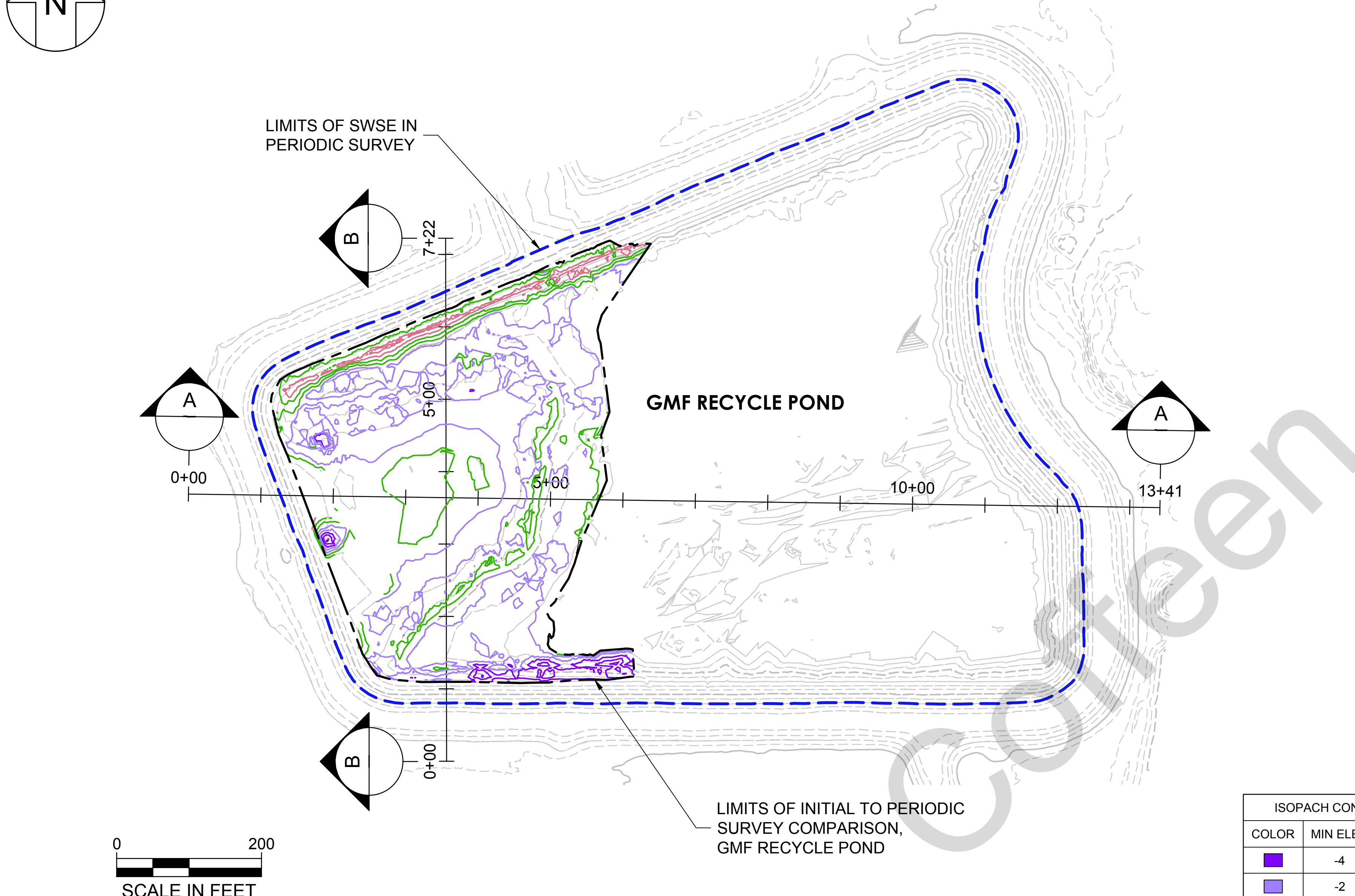
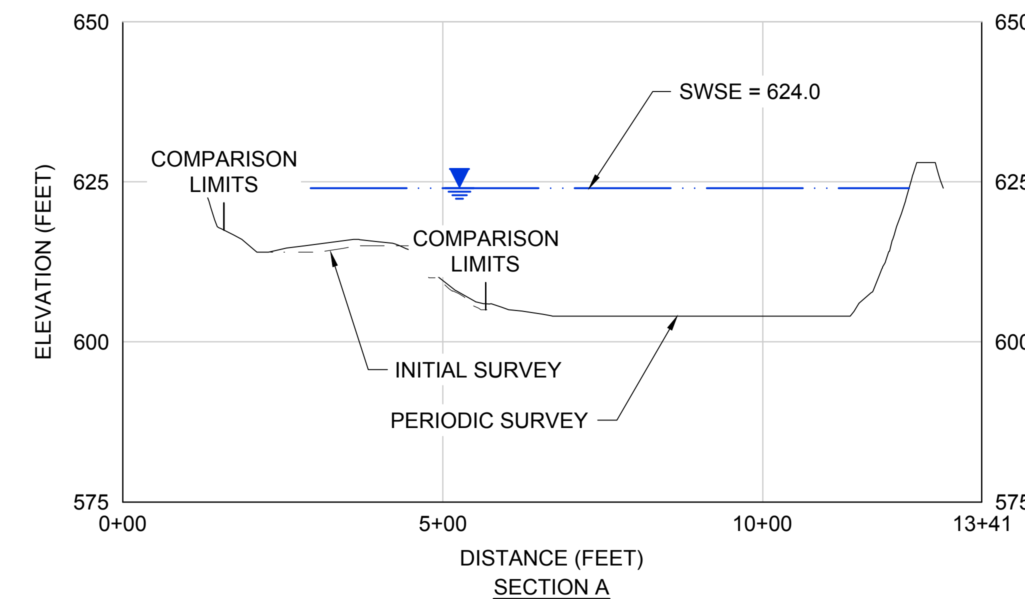
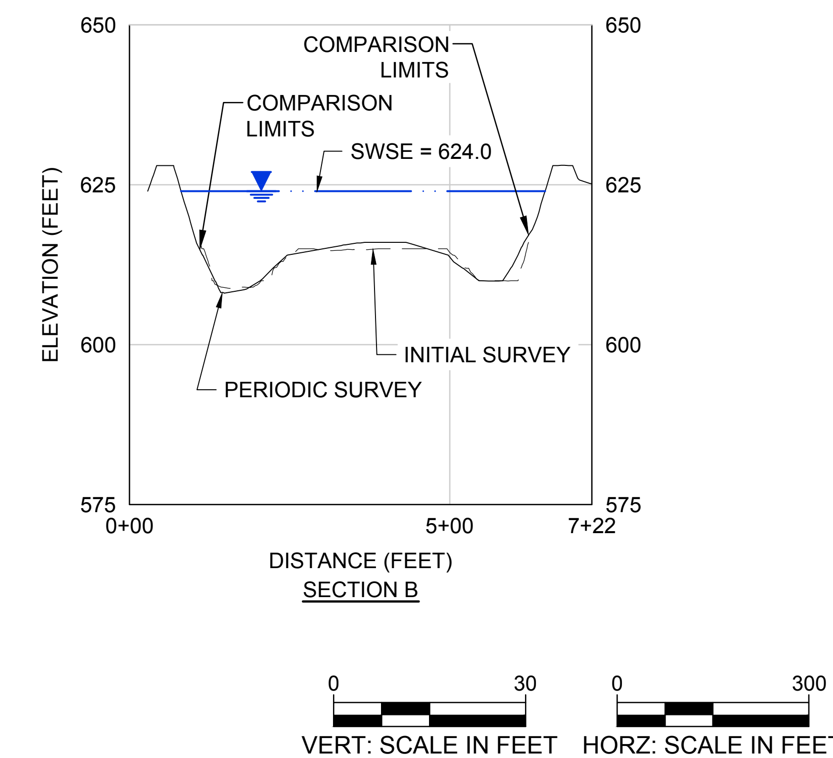
GLP8027.02 | MAY 2021

LEGEND

PERIODIC SURVEY CONTOURS







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NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING TITLED GYPSUM BATHYMETRIC SURVEY, GYPSUM MANAGEMENT FACILITY RECYCLE POND, COFFEEN POWER STATION", PREPARED BY HANSON PROFESSIONAL SERVICES INC., DATED JULY 18, 2016. A CAD FILE WAS NOT PROVIDED FOR THIS SURVEY; CONTOURS WERE APPROXIMATE DIGITIZED AND GEOREFERENCED BY GEOSYNTEC. THE INITIAL SURVEY LIMITS DO NOT ENCOMPASS THE ENTIRE GMF RECYCLE POND AND ONLY ENCOMPASS CCR THAT WAS OBSERVED IN THE GMF POND AT THE TIME OF THE INITIAL SURVEY. GEOSYNTEC HAS ASSUMED THAT NO ADDITIONAL CCR WAS PLACED OUTSIDE OF THE LIMITS OF THE INITIAL SURVEY.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER GENERATING COMPANY, COFFEEN POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.
4. THE STARTING WATER SURFACE ELEVATION (SWSE) OF THE GMF RECYCLE POND IS EL. 624.0 FT, AS NOTED IN THE REPORT TITLED "CCR RULE REPORT: INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN, GMF RECYCLE POND, COFFEEN POWER STATION", PREPARED BY HANSON PROFESSIONAL SERVICES INC, DATED OCTOBER 2016.

INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY			
SURFACE IMPOUNDMENT	CUT	FILL	NET (CU. YD.)
GMF POND	2,210	3,410	1,200 (FILL)
ABOVE SWSE	0	0	0
BELOW SWSE	2,210	3,410	1,200 (FILL)

SURVEY COMPARISION ISOPACH
GMF RECYCLE POND
COFFEEN POWER PLANT
COFFEEN, ILLINOIS

Geosyntec consultants

DRAWING 2

GLP8027.02 | MAY 2021

N

INITIAL AERIAL
07-18-2016 IMAGERY

PERIODIC AERIAL
02-26-2021 IMAGERY

0 200
SCALE IN FEET

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS - 2015 COFFEEN TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, ILLINOIS POWER GENERATING COMPANY, COFFEEN POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.

INITIAL TO PERIODIC AERIAL IMAGERY COMPARISON GMF RECYCLE POND COFFEEN POWER PLANT COFFEEN, ILLINOIS		
Geosyntec consultants		DRAWING 3
GLP8027.02	MAY 2021	

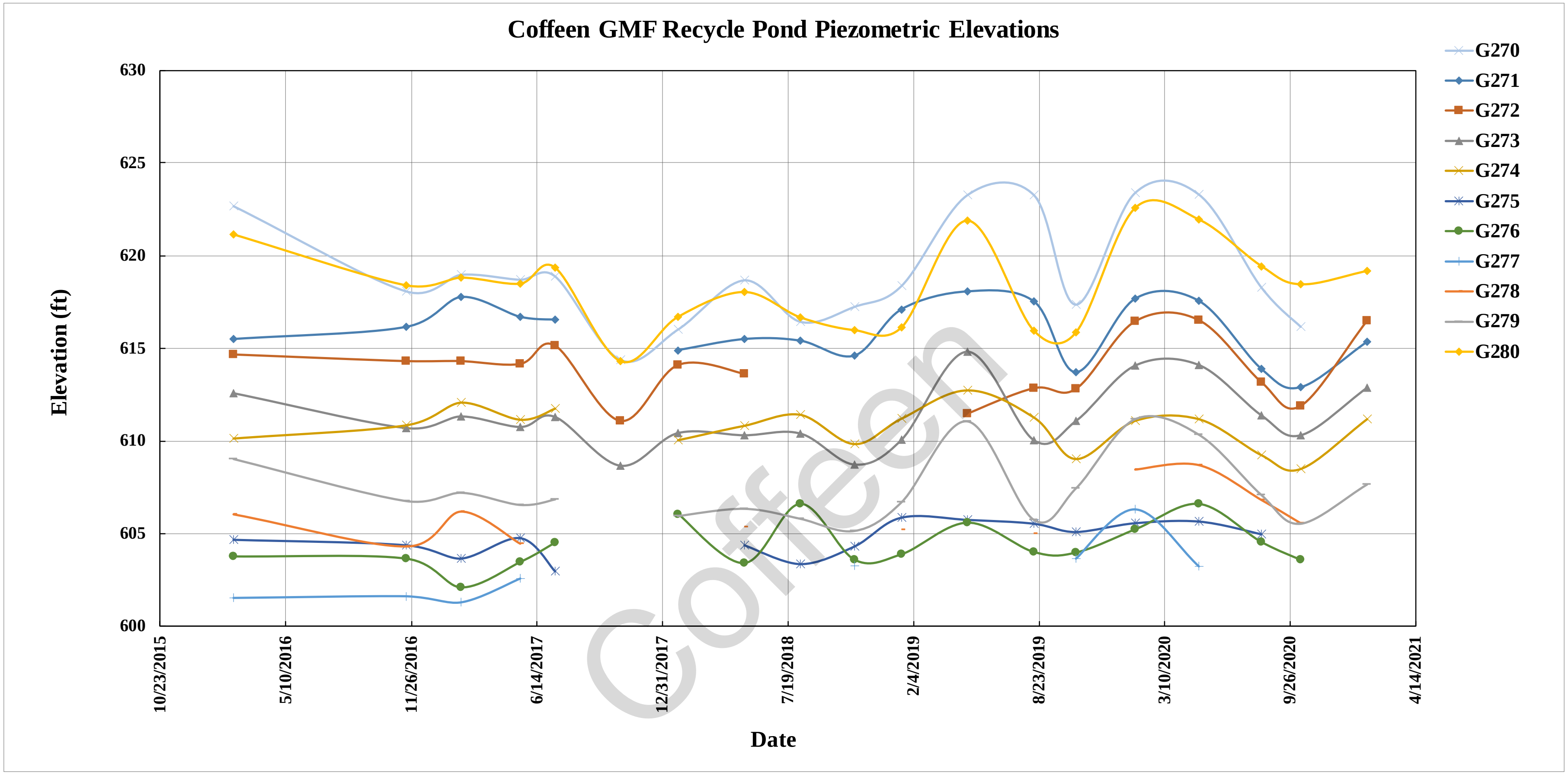
P:\CADD\PROJECTS\VISTRA PONDS\COFFEEN\FIGURES\GLP8027\02F06 - Last Saved by: KHanavec on 5/27/21

ATTACHMENTS

Attachment A

GMF RP Phreatic Data Plots

7/28/2021 3:29 PM



NOTES:
1. Piezometer data was taken from the spreadsheets titled " Coffeen GW 1017", " Coffeen GW 1018", " Coffeen GW 1019", " Coffeen GW 1020", " Coffeen GW 1021", provided by the Coffeen Power Plant.

