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July 10, 2025

Brian Rath Land Quality Bureau Iowa Department of Natural Resources 6200 Park Avenue, Suite 200 Des Moines, IA 50321

Subject: Surface Impoundment Cap Disturbance Operations Plan

Sixth Street Generating Station, Cedar Rapids, Iowa

Permit #57-SDP-34-04C

Mr. Rath:

On behalf of Interstate Power and Light Company (IPL), Alliant Energy is providing the enclosed Surface Impoundment Cap Disturbance Operations Plan, developed by SCS Engineers, for activities related to compliance with the federal Coal Combustion Residuals (CCR) Rule. This plan has been developed to meet the requirements of Iowa Administrative Code (IAC) 567 Chapter 102.16 and in accordance with related guidance.

Thank you for your review of this plan. We respectfully request the Department's review and concurrence prior to drilling activities that are scheduled for August 4-5, 2025. If you have any questions or concerns, please contact me via email (jeffreymaxted@alliantenergy.com) or by phone (608-458-3853).

Sincerely,

Jeff Maxted

Manager – Environmental Services and Corporate Sustainability

Alliant Energy Corporate Services, Inc.

CC: Amanda Blank, Matt Bizjack, Chad Wall – Alliant Energy Rick Guenther, Brad Kraemer, Tom Karwoski – SCS Engineers

SCS ENGINEERS

July 10, 2025 File No. 25225170.00

Privileged and Confidential Attorney-Client Communication

Brian L. Rath, P.E. Land Quality Bureau Iowa Department of Natural Resources 6200 Park Avenue, Suite 200 Des Moines, IA 50321

Subject: CCR Surface Impoundment Cap Disturbance Plan

Interstate Power and Light Company - Former 6th Street Generating Station

Permit No. 57-SDP-34-04

Dear Mr. Rath:

On behalf of Interstate Power and Light Company (IPL), SCS Engineers (SCS) has prepared an operations plan for coal combustion residual (CCR) surface impoundment cap disturbance at the former 6th Street Generating Station (6th Street). This plan has been developed in accordance with the Iowa Department of Natural Resources (IDNR) Dump Disturbance Guidance. The enclosed CCR Surface Impoundment Cap Disturbance Plan (Plan) describes the procedures for cap disturbance within the closure area at 6th Street. Once approved by IDNR, future disturbances of the cap or waste within the cap limits at 6th Street will be performed using the enclosed Plan.

Eight Geoprobe borings and six monitoring wells will be advanced through the cap, outside of the waste limits, this summer and fall. Project-specific details are provided in Attachment A to the Plan.

If you have any questions or concerns, please contact Jeff Maxted with Alliant Energy via email (jeffreymaxted@alliantenergy.com) or by phone (608-458-3853).

Sincerely,

Rick J. Guenther Jr. Senior Project Engineer

SCS Engineers

Brad Kraemer Project Manager SCS Engineers

RJG/AJR/EJN/TK/BRK

cc: Jeff Maxted, Alliant Energy Matt Bizjack, Alliant Energy

Encl. CCR Surface Impoundment Cap Disturbance Plan

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CCR Surface Impoundment Cap Disturbance Plan

Former 6th Street Generating Station Southwest of Coe Road NE Cedar Rapids, Iowa 52402

Prepared for:

Interstate Power and Light Company 200 1st Street S.E. Cedar Rapids, Iowa 52402

SCS ENGINEERS

25225170.00 | July 10, 2025

2830 Dairy Drive Madison, WI 53718-6751 608-224-2830

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Attachments

Attachment A Project Specific Information
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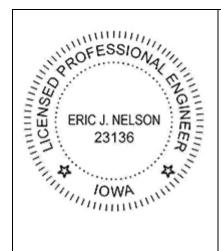
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CERTIFICATION PAGE

Eric J. Nelson, a licensed Professional Engineer in the State of Iowa, has reviewed the CCR Surface Impoundment Cap Disturbance Plan, dated July 10, 2025, for the former Sixth Street Generating Station surface impoundments closure area, located in Cedar Rapids, Iowa.

Respectfully Submitted,

SCS ENGINEERS



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of lowa.

7/10/2025

Éric J. Nelson, PE (date)

Iowa License No. 23136

My license renewal date is: 12/31/2026

CCR Surface Impoundment Cap Disturbance Plan, July 2025.



1.0 INTRODUCTION

1.1 PURPOSE

This document addresses the cap and waste management requirements associated with activities that disturb the coal combustion residual (CCR) surface impoundment cover system associated with the former 6th Generating Station (6th Street) located at 509 6th Street NE, Cedar Rapids, Iowa 52402. The location of the CCR surface impoundments is shown on **Figure 1**.

The purpose of this CCR Surface Impoundment Cap Disturbance Plan (Plan) is to:

- 1. Inform the Contractor of the expected nature of the waste material (CCR) below the cover system.
- 2. Inform the Contractor of protocols for the disturbance of the cover system and handling of waste.
- 3. Provide protocols that the Contractor must follow if unexpected materials/conditions are encountered during project activities. These protocols are being implemented to maintain compliance with environmental regulations and policies regarding classification and management of CCR.
- 4. Inform the Contractor and the Iowa Department of Natural Resources (IDNR) of the project activities, handling and disposal protocols for CCR, and work requirements associated with regulatory compliance for waste disposal.

This Plan has been prepared to comply with the requirements of Iowa Administrative Code (IAC) 567 Chapter 102.16. Additionally, the following regulations, codes, and permits may apply to project activities:

- IDNR Sanitary Disposal Project Closure Permit Number 57-SDP-34-04C
- Fugitive Dust Plan developed per 40 CFR 257.80(b)
- Final Cover System requirements in 40 CFR 257.102(d)(3)

All waste materials and soils which appear to be contaminated with wastes will be handled, transported, and disposed of at a permitted facility in compliance with regulations listed above and this Plan.

1.2 SITE BACKGROUND

1.2.1 Location & Legal Description

Interstate Power and Light Company Former 6th Street Generating Station 509 6th Street NE (Former) Latitude (Decimal degree): 41.986708 Longitude (decimal degree): -91.661864

Cedar Rapids, IA 52402

USEPA EPA Registry ID: 110013397458

See Figure 1 Site Location Map.

The 6th Street CCR surface impoundments are situated in the S1/2 of the NE1/4of Section 21, Township 83 North (T83N), Range 7 West (R7W), of the Fifth Principal Meridian, in Linn County, Iowa.

1.2.2 Site History

Prior to closure construction, the 6th Street facility included four existing unlined CCR surface impoundments including Pond 1, Pond 2, Pond 3, and Pond 4.

When the generating station was operating, bottom ash and plant waste waters from the coal burning process were discharged to Pond 1 or Pond 2. All four ponds were hydraulically connected via culverts with the option for water to bypass Pond 1 and discharge directly to Pond 2. Ponds 1 and 4 were also connected to allow water in Pond 1 to discharge to Pond 4 while Pond 2 was cleaned. Both Ponds 1 and 2 were small and were historically dredged approximately every 1 to 2 years. During normal plant operations, water in Ponds 1, 2, and 3 discharged to the next pond in series. During plant operations, Pond 4 discharged to a wetland that drains to the northwest under the railroad embankment to Cedar Lake. The Pond 4 discharge was covered by Iowa National Pollutant Discharge Elimination System (NPDES) Permit No. 5715109. In addition to CCR and plant wastewater, the ponds received runoff from the I-380 bridge via deck drains. Now that the generating station has been decommissioned, the only water draining to the ponds is from direct precipitation and runoff from the I-380 deck drains.

In 2017, IPL completed closure construction activities for the ponds by consolidating CCR in the former pond footprints and placing a cap (**Figure 2**). **Sheet 1** shows the existing conditions following closure construction. The final cover system (cap) is described in **Section 1.2.3** below.

1.2.3 Final Cover System (Cap)

The closure area has three different cover systems:

- Soil Final Cover (**Detail 1, Sheet 2**)
 - Three inches of topsoil
 - Nine inches of un-compacted fill material (rooting zone)
 - Twenty-four inches of compacted fill material
- Pond Area Final Cover (**Detail 2, Sheet 2**)
 - Twelve inches of pond stone
 - Geotextile cushion
 - Textured, face up, laminated geosynthetic clay liner (GCL)
- Swale Final Cover (Detail 3, Sheet 2)
 - Three inches of topsoil
 - Nine inches of un-compacted fill material (rooting zone)
 - Twenty-four-inches of compacted fill material
 - Textured, face up, laminated GCL

The final cover design and materials meet the federal CCR rule criteria for final cover systems in 40 CFR 257.102(d)(3).

The compacted soil cover was placed in 4-inch to 6-inch lifts and compacted to meet the compaction testing requirements of the CQA Plan (**Appendix C**).

1.3 FACILITY CONTACTS, ROLES, AND RESPONSIBILITIES

Property/Facility Owner: Interstate Power and Light Company

509 6th Street NE (former) Cedar Rapids, IA 52401

Responsible Official: Amanda Blank, PE, Director of Generation

Phone: 1-608-458-6316

Project Contact: Jeff Maxted, Manager – Environmental Services

& Corporate Sustainability, Phone: 1-608-458-3853 Alliant Energy, 4902 N. Biltmore Lane, Madison, WI 53718

Owner of the facility (hereby known as Owner). IPL is responsible for maintaining compliance with State and Federal regulations during

and after closure. IPL selected the parties charged with

implementing the design, CQA, construction of cover system, and continued maintenance of the cover system. IPL is responsible for the continued maintenance of the facility and documentation of

cap disturbance.

Engineer: SCS Engineers

2830 Dairy Drive Madison, WI 53718

Contact: Eric J. Nelson, PE Phone: 608.224.2830

Engineer for the closure design, final cover construction, and

development of this Plan.

Construction Oversight Representative:

Project Specific, See **Attachment A**. IPL will hire a firm to oversee the disturbance and repair of the cap. The firm will assist IPL with

documentation and drafting the cap repair documentation letter.

Contractor(s): Project Specific, See Attachment A.

2.0 OPERATIONS PLAN

The potential maintenance of bridge piers and other related structures, well installations, and other general cap disturbance activities will be overseen and documented when they occur. Specific project details will be added to **Attachment A** prior to work being completed. The following sections describe the requirements when the cap is disturbed and when CCR is exposed.

2.1 DEWATERING

If dewatering of excavations is required to complete the work, the water should be treated as CCR contact water. Water exposed to CCR shall be containerized and disposed of at a permitted disposal facility or in accordance with a wastewater discharge permit. IPL will provide information required to prepare a profile for disposal approval at the permitted facility.

Water above the cover within the pond final cover area can be dewatered as clean storm water under NPDES General Permit No. 9 and General Permit No. 2, as needed.

2.2 EXPOSED CCR

When disturbance of the cap requires leaving the cap open for more than 1 day of work the exposed CCR should be covered at the end of the workday. The Contractor shall cover with plastic sheeting or other methods approved by the Owner and anchored in place.

2.2.1 Storm Water Management

Open cap areas with exposed CCR will be protected from the potential exposure to storm water run-on. As needed, the Contractor will divert storm water run-on from entering open excavation areas through the cap to limit the creation of contact water. The Contractor will control run-on by placing temporary berms around the excavation area. The Contractor will cover exposed CCR with plastic sheeting (or other approved cover) when the cap will be open for more than a day to protect CCR from rain. Contractor will anchor plastic sheeting on all sides of the excavation. When covering the excavation is not feasible, Contractor will manage CCR contact water within the excavation area and per **Section 2.1**.

2.2.2 Dust Control

When CCR is exposed, fugitive dust will be controlled in the work area by following the practices listed in CCR Fugitive Dust Control Plan that was in effect during operation of the CCR units. The current plan, dated November 8, 2024, is attached (Attachment B).

2.3 CCR DISPOSAL

CCR and CCR-impacted soil will be directly loaded into disposal trucks to avoid contaminating areas outside the open excavation limits for large excavation areas. When excavation is by hand methods or small equipment, place material directly into truck or provide a separation pad (plywood/plastic sheeting) adjacent to the excavation. Small excavations in which CCR is removed, will be backfilled to replace the CCR that is removed, and this also applies to backfilling small protrusions (i.e., geoprobe soil borings, utility poles).

All CCR and CCR-impacted soil will be disposed of at a licensed disposal facility or replaced in the excavation and capped. No new CCR or other waste material may be added to a CCR unit that is closed or has initiated closure. IPL can provide a profile for disposal approval at a permitted disposal facility.

2.4 EQUIPMENT DECONTAMINATION

All equipment that comes into contact with CCR or CCR contact water shall be cleaned. The Contractor will collect all cleaning water and dispose of it as described in **Section 2.1**.

2.5 RECOGNITION AND RESPONSE TO UNEXPECTED CONDITIONS

The Contractor should anticipate encountering CCR, coal, and/or general fill below the cap. No non-CCR wastes or other foreign materials are expected within the currently capped closure areas.

However, if unexpected conditions are encountered during removal of the cap and/or excavation, the Contractor will pause the work and consult with IPL and IPL's oversight Contractor to discuss next steps.

2.6 CAP REPAIR

All cap disturbance will be repaired following completion of work.

2.6.1 Minor Penetrations

When the cap is disturbed with small penetrations such as utility poles or monitoring wells the cap can be repaired by two methods:

- Utility Boot see Sheet 3, Detail 2
- Bentonite Plug See Sheet 3, Detail 3

2.6.2 Excavations

When the cap needs to be removed in areas larger than a single penetration, the cap will be replaced with the existing cap materials and/or additional soil, geosynthetics, and topsoil. Cap materials will meet the requirements of the Construction Quality Assurance / Quality Control (CQA) Plan (Attachment C).