PIEZOMETER DATA PERIODIC CERTIFICATION, GMF RECYCLE POND COFFEEN POWER PLANT COFFEEN, ILLINOIS		
Geosyntec consultants		Figure A-1
GLP8027	7/8/2021	

\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\502_COF\502d_Periodic_Report\COF_Monitoring Wells_GWL_07082021.xlsx

Attachment B

GMF RP Site Visit Photolog

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 01

Date: 05/28/2021

Direction Facing: SW

Comments: Transfer channel overview at discharge location into GMF RP.

Photo: 02

Date: 05/28/2021

Direction Facing: E

Comments: Interior slope overview

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 03

Date: 05/28/2021

Direction Facing: SW

Comments: Interior slope overview

Photo: 04

Date: 05/28/2021

Direction Facing: SE

Comments: Interior slope overview

GEOSYNTEC CONSULTANTS

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 05

Date: 05/28/2021

Direction Facing: NW

Comments: NE interior slope overview

Photo: 06

Date: 05/28/2021

Direction Facing: NE

Comments: NE exterior slope overview

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: GMF Recycle Pond (GMF RP) **Site:** Coffeen Power Plant

Photo: 07

Date: 05/28/2021

Direction Facing: SE

Comments: Emergency spillway aprons

Photo: 08

Date: 05/28/2021

Direction Facing: N

Comments: North emergency spillway apron.

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 09

Date: 05/28/2021

Direction Facing: W

Comments: Interior of north emergency spillway pipe. No obstructions or deterioration were observed.

Photo: 10

Date: 05/28/2021

Direction Facing: S

Comments: Middle emergency spillway apron.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 11

Date: 05/28/2021

Direction Facing: W

Comments: Interior of middle emergency spillway pipe. No obstructions or deterioration were observed.

Photo: 12

Date: 05/28/2021

Direction Facing: S

Comments: South emergency spillway apron.

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 13 **Date:** 05/28/2021 **Direction Facing:** W **Comments:** Interior of middle emergency spillway pipe. No obstructions or deterioration were observed.	
Photo: 14 **Date:** 05/28/2021 **Direction Facing:** Down **Comments:** North emergency spillway drop inlet	

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: GMF Recycle Pond (GMF RP) **Site:** Coffeen Power Plant

Photo: 15

Date: 05/28/2021

Direction Facing: Down

Comments: Middle emergency spillway drop inlet

Photo: 16

Date: 05/28/2021

Direction Facing: Down

Comments: North emergency spillway drop inlet

GEOSYNTEC CONSULTANTS

Geosyntec consultants

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 17	
Date: 05/28/2021	
Direction Facing: NE	
Comments: East exterior embankment overview.	

Photo: 18	
Date: 05/28/2021	
Direction Facing: SW	
Comments: Recycle pump intake structure	

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 19

Date: 05/28/2021

Direction Facing: SE

Comments: Recycle pump house overview

Photo: 20

Date: 05/28/2021

Direction Facing: E

Comments: Recycle pump house overview

GEOSYNTEC CONSULTANTS

Geosyntec consultants

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 21

Date: 05/28/2021

Direction Facing: W

Comments: South exterior dike overview

Photo: 22

Date: 05/28/2021

Direction Facing: NW

Comments: South dike interior overview

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 23 **Date:** 05/28/2021 **Direction Facing:** SW **Comments:** South dike exterior overview	
Photo: 24 **Date:** 05/28/2021 **Direction Facing:** NW **Comments:** Former AP#2 dewatering well discharge.	

Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: GMF Recycle Pond (GMF RP)	**Site:** Coffeen Power Plant

Photo: 25

Date: 05/28/2021

Direction Facing: NE

Comments: West dike interior slope and gypsum sluice line discharge.

Photo: 26

Date: 05/28/2021

Direction Facing: NW

Comments: West dike exterior overview

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: GMF Recycle Pond (GMF RP) **Site:** Coffeen Power Plant

Photo: 27

Date: 05/28/2021

Direction Facing: E

Comments: Northwest dike interior overview

Photo: 28

Date: 05/28/2021

Direction Facing: NE

Comments: Northwest dike exterior overview

Attachment C

Periodic History of Construction Report Update Letter

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Illinois Power Generating Company
134 Cips Lane
Coffeen, Illinois 62017

Subject: **Periodic History of Construction Report Update Letter**
USEPA Final CCR Rule, 40 CFR §257.73(c)
Coffeen Power Plant
Coffeen Illinois

At the request of Illinois Power Resources Generation Company (IPRG), Geosyntec Consultants (Geosyntec) has prepared this Letter to documents updates to the Initial History of Construction (HoC) report for the Coffeen Power Plant (CPP), also known as the Coffeen Power Station (COF). The Initial HoC report was prepared by AECOM in October of 2016 [1] in accordance with 40 Code of Federal Regulations (CFR) §257.73(c) of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule, known as the CCR Rule [2]. This letter also includes information required by Section 845.220(a)(1)(B) (Design and Construction Plans) of the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 CCR Rule [3] that is not expressly required by §257.73(c).

BACKGROUND

The CCR Rule required that, by October 17, 2016, Initial HoC reports to be compiled for existing CCR surface impoundments with: (1) a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) a height of 20 feet or more. The Initial HoC report was required to contain, to the extent feasible, the information specified in 40 CFR §257.73(c)(1)(i)-(xii). The Initial HoC report for CPP, which included four existing CCR surface impoundments, Ash Pond No. 1 (AP1), Ash Pond No. 2 (AP2), the GMF Gypsum Stack Pond (GMF GSP, also known as the GMF Pond), and the GMF Recycle Pond (GMF RP), was prepared and subsequently posted to IPGC's CCR Website prior to October 17, 2016.

The CCR Rule requires that Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

IPRG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for AP1, AP2, the GMF GSP, and the GMF RP generated since the Initial HoC report was prepared, and perform a site visit to CPP to evaluate if significant changes may have occurred since the Initial HoC report was prepared. This Letter contains the results of Geosyntec's evaluation and documents significant changes that have occurred at AP1, AP2, the GMF GSP, and the GMF RP, as they pertain the requirements of §257.73(c)(1)(i)-(xii).

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the CPP AP1, AP2, GMF GSP, and GMF RP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(ii), (iv), (v), (vi), (vii), (xi), and (xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the CPP AP1, AP2, GMF GSP, and GMF RP, pertaining to §257.73(c)(1)(i), (iii), (viii), (ix), and (x) of the CCR Rule had occurred since the Initial HoC report had been developed. Additionally, information how long the CCR surface impoundments have been operating and the types of CCR in the surface impoundments, as required by Section 845.220(a)(1)(B) of the Part 845 Rule were not included in the Initial HoC report, as this information is not required by the CCR Rule. Each change and the subsequent updates to the Initial HoC report is described within this section.

Section 845.220(a)(1)(B): A statement of … how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the surface impoundment.

Ash Pond No. 1

The AP1 was in operation from 1964 until CPP was retired in 2019 and received CCR for approximately 55 years. As of the date of this report, the AP1 has been present for approximately 57 years [4].

CCR placed in the AP1 included bottom ash [4].

Ash Pond No. 2

The AP2 was in operation from 1971 to 1984, for a total of approximately 13 years. The AP2 was closed in 1984-1985 by installing a clay cover and has not since been active or received CCR. As of the date of this report, AP2 has been present for approximately 50 years. [4].

CCR placed in the AP2 was used to store and dispose of fly ash and bottom ash [4].

GMF Gypsum Pond

The GMF GSP was in operation from 2010 until CPP was retired in 2019 and received CCR for approximately 9 years. As of the date of this report, the GMF GSP has been present for a total of approximately 11 years [4].

CCR placed in GMF GSP included gypsum [4].

GMF Recycle Pond

The GMF RP was in operation from 2010 until CPP was retired in 2019, for a total of 9 years [4]. As of the date of this report, the GMF RP has been present for approximately 11 years.

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

State identification numbers (IDs) for AP1, AP2, the GMF GSP, and the GMF RP have been assigned by the Illinois Environmental Protection Agency (IEPA). Each ID is listed in **Table 1**.

Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Ash Pond No. 1 (AP1)	W1350150004-01
Ash Pond No. 2 (AP2)	W1350150004-02
GMF Gypsum Stack Pond (GMF GSP)	W1350150004-03
GMF Recycle Pond (GMF RP)	W1350150004-04

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

AP2 was closed in 2020, in substantial compliance with the written closure plan posted to IPRG's CCR Website [5], and as documented by a certified Notification of Completion of Closures posted to DMG's CCR Website [6].

The CPP was retired in December of 2019, with the generation of electricity ceased at that time. Therefore, AP1, the GMF GSP, and the GMF RP are no longer being used to store and dispose of new CCR that is actively generated by CPP, as CCR generation as ceased. All three impoundments still contain CCR and liquids that was present at the time of plant retirement. The GMF RP also previously received dewatering discharge from AP2; this inflow was ceased after AP2 was closed in 202.

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Instrumentation monitoring at AP2 is no longer required as the CCR surface impoundment was closed in accordance with §257.102 [6], and the instrumentation network was modified at that time. Therefore, the instrumentation locations shown in Appendix C of the Initial HoC report are no longer applicable to AP2.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Updated area-capacity curves were prepared for AP1, the GMF GSP, and the GMF RP in 2021 and are provided in **Figures 1**, **2**, and **3**, respectively.

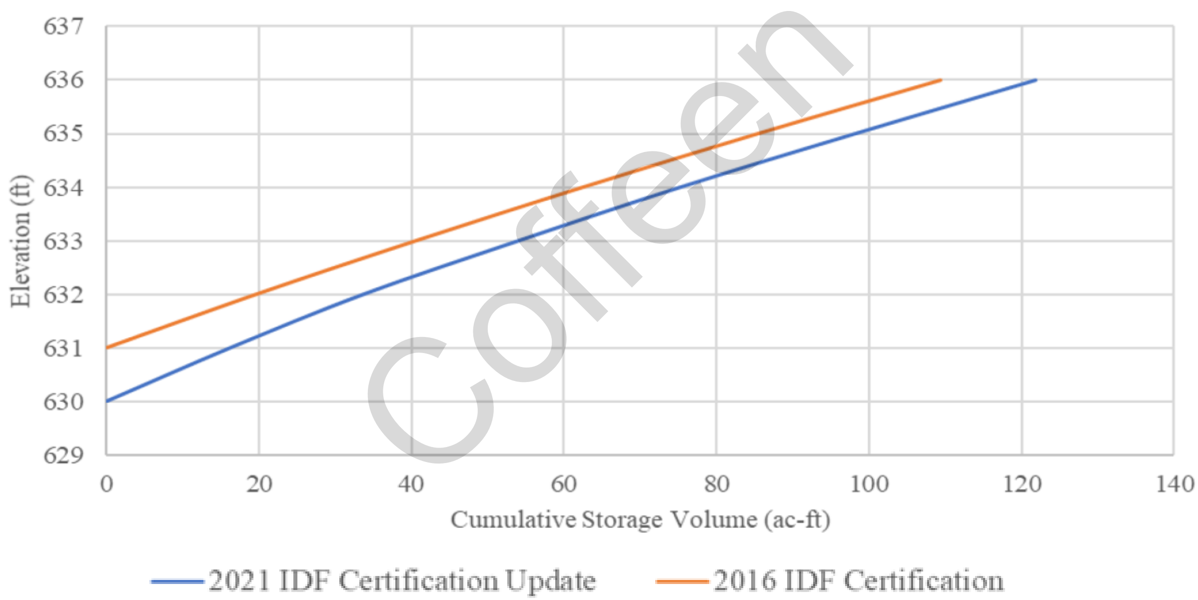


Figure 1 – Area-Capacity Curve for AP1

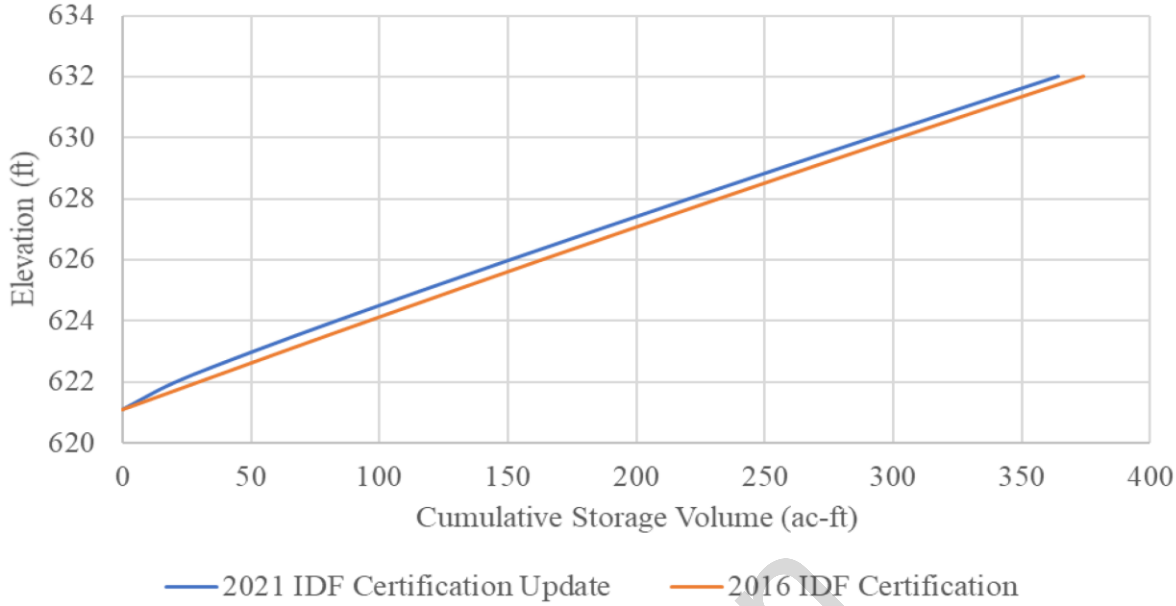


Figure 2 – Area-Capacity Curve for GMF GSP

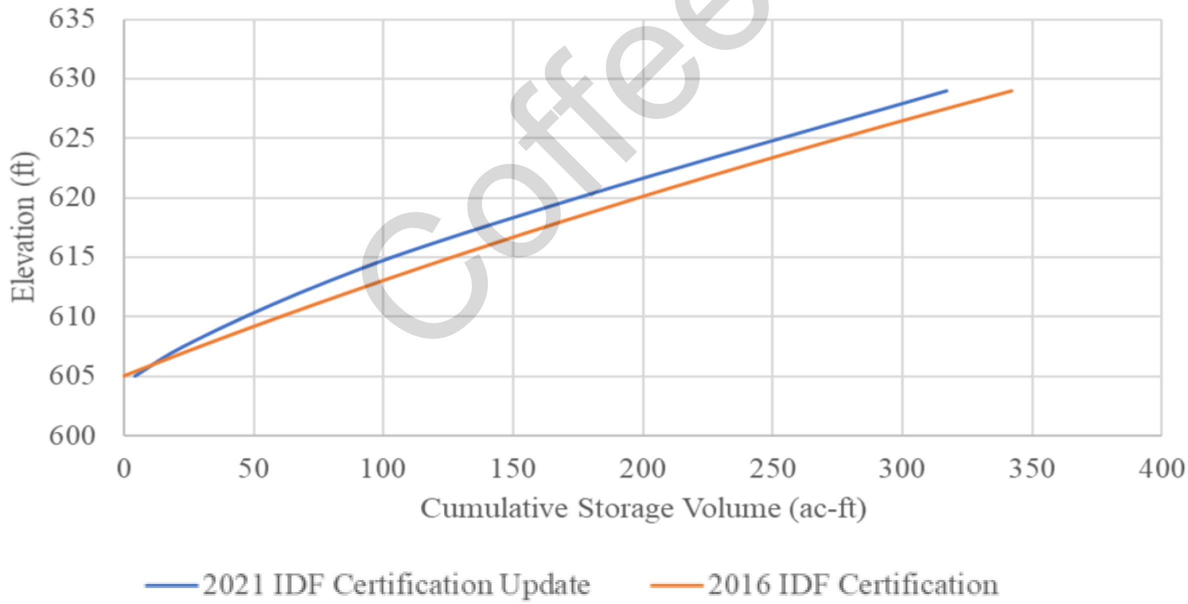


Figure 3 – Area-Capacity Curve for GMF RP

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

The primary spillway structure for AP1 was modified in 2020 by constructing a berm of bottom ash around the entrance to the spillway, to reduce the potential for freezing around the spillway during post-CPP closure conditions, with a berm crest elevation of approximately 630 ft. Design drawings for the bottom ash berm are not reasonably or readily available.

The transfer channel between the GMF GSP and the GMF RP was modified in 2020 by constructing a geomembrane-lined berm, in order to allow the normal pool level of the GMF GSP to be increased. Design drawings for the berm are not reasonably or readily available. However, survey data [3] indicates the berm has an elevation of approximately 628 ft, a top width (perpendicular to the flow direction) of approximately 75 ft, a total length (parallel to the flow direction) of 25 ft, and side slopes of approximately 4 horizontal to 1 vertical.

Valves were installed on the intake pipes for the GMF RP after the CPP was closed and plant process water intake pumping was ceased. Design drawings for these valves are not reasonably or readily available.

Updated discharge capacity calculations for the existing spillways of AP1, the GMF GSP, and the GMF RP were prepared in 2021 using HydroCAD 10 modeling software. The calculations indicate that the AP1 and the GMF RP have sufficient storage capacity and will not overtop the embankments during the 1,000-year, 24-hour, storm event. The calculations also indicate that the GMF GSP has sufficient storage capacity and will not overtop the embankments during the Probable Maximum Precipitation (PMP), 24-hour storm event. The results of the calculations are provided in **Table 2**.

Table 2 – Results of Updated Discharge Capacity Calculations

	AP1	GMF GSP	GMF RP
Approximate Berm Minimum Elevation[1], ft	636.0	632.0	629.0
Approximate Emergency Spillway Elevation[1], ft	Not Present	Not Present	624.0
Starting Water Surface Elevation[1] (SWSE), ft	630.2	625.2	622.1
Peak Water Surface Elevation[1] (PWSE), ft	631.4	626.7	623.9
Time to Peak, hr	No Discharge	10.6	No Discharge
Surface Area[2], ac	18.1	34.8	16.1
Storage[3], ac-ft	19.5	52.9	29.0

Notes:
[1]Elevations are based on the NAVD88 datum
[2]Surface area is defined as the water surface area at the PWSE
[3]Storage is defined as the volume between the SWSE and PWSE

AP2 no longer retains free water as the CCR surface impoundments was closed in 2020 [6]. Therefore, the spillways are no longer present and the information regarding these structures, as presented in the Initial HoC report, is no longer applicable to AP2.

CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at AP1, AP2, the GMF GSP, and the GMF RP since the Initial HoC was developed, based on reasonably and readily available information provided by IPRG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Lucas P. Carr, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

REFERENCES

[1] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Coffeen Power Station, Coffeen, Illinois," October 2016.

[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

[3] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

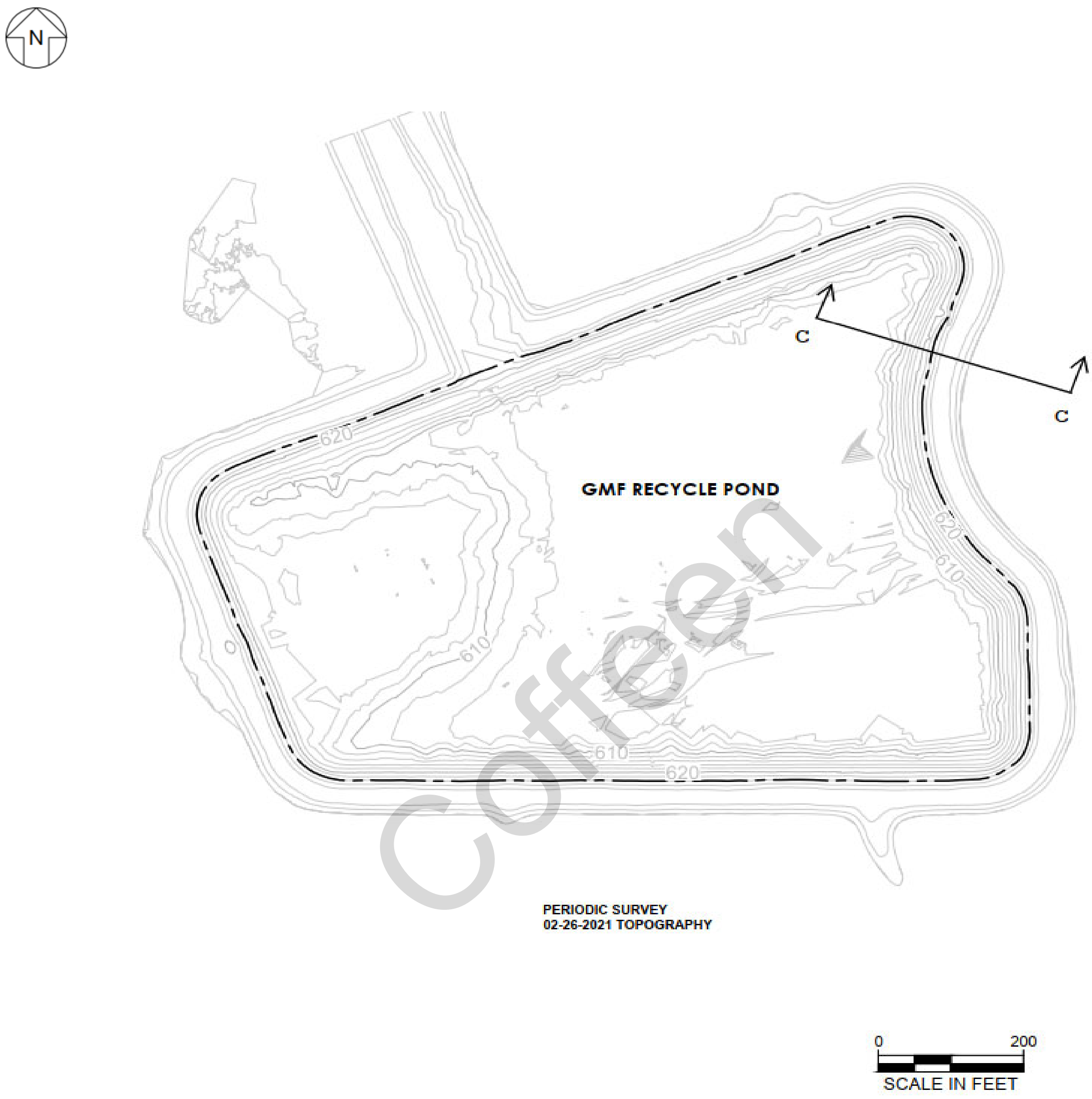
[4] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Hennepin Power Station, Hennepin, Illinois," October 2016.

[5] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, Coffeen Power Station, Illinois Power Generating Company, Ash Pond No. 2," October 17, 2016.

[6] D. Tickner, "Coffeen Power Station; Ash Pond No. 2; Notification of Completion of Closure," December 17, 2020.

Attachment D

Periodic Structural Stability and Safety Factor Assessment Analyses



NOTES:

1. The cross-sections are shown on the periodic topography of GMF RP Pond, prepared by IngenAE, dated February 26, 2021.

CROSS-SECTION LOCATION
PERIODIC CERTIFICATION
COFFEEN POWER PLANT- GMF RP POND
COFFEEN, ILLINOIS

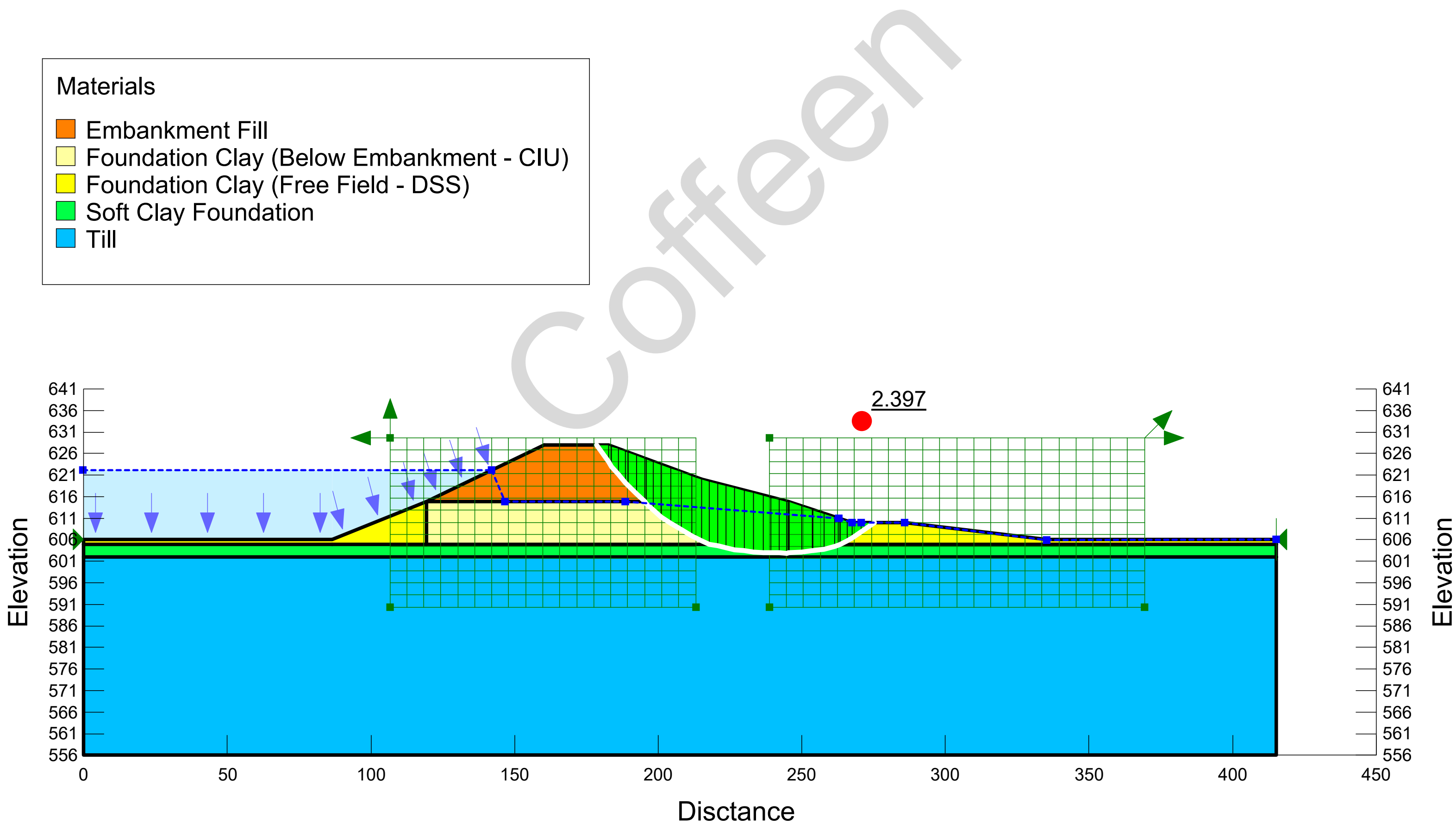
Geosyntec consultants

GLP8027	9/16/2021	Figure D-1

Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Block-Failure

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soft Clay Foundation Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1