Excavations will be backfilled with CCR from the excavation or with general fill to the previous bottom of cap elevation prior to cap replacement. Small excavations in which CCR is removed, will be backfilled to replace the CCR that is removed, and this also applies to backfilling small protrusions (i.e., geoprobe soil borings, utility poles). CCR/general fill shall be compacted prior to placement of cap (Sheet 2, Detail 1 through 3). The compacted soil shall be placed in 4- to 6-inch lifts and compacted as described in the CQA Plan.

2.7 RESTORATION

Disturbed cap areas will be restored by seeding, fertilizing, and mulching. The Contractor will place seed, fertilizer, and mulch to maximize the germination and viability of the grass seed, and minimize the seed loss due to erosion. Fertilizing, seeding, and mulching will be performed within 7 days of the cap repairs unless hindered by weather or season, in which case restoration will be completed as soon as viable.

2.7.1 Permanent Seed

Seed will meet the requirements of the CQA Plan or approved substitution seed mix. The Contractor will place seed in accordance with the CQA Plan and Iowa Department of Transportation (DOT) specifications Section 2601.

2.7.2 Fertilizer

The Contractor will obtain a fertilizer recommendation from a landscape professional based on topsoil used in the repairs.

2.7.3 Mulch

The Contractor will provide and install mulch in accordance with lowa DOT specifications Section 2601.

2.7.4 Rolled Erosion Control Product

If the cap repair work is on slopes greater than or equal to 4H:1V, the Contractor will install a rolled erosion control product in accordance with Part 3.08 of Section 9040, SUDAS Standard Specifications.

2.8 OVERSIGHT

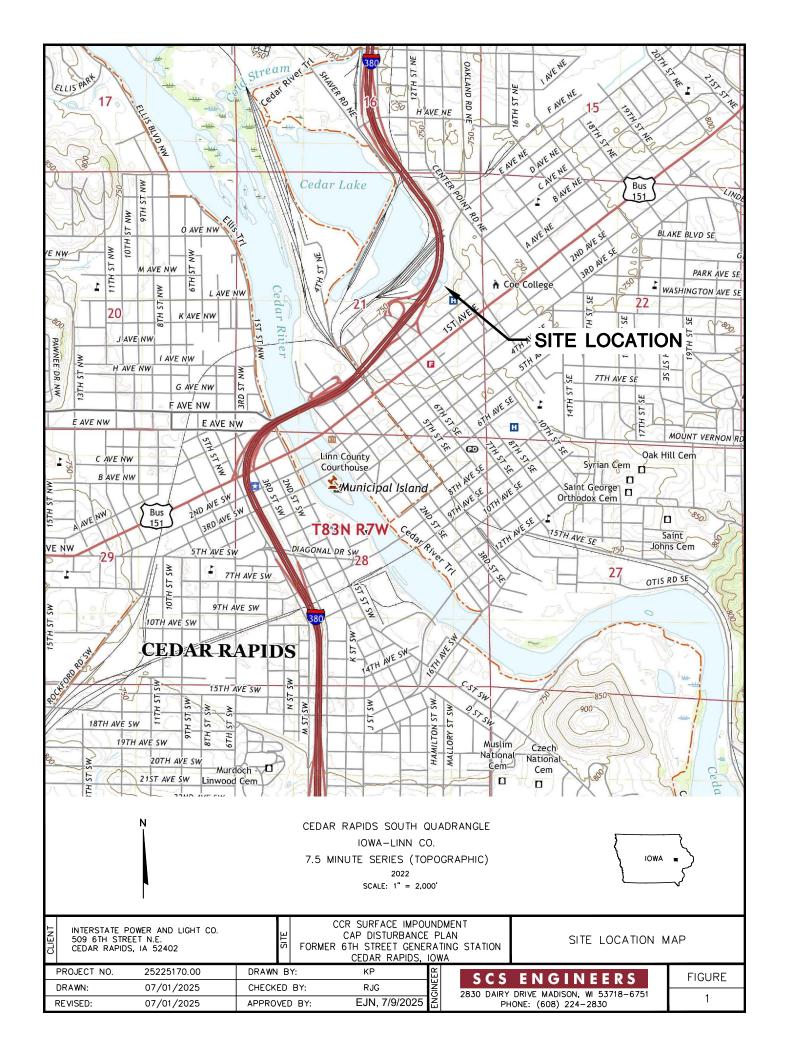
IPL will hire a professional engineering firm to oversee the disturbance and repair of the cap. Field oversight staff will document the work performed by the Contractor with daily reports and photos. The Contractor will provide necessary information, including schedule, planned methods, material tests (if needed), and disposal tickets to the oversight staff and IPL.

3.0 REGULATORY REPORTING

Upon completion of a cap disturbance project, IPL or the firm providing field oversight will compile documentation provided by their field staff and the Contractor. A report will be provided to IDNR to document the quantities of waste managed and the cap repairs.

Figures

- 1 Site Location Map
- 2 Site Layout





200 SCALE: 1" = 200'

CCR SURFACE IMPOUNDMENT
CAP DISTURBANCE PLAN
FORMER 6TH STREET GENERATING STATION
CEDAR RAPIDS, IOWA

SETTLING POND AREA

LEGEND

WELL

--- LIMITS OF FINAL COVER

ABANDONED MONITORING

ABANDONED VIBRATING WIRE PIEZOMETER

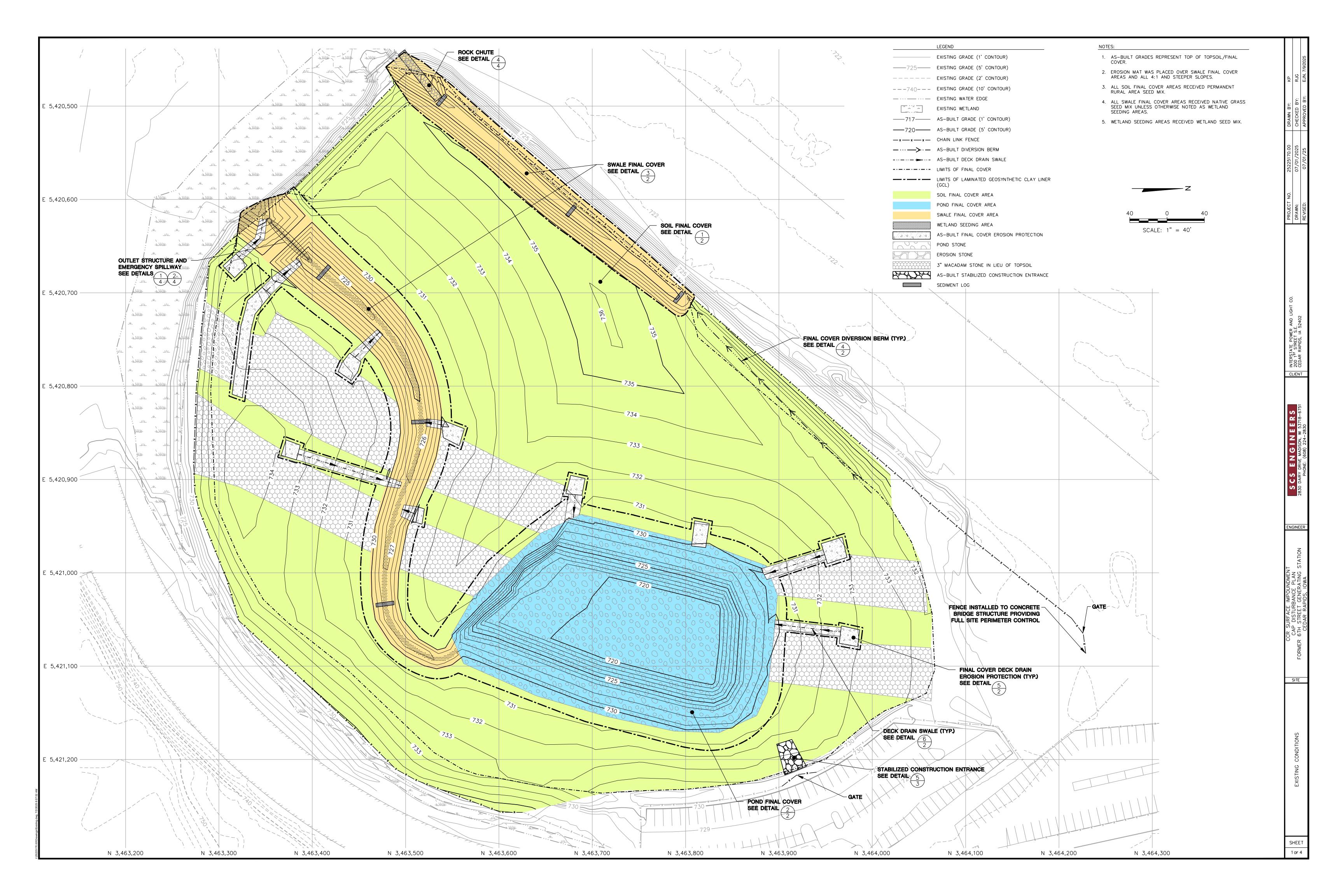
FIGURE 2

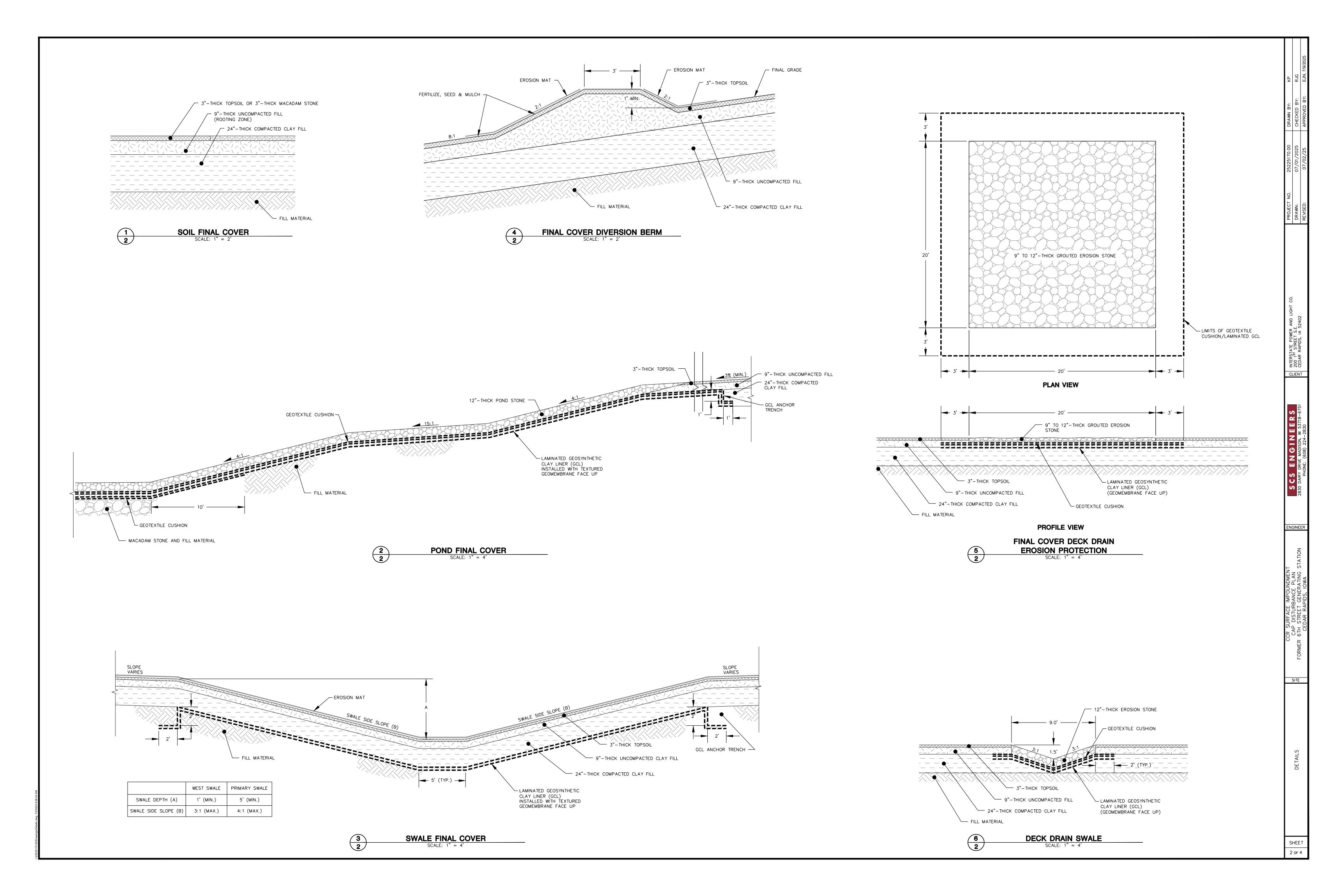
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REVISED:	07/02/2025	APPROVED BY:	EJN, 7/9/2025