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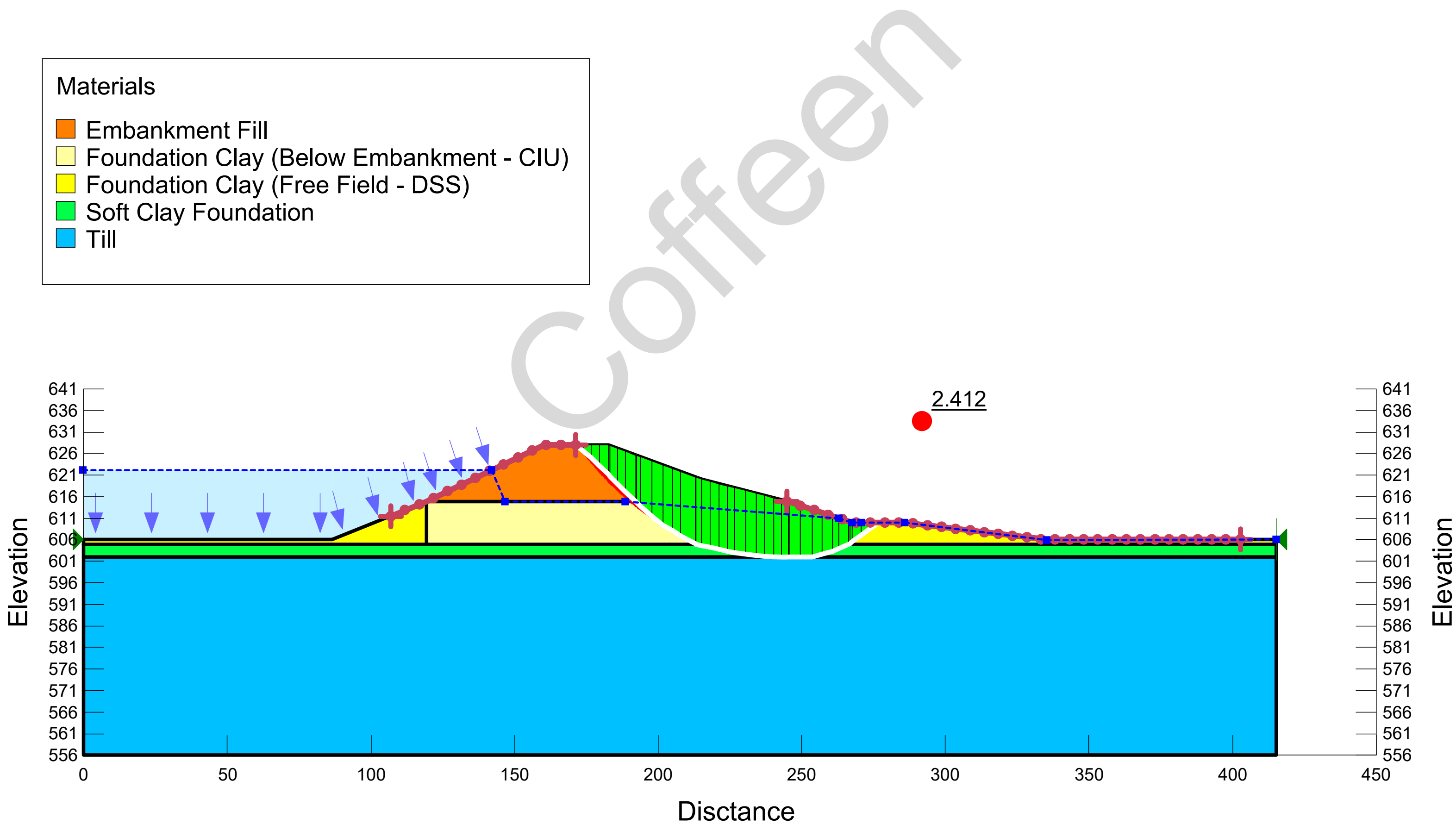
COF_GMFRP_Static & Surcharge_Drained_PK_08062021_v3.gsz

Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Entry-Exit

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soft Clay Foundation Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

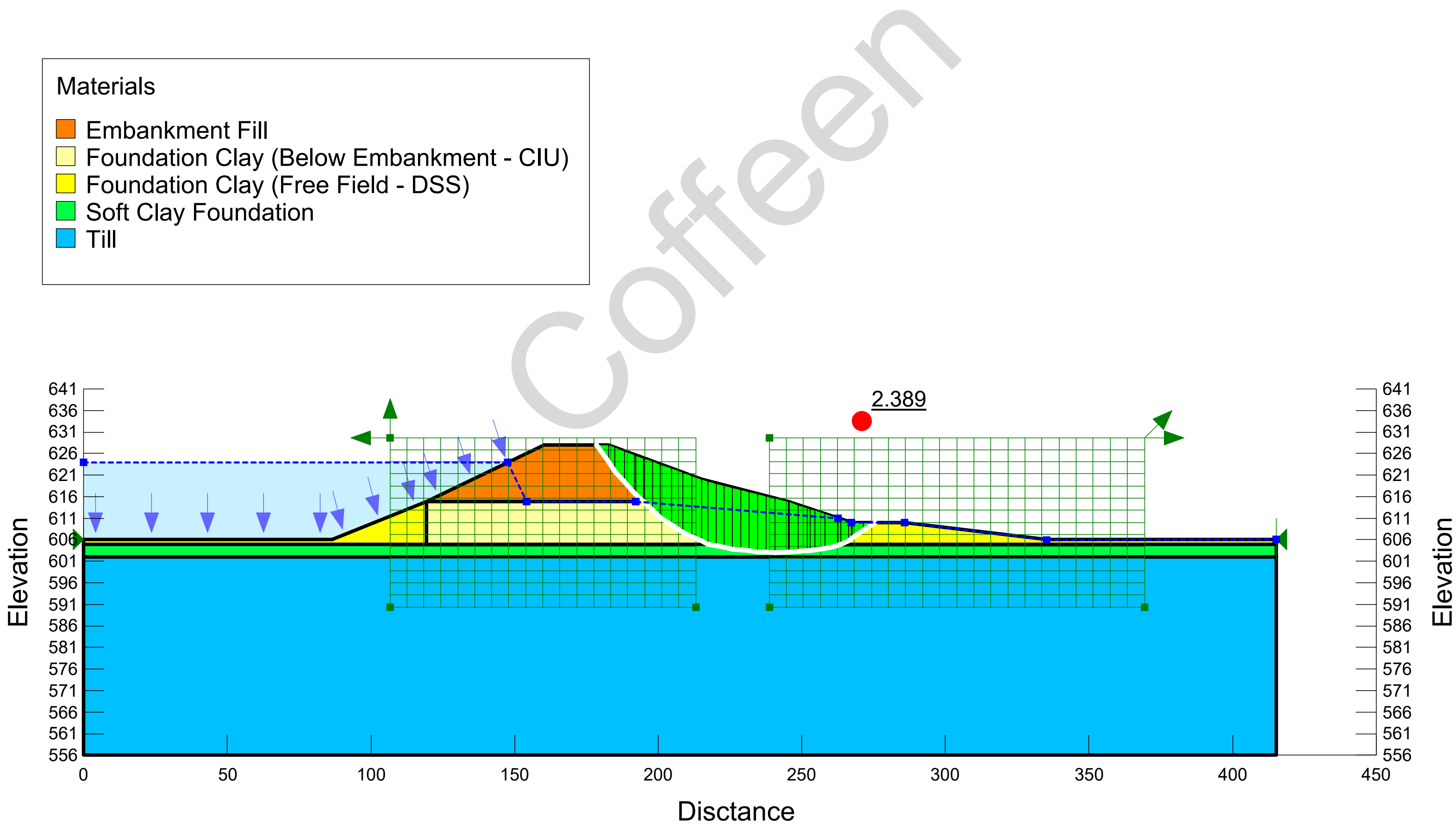


\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\502_COF\502d_Periodic_Report\GMFRP\Revised SFA\New Section 2021\GMFRP\
COF_GMFRP_Static & Surcharge_Drained_PK_08062021_v3.gsz

Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Block Failure

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soft Clay Foundation Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1



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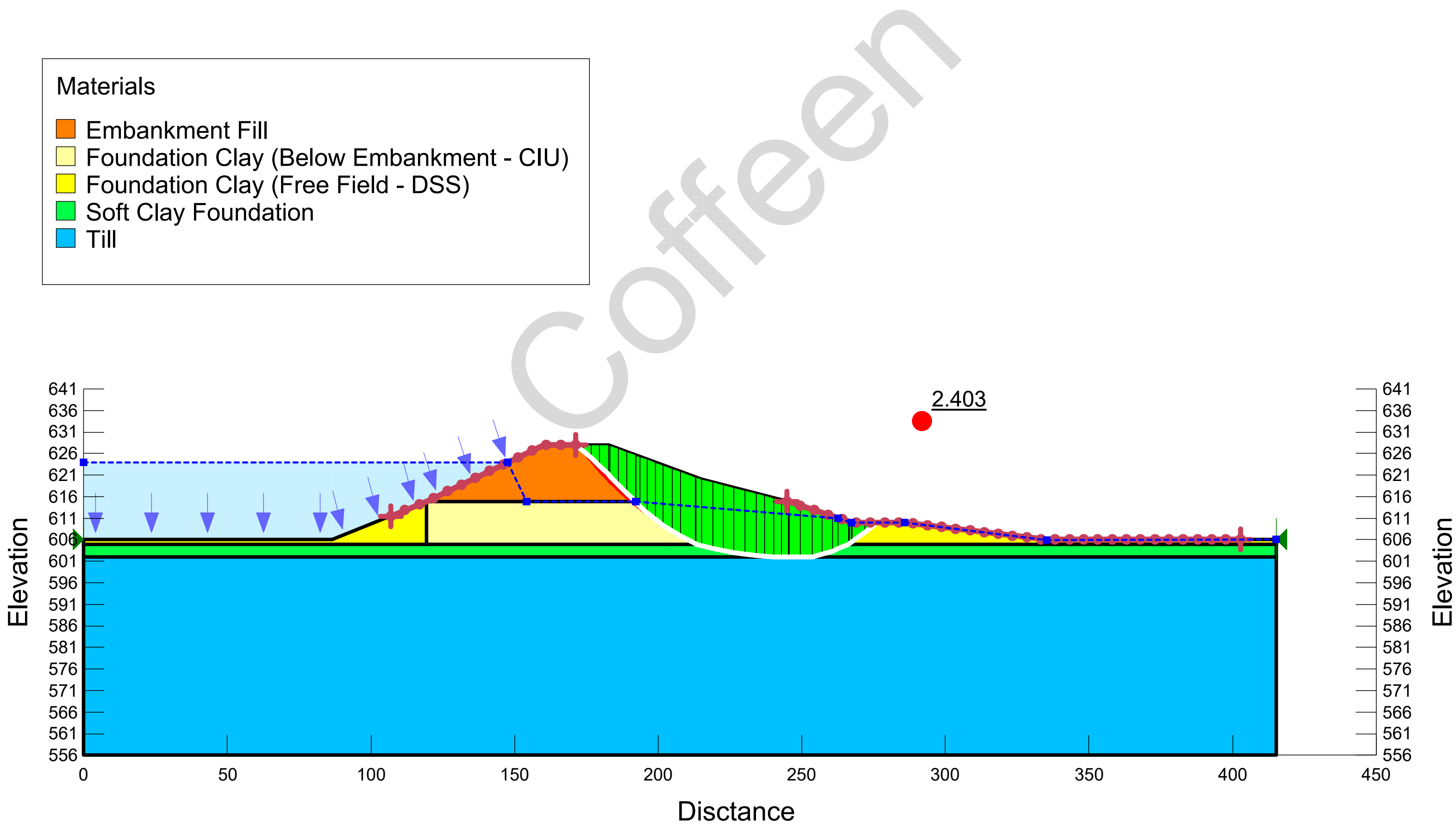
COF_GMFRP_Static & Surcharge_Drained_PK_08062021_v3.gsz

Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Entry-Exit

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soft Clay Foundation Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1