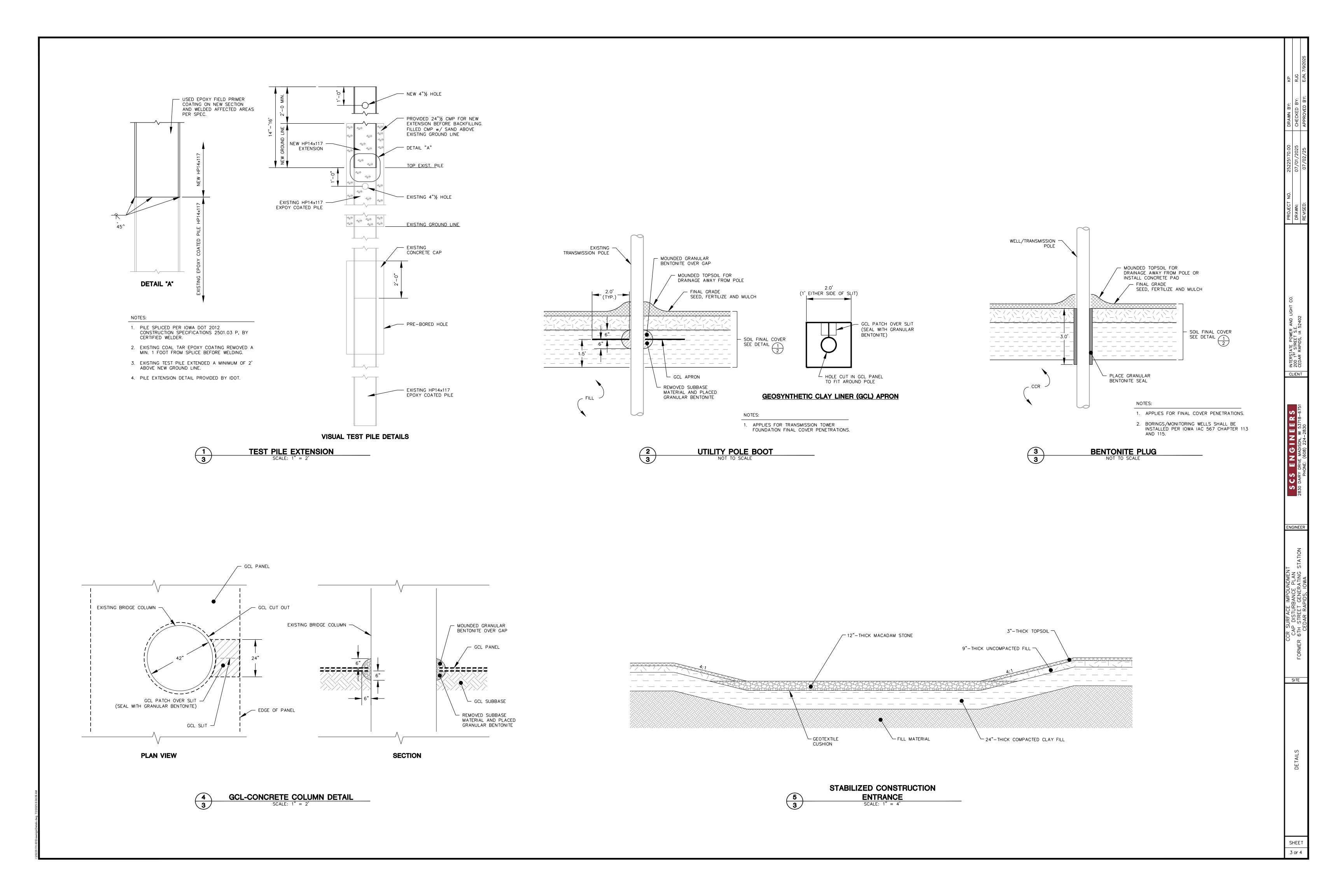
SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 INTERSTATE POWER AND LIGHT CO. 509 6TH STREET N.E. CEDAR RAPIDS, IA 52402

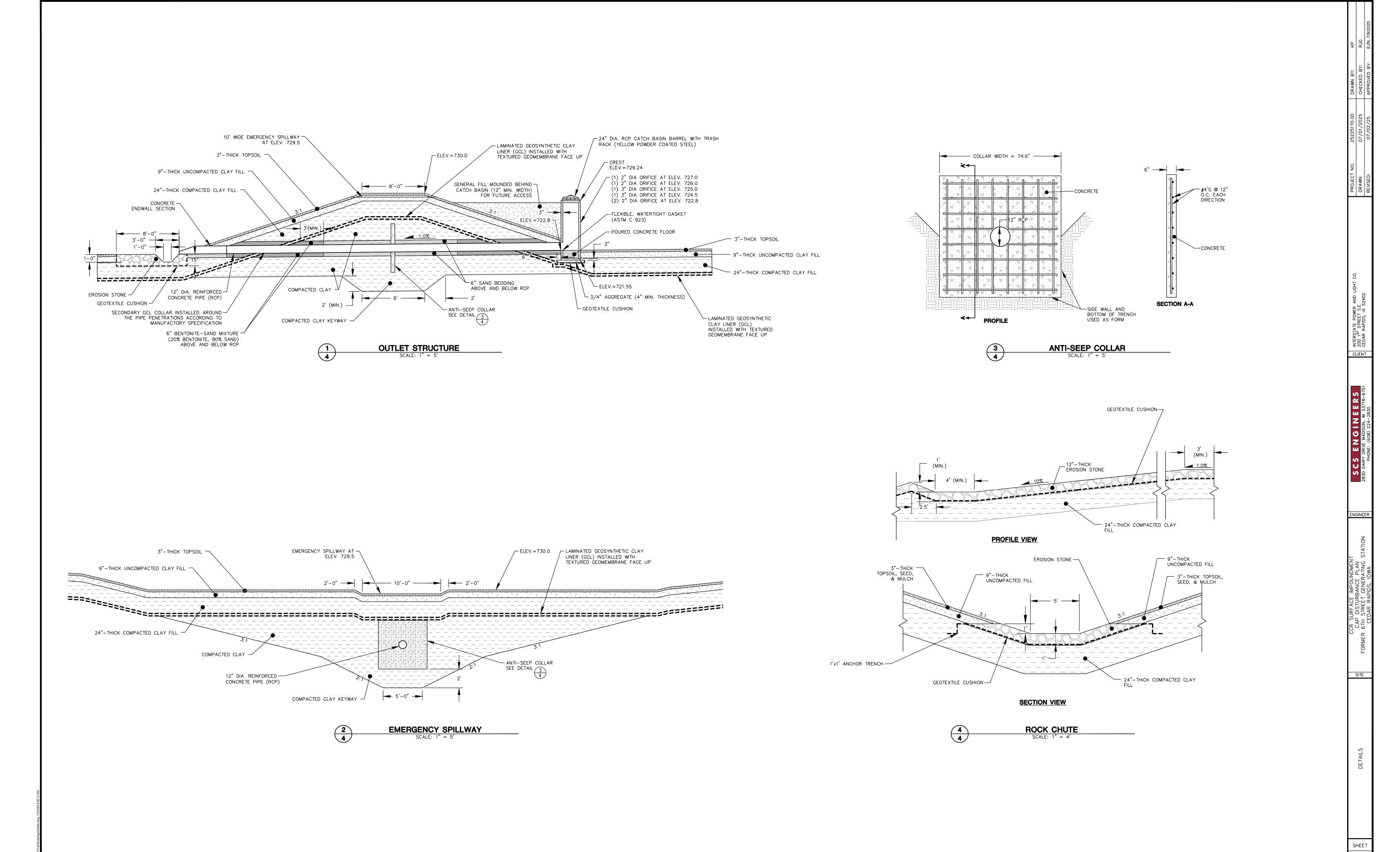
Plan Sheets

- 1 Existing Conditions
- 2 Details
- 3 Details
- 4 Details









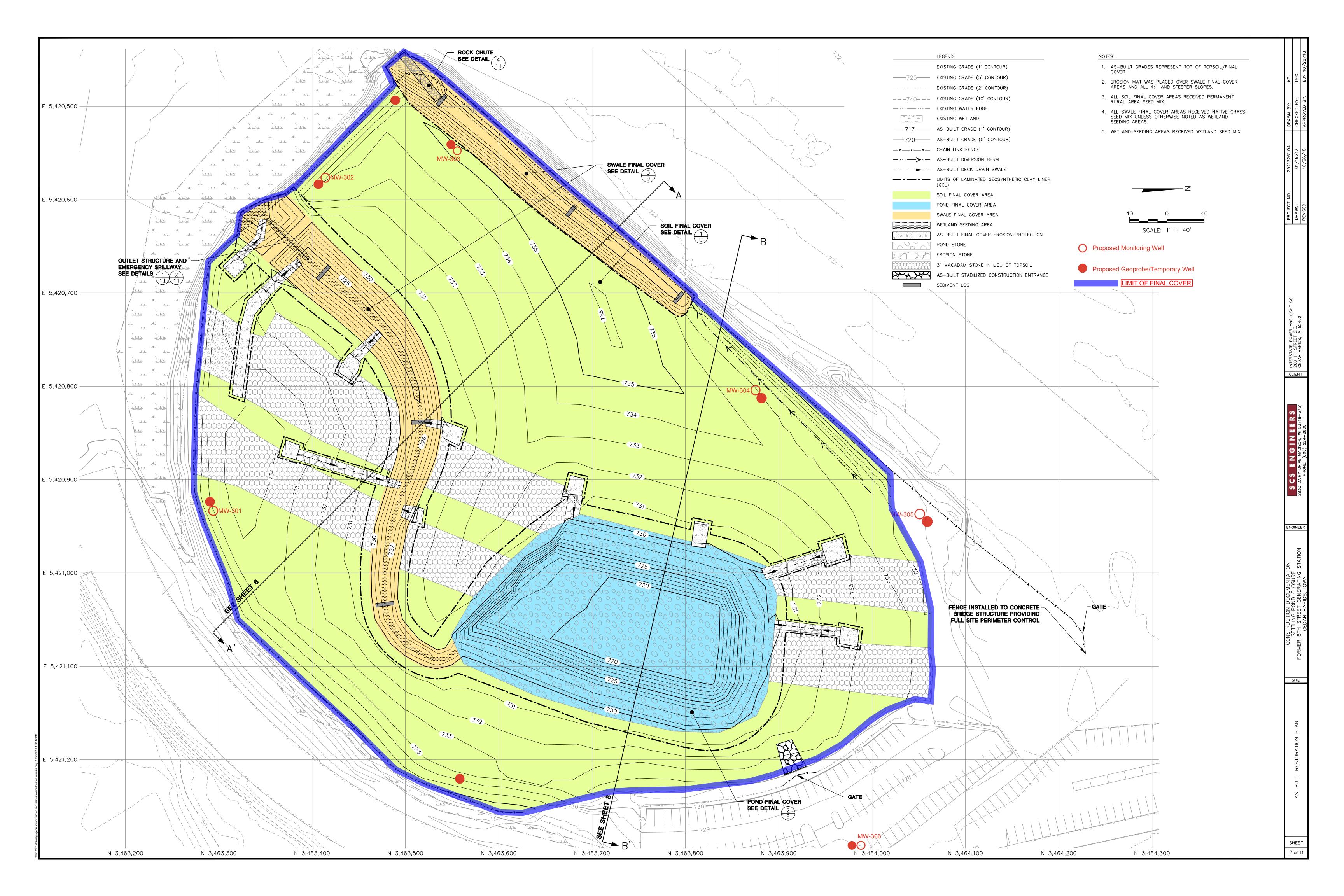
Attachment A Project Specific Information

CCR Surface Impoundment Cap Disturbance Project Details

Former Sixth Street Generation Station, Cedar Rapids, Iowa Closure Permit No. 57-SDP-34-04C

Project: Geoprobe	Borings and Groundwater Monitoring Network Installation
Est. Start/End Dates	August 2025 to December 2025
Contractor	SCS Engineers 2830 Dairy Drive, Madison, WI 53718Contact: Brad Kraemer, Project Manager/Senior Hydrogeologist Phone: 1-608-216-7350, (cell) 1-608-893-4062 Terracon 3105 Capital Way, Suite 5, Cedar Falls, Iowa 50613 Contact: Dave Cleary, Department Manager
Est. Volume of CCR Removal	Phone: 1-319-268-4728, (cell) 1-319-231-2882 To be determined (TBD)
Oversight Representative	SCS Engineers 2830 Dairy Drive Madison, WI 53718 Contact: Eric J. Nelson, PE Phone: 1-608-216-7352
Project Description	The scope of services includes eight Geoprobe borings with installation of 1-inch-diameter wells and installation of six monitoring wells. The 1-inch wells located in the Geoprobe boreholes will be abandoned with bentonite per IDNR code when the six monitoring wells are installed. See Figure A for the location of the cap disturbance and CCR excavation.

Attach additional information to this Attachment (e.g., figures showing proposed disturbance including borings, test pits, excavation limits, etc.).



Attachment B Fugitive Dust Control Plan



Interstate Power and Light Company Sixth Street Generating Station (SSS)

Coal Combustion Residuals (CCR) Fugitive Dust Control Plan

November 8, 2024

The procedures in this plan apply to the following CCR unit at this facility:

Legacy CCR Surface Impoundment

SSS Closed Ash Pond

Coal Combustion Residuals (CCR) Fugitive Dust Control Plan for Legacy CCR Surface Impoundments

November 8, 2024

Purpose of CCR Fugitive Dust Control Plan

This plan describes the measures used to minimize fugitive dust from facilities with legacy CCR surface impoundments¹, the procedure for logging citizen complaints involving CCR fugitive dust events, and the procedure for periodic review of this plan. This plan has been developed in accordance with 40 CFR 257.80(b).

Measures for Controlling Fugitive Dust

This facility permanently ended the combustion of coal and does not generate CCR. The only remaining source of CCR fugitive dust associated with this impoundment is from closure or maintenance activities required at this facility in the future.

The following measures are appropriate for minimizing CCR from becoming airborne from CCR surface impoundments at this facility:

- Establishing and enforcing a vehicle speed limit of 15 mph or less.
- Covering all open-bodied trucks that are transporting CCR off site.
- Minimizing fall distances when handling or transferring CCR.
- Utilizing a water truck to apply water to CCR and maintenance/closure areas as needed.

These measures are applicable to the CCR managed at this facility and appropriate for the conditions at this site because they are compatible with current operations and they effectively minimize the generation of fugitive dust.

Procedure for Logging Citizen Complaints

Citizen complaints pertaining to fugitive dust will be managed in accordance with Alliant Corporate Policy ENV-107. Specifically, the complaint must be reported to Environmental Services (1) via phone call and (2) in writing by submitting a completed Environmental Incident Report to Environmental Services within 10 business days. Citizen complaints will be tracked within the Alliant Environmental Management Information System ("ENVIANCE").

Procedure for Periodic Review of CCR Fugitive Dust Control Plan

The CCR Fugitive Dust Control Plan will be reviewed annually, and updated as necessary, in conjunction with preparation of the Annual CCR Fugitive Dust Control Report [40 CFR 257.80(c)].

During the periodic review, staff will evaluate each measure for controlling fugitive dust to ensure that it is still appropriate for minimizing CCR from becoming airborne at the facility, will

¹ "CCR", "CCR surface impoundment", and "Legacy CCR surface impoundment" are defined at 40 CFR 257.53.

verify that the procedure for logging complaints is sufficient, and will evaluate other operations changes at the facility to determine whether additional dust control measures should be added.

- END -

P.E. Certification

I, the undersigned, hereby certify that this CCR Fugitive Dust Control Plan meets the requirements of 40 CFR 257.80(b), was prepared by me or under my direct supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Signature	ERIC J. N. 231
Eric J. Nelson	_
First and Last Name	
23136	_
P.E. License Number	
November 4, 2024	_

Date

Attachment C CQA Plan

SCS ENGINEERS















Construction Quality Assurance

Coal Combustion Residue Settling Ponds 6th Street Generating Station Cedar Rapids, Iowa

Prepared for:

Interstate Power and Light Company

6th Street Generating Station 509 6th Street NE Cedar Rapids, lowa 52402

Prepared by:

SCS ENGINEERS

2830 Dairy Drive Madison, Wisconsin 53718-6751 (608) 224-2830

> December 2014 File No. 25212261.02

Offices Nationwide www.scsengineers.com

Construction Quality Assurance Plan Coal Combustion Residue Settling Ponds 6th Street Generating Station Cedar Rapids, Iowa

Prepared for:

Interstate Power and Light Company

6th Street Generating Station 509 6th Street NE Cedar Rapids, lowa 52402

Prepared by:

SCS ENGINEERS

2830 Dairy Drive Madison, Wisconsin 53718-6751 (608) 224-2830

> December 2014 File No. 25212261.02

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this Construction Quality Assurance (CQA) Plan is to address the quality assurance during the construction of the coal combustion residue (CCR) settling ponds final cover system at the Interstate Power and Light Company – 6th Street Generating Station, including all earthen materials (general fill, clay fill, aggregate, general soil, and topsoil) and synthetic materials (geotextile and laminated geosynthetic clay liner [GCL]).

This CQA Plan provides procedures that will provide that components of the final cover system are constructed in a manner that will maximize their performance and will safeguard components from damage during construction.

The scope of this CQA Plan includes general CQA requirements concerning roles, responsibilities, and qualifications of the parties involved; the preconstruction meeting, the geosynthetic preconstruction report, general inspection and documentation procedures, and the documentation report. This CQA Plan establishes requirements for the construction procedures and observation, field and laboratory testing frequency and methods, and acceptance for each component of the liner and final cover systems. Geosynthetic testing and acceptance standards are based on the Geosynthetic Research Institute (GRI) Test Methods GM 13 and GM 17, and on currently accepted industry standards and practice.

This plan is intended to serve as a guide and can be modified to reflect current industry standards with regard to laboratory testing methods, testing procedures, testing requirements, and applicable regulations. Any changes from this plan will be discussed in the geosynthetics preconstruction report and/or the construction documentation report as required.

The following sources were used in developing this plan:

- Geosynthetic Research Institute, GRI Test Method GCL 3, "Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)," revision 2, July 26, 2010.
- Geosynthetic Research Institute, GRI Test Method GT12(a), "Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials," revision 1, December 18, 2012.
- American Society for Testing and Materials, *Annual Book of ASTM Standards*, most recent version.
- EPA Technical Guidance Document EPA/530-SW-86-031 titled "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities."

1.2 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control are defined as follows:

- Quality assurance A planned and systematic pattern of all means and actions designed to provide adequate confidence that material or services meet contractual and regulatory requirements. This is typically performed to ensure that delivered materials or services are of desired quality.
- Quality control Those actions that provide a means to measure and regulate the characteristics of a material or service to meet contractual and regulatory requirements. This typically is performed by or for the provider of the materials or services as a control mechanism on the quality of the provider's efforts.

In the context of this CQA Plan, the terms are further defined as follows:

- Quality assurance refers to the means and actions employed by the CQA Officer to ensure conformity of the systems' installation with the CQA Plan, the construction specifications, and the construction plans.
- Quality control refers to those actions taken by the manufacturer, fabricator, or
 construction/installer to provide materials and workmanship that meet the
 requirements of the CQA Plan, the construction plans, and the construction
 specifications. Some testing efforts required by this CQA Plan may serve as both
 quality control and quality assurance measures.

1.3 GENERAL TESTING REQUIREMENTS

This CQA Plan includes references to test procedures of the American Society for Testing and Materials (ASTM) and the GRI. Test procedure references are always to the latest approved version up to the date of this document, unless specifically stated otherwise in this document.

Testing will be performed in strict accordance with the referenced test procedure and the description included in this plan, unless indicated otherwise. Any deviations to test procedures called out in this plan must be approved, in writing, by the CQA Officer or Owner prior to commencement of any work.

2.0 CQA ROLES, RESPONSIBILITIES, AND QUALIFICATIONS

2.1 CQA OFFICER

The CQA Officer will supervise and be responsible for all observations, testing, and related construction documentation as described in this CQA Plan. The CQA Officer will be responsible for preparing the construction acceptance report to certify substantial compliance

with the appropriate permit and regulatory agency. The CQA Officer will be a professional engineer registered in the state of Iowa. The owner or operator shall notify the Iowa Department of Natural Resources (IDNR) of the designated CQA officer and provide the department with that person's contact information.

The CQA Officer may delegate daily observation, documentation, testing, and sampling duties to a qualified technician or engineer with experience in the assigned aspect of construction that will serve as the Resident Project Representative (RPR). Although these duties may be delegated, the CQA Officer will retain the responsibility for these activities.

2.2 RESIDENT PROJECT REPRESENTATIVE

The RPR will carry out daily observation, documentation, testing, and sampling duties under the direct supervision of the CQA Officer. The RPR will be a qualified technician or engineer with experience in the assigned aspect of construction. The RPR will observe and document construction and installation procedures. The RPR will prepare daily summary reports and will routinely transmit the reports to the CQA Officer. The RPR will immediately notify the CQA Officer of problems or deviations from the CQA Plan or construction plans and specifications. Reporting, documentation, and resolution of problems and deficiencies will be carried out as described in **Section 4.0**. The RPR will not have authority to approve design or specification changes without the consent of the CQA Officer and the Owner.

2.3 SOILS TESTING LABORATORY

The soils testing laboratory retained will be experienced in construction soil testing in accordance with ASTM and other applicable standards. The selected laboratory will be responsive to the project needs by providing test results within reasonable time frames. This will include providing verbal communication on the status of ongoing tests and immediate communication of test results as needed to facilitate ongoing construction. Final laboratory reports will be certified by the soil testing laboratory and submitted to the CQA Officer.

2.4 CONSTRUCTION CONTRACTOR

The Construction Contractor's role will be to furnish earthwork, construction, and geosynthetics installation, and to provide overall construction responsibility for the completion of the liner or final cover component. The Construction Contractor will be experienced in final cover construction and be familiar with geosynthetic installations. The term "Contractor" is used interchangeably with "Construction Contractor" in this plan.

3.0 PRECONSTRUCTION ACTIVITIES

3.1 PRECONSTRUCTION MEETING

Prior to CCR settling pond closure construction at the site, a preconstruction meeting will be held. This meeting will include the parties involved in the construction, including the CQA Officer or designated representative, the RPR, the Construction Contractor, and the Owner.

The purpose of this meeting is to begin the planning and coordination of construction tasks, to identify potential problems that might cause difficulties and/or delays in construction, to properly interpret the design intent, and to present the CQA Plan to all of the parties involved. It is important that the rules regarding testing, repairs, etc., be known and accepted by each party to this plan.

Specific topics considered for this meeting include the following:

- Review critical design details of the project, including the plans and specifications.
- Review measures for surface water runoff and siltation control.
- Make appropriate modifications to the CQA Plan (if necessary).
- Review the roles and responsibilities of each party.
- Review lines of authority and communication.
- Review methods for documenting and reporting and for distributing documents and reports.
- Review requirements of the soil testing laboratory regarding sample sizes, methods of collection, and shipment. Also, review turn times for sample data and their implications on the construction schedule, pending receipt of acceptance data.
- Review the number and locations of the tests required for soil components.
- Review methods of final cover subgrade preparation and approval prior to geotextile and laminated GCL placement.
- Review repair procedures.
- Review the time schedule for all operations.
- Establish procedures for deployment of materials over installed laminated GCL emphasizing protection of the laminated GCL.
- Observe where the site survey benchmarks are located, and review methods for maintaining vertical and horizontal control.

- Review permit documentation requirements.
- Review the survey documentation tables and plans that identify the locations where survey documentation information is required.
- Conduct a site walk-around to review material storage locations and general conditions relative to construction.
- Set up a time and place for regular construction progress meetings.

Minutes prepared by the CQA Officer or other party designated by Owner will be distributed to all parties involved in the construction project.

3.2 GEOSYNTHETIC PRECONSTRUCTION SUBMITTAL

Prior to the installation of geosynthetic materials, a preconstruction submittal will be prepared and submitted to the IDNR. The submittal will contain, at a minimum, the following:

- Information on the chosen geosynthetic products.
- Certification from the laminated GCL manufacturer that the laminated GCL product is free of broken-off needles from the needle punching process.
- Final version of the CQA Plan, incorporating input from the selected contractor, and documenting qualifications of the third-party construction quality assurance firm and testing laboratories.
- Any modifications to the installation plan, with final proposed version of the panel layout diagram and any revisions to the details of seaming, patching, penetrations, use of prefabricated specialty sections, or repair methods.
- Any changes in geosynthetic acceptance values, test method references, and/or test procedures.

3.3 GEOSYNTHETIC PRECONSTRUCTION MEETING

Prior to placement of geosynthetics, a geosynthetic preconstruction meeting will be held. This meeting will include the parties involved in the construction, including the CQA Officer, the RPR, the Construction Contractor, the Owner, and possibly an IDNR representative.

The purpose of this meeting is to establish the lines of communication; define the Contractor's role and responsibility during the geosynthetic deployment; and review the proposed panel layout, planned seaming methods, contractor's CQC Plan, and this CQA Plan defining the rules regarding testing, repairs, etc.

Specific topics considered for this meeting include the following:

- Review critical design details of the project, including plans and specifications.
- Review Contractor's plan for dewatering and surface water control.
- Make appropriate modifications to the CQA Plan (if necessary).
- Review the roles and responsibilities of each party.
- Review the lines of authority and communication.
- Review methods for documenting, reporting, and distributing documents and reports.
- Review methods of final cover subgrade surface preparation and approval prior to geosynthetic placement.
- Review geosynthetic panel layout drawing and numbering system.
- Review repair procedures.
- Review the time schedule for all operations.
- Review final walk through procedures.
- Review proposed method to deploy materials over geosynthetic material.
- Review survey requirements prior to contractor de-mobilizing from site.
- Set timetable for regular construction meeting.

Minutes prepared by the CQA Officer or other party designated by the Owner will be distributed to all parties involved in the construction project.

4.0 GENERAL CONSTRUCTION OBSERVATION AND DOCUMENTATION

This section describes general documentation procedures to be implemented, including the use of forms, the identification and resolution of problems or deficiencies, and photographic documentation.

4.1 PROGRESS MEETINGS

Progress meetings will be held regularly at a location set by Owner. At a minimum, field supervisory and CQA personnel will attend the meeting. The purposes of the meeting are as follows:

- To review work activity and location since last meeting
- To review work schedule
- To discuss possible problems
- To review test data
- To review data documentation requirements.

Minutes prepared by Owner-designated representative will be transmitted to all parties involved.

4.2 DAILY REPORTS

A daily summary report will be prepared by the CQA Officer, or the RPR, under the direct supervision of the CQA Officer, for each day of activity and will include the following information:

- Date, project name, location, report preparer's name, and the names of representatives on site performing CQA.
- Time work starts and ends each construction workday, along with the duration and reason for work stoppages (i.e., weather delay, equipment shortage or problem, labor shortage, etc.).
- Data on weather conditions, including temperature, wind speed and direction, cloud cover, and precipitation.
- Contractor's work force.
- Chronological description of work in progress, including locations and type of work performed.
- Summary of meetings held and a list of those in attendance.
- Summary of relevant conversations that pertain to the project and who conversations were with.
- Discussion of problems/deficiencies identified and the corrective actions taken.
- Identification of laboratory samples collected, marked, and delivered to laboratory, or clear reference to the document containing such information.

Each representative will prepare field data sheets containing the following information:

- Test number, sample location, and test required
- The procedures used
- Field test results
- Personnel involved in the documentation and sampling activities
- Signature of the person performing the documentation.

4.3 FORMS, CHECKLISTS, AND DATA SHEETS

Forms developed for the purpose of documenting the construction and geosynthetic installation are to be supplied to the Owner's assigned Project Manager prior to the start of construction and/or installation for review and approval. Additional forms developed during the course of the project to document specific aspects of the project will also be supplied to the Owner's assigned Project Manager for review and approval.