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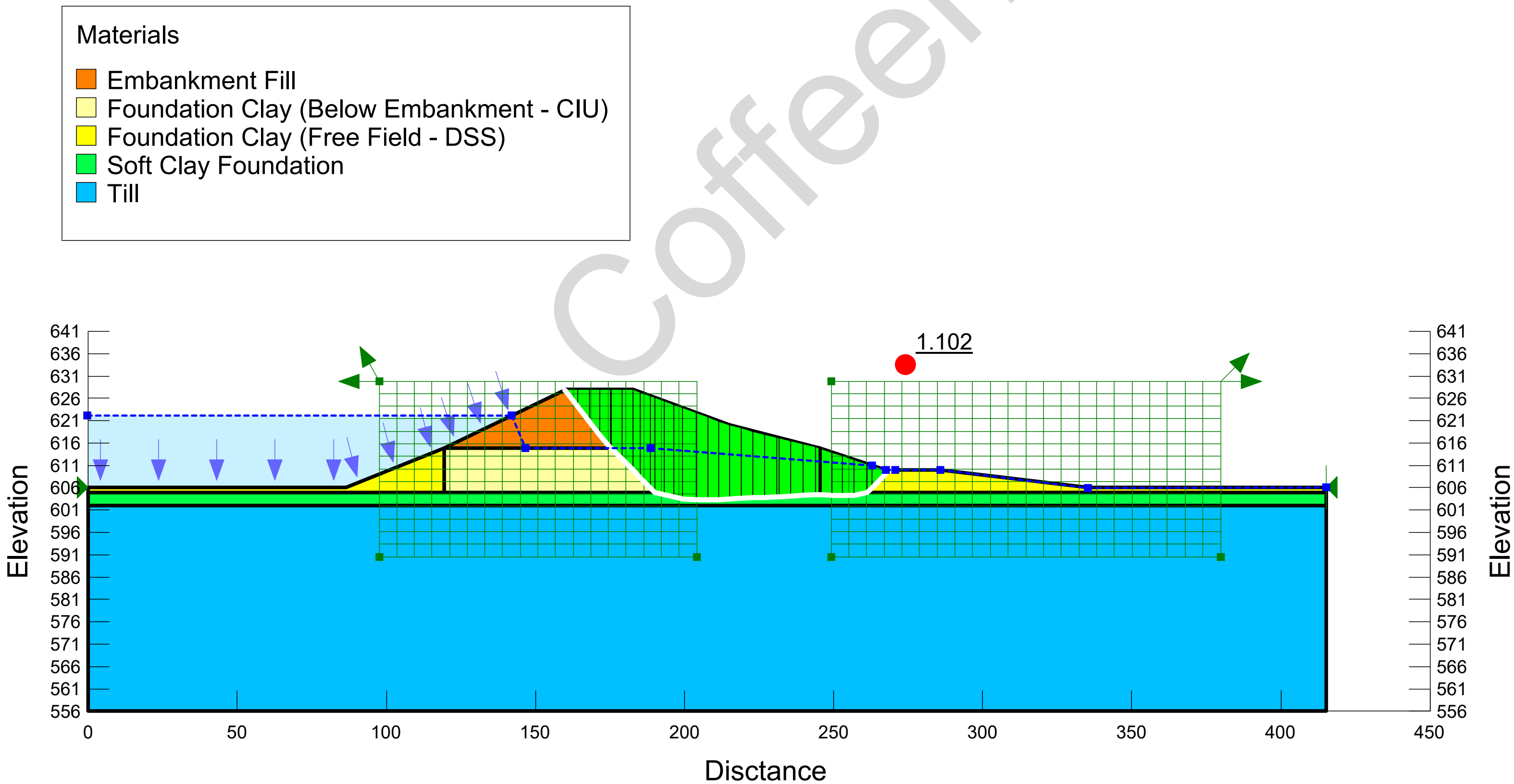
Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Block Failure

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.6 Minimum Strength: 450 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.39 Minimum Strength: 700 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.24 Minimum Strength: 450 psf Piezometric Line: 1
Name: Soft Clay Foundation Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.22 Minimum Strength: 275 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.45 Minimum Strength: 700 psf Piezometric Line: 1

Seismic Coefficient : 0.13 g



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COF_GMFRP_Seicmic Peak Undrained _PK_08182021_v2.gsz

Coffeen Power Plant
GMF Recycle Pond
Section C
Static Drained - Entry-Exit

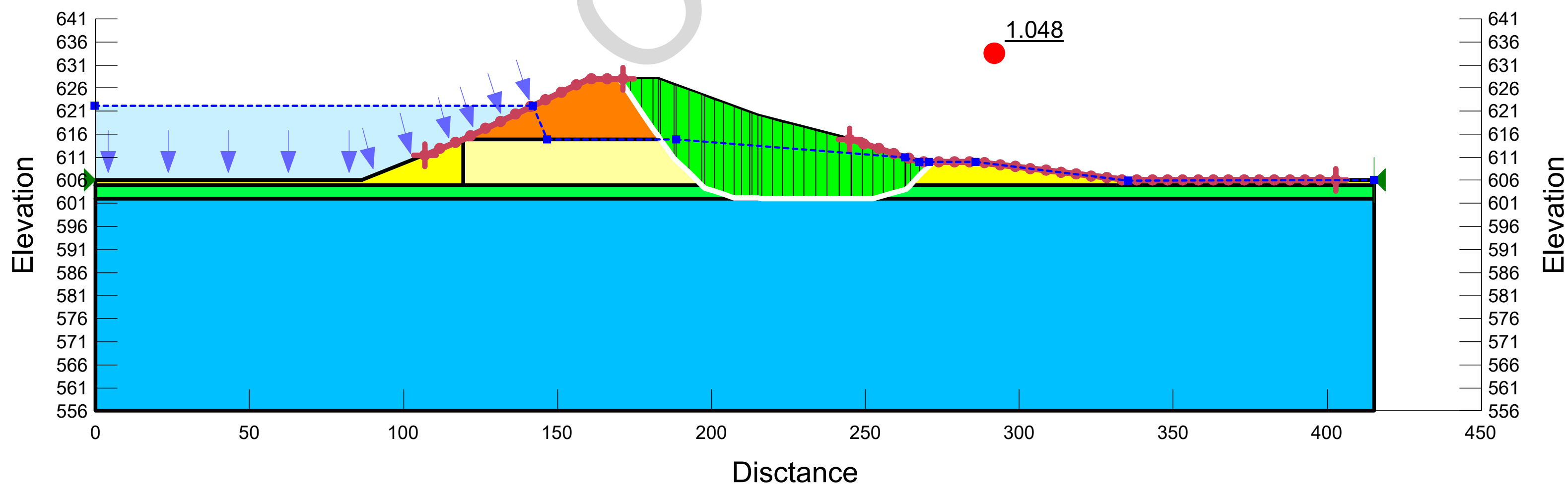
Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.6 Minimum Strength: 450 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.39 Minimum Strength: 700 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.24 Minimum Strength: 450 psf Piezometric Line: 1
Name: Soft Clay Foundation Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.22 Minimum Strength: 275 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.45 Minimum Strength: 700 psf Piezometric Line: 1

Seismic Coefficient : 0.13 g

Materials

- Embankment Fill
- Foundation Clay (Below Embankment - CIU)
- Foundation Clay (Free Field - DSS)
- Soft Clay Foundation
- Till



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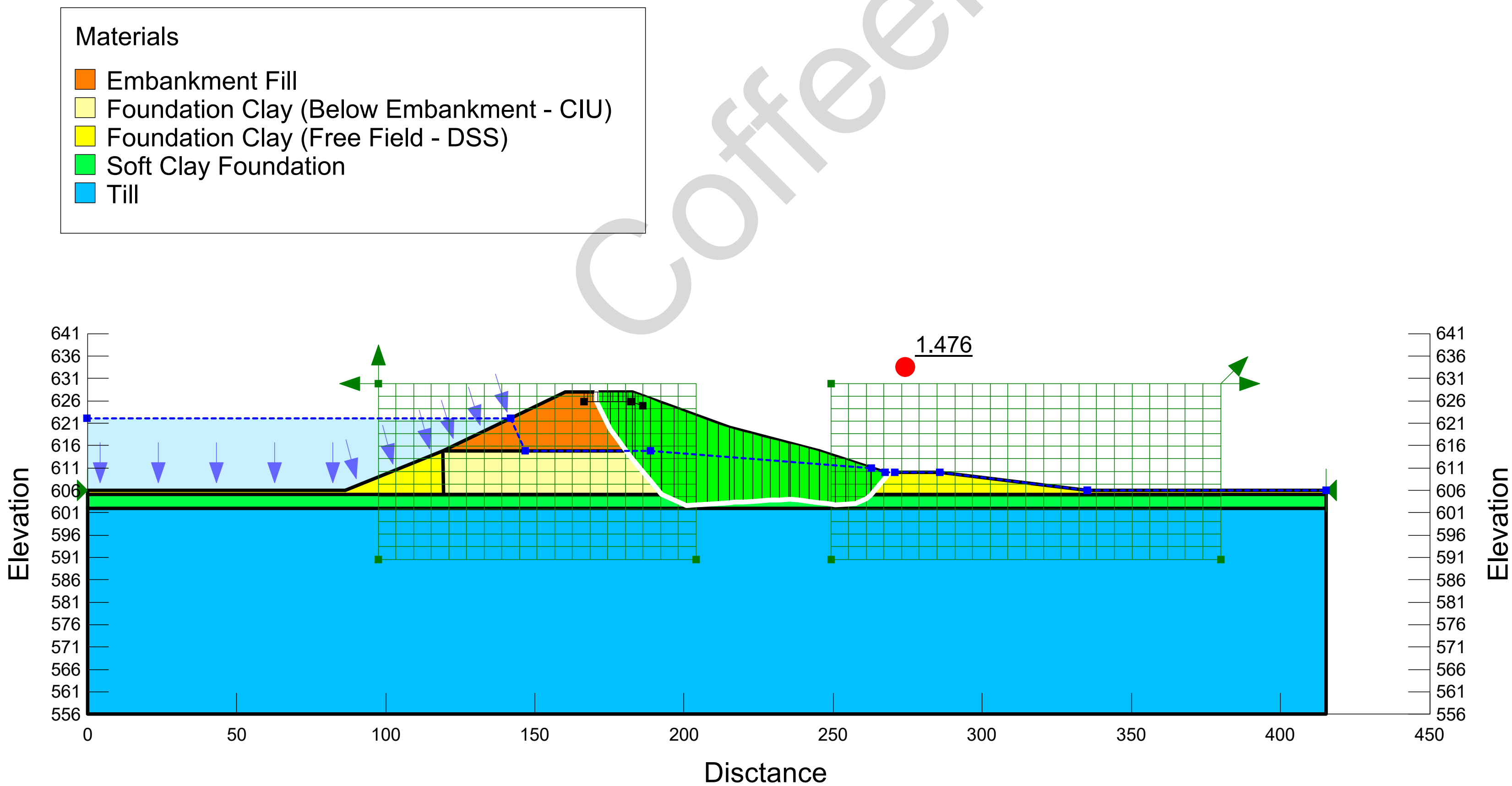
COF_GMFRP_Seicmic Peak Undrained _PK_08182021_v2.gsz

Coffeen Power Plant
GMF Recycle Pond
Section C
Post Earthquake - Block Failure

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

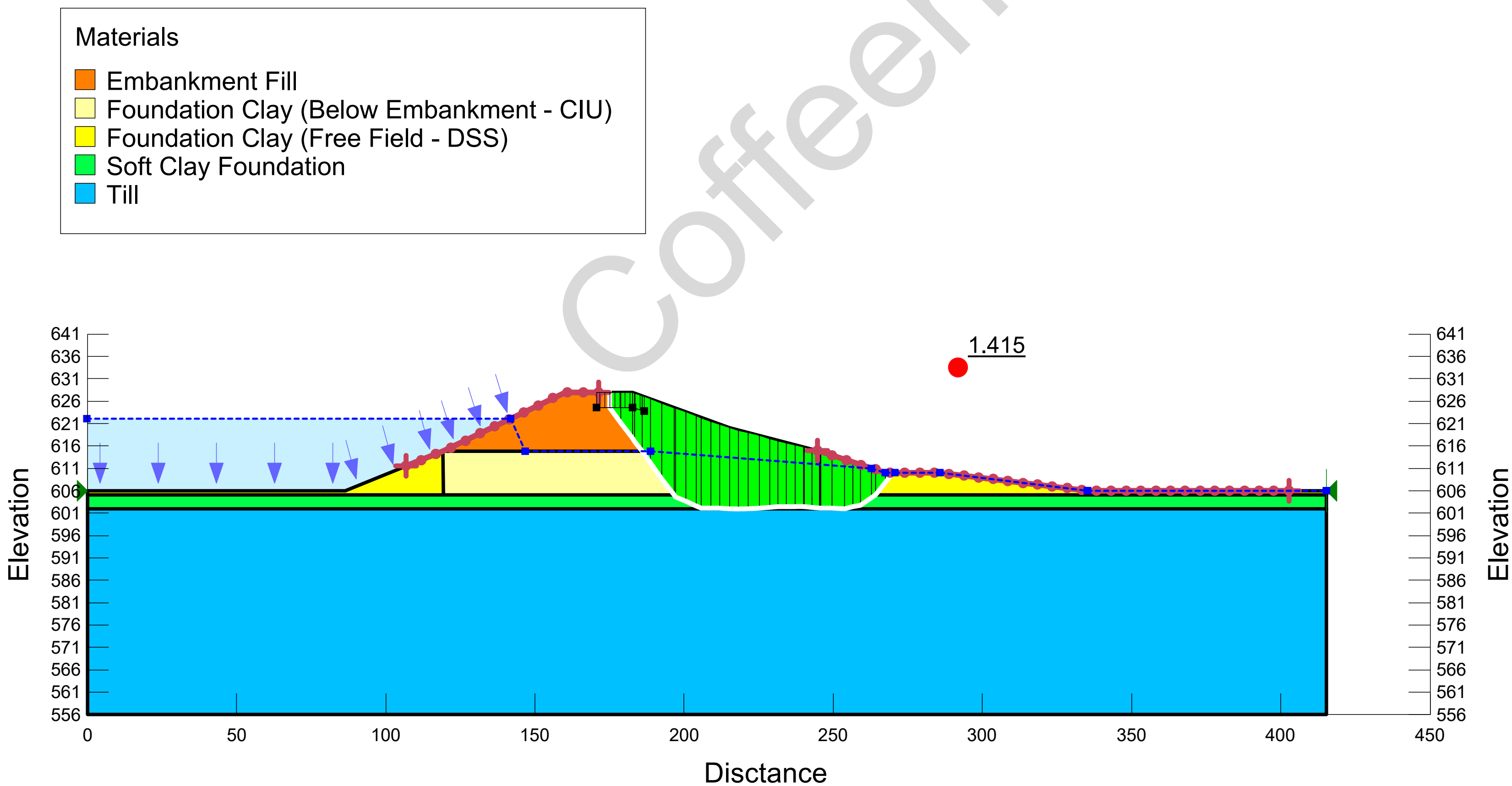
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.6 Minimum Strength: 450 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.39 Minimum Strength: 700 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.24 Minimum Strength: 450 psf Piezometric Line: 1
Name: Soft Clay Foundation Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.13 Minimum Strength: 200 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.45 Minimum Strength: 700 psf Piezometric Line: 1