4.4 PROBLEM/DEFICIENCY IDENTIFICATION AND CORRECTIVE ACTION

Problem and/or deficiency identification and corrective action will be documented in the daily summary report when a construction material or activity is observed or tested that does not meet the requirements set forth in this CQA Plan. The Summary report should clearly reference other reports, photographs, or forms that contain data or observations leading to the determination of the problem or deficiency. Problem and/or deficiency identification and corrective action documentation may include the following information:

- A description of the problem or deficiency, including reference to supplemental data or observations responsible for determining the problem or deficiency.
- The location of the problem or deficiency, including how and when the problem or deficiency was discovered, and an estimate of how long the problem or deficiency has existed.
- A list of possible causes of the problem or deficiency.
- A recommended corrective action for resolving the problem or deficiency. If the corrective action has already been implemented, then the observations and documentation to show that the problem or deficiency has been resolved must be included. This written portion is to include all parties involved in the corrective action. If the problem or deficiency has not been resolved by the end of the day that it was discovered, the daily summary report must clearly state that it is an unresolved problem or deficiency. Subsequent daily summary reports will indicate the status of the problem or deficiency until it is resolved.

If the problem or deficiency has not been resolved, the CQA Officer and the preparer will discuss the necessary corrective actions. The CQA Officer will work with the Owner and the Contractor to implement actions as necessary to resolve the problem or deficiency. A description of such problems or deficiencies and corrective actions implemented will be included in the Construction Documentation Report.

The CQA Officer, working with the Owner and the Contractor, will determine if the problem or deficiency is an indication of a situation that may require changes to the plans or specifications and/or the CQA Plan. The CQA Officer and the Owner must approve revisions to the plans or specifications or the CQA Plan. The IDNR will be consulted prior to making changes to the CQA Plan or specifications, if needed, to obtain their concurrence. Documentation of changes will be incorporated into the Construction Documentation Report.

4.5 PHOTOGRAPHIC DOCUMENTATION

Photographs will be taken to document all aspects of the installation, problems, deficiencies, and corrective actions. Photographs in any format will be stored in a permanent protective file by the

CQA Officer or the RPR. All photographs in all formats are to be turned over to the Owner upon completion of the Documentation Report.

For photographs provided in the Construction Documentation Report, the following information will be recorded:

- Date and time
- Location where photograph was taken, including information regarding the orientation of the photograph. (e.g., looking north)
- Description of the subject matter
- Unique identifying number for reference in other reports.

4.6 SURVEYING

Documentation surveying requirements for each final cover system component are defined in the respective sections. All required thicknesses noted in each section are measured vertically. Personnel experienced in construction surveying will perform required surveying.

4.7 CONSTRUCTION DOCUMENTATION REPORT

A report documenting all aspects of construction will be prepared. A Professional Engineer registered in the state of Iowa will certify the report.

5.0 PERIMETER BERM AND BRIDGE PIER MONITORING

5.1 PERIMETER BERM PIEZOMETERS

Prior to beginning dewatering and filling operations in the CCR settling ponds, vibrating-wire piezometers will be installed as follows: two at the south end of the west perimeter berm and one at the north end of the west perimeter berm at the locations shown on Plan Sheet 3. The purpose of the piezometers is for pore-pressure monitoring within the loose CCR fill and soft organic silt layers during dewatering and filling. Pore pressure must be measured prior to dewatering and filling, so that future pore pressure monitoring results can be compared to preconstruction results.

Pond dewatering is required to prepare the settling ponds for fill placement to establish the proposed final grades. Dewatering will continue until fill material has been placed to a level above the water table.

The rate of filling to establish the proposed final grades will be determined based on the piezometer monitoring results. No additional fill placement will occur until the pore water pressures within the loose fill and soft soils dissipate to within 1 foot of the preconstruction levels. As construction proceeds, this limit may be changed to reflect performance of the bridge piers. Details of the recommended pore pressure monitoring for loose fill and soft soils are described below.

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The recommended construction sequence and procedures are described below:

- At least 2 weeks prior to beginning dewatering and fill placement in the settling ponds, install the vibrating-wire piezometers as described below and obtain the initial pore pressure readings. Protect and preserve the piezometers during construction. No construction will begin until the piezometers show stabilized readings for 4 days.
- Dewater the settling ponds to maintain a groundwater level below the base of the ponds.
- Stabilize the pond bottom areas as described in **Sections 6.0** and **12.0**.
- Place and compact fill material as described in **Section 6.0** to establish a grade approximately 2 feet above groundwater. Dewatering may end when filling is complete to this elevation.
- Obtain pore pressure readings at the vibrating-wire piezometers at a frequency coordinated with the project geotechnical engineer. The frequency of the readings may vary depending on the results of the readings over time.
- When confirmed by the project geotechnical engineer, place and compact additional fill material to establish the proposed final cover subgrades. Obtain periodic readings at the vibrating-wire piezometers during filling as recommended by the project geotechnical engineer to confirm that the rate of filling is acceptable. Breaks in the filling schedule may be required if recommended by the project geotechnical engineer to allow dissipation of pore pressures and avoid excessive pore pressure levels.

Vibrating Wire Piezometer Installation Procedures

Vibrating-wire piezometers will be installed and monitored as follows:

- Install the vibrating-wire piezometer(s) in borings drilled through the existing upper fill and into the loose CCR fill and soft organic silt layers.
- At the south end of the west perimeter berm, install one piezometer within the loose CCR fill and one piezometer within the soft organic silt. At the north end of the west perimeter berm, install the piezometer within the loose CCR fill. Use RST Instruments VW2100 vibrating-wire piezometers capable of measuring pressures in the range of 0 to 0.35 MPa (megapascals), available from Geonor, Inc. (www.geonor.com), or a technically comparable vibrating-wire piezometer approved by the project geotechnical engineer. Install a fine to medium sand filter around each piezometer.
- Connect each piezometer to a readout device and obtain the initial pore water pressure readings before beginning dewatering and fill placement. Submit the readings to the project geotechnical engineer for review.

• Protect and preserve the piezometers during construction.

5.2 PERIMETER BERM SURFACE BENCHMARKS

Prior to beginning dewatering and filling operations in the CCR settling ponds, surface benchmarks will be installed at the toe of the west perimeter berm at the locations shown on **Plan Sheet 3**. The purpose of the benchmarks is to monitor vertical or horizontal movement of the west perimeter berm toe of slope during dewatering and filling. The surface benchmarks must be surveyed prior to dewatering and filling, so that future surface benchmark monitoring results can be compared to pre-construction results.

Surface benchmark recommendations:

- Install two surface benchmarks at the west perimeter berm toe of slope to allow for monitoring of vertical and lateral movement using conventional ground surveying methods.
- The benchmarks should consist of concrete monuments or similar extending below the frost line to minimize the potential for frost heave of the benchmark and disturbance from vehicles. Protect the benchmarks during construction.
- Survey the benchmarks for any changes in horizontal or vertical position, record all
 data, and submit the results to the project geotechnical engineer within 24 hours after
 survey measurements are made. Coordinate the frequency of benchmark surveying
 with the project geotechnical engineer. Discontinue fill placement if recommended
 by the project geotechnical engineer.

5.3 BRIDGE PIER BENCHMARKS

Prior to beginning dewatering and filling operations in the CCR settling ponds, surface benchmarks will be installed on each bridge pier within the project construction limits at the locations shown on Plan Sheet 3. The purpose of the benchmarks is to monitor vertical or horizontal movement of the bridge piers during dewatering and filling. The benchmarks will be surveyed prior to dewatering and filling, so that future surface benchmark monitoring results can be compared to pre-construction conditions.

Bridge pier benchmark installation and monitoring:

- Install one benchmark consisting of a 1-inch long survey nail drilled into a concrete column on each bridge pier within the construction limits to allow for monitoring of vertical and lateral movement using conventional ground surveying methods.
- Survey the benchmarks for any changes in horizontal or vertical position, record all data including temperature at the survey dates and times, and submit the results to the project geotechnical engineer within 24 hours after the survey measurements are made. Coordinate the frequency of benchmark surveying with the project

geotechnical engineer. Discontinue fill placement if recommended by the project geotechnical engineer or the Iowa Department of Transportation.

6.0 FILL MATERIAL

6.1 GENERAL

This section includes the quality assurance requirements for preparation of the base grade (bottom of fill) prior to placement of fill material and the final cover system, including placement, compaction, and grading of fill material, where required to establish final cover subgrades (top of fill). Fill material will consist of imported Ag Pave, Unit 3 and 4 bottom ash, or imported soil. Imported soil will be soil that is free of vegetation, ash, wood, organics, debris, frozen material, and rock or stone greater than 4 inches in largest dimension. All fill field tests, fill sample types, and survey measurements will be recorded in the daily summary reports (see **Subsection 4.2**) as record construction data, including locations (by coordinates) and elevations of all field tests and laboratory sample points.

6.2 PROCEDURES AND OBSERVATION

The RPR will observe the base grade and subgrade preparation activities and will document relevant observations to support certification of the following requirements:

- Upon completion of the pond dewatering, the RPR will visually observe the base grade for signs of soft or yielding spots. Any soft or yielding spots will be stabilized using one of the following methods:
 - Perform additional dewatering until the base grade is firm
 - Excavate to remove soft material
 - Place a 6- to 12-inch-thick layer of breaker run and compact it into the base grade until firm
 - Spread and compact an initial 1 to 2-foot thick layer of fill material over the soft spots and then proof roll the surface of the fill to determine whether the base grade is firm
- The RPR will observe the final cover system subgrade preparation to document that the subgrade is in substantial conformance with the specifications.
- Where fill is placed, the RPR will periodically observe loads of fill for general conformance to material specifications and may randomly sample loads. The RPR will perform routine conformance sampling as defined in **Subsection 5.3** (Sampling Requirements and Acceptance Criteria).

- All trees, stumps, roots, boulders, debris, and other material capable of deteriorating in situ material strength or of creating a preferential pathway for seepage shall be completely removed.
- No frozen fill will be used for backfilling. Any frozen fill in the compaction work area will be removed.
- Loose lift thickness for fill compaction will not exceed 12 inches.
- Unacceptable compaction density as defined by **Subsection 5.3** (Sampling Requirements and Acceptance Criteria) will be reported to the CQA Officer by the RPR. Corrective action will consist of moisture-conditioning of the fill and/or additional compactive effort as necessary.
- Upon completion of fill placement, the RPR will visually observe the subgrade for signs of soft or yielding spots. Any soft or yielding spots will be excavated and replaced with compacted fill material. Fill placed for the final cover system subgrade will be placed in accordance with **Subsection 5.2**.
- Field densities using methods described in **Subsection 5.3.1** will be measured to document that the in-place fill is in substantial conformance with the required density.

6.3 SAMPLING REQUIREMENTS AND ACCEPTANCE CRITERIA

Field and laboratory sampling frequencies are based on the area or volume of material placed. This section describes the required analyses, methods, sample frequencies, and acceptance limits. The RPR will perform field tests and will collect fill samples for laboratory analysis.

6.3.1 Field Testing

The following field testing methods will be used by the RPR during construction:

<u>Parameter</u> <u>Test Method</u>
Fill density and moisture content ASTM D6938

Field density and moisture content tests will be performed a minimum of one test for each 1,000 cubic yards of compacted fill material placed.

6.3.2 Field Testing Acceptance Criteria

Acceptance criteria for field density will require fill compaction to a minimum of 90 percent of the Modified Proctor (ASTM D1557) maximum dry density, or a minimum of 95 percent of the Standard Proctor (ASTM D698) maximum dry density.

6.3.3 Laboratory Testing

Routine laboratory testing of the material fill will be performed on samples from the fill material borrow area. Fill characteristics will be determined from representative samples.

Representative (grab) samples will be obtained on the basis of three criteria. First, an initial sample will be obtained from the fill borrow source and analyzed prior to construction. This will confirm fill characteristics and provide an initial maximum dry density and optimum moisture content for field moisture/density testing. Second, routine samples will be obtained for every 5,000 cubic yards placed. Third, in the event that changes in physical appearance or fill characteristics are observed, a sample will be obtained and analyzed. The maximum dry density and optimum moisture content values used for compaction testing may be adjusted during the course of construction based on the results of the above sampling.

The following laboratory test method will be performed by the Soils Testing Laboratory on samples collected by the RPR:

<u>Parameter</u>	<u>Test Method</u>
Moisture/Density using Modified or	ASTM D1557 (a,b) or ASTM D698 (a,b)
Standard Proctor compaction	

Atterberg Limits ASTM D4318^(d)
Grain-size analysis ASTM D422^(c)

Notes:

- (a) Five-point Proctor analysis required for first and second sampling criteria.
- (b) A one-point Proctor analysis may be utilized for representative samples collected for the third sampling criteria (apparent changes in soil quality) to verify applicability of previously analyzed moisture-density relationships. If the result does not verify applicability, then a five-point analysis will be performed in accordance with the first sampling criteria.
- (c) Distribution to be reported through the No.200 US standard sieve.
- (d) For clay or silt imported soil fill material.

Samples of the fill material will be collected by the RPR prior to the use of the material and whenever physical appearance or other changes are noticeable. These samples will be submitted to the Soils Testing Laboratory for the above testing.

6.4 SURVEYING

The final cover subgrade (top of fill) will be surveyed on a minimum 100-foot grid pattern (50-foot grid pattern in new pond and swale areas) and at key locations. Key locations include breaks in grade, toes of slopes, midpoints, and tops of sideslopes.

7.0 CLAY FILL

7.1 GENERAL

This section includes the quality assurance requirements for placement, backfilling, and compaction of clay fill. Compacted clay fill and un-compacted clay fill will be used in constructing the final cover swales.

The clay fill will be imported from one or more borrow sources.

All field tests, soil sample types, and survey measurements will be recorded in the daily summary reports (see **Subsection 4.2**) as record construction data, including locations (by coordinates) and elevations of all field tests and laboratory sample points.

7.2 PROCEDURES AND OBSERVATION

The RPR will observe compacted clay fill construction activities and will document relevant observations to support certification of the following requirements:

- The RPR will confirm the uniformity of the excavated soil to be used as clay fill. Soil placement will be monitored for segregation and removal of unsuitable material and for changes in soil type, color, texture, and moisture content.
- The Construction Contractor will segregate and/or remove unsuitable materials such as granular soil, silty or sandy clay not meeting acceptance criteria, boulders, cobbles, and organic material. A maximum clod size of 4 inches is allowed. Clods should be able to be broken down with normal construction equipment.
- The Construction Contractor will use wide track equipment to distribute clay above the laminated GCL. A minimum of 12 inches of soil cover is required to separate the equipment from the laminated GCL to prevent damage.
- The RPR will observe clay placement and will measure field densities and moisture contents, using methods described in **Subsection 6.3** (Sampling Requirements and Acceptance Criteria) to document that the compacted clay is in substantial conformance with the placement specifications and that soil placement has been conducted in a manner to achieve a uniform, homogeneous clay mass.
- Voids created by nuclear density gauge (NDG) probes will be backfilled with granular bentonite.
- Compaction equipment used shall have a minimum static weight of 30,000 pounds.
- Clay layers will be constructed in lift heights no greater than 8 inches using footed compaction equipment having feet at least as long as the loose lift height. The initial

lift placed on the GCL will be greater than 8 inches in order to reduce the likelihood of damage to the laminated GCL.

- Each lift of compacted clay will be sufficiently compacted to ensure that the clay is completely remolded.
- Areas of unacceptable, density, or moisture content as defined by Subsection 6.3
 (Sampling Requirements and Acceptance Criteria) will be documented by the RPR.
 Corrective action will consist of moisture-conditioning of the soil and/or additional compactive effort as necessary. Methods for moisture-conditioning soil are described in the next bullet item. Following corrective actions, such areas will be retested.
- If necessary, surfaces of compacted clay to receive successive lifts of compacted clay will be moisture-conditioned either by scarification and addition of water where desiccated, or by discing and air drying where saturated to promote effective bonding of lifts. Following scarification, water will be applied with a spray bar applicator or equivalent method to achieve uniform distribution.
- No frozen soil will be used for clay fill construction. Frozen soil in the compaction work area will be removed.
- Stones or other penetrating objects larger than 4 inches in the initial compacted clay will be removed. The RPR will observe this process and will document the removal of stones and other objects by the Contractor. Voids made by the removal of stones or other objects will be filled with clay soil or bentonite.
- Preconstruction planning will be undertaken to sequence construction activities to
 minimize the length of time the completed clay surface will be exposed prior to
 receiving protective cover. Protective cover will be provided by the placement
 of the un-compacted clay and shall be completed in the same construction season as
 the compacted clay construction.

7.3 SAMPLING REQUIREMENTS AND ACCEPTANCE CRITERIA

Field and laboratory sampling frequencies are based on the area or volume of material placed. This section describes the required analyses, methods, sample frequencies, and acceptance limits. The RPR will perform field tests and will collect soil samples for laboratory analysis.

7.3.1 Field Testing

The following field testing methods will be used by the RPR during construction of the compacted clay:

Parameter
Moisture content and soil density

Method ASTM D6938 A minimum of five field moisture and density tests per 8-inch lift per acre are required to be performed to verify that the correct density has been achieved. The lift thickness will be modified based on materials used in construction. The first lift placed above the laminated GCL will be 12 inches to ensure the laminated GCL is not damaged. The remaining lifts will be 6 inches each.

7.3.2 Field Testing Acceptance Criteria

Acceptance criteria for field density will require soil compaction to a minimum of 90 percent of the Modified Proctor (ASTM D1557) maximum dry density, or a minimum of 95 percent of the Standard Proctor (ASTM D698) maximum dry density. Moisture content requirements will be at least 2 percent wet of optimum if using the Modified Proctor, and at least wet of optimum if using the Standard Proctor. The acceptable range will be based on Proctor moisture-density relationships and compaction versus permeability relationships.

7.3.3 Laboratory Testing

Routine laboratory testing of the clay fill will be performed on samples from the clay borrow area and on the in-place clay soil samples collected by the RPR. Soil characteristics will be determined from representative samples.

7.3.4 Representative Sample Analysis

Representative (grab) samples will be obtained on the basis of three criteria. First, an initial sample will be obtained from the clay borrow source and analyzed prior to construction. This will confirm soil characteristics and provide an initial maximum dry density and optimum moisture content for field moisture/density testing. Second, routine samples will be obtained for every 5,000 cubic yards placed. Third, in the event that changes in physical appearance or soil characteristics are observed, a sample will be obtained and analyzed. The maximum dry density and optimum moisture content values used for compaction testing may be adjusted during the course compacted clay construction based on the results of the above sampling.

The following laboratory analyses will be performed on all representative samples obtained:

Parameter	Test Method
Moisture-density relationship using	ASTM D1557 (a, b)
Modified/Standard Proctor compaction	ASTM D698 (a, b)
Atterberg limits	ASTM D4318
Grain-size analysis	ASTM D422 ^(c)

Notes:

- (a) Five-point Proctor analysis required for first and second sampling criteria.
- (b) A one-point Proctor analysis may be utilized for representative samples collected for the third sampling criteria (apparent changes in soil quality) to verify applicability of previously analyzed moisture-density relationships. If the result does not verify applicability, then a five-point analysis will be performed in accordance with the first sampling criteria.
- (c) Distribution to be reported through the 0.002 mm particle size.

7.3.5 Laboratory Testing Acceptance Criteria

- A minimum 50 percent by weight which passes the 200 sieve.
- A Unified Soil Classification System group symbol of CL or CH.

7.4 SURVEYING

The top of compacted clay grades will be surveyed on the same 50-foot grid pattern and at key locations surveyed for final cover subgrades. Key locations include breaks in grade, toes of slopes, mid-points, and tops of sideslopes. The compacted clay thickness will be determined at surveyed locations and reported in a tabular fashion. The minimum acceptable compacted clay thickness will be 2 feet (+0.1 foot tolerance) measured vertically.

The surface of the fill area will be surveyed before and after un-compacted clay placement on a 50-foot grid pattern) using the same point locations as the compacted clay placement. The uncompacted clay thickness will be determined at surveyed locations and reported in a tabular fashion. The minimum acceptable un-compacted clay thickness will be 0.8 feet (+0.1 foot tolerance measured vertically).

8.0 STONE AND AGGREGATE

8.1 GENERAL

This section includes the quality assurance requirements for material type and placement of riprap at bridge downspouts. This section also includes requirements for material type and placement of pond stone and subgrade stabilization material.

8.2 RIPRAP

Riprap will be placed as shown on the drawings and will conform to Iowa DOT Section 4130, Erosion Stone for riprap sizes. The following table shows approximate riprap sizes as provided in the Iowa Statewide Urban Design and Specifications (SUDAS) Design Manual Chapter 7E-10.

Standard Classification	D ₅₀ Weight (lbs)	Average D ₅₀ Diameter (ft)	Max Weight (lbs)	Average Max Diameter (ft)
Erosion Stone		0.5		0.75

Riprap shall be placed as shown on the drawings.

8.3 POND STONE

Pond stone will conform to Iowa DOT Section 4122.02, Crushed Stone Base Material, with a maximum size of 3 inches, and screened over a 1-inch screen.

8.4 BREAKER RUN

Base grade stabilization material will consist of breaker run material meeting the requirements for Iowa DOT Section 4123 for modified subbase aggregate. Place breaker run as described in **Sections 6.0** and **12.0**.

9.0 COMPACTED AND UNCOMPACTED FILL

9.1 GENERAL

This section includes the quality assurance requirements for placement, backfilling and compaction of compacted and un-compacted fill for the final cover. The final cover compacted and un-compacted fill soil will be imported from one or more borrow sources. Imported soil will be soil that is free of vegetation, ash, wood, organics, debris, frozen material, and rock or stone greater than 4 inches in largest dimension. All field tests, soil sample types, and survey measurements will be recorded in the daily summary reports (see **Subsection 4.2**) as record construction data, including locations (by coordinates) and elevations of all field tests and laboratory sample points.

9.2 PROCEDURES AND OBSERVATION

The RPR will observe the subgrade preparation activities and will document relevant observations to support certification of the following requirements:

- Upon completion of the final fill materials grades, the RPR will visually observe the final cover subgrade for signs of soft or yielding spots. Any soft or yielding spots will be excavated and replaced with compacted fill materials.
- All trees, stumps, roots, boulders, debris, and other material capable of deteriorating
 in situ material strength or of creating a preferential pathway for contaminants shall
 be completely removed.
- No frozen soil will be used for backfilling. Any frozen soil in the compaction work area will be removed.
- Lift thickness for compacted fill soil compaction will not exceed 8 inches.
- Unacceptable compaction density as defined by **Subsection 5.3** (Sampling Requirements and Acceptance Criteria) will be reported to the CQA Officer by

the RPR. Corrective action will consist of moisture-conditioning of the soil and/or additional compactive effort as necessary.

- Upon completion of the compacted fill final grades, the RPR will visually observe the fill surface for signs of soft or yielding spots. Any soft or yielding spots will be excavated and replaced with compacted fill. Fill placed for the compacted fill final cover layer will be placed in accordance with **Subsection 5.2**.
- Field densities using methods described in **Subsection 5.3.1** will be measured to document that the in-place compacted fill is in substantial conformance with the required density.

9.3 SAMPLING REQUIREMENTS AND ACCEPTANCE CRITERIA

Field and laboratory sampling frequencies are based on the area or volume of material placed. This section describes the required analyses, methods, sample frequencies, and acceptance limits. The RPR will perform field tests and will collect soil samples for laboratory analysis.

9.3.1 Field Testing

The following field testing methods will be used by the RPR during construction of the compacted fill:

<u>Parameter</u> <u>Test Method</u>
Soil density and moisture content ASTM D6938

A minimum of 5 field moisture and density tests per 8-inch lift per acre are required to be performed to verify that the correct density has been achieved.

9.3.2 Field Testing Acceptance Criteria

Acceptance criteria for field density will require soil compaction to a minimum of 90 percent of the Modified Proctor (ASTM D1557) maximum dry density, or a minimum of 95 percent of the Standard Proctor (ASTM D698) maximum dry density.

9.3.3 Laboratory Testing

The following laboratory test method will be performed by the Soils Testing Laboratory on samples collected by the RPR:

<u>Parameter</u> <u>Test Method</u>
Moisture/Density using Modified or ASTM D1557 (a,b) or ASTM D698 (a,b)

Standard Proctor compaction

Atterberg Limits ASTM D4318
Grain-size analysis ASTM D422(c)

Notes:

- (a) Five-point Proctor analysis required for first and second sampling criteria.
- (b) A one-point Proctor analysis may be utilized for representative samples collected for the third sampling criteria (apparent changes in soil quality) to verify applicability of previously analyzed moisture-density relationships. If the result does not verify applicability, then a five-point analysis will be performed in accordance with the first sampling criteria.
- (c) Distribution to be reported through the 0.002 mm particle size.

Samples of the borrow area or stockpiled soil will be collected by the RPR prior to the use of the material and whenever physical appearance or other changes are noticeable. These samples will be submitted to the Soils Testing Laboratory for the above testing.

9.4 SURVEYING

The compacted fill grades will be surveyed on a minimum 100-foot grid pattern and at key locations. Key locations include breaks in grade, toes of slopes, midpoints, and tops of sideslopes. See **Section 10.3** for un-compacted fill surveying.

10.0 TOPSOIL AND SEEDING

This section includes the CQA requirements for the excavating and placing topsoil and fertilizing, seeding, mulching, and watering topsoil for vegetation. Topsoil is the final layer of soil material installed in the final cover, along the outside slopes of the perimeter berms, along the swales, and in other perimeter areas. Topsoil will be placed within the final cover areas to minimize surface water infiltration. Topsoil will be imported from one or more borrow sources.

All survey measurements will be recorded in the daily summary reports (see **Subsection 4.2**) as record construction data.

10.1 PROCEDURES AND OBSERVATION

The RPR will observe topsoil placement activities and will document relevant observations to support certification of the following requirements:

- The RPR will confirm the source and uniformity of topsoil used. Soil excavation and placement will be monitored for minimization of inorganic soil not compatible for establishment of vegetation.
- Prior to seeding, the topsoil will be worked to prepare a suitable seedbed.
- Fertilizing, seeding, and mulching will be performed in a timely manner.

10.2 ACCEPTANCE CRITERIA

The topsoil will be suitable for establishment and long-term maintenance of the selected vegetation seed mix with appropriate fertilization. At the RPR's discretion, samples may be collected for laboratory testing.

The following seed mixes and rates from Iowa DOT specification Section 2601 "Erosion Control" shall be used as shown in the Plan Set:

Nurse Crop

March 1 through October 31	
Oat	50 lbs. per acre (56 kg/ha)
Grain rye	50 lbs. per acre (56 kg/ha)
Canada wildrye (Elymus canadensis)	5 lbs PLS. per acre (6 kg/ha)

November 1 through February 28 (or 29)			
Oat	62 lbs. per acre (56 kg/ha)		
Grain rye	62 lbs. per acre (56 kg/ha)		
Canada wildrye (Elymus canadensis)	7 lbs. PLS. per acre (6 kg/ha)		
For stabilizing crop only, Canada wildrye (Elymus canadensis) seed will not be required to be certified as Source Identified Class (Yellow Tag) Source G0-lowa.			
Canada wildrye (Elymus canadensis) seed shall be debearded or equal to facilitate application of seed.			