Coffeen Power Plant
GMF Recycle Pond
Section C
Post Earthquake -Entry-Exit

Designed by: Pourya Kargar
Checked by: Lucas Carr & Zachary Fallert
Date: 09/15/2021

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.6 Minimum Strength: 450 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.39 Minimum Strength: 700 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.24 Minimum Strength: 450 psf Piezometric Line: 1
Name: Soft Clay Foundation Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.13 Minimum Strength: 200 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.45 Minimum Strength: 700 psf Piezometric Line: 1



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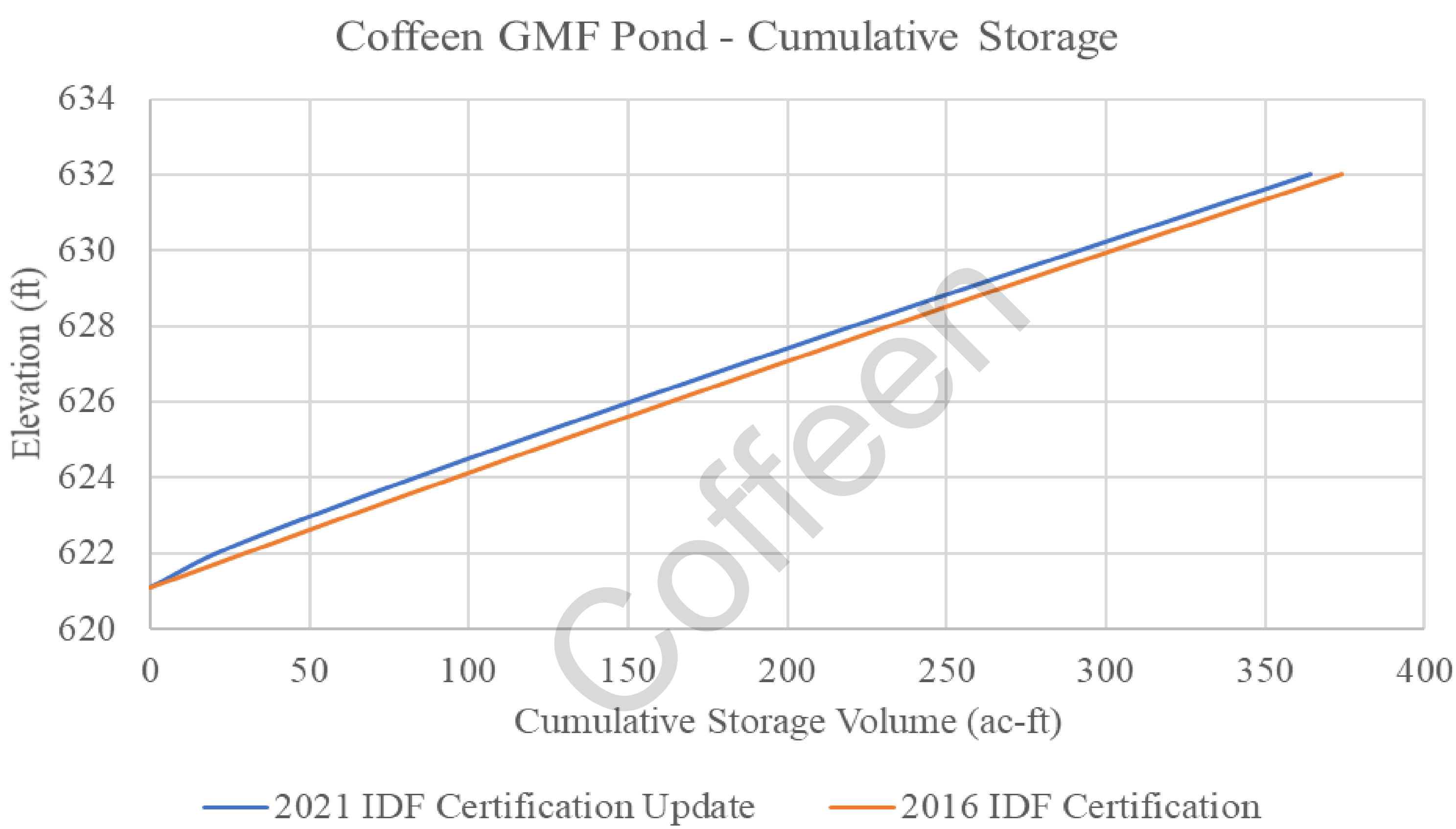
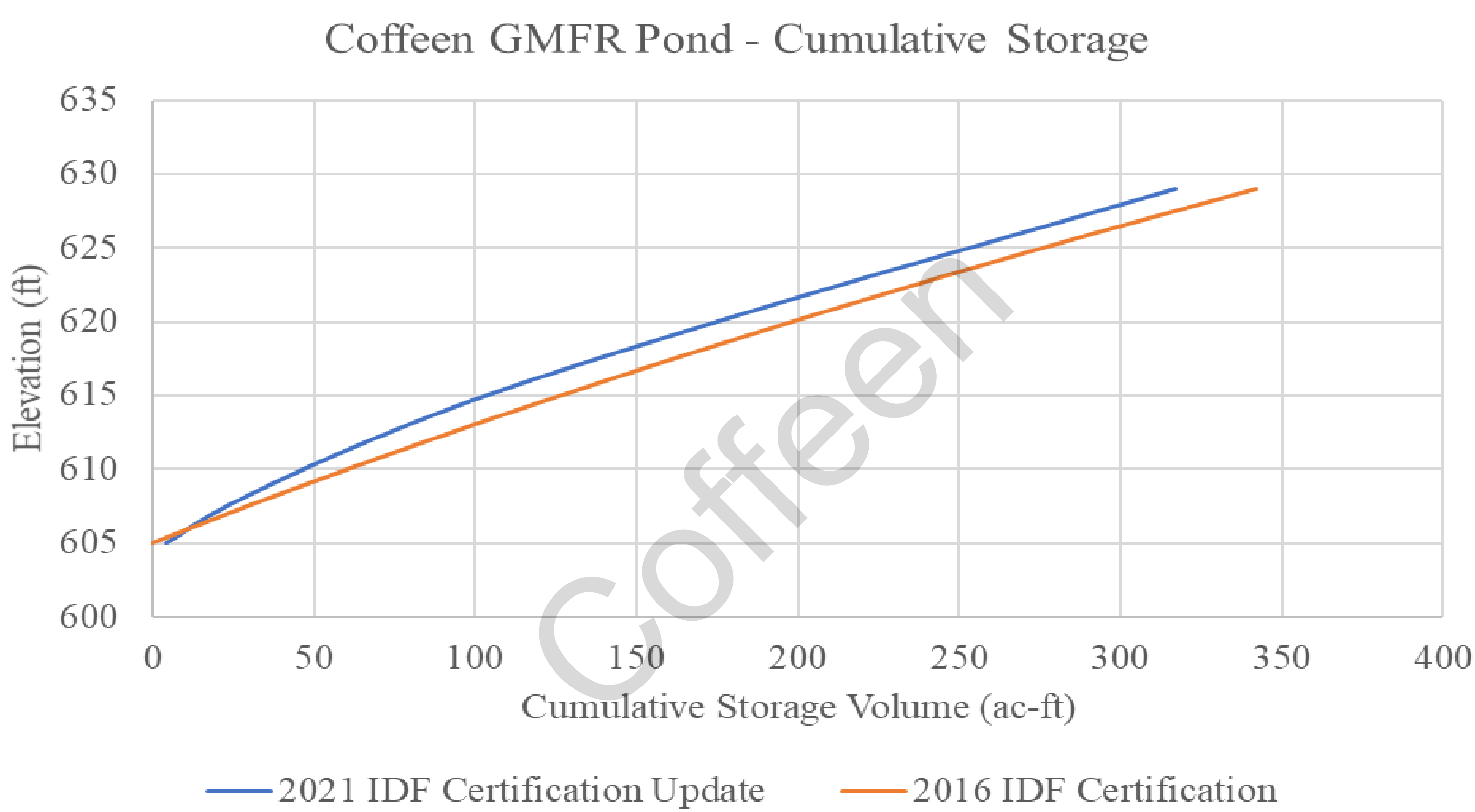
Attachment E

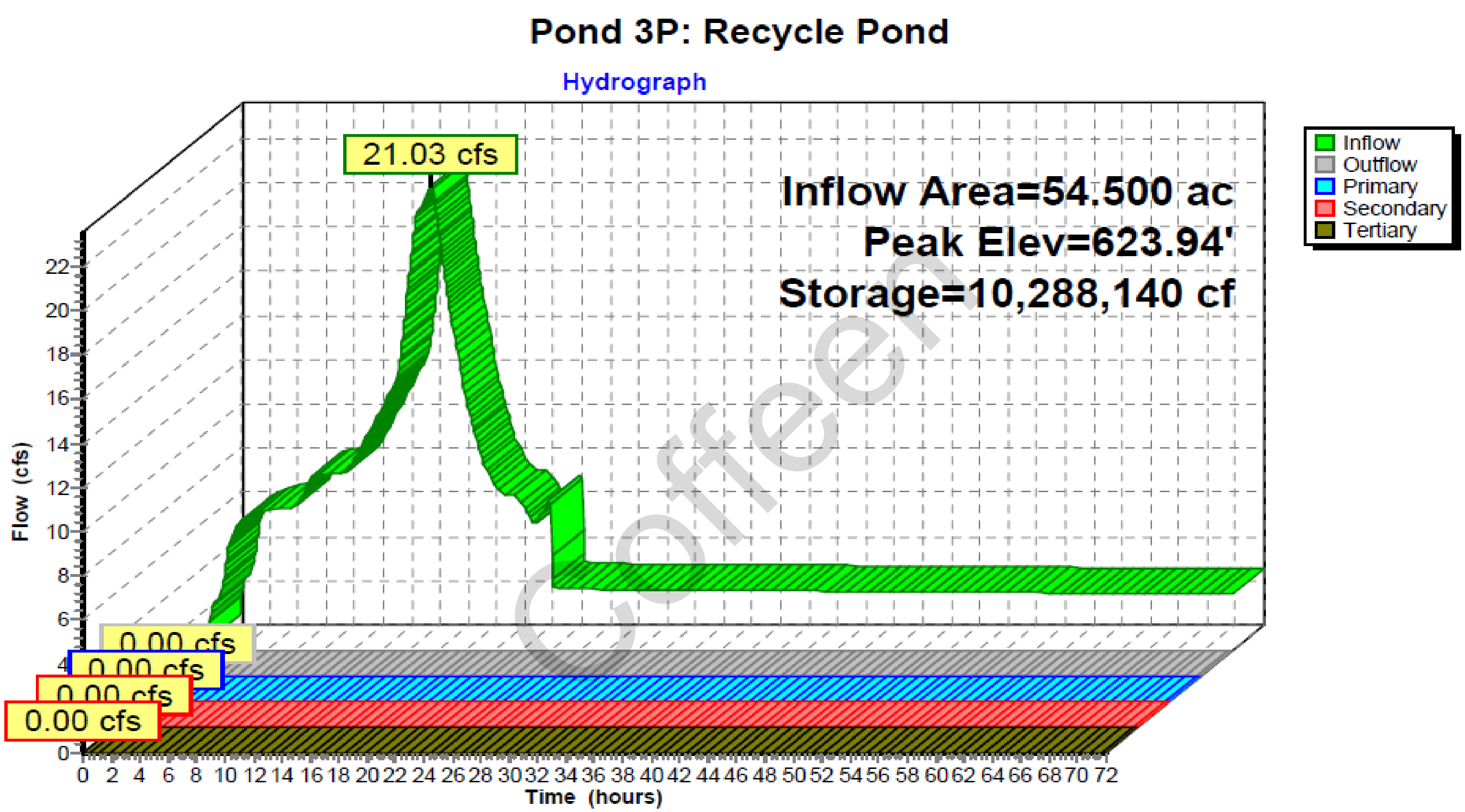
Periodic Inflow Design Flood Control System Plan Analyses



COFFEEN GMF GSP CUMULATIVE STORAGE PERIODIC CERTIFICATION COFFEEN POWER PLANT COFFEEN, ILLINOIS		
Geosyntec consultants		Figure E-1
GLP8027	9/14/2021	



COFFEEN GMF RECYCLE POND CUMULATIVE STORAGE PERIODIC CERTIFICATION COFFEEN POWER PLANT COFFEEN, ILLINOIS		
Geosyntec consultants		Figure E-2
GLP8027	9/14/2021	



GMF GSP IDF HYDROGRAPH PERIODIC CERTIFICATION COFFEEN POWER PLANT COFFEEN, ILLINOIS		
Geosyntec consultants		Figure E-3
GLP8027	9/14/2021	

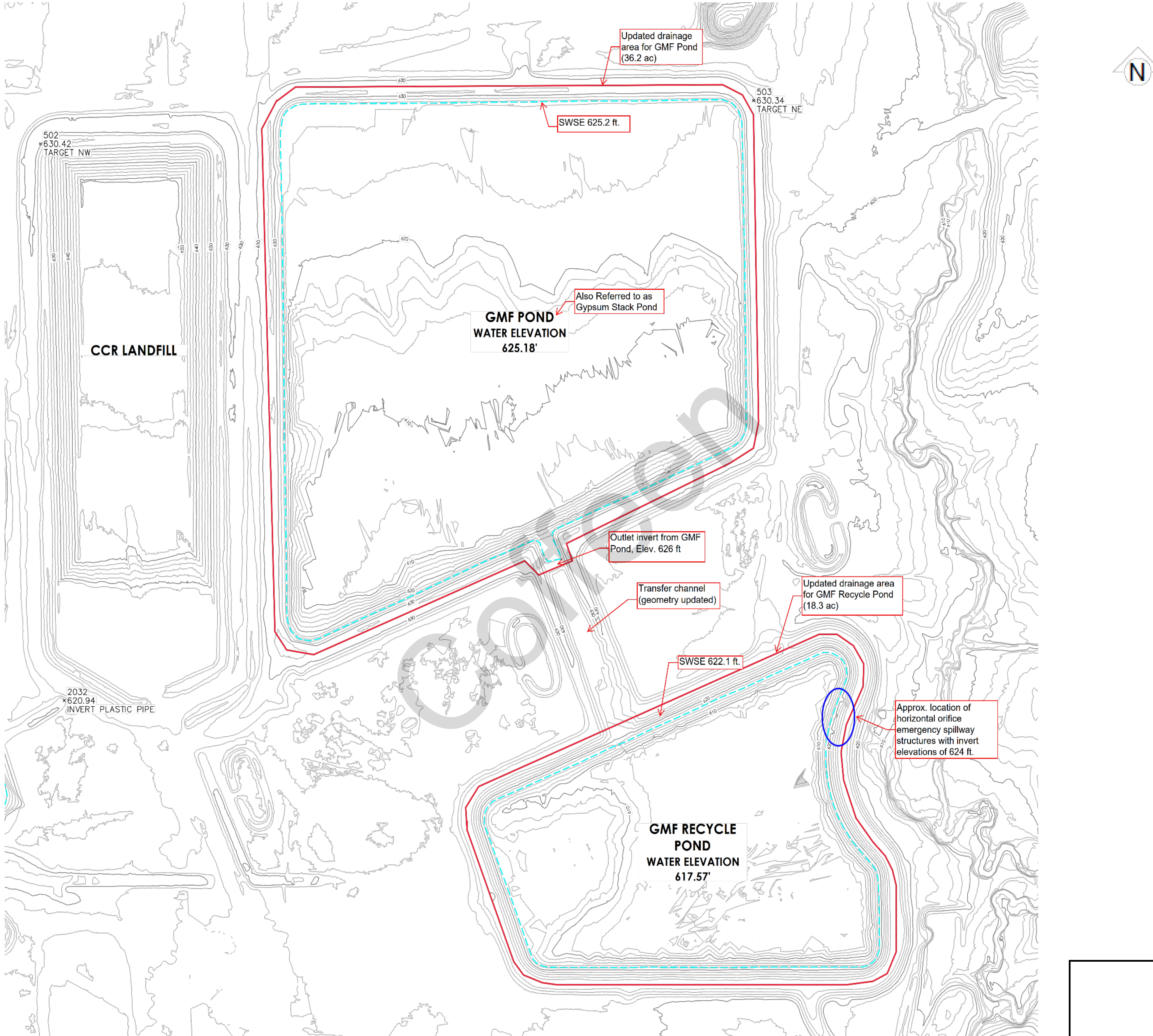


Figure based on IngenAE 2020 Site Topo

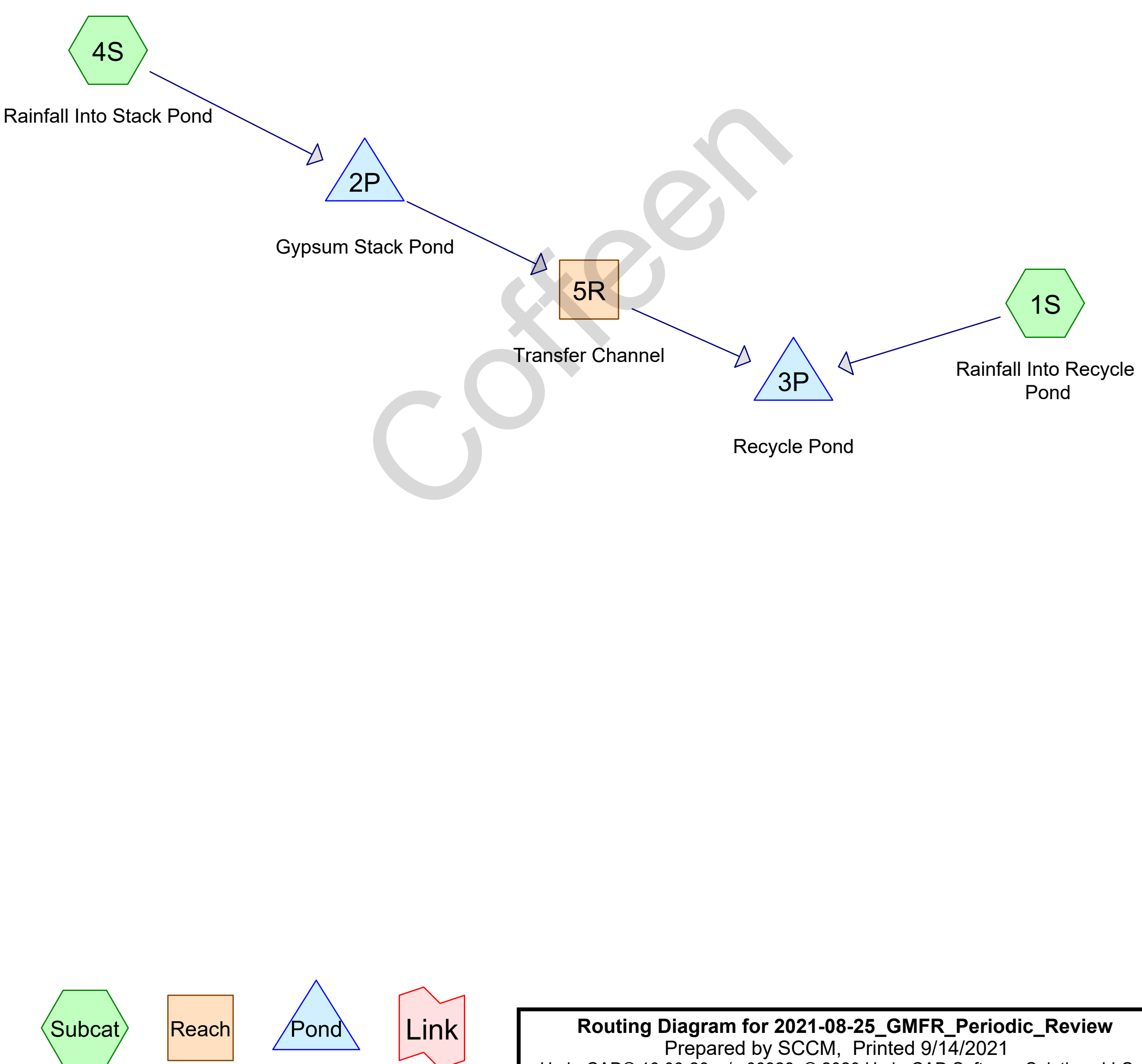
NOT FOR CONSTRUCTION - NOT TO SCALE

Coffeen Power Plant
GMF and GMFR Pond
Hydrologic Workmap

Geosyntec consultants

GLP8027 | September 2021

Figure E-4



Routing Diagram for 2021-08-25_GMFR_Periodic_Review
Prepared by SCCM, Printed 9/14/2021
HydroCAD® 10.00-26 s/n 00928 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
54.500	98	Water Surface, HSG C (1S, 4S)
54.500	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
54.500	HSG C	1S, 4S
0.000	HSG D	
0.000	Other	
54.500		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	54.500	0.000	0.000	54.500	Water Surface	1S, 4S
0.000	**0.000**	**54.500**	**0.000**	**0.000**	**54.500**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	619.00	617.60	580.0	0.0024	0.013	14.0	0.0	0.0
2	3P	615.00	613.00	92.0	0.0217	0.013	45.0	0.0	0.0
3	3P	615.00	613.00	92.0	0.0217	0.013	45.0	0.0	0.0
4	3P	615.00	613.00	92.0	0.0217	0.013	45.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Rainfall Into Recycle Runoff Area=18.300 ac 100.00% Impervious Runoff Depth=8.89"
Tc=6.0 min CN=98 Runoff=18.44 cfs 13.557 af

Subcatchment 4S: Rainfall Into Stack Runoff Area=36.200 ac 100.00% Impervious Runoff Depth=8.89"
Tc=6.0 min CN=98 Runoff=36.48 cfs 26.817 af

Reach 5R: Transfer Channel Avg. Flow Depth=0.06' Max Vel=1.51 fps Inflow=2.79 cfs 15.479 af
n=0.010 L=450.0' S=0.0044 '/' Capacity=7,454.18 cfs Outflow=2.78 cfs 15.461 af

Pond 2P: Gypsum Stack Pond Peak Elev=625.82' Storage=6,306,475 cf Inflow=36.48 cfs 26.817 af
Outflow=2.79 cfs 15.479 af

Pond 3P: Recycle Pond Peak Elev=623.94' Storage=10,288,140 cf Inflow=21.03 cfs 29.018 af
Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 54.500 ac Runoff Volume = 40.374 af Average Runoff Depth = 8.89"
0.00% Pervious = 0.000 ac 100.00% Impervious = 54.500 ac

Summary for Subcatchment 1S: Rainfall Into Recycle Pond

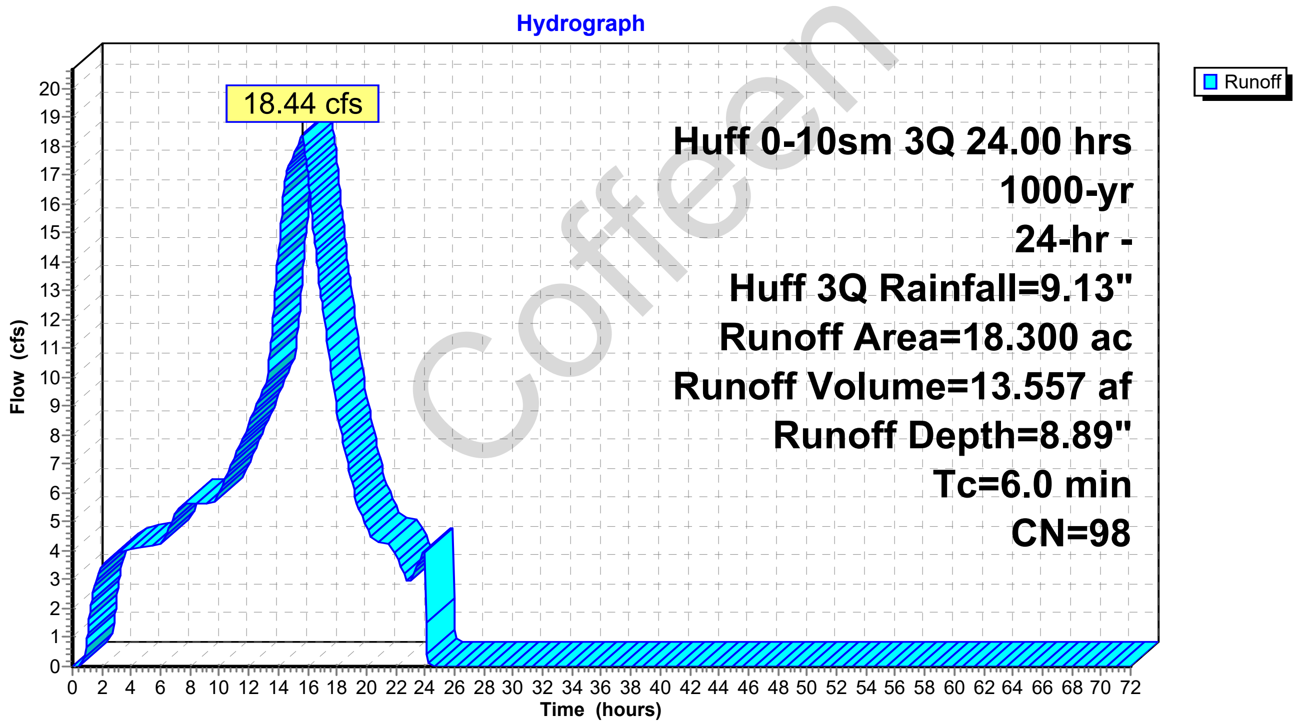
Runoff = 18.44 cfs @ 15.65 hrs, Volume= 13.557 af, Depth= 8.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 3Q 24.00 hrs 1000-yr, 24-hr - Huff 3Q Rainfall=9.13"

	Area (ac)	CN	Description
*	18.300	98	Water Surface, HSG C
	18.300		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct Fall**