Native Grass Mix

Species (Scientific Name)	Application Rate (PLS)			
Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-lowa. Oats are excluded from this requirement.				
*Big bluestem (Andropogon geradii)	6 lbs. per acre (7 kg/ha)			
*Canada wildrye (Elymus canadensis)	2 lbs. per acre (2.2 kg/ha)			
*Indiangrass (Sorghastrum nutans)	6 lbs. per acre (7 kg/ha)			
*Little bluestem (Schizachyrium scoparium)	6 lbs. per acre (7 kg/ha)			
Blackeyed susan (Rudbeckia hirta)	4 oz. per acre (280 g/ha)			
Blue vervain (Verbena hastata)	1/2 oz. per acre (35 g/ha)			
Gray-headed coneflower (Ratibida pinnata)	3 oz. per acre (210 g/ha)			
Ironweed (Vernonia fasciculata)	3 oz. per acre (210 g/ha)			

Species (Scientific Name)	Application Rate (PLS)
New England aster (Symphyotrichum novae-angliae)	2 oz. per acre (140 g/ha)
Pale purple coneflower (Echinacea pallida)	6 oz. per acre (420 g/ha)
Partridge pea (Chamaecrista fasciculata)	4 lbs. per acre (4.5 kg/ha)
Side-oats grama (Bouteloua curtipendula)	4 lbs. per acre (4.5 kg/ha)
Switchgrass (Panicum virgatum)	1 lbs. per acre (1.1 kg/ha)
Oats (Avena sativa)	32 lbs. per acre (36 kg/ha)

^{*}Note: Canada wildrye, Big bluestem, Indiangrass, and Little bluestem shall be debearded or equal to facilitate the application.

Wetland Seed Mix

Common Name	Scientific Name	PLS (per ac)	PLS (per ha)
Blue vervain	Verbena hastata	1 oz.	70 g
Boneset	Eupatorium perfoliatum	1 oz.	70 g
Nodding bur marigold	Bidens cernua	8 oz.	560 g
Swamp milkweed	Asclepias incarnata	1 lb.	1.1 kg
Sneezeweed	Helenium autumnale	2 oz.	140 g
Water plantain	Alisma plantago-aquatica	4 oz.	280 g
Arrowhead	Sagittaria latifolia	4 oz.	280 g
New England aster	Symphyotrichum novae-angliae	2 oz.	140 g
Big Bluestem	Andropogon gerardii	1 lb.	1.1 kg
Switchgrass	Panicum virgatum	8 oz.	560 g
Prairie cordgrass	Spartina pectinata	1 lb.	1.1 kg
Virginia wild-rye	Elymus virginicus	5 lbs.	5.6 kg
Bluejoint grass	Calamagrostis	1 oz.	70 g
Rice cutgrass	Leersia oryzoides	4 oz.	280 g
Dark Green bulrush	Scirpus atrovirens	1 oz.	70 g

Common Name	Scientific Name	PLS (per ac)	PLS (per ha)
Fox sedge	Carex vulpinoidea	4 oz.	280 g
Softstem bulrush	Schoenoplectus tabernaemontani	8 oz.	560 g
Spike rush	Eleocharis palustris	4 oz.	280 g
Porcupine sedge	Carex hystericina	8 oz.	560 g
Broom sedge	Carex scoparia	2 oz.	140 g
Tussock sedge	Carex stricta	2 oz.	140 g

Permanent Rural Areas

Fescue, Tall (Fawn)	100 lbs. per acre	
Ryegrass, Perennial (Linn)	75 lbs. per acre	
Bluegrass, Kentucky	20 lbs. per acre	

Except when a hydraulic seeder is used, thoroughly mix all seed specified prior to placing the seed in the seed hopper.

Fertilizer will be applied at the following rates according to seed mix:

- Nurse Crop Apply to seeded areas at the rate of 250 lbs. per acre of 13-13-13 (or equivalent)
- Native Grass Not required
- Wetland Grass Not required
- Permanent Rural Areas Apply to seeded areas at the rate of 300 lbs. per acre of of 6-24-24 (or equivalent).

Finely chopped straw mulch or equivalent will be applied to all seeded areas.

10.3 THICKNESS DOCUMENTATION

The surface of topsoil placement on the final cover will be surveyed on a minimum 100-foot grid using the same points surveyed for the compacted fill. The topsoil and un-compacted fill thickness will be determined at surveyed locations and reported in a tabular fashion. The minimum acceptable topsoil and un-compacted thickness for the final cover will be 1.0 foot (+0.1 foot tolerance).

11.0 GEOTEXTILE

11.1 GENERAL

This section of the CQA Plan applies to the non-woven geotextile used as a GCL cushion in the final cover system. The same geotextile will be placed below riprap areas.

11.2 PRE-INSTALLATION

11.2.1 Manufacturing

The geotextile will be supplied to the site in factory rolls. Prior to the delivery of any geotextile rolls, the Geotextile Manufacturer will provide the CQA Officer with the manufacturer's Quality Control Plan used for the production of the geotextile.

The Geotextile Manufacturer will provide certification, based on tests performed in accordance with the methods listed in **Table 11-1**, that the geotextile supplied under this plan will meet the material specifications listed in **Table 11-1**. These tests may be performed by the Geotextile Manufacturer's laboratory or a laboratory contracted by the manufacturer. Additionally, the manufacturer will provide certification that the manufacturer's Quality Control Plan was fully implemented for the geotextile materials supplied under this plan. The manufacturer shall provide documentation to verify the results of the manufacturer's CQC Plan implementation required by the CQA Officer.

The geotextile rolls will be tested and evaluated prior to acceptance. The CQA Officer may perform/require additional testing (i.e., conformance testing) as required by detailed specifications or as required in the judgment of the CQA Officer to verify that the geotextile meets the specifications.

11.2.2 Delivery, Handling, and Storage of Geotextile Rolls

Each geotextile roll to be used at the facility will be marked by the Geotextile Manufacturer with the following information (on a durable gummed label, or equivalent, on the inside of the core, and on the outside of the protective wrapping for the roll):

- Name of manufacturer
- Style and type number
- Roll length and width
- Batch (or lot) number
- Nominal product thickness
- Date of manufacture
- Roll number.

The Geotextile Manufacturer will use the following guidelines in packaging, wrapping, and preparing all geotextile rolls for shipment:

- When cores are required, those that have a crushing strength sufficient to avoid collapse or other damage while in use will be used.
- Each roll will be covered with a wrapping material that will protect the geotextile from damage due to shipment, water, sunlight, or contaminants.

The following practices will be used as minimum in receiving and storing geotextile rolls in the designated storage area at the job site:

 While unloading or transferring the geotextile rolls from one location to another, care will be taken to prevent damage to the wrapping or the geotextile itself. If practicable, the Contractor may use forklift trucks fitted with poles that can be inserted into the cores of rolls. The poles will be at least two-thirds the length of the rolls, to prevent breaking the cores and possibly damaging the geotextile. Rolls will not be dragged.

The geotextile rolls will be stored in such a manner so as to ensure that they are adequately protected from the following:

- Precipitation
- Ultraviolet radiation, including sunlight
- Strong oxidizing chemicals, acids, or bases
- Flames, including welding sparks
- Temperatures in excess of 160°F
- Soiling

The RPR will observe and document, throughout the pre-installation, installation, and post-installation periods, that the Installer provides adequate handling equipment used for moving geotextile rolls and that the equipment and handling methods used do not pose unnecessary risk of damage. The Installer/Contractor is responsible for the means and methods to implement the work.

The Installer will be responsible for ensuring that all materials installed meet specifications. The RPR will maintain a log of geotextile roll deliveries. The following information, at a minimum, will be recorded on the log for each shipment received at the job site:

- Date of delivery at the job site
- For each roll of geotextile, the roll number and batch (or lot) number

11.3 INSTALLATION

This section describes the quality assurance requirements applicable to the installation, observation, and documentation of geotextile.

11.3.1 Placement

The Installer will install all geotextile in such a manner as to ensure that it is not damaged and in a manner that complies with the following requirements:

- In the presence of wind, all geotextile will be secured by suitable methods. The temporary securing material will be left in place until replaced with cover material, if applicable.
- In-place geotextile will be cut with special care to protect other materials from damage that could be caused by the cutting of the geotextile.
- The Installer will take necessary precautions to prevent damage to any underlying layers during placement of geotextile.
- During placement of geotextile, care will be taken not to entrap in the geotextile any stones, excessive dust, or moisture that could damage the geotextile.
- A visual examination of the geotextile will be carried out over the entire surface after the installation by contractor to ensure that no potentially harmful objects, such as needles, are present.

11.3.2 Seams and Overlaps

The following requirements will be met with regard to seaming and overlapping of geotextile rolls:

- Geotextile seams will be continuously sewn unless heat bonding is approved by the CQA Officer and Owner. Geotextile will be overlapped 6 inches prior to seaming. The sewing method and stitch type will be per manufacturer's recommendation, but must be approved by the CQA Officer. Overlapping of geotextile without sewing may be acceptable for certain applications (e.g., seams under riprap) with approval from the CQA Officer and Owner.
- Sewing will be performed with thread made from the same base material as the geotextile, or suitable equivalent.
- The Installer will pay particular attention to seams to ensure that no materials could be inadvertently trapped beneath the geotextile.

The RPR will be responsible for observing and documenting that the Installer performs the above provisions in an acceptable manner.

11.4 POST-INSTALLATION

11.4.1 Final Examination

The RPR will perform a final geotextile examination after the installation of each geotextile layer has been completed. The objectives of the final examination are as follows:

- To examine for the presence of holes, tears, or other deterioration.
- To examine geotextile for excessive tension due to stretching of the fabric during installation.
- To examine for the presence of foreign objects (e.g., stones, soil clods) beneath the geotextile.

If there will be an extended time delay between completion of the geotextile and the start of the installation of any other cover, then the Installer will make provisions, by temporarily securing the geotextile by using suitable methods, to protect the geotextile from wind uplift. The RPR will document the placement of the temporary securing methods in the daily report.

11.4.2 Placement of Soil Materials

The Construction Contractor will place all soil materials located on top of a geotextile in such a manner as to minimize the following:

- Damage to the geotextile and underlying layers
- Slippage of the geotextile on underlying layers
- Excessive tensile stresses imposed on the geotextile

Table 11-1 Geotextile Cushion Acceptance Criteria

Property	Units	Test Method	12 oz/yd ² Acceptable Value
Grab tensile properties (1)			
Tensile strength	lb	ASTM D4632	300
Break elongation	%	ASTM D4632	50
Mass per unit area	oz/yd²	ASTM D5261	12
Puncture (CBR) strength	lb	ASTM D6241	800
Trapezoidal tear strength	lb	ASTM D4533	115
UV resistance (2)	%	ASTM D7238	70

Notes:

- 1. These tests will be performed and results reported in both the machine and cross directions.
- 2. Evaluation to be on 2-inch strip tensile specimens after 500 hours exposure.
- 3. All values are minimum average except UV resistance, which is a minimum value.

12.0 GEOSYNTHETIC CLAY LINER

This section covers the quality assurance requirements for pre-installation (includes GCL manufacturer), installation, and post-installation of GCL. The terms pre-installation, installation, and post-installation are applicable only to the GCL installation and do not apply to the overall construction of the facility.

12.1 GENERAL

This section of the CQA Plan applies to the GCL used in the final cover. The GCL will be reinforced and will be laminated to a textured HDPE geomembrane.

12.1.1 Pre-Installation

Pre-installation activities are designed to help ensure that a high-quality product is being manufactured and that it is properly delivered, handled, and stored to maintain its quality.

12.1.2 Manufacturer's Quality Control Plan (MQCP)

The manufacturer of each component of the GCL and the GCL itself shall have a Manufacturer's Quality Control Plan (MQCP) to ensure their product meets all the stated minimum properties. These manufacturers include the bentonite supplier, the geotextile manufacturer, and the GCL manufacturer.

Bentonite Supplier

The bentonite supplier shall have a MQCP, which is adhered to in the manufacturing process. This plan shall include the following information:

- Documentation that the bentonite is sodium bentonite.
- Testing that demonstrates that the bentonite meets specified gradation requirements.
- Testing indicates that the bentonite meets specified index test requirements.
- Testing that demonstrates that the bentonite has not been treated with synthetic chemicals or polymers.

At a minimum, the manufacturer shall perform the tests shown in **Table 12-1**.

Geotextile Manufacturer

The geotextile manufacturer shall have a MQCP, which is adhered to in their manufacturing process. This plan shall include the following provisions:

- Testing that demonstrates that the product is made of specified polymers.
- Testing that demonstrates that the product meets certain minimum average roll values (for geotextile).

GCL Manufacturer

The GCL manufacturer shall have a MQCP, which describes the procedures for accomplishing quality in the final product. At a minimum, the manufacturer shall perform the tests shown in **Table 12-1**.

This MQCP shall also dictate the following requirements:

- Overlap alignment lines are to be marked on the edges.
- Completed rolls are to be securely wrapped in plastic.
- Completed rolls are to be stored indoors. Provisions are to be in place to prevent rolls from being stacked too high, to be kept dry, and to prevent damage during handling.
- Quality Control certification will be provided.

12.1.3 Materials

The GCL shall consist of a layer of pure sodium bentonite clay encapsulated between two geotextiles needle-punched together and laminated to a textured HDPE geomembrane, and shall comply with all of the manufacturing processes and physical/chemical criteria listed in this section.

The bentonite clay utilized in the manufacturing of the GCL, as well as any accessory bentonite clay provided for the seaming and detail work, shall meet the manufacturer's requirements, as specified in their MQCP. The bentonite used in the manufacturing of the GCL shall also meet the requirements of **Table 12-1**.

The geotextile components of the GCL, and the geosynthetics clay liner itself, shall meet the minimum requirements of their respective MQCP. The GCL shall also meet the requirements of **Table 12-1**.

12.1.4 GCL Delivery, Handling, and Storage

The GCL panels shall be supplied to the site in factory-produced rolls. The manufacturer shall supply GCL panels to the job site in standard factory roll dimensions.