Subcatchment 1S: Rainfall Into Recycle Pond



Summary for Subcatchment 4S: Rainfall Into Stack Pond

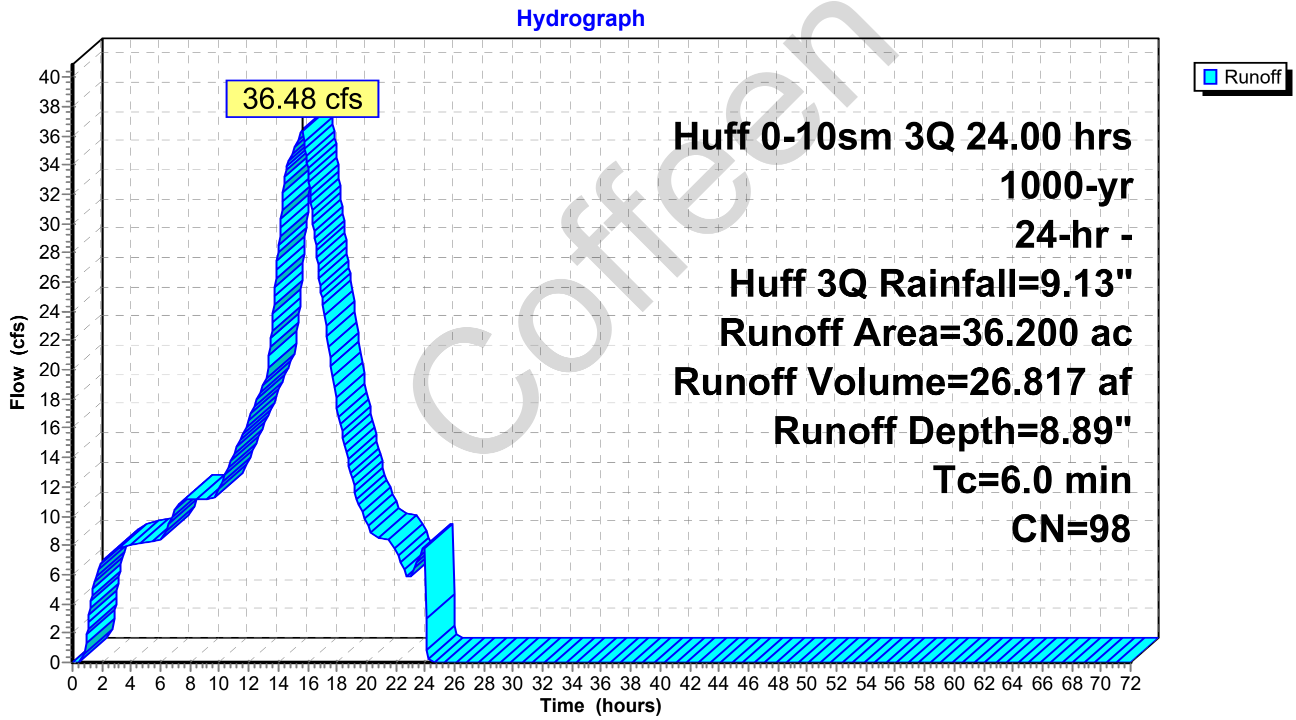
Runoff = 36.48 cfs @ 15.65 hrs, Volume= 26.817 af, Depth= 8.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 3Q 24.00 hrs 1000-yr, 24-hr - Huff 3Q Rainfall=9.13"

Area (ac)	CN	Description
36.200	98	Water Surface, HSG C
36.200		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct Fall**

Subcatchment 4S: Rainfall Into Stack Pond



Summary for Reach 5R: Transfer Channel

Inflow Area = 36.200 ac,100.00% Impervious, Inflow Depth > 5.13" for 1000-yr, 24-hr - Huff 3Q event
Inflow = 2.79 cfs @ 24.11 hrs, Volume= 15.479 af
Outflow = 2.78 cfs @ 24.20 hrs, Volume= 15.461 af, Atten= 0%, Lag= 5.3 min

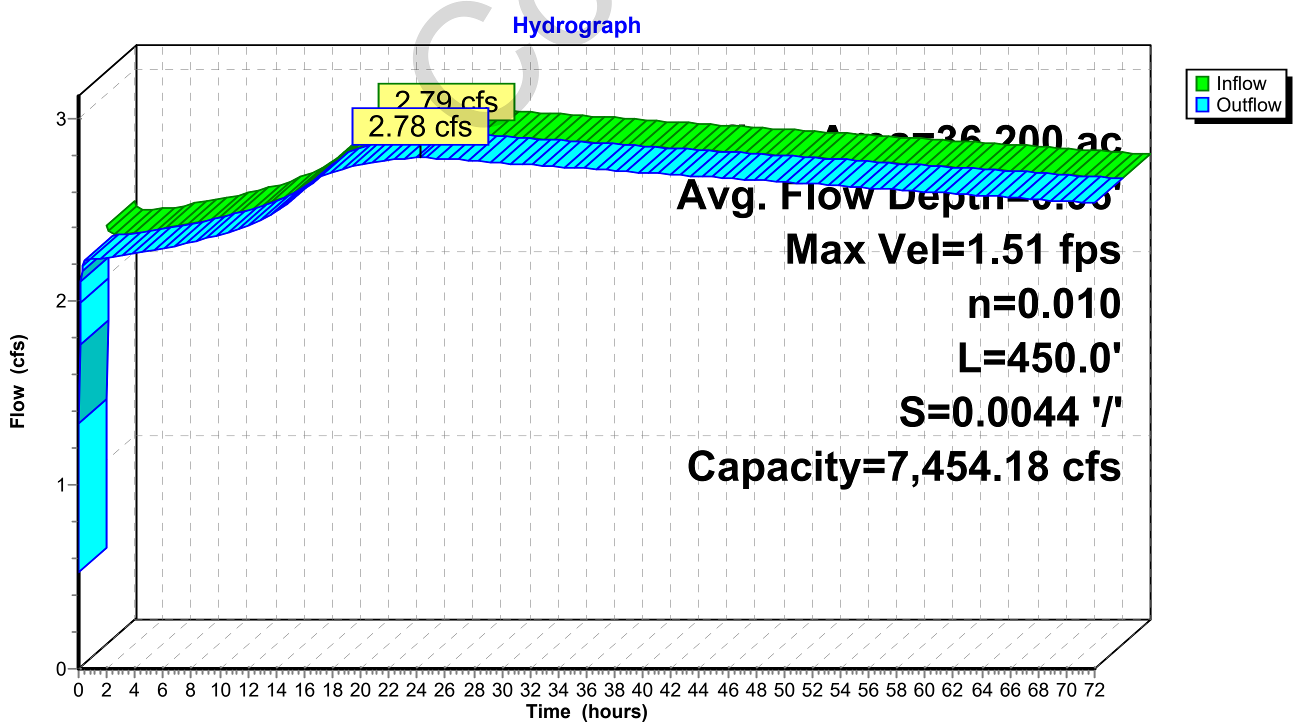
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.51 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 1.51 fps, Avg. Travel Time= 5.0 min

Peak Storage= 828 cf @ 24.20 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 6.00' Flow Area= 279.0 sf, Capacity= 7,454.18 cfs

32.70' x 6.00' deep channel, n= 0.010 PVC, smooth interior
Side Slope Z-value= 3.0 1.6 '/' Top Width= 60.30'
Length= 450.0' Slope= 0.0044 '/'
Inlet Invert= 624.00', Outlet Invert= 622.00'

‡

Reach 5R: Transfer Channel



Summary for Pond 2P: Gypsum Stack Pond

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 36.200 ac,100.00% Impervious, Inflow Depth = 8.89" for 1000-yr, 24-hr - Huff 3Q event
Inflow = 36.48 cfs @ 15.65 hrs, Volume= 26.817 af
Outflow = 2.79 cfs @ 24.11 hrs, Volume= 15.479 af, Atten= 92%, Lag= 507.8 min
Primary = 2.79 cfs @ 24.11 hrs, Volume= 15.479 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 625.18' Surf.Area= 0 sf Storage= 5,353,910 cf
Peak Elev= 625.82' @ 24.11 hrs Surf.Area= 0 sf Storage= 6,306,475 cf (952,565 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,379.1 min (2,188.8 - 809.6)

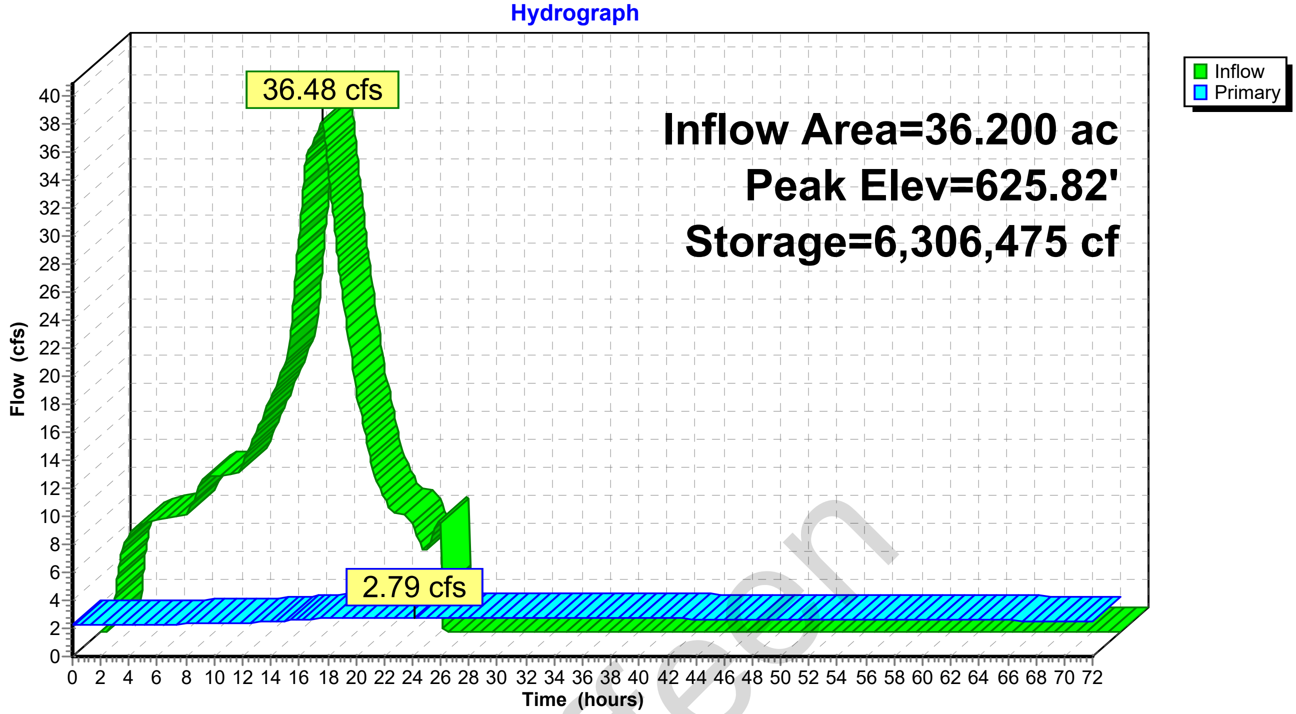
Volume	Invert	Avail.Storage	Storage Description
#1	621.10'	15,871,813 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
621.10	0
622.00	898,355
623.00	2,215,071
624.00	3,622,761
625.00	5,085,824
626.00	6,575,189
627.00	8,086,603
628.00	9,615,334
629.00	11,161,695
630.00	12,725,625
631.00	14,298,658
632.00	15,871,813

Device	Routing	Invert	Outlet Devices
#1	Primary	626.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.00 4.00 Width (feet) 45.00 60.00 75.00
#2	Primary	619.00'	**14.0" Round Culvert** L= 580.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 619.00' / 617.60' S= 0.0024 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.07 sf

Primary OutFlow Max=2.79 cfs @ 24.11 hrs HW=625.82' TW=624.06' (Dynamic Tailwater)
└─**1=Custom Weir/Orifice** (Controls 0.00 cfs)
└─**2=Culvert** (Outlet Controls 2.79 cfs @ 2.61 fps)

Pond 2P: Gypsum Stack Pond



Summary for Pond 3P: Recycle Pond

[62] Hint: Exceeded Reach 5R OUTLET depth by 1.89' @ 71.95 hrs

Inflow Area =	54.500 ac,100.00% Impervious,	Inflow Depth > 6.39"	for 1000-yr, 24-hr - Huff 3Q event	
Inflow =	21.03 cfs @	15.65 hrs, Volume=	29.018 af	
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 622.10' Surf.Area= 0 sf Storage= 9,024,347 cf
Peak Elev= 623.94' @ 72.00 hrs Surf.Area= 0 sf Storage= 10,288,140 cf (1,263,793 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	604.90'	13,809,827 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
604.90	0
605.00	193,406
607.00	824,155
609.00	1,613,462
611.00	2,487,712
613.00	3,446,903
615.00	4,502,797
617.00	5,698,519
619.00	6,966,115
621.00	8,279,014
623.00	9,634,165
624.00	10,326,769
625.00	11,023,294
626.00	11,719,818
627.00	12,416,342
628.00	13,112,867
629.00	13,809,827

Device	Routing	Invert	Outlet Devices
#1	Primary	615.00'	**45.0" Round Culvert** L= 92.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 615.00' / 613.00' S= 0.0217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 11.04 sf
#2	Secondary	615.00'	**45.0" Round Culvert** L= 92.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 615.00' / 613.00' S= 0.0217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 11.04 sf
#3	Tertiary	615.00'	**45.0" Round Culvert** L= 92.0' CPP, square edge headwall, Ke= 0.500

			Inlet / Outlet Invert= 615.00' / 613.00' S= 0.0217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 11.04 sf
#4	Device 1	624.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	624.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 3	624.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=622.10' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 121.56 cfs potential flow)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=622.10' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 121.56 cfs potential flow)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=622.10' (Free Discharge)
└─**3=Culvert** (Passes 0.00 cfs of 121.56 cfs potential flow)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Recycle Pond