Each roll of GCL supplied to the site shall be labeled with the following information:

- 1. Name of manufacturer
- 2. Product type and identification number
- 3. Batch (or lot) number
- 4. Date manufactured
- 5. Roll number

The GCL Manufacturer will ensure that the crushing strength of all GCL roll cores will be sufficient to avoid collapse or other damage while in use.

The rolls of GCL are to be carefully unloaded by the Contractor upon delivery to the site. At a minimum, the following practices should be followed in receiving and storing GCL rolls:

- While unloading or transferring the GCL rolls from one location to another, prevent damage to the GCL.
- For standard rolls, a steel support should be inserted through the roll core. The slings or lifting chains should be attached at one end to the support pipe and the other end to the bucket of a front-end loader or lifting device. A spreader bar should be used to support and spread the slings. The bar and support pipe must be long enough to prevent damage to the edges of the GCL during hoisting.
- Alternate methods of unloading or transferring GCL rolls must be approved by the RPR.
- The rolls of GCL will be stored in their original, unopened, wrapped cover in a clean dry area. The GCL should be stored off the ground on pallets or by other suitable techniques that provide continuous support over the entire length of the roll. The stored GCL shall be covered with a heavy, protective tarpaulin or stored beneath a roof. Care should be used to protect the GCL from the following:
 - Precipitation
 - Ultraviolet radiation
 - Strong oxidizing chemicals, acids, and bases
 - Flames, including welding sparks
 - Temperatures in excess of 160° F

The RPR will be responsible throughout the pre-installation, installation, and post-installation periods, for observing and documenting that the Installer provides adequate handling equipment used for moving GCL rolls and that the equipment used does not damage the GCL.

The RPR will be responsible for making certain that the manufacturer, type, and thickness of each roll are correct. The RPR will maintain a log of all GCL delivered to the job site. The following information, at a minimum, will be recorded on the log for each shipment delivered to the job site:

- Date of receipt of delivery at job-site.
- For each GCL roll delivered to the site, the roll number and batch (or lot) number.

12.1.5 Submittals

Prior to GCL installation, the GCL Manufacturer and GCL Installer will submit the following information to the CQA Officer.

GCL Manufacturer/Production Information

• Corporate background and information.

- MQCP for bentonite, geotextile, and GCL manufacturers.
- Results of tests conducted by the bentonite supplier and the geotextile supplier to document the quality of the materials used to manufacture the GCL rolls assigned to the job.
- Copy of Quality Control certifications, signed by the manufacturer. Each quality control certificate shall include roll identification numbers and results of quality control tests.
- Written certification from the manufacturer that the GCL meets the project specifications, that the GCL has been continuously inspected and found to be needle-free, that the bentonite will not shift during transportation or installation, and that the bentonite and geotextile materials meet the manufacturer's specifications.

GCL Installer Information

- Corporate background information.
- List of personnel performing field operations along with pertinent experience information, if required by RPR or CQA Officer.

The proposed panel placement diagram identifying placement of the GCL panels and seams, as well as additional details that deviate from the engineering drawings, shall be submitted prior to installation if required by the CQA Officer. The layout should be drawn to scale, shall include information such as dimensions and details, and shall be adequate for use as a construction plan.

12.2 INSTALLATION

The following installation procedures are designed to ensure the effectiveness of the GCL in meeting its design requirements and to simplify the deployment procedures. These procedures are to be followed by the Installer, unless the Installer proposes alternate procedures in writing to the CQA Officer and the CQA Officer approves these alternate procedures.

12.2.1 Testing Requirements

This subsection describes the test methods, including sampling procedures and frequencies (if applicable), and the role of the Geosynthetic Testing Laboratory in testing the GCL roll samples. Unless specified otherwise, all sampling procedures will be performed in accordance with the referenced test method defined in this section.

Testing Methods

GCL roll samples will be collected at the Manufacturer's plant by a technician of the Geosynthetic Testing Laboratory or on site by the RPR and Contractor. Sample sizes shall be as required by the Geosynthetic Testing Laboratory. If required, GCL samples will be collected and tested as specified in **Table 12-1**.

The Geosynthetic Testing Laboratory will be responsible for performing the tests on samples submitted to them. Results of tests performed will be reported to the RPR and CQA Officer. Retesting of GCL rolls for quality assurance purposes, because of failure to meet any or all of the acceptance specifications in this section, can only be authorized by the CQA Officer or Owner.

Procedures for Determining GCL Roll Test Failures

Table 12-1 lists the specifications that are applicable to the GCL. For any referenced test method that requires the testing of multiple specimens, the criteria in **Table 12-1** shall be met based on the average results of the multiple specimen tests.

The following Procedure will be used for interpreting results relative to acceptance or rejection of rolls, lots, and shipments of GCL to the site:

- If the test values meet the stated specifications, then the roll and batch will be accepted for use at the job site. If the sample represents all rolls from an entire shipment, then the entire shipment will also be considered accepted.
- If the result does not meet the specification, then the roll and the batch shall be retested at Contractor's expense using specimens either from the original roll sample or from another sample collected by the RPR. For retesting, two additional tests shall be performed for the failed test procedure. (Each additional test shall consist of multiple specimen tests if multiple specimens are called for in the failed test procedure.) If both of the retests are acceptable, then the roll and batch shall be considered to have passed this particular acceptance test; if either of the two additional tests fail, then the roll and batch shall be considered unsuitable without further recourse. RPR may obtain samples from other rolls in the batch. On the basis of testing these samples, the CQA Officer may choose to accept a portion of the batch while rejecting the remainder.

If retesting does not result in passing test results as defined in the preceding paragraph, or if there is any other nonconformity with the material specifications, then the Contractor shall withdraw the rolls from use in the project at the Contractor's sole risk, cost, and expense. Once withdrawn, the same rolls shall not be resubmitted for use. Cost and expense for removing this GCL from the site and replacing it with acceptable GCL shall be the sole risk and responsibility of the Contractor.

12.2.2 Required Equipment

The following installation equipment is required on site:

- Front-end loader, crane, or other similar equipment. The selected piece of equipment shall not cause damage to the subgrade, such as rutting. The Installer shall verify in the presence of the RPR that the selected piece of equipment does not damage the subgrade.
- A spreader bar to prevent slings from damaging the ends of the rolls.
- Several steel pipes to be inserted into the roll's core for lifting.

- Wooden pallets for above ground storage of the GCL rolls.
- Heavy waterproof tarps for protecting all GCL rolls.
- Sandbags for securing the GCL during installation and for the tarps.
- Adhesive or tape for securing patches.
- Granular bentonite for seams, patches, and penetrations.

12.2.3 Surface/Subgrade Preparation

GCL installation should not begin until a proper subgrade has been prepared to accept the GCL. Base material should be fill or soils free from angular rocks, roots, grass, ruts, and vegetation. Foreign materials and protrusions should be removed, and all cracks and voids should be filled and the surface made smooth and uniformly sloping. Unless otherwise required by the contract specification and drawings, the prepared surface should be free from excessive moisture, loose earth, rocks, or clay clods larger than 2 inches in diameter, rubble, and other foreign matter. If breaker run rock has been compacted into the GCL subgrade, the subgrade will be covered with a geotextile cushion prior to placing the GCL. The subgrade should be uniformly compacted to ensure against localized settlement and rutting under wheel loads and should be smoothed with a smooth drum or vibratory roller.

The surface on which the GCL is to be placed should be maintained in a firm, clean, and smooth condition, free of standing water during GCL installation. Vehicular traffic on the subgrade of the GCL shall be restricted to the minimum weight and number of machines needed to deploy the GCL. Vehicles shall be operated to minimize the formation of ruts and surface deformations.

12.2.4 Deployment

As each roll is moved from the storage area, the Installer or RPR should remove the labels for storage in the project file.

The rolls of GCL should be brought to the area to be lined with a front-end loader and support pipe set up such that the roll of GCL is fully supported across its length. A spreader bar or similar device should be used to prevent the lifting chains or slings from damaging the edges. Dragging of the GCL should be minimized.

The Contractor shall ensure that, and the RPR will verify that, the following criteria are being met:

- The equipment used does not damage the GCL by handling, excessive heat, leakage of hydrocarbons, or by other means.
- The prepared surface underlying the GCL has not deteriorated since previous acceptance, and that it is still acceptable at the time of GCL placement.
- Personnel working on the GCL do not smoke, wear damaging clothing, or engage in other activities that could damage the GCL.

- The method used to unroll the GCL does not cause damage to the GCL, and/or the subgrade.
- The method used to place the rolls minimizes wrinkles (especially wrinkles between adjacent panels).

Do not place GCL during precipitation, in the presence of excessive moisture, in any area of ponded water, or during excessive winds. The GCL must be dry when installed and must be dry when covered.

The geomembrane side of the GCL should face upwards and the geotextile side of the GCL should face downwards (unless otherwise dictated by project requirements). The GCL will be placed over the prepared surface in such a manner which minimizes material handling.

The GCL panels should be placed in a manner which ensures sufficient overlap as described in **Subsection 12.2.5**. Whenever possible, horizontal seams should not occur on slopes steeper the 7H:1V. If horizontal seams are required on slopes, seams should be staggered to provide no end seams within 25 feet up- or downslope on adjacent panels.

The cover material (i.e., geomembrane) should be placed over the GCL during the same day as the placement of the GCL. Only those GCL rolls, which can be covered that same day, should be unpacked and placed in position.

When wind conditions can affect installation, the GCL installation should be started at the upwind side of the project and proceed downwind. The leading edge of the GCL should be secured at all times with sandbags or other means sufficient to hold it down during high winds.

The GCL should be installed in a relaxed condition and should be free of tension or stress upon completion of the installation. Stretching of the GCL to fit will not be allowed. Deployed rolls (panels) should be straightened by the installation personnel to smooth out creases or irregularities.

The RPR will visually inspect the geotextile quality, bentonite uniformity, and the degree of hydration, if any, of the GCL. Any areas in need of repair shall be marked.

12.2.5 Seaming

Once the first panel has been deployed, adjoining panels should be laid with a 6-inch minimum overlap on longitudinal seams, and 20 inches on the panel end seams, depending on project specifications. Six-inch and 20-inch overlap lines shall be marked on the GCL to assist in obtaining the proper overlap. When connecting GCL panels from a prior construction phase to a new construction phase, a minimum one-foot overlap should be provided between the previously placed panels and the newly placed panels. All dirt, gravel, or other debris should be removed from the overlap area of the GCL.

Seam overlaps, whenever possible, should be placed such that the direction of flow is from the top panel to the underlying panel to form a shingle effect.

If the GCL requires a granular bentonite seam, then the overlapping panel edge should be pulled back and granular sodium bentonite should be poured continuously along all seams and lap areas for the panel edge to the 6-inch lap line, at a minimum application rate of one-quarter pound per lineal foot.

12.2.6 Patches/Repairs

Irregular shapes, cuts, or tears in the installed GCL should be covered with sufficient GCL to provide a 12-inch overlap in all directions beyond the damaged area. A layer of granular bentonite shall be placed in the overlap zone in accordance with the Manufacturer's recommendations. An epoxy-based adhesive, or other approved method, shall be used to secure the patch during backfill operations.

12.2.7 Penetration Seals

The GCL should be sealed around penetrations, pipes, and structures in accordance with the recommendations of the GCL manufacturer.

12.2.8 Covering GCL

Only the amount of GCL that can be inspected, repaired, and covered in the same day should be deployed. The GCL must be covered the same day it is installed.

Geosynthetics

When covering the GCL, precautions shall be taken to prevent damage to the GCL by restricting heavy equipment traffic. If textured geomembrane is to be placed over the GCL, deployment methods shall be selected to prevent tearing or combing out of fibers of the GCL.

The following requirements apply to soil placement over the GCL:

- Do not drive equipment used for placing the soil directly on the GCL.
- A minimum thickness of 1 foot of soil is required between low ground pressure (<5 psi) tracked equipment and the GCL.
- A minimum thickness of 2 feet of soil is required between the GCL and all other tracked or flotation wheeled equipment.
- A minimum thickness of 3 feet of soil is required between rubber-tired vehicles and the GCL.

Any leading edge of panels of GCL left unprotected must be covered with heavy, waterproof tarp that is secured and protected with sandbags or other ballast.

12.2.9 Submittals

During GCL installation, the GCL Installer shall submit the following information to the CQA Officer:

- Daily records/logs prepared by the Installer documenting work performed, personnel involved, general working conditions, and any problems encountered or anticipated on the project. These records shall be submitted on weekly bases.
- Copy of subgrade acceptance forms by the Installer.
- Quality control documentation.

Table 12-1
GCL Material Tests, Test Methods, and Acceptance Criteria

	Property	Test Method	Units	Criterion	Acceptance Value(1)	Minimum Conformance Testing Frequency ⁽²⁾
Bentonite properties	Free swell	ASTM D5890	ml/2g	Minimum	24	1/100,000 sf
	Fluid loss	ASTM D5891	ml	Maximum	18	Not Required
Physical GCL Properties	Grab strength ⁽⁶⁾	ASTM D6768	lb/in.	MARV ⁽⁴⁾	23	1/100,000 sf
	Bentonite mass per unit area ⁽⁵⁾	ASTM D5993	psf	Minimum	0.75	1/40,000 sf
	Peel strength ⁽⁶⁾	ASTM D6496	lb/in.	Minimum	2.1	1/100,000 sf

Notes:

- 1. Values are based on representative manufacturer's product data, current acceptable industry standards, and practice.
- 2. CQA Officer to coordinate conformance testing at the specified frequencies (minimum) on the GCL rolls supplied to the project.
- 3. Conformance testing is not required if GCL manufacturer provides testing documentation at the required frequency prior to shipping.
- 4. MARV = Minimum average roll value.
- 5. Bentonite mass/unit area reported at 0 percent moisture content.
- 6. All tensile testing performed in the machine and cross direction. Acceptance value is for the machine direction test.